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“Read! In the name of your Lord Who has created (all that exists)”
Surat Al - 'Alaq (The Clot) XCVI

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VISION

The National Defence College is dedicated to be the premier national centre of excellence in security, strategic and development studies.

MISSION

To educate and train selected senior Armed Forces and Civil Services officers at operational and strategic level of national security and development.

To focus on long term national security and development issues and suggest appropriate national response.

To support the national agencies in policy making on security and development matters.

To support the Armed Forces on strategic and operational level planning of warfare.

To strengthen Civil-Military relation in Bangladesh.

To strengthen Military to Military cooperation in the region and beyond.

FOREWORD

With a vision: "to develop as the national centre of distinction on security studies- meeting the challenges of the 21st century" National Defence College is on its track since 1999. Since then the college has been relentlessly go-getting to present time- befitting academic curricula to the potential policy planners, leaders and strategic thinker of the future. Definitive intent of the college is to enlarge a balanced outlook and visualization amongst the Course Members with a view to providing knowledge based leadership at strategic and operational level. Now its 13 years long existence , we feel proud to be recognized as the premier institution at home and abroad.

National Defence College has always been emphasizing on conducting class research in contemporary issues on defence and national security. The main aim of the research is to enable Course Members to make an original contribution to a subject of national or international interest , or that has a bearing on the national security of Bangladesh. The college journal is a mirror image of the research works that are carried out at the college. I am pleased to note that the 11th issue of the NDC Journal contains the selected "Individual Research Paper " of the Course Members of both National Defence Course-2010 and Armed Forces War Course -2010. It also includes one guest paper. The Editorial Board has accommodated topics of assorted subjects and intrinsic worth. It is my firm believe that the readers will come across the articles worth reading and academically thought-provoking.

I congratulate all the members who have contributed to this journal. I thank the Editorial Board for editing and publishing the journal as designed and programmed. This issue of the journal is yet another landmark in the passageway of advancement of National Defence College, Bangladesh.

MOLLAH FAZLE AKBAR
Lieutenant General
Commandant

EDITORIAL

It gives me great pleasure to present the second part, volume 10 of the 'NDC Journal'. The articles are selected from individual research papers that the members of the Course had submitted as part of the course curriculum. The Course Members, during nearly a yearlong stay in the NDC spent a lot of time doing research on security and development related issues. The College believes that a senior civilian or military officer should have a good understanding of the major economic, political and social issues facing the nation and be able to recommend measures to face the challenges.

National Defence College has been very regular in bringing out its `NDC Journal` every year on time. This speaks of highly of the laborious effort and genuine commitment on the part of both the editorial staff and writers. While research papers are usually of 10000 -15000 words, the abridged versions are of 4000 -6000 words. The abridgement is executed in a manner that the inner significance and depth of the contents do not lose their objectives and preciseness.

Forty six members of the National Defence Course-2010 and twenty two members of Armed Forces War Course-2010, as integral part of their course requirement, prepared Individual Research Papers (IRP) on topics pertinent to national security and warfare strategy. Out of all IRPs in total 7 (seven) have been adjudged for publication in the current issue in abridged form. The articles reflect complex and intricate multidimensional issue emanated from the long diversified experiences and the curriculum based deliberations and discourse during their trainings on various topics concerning comprehensive national security.

This volume includes papers of different categories concerning national security. These draw attention to Food Security – Way Ahead for a Hunger Free Bangladesh, Cyber Crime in Bangladesh: Implications and Response Strategy, Modernization of Fire Service & Civil Defence – A Need of the Time, Alternative Energy Options for Bangladesh, Chinese Economic Growth and Its Fallout on South Asian Countries, Carbon Mitigation: Clean Coal Through Carbon Capture & Storage Under Clean Development Mechanism for Energy and Climate Security in Bangladesh and Counter Piracy: Orchestrating the Response. A reader, before getting into the pleasure of reading, can get an idea of what these papers are about from the abstracts included at the beginning of this journal. We would like to express our sincere gratitude to the Chief Patron Lieutenant General Mollah Fazle Akbar, ndc, psc, the Commandant of NDC for his valuable guidance.

Research is a highly committed undertaking. Despite all efforts, unintentional errors in various forms may appear in the journal. We ardently request our valued readers to pardon us for such unnoticed slights and shall consider ourselves rewarded to receive any evocative criticism. We hope that all papers included in this volume will satisfy our readers.

Mohammad Saiful Kabir, ndu, psc,
Commodore, BN
Senior Directing Staff (Navy)

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ABSTRACT

FOOD SECURITY-WAY AHEAD FOR A HUNGER FREE BANGLADESH

Brigadier General Md Nasim Akhter, ndc, afwc, psc

Food security is not just about "demand and supply" of food; it encompasses "availability", "accessibility" and "utilization" by every households and individual at all time. Bangladesh cannot be termed as food secured country as it is yet to meet the facets of food security definition. Poverty is the biggest impediment in achieving food security in Bangladesh. It is also a source of hunger. In last three decades Bangladesh has tripled its rice production keeping pace with growing population, one of the densest in the world. Significant progress has been made in other crops production like wheat, vegetable, livestock, poultry, fisheries etc too. The country, hinging between "self sufficiency" and "near to self sufficiency" in food, mostly depends on bumper production or damage by natural disaster which is very often and severe. Shrinking land, effects of climate change and erratic nature are causes of food insecurity besides malnourishment, hygiene, inapt policies implementation, poor market infrastructure etc. The study analyses the programs, laws, rules and policies undertaken by the government to attain food security revealing that poor and disjointed implementation remains as hindrance in accomplishing those. The study suggests that a separate supervisory authority may be formed to plan, coordinate and monitor implementation of appropriate polices for Bangladesh. Furthermore, modernizing cultivation and large cooperative system are two cardinals Bangladesh agriculture has to embark upon in order to increase production in future. Weather resilient high yield varieties, genetically modified and bio-tech varieties should be invented and released sufficiently to the farmers. Use of ICT especially in enhancing extension system is of paramount important. It is felt that food security could be incorporated in the list of MDGs since most of its (MDG) targets are similar to the components of food security. The thesis concludes by suggesting that the definition of food security, if pursued with sincerity and wisdom the country will be able to do away with hunger forever.

CYBERCRIME IN BANGLADESH:

IMPLICATIONS AND RESPONSE STRATEGY

Brigadier General Md. Khurshid Alam, ndc,psc

Cybercrime is becoming a serious concern of the modern world. With the spiralling technological advancements, more number of functions and services are increasing their reliance on ICT-based networks. Such reliance in the foreseeable future is likely to involve most of the socio-politico-economic, as well as military affairs around the globe. Alarmingly, cyber criminals are creeping at the heels of these technological advents and terrorising individuals, communities, societies, organisations and states by hi-tech theft, forgery, defamation, sabotage, propaganda and other malicious activities. The convenience of committing the crime without being easily detected makes cyber criminals nearly invincible. While the detrimental effect of cybercrime is more pronounced in developed countries, the crime is still less evident in Bangladesh. There are, however, symptoms popping up sporadically which allude to a potential threat that is likely to grow along with the 'Digital Bangladesh'. The awareness and preparedness of the country in this regard is apparently dubious. This paper attempts to evaluate the vulnerability and awareness of Bangladesh concerning cybercrime, and suggest an outline strategy to deal with it. A conceptual overview, skimmed chiefly out of published materials, is presented at the beginning. The vulnerabilities and preparedness is then evaluated before recommending a response strategy to fight cybercrime. The analysis is primarily based on personal experience and interactions with the concerned elite.

The degree of awareness in this regard, and hence the preparedness, is minimal. The country needs to immediately start building up and enhancing its capability to deal with cybercrimes. Such efforts should include legislative, judicial and executive aspects, and development of a holistic approach involving all technocrats, administrators, users and beneficiaries of cyber facilities. Promulgation of relevant laws and their effective enforcement; building awareness; acquiring technical knowledge and capabilities, etc are also vital in this regard.

MODERNIZATION OF FIRE SERVICE AND CIVIL DEFENSE - A NEED OF THE TIME

Joint Secretary Syed Mustafizur Rahman, ndc

Bangladesh is a disaster prone country. Often it has to experience very tragic incidents of fire, building collapse and motor launch capsize causing irreparable loss of lives and properties. Moreover, seismologists predict that the city of Dhaka and certain parts of the country are likely to experience major earthquakes which might be at Richter scale 6 or more. If the predictions of seismologists happen to be true, the consequences will be unimaginable. The Department of Fire Service & Civil Defense in Bangladesh is the only organization to address these calamities. But it has a number of limitations which stands as a barrier on the way to its addressing disasters in recent years and years to come in future. Moreover, the civil defense parameter of the organization is inactive. Civil defense has the capacity to address disasters and develop disaster preparedness among people effectively even during warfare situation. The aim of the study is to examine the existing capability of the fire service and civil defense directorate. To evaluate the constraints of the organization, few major fire incidents in recent times have been reviewed. Interview of concerned personnel including the director general of FS&CD have been taken. The existing structure, management, manpower, equipments & rules and regulations of Bangladesh FS&CD directorate has been examined. The study argues that the existing capability of Bangladesh FS&CD Directorate is not up to the mark to address disasters . So, it is recommended that the FS&CD Directorate need to be modernized. Its structure, management, manpower, equipments, etc. should be reorganized and updated as per need of the time. With this end in view the organizational structure of the same at Singapore known as SCDF is also examined and compared to that of Bangladesh. On the basis of the above examination and analysis a consistent recommendation is made to modernize the existing Fire Service & Civil Defense directorate.

ALTERNATIVE ENERGY OPTIONS FOR BANGLADESH

Lieutenant Colonel S M Ali Azam, afwc, psc, ASC

Amongst fossil fuels Bangladesh is endowed with only limited reserve of gas and coal. Failing to explore coal sector, she developed a gas dependent energy system, thus caused early depletion of the reserve, leaving only about 12 TCF remaining. With present consumption rate this reserve may be sufficient for next three to four years. Presently the country is facing about 33 percent power deficiency where gas

shortage accounts half of the shortfall. Few of the gas-based fertilizer factories are closed, power connection to new industries is stalled and production of all other industrial sectors is drastically reduced due to energy crisis. Poor quality power supply costs the country as much as two percent in GDP growth each year. Energy inefficiency also tolls the country about one-fourth of the energy wastage. Under this crisis situation, it is essential for the country to explore alternative energy options to meet her growing energy need. Despite having vast renewable energy potentials, she could not yet commercialize the harnessing process. Renewable energy is mostly being used in the rural areas meeting domestic needs only. In this paper, descriptive study has been carried out on both primary and secondary data sources to examine the energy sustainability with her leftover fossil fuel reserve. The research also analyzed country's alternative energy potentials and viability coupled with the energy efficiency index. The outcome of the research denotes that, about 80 percent electricity need of the country can be tapped systematically from renewable sources. At the same time energy efficiency improvement can give green solution to country's growing energy need now and for few contemplated years without additional generation. Accordingly the paper recommends few viable alternative energy options and energy efficiency strategy to meet the long term energy security.

CHINESE ECONOMIC GROWTH AND ITS FALLOUT ON SOUTH ASIAN COUNTRIES

Brigadier General Abdullah Mohammad Feroz Chowdhury, ndc, psc, G+

China is presently the second largest economy of the world with Gross Domestic Product (GDP) 8.7%, the highest growth in the world. Since 1949, suitable reforms, inflow of Foreign Direct Investment (FDI), large manufacturing sectors, consumption of own energy resources, huge cheap labour force and favourable balance of international trade contributed to her such growth. By 2025, China is likely to become the world's largest economy and surpass USA. For keeping steady GDP, her demand of energy would also rise exponentially and China will need to secure Sea Lines of Communications (SLOC) through Pacific and Indian Oceans that brings in the context of her strategic relations with and economic fallout on the South Asian countries. Taking India onboard, China would strengthen her relations with all South Asian countries through trade and investments for her secured energy and continued supply of raw materials. In 21st Century, economic interest gets priority over the ideology. Bangladesh being geographically located at an important place of South Asia can benefit

from Chinese economic growth in the fields of exploration of mineral resources, interstate connectivity and development of Bangladesh's Deep Sea Port. The trade deficit between Bangladesh and China may also be minimized by Chinese investment. For this, it is imperative that the road connectivity to China through Myanmar or India must be done as a priority. Bangladesh should maintain a concrete defence policy with both India and China and modernize her Armed Forces as smart, professional and modern one with the assistance of China. Bangladesh should also strive to strengthen her relation with Myanmar and reap economic benefit from its closest neighbour as well as reduce military threat. It is hoped that such developments would facilitate resolving Bangladesh's maritime boundaries with her neighbours and make Bangladesh a manufacturing and exporting hub for Asia.

CARBON MITIGATION: CLEAN COAL THROUGH CARBON CAPTURE & STORAGE UNDER CLEAN DEVELOPMENT MECHANISM FOR ENERGY AND CLIMATE SECURITY IN BANGLADESH

Major General Abul Hossain, ndc, psc

The potentialities for adaptation of society and ecosystems will rapidly decline with an increasing risk of community disruption through health impacts, water shortages and food insecurity for climate change (CC). Bangladesh will be severely affected causing untold suffering and instability for scarcity of food, shelter, water and large-scale migration.

Fossil fuel contributes 80% of GHG. Coal is the major fossil fuel for generating electricity in the industrialized nations and emerging economies. It will continue to do so as long as it is cheap and plentiful. The major challenges for coal are its 'impacts on environment for carbon dioxide (CO2).

Bangladesh has 3.3 Gt coal energy reserve awaiting exploration for subsequent use for electricity production. Clean Coal Technology is the best option to use available coal while ensuring energy and climate security. Bangladesh should follow China and India in pursuance of Near Zero Emissions Coal (NZEC) and Carbon Capture and Storage (CCS). Bangladesh can harness this opportunity for CC commitments under Clean Development Mechanism (CDM) and global carbon emission trading. She can take the advantage of CCS's contributions towards sustainable development to coal-based Non-Annex I countries for Green House Gases mitigation through use of CCS via CDM.

CCS technologies enable emissions of CO2 to be stripped out of the exhaust stream from coal-fired power stations and stored in depleted gas fields or unmineable coal seams. The majority of the Bangladesh gas fields will deplete by 2020-2030. Bangladesh gas fields and Coal Bed Methane (CBM) seams at Jamalganj provide good prospect for carbon sequestration.

Bangladesh should strongly negotiate in the Conference of the Parties as one of the most vulnerable countries of CC. Bangladesh can achieve billion dollars economic as well as skilled jobs and advanced technologies benefits for CCS from the developed countries.

COUNTER-PIRACY: ORCHESTRATING THE RESPONSE

Captain Muhammad Musa, (G), afwc, psc, BN

Causes of sea piracy are very complex and often defy easy solution. One of the major reasons for reemergence of piracy over the past two decades was an enormous increase in both international and domestic maritime trade and large number of ports. This, in turn, offered almost limitless range of tempting, high-payoff targets for pirates and terrorists. In many undeveloped countries, lack of adequate naval forces or coast guard and maritime surveillance capabilities combined with coastal and port-side security make it much easier for various criminal groups to commit piratical acts. Escalation of piracy at sea in recent years has been a matter of great concern to the maritime community and has prompted International Maritime Organization (IMO) to make combating it a central theme of its work. The reality, of course, is that piracy is too complex and has become too entrenched for any one entity to deal with it effectively. After the hijacking of one of the Bangladeshi flag vessel in 2010, people of Bangladesh came to know about modern day hijacking in the open sea and their activities. Through a series of measures, developed and implemented with the strong and much appreciated co-operation of the littoral States and the unreserved support of the shipping industry, the scourge of piracy in those waters has significantly reduced nowadays. The United Nations, alliances (political and defense) of States, Governments acting collectively or individually, military forces, shipping companies, ship operators and ships' crews, all had a crucial part to play in order to rid the world of the threat posed by sea piracy. To alleviate this unacceptable situation, no effort should be spared. Shipping companies must ensure that their ships rigorously apply the IMO guidance and industry-developed Best Management Practices in their entirety, so that, when venturing into the seas

and oceans, they comply with all the recommended measures as no ship is invulnerable. Some success in thwarting pirate attacks can already be claimed from the falling percentage of attacks that prove successful. Nevertheless, as the statistics so bleakly indicate, piracy and armed robbery against ships remain real and ever-present dangers to those who use the seas for peaceful purposes. So long as pirates continue harassing shipping, hijacking ships and seafarers, the maritime institutions can neither be proud of, nor content with, the results achieved so far. A comprehensive approach is badly needed in to deter sea piracy in the world's ocean. The military action alone cannot resolve the problem of piracy. It must be only a part of a much broad and comprehensive series of actions. The main causes of piracy are predominantly political, economic, and social. Hence, the long-term solution can be found only if the international community and regional governments make concerted efforts to solve the root causes of piracy.

FOOD SECURITY-WAY AHEAD FOR A HUNGER FREE BANGLADESH

Brigadier General Md Nasim Akhter, ndc, afwc, psc

INTRODUCTION

With the increase of global population, the demand for food has risen to a height that food "production" cannot meet the demand. Food security issue in contemporary time came under focus only in 1960s with the "Green Revolution" as the World body's initiative at the wake of frequent famine, poverty, and hunger due to food insufficiency. Earlier food security used to be seen as availability of food only. In 1974 World Food Summit (WFS) a simple definition of food security was agreed upon by the member states. However, it went under several changes over the years to reach to an acceptable definition by WFS 2006. The definition now includes "availability", "accessibility" and "utilization".

One hundred percent of rural households' economy of Bangladesh is agro based while 48% of the country's employment is consumed by agriculture sector. Bangladesh, being an over-populated country with highest population density suffers the wrath of poverty since its inception in 1971. The country with the utmost hard work of the scientists and farmers grew rice almost three times more than it had grew in 1970s. Bangladesh tried to cope up with the population growth but yet to meet the criteria of food security. Presently 41.2% people are below poverty level rendering inability to buy appropriate food containing correct nutrients resulting prevalence of huge malnutrition. Ignorance, on the other hand, kept the solvent households undernourished too.

Agriculture is also dependent on nature. Experts predict that food security issues might bring changes in world order even wars in future. Disaster prone Bangladesh suffers severe setback in agriculture production due to frequent flood, drought, cyclone, salinity etc. Governments over the years are striving hard to ensure food security in the country. Steps taken to halve poverty under the auspices of Millennium Development Goals (MDG) have been found on track which will directly contribute in attaining food security. Scientific approach to increase production and efforts to keep the cost affordable must go in parallel. Political and diplomatic approaches to global forums against global warming, environmental pollution, bio-fuel issue, hoarding etc will make significant impact in ensuring food security in Bangladesh.

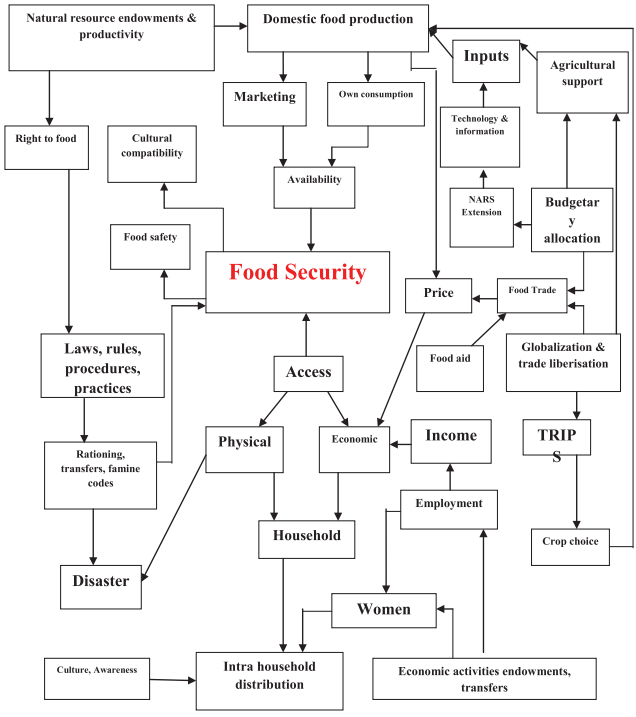
CONCEPT OF FOOD SECURITY AND ALLIED GLOBAL ISSUES

Concept and Definitions of Food Security

Food security is not a new concept rather it had been a concern for many centuries. Thomas Robert Malthus (1766-1834), in known history, first said about food security in his famous theory "An *Essay on the Principles of Population*, shortly known as *First Essay*, 1798. Neo-Malthusians argue that more than two centuries since the first essay the simple theory of Malthus was not proved true till 1980s and 1990s when the world at last had reached a critical turning point (Dyson, 1999, p.11). The debate on the concept of food security prolonged for a long period.

Food security does not mean food only. The diagram below shows that food security encompasses economical, social, political and cultural values directly influencing dietary habit, food production, distribution system, market facilities, natural disaster etc.

Table 1: A Complex Dimension of Food Security



Source: Internet

Food Security: Food security was defined in WFS held in 1974 as "availability at all times of adequate world food supplies of basic foodstuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices" (UN, 1975). The WFS at Rome in 1996 adopted a more viable and composed definition, "Food security, at the individual, household, national, regional and global levels [is achieved] when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (FAO, 1996). A widely accepted definition thus stood hitherto as "Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO, 2006). It thus has three distinct components, "availability, "access" and "nutrition".

Food "Availability": Nutritious food should be obtainable by households of all levels in adequate quantity at all time of the year may be at home or at market. On the other hand it is the sum of domestic production, imports (both commercial and food aid) and changes in national stock (Gerald, 2003).

Food "Access": Access means individual's affordability to acquiring appropriate food for a nutritious diet.

"Utilization (Nutrition)": Food utilization relates to the capacity of an individual to absorb and utilize the nutrients in the food she/he consumes and is determined by practices, beliefs, eating habits, hygiene, sanitation and health (Gerald, 2003).

Causes of Food Insecurity

The core reason of food insecurity arises when the demand and the supply equation varies. The population growth in the world is in the rise as a natural phenomenon which increases pressure on the supply curve. In the projected population growth of the world, birth rate is more than the death rate as such there are growth of population (Dyson Tim, 1996). Nature and environment play vital role in food grain production. Deforestation, cutting of hills, construction of dams etc has distressed the nature to support cultivation. Manmade pollution now is standing as direct cause of food security. Poverty, including the associated vulnerability of natural or man-made shocks is the root cause of food insecurity and nutrition. Food security, nutrition and population growth stand in a particularly complex long term relationship.

FOOD SECURITY – BANGLADESH PERSPECTIVE

Food Security Scenario in Bangladesh

Having seen the global scenario of food security an overall purview of Bangladesh can easily be predicted. Bangladesh is an agrarian society with the country's 76% of total population living in the rural areas. 90% of the villagers are directly related to agriculture. According to Bangladesh Bureau of Statistics (BBS) 2005/2006, the agriculture sector employs about 48% of the total labor force of the country and provides over 90% of the total rural employment (Kabir, Husain and Hossain, 2009, p 180). Crop sub-sector contributed more than 11.72% to the GDP in 2006-2007. Most agricultural production still is concentrated on a limited number of crops, with rice accounting for about 79% of total cultivated area. Other major crops include wheat (5%), jute (3.2%), pulses (4%), sugarcane (1.2%), and oilseed (3%) and high value crops including vegetables, fruits, spices and potatoes (Hossain, 2010). Presently, due to poverty, 41.2% of the population cannot afford the meal of required (2122) kilo calories.

Bangladesh's production of food grain has shown a steady increase since independence, increasing from 11 million metric tons in the 1970s to 33 million metric tons in 2009. Records show that in 1970s, 70% population was under the food consumption poverty line (MoFDM and WFP, 2005). Table below shows that except pulse and wheat all crops increased in production as the time passed.

Table 2: Production of Different Food Crops in Recent Past (In lakh mt)

Crops	2004-2005	2005-2006	2006-2007	2007-2008
Rice	251.57	265.309	273.19	289.31
Wheat	9.76	7.35	7.37	8.44
Maize	3.56	5.22	9.02	13.46
Potato	48.56	41.61	51.67	66.48
Pulses	3.16	2.79	2.71	2.05
Oil seeds	11.80	5.95	6.25	6.42
Vegetable	65.31	57.32	69.67	86.85
Spices	10.00	11.82	14.05	13.68
Total	403.72	397.36	433.93	486.69

Source: BBS 2008, Bangladesh Economic Review 2008 and Hossain, Ismail 2010

According to the WB, approximately 33 million of the 150 million people in Bangladesh cannot afford an average daily intake of more than 1800 kilocalories (minimum standard for nutrition as set by the WFP). About 50% of country's population, mostly poor, lives in the disaster prone areas, complicating their already vulnerable situation further. During natural disasters, families often lose what few possessions they own and deepen their level of poverty.

Is Bangladesh Food Secured Country?

Despite huge population increase there has not been any incident of death due to hunger since last three decades. Can Bangladesh be termed as hunger free or food secured country then? The answer is probably not that easy to find out. To get a prudent and ingenuous answer, indicators of food security (availability, access and utilization) are examined in Bangladesh context subsequently.

Availability: Bangladesh National Food Policy (NFP), 2006 and its Plan of Action (PoA) have set "adequate and stable supply of safe and nutritious food" as an objective to ensure this core dimension of food security in Bangladesh. Table below shows per capita availability of food grain is more in 2007 than in 2001. It also reveals that food gap existed till late 2001 while it improved through mid 2000s, again reduced up to 2007 i.e. food production is not a sustained phenomenon in Bangladesh.

Table 3.1: Food Grain Availability and Requirement

Financial Year	Net Production	Mid Year Population	Food Requirement	Food Gap	Import/ Aid & Procurement	Domestic Procurement	Availability	Per Capita Available
01/02	23315	133.00	22020	1295	2752	1053	25013	515
02/03	24025	135.00	22351	1674	4402	947	27480	558
03/04	24699	137.54	24549	150	3467	843	27323	544
04/05	23520	139.76	24945	-1425	4377	899	26968	529
05/06	24539	141.80	25309	-771	3510	945	27103	524
06/07	25250	143.91	25686	-436	3689	1140	27799	529

Note: 1. Seed feed and waste has been calculated @ 10%. 2. Population figures are adjusted by population census 2001. 3. Per capita intake has been calculated @453.6 gm from 1997/98 to 2002/03 and @ 489 gms from 2003/04 to 2006/07

Source: FPMU, 2009

Access: The poverty at national level has been marked at 41.2% in 2010 (Mahmud, 2010). Poor don't have access to food even when available at the market because of lack of purchasing power. On the other hand 39.8% people are in food security risk of whom 19.2% are in transitory risk while 80.8% are in chronic food insecurity (Mahmud, 2010). A good percentage of people of the country can not afford required food for some period of time or throughout the year.

Nutrition: Bangladesh has maximum malnourished people i.e. they consume less than 2122 kilo calories or earn less than one and a quarter dollar a day. The financial condition doesn't permit poor to go for balanced diet. At the same time preference of rice over other crops is a social practice contributing incessant shortfall of other nutrient in the diet. Bangladesh falls short in fullfilling other factors of health and hygiene issues which are vivid in all the social indicators, like 36% of population have access to adequate sanitation (2006), 47% to safe drinking water (2007), under five mortality rate is 61% (2007), infant mortality rate is 47% (2007) (FAO, 2010).

It thus can be said that though at national level there exists no deficiency of food but difficulties and disparities are in abundance at household and individual level.

Causes and Challenges of Food Security - Bangladesh Perspective

Overpopulation: Domestic demand is bounded by population growth and inelastic demand (inelastic to price as well as income) for agricultural products (Faruqee, 1998). Population growth is 2 million per year while the land is decreasing by 1% annually. The crop production vis a vis the demand is going through a line between deficiency and surplus. Any of the negative factors would cause less food production and affect the determinants of food security.

Poverty: Food insecurity is an analogy of poverty in Bangladesh. According to the statistics about 41.2% of 114 million people of Bangladesh live below poverty level i.e. their daily calorie intake is less than 1800 k cal as set by the World Bank. Table below shows improvement in poverty scenario from 2000 to 2005. However, the scenario has deteriorated in 2010 where the poverty level has increased to 41.2%.

Table 3.2: Poverty in Bangladesh				
Survey Year	Residence	DCI Method	CBN Method	
			Upper Poverty Line	Lower Poverty Line
2005	National Rural Urban	40.4 39.5 43.2	40.0 43.8 28.4	25.1 28.6 14.6
2000	National Rural Urban	44.3 42.3 52.5	48.9 52.3 35.2	34.3 37.9 20.0
Source: FPMU, 2009				

Natural Disaster: By nature Bangladesh is a disaster prone country. The numbers of disaster like tornado, flood, cyclone, and drought have increased in number destroying not only the standing crop but also diminishing the purchase power of the people, a scenario of recent disasters in Bangladesh is shown below:

Table 4 : Economic and Human Loses in Major Disasters in Bangladesh			
Year	Disaster	Economic Loss	Death
1970	Cyclone	n/a	500000
1987	Flood	US$ 1000 million	n/a
1988	Flood	US$ 1200 million	1708
1991	Cyclone	n/a	138868
1998	Flood	US$ 2800 million	918
2004	Flood	US$ 2200 million	747
2007	Cyclone (Sidr)	US$ 1642 million	3406
2007	Flood	US$ 1100 million	800
Source: Razzaque, 2010			

Use of Chemical and Loss of Soil Fertility: There has been indiscriminate use of fertilizers and other chemicals, and poor irrigation management causing extensive depletion of organic matter in the soil in croplands and in fact, most

of the soils of the country have reached a state of impoverishment and sickness (Ahmed and Hassanuzzaman, 1998).

Slow Pace of Modernization: Bangladesh produces 1 to 2 tons of rice per hectare where as China and developed countries in the same size of area produce 8 to 10 tons of rice by utilizing modern technology (Kabir, Husain and Hossain, 2009). The irrigation equipments like shallow and deep tube wells, tractors were first introduced before 1971 but were not much taken by the farmers till today.

Poor Infrastructure, Market Linkage and Bank Loans: The biggest constraints for the poor farmers in accessing food is not technology only but more basic inputs such as land, water, energy, and other resources, access to local markets, decent roads, grain stores, affordable credit, rural extension services and as a whole, adequate and well functioning infrastructure (Weekly Holiday, 13 February, 2004). Mostly farmers, in absence of market linkage fall prey to the middlemen (retailers, whole sellers, traders) who take greater than 60% market share of agricultural products, while government and cooperatives are able to buy only 20% of it (The 200-Village Project, 2010). Corruption of the loaning authority forces the peasants to fetch loans from NGOs at times at very high interest rate causing further rise in production cost.

Effects of Climate Change: The seasons are becoming extinct due to climate change. Average temperature and rainfall have changed increasing frequency and intensity of natural disasters. Decline of precipitation resulted droughts and less water in the rivers. As a result there is scarce of surface water especially in the rivers causing salt water from the Bay of Bengal to penetrate (has penetrated ~100 kilometer; average water salinity increased by more than 172%). The scenario will be worsening further if adequate measures are not taken in time. (Mustafa, 2009).

