Sustainable Development in South Asia

Need for Cooperation in Food-Water-Energy Security

CUTS International

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Acronyms

ADB	:	Asian Development Bank
AFTA	:	ASEAN Free Trade Area
APAN	:	Asia Pacific Adaptation Network
ARF	:	ASEAN Regional Forum
ASEAN	:	Association of Southeast Asian Nations
AWDO	:	Asian Water Development Outlook
BCM	:	Billion Cubic Meters
BP	:	British Petroleum
CAGR	:	Compounded Annual Growth Rate
COP	:	Crude Oil Price
CSOs	:	Civil Society Organisations
CUTS	:	Consumer Unity & Trust Society
DFAT	:	Department of Foreign Affairs and Trade
DFID	:	Department for International Development
DMCs	:	Developing Member Countries
ECOSOC	:	Economic and Social Council
ESCAP	:	Economic and Social Commission for Asia and the Pacific
FAO	:	Food and Agricultural Organisation
FPI	:	Food Price Index
GCNEP	:	Global Centre for Nuclear Energy Partnership
GDP	:	Gross Domestic Product
GHGs	:	Green House Gases
GHI	:	Global Hunger Index
GLOF	:	Glacial Lake Outburst Floods
GWh	:	Gigawatt Hours
HDI	:	Human Development Index
HDR	:	Human Development Report
HYV	:	High-Yield Variety
ICIMOD	:	International Centre for Integrated Mountain Development
IEA	:	International Energy Agency
IFAD	:	International Fund for Agricultural Development
IFPRI	:	International Food Policy Research Institute
IME	:	Institute of Mechanical Engineering
INR	:	Indian Rupee
IWT	:	Indus Water Treaty

IWTT	:	Inland Water Transit and Trade
KWh	:	Kilowatt Hour
MCF	:	Million Cubic Feet
MDGs	:	Millennium Development Goals
MFN	:	Most Favoured Nation
MRC	:	Mekong River Commission
MT	:	Metric Tonne
MTOE	:	Million Tonnes of Oil Equivalents
MW	:	Megawatt
MWh	:	Megawatt Hour
NARS	:	National Agricultural Research System
NGOs	:	Non-Governmental Organizations
NTB	:	Non-Tariff Barriers
PDS	:	Public Distribution System
PPP	:	Purchasing Power Parity
SAARC	:	South Asian Association for Regional Cooperation
SAC	:	South Asian Countries
SAFRS	:	SAARC Food Security Reserve
SAFTA	:	SAARC Free Trade Area
SAGQ	:	South Asian Growth Quadrangle
SAPTA	:	SAARC Preferential Trading Arrangement
SAR	:	South Asian Region
SARI/E	:	South Asia Regional Initiative for Energy
SAWI	:	South Asia Water Initiative
SDGs	:	Sustainable Development Goals
SDIP	:	Sustainable Development Investment Portfolio
SEC	:	SAARC Energy Centre
SMG	:	Smart Mini-Grid
TCF	:	Trillion Cubic Feet
TERI	:	The Energy and Resources Institute
TPES	:	Total Primary Energy Supply
TSC	:	Total Sanitation Campaign
UN Water	:	United Nations Water
UNEP	:	United Nations Environment Programme
UNFCCC	:	United Nations Framework Convention on Climate Change
USAID	:	United States Agency for International Development
WCED	:	World Commission on Environment and Development
WEF	:	World Economic Forum

Preface

South Asia, one of the fastest growing regions in the world, is struggling hard to narrow the gap between the extreme levels of poverty and prosperity. Lately, economic development in this region has heightened the concerns about climate change that have put the concept of sustainable development at the centre of the development debate. The deleterious impact from carbon gas emissions coupled with growing occurrence of natural calamities have severely threatened three vital resources of human sustenance: food, water and energy. They are intimately linked — alterations in any one of these resources is most likely to impact the subtle nexus that embodies the system of sustainable development.

The food sector is marred by densely populated agrarian provinces with high number of poor who are extremely malnourished, declining agricultural productivity, diminishing size of farm holdings, excessive dependence on traditional means of food production and high dependence on livelihood. Food security has long been a matter of concern and scientific findings from international organisations have predicted that food scarcity will exacerbate in this region in the coming future.

In the case of water, some of the sub-regions are likely to enjoy adequate water availability in the near future but many others are already facing water stress. Climate change has severely impacted the Himalayan region which sustains majority of rivers basins in South Asia. Consequently, this region has long faced contentious issues of trans-boundary river water sharing. This is one of the major sources of mistrust and challenges the willingness to cooperate.

The energy sector is already under stress from over-exploitation of natural resources and excessive dependence on energy extraction from fossil fuels. Many rural sub-regions are devoid of electricity, with an estimated 600 million people in South Asia completely lacking access to electricity or other commercial energy services. While the region has a significant proportion of untapped hydropower and solar resources, nothing substantial is being done to address these opportunities due to several regional concerns and financial constraints.

In such a backdrop, this Discussion Paper explains the concept of sustainable development in the existing sectors of food, water and energy in South Asia, by highlighting the intimate level of inter-connectedness between these systems. It tries to highlight the pertinence of Regional Cooperation in these areas as one of the major solutions for resolving on-going disputes and misunderstandings that have been degrading the shared growth potentialities of the region.

In doing so, it dwells on the rationale for Regional Cooperation, efforts made so far, reasons behind non-success, latest developments and some suggestions for augmenting Regional Cooperation in South Asia by harnessing the available opportunities in food, water and energy sectors as well as learning from successful regional initiatives from other parts of the world.

This is a preliminary work of CUTS International that can be used for using it as a reference for implementing its activities under the Sustainable Development Investment Portfolio programme supported by the Department of Foreign Affairs and Trade, Government of Australia. Thanks are due to DFAT, Australia for giving us this opportunity and making us an integral part of its long-term work towards the better achievement of food, water and energy security in South Asia. And, I also thank my colleagues for their collective work.

The intention of this paper is to make the readers aware of the realities in respect to sustainable development challenges faced by this region. I hope it will help CUTS and other partners of this initiative to identify and influence the necessary domains of change in order to address social, economic and environmental dimensions of sustainable development and nexus between and among food, water and energy security issues in South Asia.

Bipul Chatterjee
Deputy Executive Director
CUTS International

Executive Summary

Sustainable development in the ambits of food, water and energy is a matter of paramount concern for all the nations throughout the world and specifically for South Asia. The region faces the brunt of interminable population growth rate. Unfavourable variations in climate change have made the situation murkier. Consequently, the basic sectors of human sustenance are gripped by the claws of excessive resources degradation that has raised concerns over the quality of human life and brought the concept of sustainability to the forefront. The intimate link between food, water and energy has on very many occasions disturbed by variable hydrology of the region combined with high poverty and population density; concentration of the region's' poor on degrading agricultural sector; water- dependent subsistence livelihoods; over- exploitation of natural resources; and limited intra-regional cooperation and weak institutional capacity.

Moreover, the present climate subtleties are most likely to have economic, social, political, environmental and security implications that are still imprecisely understood by this region. The debate on food, water and energy securities and its effects on South Asia have fanned out throughout the world, demanding attention from various national and international organisations to come to the region's rescue.

The present paper has tried to use the concept of sustainable development in three vital sources of human sustenance for addressing the challenges of insecurity and scarcity. Through the intimate linkages between food, water and energy, this paper has tried to explain how repercussions from one sector can affect the other two sectors in an unfavourable way. The paper has laid emphasis on the need for having strong and efficient regional governance frameworks as a key to address these challenges in South Asia. Regional Cooperation has long been viewed as a solution for addressing the scarcity issue in the ambits of food, water and energy.

South Asia has been successful to a certain extent in shaping a regional governance framework in relation to food and energy security (SAARC Food Bank, proposed SAARC Seed Bank and SAARC Energy Charter) but till date none of the countries have come to a general consensus on framing a regional governance framework for water security. Until and unless a strong regional governance charter is established in South Asia that prudently handles the issues related to food, water and energy securities, it will be nearly impossible to reach the goal of sustainability in these three vital areas of human subsistence.