Not Adhering to the Rules/Laws: There exist numbers of rules and laws especially on food safety enacted by the governments. These rules are not adhered by all concern, as a result consumable food remains at the risks of being adulterated there by compromising its nutrient value.

***Lack of Policies and Concerted Efforts*:** The spectrum of food security is wider than agriculture. Until recently the matter was confined to agriculture only. Contributions of Government Organizations (GO), Non Government Organizations (NGO) and private sectors are vivid but seem not well harmonized. On the other hand food production did not increase in Bangladesh as of Thailand, Philippines and Vietnam as they; (1) brought maximum land under irrigation system, (2) adopted commercial farming, (3) ensured crop insurance, guaranteed crop marketing, guaranteed power supply, health of children under 5 etc.

Measures of Bangladesh in Ensuring Food Security

Bangladesh Constitution (article 15 a) made food as a fundamental right of its citizen and warranted the government to ensure it. Ministry of Food and Disaster Management (MoFDM) is the lead ministry to pursuit the task. The objective of the Bangladesh government is to provide food to all at all times, as food is required for an active and healthy life. These commitments of the government have also been spelt out in international forums such as GATT Uruguay Round and the MDG (2000) to reduce the number of poor people by the year 2015 (Kabir, Husain and Hossain, 2009). Fighting food and nutrition insecurity is considered by the Government a key mean for the country to become a middle income country by 2025 (Food Division, 2010).

Policy, Reforms and Strategies: Government has taken different policies which emphasized intensification of cereal production, diversification of high value crops, processing of agriculture products, raising the production of fishery and live stock products. Poverty Reduction Strategy Paper (PRSP) has placed special emphasis on technological advancement in agricultural research and strengthening capacity of National Agriculture Research System (NARS) and through fortifying agricultural research-extension linkage (Hossain, 2010). Besides, there are number of laws and regulations regarding food safety in vogue to maintain good health and safety standard. The National Food Policies 2006 represents a follow-up to the National Food Policies of 1998. It has been approved by the Cabinet in August 2006. The goals and objectives of the policy are:

Objective -1: To ensure adequate and stable supply of safe and nutritious food

Objective -2: To enhance purchasing power of the people for increased food accessibility.

Objective -3: To ensure adequate nutrition for all (especially women and children).

Modus Operandi: Food security being a challenge the governments went all out in achieving self sufficiency in food by 2013. Various steps taken to ensure food security are:

Subsidies and Incentives in Agriculture: An amount of 7649 crore taka was allotted in the budget (2008-09) for agricultural development. Amount of subsidy in respect of fertilizer both Urea, and non urea has been increased by 15%. 144.39 crore taka was allotted for rehabilitation purpose in 2008-09. Government has exempted electric bill for irrigation and agriculture purpose up to 20%. Interest rate of cultivating crops like pulse, oilseed and spices has also been reduced from 8% to 2% (Bangladesh Economic Review, 2009).

Banks Credits: Every farmer now can open bank account with only 10 taka for better and safe transaction of loan or grant money. The table below reveals that despite good amount of money remains unrecovered the governments kept on increasing the loan amount every year.

Table 5: Agriculture Credit Disbursements and Recovery (in Crore Tk)

Fiscal Year	Target	Distributed	Recovery
2004-05	5537.91	4956.78	3171.15
2005-06	5892.21	5496.21	4164.35
2006-07	6351.30	5292.51	4676.00
2007-08	8308.55	8580.66	6003.70
2008-09	9379.23	9284.46	8377.62

Source: Ministry of Finance 2010, "Bangladesh Economic Review 2009",

Of late the Bangladesh Bank has declared its "Farm Loan Policy 2010-11" with the target to disburse tk 12,617.40 crore. In fiscal year 2009-2010 the target was taka 11,500 crore (Bangladesh Economy, 2010).

Constructing Embankments and Roads: These infrastructure issues are well taken care by Local Government Engineering Department (LGED), Roads and Highways (R & H), MoFDM.

Carryout Research on Climate Resilient High Yield Varieties of Crop and Technical Innovation: To date, BRRI has developed 47 modern variety (MV) to suit the ecological conditions of all three rice growing seasons including saline water and drought resilient paddy (Hossain, 2003). BARI and Bangladesh Institute of Nuclear Agriculture (BINA) developed 27 varieties of wheat, 30 potatoes, 35 oilseeds, 32 pulses, 36 fruits, 44 vegetables, 12 spices114 other crops. While Bangladesh Jute Research Institute (BJRI) released so far 40 varieties of jute and Bangladesh Livestock Research Institute (BLRI) has developed 53 technologies for animal disease control and increasing livestock production (Hossain, 2010).

Social Safety Net Programs: Various arrangement has been kept to make food available to the marginal and poor farmers (including fisherman, livestock farmers), calamity affected population. Food for Works (FFW), Vulnerable Group Feeding (VGF), Vulnerable Group Destitute (VGD), Test Relief (TR), Open market Sale (OMS) and normal relief are some of the initiatives by the government.

Water Management and Irrigation: Every year efforts are made to bring more land under irrigation for better production. Beside regular dredging efforts are made to undertake capital dredging for holding more water and reduce flash flood. The table below shows government efforts of increasing irrigated cultivable land every year:

Table 6: Areas under Irrigation Up to 2008.

Types of Irrigation	2004-05	2005-06	2006-07	2007-08	2008-09
A)Surface Water: Major irrigation, Traditional, etc (A)	1550947	1588390	1565640	1682295	1832360
Underground water: Deep Tube Well, Light Tube Well (B)	3814088	3821269	3935788	4125107	4220580
Total (A&B)	5365035	5409659	5501428	5807402	6052860

Source: Ministry of Finance 2010, "Bangladesh Economic Review 2009"

Storage and Procurement: Government has taken up a project of increasing food grains storage capability from 1.5 million mt in 2010 to 2.2 million mt by 2015 and to 3million mt by 2021[1].

Health, Nutrition and Persuasion of MDG: Health and nutrition is one of the most important aspects of food security. Government is actively pursuing the MDGs set for the country. As far as targets like, access to pure drinking water and sanitation are concern Bangladesh is on track according to midterm progress report of 2008 while in other sectors the progress is not encouraging.

Other Initiatives: There are many other facilities and incentives offered by the government to keep the food grains available and affordable to the poor people of the country. Exporting agro items are encouraged by the government. The country earned US$832.27 and US$ 987.56 million in FY 2006-07 and 2007-08 by exporting agro product which is 6.83% and 7.00% of total export earning respectfully (Ministry of Finance, 2008).

1. Talukder Ruhul Amin, additional Director, FPMU, Dhaka, interview on 27 July 2010.

CRITACAL ISSUES AND CHALLENGES - ANALYSIS

Overview

Bangladesh's journey towards food security is not easy. Besides numerous programs by government, international and regional forums/bodies and by the resilient farmers of the country the expected result is yet to be achieved. There remain several dilemmas and challenges that hinder the tall task of achieving food security in the country. The issues are critical but imperative to ensure sustained food security. An analytical study on the issues discussed in preceding chapters has been made in subsequent paragraphs with a view to formulating a viable discourse for food security in Bangladesh.

Increase Food Growth to Feed Increasing Mouths: Bangladesh is in the risk of food insecurity at any point of time of the year owing to natural disaster or unstable international market. In late 2000s the population grew at a rate of more than 2%, coupled with global price hike and natural disaster the situation got precarious. More growth of food grain (not more enough to mitigate the loss incurred in cyclone Sidr-2007 and subsequent flood) could not solve the problem. Government had to undergo difficult situation in feeding its population. Such situation is likely to be repeated with more critical and insecure dimensions. So, increasing food growth only would not serve the purpose, food security also needs equal importance to other sectors like population control, eradication of poverty etc.

Nutrition from Food Intake, Dietary Habit and Empowerment of Women: Rice dominates 88% of the menu which does not full fill the requirement in proper nourishment. Fat, protein, other minerals and vitamin are also required which is available in fish, meet, oil seed, fruits, chicken, eggs etc. It is seen that intake of cereals and vegetables reached near adequate level though serious inadequacy of pulses, oils and livestock products in rural area prevails. Empowerment of women is a better option to ensure food safety at household level. Changing dietary habit and safe food need education, motivation, social and cultural revolution.

Food Diplomacy - Food Aid and Food Import: Absence of trusted and tested food diplomacy with other food exporting countries has put the country into deep trouble in case of global or domestic crises as we experienced in 2007 and 2008.

Infrastructural Development: Bumper production of crop can't be utilized to the fullest due to lack of adequate and appropriate storage facilities. Communications from the growing field to the market is very poor rendering it difficult for the farmers to get profit on their investment. Market linkage,

roads, processing industries, etc are linked with the other hence need a multi dimensional approach for solution.

Efficient Water Management: Ours is a rain fed and surface water dependent agriculture. Indiscriminate urbanization, filing up water catchment areas, lifting water by the upper riparian countries and effects of climate change has made irrigation very difficult. Unsystematic lifting underground water is posing threat to availability of safe drinking water. Holding excess flood water to utilize in dry season and recharging the underground water aquifers have become a real challenge.

Policy Issues: Enabling objectives of the components of food security i.e. availability, access, and utilization (nutrition) are very much common to the objectives of MDG, perspective development plan of ADP or objectives of PRSP. Possibility of overlapping or question of "nobody's business" might jeopardize the goals of ensuring food security. Moreover the easting PoA has over sighted the following aspects:

- Impacts of climate change.
- Affects of shrinking trend of food aid.
- Inadequate focus on public food management.
- Weakness of governance in food and agriculture sectors seem has lost sight.

Harnessing Related Efforts to Achieve Dividend: More than dozens of ministries/divisions and NGOs are involved in pursuing the targets of MDG and food security. Efforts of all these organizations/institutions are not harnessed under single umbrella. It calls for intimate coordination; efficient management else accomplishing the objective might be at jeopardy.

Small Household Cultivation vis-a-vis Commercial Farming–A Dilemma: Most of the food surplus and exporting countries got success in increasing production through commercial farming. Bangladesh's agriculture on the other hand has progressed through small level farming and cooperatives by small households and marginal farmers. Shifting to large/commercial farming is a requirement to increase food production. In Bangladesh the socio-cultural scenario won't allow any other means but cooperative system.

Inappropriate Policy on Budget: The budgetary allocation is allotted to various sectors like agriculture, food, livestock, health etc. Harmonized and efficient management of so many sectors are required to accomplish the components of food security, which Bangladesh lacks. Budget, if allocated theme wise, could probably become easy to achieve the thematic issues like food security.

Effects of Boro Cultivation: Boro cultivation though brought revolution in increasing food production in Bangladesh, has made several negative effects on environment, like; (1) pushing out major non-cereal crops-such as pulse and oilseeds-that were important sources of protein and micronutrients for the poor; (2) decline in soil fertility due to raising two MV rice crops, which are heavy users of soil nutrients; (3) heavy use of pesticides, which have led to adverse impacts on the quality of surface water and fish habitats; (4) over-exploitation of groundwater resources leading to adverse impacts on the supply of drinking water; and (5) the arsenic contamination of groundwater that is widely prevalent in Bangladesh (Hossain M, 2009).

WAY AHEAD FOR BANGLADESH

Crop Diversification and Increase of Rice Production Including Outsourcing vis-a-vis Poverty Alleviation and Population Control: The crop needs to be produced making highest utilization of the land; however there will be an optimum time and production for which long term plans of other social indicators like poverty, illiteracy, population control, etc to be undertaken right away. Increasing human resource may be utilized to grow crop in overseas land and add to own production. Crop has to be diverse to lift dependency on rice, on other hand high value crop including sources of fat, protein and other vitamins for living a healthy life are to be produced at large.

Revamping NFP 2006: The NFP-2006 has rooms to improve upon following issues:

- ***Climate Issue***: The climate is a colossal factor which needs well thought plan to face its cynical impacts. The dimensions and severity of climate has to be appropriately anticipated by the planners and take remedies accordingly. The aspects of compensation should not lose sight too. This money should be utilized for building infrastructure, research, ICT and buying equipment.

- ***Food Aids/Grants***: At the wake of shrinking food aids proper food diplomacy with rice surplus/exporting countries should be engaged for guaranteed support. USA, ASEAN countries and China are better options in this regard.

- ***Public Food Management Strategy***: Public food management will encompass giving input to the farmers, ensuring energy for irrigation in time, adequate procurement, establishing farmer friendly market that ensures guaranteed sale of their produces and storing as buffer stock, ensuring implementation of safety net programs, import in time and keeping the essential food grains within affordable reach. An elaboration will be needed in the PoA to make the plan viable.

GOs and NGOs-Complimentary to Each Other in Micro Management: NGOs are playing a vital role in eradicating poverty, ensuring hygiene and sanitation etc at the micro level and have brought significant impact. Government may explore the capability, resources and network of NGOs to distribute microcredit, enhance extension system, build awareness regarding health and hygiene, and popularize ICT and many other efforts in a bid to enhance food security.

Modernization of Cultivation: The tractors, power tillers, harvesting machines etc should be made available at very less price. Petty items like leaf color chart, drum seeder etc must be made available at affordable price. The extension service should be IT based and taken to the doorsteps like "KIOSK" of India where peasants will be able to know the market price of their produces, advice on disease, fertilizer, weather forecast etc. HYV, GM, bio-tech MV should be invented and given to the farmers adequate in number.

Food Security a Part of MDG: Many of the food security components are included as social indicators and taken care by MDG targets. On the other hand all 48 ministries and 50 divisions including line ministries for food security (MoFDM, MoA, MoH and MoFL) are involved in attaining MDGs. Their works are not well harnessed due to difficulty in coordination among so many organizations. Hence, food security, if included in MDG will reduce overlapping of efforts and help implement the entire gamut under one umbrella program.

Research, Develop and Popularize HYV and Weather Resilient Varieties: To face the harmful impacts of climate, research should be undertaken to invent adverse climate resilient variety of rice, wheat and other food grains and livestock. The yield period and gap if lessened would increase crop intensity. Researchers and the research institutions should be set free with all kinds of assistance including money both by government and international bodies.

Ensure Food Safety: Existing rules and laws of food safety need revision, update and strict enforcement. Besides, motivation at all level including infusion into the education curriculum may bring positive result in long term. At household level, in the rural areas women who make meals should be motivated about safety and nutrient value of food being served. NGOs and electronic media will be of good use in this regards.

Commercial Farming Though Cooperative System: To cope with the future challenges best practices in other countries like commercial farming (crops and cattle) may be followed. Instead of replicating their system large scale farming may be ensured by putting entire cultivable land under cooperative zone/sub-zones.

Change in Dietary Habit: Rice based menu don't offer all nutrients required for healthy life. More incentives and motivation to be rendered to sensitize people take varied food in their menu. Households should be encouraged to rear and culture fat and protein sources. Proper and true implementation of "Ekti Bari Ekti Khamar" project will be of good use in this regards.

Thematic Area Development Budget: To avoid complexity of coordination and duplication of efforts/resources government should allocate budget on thematic area like food security as package. A supervisory or controlling authority may be formed with the representatives of the line ministries, divisions and experts to coordinate the efforts and allocated resources in this regard.

Sectoral Cultivation: Basing on cost effectiveness of production crop should be cultivated in appropriate land/area. Like, Boro should be cultivated in low-lying area where irrigation is gainful.

CONCLUSION

In the constitution of Bangladesh the government has been bestowed with the responsibility of ensuring food for all its citizens. Food security issue can't be seen in isolation as "feeding people" only, it has relation and influence of other health, social and economical aspects. Food security essentially does not mean production of sufficient food only. It means that food should be available at the market for the households to procure as much as required at affordable price. These foods should be containing adequate and appropriate nutrients to maintain a healthy and active life. Lastly the people should have access to proper sanitation, pure drinking water and hygienic lifestyle.

Last three decades the country tripled its food production, mainly rice, to feed its population. 41.2% people being below poverty line the country is in a vicious cycle of poverty, over population and food insecurity. The poor households are unable to consume balanced food with required nutrient value because they are either not available and (or) not affordable.

Natural disaster and climate change imprint huge impacts on food production and impede poverty eradication process. Governments of Bangladesh over the period have under taken various means to ensure food for all in the form of self sufficiency in food but could not be successful in all aspects. The country achieved success in exterminating starvation but could not do away with hunger and malnutrition. A great progress has been made in increasing crop intensity and inventing weather resilient crop varieties. But what will happen at the breakeven point is a serious question to be thought upon. However, food security seems not a far cry for Bangladesh; it needs to be brought in a comprehensive package.

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CYBERCRIME IN BANGLADESH:
IMPLICATIONS AND RESPONSE STRATEGY

Brigadier General Md. Khurshid Alam, ndc, psc

INTRODUCTION

Information and Communication Technologies (ICT) have transformed modern lifestyles. These have provided us with real-time communications, borderless and almost unlimited access to information and a wide range of innovative services. Cyberspace has supplemented, if not substituted, functions and services ranging widely from routine personal life to national and global affairs. The immense convenience offered at an astounding speed dissolving all spatial limits make cyberspace indispensable to a modern world that is still at pains to fathom its potential. As dependence increases on technology, so does vulnerability due to its abuse. It has also led to vast quantities of malware and spyware circulating freely on the Internet, and an alarming rise in the number and scale of cyber criminals.

Cybercrimes, generally involving computers and networks, are embarrassing governments and individuals; impairing systems; and causing loss of billions of dollars every year. These crimes in reality include copyright infringement, software piracy, password cracking or cheating by others' ID, cyber pornography, e-mail threats, e-stalking, hacking others' websites and so on. The world is threatened, perhaps, by the worst form of aggression through these crimes. The increased reliance on the Internet by business, government and society makes it a prime target for criminals' intent on disrupting economy and way of life. Cybercrime has grown to be larger than illicit drug sales worldwide and it is estimated that losses from intellectual property to data theft in 2008 ranges as high as $1 trillion.

How much is Bangladesh vulnerable to cybercrime; is she aware; and is she ready to respond to this threat and what should she do to counter this? While some studies are carried out about the use and development of the cyberspace, no serious evaluation is done of the nature of threat that is tagged with it, the degree of damage it can do, or the amount of loss it can incur. At present, the cybercrimes in Bangladesh scenario includes life threatening email to important personalities, malicious mail to foreign diplomatic missions, pornography, fraudulent mail for the realization of money, inserting porno movies to the well-known web sites are a few to name. Much, however, remains unreported, most of which may not have taken a devastating toll yet. When we are envisioning 'Digital Bangladesh',

Bangladesh is more exposed to the evils of technological crimes. Unfortunately, we are not much aware of this crime and consequences.

This paper attempts to evaluate our vulnerability, as well as the preparedness, by analyzing the degree of penetration of cyberspace in the country and the nature of threats accompanying it. A conceptual overview, skimmed chiefly out of published materials, is presented at the beginning. The vulnerabilities and preparedness is then evaluated before recounting a response strategy to fight cybercrime. Finally, the paper suggests an outline strategy to deal with cybercrime in Bangladesh.

A CONCEPTUAL OVERVIEW OF CYBERCRIME

What is Cybercrime

Cybercrime is apparently a 'crime' committed using 'computer' or 'network', or 'hardware device' or 'cyber space'. The Council of Europe's Cybercrime Treaty uses the term 'Cybercrime' to refer to offences ranging from criminal activity against data to content and copyright infringement. Cybercrime is generally defined as the crime in which computer has been used as either the target or tool for carrying out the crime.

Forms of Cybercrime

There are many forms of cybercrime and various new forms and techniques are noticed day by day. However, the principle forms of cybercrimes are appended below:

Hacking. Hacking in simple terms means illegal intrusion into a computer system without the permission of the computer owner/user. Hackers make money through raiding bank accounts, credit card fraud, telephone call selling, product/service fraud and espionage.

Salami Attacks. This kind of crime criminal makes insignificant changes in such a manner that such changes would go unnoticed. For example, the criminal makes such program that deducts a small sum (say Taka 2.50 per month) from the account of all customers of the Bank and deposits the same in his account.

Distributed Denial of Service (DDOS) Attack. This is an act by the criminal, who floods the bandwidth of the victim's network or e-mail box with spam mail and bogus messages, thereby effectively closing the routine traffic or cause it to crash.

Virus/Worm Attacks. Viruses are programs that attach themselves to a computer or a file and then circulate themselves to other files and to other computers on a network. They usually affect the data on a computer, either by altering or deleting it.

Trojan Attacks. A Trojan-Horse is a code fragment that hides inside a program and performs a disguised function. It is a popular mechanism for disguising a virus or a worm and can be camouflaged as a security related tool. A Trojan was installed in the computer of a lady film director in the US and obtained her nude photographs through webcam. She was later harassed by the criminals.

E-mail Spoofing. A spoofed e-mail may be said to be one that misrepresents its origin. It shows its origin to be different from which actually it originates. Many of us have experienced 'Urgent Help Mail' from a known friend requesting immediate financial help, which otherwise is false.

Dissemination of Obscene Material. Pornography on the net may take various forms. It may include the hosting of web site containing these prohibited materials. These obscene matters may cause harm to the mind of the adolescent and tend to deprave or corrupt their mind.

Phishing and Credit Card Fraud. It is a technique of pulling out confidential information from the bank/financial institutional account holders by deceptive means. If electronic transactions are not secured, the credit card numbers can be stolen by the hackers who can misuse this card by impersonating the credit card owner.

Cyber Criminals

Cyber criminals are an ever present menace in every country connected to the Internet. The cyber criminals constitute of various groups or category as shown below:

Children and Adolescents. The simple reason for this type of delinquent behaviour pattern in children is seen mostly due to the inquisitiveness to know and explore the things. Other cognate reasons may be to prove themselves to be outstanding amongst other children in their group.

Organised Hackers. These kinds of hackers are mostly organised together to fulfil certain objective. The reason may be to fulfil their political bias, fundamentalism, etc. The Chinese are said to be one of the best quality

hackers in the world. They mainly target the other governments' sites with the purpose to fulfil political objectives.

Professional Hackers/Crackers. These kinds of hackers work are motivated by money and mostly employed to hack the site of the rivals and get credible, reliable and valuable information. Further they are employed to crack the system of the employer basically as a measure to make it safer by detecting the loopholes.

Discontented Employees. This group include those people who have been either sacked by their employer or are dissatisfied with their employer. Traditionally, internal attacks posed the greatest threat to computer networks, which accounted for about 70 percent of all attempted intrusions.

Difficulties to Address Cybercrime

Highly Technical and Innovative Methods. Unlike traditional criminals, cyber criminals are sufficiently educated and highly specialised in computer systems and networking. The cyber attacking tools and methodologies are becoming widely available and skills required by malicious users to launch cyber attacks are reducing with time. The problem encountered in guarding a computer system from unauthorised access is that there is every possibility of breach not due to human error but due to the complex technology. By secretly implanted logic bomb, key loggers that can steal access codes, advanced voice recorders; retina imagers etc that can fool biometric systems and bypass firewalls can be utilized to get past many a security system. All of this emphasises how sophisticated and innovative terrorists have become and how complicated it is for country like Bangladesh to develop and coordinate all of the necessary security measures to counter such threats.

Cross Jurisdictional Boundaries Electronically. Cyberspace is a virtual place beyond the jurisdictional boundaries and it is difficult to address with territorial approach. Law was actually a territorial concept so long as we did not have any kind of familiarity with computer, Internet and cyber space. So, existing laws or legal principles whether domestic or international character comprise territorial approach. Therefore, the traditional principles of jurisprudence or of the legal philosophy need to be revised to cope with the cyber necessity. Cyberspace being an international territory claims a substantial recognition in the arena of international law, which will open the door of the trial of cyber offender under a previously systematised set of laws.

No Physical or Human Evidence. In the traditional investigative procedure, physical evidence plays the pivotal role to discover the truth. But in case of cyber offence, the offender's location, profile, identification, physical evidence remains an enigma to the investigator. Cyber attackers can conduct their operations remotely from anywhere in the world and there are no physical barriers or check points to cross. As such, the actions of cyber criminals are very difficult to track and they can comfortably hide their personalities and location.

CYBERCRIME AND BANGLADESH – VULNERABILITY AND PREPAREDNESS

A Picture of Cybercrime – Bangladesh Perspective

Cybercrime is a contemporary phenomenon to Bangladeshi people. Although presently Bangladesh is not as vulnerable to cybercrime as the developed countries are, but there is little room for complacency. Once 'Digital Bangladesh' comes in reality, we will certainly face the critical situations that are being suffered globally. At the moment, Bangladesh is not aware of her cyber security. Though computer is becoming a common household item and the number of Internet users has already crossed ten million, very few computer-related offences are reported to the police. However, a few of the major cybercrime incidents that bring to the notice of the public are discussed below:

On 23 August 2004, an e-mail was sent to the Bangla daily Prothom Alo, containing death threat to Sheikh Hasina, the then leader of the opposition in parliament. Two days later, another e-mail received that also contained death threat for Khaleda Zia, the then Prime Minister, her eldest son and some members of parliament. These were the first two incidents of cybercrime.

In 2008, the website of the Rapid Action Battalion (RAB) was hacked. The hacker, Shahee Mirza wrote on the RAB website, 'You do not know what the cyber security is or how to protect yourself' [The Daily Star, 6 September, 2008]. Following his arrest, he confessed that he had hacked not only the RAB website but also several local and international websites, including that of the Bangladesh Army.

On 21 March 2010, 19 of the 64 district web portals were hacked, immediately after inauguration by the Prime Minister on 10 January. This was the last known invasion in the government's cyber territory and reportedly the first criminality by foreign hackers.

Social Defamation and Privacy Violation. Exploitation of Social Networking and Chat sites leave our population, especially the younger generation vulnerable to different types of social attacks. Password cracking or cheating is a common crime done by juveniles in Bangladesh. These crimes are mainly committed by doing fun through facebook. Apurbo and Sohana Saba, popular drama-artists, disclosed that someone had opened facebook account by their name and photo, and used this as camouflage of cheating people. In Pirojpur, a student leader lured a class X student to a love trap, raped her and recorded it in a cell phone. The video footage reached local youths through cell phones, flash drives and CDs, which are now on sale in video stores. These are a few incidents how cheats blackmail girls and popular personalities using cyber technique.

National Values, Belief and Faiths. Bangladesh is all along known to be an embodiment of a moderate society characterized by liberally practicing religious people with high resilience, forbearance, modesty and strong attachment to the traditional culture, values and belief. Malicious and clandestine propaganda through Internet may impair the harmonious social bondage and where people of various faith and sectarian views live in peace and harmony. Teen agers who use Internet have been more prone to pornography than the use of huge scholastic exploration in the domain which is highly antithetical to the mores, faith and values embedded in the society of Bangladesh. Thus cybercrimes have a devastating effect on the traditional cultural and religious values and erode the moral values by the strong dominance of the negative character of western culture.

Economics and Finance. Although cyber attacks have caused billions of dollars damage in financial sector, we have yet witness the implications of a catastrophic cyber attack in Bangladesh. Cyber attackers generally disrupt the banks, the international financial transactions, the stock exchanges. 'The impact of cybercrime is not as alarming in Bangladesh because financial transactions have not yet been fully facilitated online,' says Freddy Tan, chief security advisor of Microsoft Southeast Asia. He warns that as soon as financial transactions are allowed online computer crimes will increase at an unprecedented rate, unless the government acquires the tools and infrastructure to prevent, detect and prosecute them.

Embedded Threats. Modern equipment comprises of number of systems and sub systems, of which embedded systems are used by all critical sectors of economy including Armed Forces. Today's chips contain millions of integrated circuits that can easily be configured by the manufacturer so that they also contain some unexpected functions. They could be built so that they fail after a certain time,

blow up after they receive a signal on a specific frequency, or send radio signals that allow identification of their exact location – there are innumerable possible scenarios. Bangladesh does not have any sanitisation agency at the National level and large amount of 'commercial off the shelf' equipment and weapon systems in our inventory are ex Import. Any deliberate attempt by our adversaries by planting malicious codes in the embedded systems could result in a catastrophe.

E-espionage and Cyber War. In cyber war computers are simply another tool, to be used by these same people for espionage. Our adversaries may conduct e-espionage on our government, university research centres, industries and Armed Forces. They may also seek to prepare for cyber strikes during a confrontation by mapping our e-governance information systems, identifying key targets, and lacing our infrastructure with back doors and other means of access. During crisis, adversaries may seek to intimidate the Nation's political leaders by attacking Critical Information Infrastructure (CII) thereby eroding public confidence in the political system. Bangladesh is utterly exposed to this dangerous espionage threat and we are hardly prepared to combat this.

State of Awareness and Preparedness

Government Organisations. State of awareness among the public servants to guard against cyber attack is disheartening. No dedicated organisation has been devised exclusively to handle cyber related issues. However, Bangladesh Telecommunication Regulatory Commission (BTRC) coordinates cyber infrastructures as a part of communication domain. In the absence of proper organisations and agencies dedicated to different domains of information security no worthwhile initiatives can be taken to secure critical national information infrastructure. The government has already taken some initiatives, the project; 'access to information' working under Prime Minister's Office is a case in point.

Corporate and NGOs. NGOs and corporate offices are better equipped with computer and Internet than public offices. Most of the senior executives are at ease in communicating through e-networking system. Some of the IT officials have fair knowledge on cybercrime but other than few reputed organisations cyber security awareness have not got due importance. Larger corporate bodies and reputed NGOs have adequate resources and skill to guard against cyber attacks and even capable to share experiences with public offices. But they need national cyber guidelines and regulating authority to skillfully safeguard their network and computers.

Legal Dimensions and Law Enforcement Agencies

Laws and Relevant Issues. The government of Bangladesh has shown a positive approach by formulating some policies and Acts as safeguards for cyber victims. Namely, the National ICT Policy, Cyber Law, Information Technology (Electronic Transactions) Act (ITETA 2000). Latest enacted 'Bangladesh Tatha O Jogajog Projukty Ain 2006' (ICTA 2006) has made provisions to development of information technology and brought the cyber criminal within the ambit of criminal jurisdiction. The Act is comprised with nine chapters with 90 sections. Even for the speedy and effective disposal of cases, government can also establish one or more cyber tribunal. If the accused is absconded, tribunal can try the case in absentia. Punishments for such crimes range between six months to 10 years in jail with financial penalties.

Cybercrime Control Component. In Bangladesh cybercrime seems to be still a low priority for the police. As our police have not been furnished with modern techniques and technology to investigate even traditional crimes, we cannot expect them to acquire the necessary skills overnight to investigate the most complicated hi-tech computer-related crimes. However, Bangladesh police set up a special outfit to curb cyber crimes in 2007, which is the country's first policing unit against such crime. Presently two special units are operating under Crime Investigation Department (CID) at Dhaka and Chittagong of strength 10 each. These are at very rudimentary stage and presently dealing with cell phone related petty crimes only. RAB is also laying emphasis on gearing up its capacity to combat technology-based terrorist activities. But there is not much initiative in the present police training system to grow proficiency in investigating cyber related crimes. However, various organizational and procedural aspects to deal with these hi-tech crimes are being formulated. Presently, under an act, all telecom and Internet service providers are to maintain log of all their customers and such data are to be produced on demand to any designated enquiry officer from Law Enforcement Agency.

Difficulties to Investigate Cybercrime.

a. Under the ICTA 2006, crimes are non-cognizable (Section -76(2) and police cannot go for investigation without warrant. This has taken away freedom of investigation from law enforcing authority.

b. Presently other than two special units under CID, no other police establishment are capable to handle cybercrime issues and these units seriously lack trained investigators, equipment and manpower.

c. Difficulty in defining the crime, jurisdictional issues, detection techniques and collecting digital evidence are also complicated area in investigating cybercrime.

d. There is no special analysis site in conformity with global secure police communication system to provide real-time monitoring of cyber activities.

e. Digital forensic laboratory for investigation and detection of cybercrime with professional experts are essentially required, which we seriously lack.

RESPONSE STRATEGY TO FIGHT CYBERCRIME

General

To respond to cyber threats government has initiated both comprehensive prevention and enforcement measures. First and foremost, we need to formulate a National Cyber Security Policy which would guide to all officials, citizens, businesses and individuals on cyber issues. A strong regulatory framework along with enacting stringent laws is also necessary. Some of the key facets to combat cybercrime are enumerated in subsequent paragraphs.

Educate People – A Concerted Effort

Education contributes to developing a layer of defence in deep security approach and constitutes a real human capacity to help the governments in defeating cyber challenges. Human resource development and appropriate cyber security education programs should exist at several levels (school, college, university) in all cyber security fields. Educational programmes should be effective and available for each kind of stakeholder, i.e. policymakers, justice, police and military professionals, business managers, information technology professionals and end-users. Educational programmes should also include curriculum comprise with moral and social ethics and users' code of conduct for the future IT fellows not to use the technology in a morally reprehensible manner.

Constitutional Provisions

The protection available under the constitution of any country is the strongest and the safest one since it is the supreme document and all other laws derive their power and validity from it. If a law satisfies the rigorous tests of the Constitutional validity, then its applicability and validity cannot be challenged and it becomes absolutely binding. The constitution of Bangladesh, like other constitutions of

the world, is organic and living in nature and is capable of moulding itself as per the time and requirements of the society. The menace of cybercrimes can be effectively curbed, if not completely eliminated, if the three sovereign organs of the constitution work collectively and in harmony with each other. Further, a vigilant citizenry can supplement the commitment of elimination of cybercrime. These are discussed in subsequent paragraphs.

Organisational Undertakings and Obligations

Strengthen Law Enforcing Agencies. To fight against cyber criminals a highly professional and extraordinarily well-equipped law enforcing agency is of paramount importance. 'Cyber incident response unit' and 'cyber crime investigation cell' should be set up at least every divisional headquarters within law enforcement mechanism. Subsequently such outfit may be expanded up to district level by enhancing 'capacity', good police work, skilled investigators, training in the field and providing adequate logistic support. There is also a need to share expertise with other members of Interpol who are technologically advanced. A special analysis site in conformity with global secure police communication system should also be developed which would provide real-time monitoring of cyber activities.

Develop "Computer Emergency Response Team (CERT)". CERT and Computer Security Incident Response Team (CSIRT) are organizations responsible for providing accurate, timely and trusted security information for threat and vulnerabilities carry out awareness and advance warning and assist its constituents in mitigating computer security incidents. Bangladesh CERT (BDCERT) was formed in July 2007 and started its operation fully on15th November 2007 but yet to be recognized by the government. It started its journey with few self motivated individuals on a voluntary basis. BDCERT was approved as General Member by APCERT December 2008 in and by OIC-CERT in January 2009. BD CERT is still in its formative stage. It also works along with other CSIRTs in the region and around the globe. However, it has no means to coordinate with law enforcement agencies as well as with medias for its operations.

Corporate Offices and NGOs Responsibilities. No government just alone can fight cybercrime, it needs active support of all actors of the society specially the NGO's and corporate bodies. A survey of the US National Institute of Justice revealed that the business and financial institutions comprise 46 percent of computer crime targets while the government comprises only 8 percent [Samuel & Charles, The Police in America]. So, corporate offices and NGOs must come forward to augmenting the governmental initiatives with money, logistics and

specialised manpower. Mumbai Cyber Lab is a unique initiative of police-public collaboration for training police officers in investigation of cybercrime. Bangladesh should follow this path and government should initiate dialogs with the NGOs, corporate bodies and donor organisations for sharing government's vision and tentative roadmap towards cybercrime free 'Digital Bangladesh'.

International Cooperation. There are a number of initiatives underway through international organizations on cyber cooperation. The Interpol has formed IT Crime Group that promotes best practices towards investigations to combat these incidents. The G-8's hi-tech crime sub-group prosecutes criminal and terrorist acts that make use of computer networks and other new ICTs. International Multilateral Partnership Against Cyber Threats (IMPACT) is another organisation formed in 2008 under the umbrella of UN global cyber security initiative. An understanding between Bangladesh and IMPACT has already been established to gain its support. Presently, BTRC is working on behalf of the government to tie up the accord. So are many international organisations working for similar objectives. Bangladesh needs to work in close coordination with these international organisations to safeguard her interests.

RECOMMENDATIONS

From the forgoing discussion certain recommendations are appended below for due consideration:

a. Formulate a National Cyber Security Policy as well as establish an entity for overall coordinating and directing responsibility. BTRC may be strengthened to develop as regulatory body of cyber related issues.

b. Create appropriate structures at all level with well-defined role and responsibilities so that human resources with adequate skills, knowledge and training are available to securely manage the information infrastructure.

c. Create awareness and build momentum. Conduct extensive media campaigns and other civic activities to build mass awareness on cyber criminal activities. Initiate programmes to educate everybody about their cyber right and also edify parents on how to filter harmful Internet contents.

d. Initiate dialogs with the NGOs, donor organisations and corporate bodies for sharing government's vision and tentative roadmap towards combating cybercrime.

e. Encourage senior officials of the government and public organisations

to learn basic operations of Internet with alertness for functioning independently.

f. Enhance law enforcement's capabilities for preventing and prosecuting cyber attacks.

g. Promulgate stringent laws towards the menace of cybercrime. Laws should create deterrence in the mind of criminals.

h. Every effort should be made for international cooperation to enable the information sharing, reduce vulnerabilities, and deter malicious users.

j. A national level agency may be created for sanitisation of hardware, software and computer related gadgets specially used in sensitive organisations.

CONCLUSION

Our reliance on networks will only continue to grow in the years ahead. There is a constant need to review cyber strategy as technologies advance, as threats and vulnerabilities change, and as understanding of the information security issues improve. It is not possible to eliminate cybercrime from the cyber space. It is quite possible to check them. History is the witness that no legislation has succeeded in totally eliminating crime from the globe. The only possible step is to make people aware of their rights and duties and further making the application of the laws more stringent to check crime. Computer and information security, data protection, and privacy are all growing problems. No single technology or product will eliminate threats and risk. Securing our computers, information, and communications networks secure our economy and our country. Finally, it may be submitted that the collective effort of government and the people is only a possible way to see the peoples' dream of a Digital Bangladesh in existence and could protect individual and national security of the state from the aggression of cyber criminals. Remember our new enemies are just a mouse click away!

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70. Professor Jamilur Reza Chowdhury, Former Vice Chancellor, BRAC University and Former Professor of BUET, on 21 July 2010 at 11 am.

Author

Brigadier General Md. Khurshid Alam was borne on 23 March 1960 and commissioned in the Corps of Signals in December 1980. In his long career in army, he served in command, staff and instructional appointments. He commanded two signal units and was Commandant of 'Centre and School of Military Police, Education and Administration' (CSMEA) and 'Signal Training Centre and School' (STC&S). In addition to regimental staff appointments, he was Brigade Major, Grade 2 Staff at Military Training Directorate, and Grade 1 and 2 Staff at Military Operations Directorate at Army Headquarters. He also served as Director of Directorate General of Forces Intelligence (DGFI). His instructional appointments include Platoon and Term Commander in Bangladesh Military Academy (BMA) and Chief Instructor in Army School of Education and Administration (ASEA). In the United Nation peacekeeping mission, the officer worked as a military observer in Namibia (UNTAG, 1989-90) and as contingent member in Sierra Leone (UNAMSIL, 2001-02). Brigadier General Alam attended many courses at home and abroad including Junior Command in India. He is graduate of Defence Services Command and Staff College (DSCSC) and National Defence College (NDC) of Bangladesh. He also holds Masters Degrees in Defence Studies and Business Administration. He visited many countries across the globe.

MODERNIZATION OF FIRE SERVICE AND CIVIL DEFENSE - A NEED OF THE TIME

Joint Secretary Syed Mustafizur Rahman, ndc

INTRODUCTION

Bangladesh Fire Service & Civil Defense (FS&CD) Directorate is a government organization aimed at promoting public welfare and security. It is the first responder organization to help and rescue life and property of jeopardized people at any natural or man made calamity. Bangladesh is a natural calamity prone country due to its geographic location. Very often it undergoes such disasters with huge loss of lives & properties almost every year. Apart from these there are instances of fire[1], collapse of buildings, water transport capsize, cyclone, flood etc which sometimes appear very painful & embarrassing on the part of the country. There is also risk of earthquake which might cost unbearable situation for densely located old and new buildings[2] of Dhaka and other cities of the country. Department of Fire Service and Civil Defense is the only organized institution to extinguish fire, encounter accident, rescue injured locked people, give emergency first aid, ambulance services for patients, etc. It also imparts security and first aid training to people of different government & private organizations.

With the advancement of technology, conflict between states on different issues and ideologies have come forward. Modern warfare technique[3] is able to spread swiftly inside the territory of the opponent country causing irreparable damage to it. The technology based air power has the radical capacity to shape battlefield now a day. It has unique ability to influence the outcome of a conflict at any level of warfare. The ready instance of it was Japan's raid on Pearl Harbor in 1941 and recent US led air attack in Iraq during Gulf war. To address such situation beforehand there is no alternative to proper civil defense structure, management and training. Bangladesh, as a small country, with its vulnerable geographic location may be subject to such attack any time. Civil Defense involves a variety of practical measures to protect civilians in war and natural disasters .The purpose of Civil Defense is to ensure protection of civilian lives & properties including maintenance of utility services. The major task of Civil Defense[4] includes warning system, arrangements for evacuation, management

1. Yearly fire data-2009 by FS&CD Directorate
2. Protection of civic life of Dhaka city during earth quake –research paper by ARDOC Mymensingh, page -1 para-2.
3. Protection of civic life of Dhaka city in the face of hostile air campaign- research paper by ARDOC Mymensingh, page-1 para-1
4. Civil Defense Manual-1950, page 15, 17, 18, 58

of shelters, fire fighting & rescue, medical services including first aid, repair of indispensable public utilities and safeguarding objects essential for survival. So, the importance of Civil Defense in Bangladesh need not to be emphasized more.

The existing management and organizational aspect of fire service & civil defense in Bangladesh is not up to the mark. It has measured lacking in necessary modern equipments as well as shortage of manpower. Moreover the Civil Defense side is almost neglected & inactive as if it is thought that Bangladesh is not supposed to face any warfare situation in future. But this thought is not wise and safe as a sovereign nation. So considering the practical situation, the Fire Service & Civil Defense Directorate needs to be given due attention to examine its present capability in detail and take necessary measures enabling it to cope with the intensity of changing future disasters both natural and man made.

The study recommends a reasonable Fire Service & Civil Defense structure which will cater to the need of the time. It also aims to assess the existing capability of The FS&CD Directorate.

An Overview of the FS&CD Directorate of Bangladesh.

In 1982 The Directorate of FS&CD emerged as a new organization under Ministry of Home Affairs with the combination[5] of Fire Service Department and Civil Defense Directorate of Ministry of Home Affairs and the Rescue Department of the Ministry of Communication. The aim of the organization is to protect human life and property during disasters both man made and natural.

Historical Background

As a new born nation Bangladesh inherited the Fire Service & Civil Defense organization from the then East Pakistan. From documents available it is learnt that the President of Pakistan promulgated an Ordinance in this respect known as "The East Pakistan Fire Services Ordinance,1959" with a view to maintenance of fire brigade, licensing of warehouse & for certain other matters. Under the provision of this ordinance a rule was framed titled "The East Pakistan Fire Services Rules, 1961". The ordinance of 1959 was amended in 1970. After emergence of Bangladesh it owned "The East Pakistan Fire Services Ordinance" 1959 & "The East Pakistan Fire Services Rules 1961". The Ordinance of 1959 was amended in 1974 and the Rule of 1961 was amended twice, once in the year 1999 and next in 2000. At the last, the government of Bangladesh framed a law with a view to fire prevention, extinguishing and rescue operation of fire in

5. Protection of civic life of Dhaka city during earthquake- a research paper by ARTDOC page no.12

2003 known as – 'Ogni Protirodh O Nirbapon Ayn, 2003' Besides, Bangladesh succeeded Pakistan's structure of Civil Defense Organization and enacted 'The Civil Defense Act, 1952'. Its role and function during peace & war time is still in place. Though its name bears the function of Civil Defense, in reality the Civil Defense parameter of this organization did not flourish accordingly.

Existing Structure & Management

The organogram of FS&CD Directorate of Ministry of Home Affairs shows that the organization is headed by a Director General. There are 3 directors, 11 Deputy Directors, 28 Assistant Directors, 69 Deputy Assistant Directors, 44 Senior Station Officers, 217 Station Officers with a total number of 6,343 officials in 90 different categories. Among those 46 first class officers, 141 second class officers, 5813 class three officer/staffs and 343 class four employees.

Six Divisional offices are headed by 6 Deputy Directors , 21 greater district headquarter offices headed by Assistant Directors, & 64 district offices are headed by Deputy Assistant Directors throughout the Country. The main Operational Units i.e. Fire Stations are headed by Senior Station Officer/Station Officers. Total Number of existing Fire Stations is 215 and construction of 154 new Fire Stations is going on under four projects. There are nine river fire stations. It has a training institute at Dhaka headed by a Principal.

There are four workshops which are located in Dhaka, Chittagong, Rajshahi and Khulna. Maintenance & repair of vehicles and fire fighting equipments are done here.

Civil Defense Aspect of the Organization

Before creation of the Directorate of Fire Service & Civil Defense in 1982, Civil Defense Organization had separate identity, structure and management. Its aim was to protect the Civilian lives & properties during war and peace time. So this organization had a post of Director known as Director Civil Defense, under him there were several Deputy Directors and Assistant Directors with some staffs . In the District and Sub Division level Deputy Commissioner (DC) and Sub Divisional Officers (SDO) respectively were the Ex- Officio Controllers of Civil Defense. There were Deputy Controller and Civil Defense Officers at District level and Assistant Controller at Sub division level who belonged to Civil Defense department and were under the command of D.C and S.D.Os regarding functions of Civil Defense. D.C and S.D.Os were responsible for executing all Civil Defense schemes, organization & training of the Civil Defense Services in the District and Sub divisions respectively.

There was warden service[6] the function of which was to assist and advise the public in observance of Civil Defense measures in emergency situation. Apart from these, there was a training academy and a training school in Dhaka. All officers and officials related to the function of Civil Defense would have been trained here. In the district & sub-division level students-teachers of educational institutes, officials of government, semi government and private organizations were given essential emergency training[7].

Manpower

Manpower statement of the organization shows that 5939 staffs are presently working against 6343 sanctioned posts. 404 posts are lying vacant. Among those, out of 46 class-1 posts 21 posts are vacant, out of 141 class-2 posts 56 posts are vacant, out of 5813 class-3 posts 311posts are vacant and out of 343 4th class posts 16 are lying vacant. . For smooth running of the functions of such an important organization shortage of manpower is a hurdle. The Directorate has proposed additional 441 manpower against 51 different posts to the Ministry of Home Affairs to gear up capability of the organization.

Vehicle – Pump and Equipments

The position of necessary equipments of the organization shows that large number of equipments like Turn table ladder (TTL), snorkel, emergency tender, home tender, breakdown van, lighting unit, chemical tender, fire float, rescue speed boat, heat protect suit, breathing apparatus, helmet, gumboot, rescue command vehicle, forklift are running short as per TO&E. Most of those equipments are very essential for fire fighting & rescue, building collapse and oil/chemical fire extinguishing cases.

Rules and Regulations

'The East Pakistan Fire Services Ordinance, 1959' & 'The East Pakistan Fire Services Rules, 1961' are still applicable in Bangladesh. After liberation the Rule of 1961 was amended twice, once in the year 1999 and the other in 2000. At last the government of Bangladesh framed an Act with a view to fire prevention, extinguishing and rescue operation of fire in the year 2003 known as –' Ogni Protirodh O Nirbapon Ayn 2003' but no rule is yet framed under it. The directorate sent such a proposal to the Ministry of Home Affairs in 2008.

Besides, Bangladesh owned Pakistan's structure of Civil Defense Organization and enacted 'The Civil Defense Act, 1952'. Its role and function during peace & war time is still in place.

6. Civil Defense Manual-1950, p.27
7. Civil Defense Manual 1950, p.14

Limitations of Present FS&CD Organization

On examination of the present structure & management, manpower, equipments, etc. of the Directorate of FS&CD and basing on key informant interview, few case studies, an opinion survey from all walks of life, some limitations of the organization were identified. Furthermore informal discussion with staffs and related documents revealed some points of dissatisfaction among the staffs of the organization.

On analysis of the information about constraints of existing Fire Service & Civil Defense Organization which remains on the way to its becoming a dependable ideal resort for people in moments of disaster is identified as follows:

Establishment of Fire Stations in Each Upazilla: It is essential to establish at least one Fire Station in each Upazilla to cover all parts of the country under Fire Safety net work.

Shortage of Manpower: At present 404 posts are lying vacant out of the sanctioned posts as per TO&E. The Directorate has proposed additional 441 posts in 51categories for smooth running of its function. Shortage of necessary manpower is a vital back log for such an organization for smooth running of its function.

Shortage of Modern Equipments : The organization is running short of a big number of very essential disaster fighting equipments, among those – Turn table ladder (used for fire fighting in high rise building), Snorkel (used for fire fighting & rescue), Emergency tender (used in case of building collapse), Foam tender (used for fire due to oil), Chemical tender (used in case of fire due to chemical) are mentionable. These equipments need to be available in all the 44 class-1 Fire stations. Moreover for modernization of the organization the Directorate produced another list of 69 kinds of essential equipments to the researcher which was sent to the Ministry of Home Affairs for approval. An organization dealing with very important security aspect of the nation should be looked after with due care and priority.

Need for Advanced Training : Since Bangladesh is a disaster prone country and the nature & intensity of different disasters do not care any prediction, the members of FS & CD need to be given latest and modernized training at home and abroad so that they can cope with the forms of disaster.

Inactive Civil Defense Structure and Function : Before creation of The Directorate of Fire Service & Civil Defense in 1982, Civil Defense Organization

had separate identity, structure and management as per 'Civil Defense Act, 1952'. Its aim was to protect the Civilian lives & properties during war and peace time. But now there is no structure, management and function of Civil Defense. Only there is a part of civil defense in the Basic training curriculum at Fire service & Civil Defense Training Center, Mirpur, Dhaka. In case of any sudden warfare the nation might have to face very hard situation.

Circumstantial Hazard While Addressing Disaster:

In most of the fire incidents circumstantial hazards stand to be a major obstacle in fire fighting measures. The salient features of these obstacles as found in the case studies and opinion of the operational staffs are as follows :

- Fire service is not informed in time.
- Exact location is not given which causes delay of the fire units to reach the spot.
- Very narrow approach lane or road.
- Unauthorized shops/stalls, construction materials on lanes.
- Unplanned digging of lanes/roads.
- Unplanned electric, telephone & dish cables on roads.
- Want of water source near the spot.
- Chaotic situation created by mob or unwanted visitors.

It is necessary to remove these hazards in an integrated way with the help of concerned departments or agencies. People need to be sensitized.

Implement and Enforce Regulations on Fire Safety: From the case study of Bashundhara shopping mall fire incident it is known that the incumbent organization violated approved plan of RAJUK in constructing floor plan of the mall. The terms & conditions of high- rise building mentioned in the clearance certificate of Fire Service & Civil Defense directorate is violated by the organization. There was no fire exit or fire lift. Bangladesh National Building Code (BNBC) was not followed. But in fact no authority took any legal step against those illegal activities of Bashundhara authority. If necessary legal action was taken in time such problem would not have arisen.

Discriminatory Position of Certain Officer/Staffs of FS & CD : Since the pay scale of Station Officer and Fire Man were higher than those of Sub-inspector and Constable of Police before Liberation and at present the pay scale of Station Officer &Fire Man have been lower than those of the police member.

It is obvious that such discriminatory and humiliating step is bound to reflect negative impact on the efficiency of concerned officials.

Welfare of Officer/Staffs: Welfare of Personnel is closely linked with their efficiency in work. So, it is wise to ensure their security aspect duly. The 'Fire Service & Civil Defense Risk allowance Rules-2007' which was sent to the Ministry of Home Affairs need to be examined & taken care of.

Initiative from the Government for Modernization

Recently the Government has decided to modernize the Organization after the tragic Nimtoli fire incident. Establishment of 156 new Fire Stations under 4 projects are going on. Earlier the Directorate sent a proposal for approval of additional 441 Posts in 51 categories and 69 kinds of essential Fire fighting equipments and 7 Development Project proposals for modernization of the Organization to the Ministry of Home Affairs. Apart from these with the help and funding of Comprehensive Disaster Management Program (CDMP), community level training (Pilot Project) is given to 1000 volunteers identifying the vulnerable earthquake prone areas of Dhaka, Sylhet and Chittagong initially . In this way a total of 62,000 volunteers will be developed under Community Level Collapse Structure Search & Rescue (CLCSSR) training course.

But from the study it is realized that those initiatives were not enough to update the capability of the organization to address disasters of the time. Because apart from the areas of Govt. initiatives there are some areas without developing those the end of modernization will not be fruitful.

Priority Areas Need to be Modernized

Need to Shift the Purview of the Ministry:

The function of the directorate of FS & CD is very much related to disaster management. It has no functional similarity or belongingness to the Ministry of Home Affairs. So, there is no justification of its remaining under the purview of the MOHA. On the other hand we have no isolated disaster management ministry. There is a Disaster management bureau under the 'Ministry of Food and Disaster Management'. So, considering the importance of various and recurrent disasters in our country it is high time to establish a separate ministry named 'Ministry of Disaster Management' and to address disasters in an integrated & effective way- FS&CD directorate, Disaster Management Bureau and Space Research and Remote Sensing Organization (SPARRSO) should be brought under that ministry. The new ministry should be under control of the Prime Minister.

Establishment of Fire Station in Each Upazilla:

At least one Fire Station need to be established in each Upazilla to cover fire safety to all parts of the country.

Establishment of Fire Stations in Certain Industrial & Densely Populated Districts:

As per proposal of commerce Ministry, projects for establishing fire stations. In 17 places of 12 Industrial & densely populated districts need to be implemented in time. Besides these as per risk in Metropolitan areas number of fire stations need to be increased.

Manpower:

The vacant posts as per TO&E should be filled in urgently. The additional manpower as suggested by the Directorate need to be recruited soon.

Equipments:

The total number and kinds of disaster fighting equipments proposed by the Directorate for capacity building of the organization need to be procured on priority basis

Implementation of Development Projects:

The Development Projects Proposed by the Directorate need to be Examined and considered duly in time.

Advanced Training:

All personnel concerned with disaster fighting need to be given specialized training at home and abroad.

Activation of Civil Defense Structure & Function:

Civil Defense aspect has a broader range of disaster addressing capability both man made and natural. It renders a sustainable preparation in case of any sudden warfare situation or earthquake which is not possible by the present Fire service & civil defense structure and management. So, it needs to be revived in the light of 'The Civil Defense Act, 1952'.

i) Special & updated curriculum need to be introduced in schools and colleges about emergency preparedness.

ii) Civil Defense training program should be reinforced in Districts and Upazilla level with updated curriculum. People of all walks of life need to be brought under this training program.

iii) Documentary films should be shown on it in interior parts of the country for sensitizing the common people.

iv) Warden Service needs to be activated properly.

v) District and Upazilla Civil Defense activities should be revived.

Circumstantial Hazard During Disaster Addressing:

To avoid this obstructive situation people of all walks need to be sensitized first. All local government organizations should take active roles for it. Department's concerned need to ensure that the lanes/roads do not go under unauthorized occupation & remain clear.

Implement and Enforce Regulations on Fire Safety:

Implementation of fire safety regulation, Bangladesh National building Code (BNBC) regulations and RAJUK approved plan need to be ensured strictly. Concerned authority should spare no scope to bypass those. If necessary, Law should be enacted to keep it beyond the jurisdiction of the courts like that of land acquisition by the Government.

Establishment of Media Center:

A media center needs to be established to develop consciousness among people about various aspects of disaster preparedness.

Discriminatory Position of Certain Personnel of FS&CD:

Pay scale and status of The Station officer/Staff officer and Fire man should be redressed after proper examination for the sake of their job satisfaction.

Welfare of Personnel Engaged in Operational Task:

The draft of the 'Fire Service & Civil Defense Risk Allowance Rules-2007' which contained proposal for compensations in case of death, full and half invalidity of the personnel during operational task need to be examined & considered. The matter of approved risk allowance by the Finance Ministry need to be reviewed by inclusion of all the Officers & staffs of the organization with enhanced rate as was proposed by the directorate, because they belong to the essential service category involving high risk.

Fire Service & Civil Defense Model of Singapore

Due to similarity in roles and functions, the Singapore Civil Defense Force (SCDF) and Singapore Fire Service (SFS) were formally integrated in 1989 and the organization was named 'Singapore Civil Defense Force' (SCDF). The SCDF is under the purview of the Ministry of Home Affairs. The main role of SCDF is to provide fire-fighting, rescue and emergency ambulance services, mitigating hazardous materials incidents, as well as formulate, implement and enforce regulations on fire safety and civil defense shelter matters. The SCDF also actively engages the local community through its wide-ranging public-educational programs and community- based activities to enhance the resilience and emergency preparedness of the civilian population. Bangladesh Fire Service & Civil Defense directorate is also under the purview of the Ministry of Home Affairs. The aspect of organizational structure of SCDF is like that of Bangladesh FS&CD. In Singapore the units are separate which are not in Bangladesh. However, the nature of jobs is same. The Organizational head of SCDF is called 'Commissioner', where as in Bangladesh the same is called 'Director General'. In Singapore there are two wings headed by two directors under the 'commissioner', they are – 'senior director (emergency services)'and 'senior director (corporate services)'. In Bangladesh there are three directors under the Director General, the third one is director(development, training & planning). The important lacking in the Bangladesh FS & CD is that it has no medical department/services. Recently the DG has proposed for a 20 bedded burn unit with hospital in his development projects proposal. The training unit needs to be totally isolated like that of Singapore. Because training is the most vital and basic need in the organization.

RECOMMENDATIONS

Due to the recurrent nature of disasters - both man made and natural, and considering the grave losses of lives and properties due to those in a disaster prone country like Bangladesh, it is the need of the time to take necessary action without further delay. From the above study on the subject, the following measures are recommended to modernize the Fire Service & Civil Defense Directorate:

i) A new Ministry under the control of the Prime Minister named -'Ministry of Disaster Management' should be established. The directorate of FS & CD, Disaster Management Bureau and SPARRSO need to be brought under this new Ministry.

ii) Medical Services/Hospital unit need to be established under this organization.

iii) Training side need to be isolated and made separate unit.

iv) Civil Defense aspect need to be activated as per 'Civil Defense Act,1952'

v) Introduce latest curriculum of disaster preparedness in schools and colleges.

vi) People of all walks of life up to remote places of the country should be brought under disaster preparedness training program. Documentary films on it may better serve the purpose.

vii) Warden Service needs to be revived in districts and upazillas.

viii) Ensure establishing Fire stations in each upazilla and important Industrial areas of the country.

ix) Post and recruit necessary manpower for the Directorate.

x) Ensure supply of necessary modern fire fighting equipments as per requisition of the Directorate.

xi) Impart advanced training to concerned officials at home and abroad.

xii) To remove circumstantial hazard during addressing disasters, integrated efforts need to be taken with the help of concerned departments/ organizations. Steps need to be taken to sensitize people by the Local Government Agencies and Administration.

xiii) Formulate, implement and enforce regulations on fire safety and civil defense matters.

xiv) Welfare aspect of the Personnel should be taken care of and the draft proposal of 'Fire Service & Civil Defense Risk Allowance Rules-2007' need to be examined.

xv) Discrimination in the pay scale of station officer and fire man need to be examined and considered properly.

CONCLUSION

Disaster is a recurrent and inevitable phenomenon in the lives of the people of Bangladesh. With the advancement of technology and knowledge, the scope of protection has developed. What we need is well preparedness, knowledge and logistic support. Above all, commitment of the government and people's cooperation are guiding factors for it. There is no way but to enhance the capability of FS & CD reorganizing its structure and management to cope with the disasters of the time. Simultaneously, people of all walks of life need to be sensitized about all aspects of disaster.

The suggested measures should be given due importance. The memories of the tragic incidences of Nimtoli, Bashundhara and Taltola slum fire incidents, some tragic building collapses of very recent past are still fresh in the minds of Bangladeshi people. If any earthquake at Richter scale 6 occurs, the impact will surpass our imagination. Moreover we need to have technical knowledge about what necessary measures to be taken during air attack or warfare situation. So, modernization steps of the Fire Service & Civil Defense Directorate on the suggested areas need to be taken on priority basis.

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Author

Syed Mustafizur Rahman hails from Khulna, Bangladesh in 1954 . He had his Honours Graduation in English from Dhaka University in 1977 and joined Bangladesh Civil Service (Administration Cadre) in 1983 as a member of BCS-1982 regular batch. He started Career as an Assistant Commissioner & Magistrate and successively held positions of Upazila Nirbahi Officer, Additional Deputy Commissioner, Secretary, Board of Investment, Deputy Commissioner, Private Secretary to Minister, Member, Rajdhani Unnayan Kortripokho (RAJUK), Joint Secretary in the Ministries of Health & Family Welfare and Home Affairs. He traveled Singapore, Thailand, India, Malaysia, Indonesia, Australia, Srilanka, Nepal and France on various occasions. His hobby is roaming about in Village area, reading and listening to music that tell of Life & core feeling. Mustafiz is married to Nazneen, a house wife and blessed with two sons and a daughter. Elder son Shanto is an Executive Officer of Jamuna Bank Ltd. Younger son Komol is a fourth year student of bachelor of fine arts honours at Charukala Institute of Dhaka University and daughter 'Shashi' is a student of class seven. He is proud Grand father of 'Zaad' (8 months) with daughter-in-law 'Pranti'.