The Nexus

Food, water and energy are intricately linked and alterations in any one of the resources can have severe ramifications on the other two resources. The relationship between these three resources can be explained in simple terms. Food production requires water and energy; water extraction and distribution requires energy; and energy production requires water. Food prices are also highly volatile to the cost of energy inputs through fertilisers, irrigation, processing and transport.

The intricacies between the linkages of food, water and energy security make this nexus susceptible to numerous risks. Apart from the population growth and climate change pressures, this nexus is extremely sensitive to the political and governance framework. Risk mitigation strategies such as effective and strong regional governance framework related to food-water-energy securities, conflict mitigation stratagems along with optimal utilisation of natural resources will help any country/region to achieve the objective of food, water and energy securities.

Food, Water and Energy Security in South Asia

The poor and marginalised in South Asia have been (and are still) living in conditions of chronic and transitory food insecurity over the years. South Asian Countries (SAC) have not made a remarkable progress in reducing the Global Hunger Index (GHI) and is still gripped by the claws of malnutrition and hunger. South Asia also has the highest incidence of child malnutrition in the world along with a huge proportion of population that is still undernourished. Even though a huge proportion of population in South Asia depends upon agriculture for subsistence, but the value added by this sector to the overall GDP has declined over the years.

With every passing day, the demand for food is increasing with the growing population, which is directly impacting food supply and food access. Land fragmentation and usage of unsuitable agricultural practices have deteriorated the regions' agrarian sector. South Asia has witnessed an inflationary trend in the agricultural commodity prices over the past couple of years. One of the reasons for the sudden surge in the Food Price Index (FPI) can be attributed to the price of oil. Even though irrigated agriculture accounts for 60-80 percent of food production in South Asia (about 39 percent of cropland is irrigated), but water scarcity is directly impacting the productivity of this sector.

Climate change has exacerbated its deleterious impact on the staple crops of South Asia. Research states that rice yields in India will see a decline of 4 percent till 2020, 7 percent till 2050 and 10 percent till 2080. Wheat yield is projected to decline by 6 percent till 2020 and maize yield by 20 percent till 2020, 2050 and by 23 percent till 2080. The major cause for the decline in the yield of the country's staple cereals has been attributed to the rise in temperature. South Asia has also been unsuccessful in tapping the potential of intra-regional trade and therefore is considered as the least integrated region in the world, despite its attempts to liberalise trade using various unilateral, bilateral, multilateral and regional arrangements.

Water in this region has been exposed to numerous pressures such as population growth; extensive resources extraction; concretisation of forests; exploitation of this resource for food and energy generation; and rapid systematic change in climate variability. Data shows that India, Pakistan and Maldives are clearly showing sign of water stress since water availability per occupant is already below the threshold limits. Bhutan is the only country in South Asia that is most likely to be saved from extreme water stress situations for some couple of years. In terms of other indicators, improved access to water sources for all the countries in South Asia has recorded a satisfactory progress in making water reach a vast proportion of population. The proportion of people using improved sanitation facilities has increased from 2000 to 2011.

Countries like Maldives and Sri Lanka have done exceptionally well in making water reach a vast majority of population (for sanitation purposes) but when it comes to countries like India, Bangladesh and Pakistan, the statistics shows that these countries are lagging far behind. The

agricultural sector, as a whole, is the largest consumer of water in South Asia but uses water with low efficiency and productivity.

Water in South Asia, apart from other issues, is also subjected to conflicts for trans-border sharing and management. Hydro-politics along with division of the river basin waters continues to be a catalyst for water- sharing conflicts in South Asia. Political tensions and animosity issues have exacerbated since the 1990s, in worsening the trust deficit and making individual nations more paranoid about their rivers. The major water conflicts (mainly centred on construction of hydropower generation projects) are prominent between India-Pakistan, India-Bangladesh and India-Nepal. Unquenchable thirst for water and greedy internal politics has raised the concerns given rise to urgency about forming a consensus on a particular problem-solving mechanism to addressing the plea of water security needs of region.