ALTERNATIVE ENERGY OPTIONS FOR BANGLADESH

Lieutenant Colonel S M Ali Azam, afwc, psc

"Because we are now running out of gas and oil, we must prepare quickly for a third change, to strict conservation and to the use of coal and permanent renewable energy sources, like solar power."

-Jimmy Carter
Televised speech, 1977

INTRODUCTION

Bangladesh (BD) is facing acute energy crisis due to shortage of fossil fuel reserve, chronic energy inefficiency and failure to harness alternative energy resources. She houses limited reserve of natural gas and coal, and imports huge quantity of petroleum products accounting billons of dollar to meet her energy need[1]. Till now BD couldn't source any alternative commercial energy. Many countries of the world are harnessing renewable energy (RE) to ensure sustained energy security. As per the International Energy Outlook 2009, RE alone contributed over 13.5 percent of world's total energy need in 2009[2]. Globally RE has added a new dimension in the energy sector providing green solution to energy crisis coupled with creating millions of green jobs. BD also has vast RE potential but couldn't yet explore this sector. Till now contribution of RE in BD is very minimal, and restricted to rural domestic needs only.

BD is basically a mono-fuel dependent country. About 90 percent of her electricity and 100 percent of urea fertilizer is produced using natural gas[3]. In all, country's 75 percent commercial energy is based on natural gas[4]. As of April 17, 2010, BD has a balance of proven gas reserve (P1) 6.93 Trillion Cubic Feet (TCF) and probable reserve (P2) is 5.5 TCF[5]. Under the present demand scenario, if P2 reserve could be converted into proved reserve, balance reserve is estimated to be sufficient up to the year 2014-2015[6].

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Bangladesh houses approximately 2,700 million tons of coal in five coal fields so far discovered, which is equivalent to about 37 TCF gas heat equivalents[7]. Globally, coal is the most abundant, least expensive energy source, and accounts for over 50 percent of US electrical energy, over 65 percent of Indian energy and over 70 percent of Chinese energy[8]. But BD yet couldn't explore her coal resources due to multiple reasons. If BD fails to exploit her coal resource shortly, she would face a severe energy crisis.

Energy inefficiency in BD is another issue that causes approximately 25 percent wastage of energy[9]. Energy inefficiency is evident in generation, supply, demand and end-users sides. Government of BD (GoB) immediately needs to check the energy inefficiency, and requires a gradual but rapid shift from gas to coal fuel for generating power. Simultaneously she should also harness RE energy resources. Under the present gas situation if the government does not secure alternative energy system at short, mid and long term basis, the country would soon plunge into energy insecurity.

ENERGY OVERVIEW OF BD: NONRENEWABLE

Gas Situation Analysis

SIZE OF THE GAS RESERVE IN BANGLADESH

Till now 23 gas fields have been discovered in BD. The estimated recoverable proved and probable (P1 + P2) reserve of the country is 21.05 TCF. Out of which, as of June 2009, a total of 8.37 TCF gas has already been produced and as such the left over proved and probable (P1 + P2) recoverable reserve is 12.43 TCF. The probable (P2) reserve needs to be converted into proved reserve (P1) through further appraisal/development drilling program. Summary of the remaining reserve is shown at Table 1.

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TABLE 1: SUMMARY OF GAS RESERVE			
Serial	Type of Reserve	Remaining Balance (TCF)	Remark
1	Proven (P1 with 95% probability)	6.93	Sufficient up to 2011
2	Probable (P2 with 50% probability)	5.5	Sufficient up to 2015
3	Possible (P3 with 10% Probability)	7.7	Sufficient up to 2019
4	Total	12.43	Excluding P3
5	Present requirement 0.7 TCF/year		
Source: Prof. Dr. Md. Hossain Monsur, Chairman Petrobangla, Financial Express, July 13, 2010 and Centre for Policy Dialogue (CPD), A Set of Proposals for the National Budget FY2010-11, April 17, 2010.			

Present Gas Demand Analysis. BD basically depends on natural gas as the prime source of energy[10]. Sector wise gas demand scenario is shown below at Chart 1. At present, average yearly gas demand of the country is approximately 0.7 TCF[11], and the projected demand growth is 10 percent[12].

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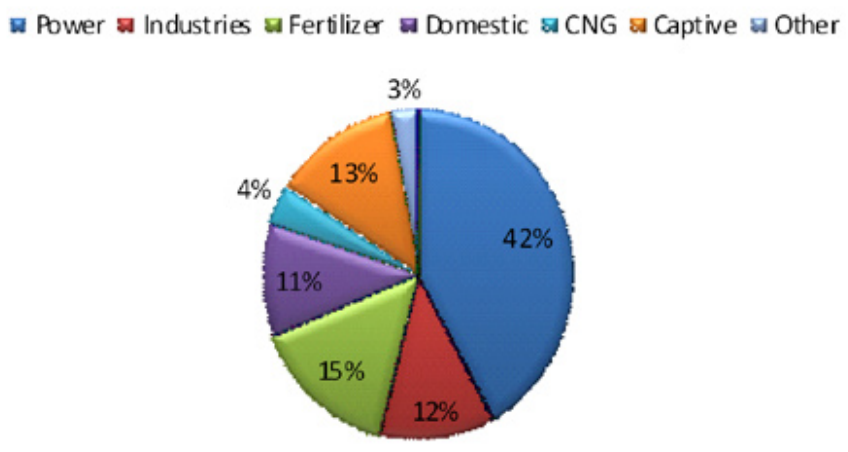
12. Petrobangla Annual Report 2008, p.37

Chart 1: Sector wise Gas Demand 2007-08



Source: PETROBANGLA Annual Report 2008

Present Gas Supply Scenario. As of April 2010, daily gas production capacity was about 2000 MMCFD against the daily gas demand of 2500(+) MMCFD, resulting in a daily gas shortage of about 500(+) MMCFD[13]. Presently BD's national power generation capacity is only 4000 MW against a peak demand of 6000 MW[14], causing a load shading of 2000 MW per day. Due to shortage of supply of gas 700 MW power generation is stranded.[15] Three of the fertilizer factories of BD are closed[16]. Production of all other industrial sectors is drastically reduced. Connection to new industries is stalled[17]. GDP has fallen down from 6.2 to 5.9[18]. Studies show that poor quality power supply costs the country as much as two percent in GDP growth each year[19]. According to a Dhaka Chamber of Commerce and Investment study (April 2010) at least 65 percent industries are victims of acute load shedding.

13. Prof. Dr. Md. Monsur Hossain, Bangladesh Indigenous Oil and Gas in Perspective, Energy and Power Magazine, Yearly Edition, June 16, 2010, p 29.
14. Mollah Amzad Hossain and Saleque Sufi, The Nightmare goes on, Energy and Power Mazagine, Yearly edition, June 16, 2010, p. 15.
15. Tamim M. Professor, Loc Cit.
16. Brigadier General Md. Anisuzzaman Bhuiyan, Power Crisis In Bangladesh – Is Nuclear Energy The Most Viable Option?, Dissertation Paper submitted in NDC, 2009, p.4.
17. Maqbul-E-Elahi Md, Wayout from Energy Debacle, Energy & Power Magazine, May 10,2010, p.20.
18. Asian Development outlook 2009,p.1, at http://www.adb.org/Documents/books/ADO/2010/BAN.pdf
19. Manzur ahmed, FTAC Prescription for Power, Energy and power Magazine, June 16, 2010, p.167

Coal Situation Analysis

Size of the Reserve. BD houses 0.26 percent of world's coal reserve amounting 2900 million tones[20]. As per the official report of May 08, 2010, the size of the reserve so far discovered, is about 2,700 million tons in five coal fields. Details of coal reserve are given below:

TABLE 2: COAL RESERVE IN BANGLADESH

Serial	Place/Field (Discovery)	Depth (Meter)	Area (Sq.km)	Proven Reserve (Million Ton)
1.	Barapkuria, Dinajpur (1985)	119-506	6.68	390
2.	Khalaspir Rangpur (1995)	257-483)	12.00	143(GSB), 685 (Hosaf)
3.	Phulbari, Dinajpur(1997)	150-240	30.00	572
4.	Dighirpar Dinajpur (1995)	327	Yet to be Known	200 (Partly evaluated)
5.	Jamal Ganj/Jaipur (1965)	900-1000	1600	1050
Total				3,040

Source: Professor M Tamim, PMRE Dept, BUET (mdtamim@yahoo.com), January 2009

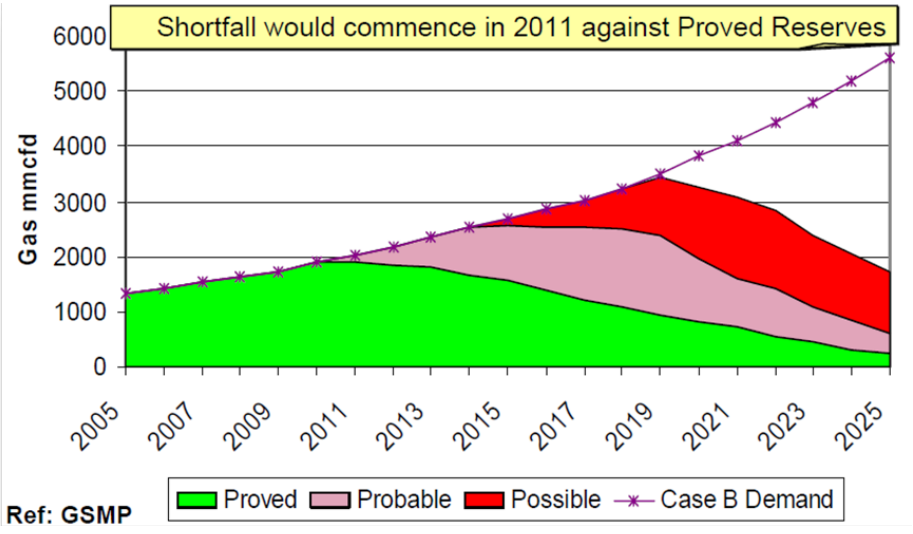
Coal Supply and Demand Analysis. So far BD could not explore her coal sector except for extracting 2.40 million metric tons. Most of the coal is being used in 2x125 MW mine mouth power plants and small portion are being used in coal based industries. Coal contributes to produce 250 MW power per day only. By achieving the full-targeted capacity, the coal will fire most of the commercial sector except for industries where gas is used as raw material.

20. 20 http://en.wikipedia.org/coal#world_coal_reserve, visited July 19, 2010.

Energy Sustainability Analysis

Demand and Supply Analysis. Projected demand and supply carve is shown at Chart 2 below.

Chart 2: Current Reserve Category: Supply and Demand Balance



Source: Professor M Tamim, PMRE Dept, BUET (mdtamim@yahoo.com), January 2009

From the chart it can be visualized that demand will continuously rise while gas reserve will be depleted. From 2011 the energy depletion will fall sharp. If new field is not discovered, the existing reserve will be exhausted by 2015.

Energy Sustainability Analysis. From the analysis it is evident that, under current scenario existing gas and coal reserve cannot meet the sustained energy need of the country beyond 2015. No gas from deep-water percentage sharing contract (PSC) can be expected within foreseeable short time. Again, it takes about five years to install a coal based PP, on the contrary a small RE PP takes only one year to be operational. If even the coal mining gets into full effect, yet the consumer sector e.g. power generation, industrial, transport and domestic etc are not ready to be fueled by coal. So the country has to harness alternative energy options to fuel her economy.

ENERGY SECURITY THROUGH ENERGY EFFICIENCY

Energy Security

Energy security is an umbrella term that covers many concerns linking energy, economic growth and political power[21]. Energy security has two key dimensions, reliability and resilience. Reliability means users are able to access the energy services when they require. Resilience is the ability of the system to cope with shocks and change[22]. Energy security is not a 'one day matter'. Long term measures to increase energy security center on reducing dependence on any one source, increasing the number of supplies, exploiting native fossil fuel or renewable energy resources, and reducing overall demand through energy conservation measures[23]. Indigenizing energy technology is also a key factor of energy security.

GoB has a vision to provide electricity to all by the year 2020[24]. But with its generation capacity, the estimated demand-supply gap is currently 2,000 MW in peak hours while gas shortages account for nearly half of this gap[25]. To connect all with electricity, estimated requirement in 2020 would stand 20,000 MW with need of additional 20 TCF gas39. But present reserve of gas would be exhausted latest by 2015. So, GoB is to devise a strategy to source alternative energy options whilst conserve the existing energy resources through EE, and diversifying the energy mix.

Energy Efficiency (EE)

Concept of EE. EE is defined as economic investments in energy generation, delivery and end-use equipment, facilities, buildings and infrastructure that deliver higher useful energy outputs or services[26]. EE is regarded as 'fifth fuel[27]'' by the energy management experts. In essence, efficiency is the percentage of input to a system that comes out as useful output. EE is more important than generating energy since it does not involve fueling, and so has zero CO_2 emission. As per the opinion of Dr. Saiful Haque, Director RE Center, Dhaka University, 'one Negawatt (NW)[28] saved is equivalent to two MW generated'.

21. The New Energy Security Paradigm, World Economic Forum in partnership with Cambridge Energy Research Associates, Spring 2006, at http://www.weforum.org/pdf/Energy.pdf, (visited August 06, 2010)
22. www.med.govt.nz/templates/MultipageDocumentPage____32084.aspx (visited August 06, 2010)
23. http://en.wikipedia.org/wiki/Energy_security (visited August 06, 2010)
24. RE Policy, GoB, November 2008, paragraph 1.1
25. Tahsina, Rafa, Pioneering Renewables for Greener Life, Green Page, Energy and Power, Jun 16, 2010
26. Abdul Wadud, Former Managing Director, RPGCL, Energy Efficiency: It is a Need of the Day, Energy & Power Yearly Issue June 16, 2010, p 155.
27. Yameen Farook, The Fifth Fuel, Energy & Power Magazine, Yearly Edition, June 16, 2010, p.97
28. Negawatt (NW) - a measure of energy efficiency; a unit in watts of energy saved. The word "negawatt" was coined by Amory Lovins, a Harvard and Oxford-educated experimental …. "Every negawatt generated has the potential to increase our wealth and health as few other investments can. Negawatts enable us to do more with less and the opportunities are almost boundless. Energy efficiency is the great new energy resource of our future and a vital key to a sustainable environment."

But unfortunately the wastage of energy in BD is around 25 percent. The EU has identified EE as a key element in Green House Gas (GHG) emission reduction in the short run[29].

Approach to EE. Holistic energy conservation is a sustainable and green solution which can alleviate major part of BD's ongoing energy crisis. Expert opines approximately 700 MW can be saved readily through EE[30], while systematic management can save much more which is analyzed in subsequent studies. For systematic efficiency development effective energy auditing is necessary[31].

Major Inefficient Sectors in Bangladesh

Power Generation Sector. The study shows that, through efficiency improvement of the age old PPs, BD can target nearly 1000 NW as capacity improvement[32]. Introducing cogeneration system and managing transmission and distribution (T&D) loss, country can save 500 NW and 700 NW respectively[33]. In all EE in power sector can save about 2200 NW equivalent to 235 MMCFD of gas.

Fertilizer Sector. Compared to KAFCO, the government owned plants consume 30 to 300 percent more natural gas to produce one ton of urea[34]. If all the plants under BCIC could achieve KAFCO's performance, than 75 MMCFD of gas could have been saved per day or using CCGT more than 800 MW of electricity could be generated 48.

Paper and Sugar Mills. In a modern paper mill the steam consumption to dry one MT of paper is two MT whereas in many paper mills in BD about four MT of steam is required to dry one MT of paper[35]. The sugar mill in BD consumes more than four MT of steam to produce one MT of sugar whereas even in our neighboring country the consumption of steam is two MT to produce one MT of sugar[36].

29. RE-thinking 2050 –100% renewable energy by 2050 - let's invent tomorrow today at http://www.ren21.net/forum/forum.asp?id=27
30. Yameen Farook, Loc Cit.
31. Prof. Dr Ashraful Islam, Energy Audit and its Impact in BD, Key Note Speech in the Seminar organized in Military Institute of Science and Technology on October 09, 2010.
32. Dr. Ijaz Hossain, EE Improvement Potential in Power Generation and Fertilizer Plants, Energy & Power Yearly Magazine, June
33. Abdul Wadud no 38 and Yameen Faruk 39.
34. Abdul Wadud Op Cit p.158.
35. Abdul Wadud Op Cit, p158.
36. Ibid.

Miscellaneous Appliances. The technical and economic potential exists to save 20- 40 percent of energy from electric and electronic systems[37]. For study, if average 30 percent energy wastage is taken as the middle figure, it comes 900 NW. Because domestic sector consumes around 80 percent of total 400 MW electricity being supplied now[38], that equals to 3200 MW. Wastage is 30 percent of this 3200 MW accounts 960 NW or 900 NW as round figure. A study shows that replacing normal bulbs with energy saving bulbs alone can save 200 MW of electricity per day[39]. If quality reflectors can be fitted with the bulbs the reflector roughly doubles the optical efficiency of the fixture[40]. Thus actual saving would be 400 NW.

RE POTENTIALS AND OPTIONS FOR BANGLADESH

RE Potentials of Bangladesh

General. GoB is yet to determine her RE potential officially[41]. Some of the RE experts opine that around 80 percent of the country's energy demand for electricity could be addressed by using RE systems[42]. Different other experts made some estimation by sectors. Those are analyzed in subsequent study.

Status and Potentials of Solar Energy

Status of Solar Energy. GoB has planned to meet 10 percent of her energy requirement through solar source in the next five years which equivalents to 500 MW of electricity[43]. By now over 500000 SHS have been installed in rural villages and demand is growing[44]. About 20,000 Solar Home Systems are being installed per month[45]. But these are mostly standalone system, and so contribute hardly anything to the commercial energy requirement. Till now BD produces approximately 35 MW[46] per day. BD requires a commercial boom in this sector. Some experts of practical approach opine that it is possible to add 300 MW through solar energy by 2015, if right fiscal and regulatory initiatives are taken[47].

37. Ibid.
38. Shamin Ara Hasan, Zero Energy Building, Energy & Power Magazine, Yearly Issue 2010, P55
39. Energy and Power report by Shamsul Hoque Bipu, Tk 61 Billion Budget to Revamp Power, Energy (Statement of Minister for Finance, GoB), June 16, 2010, p. 187.
40. http://www.green-trust.org/wiki/index.php?title=Negawatt, and http://en.wikipedia.org/wiki/Negawatt_power
41. GoB RE Policy 2008 and Interview with Mr. Tapos Kumar Roy, no. 53.
42. Sajed Kamal, a scientist and teacher at Brandeis University, Massachusetts in the US, Energy & Power, August 8, 2010.
43. Statement of Mr. Subed Ali Bhuyian, chairman of the parliamentary standing committee on ministry of power, energy and mineral resources. And Wadud Abdul, Engineer, Solar Power, The Daily Star, January 18, 2010.
44. Dipal C Barua, A Solar Mision for BD, Energy and Power, Yearly Issue, June 16, 2010, p.114
45. Ibid
46. Statement of Mr. Subed Ali Bhuyian, no.73.
47. Dipal C Barua, A Solar Mision for Loc Cit

Solar Energy Potentials of BD. Experts in this discipline opine that BD has the potential to produce 10,000 MW of electricity daily from solar source[48]. Through Solar Agriculture GoB can save around 1000 MW. Some experts opine that installing solar PV on the rooftop in the urban areas, it is possible to harness 2000 MW[49]. Solar program alone can power more than 75 million rural people, and in process solar system can reduce huge burden from the national grid.

Cost Benefit Analysis. Some arguments say that solar energy is very expensive[50]. As the counter arguments one should analyze the subsidies given by GoB to the consumers and the supplier (rental PP)[51] and the pattern of global fossil fuel price rise along with environmental cost. At the same time, mass production and technological innovation will bring dramatic decrease in cost of solar energy. This is already happening. And the cost of solar power has decreased about 60 per cent from 1991 to 2003 and about 47 percent from 2006 to 2010[52] respectively.

Status and Potentials of Biogas in Bangladesh

Current Status of Biogas in BD. So far 25283 biogas plants have been installed in BD[53]. Except for 250 KW biomass based PP at Kapasia, Gazipur[54] most are used for domestic purposes.

Potentials of Biogas in BD. According to an estimate BD can obtain 29.7 billion meter3 of biogas from the livestock which is equivalent to 1.5 million tons of kerosene[55]. Apart from this, it is also possible to get biogas from human excreta, poultry dropping, waste, marine plants etc. If each family of BD can be associated with a biogas plant, then only human excreta will give about 10 billion meter3 biogas[56]. Another study denotes that, BD has the potentials of producing about 3.19109 meter3 of gas from cattle dung [57]. BD also has huge potentials to produce biogas from poultry waste. Utilizing the waste produced from Dhaka City alone, it is possible to produce 175.2 GWh (gross) of electricity annually[58].

48. Solar Power and Energy saving , Editorial, New Nation, July 17, 2006.
49. Dr. Saiful Op Cit
50. Shabbir A Bashar, Solar Power as a Prime Energy Source in BD, The Daily Star, December 26, 2009.
51. GURUMIA.COM at http://gurumia.com/2010/05/04/tk-5000cr-needed-in-subsidy-for-peaking-rental-power-plants/
52. Dipal C Barua, Op Cit, p.114
53. Patricia Stevens, Rural Electrification BD, Energy and Power, June 16, 2010, p.149
54. Brigadier General Md. Anisuzzaman Bhuiyan, no. 22.
55. Prof. A.K.M. Sadrul Islam, and Mazharul Islam, Status of Renewable Energy Technologies in Bangladesh, ISESCO Science and Technology vision, Volume 1 - May 2005, p.52
56. Ibid.
57. Banglapedia, National encyclopedia of BD, at http://www.banglapedia.org/httpdocs/HT/B_0520.HTM
58. Ibid.

Commercial Use of Biogas. Except for three biogas based electricity generation plants, till date, biogas produced in BD is used for cooking and lighting purposes of rural households. But there exists enormous potentials to use biogas as commercial source of fuel and electricity. Instead of CNG, biogas can be processed to power the cars[59]. BD has plenty of opportunity to use biogas at commercial basis to produce electricity[60]. Biogas can also be used commercially to produce bio-oil as a fossil fuel substitute[61].

Status and Potentials of Wind Energy

Present Status of Wind Energy. Till date there is no mentionable footprint of wind energy in BD. For the first time BPDB implemented a pilot project of 0.90 MW capacity of the grid connected wind energy in the Muhuri Dam areas[62]. BPDB installed another 1000 kWp capacity Wind-Battery Hybrid Power Project at the Kutubdia Island, Cox's Bazaar in 2006. LGED, BCAS supported by ODA launched WEST project in 1995 to monitor wind data. Without making any significant contribution the project was closed after one year.

Wind Energy Potentials in BD. RE experts opined that, if BD uses only five percent of the coastal areas and installs 2.5 MW size wind turbines, the total gross potentials of wind power is more than 25000 MW[63]. With only 25 percent Plant Load Factor of the wind power plants, then total energy generation potential is 54750 GWh per year[64].

Small Hydro and Bio-fuel Potentials in Bangladesh

Small Hydro Potentials. From the study it is evident that, out of existing 230 MW installed capacity at Karnafuli Hydro Station produces only 29 MW due to low height of water[65]. LGED initiated a micro-hydro power unit at Bamerchara, Chittagong. Due to low water level the project generates only four KW against installed 10 kW[66]. From the current situation it seems that, hydropower generation scope in BD is very limited[67], and the prospect is reducing day by day due to ill fate of the rivers.

59. Biogas as Vehicle Fuel A European Overview, by Stockholm, Trendsetter Report No 2003:3, October 2003, p.8, at http://213.131.156.10/xpo/bilagor/20040115134708.pdf
60. Bangladesh: Biogas Electricity Generation from Poultry Waste, at http://projects.wri.org/adaptation-database/bangladesh-biogas-electricity-generation-poultry-waste
61. Dinesh Mohan, Department of Chemistry, Mississippi State University, Pyrolysis of Wood/Biomass for Bio-oil: A Critical Review, at http://pubs.acs.org/doi/abs/10.1021/ef0502397
62. http://www.lged-rein.org/database.php ?pageid=67
63. Ibid.
64. Ibid.
65. http://www.lged-rein.org/gtz.php.
66. Ibid.
67. Md. Nehal Uddin, Country Presentation on Regional Clean Coal Partnership Programe at http://www.sari-energy.org/ PageFiles/What_We_Do/activities/Regional_Clean_Coal-Sep_2008/Clean_coal/Day1-session1/Session_I_Clean_Coal_Partnership-Bangladesh_perspective.pdf (visited October 13, 2010)

Bio-fuel Ethanol. GoB owned 14 sugar mills produce 70 thousand tons of bagasse per annum[68]. Setting appropriate technology, ethanol can be produced from this byproduct. Ethanol may be used to fuel the cars. Utilizing the total present byproducts, country can save Tk. 1.23 billion per annum[69]. GoB is considering setting up machinery with dual production, sugar and electricity[70].

Status and Potentials of Tidal Energy in Bangladesh

Tidal Power Potentials in BD. BD may harness energy from coastal tidal resources by applying low and medium head tidal movements[71] from Khulna, Barisal, Bagerhat, Satkhira and Cox's Bazar regions. The infrastructure needed for barrages and sluice gates is already present in these regions. The most favorable locations for tidal power application of this type are on the eastern side of the delta region (e.g. Sandwip).

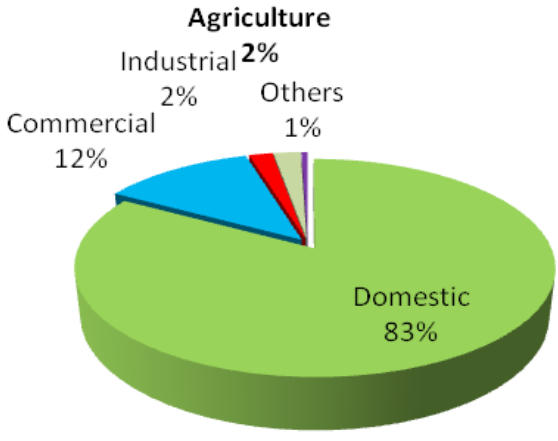
Financial Viability Analysis. Tidal PP has a potential life of more than 40 years[72]. Although the initial investment is high, but over the period the cost falls down since there is minimum maintenance cost. Basically the cost of electricity after the capital costs have been paid off in 15 or 20 years can be assumed to be nearly zero.

Zero Energy Building (ZEB) Thoughts

General. Building industry is one of the major areas where maximum energy consumption and GHG emissions take place. From Chart 3, it is seen that domestic sector consumes over 80 percent electricity. With ZEB concept GoB can save minimum 25 percent energy by 2020.

68. Md Mahtab Uddin, Prospect for Alternative Energy in BD, The Daily Observer, January 13, 2008.
69. Ibid.
70. Sugar Mills Plan to Generate Cane Power, Financial Express, February 08, 2010
71. Mahbubuzzaman, M. Shahidul Islam, Md. Mahfuzar Rahman, no.3, Low head tidal movements (2~5 m head) & Medium head tidal movements (> 5 m head).
72. M. Salequzzaman, Peter Newman, Mark Ellery and Brendan Corry, Thesis Document for Phd, on Prospects of Electricity from Tidal Power in Coastal Regions of Bangladesh, Murdoch University, Australia, 2005.

Chart 3: Percentage of Electricity Consumed in FY 2006-2008



Source: Energy & Power Magazine, Yearly Issue 2010

Concept of ZEB. A zero or low energy building can be defined as a built form, where the total energy consumed by it throughout its entire life cycle is generated by the building from renewable energy sources[73]. From above definition, it is clear that a ZEB will not be using any energy produced from fossil fuel to operate the building[74]. USA planned to reduce 28 percent electricity consumption applying ZEB concept[75]. Similarly BD can target minimum 25 percent electricity (1200 MW) savings adopting ZEB concept.

VIABLE ALTERNATIVE ENERGY OPTIONS AND IMPLIMENTATION STRATEGY

Viable RE Options

From the study it is evident that, BD has huge potentials of harnessing solar, wind, biogas, tidal, bio-fuel and bio-oil from in-house. These are financially viable, environment friendly, and offer guaranteed source of supply. Harnessing those potentials, BD can meet 80 percent of her electricity need. Through EE GoB can development her power up to 2016 without generating any electricity.

73. Shamim Ara Hasan, Associate Professor,Department of Architecture, BUET, Zero Energy Building, A new Benchmark for Building Industry, EP Yearly Issue, June 15, 2010, p.55
74. Zero-energy building, Wikipedia at http://en.wikipedia.org/wiki/Zero-energy_building (visited August 13, 2010)
75. American Society of Heating, Refrigerating and Air-Conditioning Engineers(ASHRAE) Journal, p 66, at http://www.ashrae.org/docLib/20081021_understanding_zero_eb.pdf

Due to ill fate of the river, mini hydro power potential is very limited now, and declining. So, mini/micro hydro power generation seems not viable for BD now. She has very limited tested potential of geothermal energy. Again, exploring geothermal energy involves a process short of mining, which might not be economically viable at this moment. Amongst the marine energy, only tidal power seems to be viable for BD now. Thus, harnessing geothermal energy and other forms of marine energy may be put under R&D.

Policy and Awareness Strategy for RE in Bangladesh

Policy Support. Following policy support is necessary to explore RE sector:

a. **Enactment of Laws.** It is necessary to enact laws on use of energy efficient plants and appliances for both suppliers and users' side[76]. BD Standard Testing Institute (BSTI) should set a minimum standard of EE before any plant is set and electric and electronic appliances are marketed. The law should also enforce all electricity users to produce minimum 10 percent of respective energy need. GoB should also bring ZEB concept mandatory for commercial and high rise buildings by laws.

b. **Financial Policy.** To attract the private entrepreneur in the RE sector, GoB should implement Feed-in tariff[77] policy. Dr. Saiful Haque of RE Centre, Dhaka University opines that, if net metering policy[78] is adopted in BD, in one year more than 500 MW power can be generated through private entrepreneur. He suggested the GoB to set the price of per unit electricity Tk. 30 and 10 generated from solar and wind power respectively.

Public Awareness. Most of the citizens of BD are not yet aware of the advantages of RE. GoB should launch comprehensive media campaign to encourage people for generating and using RE. The media campaign should highlight:

a. Energy security ranks after food and security in the priority agenda.

b. RE is a onetime investment.

76. Interview with Dr. Saiful Haque, August 14, 2010.

77. A feed-in tariff is a policy mechanism designed to encourage the adoption of renewable energy sources and to help accelerate the move toward grid parity. The cost-based prices therefore enable a diversity of projects (wind, solar, etc.) to be developed, and for investors to obtain a reasonable return on renewable energy investments. This principle was first explained in Germany's 2000 RES Act. Feed-in tariff, From Wikipedia, the free encyclopedia, at http://en.wikipedia.org/wiki/Feed-in_Tariff

78. Net metering is a low-cost, easily administered method of encouraging customer investment in renewable energy technologies. Net metering programs serve as an important incentive for consumer investment in renewable energy generation. Net metering enables customers to use their own generation to offset their consumption over a billing period by allowing their electric meters to turn backwards when they generate electricity in excess of their demand. American Wind Energy Association, http://www.awea.org/faq/netbdef.html

c. After being connected with RE, no more load shedding.

d. RE involves no line rent.

f. No GHG emission, so there is no environmental cost.

g. Creates hundreds and thousands of green jobs especially in the job hungry rural areas.

h. Allows saving the fossil fuel as fixed deposit for next generation.

Suggested Strategy for RE Roadmap

General. Setting national RE targets can be an important part of a RE[79]. GoB may start harnessing, RE resources commercially. She should kick off with smaller projects. When RE technology (RET) will be matured and indigenous production will start in-house, public and private entrepreneur may install bigger plants in a joint venture. For sustained supply, minimum duel source hybrid generation service should be installed together. A suggested perspective plan is discussed in the subsequent paragraphs.

Short Term Plan (First Five years). GoB may enforce the EE law, and decommission all energy inefficient plants in phases. In the generation side, the strategy should be to install smaller plants (below 5 MW)[80]. The strategy should include:

a. Installing roof top solar panels and waste energy plants in the cities.

b. Solar and biogas plants in the towns and villages.

c. Tidal, wind and solar power in the coastal areas.

d. Producing ethanol fuel in the sugar mills.

e. Ongoing stand alone solar PV and biogas project should continue in the rural areas.

f. Important focus is required on capacity building. It is necessary to establish RET institutes to develop both technology and creating experts in RE sector.

g. Sufficient budget should be allotted in RE sector to support the roadmap.

h. Instead of installing gas based PP GoB may setup coal-fired and RE plants in future.

79. http://en.wikipedia.org/wiki/Renewable_energy_commercialization
80. Dr. Saiful Haque no. 106.

Mid Term Plan (Second Five Years). It is expected that global fossil fuel market will continue to increase reaching US $170 per barrel by 2030[81], while cost of RET will decrease. At this economic and technological lead point; GoB should launch medium size (five to 10 MW) plants. Whilst priority should still be on the private sector, GoB may launch projects in joint venture. BD should continue to develop indigenous RET and create RE expertise to be self-dependent.

Long Term. Considering the development in the RE sector in this 10 years, GoB should review the RE policy. However, in the long term GoB may install larger plant both at public and private sector. Meanwhile GoB is likely to create expertise in-house for further R&D. By that time geothermal and other forms of marine/ocean energy is likely to attain as a feasible option.

Supply Methodology

Experts and the government officials of this discipline opine that any distribution system other than existing one requires prior permission of the government[82]. As such, subject to approval following supply methodology may be adopted for guaranteed sell by the investors:

a. **Standalone System.** A standalone system can generate power for individual house appliances. It is feasible everywhere but mostly in rural areas.

b. **Off Grid[83].** Off-grid electrification can provide an alternative solution for many low-demand users, at lower cost than grid extension. It could be a growing market for small types of rural energy service companies in BD.

c. **Mini Grid[84].** In rural areas and remote settlements further from the national grid, mini-grid and off-grid solutions may be more attractive, since they can be deployed more rapidly than grid solutions[85]. GoB may connect cluster of village and buildings in the urban areas with mini grid.

81. Energy outlook 2009.
82. Discussion with Dr. Shawkat Akber and Mr. Rabindranath Roy Chowdhury, Joint Secretary, Ministry of Power, Energy and Mineral Resources, October 9, 2010.
83. http://www.drfn.org.na/pdf/energy_factsheets/offgrid_minigrid.pdf
84. Ibid.
85. Energy for a Sustainable Future, The Secretary-General's Advisory Group On Energy And Climate Change (Agecc) Report, New York, April 28, 2010

d. Smart Grid In the urban area, cluster of buildings can be connected to smart grid[86]. In the urban area, residents generally use the rooftop for domestic purpose. So solar PV can be installed using part of the rooftop, and be connected to smart grid for selling excess electricity. This rooftop PV panel project may potentially add 2000 MW to the grid[87].

e. **RE Certificate (REC).** In all distribution system, REC method of marketing may be followed to guarantee the supply and payback[88].

Investment Strategy

Globally, RE sector is explored by the private sector[89]. Government works as the facilitator, and provides policy, strategy and financial support. Thus GoB should attract private entrepreneur including NGOs to explore her RE sector commercially. Authority should look at how the cell phone companies have installed transmission towers on rooftop at rental basis. This gives a clear message of the possibility to install solar PV similarly. With correct policy support GoB may attract individual and small group investor to generate RE commercially.

RECOMMENDATIONS

Basing on the outcome of the study following recommendations are made to address the problem:

a. Considering the cost benefit analysis, implementation time, available RE technology and resource potentials, the study recommends GoB to explore RE sector at commercial basis in following order of priority:

86. A smart grid delivers electricity from suppliers to consumers using two-way digital technology to control appliances at consumers' homes to save energy, reduce cost and increase reliability and transparency. It overlays the electricity distribution grid with an information and net metering system. At Smart grid Wikipedia at http://en.wikipedia.org/wiki/Smart_grid
87. Dr. Saiful Haque Op Cit
88. A REC represents the property rights to the environmental, social, and other nonpower qualities of renewable electricity generation. A REC, and its associated attributes and benefits, can be sold separately from the underlying physical electricity associated with a renewable-based generation source……One REC is equivalent to one megawatt hour of electricity generation. ….. Basically, a REC is a form of renewable energy currency and through Energy Matters; you can sell your RECs to us and use the money as a point of sale discount on items you buy! And http://www.energymatters.com.au/carbon-trading/recs/index.php At, Green Power Partnership, at http://www.epa.gov/greenpower/gpmarket/rec.htm
89. Khan, M. Rezwan, Micro-grid for Rural BD; Cost and Benefit, Energy and Power Magazine, June 16, 2010. and 3TIER Testifies before U.S. Congressional Committee on Renewable Energy Forecasting, a press release, June 16, 2010, at http://www.3tier.com/en/about/press-releases/3tier-testifies-us-congressional-committee-renewable-energy-forecasting/

(1) Solar and biomass simultaneously.
(2) Wind energy.
(3) Ethanol and Biodiesel.
(4) Tidal power.

b. Under the existing gas crisis situation, instead of installing gas-based power plants GoB should explore coal sector and setup coal-fired power plants at priority basis.

c. To generate RE commercially, government should immediately introduce feed- in- tariff and net metering system to attract private sector for exploring the RE industries. Government should also establish off grid, mini grid and smart grid electricity distribution system to encourage the private entrepreneur.

d. Government should enact Energy Conservation Act to enforce energy conservation and lawfully implement EE.

e. Instead of giving subsidy in the price of electricity and reducing price of gas, government should pay additional subsidy to white certificate holders both individual and organization level. This option will encourage EE, save energy and increase energy tariff for the government.

f. Instead of giving subsidy in electricity, government may grant loan without interest to the builders for encouraging the construction of ZEB. It should be compulsory for high rise and commercial buildings forthwith while for any construction in metropolitan cities may be obligated to follow ZEB code in next five years. This option would save about 1000 MW per day.

CONCLUSION

Amongst fossil fuels Bangladesh is endowed with only limited reserve of gas and coal. Natural gas is the only indigenous source of commercial energy in BD. She houses about 2.7 billion MT of coal. Due to multiple uncertainty she could not yet explore the coal sector at optimum pace. Failing to explore coal sector, she developed a gas dependent energy system, thus caused early depletion of the reserve, leaving only about 12 TCF remaining. With present consumption rate this reserve may be sufficient for next three to four years. Presently the country is facing about 33 percent power deficiency where gas shortage accounts half of the shortfall. Few of the gas-based fertilizer factories are closed, power connection to new industries is stalled and production of all other industrial sectors is drastically reduced due to energy crisis. Poor quality power supply costs the country as much as two percent in GDP growth each year.

Under this crisis situation, it is essential for the country to explore alternative energy options to meet her growing energy need. Despite having vast renewable energy potentials, she could not yet commercialize the harnessing process. Renewable energy is mostly being used in the rural areas meeting domestic needs only. The research denotes that, about 80 percent electricity need of the country can be tapped systematically from renewable sources. At the same time energy efficiency improvement can give green solution to country's growing energy need now and for few contemplated years without additional generation.

About 30 percent of energy wastage occurs in BD combining supply and demand side together. Most of the power plants, fertilizer industries, paper, sugar and cement factories and other industrial and domestic sectors waste energy which accounts about 3100 NW of electricity per day. Through managerial solution GoB can save another 600-700 MW. In all, the country can save about 4000 NW through EE. Thus it is evident that, through EE, GoB can meet the growing energy need till 2014 without installing any additional capacity and causing no dipping to her energy reserve. This option will give green solution to the rapid energy depletion, and allow lead time to source alternative energy options.

It is to be noted that, sustainable energy includes energy conservation, EE and alternative energy options. To conserve energy and achieve EE, GoB needs to enact Energy Conservation Act. The act should obligate all grid users to generate minimum 10 percent of his energy requirement from RE source. The act should also enforce ZEB concept for commercial and high rise buildings forthwith while for all building in the municipal corporation in next five years. GoB needs to maintain minimum standard of EE through S & L process. Instead of giving subsidy in the cost of electricity and gas at flat rate to all, GoB may give maximum leverage to the white certificate and REC holders only.

To encourage both use and generation of RE, massive public awareness program is necessary. If the advantages from users' point of view and benefit from generation point of view are communicated to the citizens, they will be encouraged to use and invest at individual and entrepreneur level for commercial generation. But as the upfront investment and production cost is more than conventional grid electricity, GoB needs to introduce feed in tariff and net metering system.

For commercial beginning of RE, a long term perspective plan is essential. To meet the ongoing energy crisis, as a short term measure, GoB may install small RE plants with capacity of less than five MW through private sector. The order of priority should be solar and biomass, wind, bio-fuel and tidal power. As

mid-term strategy, BD should install plants with capacity up to 10 MW through private sector and in joint venture with private and public sector. In the long term GoB should install larger plants both by private, public and joint venture. By this time R&D should be able to develop new technology and source.

For commercial distribution GoB may introduce off grid supply for localized rural area, mini grid for cluster of villages and buildings in urban areas. GoB may also introduce smart grid distribution system in the city areas. If GoB can ensure proper policy and financial support side by side sound distribution and accounting procedure, it can fulfill the vision of achieving 10 percent energy need from RE by 2015. While in the mid and long term, she can meet 80 percent electricity need from RE sector.

It is to be remembered that, sustained energy security includes guaranteed source of energy, efficient generation and supply system, indigenous technology and expertise and diversified energy options. Imported energy, technology and expertise may not work in case of emergency. Similarly, natural gas as single source now and coal in future cannot ensure lasting energy security. RE options are abundant in-house but technology and expertise are inadequate in BD. So, GoB needs to conserve natural gas, explore coal and RE sector and develop RET and expertise keeping it on the top of national development agenda.

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CHINESE ECONOMIC GROWTH AND ITS FALLOUT ON SOUTH ASIAN COUNTRIES

Brigadier General Abdullah Mohammad Feroz Chowdhury, ndc, psc, G+

INTRODUCTION

"Let China Sleep, for when the Dragon awakes, she will shake the world."
–Napoleon Bonaparte[1]

China is now the most irresistible force in the world economy. Its economy is growing at a faster rate. Presently, Chinese economy is the second largest economy in the world after USA[2]. History of Chinese economic growth is of more than half a century old which started from agricultural development and grew through industrialization under the centralized control. From Mao Zedong to Deng Xiaoping, the Chinese economy went under several reforms turning the country from starvation to a country of economically rising power. According to World Bank[3], China has sustained an average of 8% Gross Domestic Product (GDP) growth annually, achieving one of the highest rates to 11.90% in 2009.

China is known as one of the largest recipients of Foreign Direct Investment (FDI) and a global manufacturing hub. Though due to the world financial crisis FDI in China fell slightly low but according to statistics of China's Ministry of Commerce (MOFCOM), in 2009, financial total FDI was US$ 92.4 billion and expected to be US$ 100 billion in 2010[4]. China's FDI outflows took off to US$ 52.2 billion in 2009 as a result of the government's adoption and promotion of a "go global" policy aimed at establishing the country's investors as international players. Besides Africa, Europe and Latin America, China's outward FDI now focuses on the South Asian neighbours in the quest of its dominance in Indian Ocean to ensure Sea Lines of Communication (SLOC) and also in search of energy to maintain its steady GDP growth.

Like China, India is the largest economically growing country in the South Asia with average GDP 6-7%[5]. As India has entered the global economic and

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energy market, it has encountered an important competitor, China, a rising military power with a vast appetite for oil and other raw materials. Resources available in the South Asian countries like Bangladesh, Myanmar, Sri Lanka, Nepal etc drawn China's attention. Therefore, much of her recent military, diplomatic and economic policy has been aimed at exploiting a maritime geography that would enable it to flank Asia's major sea-lanes and trading routes. Both China and India are now working on acquiring other sources of energy and their efforts are focused on oil, natural gas and nuclear energy. Therefore, they will compete to invest in other countries for their energy requirement. It is therefore worthwhile to study Chinese economic growth which should also cover Chinese political, economic and security relations with the South Asian countries and fallout of Chinese economic growth on South Asian countries.

PATTERN OF CHINESE ECONOMIC GROWTH

Growth before Modernization

Since 1949, Peoples Republic of China (PRC) mainly relied on agriculture where land and peasants were brought under agricultural collectives. This phase of collectivization brought widespread famine in the country in1956 but allowed rising of capital for industrialization. From 1958 to 1963, China went under further round of collectivization with emphasis on light industry and construction projects leaving productive land left unplanted. This brought country wide famine, droughts and floods killing estimated 2 million people but Chinese economy initially grew and by 1958, agricultural production almost doubled from 1949, coal production quadrupled and steel production grew five times.

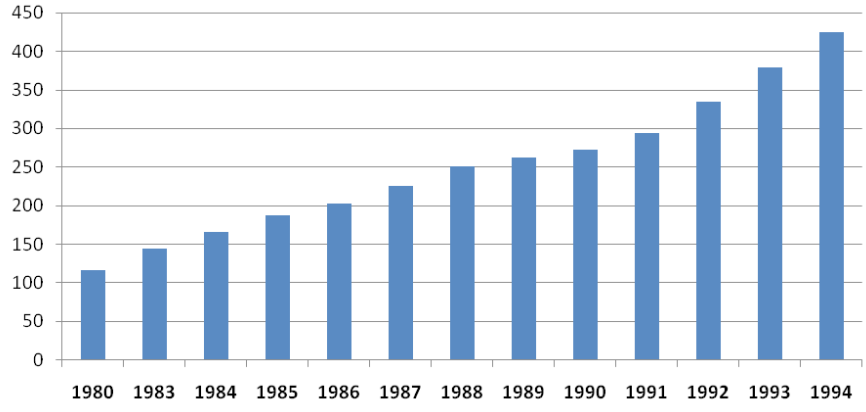
Growth since Modernizations

After the death of Mao in 1976, Deng Xiaoping's pragmatic Four Modernizations programme comprised of agriculture, industry, national defence and science and technology expanded rural income and incentives, encouraging experiments in enterprise autonomy, reducing central planning and establishing FDI in Mainland China. Thus, Deng's reforms shifted China's development strategy to emphasize on light industry and export-led growth[6]. After Deng, Jiang Zemin maintained political stability, kept things on track in the difficult years of the late 1990s and healthy economic development. Under Jiang's leadership, Mainland China has sustained an average of 8% GDP growth annually, achieving one of the world's highest rates of per capita economic growth, and became the world's fastest growing major

6. Hodder, Rupert, 'The Creation of Wealth in China', London, Belhaven Press, 1993, p.71.

economy[7]. China's GDP growth from1980 to 1994 is shown at Chart 1.

Chart 1: Chinese GDP Growth, 1980-1994 (in US$ Billions)



Source: Can China's Growth be Sustained?[8].

Economic Development (2002-Present)

The China's economy grew at an average rate of 10% per year during the period 1990-2004; the highest growth rate in the world. After Jiang Zemin, both President Hu Jintao and Premier Wen Jiabao launched Economic Stimulus Plan to specifically deal with global financial crisis of 2008-2009. By the end of 2009, it appeared that the Chinese economy was showing signs of recovery[9].

GDP Growth

China's economy started growing since 1978. Between 1983 and 2008 double-digit real GDP growth was around 10% per year in real terms. In 2008, the global economic crisis began to reduce China's growth rate. Remarkably, GDP in China again expanded at an annual rate of 10.70 % in the first quarter of 2010. Chart 2 shows Chinese GDP growth from 1990-2009.

7. People's Republic of China, available at: http://en.wikipedia.org/wiki/People's_Republic_of_China, accessed on May 03, 2010.
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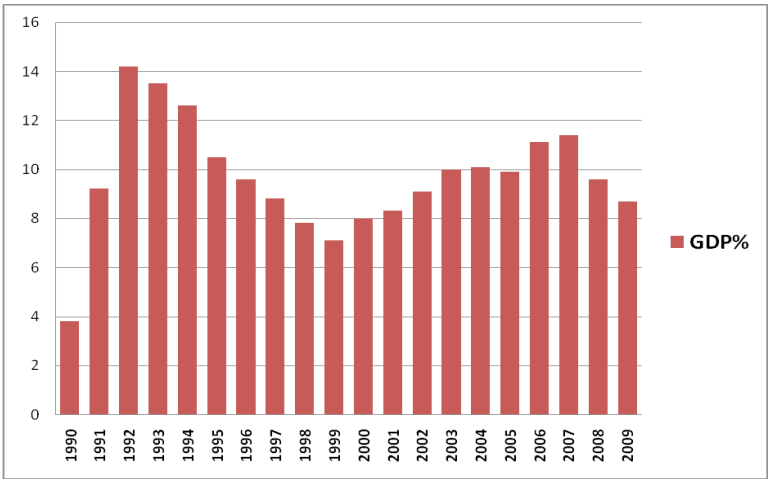
Chart 2: Chinese GDP Growth 1990-2009 (Real Annual Growth Rate %)

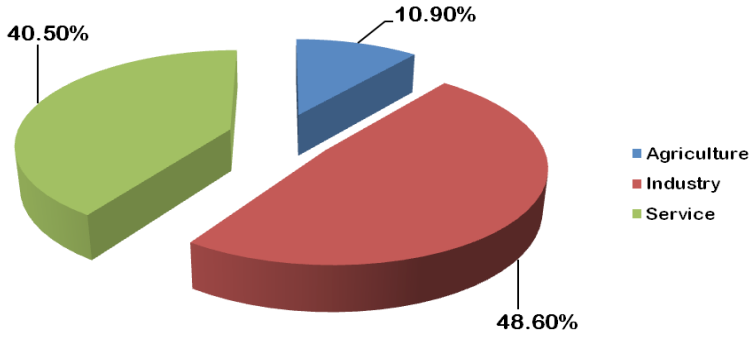


Source: Yao, Shujie and Dan Luo, Chinese Economy 2009: Leading the World Economy out of Crisis[10].

Size and Structure of the Economy

Major contributors to the Chinese economy are agriculture, industry, and services. Chart 3 shows major contributing sectors to the Chinese economy.

Chart 3: China's GDP – Composition by Sector



Source: China GDP-Composition by Sector[11].

10. Available at: http://www.nottingham.ac.uk/cpi/documents/briefings/briefing-59-sy-econ-review-2009.pdf, accessed on August 10, 2010.
11. Available at: http://www.indexmundi.com/china/gdp_composition_by_sector.html, accessed on May 29, 2010.

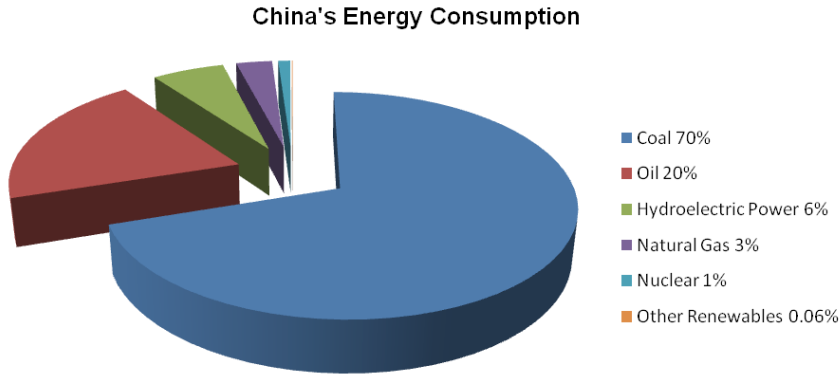
Manufacturing Sector

Chinese manufacturing sector is the heart and soul of its economic strength. Many factors like cheap labour, good quality infrastructure and the huge size of the domestic market have made the country one of the most attractive place in the world to invest. China's manufacturing sector now ranks the 4th in the world after the US, Japan and Germany.

Energy Consumption

China's 70% energy requirement is fulfilled domestically from coal and 20% oil is imported from Africa, Middle East and Central Asian States (CAS)[12]. As a rapidly growing country, China's energy needs are likely to balloon over the coming decades. China's recent diplomatic, military and investment relations are significant with the countries like Myanmar, Sri Lanka, Bangladesh and CAS in the quest of energy search. Chart 4 and 5 shows total energy consumption in China by type and for robust growth energy demand respectively.

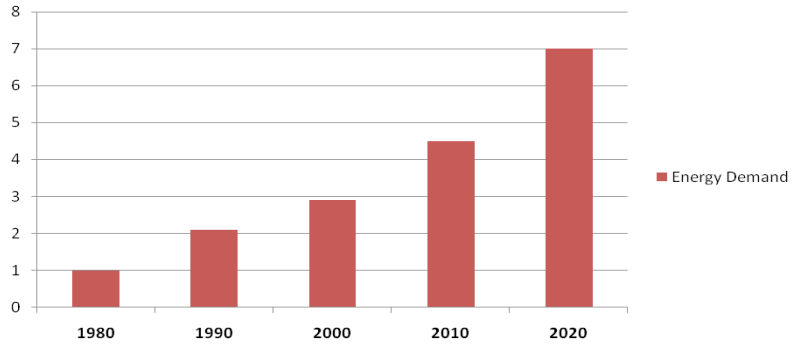
Chart 4: Total Energy Consumption in China by Type



Source: IEA, International Energy Annual Report 2006[13].

12. Sautman, Barry, Trade, Investment, Power and China in Africa, available at: http://www.zcommunications.org/trade-investment-power-and-the-china-in-africa-discourse-by-barry-sautman, accessed on April 02, 2010.
13. Available at: http://www.ieawind.org/AnnualReports_PDF/2006%20AR%20IEA%20Wind/2006%20IEAWind%20AR.indd.pdf, accessed on July 20, 2010.

Chart 5: China's Robust Growth in Energy Demand (In %)

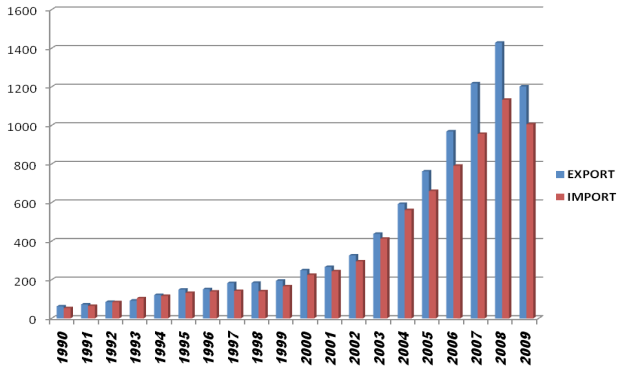


Source: China Output Tops Forecast as 'Robust' Demand Aids World Growth[14].

China's International Trade

International trade has been used to bring in new equipment and technologies and to meet scarcities in the domestic economy since China has sought to modernize its economy. Exports have been used as a means of producing foreign earnings to pay for the imports. Chart 6 shows Chinese export import trade with the world.

Chart 6: Chinese International Trade with the World (US$ Billions)



Source: Yao, Shujie and Dan Luo, Chinese Economy 2009: Leading the World Economy out of Crisis[15].

14. Available at: http://www.businessweek.com/news/2010-09-11/china-output-tops-forecast-as-robust-demand-aids-world-growth.html, accessed on June 17, 2010.
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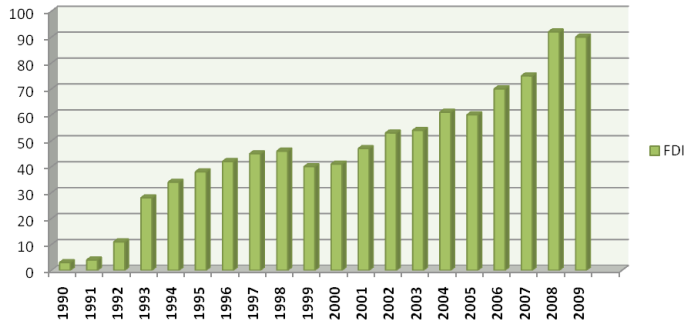
Chinese Inflow and outflow of FDI

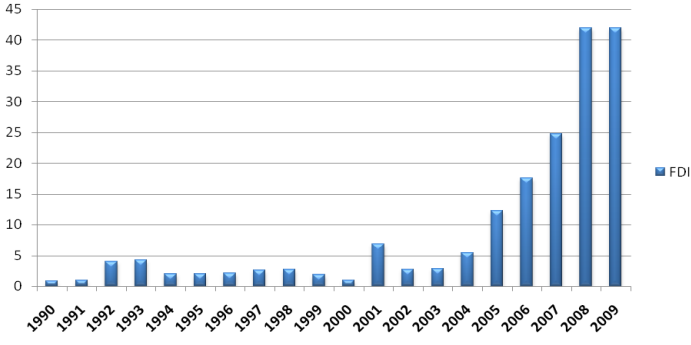
Since 1980, FDI inflows grew steadily but remained relatively low. Accession to the WTO in 2002 promoted China to top position as an FDI destination. By 2009, contracted FDI was more than double utilized FDI. China's outward FDI also has grown tremendously, and was driven by China's increasing needs to secure overseas energy and raw material resources. Chinese FDI in South Asia is very negligible compared to other trading partners. Chinese FDI inflows and outflows are shown at Chart 7 and 8.

Chart 7: Chinese Inflow of FDI 1990-2009 (US$ Billions)



Source: Yao, Shujie and Dan Luo, Chinese Economy 2009: Leading the World Economy out of Crisis[16].

Chart 8: Chinese Outflow of FDI 1990-2009 (US$ Billions)



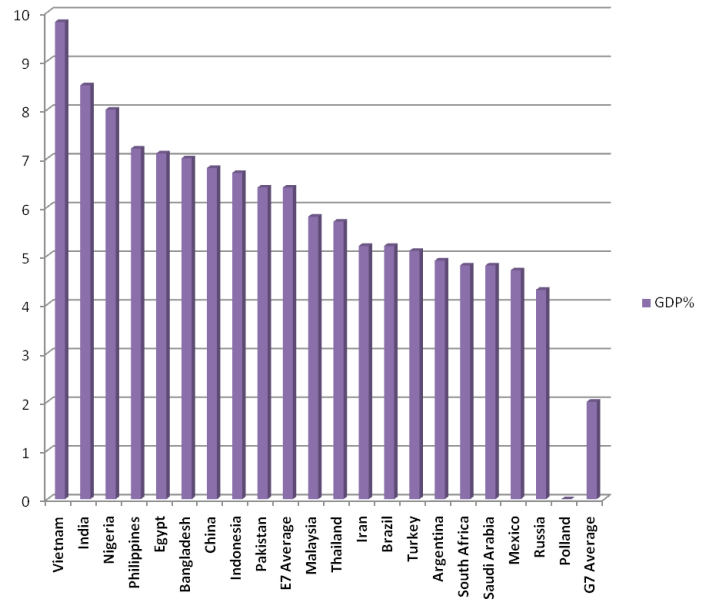
Source: Yao, Shujie and Dan Luo, Chinese Economy 2009: Leading the World Economy out of Crisis[17].

16. Available at: http://www.nottingham.ac.uk/cpi/documents/briefings/briefing-59-sy-econ-review-2009.pdf, accessed on July 20, 2010.
17. Ibid.

Projection of Future Economic Growth

In the next ten years, China's economy is likely to increase at a rate 7% - 8%. By 2020, should price index remains the same as of today, GDP will amount to US$ 38 trillion[18]. By 2050, China's economy will be just 20 % larger than that of the USA[19]. Chart 9 shows projected real growth rate for Chinese economy by 2050.

Chart 9: Projected Growth Rate for Emerging Economies 2007-2050 (US$)



Source: India to grow to almost 90% of US economy by 2050, China to overtake US economy by 2025, Vietnam may be fastest growing of emerging economies[20].

Problems of Chinese Economic Growth

Since 1978, Chinese economy has maintained a steady growth. Corruption and central government's failure to control affairs of local government level, dependency on outside world for hydrocarbons to continue industrial growth, growing income inequality, inefficient banking sector, undervaluation of yuan,

18. Lee, Joseph, Prospect of China's Future Economy Growth. , available at: http://www.china-window.com/china_economy/china_economy_guide/prospect-of-chinas-future.shtml, accessed on May 23, 2010.
19. Dadush, Uri, The G20 in 2050, available at: http://www.carnegieendowment.org/publications/index.cfm?fa=view&id=24195, accessed on March 12, 2010.
20. Available at: http://www.pwc.com/in/en/press-releases/india-grow.jhtml, accessed on July 20, 2010.

overheating economy, shortage of power, and nationwide unemployment are the major hindrance to such growth. Her large industries started shifting in other countries where cheap labours available. Outside buyers' attention have also been drawn by those countries (like Bangladesh, Sri Lanka, India etc) where industrial products like garments/apparels, agricultural products and textile goods are less costly than China. Therefore, China will have to invest to the neighbouring countries in search of energy to continue her economic growth and if necessary will compete with other economically rising countries.

CHINA – SOUTH ASIA POLITICAL AND SECURITY RELATIONS

Sino-India Relations

Since the early 1950s, the relation between India and China was characterized by border disputes that resulted in military conflict[21]. From 1988, both the countries successfully attempted to reignite diplomatic ties the result of which is China's declaration of support to India's bid for a United Nations Security Council (UNSC) seat[22]. India's nuclear deal with US in late 2008, Chinese access to maritime facilities through Myanmar, Bangladesh, Sri Lanka, Pakistan and Maldives with the ambition of Blue Water Navy in Indian Ocean weakened their relations. Recent visit of Chinese Premier to India, Chinese-Indian relations has gained a new momentum of strategic and cooperative partnership for peace and prosperity of South Asia. However, since India and China are rapidly growing economies in the world with vast appetite for oil and other raw materials, China is likely to become a principal competitor to India in global quest of energy and both these countries will continue investing in other countries of South Asia.