The accelerating pace of economic growth in South Asia has also led to an increase in the demand for energy. But the major resources contributing to the region's energy needs are not able to meet the persistently increasing energy demand, thus leading to demand-supply deficit. Most of the SAC are highly dependent upon the import of fuel for meeting their energy requirements. Bangladesh, Bhutan, Maldives, Nepal and Sri Lanka are totally dependent on imported fuel to meet the demand for petroleum products. Huge proportions of population residing in other SAC are still without access to electricity, particularly the ones in rural areas. The darkness in South Asia's energy sector is due to issues related to energy access and supply; energy trade infrastructure; region's high dependence on crude oil and petroleum imports for meeting energy needs; inefficient and limited utilisation of renewable energy resources; lack of financial capabilities to take forward energy generation projects with lumpy capital investments; and cumbersome legal and regulatory framework for energy trade.

Enhancing Regional Cooperation

Regional Cooperation has long been viewed as a means to tackle the scarcity and insecurity situations in the ambits of food, water and energy but till date nothing significant has been accomplished from South Asia's existing regional framework. The benefits from an effective regional governance framework for food, water and energy are particularly relevant to SAR because of the nature of its growing economies, complementarities in agricultural production (but lack of complementarity in bilateral trade), feasibility with respect to geographical access, commonalities regarding food-water-energy insecurities and commonalities in demographic characteristics (the number of poor, gender disparity and dependence on employment sector). Institutional cooperation at the regional level will necessitate efficient functioning of regional administrative bodies, thereby surmounting constraints that hinder economic and social well-being of the region's citizens.

Looking at the current scenarios in the respective sectors of food, water and energy in South Asia, it becomes pertinent to augment the working efficiency of the existing Regional Cooperation frameworks, specifically SAARC. SAARC's role is pivotal in enhancing Regional Cooperation in the ambits of food, water and energy and also stimulating the working efficiency of organisations like SAARC Food Bank and Energy Centre that are working under its aegis. Strengthening of SAARC as an efficient regional institution will foster economic prosperity and lessen the drift between the unfriendly neighbours. The role of sub-regional groupings and scientific organisations like ICIMOD and TERI can be beneficial in enhancing and improving the unfavourable conditions in this region since these organisations are stronger, better coordinated and well managed.

South Asia can also learn from the successes of other regional organisations like ASEAN. With regards to food security, SAARC should learn lessons from AFTA (ASEAN Free Trade Area) and ASEAN Emergency Food Reserve System that have time and again proven their efficacy as compared to SAARC on account of increasing political cohesion and economic coordination among the member countries. With regards to water governance, the Mekong River Commission (MRC) under ASEAN or the Nile Basin initiative that effectively covers all the aspects of water governance with a robust, binding dispute resolution mechanism, can serve a good model for South Asia for working towards better management and governance of trans-border water sharing. ASEAN has also been successful in forming a regional institution particularly dealing with political and security issues of common interest and concern (ASEAN Regional Forum). A SAARC Regional Forum to discuss disputes would be a proper way to take political pressure away from SAARC Summits but the creation of such a mechanism seems unlikely as long as SAARC lacks a common vision of regionalism.

ASEAN's energy market is more efficient than compared to South Asia's. ASEAN already has an operative energy market that is working efficiently and recent concerns over climate change and energy linkages have made this organisation to emphasise on strategies for further strengthening of renewable energy development, such as bio-fuels; promoting open trade; and cooperation in the renewable energy industry. SAARC can learn a lot from the working model of ASEAN and should incorporate positive changes as far as it is possible.

The role of CSOs and international donor organisations needs to be strengthened in South Asia as these agencies play a critical role in making positive transformation in the society and also influence policy reforms. In South Asia, efforts of these agencies have proven to be successful in making the general public and the government understand the nuances and benefits of increased Regional Cooperation. Apart from food and energy sector, initiatives by different international donor organisations related to water in South Asia have been rewarding and the results speak out of their performance.

Finally, India has to play a central role in stimulating all the activities of other SAC for reaching a consensus on formation and strengthening of mutually cooperative regional organisations in South Asia. Rather than perceiving India as a road block for regionalism, this country should be viewed as a big brother that can smoothen the process of advocating regional harmony and to do so, India has to demonstrate the magnanimity of a big power and show a spirit of camaraderie in accommodating the wishes of its smaller neighbours without putting at stake the sentiments and well-being of its own citizens.