Sino-Pakistan Relations

Pakistan maintained "all weather relationship" with China for the last six decades[23]. Pakistan is China's strongest link to the Islamic world and therefore China is not going to abandon Pakistan even if her relation with India improves. China-Pakistan military-strategic relations are improving further in the wake of Indo-US nuclear deal. Chinese Premier Wen's visit to Pakistan is of great significance in advancing the all-weather strategic partnership of cooperation between China and Pakistan[24]. China's development of the Gwadar Port with

21. Sino-Indian Relations, available at: http://en.wikipedia.org/wiki/Sino-Indian_relations, accessed on June 20, 2010.
22. Hunter, Alan and John Sexton, Contemporary China, London, Macmillan Press Limited, 1999.
23. People's Republic of China-Pakistan Relations, available at: http://en.wikipedia.org/wiki/People's_Republic_of_China_%E2%80%93_Pakistan_relations, accessed on August 16, 2010.
24. Consolidating China-Pakistan Friendship, Pragmatic Cooperation, available at: http://www.thenews.com.pk/TodaysPrintDetail.aspx?ID=22432&Cat=2, accessed on December 27, 2010.

the facility to berth destroyers and other naval vessels[25] and recent signing of 35 different arrangements deal in Pakistan for investment of US$ 25-35 billion indicates such a trend[26].

Sino–Bangladesh Relations

The bilateral relations between China and Bangladesh have been one of the priorities to all the successive governments. Bangladesh's location in between South Asia and Southeast Asia is highly important to China, especially important for her land locked south western provinces. Since 1975, China has assisted Bangladesh in infrastructure, power including hydropower and coal mining, industrial plants, telecommunications, flood control, disaster prevention, river training, irrigation and water resources utilization. Bangladesh also sought Chinese assistance to build the deep seaport and direct road link with China.[27].

Sino – Sri Lanka Relations

Sri Lanka's relations with PRC remained strong over a half-century[28]. Development of the Hambantota Multi-purpose Project and recent arms support and diplomatic heft at the UN to keep the western-led move in imposing truce of the Security Council agenda while defeating LTTE revolutionary group, are the examples of the strong relations between these two countries. While Indian policy response to her old friend Sri Lanka seems to be ad hoc and not strategic with the immediate and long term interests where as China's policy caters for its interests of today, tomorrow and the day after.

Sino – Myanmar Relations

Myanmar's location on the tri-junction of South Asia, Southeast Asia and China is potentially important for China to achieve its strategic presence in the Indian Ocean and trading outlet for its landlocked inland south-western parts[29]. Therefore, since 1988, China supports Myanmar's current military regime through the full spectrum of political, strategic, and economic ties disregarding the external pressures. By the year 2050, China is expected to achieve world-class Blue Water Navy status and Myanmar would be crucial for China's

25. Chinese Mulling US$ 13 billion in Gwadar, available at: http://eproperty.pk/news/2008/05/09/chinese-mulling-13b-investment-in-gwadar, accessed on March 21, 2010.
26. Jiabao's Visit to India and Pakistan, available at: http://www.thenews.com.pk/TodaysPrintDetail.aspx?ID=22432&Cat=2, accessed on December 27, 2010.
27. http://www.weeklyblitz.net/796/Sino-bangladesh relations,
28. RATATHOTA.COM, Sino-Sri Lanka Relations: Durable Partnership, Mutual Benefit, available at: http://digitallife.lk/oopadoopainfo/wordpress/?p=1299, accessed on 05 July 2010.
29. Burma-People's Republic of China Relations, available at: http://en.wikipedia.org/wiki/Burma_%E2%80%93_People's_Republic_of_China_relations, accessed on March 10, 2010.

multi-directional access to both Pacific and Indian Oceans[30]. Thus China's strategic gains in cultivating relations with Myanmar have long-term security implications.

Sino – Nepal Relations

Nepal established diplomatic relations with the China and formally recognized Tibet as a part of China in 1956[31]. Geographical location and current political changes make Nepal very important for China. But due to the excessive influence of India, the presence of China in Nepali politics remained dimmer.

Sino-Bhutan Relations

Bhutan and PRC do not maintain official diplomatic relations. China shares a contiguous border of 470 km with Bhutan. In 1988, China and Bhutan signed a bilateral agreement for maintaining peace on the border and peaceful coexistence.

Sino-Maldives Relations

In 1972, China and Maldives established their diplomatic relations[32]. In the year 2005, when Britain was desperate for her presence in the Indian Ocean region and wanted UK-sponsored, opposition-backed coup in Maldives, China clinched a deal and established a naval base in Marao Islands of Maldives in the Indian Ocean and deployed her nuclear-powered submarine as part of her encirclement of India and neutralized its offensive power projection in the Indian Ocean.

FALLOUT OF CHINESE ECONOMIC GROWTH ON SOUTH ASIAN COUNTRIES

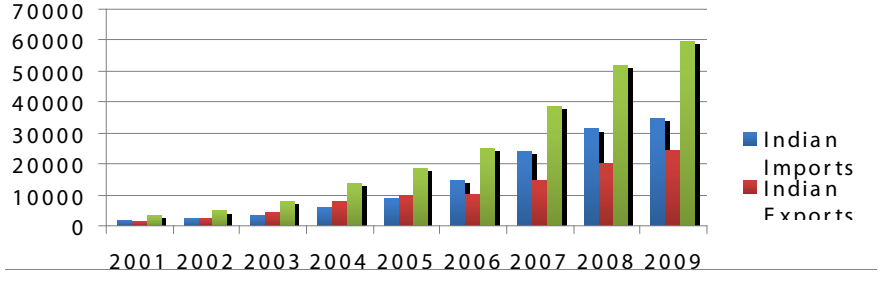
Sino-India Trade and Investment Relations

China as India's second largest trading partner, imports raw materials from India and exports machinery and electrical equipments to India[33]. In 2009, trade volume between China and India was US$ 36.6 billion and would cross the

30. Geng, Lixin, Sino-Myanmar Relations: Analysis and Prospect, available at: http://www.international-relations.com/CM7-2WB/Sino-Myanmar.htm, accessed on July 20, 2010.
31. People's Republic of China-Nepal Relations, available at: http://en.wikipedia.org/wiki/People's_Republic_of_China_%E2%80%93_Nepal_relations, accessed on April 05, 2010.
32. Foreign Relations of Maldives, available at: http://en.wikipedia.org/wiki/Foreign_relations_of_the_Maldives, accessed on May 15, 2010.
33. Trade Relations between India-China, available at: http://blog.made-from-india.com/Trade_relations_between_India_and_China-22.html, accessed on May 30, 2010.

target of US$ 60 billion by 2010 and China will overtake the United States to become India's largest trading partner. During Chinese Premier's recent visit to India, they signed about 50 business deals worth US$ 16 billion and both set a new bilateral trade target of US$ 150 billion by 2015 to expand cooperation in investment, high technology and energy[34]. Trade volume of China and India is shown at Chart 10.

Chart 10: Pattern of China-India Trade Volume 2001-2008 (value in US$ Millions)



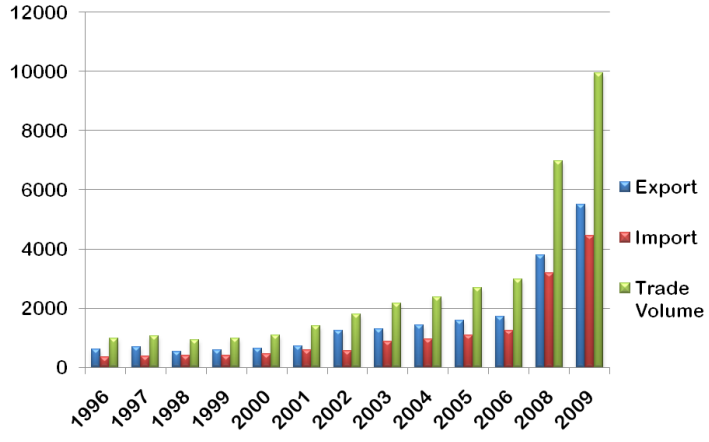
Source: The 'Dragon' and the 'Elephant' and Global Imbalances[35].

Sino-Pakistan Trade and Investment Relations

Security and strategic interests will always dominate Sino-Pakistan trade and investment relations. China is now Pakistan's largest trading partner in Asia[36]. Trade volume between China and Pakistan rose to US$ 6.98 billion in 2008 which was only US$ 964 million in 1996 and reached approximately US$ 9.95 billion in 2009. China-Pakistan trade volume is shown at Chart 11.

34. Enhancing Political Trust, Cooperation with India, Available at: http://english.peopledaily.com.cn/90001/90776/90883/7236054.html, accessed on December 27, 2010.
35. Available at: http://www.ibei.org/admin/uploads/publicacions/42/ang/WP_IBEI_29.pdf, accessed on July 20, 2010.
36. China-Pakistan Relations, available at: http://www.chinadaily.com.cn/china/2006-11/14/content_732562.htm, accessed on March 13, 2010.

Chart 11: Pattern of China-Pakistan Trade Volume 1996-2009 (Value in US$ Millions)



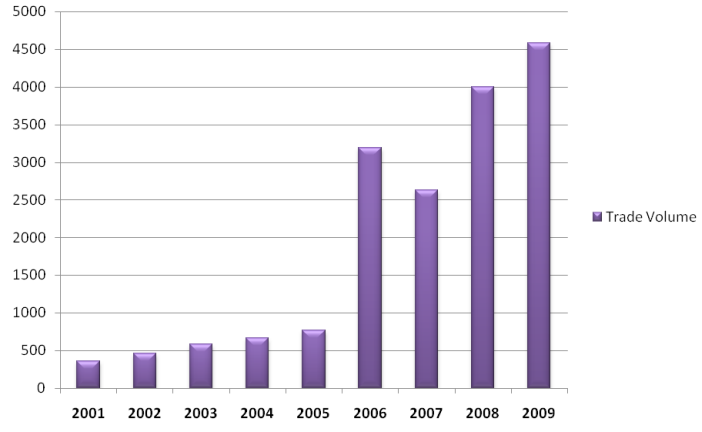
Source: China-Pakistan Trade Relations[37].

Sino–Bangladesh Trade and Investment Relations

China and Bangladesh both have made a great progress in trade and investment relations and China is now one of the largest trading partners of Bangladesh. From January to October 2009, the total volume of bilateral trade reached US$ 5.4 billion and is expected to exceed US$ 6 billion in 2010[38]. However, there exists a trade imbalance, for which China has announced a major aid of US$ 700 million to encourage investment. Bilateral trade volume between China and Bangladesh is at Chart 12.

37. Available at: http://www.pitad.gov.pk, accessed on August 02, 2010.
38. China-Bangladesh Relationship, available at: http://newstoday.com.bd/index.php?option=details&news_id=15764&date=2010-12-26, accessed on December 27, 2010.

Chart 12: Pattern of China-Bangladesh Trade Volume 2001-2009 (US$ Millions)



Source: Dhaka, Beijing to Establish Closer Comprehensive Partnership[39].

FDI proposal, endorsement of Kunming-Chittagong road linking project, investment to construct Chittagong Deep Sea Port for her supplies to reach western land locked states and oil and gas exploration both on and off shore are the Chinese efforts to take Sino-Bangladesh economic relations to a greater height[40]. Bangladesh and Myanmar also signed a deal in July 2007 to link up with China in a tri-nation network[41]. Such link would open up immense opportunities to expand Sino-Bangladesh and Myanmar-Bangladesh trade volume to a large proportion[42]. Bangladesh agreed to allow India to use Chittagong Port and Ashugonj River Port for reaching her commodities to northeastern provinces. If all these agreements are implemented, Bangladesh would become a business hub for all the Asian countries in this sub-continent.

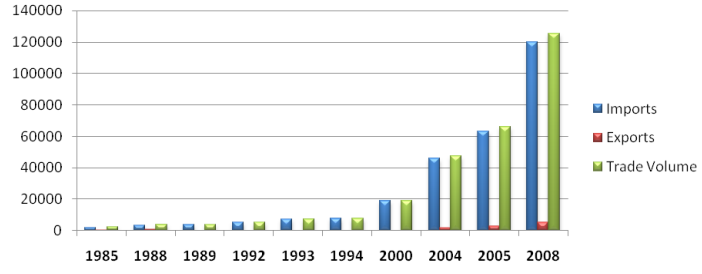
Sino – Sri Lanka Trade and Investment Relations

The economy of Sri Lanka is growing at a faster rate after the end of internal conflict. Trade between China and Sri Lanka has doubled over the last 5 years from US$ 660 million to US$ 1.13 billion. Trade volume between China and

39. Available at: http://www.defence.pk/forums/bangladesh-defence/51201-bangladesh-china-summit-cooperation-significance.html, accessed on July 17, 2010.
40. Kunming Statement, available at: http://www.bipss.org.bd/index.php/page/bipss-ydrc-jointly-affirm-the-kunming-statement-1, accessed on August 25, 2010.
41. Myanmar Proposes Road Network with China, Bangladesh, available at: http://in.reuters.com/article/idINIndia-39680820090517, accessed on September 12, 2010.
42. Discussion with Ashfaqur Rahman, Former Ambassador, Chairman, Centre for Foreign Affairs Studies, at Gulshan, Dhaka, July 20, 2010.

Sri Lanka increased significantly in the recent years. Both China and India are increasingly competing for lucrative and strategic investments in Sri Lanka after she has defeated LTTE, ending of internal conflict in 2009. China-Sri Lanka trade volume is shown at Chart 13.

Chart 13: Pattern of China-Sri Lanka Trade Volume 1985-2008 (Rs. in Millions)

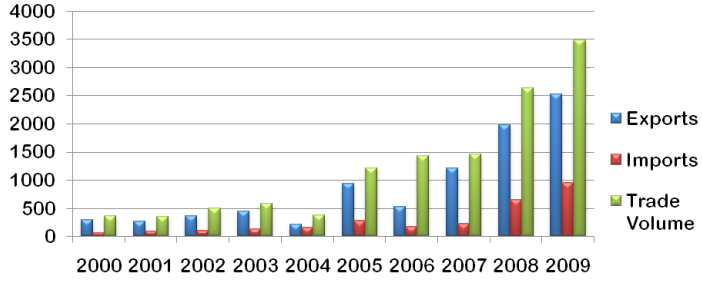


Source: China and Sri Lanka Bilateral Relations[43].

Sino – Myanmar Trade and Investment Relations

Since 1988, economic relations between China and Myanmar has accelerated and increased eight fold by 2009/2010. Trade volume between China and Myanmar is shown at Chart 14.

Chart 14: Pattern of China-Myanmar Trade Volume 2000-2009 (Value in US$ Millions)



Source: Yhome, K, India-Myanmar Relations (1998-2009)[44].

43. China-Sri Lanka Relations, available at: http://chinaconsulate.khb.ru/eng/wjb/zzjg/yzs/gjlb/2782/, accessed on May 05, 2010.
44. Available at: http://www.observerindia.com/cms/export/orfonline/modules/occasionalpaper/ attachments/ ind-myn-OP_1236338801296.pdf, accessed on July 20, 2010.

China at the moment is the largest foreign investor in Myanmar with loans, labour contracts, and emergency aid. China's Petroleum and Chemical Corporation signed a good number of deals with Myanmar Oil and Gas Companies for the exploration of gas and oil from inland and offshore fields of Myanmar including oil pipeline from the western coast of Myanmar to Kunming. India also made great efforts to secure Myanmar's gas and reached an agreement with Myanmar to purchase the gas with more favourable conditions based on 'take or pay'. India further signed an agreement with Myanmar to develop Sittwe Port and connect it to the Indian state of Mizoram[45]. Both China and India are in competition for the acquisition of energy resources from Myanmar.

Sino – Nepal Trade and Investment Relations

Trade relation between Nepal and China though enhanced but for its major economic activities, Nepal would remain dependent on Indian market. With the changed political scenario in Nepal both India and China are in competition to invest and exert their influence. China was the third largest investment generation for Nepal during the year 2008/2009[46] and recent India's investment topped the list among the foreign investments in Nepal.

Sino-Bhutan Trade and Investment Relations

Border trade volume between China and Bhutan is insignificant[47]. Importance of Bhutan is negligible to China because of its very landlocked geographical location.

Sino-Maldives Trade and Investment Relations

China and Maldives started direct economic and technological cooperation since 1981[48]. Since 2002, China is one of the most favoured trading partners for businessmen in the Maldives. Chinese signing of a 25-year lease agreement with Maldives for use of Marao Islands created jobs for the locals who are dependent on tourism and fishery.

45. Kaladan.com, Kaladan Project, available at: http://kaladan.com/kaladan-project/, accessed on May 31, 2010.
46. Ibid.
47. Bhutan-China Relations, available at: http://countrystudies.us/bhutan/51.htm, accessed on March 06, 2010.
48. Hilath, China-Maldives Relation, available at: http://www.hilath.com/?p=1740, accessed on April 02, 2010.

RECOMMENDATIONS FOR SOUTH ASIAN COUNTRIES AND OPTIONS FOR BANGLADESH

Recommendations for South Asian Countries

China's economic, diplomatic and security relations with South Asian countries must remain robust and stable if India views those ties as non-threatening[49]. In such a situation, South Asian countries must derive benefit from Chinese economic fallout.

Instead of seeing China's influence over the Indian Ocean as containment to India and to obviate clash of interest, both China and India should ensure complementary policy rather than conflicting one's and derive mutual benefits through opening and building interstate railway and road network and allow South Asian countries to reap benefit from their economic growth.

The present growing friendly relations between China and India and with other South Asian countries must hold good for ensuring regional peace and economic prosperity taking US onboard so that both the partners are assured of the energy supplies through Indian Ocean.

Maintaining an all-weather friendship with China, Pakistan should not be concerned if both China and India are normalizing their ties. Rather, taking China into confidence, both these countries must solve their long standing Kashmir issue for the peace and stability of South Asia.

Sri Lanka should consolidate her traditional friendship with both India and China, strengthen mutually beneficial economic cooperation and promote all round cooperative partnership.

As Nepal has immense importance for China and India, Nepal should formulate appropriate foreign policy and maintain mutual trust and co-existence with both characterized by courage and devoid of any appeasement. Similar kind of policy should be adopted by Bhutan and Maldives with China and India.

Investment of both India and China in Nepal for power generation and effort of transferring gas or oil through pipeline from Myanmar should also benefit other South Asian neighbours. SAARC forum may be best utilized to venture such trade, political and military cooperation among most of the South Asian countries. If necessary, China may be included in the SAARC as 9th member state instead of having only observer status.

49. Karim, Mohd Aminul, 'China and the West: Emergence of New Security Relations', biiss journal, Dhaka, Bangladesh Institute of International Strategic Studies, Volume 28, Number 1, 2007.

Viable Options for Bangladesh

Sino-Bangladesh relation should not be seen as a zero sum game with respect to India. Effort should be made to bring two way investment and mutual cooperation for better economic progress of Bangladesh.

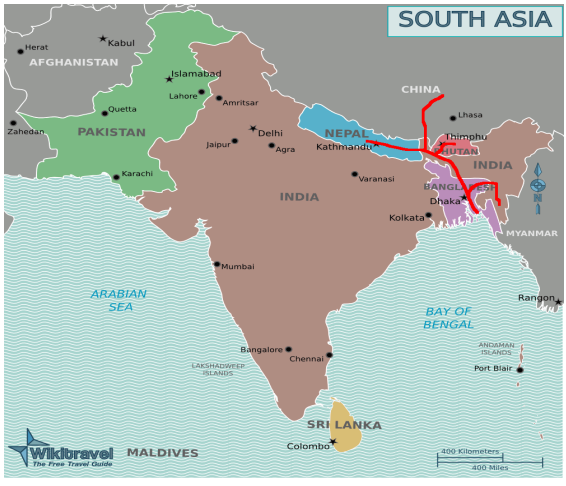
The trade deficit between Bangladesh and China may be minimized by Chinese investment. For this, it is imperative that the road connectivity to China through Myanmar or India must be done as a priority.

Geographically, Bangladesh can be a business hub in the relation of South Asia and South East Asia. Chinese proposal of constructing Deep Sea Port in the Bay of Bengal and interstate connectivity on tri-nation network by linking Chittagong Port to Yangon, Kunming and Indian northeastern land locked provinces must be considered without wasting time[50].

Bangladesh must take benefit of the recent treaty signed by India with Myanmar for connectivity from Sittwe Sea Port to Mizoram state of India having a link from Chittagong so that the trade and transit benefits from India to South East Asia and between India and China should not only go to Myanmar.

Bangladesh can arrange infrastructural development and service quality at Chittagong Port which can be a gateway for both east and west. Bangladesh should also initiate a positive approach to have pipelines going directly from Chittagong Port to southwest provinces of China including Nepal, Bhutan and northeast provinces of India.

50. Rahamatullah, M, 'Regional Transport Connectivity: Opportunities for Bangladesh', biiss journal, Dhaka, Bangladesh Institute of International Strategic Studies, January 2010.



Map showing Oil Pipelines that connects Bangldesh, Nepal, Bhutan, India and China.

In 21st Century, economic interest gets priority over ideology. If India or China can compete in investment and benefit from Myanmar, Bangladesh should also strive to strengthen her relation and economic ties with Myanmar and reap economic benefit from its closest neighbour as well as reduce military threat.

For Bangladesh's security, neither China nor India is a threat. Bangladesh should maintain a concrete defence policy with both these countries and at the same time modernize her Armed Forces as smart, professional and modern one with the assistance of China by getting military hardware, training etc.

Bangladesh has potentials and received offer from China for the exploration of oil and gas both in and off shore. Bangladesh must take immediate measures to resolve her maritime boundaries with both India and Myanmar to take advantage of such offer. China can be a key factor in solving these issues and start exploring natural resources from within Bangladesh maritime zone.

China has developed software industries jointly with India. Software development can be another important sector for Bangladesh, since intellectual capabilities of Bangladeshis' and Indians are the same as they are from the same stock.

Bangladesh's power generation is far short of its requirement. Nepal has the potentials of generating 80,000 MW of electricity where both India and China are investing. Bangladesh must endeavour for multilateral approach to have reasonable share of power being generated in Nepal for running her industrial sector smoothly.

CONCLUSION

Since the founding of PRC in 1949, during Mao period, China went under several reforms like Social Revolution, Great Leap Forward, and Cultural Revolution. None of these reforms could bring significant success in the economy of China. In 1976, after the death of Mao, Deng Xiaoping gradually moved with a pragmatic Four Modernizations programme which brought a dramatic change in the economy. Later, his Reforms and Opening Up succeeded further in doubling GDP and ensuring food and clothing for people. By 2009, China became second largest economy in the world.

Keeping her expansion of economic market, security and energy quest in mind, in the recent years, PRC is attempting to enhance her political economic and security relations with most of the South Asian countries. China's access to maritime facilities through Myanmar, Bangladesh, Sri Lanka, Pakistan and Maldives are part of its quest to establish her regional power profile; and as a means to challenge and contain India in its own South Asian backyard. Both India and China are presently in a new great game under their respective spheres of influence in the Indian Ocean region to have their complementary and competitive enhanced political and security relations.

Since Chinese economy is growing at a very fast rate, her quest to benefit from South Asian countries would compel her for massive investment in this region. India being another economically rising country together with other small states including Myanmar can maintain a very peaceful coexistence benefiting them from China's huge economic fallout. Bangladesh being one of the least developed countries should derive maximum benefit allowing both these countries to invest in developing infrastructure for interstate connectivity, ports and exploration of minerals. Bangladesh should pursue multilateral diplomatic and trade relation with both China and India and make her a business hub for both South East and South Asia.

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He served as Grade 2 Staff of UNPROFOR (Bosnia Herzegovina) and Contingent Member of UNAMSIL (Sierra Leon). He attended a seminar on South East Asian Security (SEAS 2008) in Hawaii, USA, China and India. Brigadier General Feroz visited many countries across the world.

He is father of two daughters, both are studying Engineering. Mrs Noor Jahan Feroz served in two different educational institutions of Bangladesh Army. His hobbies are gardening and playing golf.

CARBON MITIGATION: CLEAN COAL THROUGH CARBON CAPTURE & STORAGE UNDER CLEAN DEVELOPMENT MECHANISM FOR ENERGY AND CLIMATE SECURITY IN BANGLADESH

Major General Abul Hossain, ndc, psc

INTRODUCTION

The Earth faces the grave threat of climate change (CC). R.K. Pachauri, the chairperson of the Inter Governmental Panel on CC (IPCC) based on scientific studies projects that if nations continue to emit green house gases (GHGs) at current levels, the average global temperature would exceed the tipping point and cause irreversible CC by 2015. The possibilities for adaptation of society and ecosystems will rapidly decline with community disruption through health impacts, water shortages and food insecurity for temperature above 2oc of pre-industrial levels1. Bangladesh will be severely affected causing untold suffering and instability for scarcity of food, shelter, water and large-scale migration.

Energy security is the prime concern of every nation. Source and supply of energy has always remained one of the focuses of nation states. Exploitation of traditional, non traditional energy sources and secured supply ensure energy security.

Coal is the dirtiest of all fossil fuels. Study reveals that coal will meet over 25% of global energy demand in the coming decades. Coal is the major fossil fuel for generating electricity in the industrialized nations and emerging economies. It will continue to do so as long as it is cheap and plentiful. The major challenges for coal are its 'impacts on environment for carbon dioxide (CO_2). CO_2 makes up 80% of anthropogenic GHGs emissions causing global warming (GW). The main anthropogenic sources of GHGs emissions are energy.

The alarming environmental degradation and rise of global temperature have forced the energy experts to make a transition to a new era of greener, cleaner energy development to meet CC. Clean Coal Technology (CCT) seeks to reduce harsh environmental effects by using multiple technologies to clean coal and contain its emissions. Carbon capture and storage (CCS) is perhaps the most promising clean coal technology. Captured CO_2 is stored in geological formation or ocean bed.

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1. Mazo, Jeffrey (2010) " *Climate Conflict-How global warming threatens security and what to do about it",*New Yourk, USA, Routledge, p. 12

Robert Malone, Chairman and President British Petroleum (BP) America said that "Deploying CCS at scale is not as much a question of technology availability but of economic viability. CCS is available today to play a significant role in reducing GHG emissions and addressing CC." The present investment cost of CCS is US$ 40-80/t CO_2 but this cost is reducing to the range of US$ 40 – US$ 60/t.

Bangladesh has very limited energy resources. Gas and coal are the most exploreable energy resources with 12.52 Tcf of gas and 3.3 Giga ton (Gt) of coal reserve. All the gas fields are likely to deplete by the year 2030. Coal is yet to explore to its full capacity. Bangladesh can convert coal into electricity through CCT using CCS under Clean Development Mechanism (CDM). Depleted gas fields and coal bed methane (CBM) seams provide opportunity for carbon sequestration. CCS technology along with improved efficiency can reduce CO_2 emissions to the atmosphere by 80%-90% at coal-fired power stations.

To avoid CC, synergy between energy and climate security is a requirement. Bangladesh can mitigate carbon and contribute positively to CC and the gross domestic product (GDP) through CCT under CDM for energy and climate security. CDM under Kyoto Protocol for emerging economies like Bangladesh is the key to address the challenges of environmental pollution and GW.

There are several Near Zero Emission Coal (NZEC) projects under operation around the globe. Recently China and India also have under taken some NZEC projects. Bangladesh can harness this opportunity for NZEC technology negotiating strongly in conference of parties (COP) and maintaining close liaison with UK, USA, Australia, and through global and regional emissions trading market. The paper attempts to focus on three objectives. These are discussing the CC its impacts and carbon problem; analyze energy scenario in Bangladesh including potential of coal for energy and climate security and explore CCS under CDM options for Bangladesh for CCT.

CC AND CARBON PROBLEM

CC and Its Impact

CC in generaly refers to long-term changes in climate, including average temperature and rainfall.[2] However, the observed changes in the climate system over the 20th century are due to anthropogenic cause. The past decade has seen the hottest summers, the fiercest cyclones and typhoons and alarming rise in sea

2. http://www.climatechange.gov.au/climate-change.aspx.Retrieved on June 30,2010

levels. Cyclone SIDR, Ayla and Nargish that lashed Bangladesh and Myanmar are seen more as disasters triggered by CC[3]. Alarmingly, we may have already passed tipping points that are irreversible within the time span of our current civilization[4].

The expected consequences of climate change include rising sea levels and population displacement, increase severity of typhoons and hurricanes, droughts, floods, disruptions of water resources, extinctions and other ecological disruptions, wild fire, severe disease outbreaks, and declining crop yields and food stocks[5]. CC will cause a large migration of peoples, scarcity of foods and shelters leading to internal and external unrest. The climate conflict will be spreader amongst the countries.

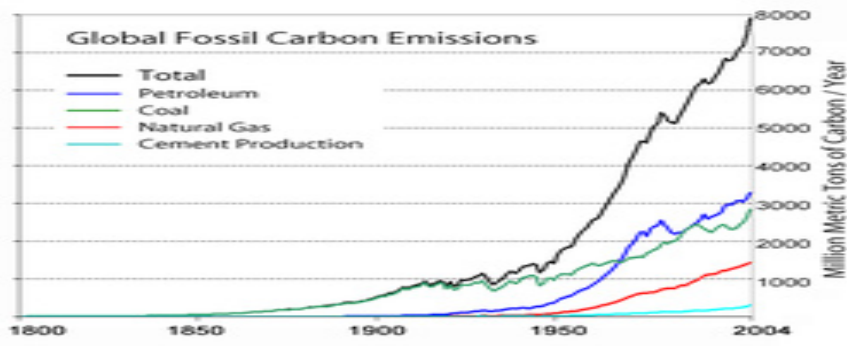
Due to CC, Sea Level Rise (SLR) will be 14 cm, 32 cm and 88 cm by the year 2020, 2050 and 2100 respectively[6]. Major portion of many island states will go under water. It will seriously affect Developing and Least Developed Countries (LDCs). 50 to 100 centimeter (cm) rise of sea levels by 2100 will displace 10% population of the world (more than 600 million peoples)[7]. About 0.5-meter rise in sea level would inundate an area of 22,000 sq.km of Bangladesh, affecting 17 million people[8]. The other impacts would be on Agriculture, Bio-diversity and Forestry, Human Health, Fisheries, Drainage, Fresh water etc.

Carbon Problem

Many of the challenges we face, from poverty to armed conflict links to the effects of GW and CC. Fossil fuel burning causes dangerous interference in the climate offering growth of GHGs in the atmosphere. Fossil fuels emit 80% of GHGs and CO_2 only accounts for more than 77% of total emissions. The main anthropogenic source of GHGs emissions is energy. Details of anthropogenic source are given in fig 1&2 below.

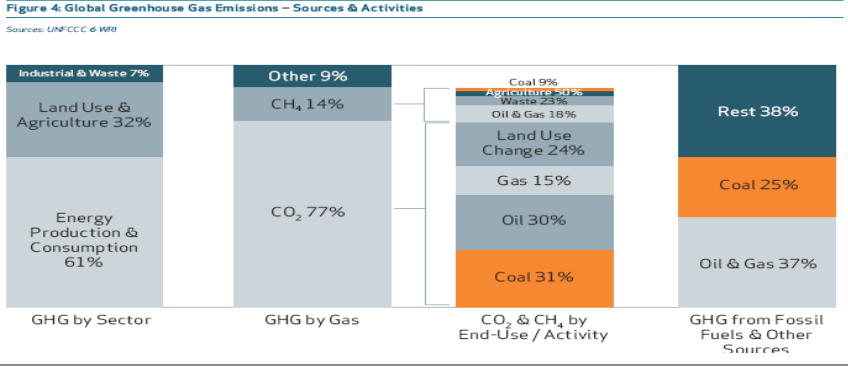
3. Chaudhary, Prashant, 2009,'Enemies of the Earth' India Today, December 21, pp 31-36. Available at http://subscriptions.digitaltoday.in/subscriptions/itoday/regionlInt.html.Retrieved on May 15, 2010.
4. Hossain, Md, Billal, 2009'International and National Response to climate change', *World Environment Day(WED) 5 June 2009*, DoE, MoEF, Peoples Republic of Bangladesh, p.55
5. Mazo, Jeffrey, Op. cit., p.55
6. Hossain, Md, Billal, Op. cit., p.55
7. Danesh Dr.Md Miah 'Change: Carbo*n* Trading and Sustainable Development World Climate', WED 5 June 2009, DoE, MoEF, Peoples; Republic of Bangladesh, Pp, 18.
8. United Nations Environment programme (UNEP) Potential Impact of Climate Change.

Figure 1: Modern global anthropogenic carbon emissions.



Source: (http://en.wikipedia.org/wiki/Greenhouse_gas)

Figure 2: Global Greenhouse Gas Emissions – Sources & Activities



Sources : UNFCCC &WRI

ENERGY AND CLIMATE SECURITY

Energy Scenario

Energy is the main driving force for the economic growth of a country. Bangladesh requires adequate supply of energy to attain desired prosperity within stipulated time. We must explore all available resources to produce electricity to fulfill the development needs**.** Electricity demand projection is given in Table 1 bellow:

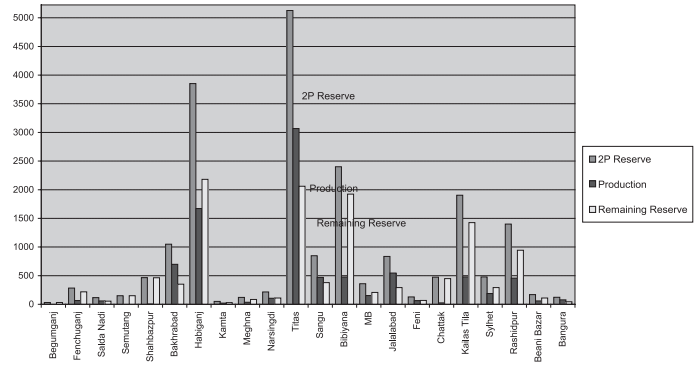
Table 1: Electricity Demand Projection by PSMP-2006			
Year	5.5 %GDP	8 %GDP	Remarks
2008	5569MW	5904MW	* Presently Bangladesh has about 2000 MW electricity shortages.
2009	6066 MW	6567MW	
2010*	6608 MW	7355MW	
2013	8364MW	10473MW	
2015	9786MW	13408MW	
2020	13993MW	24445MW	
2025	19312MW	41899MW	
Source: Petrobangla			

Potentials of Gas Resources in Bangladesh

Gas is the major exploreable and only dependable energy resource in Bangladesh. There is huge deficit between demand and supply of gas. However, there are hopes as well as despair about the potentials of gas in Bangladesh. Proven and probable reserve, exploration, production and depletion state of gas are given in table-2 and figure-3 &4 below:

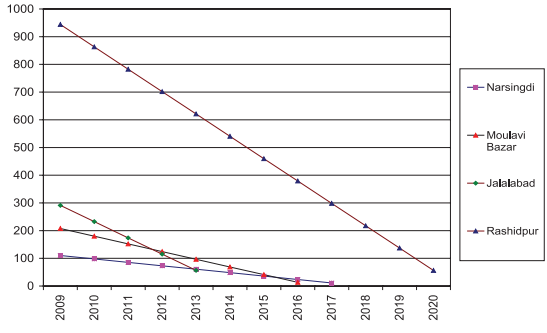
Table 2: Summary of Gas Reserve as of 31st December 2009		
Gas Initially place (Proven + Probable)	28,619.70 Bcf	28.62 Tcf
Recoverable (Proven + Probable)	20,631.50 Bcf	20.63 Tcf
Gas Production in December 2009	58.30 Bcf	0.06 Tcf
Cumulative Production as on 30th December 2009	8106.80 Bcf	8.11 Tcf
Remaining Reserve	12,524.70 Bcf	12.52 Tcf
Source: Hydrocarbon Unit, Energy & Mineral Resources Division		

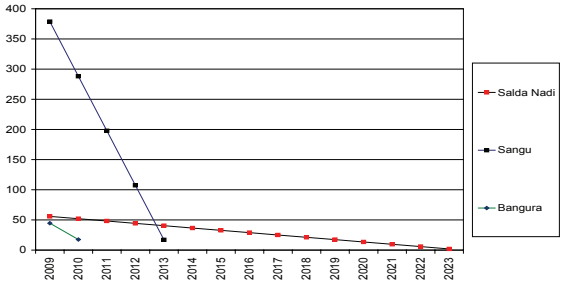
Figure 3: Field Wise Gas Reserve (2P), Cumulative Production and Remaining Reserve (Bscf)

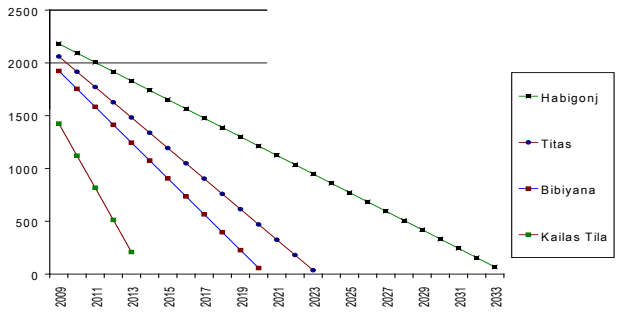


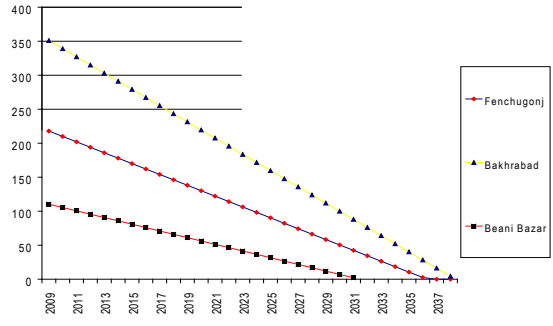
Source: Hydrocarbon Unit, Energy & Mineral Resources Division

Figure 4: Depletion Picture of Gas Field (@ Base Year 2008)









most of these gas fields will deplete by 2030

Coal: A Sustainable Energy

Fossil fuels dominate around 80% of energy needs. Coal will meet over 25% of global energy demand. Coal is abundantly available, affordable, reliable, geographically well distributed and easy and safe to transport. Coal markets are well functioning and responsive to changes in supply and demand[9]. It is the major fossil fuel to generate electricity in the industrialized nations, emerging economies and continue to do so as long as it is cheap and plentiful. The major challenges for coal are its 'impacts on GW for CO_2, which makes up 80% of anthropogenic GHGs emissions.

9. World Coal Institute -Document, 'Coal Meeting the Climate Challenge-Technology to Reduce Green House Gas Emissions', World Coal Institute, London, p.3 available at (http://www.worldcoal.org/carbon-capture-storage/financing-ccs/ accessed on 24 june, 2010).

Clean Coal Technology (CCT)

CCT seeks to reduce harsh environmental effects by using multiple technologies to clean coal and contain its emissions.[10] **CCS** - perhaps the most promising CCT -catches and sequesters CO_2 emissions from stationary sources like power plants. **Fuel- gas separation**- removes CO_2 with a solvent, strips off the CO_2 with steam, and condenses the steam into a concentrated stream. **Oxy- fuel combustion**- burns the fuel in pure or enriched oxygen to create a fuel gas composed primarily of CO_2 and water. **Pre -combustion capture**- removes CO_2 before it burns as a part of a gasification process. CO_2 is stored in either geological formation or ocean bed[11]. CCS technology along with improved efficiency can reduce CO_2 emissions to the atmosphere by 80%-90% at coal-fired power stations[12].

NZEC

NZEC technology enables coal to contribute to zero-carbon energy. To achieve NZEC generation, it is necessary to capture and sequester the carbon emissions. The joint UK-China NZEC initiative addresses the challenge of increasing energy production from coal in China and the need to tackle growing CO_2 emissions[13].

Potentials of Coals in Bangladesh

Coal resources of 3.3 billion ton in coalfields as shown in table -7 have high prospective to meet the energy needs of Bangladesh. Bangladesh has good quality coal. There are also exploration potentials of more coal. Coal import is easy and available from neighboring countries. Clean coal technology is available and environment friendly.

Coal Bed Methane (CBM) is also an important source of energy. Jamalgonj coal deposit has a potentiality of about 500 Bcf CBM. CBM is a form of natural gas, composed mostly of methane and found in coal beds worldwide. Extraction of CBM is technologically feasible and economically viable. CBM extraction can provide immediate relief to the current energy needs. Moreover, extraction of CBM does not exclude coal mining using open-pit or underground mining of the same fields later. Extraction of CBM before mining the coal actually reduces dangers of methane outburst during underground mining[14].

10. HowStuffWorks and the web http://science.howstuffworks.com/environmental/green-science/clean-coal.htm Retrieved on 03-09-2010.
11. ibid.
12. ibid.
13. http://www.nzec.info/en/. Retrieved on 08-09-2010.
14. Islam, Md, Rafiq"Potential for Coal Bed Methane in Bangladesh" Energy Bangla, 2009, available at http ://www.energybangla.com/index.php?mod=article&cat=CoalSector&article=1943. Retrieved on 12-07-2010.

Table 3: Estimated Coal Reserve

Location/ Field	No. of Wells Drilled	Estimated coal resources (Million Tons)	Total in-situ reserves (Million Tons)	Proved in-situ reserves (Million Tons)
Barapukuria, Dinajpur	31 (118-509m)	390	390	303
Khalashpir, Rangpur	14 (257-483m)	685	685	143
Phulbari, Dinajpur	108 (150-240m)	572	572	288
Jamalgonj, Joypurhat	10 (640-1158m)	1053	-	-
Dighipara, Dinajpur	5 (328-407m)	600	600	150
Total		3300	2247	884

Source: Petrobangla

Climate versus Energy Security

Fossil fuels provide 80% of global energy and are responsible for 65% of global GHGs. World large energy reserve is in the unstable region and supply during crisis is very critical. The energy security and climate security thus seems conflicting as well as crucial.

Objective of climate change policies is an effectively zero-carbon-emitting energy sector in the developed world and substantially lower carbon emissions in the developing world. The energy sector will need to change radically in the coming decades to meet both climate and energy security. Increased energy efficiency and greater use of most renewable energies, will enhance climate and energy security. Other energy sources are not so benign and be used with 'do-no-harm' approach.

Bangladesh needs a suitable 'energy mix' for energy security in the form of fossil fuel, nuclear and renewable energy. It also needs optimum utilization of energy through energy efficiency, options for greater quality of supply from

international and regional sources and decreased energy demand through energy efficiency[15].

Bangladesh lacks capacity to exploit resources for energy and climate security. Global carbon policy initiative for carbon sequestration will provide good opportunity for Bangladesh to use its coal for energy and climate security. Bangladesh as a MVC for CC must build the capacity and negotiate in the COP for NZEC technology and fund under CDM from Annex 1 countries.

CARBON CAPTURE AND STORAGE (CCS)

Mitigation of GHGs in Non-annex 1 Countries under CDM

Non-annex countries need support, both financial and technical to mitigate carbon emissions and reconcile economic development. One of the means of achieving this is the Kyoto Protocol's CDM. The World Bank's Prototype Carbon Fund is a public private partnership that operates within the CDM.

In July 2005 the U.S., China, India, Australia, as well as Japan and South Korea, agreed to the Asia-Pacific Partnership for Clean Development and Climate. The pact aims to encourage technological development that may mitigate GW and aid both growth and a cleaner environment simultaneously[16].

Presently emerging economies have undertaken a number of clean development projects under CDM for carbon sequestration. New Carbon Policy Initiative by the developed countries is favorable for global carbon trading for developing and LDCs. Bangladesh should harness this opportunity through strong negotiation.

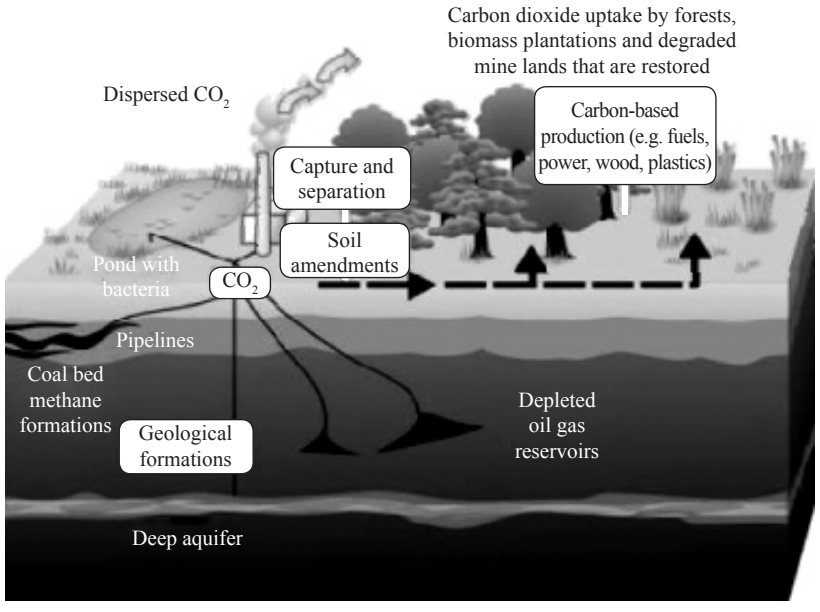
To provide more opportunities for developing countries to adapt clean technologies, UNEP and WTO urged the international community to reduce trade barriers and to conclude the Doha trade round , which includes opening trade in environmental goods and services[17]. Experts suggested that up to the year 2050, an effort to cap GHGs emissions would benefit developing countries significantly when combined with enhanced adaptation.

15. Hossain, Mollah Amzad (2008), "Interview-Bangladesh Needs to Find Right Mix of Energy Resources", Energy & Power, 16 February, Pp. 29-30.
16. Climate Change Mitigation from Wikipedia, the free encyclopedia. Available at http://en.wikipedia.org/wiki/ Climate_change_mitigation#Mitigation_and_developing_countries. Retrieved 14 May 2010.
17. Free trade can help combat global warming, finds UN report, UN News Centre, 26 June 2009. Available at http://www.un.org/apps/news/story.asp?NewsID=31278&Cr=trade&Cr1=environment#.Retrieved 14 May 2010.

CCS to Mitigate CC

CCS is a plan to mitigate CC by capturing CO_2 from large point sources. CCS applied to a modern conventional power plant could reduce CO_2 emissions to the atmosphere by approximately 80%-90% compared to a plant without CCS[18]. CCS technologies enable emissions of CO_2 to strip out of the exhaust stream from coal combustion or gasification and stored in deep saline or geological formations, depleted oil and gas fields, or un-mineable coal seams as shown in figure 5 below:

Figure 5: Terrestrial and Geological Sequestration of CO2 Emissions from a Coal-Fired Plant



Sources (http://wapedia.mobi/en/Climate_change_mitigation?t=1.3. Retrieved 12-07-2010)

Costs of CCS

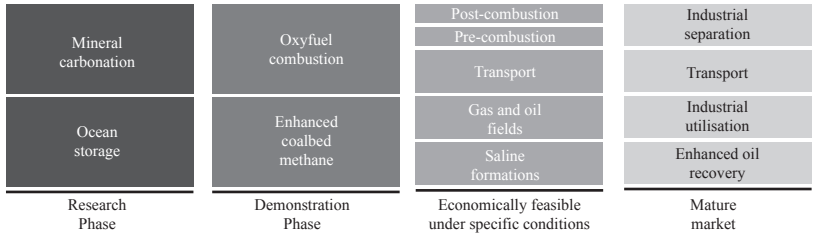
The cost of CCS for power generation from coal is between US$40 and US$90 per ton of CO_2. IEA has found that stabilizing emissions without CCS raises costs by over 70%. Economies of scale and efficiency improvements reduce cost.

18. Main article: Carbon capture and storage Available at http://wapedia.mobi/en/Climate_change_mitigation?t=1.3 . Retrieved on 16 May 2010.

CCS Technology

Different categories of CCS technology (figure 6).

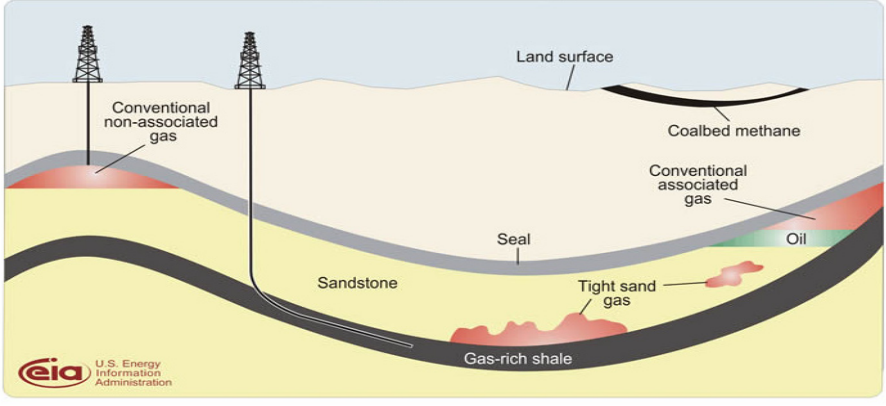
Figure 6: Maturity of CCS Technology



Source: IPCC 2005

Geology of Natural Gas Resources

Figure 7: Schematic Geology of Natural Gas Resources



Source; U.S. Energy Information Administration

Conventional gas accumulations occur when gas migrates from gas rich shale into an overlying sandstone formation, and then becomes trapped by an overlying impermeable formation, called the seal. Associated gas accumulates in conjunction with oil, while non-associated gas does not accumulate with oil[19]. CBM does not migrate from shale. It is generated during the transformation of organic material to coal.

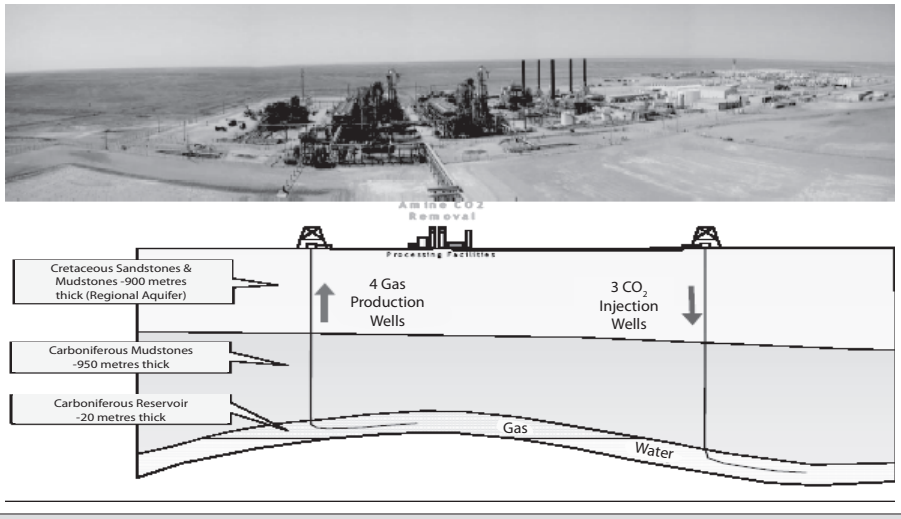
19. U.S. Energy Information Administration (eia) available at http://www.eia.gov/oil_gas/natural _gas/ special/ ngresources/ngresources.html. Retrieved 14-07-2010.

Geological formations currently are the most secured and promising storage capacity of CO_2[20]. IPCC 2005 Special Report on CCS found that the risk of leakage from geological storage more likely to be less than 1% over 100 years and likely to be less than 1% over 1000 years.

Case Study -1: Geological Storage of CO2

In Algeria at Salah Desert, industrial scale demonstration projects for conventional CCS of CO_2were undertaken by BP group technology for CO_2 storage at an incremental cost of US $ 6/t CO_2 without commercial benefits for test bed for CO_2 monitoring technology. Salah project addressed various aspects of the CCS benefits, challenges and technology options for stabilization. It was a CCS for coal plants in Salah depleted gas field (figure 8).

Figure 8: CO_2 Storage Operation in Salah Gas Field.



Source:http://unfccc.int/files/meetings/sb24/in-session/application/pdf/sbsta_may_20th_in _salah_wright.pdf

The result of the project provided with (1) excellent analogue for other countries; China, Europe, North America (2) already stored I mmt CO_2 (3) Incremental cost was US$ 6/t CO_2 and no commercial benefit earned. (4) Research project cost was US $30 million.

20. Main article: Carbon capture and storage Available at http://wapedia.mobi/en/ Climate_change_mitigation?t=1.3 . Retrieved on 12 May 2010.

Case study-2: Coal Mine Methane (CMM)

CMM is a significant source of energy in Australia and the USA and is of growing importance in a number of other countries, including China, Germany, Kazakhstan, Poland, Russia, Ukraine and UK. Xstrata oaky Creek power station in Queensland, Australia was commissioned in 2006 and is expected to save 341,000t CO_{2-4} per annum. The gas-fired station uses methane extracted from the coalmine to generate electricity for supply to the national grid.

CCS under CDM

Under the Kyoto Protocol's 'Flexibility Mechanisms' – the CDM, Joint Implementation (JI) and Emissions Trading – are adapted for large-scale CO_2 mitigation projects, such as CCS. An important step has been the recent approval by the CDM Executive Board (CDM EB) of a "Consolidated Methodology for New Grid Connected Fossil Fuel-Fired Power Plants Using a Less GHGs Intensive Technology". The new methodology allows Certified Emissions Reduction (CERs) credits to issue for the CO_2 emissions[21].

IETA's Views on CCS

- CCS is an important part of a portfolio of options available for CC mitigation.
- CCS is urgently needed to meet near-term emission reduction targets and longer-term stabilization of atmospheric CO_2 concentrations.
- CCS is a proven technology. The oil and gas industry has gained considerable experience over several decades relating to the capture, transport and storage of CO_2 and the monitoring of CO_2 injected in geological formations.
- CCS can contribute towards sustainable development to coal-based developing countries for GHGs mitigation.
- CCS needs incentives for deployment due to the additional costs of capture, transport and storage. Certain "early opportunities" for CCS deployment could be incentivized via CDM for wider deployment in the medium-term.
- Project-based mechanisms provide a valid potential incentive for CCS deployment in non-Annex I countries for "early opportunities.
- Early deployment of CCS projects in developing countries will come with good expertise and capacity building efforts from developed countries.

21. WCI Climate Policy Paper 5 – Investing in CCS accessed to http://www.worldcoal.org/carbon-capture-storage/financing-ccs/.Retrieved 02-07-2010.

Global Carbon Policy Analysis

This new report "Global Carbon Policy Analysis: Policy Initiatives Driving the Growth of Carbon Sequestration Market" provides an in-depth analysis on the policy initiatives by the EU, US, Canada, Australia and other developed and developing economies. The report suggests investment decisions in CCS projects by providing trends and information on global carbon trading policies. It provides an opportunity on the current investments in CCS projects globally[22].

The EC's commitment towards reducing GHGs has accelerated the deployment of CCS projects globally. EU has promoted these projects by incentivizing power plants that are planning to modernize with integrated CCS facilities. EU has fixed the cap on distribution of excess carbon emission allowances to achieve emissions reduction ahead of 2020. EU member states can partner with emerging nations to develop net zero emission plants and these investments can be traded with the emissions reduction.

UK and China are in the implementation of China's first NZEC power plant China-EU (COACH) project, which is expected to be operational by 2015. China is also working closely in conjunction with the UK and receiving financial and technological support for many CCS projects. It is vital to achieve global carbon trading schemes and meet the wider environmental challenge. CDM is a key to engage emerging economies. Bangladesh can negotiate strongly as MVC of CC for CERs from CDM Executive Board (CDMEB) for CCT power plant. Government can promote CCS as a public good under PPP for initial research project.

22. http://www.pr-inside.com/global-carbon-policy-analysis-policy-initiatives-r1452861.htm. Retrieved 02-07-2010.

Figure 9: Kamta gas field

Source: Hydrocarbon Unit, Energy & Mineral Resources Division

Kamta Well #1figure 9 was drilled in 1981 to a depth of 3618m. BAPEX's technical consultant BGR (Fedaral Institute for Geo-science & Mineral Resources, Germany) selected Kamta gas field for lean period gas storage. Later no detail study or action was carried out for feasibility.

Depleted Gas Fields and Coal Seams.

Experts opine that almost all of present 24 Gas Fields of Bangladesh will deplete by 2020-2030 (figures 4). These depleted gas fields of Bangladesh is a large geological formation for carbon storage and could be a huge source of income for carbon trading through CCS. Jamalganj and Jaypurhat CBM coal seams is also good for exploration and carbon sequestration.

Benefits of CCS

Technological Benefit

Now the mature CCS technology is available in the developed world. The annex 1 countries are committed under Kyoto Protocol to transfer technology to developing countries and emerging economies. It will yield benefit from the skilled jobs and advanced technologies.

Economic Benefits

Carbon trading is presently operating in EU markets. Experts opine that it will be functional in US market also. The market price for per ton of CO_2 currently is 20 US$. It will increase with opening of US market. Bangladesh gas fields are well impermeable as it contained gas under high pressure for thousands of years. Approximately 419.22 $X10^{-3}$ Giga tons of CO_2 (equivalent to 20.63 tcf of gas) can be stored; whose cost would about be US$ 8385 Million dollars.

Table 4: Cost Benefits for CCS in Bangladesh Gas Fields.

Storage Type	Volume				CO2	Cost in Million Dollors
	Tcf	Bcf	B.Cu.m (Bcfx0.02834)	G.t (B.Cum x 0.717kg)	G.t	(@US$20 per ton CO2
Gas Fields	20.63	20,631.50	584.70	419.22 X10-3	419.22 X10-3	8384.55
Oil Fields			Not calculated			
CBM Seams			Not calculated			

Source: Reference for estimation " CDM and its Opportunities in Bangladesh", Waste Concern, November, 2004, p. 8

Social Aspect

Bangladesh is a land scarce country. Gas fields are either on private/ government land or near to the population. Most of the people are illiterate and lack adequate knowledge on CCS. People will be suspicious and skeptic about the bad effect of CO_2 storage and its leakage. Our divisive political culture may take an opposite view with the ruling regime. This may create social chaos and unrest, which may turn to a movement. Social awareness and political consensus is a precondition for such huge projects of global nature.

RECOMMENDATIONS

Strong Negotiation at COP. As a victim of CC and a leader of MVCs and LDCs, Bangladesh will have to negotiate strongly in the coming COP for climate agreements for GHGs emissions reductions for second and more terms including fund for CC.

Carbon Mitigation. Though Bangladesh emits very less GHGs, even then Bangladesh should follow low carbon path in its economic growth and secure considerable climate fund and technology.

Energy Security. Bangladesh will have to ensure its energy security through energy mix exploiting all local resources and exploring regional & international resources and opportunities.

Energy and Climate Synergy. Bangladesh will have to maintain synergy between energy and climate security through renewable energy, energy efficiency, clean coal and CCS.

CCT. GOB will have to explore its huge coal resources without delay and use it as NZEC for electricity production under CDM for CC.

CBM. GOB needs to extract CBM at Jamalganj, Joypurhut for CO_2 sequestration in un-minable coal seams, while producing methane.

CCS in Depleted Gas Fields. GOB will have to exploit the opportunity of carbon sequestration in depleted gas fields of Bangladesh in near future under CDM.

International Oil and Gas Industry in CCS. GOB will have to take the advantage of the International Oil and Gas Industry in Bangladesh for CCS as they have gained considerable experience over several decades relating to the capture, transportation and storage of CO_2 and the monitoring of CO_2 injected in geological formations.

CCS in Coal-based Developing Countries. GOB will have to take advantage of CCS's contributions towards sustainable development to coal-based developing / non-Annex I countries for GHGs mitigation through use of CCS under CDM from the developed countries. She should also pursue for CCS early deployment as incentives and project-based mechanisms via CDM for expertise and capacity building.

Economic and Technological Benefits for CCS. GOB should take the advantage of billions dollars economic benefits and technological benefits of skilled jobs and advanced technologies under CDM for CCS for CC.

Social Aspect. GOB should not ignore the social aspect, the skepticism about the bad effect of CO_2 storage and its leakage. Social awareness and political consensus should be built for such huge projects.

CONCLUSION

The impact of CC will be the SLR, a large migration of people, increase typhoons, cyclones and floods, disruptions of water resources, extinctions and other ecological disruption, severe disease outbreaks, scarcity of foods and shelters leading to internal and external unrest. The climate conflict will spread amongst the countries.

About 0.5-meter rise in sea level would inundate an area of 22,000 sq.km of Bangladesh, affecting 17 million people. The other impacts would be on Agriculture, Bio-diversity and Forestry, Human Health, Fisheries, Drainage, Fresh water etc. Many of the challenges we face, from poverty to armed conflict, are linked to the effects of GW and CC. Fossil fuel burning is causing dangerous interference in the climate offering growth of GHGs.

Bangladesh has huge shortage of gas production for the generation of electricity. It has 3.3 Gt of coal reserve including CBM. Coal is very cheap, affordable and coal market is well functioning around the globe. Fossil fuels provide 80 per cent of global energy and responsible for 65% of global GHGs. The energy and climate security thus seems conflicting. There are a number of ways to reduce emissions from the energy sector like renewable; switching to near-zero-emission sources; and CCS of fossil fuels etc.

Bangladesh lacks capacity to exploit resources for energy and climate security. Global carbon sequestration provides good opportunity for Bangladesh to use its coal for energy and climate security. Bangladesh can build the capacity and negotiate in the COP for NZEC technology and fund under CDM from Annex 1 countries. She can get huge investment and financial support to ensure environment friendly production processes in the clean coal energy sector through negotiations as a leader of LDC and MVC of the world CC movement.