1
Introduction

The concept of Sustainable Development has evolved over the years. The earliest traces of this visionary development paradigm[1] can be found out in the essay written by a notable economist Thomas Robert Malthus (1766-1834) titled An Essay on the Principle of Population. The essay pointed out that 'population, when unchecked, increased in a geometrical ratio and subsistence for man in an arithmetical ratio' (Rogers, Jalal, & Boyd, 2008). Malthus predicted that with the existing rate of population growth rate, the world will face natural resource scarcity and human population will eventually starve off or live at a minimal subsistence level (Paul, 2008). His findings were appraised as well as criticised by many other social science scholars but this exemplary piece of work laid down the base of sustainability to be considered as issue of utmost importance throughout the world.

The term sustainable development was heightened and propagated in the report 'Our Common Future', published by the World Commission on Environment and Development in 1987 also known as the Brundtland report. The classic definition of sustainable development laid down by this report is "development which meets the needs of the present without compromising the ability of future generations to meet their own needs." Even though the concept of Sustainable Development calls for a convergence between the three pillars of economic development, social equity, and environmental protection but still the concept remains elusive in laying emphasis on any one of the three mentioned pillars.

Sustainable Development concept has been seen through the prism of different conceptual frameworks over the course of time but since the Rio Summit, Sustainable Development has often been catalogued as an environmental issue (Drexhage & Murphy, 2010). For the present study, the broad concept of Sustainable Development has been narrowed down to focus on the availability of the resources, and linking it to food, water and energy securities. Since the planet is facing natural resource scarcity along with unfavourable changes in the climate, it becomes pertinent to link the goal of sustainable development with food-water-energy security. As Tommy Koh[2] in the latest report titled Asian Water Development Outlook (AWDO)[3] wrote, "Water security, together with food security and energy security, is ultimately about human security."

The definition of food, water and energy security have been modified over time, depending upon the country or region, but the basic essence of these definitions has been judiciously articulated by the following leading international organisations:

Food security is defined by the Food and Agricultural Organisation (FAO)[4] as- "Food security [is] a situation that exists when all people, at all times, have physical, social and economic access to

sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life." The objective of achieving sustainability in the food sector will benefit not just one particular country but the entire region as a whole if the countries come together, cooperate and work for achieving this internationally agreed development goals. Food security is essential for the achievement of the UN's 'Zero Hunger Challenge',[5] which encourages comprehensive efforts from all the partners to scale up their efforts and turn this vision of an end to hunger into a reality. Therefore, this study has extensively covered the aspect of Regional Cooperation and its importance in accelerating the pace of achieving food security in South Asia.

Water security is defined by UN-Water[6] as "The capacity of a population to safeguard sustainable access to adequate quantities of and acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability." One of the major elements of water security is adopting collaborative approaches to trans-boundary water resources management within and between countries to promote freshwater sustainability and cooperation (UN Water, 2013). More emphasis has been placed on the aspect of trans-boundary water resource management and cooperation between the countries for the context of this study.

Energy security has been defined as "access to clean, reliable and affordable energy services for cooking and heating, lighting, communications and productive uses" (United Nations),[7] and as "uninterrupted physical availability [of energy] at a price which is affordable, while respecting environment concerns." Along with the elements mentioned in the definition, this study has widely incorporated the issues and solutions regarding Regional Cooperation in sharing and access to renewable energy in South Asia.

2

Worldwide Overview of Natural Resource Endowments

In the developmental era, countries that were struggling hard to sustain the well-being of its citizens in the past have emerged as one of the fastest- growing economies in the world. One of the South Asia countries-India, has been a pioneer in achieving a remarkable rate of GDP (in terms of Purchasing Power Parity) which is third largest in the world. But growth comes at a cost and this cost has proven to be quite hefty in terms of availability of the total endowment of natural resource. Countries throughout the world (developed as well as developing) have been trying hard to attain maximum utility from the available natural resources but no sooner they will realise that this exploitation trend has reached its threshold limit. 'Exploitation' is a word that has gained prominence through the passage of time. Rapidly increasing economic activities have pressurised the natural resources endowment on this planet. Natural resources have been exploited to unacceptable limits in order to meet the never- ending demands of our growing population. With around 8 billion population, it is expected that there will be an inevitable increase in the demand for natural resources, but the irony is that some of the highly important resources are becoming scarce.

It is clear that food, water and energy — the basic and highly used means of subsistence, are facing scarcity problems. The United Nations Food and Agriculture Organisation (FAO) projects a 50 percent increase in demand for food by 2030, and the International Food Policy Research Institute (IFPRI) expects a 30 percent increase in demand for water, with other estimates rising to over 40 percent. Some estimates points out that water use worldwide has grown nine times[8] over the 20th century whereas the per capita supply of water reduced by one-third[9] in just 20 years from 1970 to 1990. A recent study on crop protection by BASF Ltd. points out that in the year 2005, there was 2,200 m^2 of farmland available to supply the food needs of one human being but by 2030 only 1,800 m^2 of farmland will be left to supply the infinitely growing demand for food (BASF, 2013-The Chemical Company). FAO has also predicted that by 2025, 1.8 billion people will be living in countries or regions with absolute water scarcity. The International Energy Agency (IEA) forecasts that the world economy will demand at least 40 percent more energy by 2030 which will be heavily dependent on freshwater withdrawals. According to IEA data, from 1990 to 2008, the average energy use per person has increased by 10 percent while world population increased by 27 percent. Overall, there has been an increase of 39 percent in energy use from 1990 to 2008 throughout the world.

Water, oil and natural gas are the three most exploited natural resources that are under severe pressure from the current rate of consumption (Ruz, 2011). The BP Statistical Review of World

Energy in June, 2013 measured that a total 188.8 million tonnes of global oil has been left for use, which is only enough for the next 46.2 years, should global production remain at the current rate (Ruz, 2011). Looking at the current statistics of these resources, in order to meet the infinitely growing demand for food, water and energy, significant and perhaps drastic changes in water use will be required as well as new sources for food and energy production will have to be exploited (World Economic Forum, 2011).

Coal, another source of energy production, will also deplete in the coming future, looking at the consumption trends in China and other countries. In 2000, China accounted for 28 percent and other parts of Asia accounted for 19 percent of world coal consumption. China and India have decent reserves of coal (as compared to oil and gas reserves) but since these countries are profoundly increasing their rate of coal consumption, it is expected that levels of coal reserves will deplete at an increasing rate. Eventually, the supply of coal will fall short of the growing coal demand in the coming years (Ruz, 2011). It is surprising to note that India (though being world's third largest coal producer)[10] has increased its coal imports in the recent years. India ranks eleventh among the top coal importers of the world.[10] The statistics with respect to natural resource availability are evidence of severe crisis that can most possibly imperil the survival of humans in the near future.

Food, water and energy scarcity will not only degrade the presently growing economies but it will adversely impact the survival of human population. Burgeoning innovation in the sophistication of technology for smooth and less time- consuming natural resources mining have also intensified the concerns on the remainder of natural resources that would be available for the forthcoming generation. To worsen the present situation, climate change has exacerbated the state of natural resources scarcity, specifically in the domain of food, water and energy. Extreme variation in the weather has been detrimental to the production of various agricultural commodities and it has been predicted that extreme weather events such as droughts and floods are going to become more frequent in different regions of the world, adding to the global burden of hunger caused by poverty, weak governance, conflict and poor market access (JR et al., 2012).

In the light of the above- mentioned crisis, it becomes imperative to secure food, water and energy security throughout the planet, starting from the most vulnerable regions of South Asia and Sub-Saharan Africa. Regional cooperation has long been viewed as a solution for addressing the scarcity issue in the ambits of food, water and energy. South Asia has been successful to a certain extent in shaping a regional governance framework in relation to food and energy security (SAARC Food Bank, proposed SAARC Seed Bank and SAARC Energy Charter) but till date none of the countries have come to a general consensus on framing a regional governance framework for water security. Until and unless a strong regional governance charter is established in South Asia that prudently handles the issues related to food, water and energy securities, it will be nearly impossible to reach the goal of sustainability in these three vital areas of human sustenance.