CCS technology is the only currently available technology that allows very deep cuts 80%-90% in CO_2 emissions to atmosphere from fossil fuels. CCS technologies enable emissions of CO_2 to strip out of the exhaust stream from coal

combustion or gasification and stored in depleted oil and gas fields or unmineable coal seams. Geological formations, depleted gas fields are currently considered the most promising storage of CO_2. Gas has been there with very high pressure for thousands of years and leakage percentage for storage of CO_2 is near to zero or likely to less than 1% in 1000 years. The success of the Salah and Xstrata oaky projects provided with excellent analogy for other countries for CCS.

The cost of CCS for power generation from coal is estimated between US$40 and US$90 per ton of CO_2. Storage at sites, capture and compression costs dominate the overall cost. IEA has found that stabilizing emissions without CCS raises costs by over 70%. Power plants with CCS reduces CO_2 emissions by 80%-90%.

Experts opine that Geological Formations of Bangladesh Gas Fields could be good for CO_2 storage. The depth is adequate, other features and permeability are also considered feasible for carbon sequestration. CCS can benefit Bangladesh technologically and financially. Under Kyoto Protocol developed countries have binding responsibility to transfer technologies to developing countries for emissions reduction. Bangladesh can achieve CCS and CCT for NZEC under CDM to convert its huge coal resource to clean electricity.

Carbon trading is presently operational in EU, markets. The market price for per ton of CO_2 currently is US $20. Present gas fields of Bangladesh possibly will deplete by 2020-2030. Bangladesh can earn billion dollars for carbon sequestration only from developed countries for CC.

LIST OF ABBREVIATIONS

Annex I Countries.	OECD Countries and Economies in Transient Countries
BP	British Petroleum
BAPEX	Bangladesh Petroleum Exploration & Production Co. Ltd
CBM	Coal Bed Methane
CC	Climate Change
CCT	Clean Coal Technology
CCS	Carbon Capture and Storage
CDM	Clean Development Mechanism
CDM EB	CDM Executive Board

CERs	Certified Emissions Reductions
CMM	Coal Mine Methane
COACH	COoperation Action within CCS CHina-EU
CO_2	Carbon Dioxide
COP	Conference of the Parties
EU	European Union
GHGs	Green House Gases
GoB	Government of Bangladesh
GW	Global Warming
Gt	Giga Ton
GDP	Gross Domestic Product
IETA	International Emissions Trading Association
IPCC	Inter Governmental Panel on Climate Change
JI	Joint Implementation
LDCs	Least Developed Countries
MVC	Most Vulnerable Country
MW	Mega Watt
Non-Annex I Countries	Mostly Developing Countries Including LDCs
NZEC	Near Zero Emission Coal
OECD	Organization of Economic Cooperation and Development
PSMP	Power Sector Master Plan
SLR	Sea Level Rise
UNEP	United Nation Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
WRI	World Resources Institute
WTO	World Trade Organization
2P	Proven + Probable

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COUNTER-PIRACY: ORCHESTRATING THE RESPONSE

Captain Muhammad Musa, (G), afwc, psc, BN

Introduction

Definition of the Term Piracy is a form of illegal belligerence. It is not identical to coastal raiding, unarmed theft from ships, maritime terrorism, and maritime aspects of insurgency. It was traditionally and universally condemned both in customary international law and in treaty commitments. The UN Convention on the Law of the Sea (UNCLOS) adopted in 1982 and entered into force in 1994, defined piracy as any illegal acts of violence or detention or any act of depredation, committed for private ends by the crew or the passengers of a private ships or a private aircraft and directed on the high seas against another ship or aircraft or against person or property on board such ship or aircraft; against a ship, aircraft, person or property in a place outside the jurisdiction of a states; (b) any act of voluntary participation in the operation of a ship or of an aircraft with knowledge of facts making it a pirate or aircraft; (c) any act of inciting or of intentionally facilitating an act described in paragraph (a) or (b). In legal terms, pirates need to use a ship to attack another ship.

The escalation of piracy at sea in recent years has been a matter of great concern to the maritime community and has prompted International Maritime Organization (IMO) to make combating it a central theme of its work. The reality, of course, is that piracy is too complex and has become too entrenched for any one entity to deal with it effectively. The United Nations, Governments acting collectively or individually, military forces, shipping companies, ship operators, ships' crews, among others, all have a crucial part to play if shipping is to be rid of this crime and the integrity of strategically important shipping lanes maintained. What is needed is a collective effort, and that is why IMO chose "Piracy: orchestrating the response" as its theme for World Maritime Day 2011 and to underpin its own work in this area during this year and beyond.

A recent study has revealed the shocking statistics that, during 2010 alone, 4,185 seafarers were attacked by pirates using firearms, even rocket propelled grenades; 1,090 were taken hostage; and 516 were used as human shields. No fewer than 488 were reported suffering significant psychological or physical abuse. Moreover, while innocent seafarers bear the brunt of these crimes, the world economy suffers too – an annual cost that is now estimated to be between 7 billion and 12 billion US dollars. And, with more than 12 per cent of the total volume of oil transported by sea flowing through it, the strategic importance of the Gulf of Aden can be severely affected, while ships, electing to divert via the

Cape of Good Hope to avoid being attacked by pirates, face significantly longer voyages with all the associated costs and environmental consequences.

After the hijacking of the Bangladeshi flag vessel MV Jahan Moni on 5th December 2010 with 23 Bangladeshi nationals, people of Bangladesh came to know about modern day hijacking in the open sea by Somali pirates and their activities. Piracy off Somali coast has been a threat to international shipping since the second phase of the Somali Civil War early this century. Since 2005, many international organizations, including the International Maritime Organization and the World Food Program (WFP), have expressed concern over the rise in acts of piracy. Piracy has contributed to an increase in shipping costs and impeded the delivery of food aid shipments. Ninety per cent of the WFP's shipments arrive by sea and ships into this area now require a military escort.

However, this thorny issue has lately manifested itself in other parts of the world, most notably – but not exclusively – in the waters off the coast of Somalia, the Gulf of Aden, the Arabian Sea and the wider Indian Ocean. Ships carrying oil out of the Persian Gulf and the Gulf of Oman are now firmly within the sights of pirates, who have become bolder, more audacious, more aggressive and violent and seem to be better organized than ever before.

Initiatives of IMO to Counter Piracy and Armed Robbery at Sea

IMO is implementing an anti-piracy project, a long-term project which began in 1998. Phase one consisted of a number of regional seminars and workshops attended by Government representatives from countries in piracy-infested areas of the world; while phase two consisted of a number of evaluation and assessment missions to different regions. IMO's aim has been to foster the development of regional agreements on implementation of counter piracy measures.

As a manifestation of its overall concern about safeguarding human life at sea, the Organization has chosen, as the theme for this year's World Maritime Day, to highlight the efforts it has been making, over several years, to meet the challenges of modern-day piracy and, in so doing, generate a broader, global response to eradicate it. The intention has also been to complement and continue work in the spirit of last year's theme, which was dedicated to seafarers. From the early 1980s until recently, the anti-piracy campaign of IMO was focused on the traditional hot spots of the Straits of Malacca and Singapore and the South China Sea. Through a series of measures, developed and implemented with the strong and much appreciated co-operation of the littoral States and the unreserved support of the shipping industry, the scourge of piracy in those waters has significantly reduced nowadays. IMO has devised a multi-faceted action plan, designed to address the problem at several levels. Although the waters off

the coast of Somalia and in the wider Indian Ocean constitute the current piracy "hot spot", IMO's action plan draws heavily on the Organization's considerable experience of tackling piracy in other parts of the world, most notably the straits of Malacca, Singapore and the South China Sea.

International Response

The rise in piracy in several critical areas of the world's maritime trade was initially slow and rather anemic. Initially, there was little or no coordination in the employment of naval forces of several nations operating in the same general area. In the past several years this situation began to change for the better. Occasionally, a lethal force was used against Somali pirates. However, this had little or no effect on Somali pirates. Currently, most of naval activities at the present are in the Gulf of Aden and off Somalia's coast. The U.S. Naval Forces Central Command (NAVCENT) controls the combined maritime forces operating in the Arabian/ Persian Gulf, Gulf of Oman, Red Sea, the Arabian Sea and in the Indian Ocean.

In January 2009, NAVCENT established Combined Task Force 151 (CTF-151) is one of three task forces operated by Combined Maritime Forces (CMF). In accordance with United Nations Security Council Resolutions, and in cooperation with non-member forces, CTF-151′s mission is to disrupt piracy and armed robbery at sea and to engage with regional and other partners to build capacity and improve relevant capabilities in order to protect global maritime commerce and secure freedom of navigation. In August 2008, CTF 151 and its partners established Maritime Security Patrol Area (MSPA) in the Gulf of Aden. In April 2009, CTF 151 consisted or some two dozen ships from the U.S., UK, Canada, Denmark, France, Germany, Greece, Italy, Malaysia, Netherlands, Saudi Arabia, Spain, Turkey, and Yemen. Later Bahrain, Jordan, Japan, Singapore, South Korea, Poland, and Belgium will also took part in the operation.

In December 2008 the European Union (EU) Naval Forces (EU-NAVFOR) launched Operation Atlanta to replace operation Allied Provider. Atlanta is the first naval operation conducted under the framework of the European Security and Defense Policy (ESDP). The force currently comprises of about 20 ships and 1,500 personnel. The main purpose of the operation is to conduct naval surveillance in Somali waters. EU NAVFOR established online center known as Maritime Security Center-Horn of Africa (MSC-HOA) for transiting ships for recording their movements voluntarily and to receive updated threat information. Similar service is provided by the UK maritime trade operations in Dubai and the U.S. Navy's Maritime Liaison Office in Bahrain.

Russia, India, Malaysia, People's Republic of China (PRC), and South Korea also deployed warships off Somalia' coast though not being the part of the NATO or EU NAVFOR but working with same objectives to defend their own shipping operating in these routes. PRC joined international anti-piracy force by sending two destroyers to the Gulf of Aden in December 2008; its first expeditionary deployment of naval forces since 1949. The Russian Navy joined the international counter-piracy force in October 2006. Currently, the Russian Pacific Fleet task force composed of one destroyer, a salvage tug, a tanker, and naval infantry unit is also deployed in the Gulf of Aden to conduct aerial reconnaissance, searches of suspected vessels, and escorting Russian merchant ships. Also in October 2008, the Indian Navy for the first time conducted anti-piracy patrols to protect Indian ships in the Gulf of Aden.

Response by the international maritime community to the growing threat of piracy was limited largely to encouraging regional cooperation among the countries affected by piracy. For example, the littoral states of the Strait of Malacca and other Asian governments established in 2006 the Regional Cooperation Agreement on Combating Piracy and Armed Robbery (ReCAAP). It established procedures for coordinating responses to piracy and sharing best practice among law enforcement and security personnel. The ReCAAP's Information Sharing Center (ISC) was established in Singapore. Other bilateral agreements were signed among Malaysia, Indonesia and Singapore. This agreement is one of the principal reasons why piracy in the region has been drastically reduced. In contrast, the problem of piracy in the Gulf of Aden and off Somalia's coast is much more difficult to solve.

Somalia is a failed state. The regional countries are weak and their naval capabilities are inadequate. Yet the representatives of 17 regional governments met at the IMO-sponsored meeting in Djibouti in January 2009. They adopted code of conduct concerning the Repression of Piracy and Armed Robbery against ships in the western Indian Ocean and the Gulf of Aden. Three regional facilities were established: the Maritime Rescue Coordination Centre in Mombasa, Kenya; the Sub-Regional Coordination Centre in Dares Salaam, Tanzania. A Regional Maritime Information Center will be established in Sana'a, Yemen. The Contact Group on Piracy off the Coast of Somalia (CGPCS) intends to adopt interim measures to facilitate regional coordination until a dedicated coordination center to support the Djibouti code of conduct is in force.

International maritime organization (IMO) also collects information on reported accidents and issuing guidance to ship owners and operators and ship's masters. The IMO has issued detailed guidance and recommendations

for governments and commercial vessels to prevent, deter and respond to pirate attacks. It also publishes monthly reports on piracy and armed robbery against ships around the world. The International Chamber of Commerce—International Maritime Bureau (ICC-IMB) established a 24-hour piracy reporting center in Kuala Lumpur, Malaysia. The IMB and the EU's MCSHOA issue periodic "Industry Updates" detailing recent trend in piracy attacks and making recommendations to vessels transiting piracy-infested waters. The ICC Piracy Reporting Center (ICC-PRC) in Kuala Lumpur under auspices of the ReCAAP publishes monthly, half-yearly and annual reports on piracy and armed robbery. The U.S. Office of Naval Intelligence (ONI) publishes weekly reports on Worldwide Threats to Shipping including piracy.

Regional Cooperation to Combat Piracy

Regional cooperation among states has an important role to play in solving the problem of piracy and armed robbery against ships, as evidenced by the success of the regional anti-piracy operation in the Straits of Malacca and Singapore. The Regional Cooperation Agreement on Combating Piracy and Armed Robbery against ships in Asia (RECAAP), which was concluded in November 2004 by 16 countries in Asia, and included the RECAAP Information Sharing Centre (ISC) for facilitating the sharing of piracy-related information, is a good example of successful regional cooperation which IMO seeks to replicate elsewhere.

Few Root Causes of Piracy

Causes of piracy are very complex and often defy easy solution. One of the major reasons for reemergence of piracy over the past two decades was an enormous increase in both international and domestic maritime trade and large number of ports. This, in turn, offered almost limitless range of tempting, high-payoff targets for pirates and terrorists. In many undeveloped countries, lack of adequate naval forces or coast guard and maritime surveillance capabilities combined with coastal and port-side security make it much easier for various criminal groups to commit piratical acts. Also, pervasive corruption and emergent void of judicial prerogative have encouraged official complicity in high-level pirate rings. Piratical acts are also made easier because of global proliferation of small arms.

A failed or weak state is characterized by the almost complete breakdown of law and order and extreme poverty and unemployment. This, in turn, provides a fertile ground for the rise of and activities of various criminal groups that might be involved in piracy and terrorism. For example, in Somalia the provisional

government lacks authority over most of its territory. More than 40 percent of Somalis live in extreme poverty and almost 2/3 of households subsist on $ 2 per day. About 2/3 of Somali youths are without jobs. Other causes for the rise of piracy in Somalia include inter-clan rivalry, corruption, arms proliferation, extremism, and pervasive impunity.

Piracy Effects

Piracy has several direct and many indirect effects. Economic impact of piracy is felt in many ways. They include ransom payments, damage to ships and cargoes, and delays in delivering cargoes. Annual costs to maritime industry because of piracy are estimated to be between $ 1.0 an $ 16.0 billion. Piracy results in the increased maritime insurance rates. For example, the ship insurance rates rose to $ 20,000 per trip in 2009 from $ 500 in 2008. Merchant ship owners and operators are forced to pay for self-defense measures. In some cases, the increased threat from piracy might force the ship owners or operators to use much longer but safer routes. For example, because of the increased piracy in the Gulf of Aden and off Somalia's coast some shipping companies directed their ships to sail around the Cape of Good Hope thereby adding some 3,500 miles per voyage from Rotterdam to the Persian (Arabian) Gulf. Hence, a ship can make five instead of six trips per year. It also greatly increases the fuel consumption and costs. Because of detours of the ships around Cape of Good Hope and economic downturn maritime traffic through the Suez Canal was greatly reduced. The Suez Canal revenues have declined in the recent months because of decreased economic activity and the piracy threat into the canal approaches in the Gulf of Aden. The Suez Canal revenues are expected to fall from $ 5.1 billion in FY 2008 to about $ 3.6 billion in FY 2010 or 30 percent decrease in two years. Piracy adversely affects fishing in some parts of the world. For example, tuna catches in the southwestern Indian Ocean, one of the world's richest fishing grounds, fell by 30 percent in 2008. This had a major impact on Seychelles because some 40 percent of its earnings came from fishing.

Piracy also represents the threat to humanitarian aid deliveries in the Horn of Africa. About 7.2 million Ethiopians currently receive emergency humanitarian assistance and an additional 4.9 million will require some assistance in the first half of 2009. In Somalia an estimated 3.2 million people or 43 percent of the population required humanitarian assistance. Piracy also can potentially trigger a major environmental disaster if the violent acts occur in crowded sea lanes such as Bab-el-Mandeb or the Strait of Malacca transited by heavy laden oil tankers.

Politically, widespread piracy and lawlessness undermines and weakens the government's legitimacy by encouraging corruption among elected government

officials. For example, piracy in Somalia greatly contributed to deterioration of law and order, proliferation of illegal arms, and increase in the well funded militia. The non-crime economy has been eroded by the piracy-fueled business.

While IMO has positioned itself in the epicenter of the concerted efforts being made, it cannot alone supply an instant solution to the issue – particularly since, although piracy manifests itself at sea, the roots of the problem are to be found ashore. Nevertheless, through the action plan and initiatives, and in collaboration with other interested parties, equally determined and committed, IMO is confident that it will be able to make a difference where the problem is being most acutely felt at sea. A United Nations report and several news sources have suggested that piracy off the coast of Somalia is caused in part by illegal fishing and the dumping of toxic waste in Somali waters by foreign vessels that have, according to Somali fishermen, severely constrained the ability of locals to earn a living and forced many to turn to piracy instead. After seeing the profitability of piracy, since ransoms are usually paid, warlords began to facilitate pirate activities, splitting the profits with the pirates. However, in most of the hijackings, the bandits have not harmed their prisoners.

Precise data on the current economic situation in Somalia is scarce, but with an estimated per capita GDP of $600 per year, it remains one of the world's poorest countries. Millions of Somalis depend on food aid and in 2008, according to the World Bank, as much as 73 per cent of the population lived on a daily income below $2.0. These factors and the lucrative success of many hijacking operations have drawn a number of young men toward the gangs of pirates, whose wealth and strength often make them part of the local social and economic elite. Abdi Farah Juha a pirate leader who lives in Garoowe (100 miles from the sea) told the BBC, "They have money; they have power and they are getting stronger by the day. They wed the most beautiful girls; they are building big houses; they have new cars; new guns."

The Transitional Federal Government has made some efforts to combat piracy, occasionally allowing foreign naval vessels into Somali territorial waters. However, more often than not, foreign naval vessels chasing pirates were forced to break off when the pirates entered Somali territorial waters. The East African Seafarers' Association estimates that there are at least five pirate gangs and a total of 1,000 armed men. According to a BBC report, the pirates can be divided into three main categories:

a. Local Somali fishermen, considered the brains of the pirates' operations due to their skill and knowledge of the sea. Most think that foreign boats have no right to cruise next to the shore and destroy their boats.

b. Ex-militiamen, who previously fought for the local clan warlords, or ex-military from the former Barre government used as the muscle.

c. Technical experts, who operate equipment such as GPS devices.

According to Globalsecurity.org, there are four main groups operating off the Somali coast:

a. The National Volunteer Coast Guard (NVCG), commanded by Garaad Mohamed, is said to be specialised in intercepting small boats and fishing vessels around Kismayo on the southern coast.

b. The Marka group, under the command of Yusuf Mohammed Siad Inda'ade, is made up of several scattered and less organised groups operating around the town of Marka.

c. The third significant pirate group is composed of traditional Somali fishermen operating around Puntland and referred to as the Puntland Group.

d. The last set are the Somali Marines, reputed to be the most powerful and sophisticated of the pirate groups with a military structure, a fleet admiral, admiral, vice-admiral and a head of financial operations.

Response

The United Nations, alliances (political and defense) of states, Governments acting collectively or individually, military forces, shipping companies, ship operators and ships' crews, all had a crucial part to play in order to rid the world of the threat posed by piracy in the vast expanse of the Indian Ocean. To alleviate this unacceptable situation, no effort should be spared. Shipping companies must ensure that their ships rigorously apply the IMO guidance and industry-developed Best Management Practices in their entirety, so that, when venturing into the western Indian Ocean region, they comply with all the recommended measures: no ship is invulnerable, in particular those with relatively low freeboards and slow steaming speeds. And Governments need to back up their oft-stated concern over the situation by deploying military and other resources commensurate, in numbers and technology, with the scale of the problem and with a realistic chance of dealing with it effectively.

The IMO has made the piracy problem the theme for this year's World Maritime Day, with the title "Piracy: orchestrating the response". It is for all these reasons that IMO has decided to make combating piracy not only the theme

for World Maritime Day but also a central theme of its work this year and for as long as necessary. In conjunction with this theme, the IMO has developed an action plan that it hopes will ultimately lead to a sustainable solution through deterrence, security, the rule of law and economic development ashore. The 286 piracy incidents, 67 hijacked ships and over 1130 seafarers directly impacted by the continued and increasing piracy problem in the world's oceans and particularly off the Horn of Africa over the past 12 months has resulted in an "completely unacceptable situation" as mentioned by the UN Secretary General, General Ban Ki-moon in a recent speech at the IMO Headquarters in London. In the presence of UN Secretary General Ban Ki-moon, as well as the heads of several other key stakeholders, IMO's launched an action plan for 2011 has six prime objectives:

a. Increase pressure at the political level to secure the release of all hostages being held by pirates;

b. Review and improve the IMO guidelines to Administrations and seafarers and promote compliance with industry best management practice and the recommended preventive, evasive and defensive measures ships should follow;

c. Promote greater levels of support from, and coordination with navies;

d. Promote anti-piracy coordination and co-operation procedures between and among States, regions, organizations and industry;

e. Assist states to build capacity in piracy-infested regions of the world, and elsewhere, to deter, interdict and bring to justice those who commit acts of piracy and armed robbery against ships; and

f. Provide care for those attacked or hijacked by pirates and for their families.

With so many players involved, if the fight against piracy is ultimately to succeed, all concerned must be reading from the same score – hence IMO's choice of "Piracy: orchestrating the response" as its overall theme for the year.

Raising Awareness

Much of IMO's anti-piracy campaign has focused on raising awareness of the issues and galvanizing those who may be in a position to act. Workshops on preventing and suppressing piracy were held at IMO HQ on regular basis in order to raise awareness among those responsible for the oversight and delivery

of seafarer training. In the workshops, briefings were given by representatives of flag States, industry groups, the Contact Group on Piracy off the Coast of Somalia (CGPCS), navies and the IMO Secretariat. The workshops reiterated the need for urgent and coordinated action from Governments, the shipping industry and the maritime community to address the escalating crisis. Among other things, the meeting agreed on the need for compliance with the IMO guidance and industry best management practices; the need for improved co-operation, communication with, and deployment of, naval forces operating in the area; and the need for more proactive measures to avoid ships becoming victim to this organized criminal activity at sea.

A further meeting took place at IMO Headquarters to discuss ways of promoting greater levels of support from, and coordination with navies. The meeting noted that the naval vessels deployed in the Gulf of Aden had been effective in reducing the number of merchant ships being hijacked while transiting this vital shipping lane but that, unfortunately, the pirates' increased operating area had not been matched by an increase in naval vessels, maritime patrol and reconnaissance aircraft or other surveillance assets provided by Governments. The meeting concluded that Member States should be encouraged to provide appropriate assistance, both from military and other sources. It was these meetings that prompted IMO to issue Circular letter No.3164, advising that an unacceptably high proportion of the ships transiting the Gulf of Aden and western Indian Ocean were not registered with the Maritime Security Centre Horn of Africa (MSCHOA); were not reporting to United Kingdom Maritime Trade Operations (UKMTO) Dubai; were showing no visible deterrent measures; and were not responding to navigational warnings to shipping promulgating details of pirate attacks and suspected vessels. It strongly urged all those concerned, particularly Administrations, industry representative bodies, seafarer associations, ship owners and companies to take action to ensure that ships' masters receive updated information unfailingly and that all the recommended preventive, evasive and defensive measures are fully and effectively implemented.

Success So Far

Some success in thwarting pirate attacks can already be claimed from the falling percentage of attacks that prove successful. Despite the number of pirate attacks overall continuing to cause concern, there is, nevertheless, some cause for optimism. The percentage of attempted attacks that proves successful for the pirates has dropped, from more than 40 percent historically to less than 20 percent this year – testimony, no doubt, to the effectiveness both of the naval presence in the region and of the best management practices for ships developed by the industry and promulgated through IMO.

Nevertheless, as the statistics so bleakly indicate, piracy and armed robbery against ships remain real and ever-present dangers to those who use the seas for peaceful purposes. So long as pirates continue harassing shipping, hijacking ships and seafarers, the maritime institutions can neither be proud of, nor content with, the results achieved so far. More needs to be done, including the capture, prosecution and punishment of all those involved in piracy; the tracing of ransom money; and the confiscation of proceeds of crime derived from hijacked ships, if the ultimate goal of consigning piracy to the realms of history is to be achieved.

Piracy is a serious issue, but it is all too easily oversimplified in terms of numbers of attacks and responses required. It is a complex problem that needs to be kept in perspective. Again, piracy is prone to exaggeration and obfuscation about the true interests and contributions of stakeholders. There are some inconvenient truths about sea piracy that need to be appreciated.

Some countries are using sea piracy for their strategic advantage, but others may lose out. A senior Yemeni minister recently noted that "internationalizing the Red Sea" with the increased presence of foreign warships posed "a real threat on Yemen's security and stability in particular and on the region in general". The threat of piracy is also used as justification for naval spending. In direct terms, this leads to an environment of increased naval activity that is potentially destabilizing, with greater numbers of aircraft, warships and submarines at sea, including in areas such as the seas of East Asia, where sovereignty disputes and bilateral tensions already exist. In indirect terms, defence spending has a high opportunity cost as it diverts resources from important programmes for economic development, social improvement and poverty alleviation.

For the international shipping industry, the direct economic losses as a consequence of piracy are relatively low, although insurance premiums for ships passing through piracy-prone areas have increased. Much depends on the quality of a ship and her crew. A valuable ship with a valuable cargo is more likely to be operated by a well-trained and motivated crew who will take all precautions against being successfully hijacked.

The Way Ahead

IMO has been dealing with piracy issues for many years. The Straits of Malacca and Singapore were the previous focus of attention. There, through a series of measures, developed and implemented with the strong co-operation of the littoral States and the support of the shipping industry, we have been able to help significantly reduce piracy in those parts of the world. And it was as long ago as 2005 that IMO first drew the attention of the United Nations Security

Council to the problem of piracy off the coast of Somalia. The need has been identified to seek solutions concurrently in three distinct time horizons. In the immediate term, there is a need to contain piracy and thwart pirate attacks; in the mid-term, a need to undermine organized crime entities to plan and mastermind pirate operations and make it harder for pirates to engage in and conduct such operations; and, in the long term, the international community as a whole must help the people of Somalia to rebuild their country and establish the forces of law and order so that crime is no longer the preferred option for them. It is crucial that the political will among those Governments that have the potential to make a difference is translated into reality in a manner that the severity of the issue demands. Resources being made available; legislation to ensure pirates do not escape prosecution being expeditiously adopted and rigorously enacted; and ensuring that all ships transiting piracy-infested areas comply with the recommended best management practices – all these need to maintain a high priority on the agenda of all those concerned.

While IMO has positioned itself in the epicenter of the concerted efforts being made, it cannot alone supply an instant solution to the issue – particularly since, although piracy manifests itself at sea, the roots of the problem are to be found ashore. Some success in thwarting pirate attacks can already be claimed, as can be seen from the falling percentage of attacks that prove successful. Nevertheless, as the statistics so bleakly indicate, piracy and armed robbery against ships remain real and ever-present dangers to those who use the seas for peaceful purposes. So long as pirates continue harassing shipping, hijacking ships and seafarers, we are neither proud of, nor content with, the results achieved so far.

More needs to be done, including the capture, prosecution and punishment of all those involved in piracy; the tracing of ransom money; and the confiscation of proceeds of crime derived from hijacked ships, if the ultimate goal of consigning piracy to the realms of history is to be achieved. The theme of this rallying point is aimed at all those who can make a difference can focus their efforts.

CONCLUSION

The problem of piracy is increasing in some part of the world's ocean. It already poses a grave danger to safety of merchant shipping in several focal points of maritime trade and approaches to major ports. This problem cannot be allowed to fester because it will become progressively more difficult to resolve successfully. The problem of piracy should not be exaggerated. It should not be underestimated either. It is critically important that piracy in the focal points of maritime trade such as major international straits and their approaches is brought

under control soon. The problem of piracy is complex and its solution will require a comprehensive solution encompassing the use of both military and nonmilitary sources of power by the major powers and international community as a whole. This will require much time, patience and relatively large resources.

Current policies in countering the threats of piracy are timid, sporadic and incoherent. A comprehensive approach is badly needed in radically reducing the threat of piracy of east and west coasts of Africa, South and Southeast Asia. Another important objective should be to deter the emergence of piracy in other parts of the world's ocean. The military action alone cannot resolve the problem of piracy. It must be only a part of a much broad and comprehensive series of actions. The main causes of piracy are predominantly political, economic, and social. Hence, the long-term solution can be found only if the international community and regional governments make concerted efforts to solve the root causes of piracy. These actions would require much time and effort. In the meantime, governments directly affected by acts of piracy and international community must do everything possible to ensure the safety of maritime traffic in the pirate-infested area. This, in turn, require a decisive use of one's military forces aimed to destroy or neutralize major part of pirate network and thereby create conditions for ensuring safety of maritime traffic. A decisive use of force against pirates and their leaders and enablers ashore is also one of the keys for restoring the government legitimacy and authority over its territory.

Insufficient attention has been given to the responsibilities of flag states and ship-owners in preventing piracy. The depressed state of the international shipping industry has led to greater numbers of unemployed or underemployed ships and cost-cutting measures that are contributory factors to the increase in piracy. Flag states should be more proactive in ensuring ships are not vulnerable to attack, and the IMO might look more closely at the problem of sub-standard ships, their vulnerability to attack and the consequences of the shipping recession for maritime security. The choice of the theme 34th celebration of World Maritime Day will provide an appropriate rallying point around which all those who can make a difference can focus their efforts. In the meantime, the thoughts and prayers are with those seafarers, who, at present, are in the hands of pirates. May they all be released unharmed and returned to their families soon.

The United Nations, alliances (political and defence) of states, Governments acting collectively or individually, military forces, shipping companies, ship operators and ships' crews, all have a crucial part to play in order to rid the world of the threat posed by piracy in the vast expanse of the Indian Ocean. To alleviate

this unacceptable situation, no effort should be spared. Shipping companies must ensure that their ships rigorously apply the IMO guidance and industry-developed Best Management Practices in their entirety, so that, when venturing into the western Indian Ocean region, they comply with all the recommended measures: no ship is invulnerable, in particular those with relatively low freeboards and slow steaming speeds. And Governments need to back up their oft-stated concern over the situation by deploying military and other resources commensurate, in numbers and technology, with the scale of the problem and with a realistic chance of dealing with it effectively.

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