3
Theoretical Framework of Food, Water and Energy Security

Out of all the available resources, food, water and energy are most needed to sustain life on this planet. These resources are widely used and intimately linked. The linkages between food, water and energy are intricate and alterations in any one of the resources can have severe ramifications on other two resources. The nexus approach tries to examine how and where these systems interact with each other and since all these resources are intertwined, it is vital to understand the outcomes from action taken in one system on one or both of the other systems (GRACE, 2013). The relationship between these three resources can be explained in simple terms. Food production requires water and energy; water extraction and distribution requires energy; and energy production requires water. Food prices are also highly volatile to the cost of energy inputs through fertilisers, irrigation, processing and transport (World Economic Forum, 2011). The sub- linkages between these resources have been explained further.

Water and Food Linkages

Water sustains production of all food products, specifically agricultural commodities. Food production is by far the largest consumer of global fresh water supplies. Agriculture accounts for approximately 3,100 billion m^3 or 71 percent of global water withdrawals today, and this extraction rate is expected to increase to 4,500 billion m^3 by 2030 (Mohtar & Daher). Looking at the water consumption rate by this sector, agriculture can be held responsible for much of fresh water over-exploitation. Irrigation requires substantial amount of water as compared to other means of crop production and most developing countries throughout the world depends upon non-conventional means of irrigation system. Apart from agricultural commodities, other food products like meat consume exorbitant amounts of water in their production process. A lot of water goes into the production of one kilograms of particular food commodities like rice and meat (refer to Table 1).

'Virtual water' is a term that explains how much water goes into the production of one unit of a particular agricultural or industrial product. Virtual water has also been called 'embedded water' or 'exogenous water', the latter referring to the fact that import of virtual water into a country means using water that is exogenous to the importing country. Exogenous water is thus added to a country's 'indigenous water' (Hoekstra, 2003).

Table 1 specifies the amount of water in litres that goes into production of one kilogram of different food products. Meat products, like beef, drink up a lot of water, as do agricultural

commodities like rice and soybean. The expanding economies of South Asia are undergoing a change in their consumption pattern — a shift from primarily grain-based foods to include a greater diversity of meats and vegetables. The implications of changes in the consumption pattern of population residing in developing countries will most likely have a detrimental impact on the water sector.

Food production further influences the water sector through land degradation which decreases soil fertility; changes in runoff; disruption of groundwater discharge as a result of excessive water withdrawals (India has already exploited much of its groundwater for agriculture) and water quality which gets contaminated due to excessive fertiliser utilisation (Interactions among Water-Food-Energy). About 1.3 billion tonnes of food — which constitutes approximately 30 percent of total food produced in the world — is lost or wasted every year, which indirectly means that the water used to produce it is also wasted (Gustavsoon et al., 2011). Thus, if the world reduces its food wastage by about 50 percent, around 1,350 km^3 of water would be saved at the global level (UN Water Day 2012).

Table 1: Water requirement for producing different food commodities

Food Products	Water Requirement (in litres)
Wheat*	1,150
Rice*	2,656
Maize*	450
Potato*	160
Soybean*	2,300
Beef **	15,415
Sheep Meat**	10,412
Pork **	5,988
Butter**	5,553
Apple **	822

*Source: *Hoekstra, 2003; ** IME Food Waste Report, 2002*

Water and Energy Linkages

Energy and water use are closely interwoven. Water is required to produce energy and energy is required for extraction, treatment and redistribution of water. Water is needed for energy generation, cooling, resource extraction and refining, transportation, and bio energy production. In the industrial sector, the most common way of making electricity is by producing steam from boiling water that is used to spin electricity-generating turbines. Fuel production — coal mining, natural gas extraction, and growing crops for biofuels — also requires extensive water supplies, as does refining fuels for transportation (Union of Concerned Scientists , 2012). The International Energy Agency (IEA) calculates that water consumed for energy production would increase from 66 billion cubic metres (bcm) today to 135 bcm annually by 2035. The agency estimates oil and natural gas production together would account for 10 percent of global energy-related water demand in 2035 (Lavelle & Grose, 2013).

Water requires energy in many ways. Countries require transporting water to different places that is reliant on transport facilities that is heavily energy dependent. For treating contaminated water, the solutions for improving water quality, including waste -water treatment, depend on energy. Desalination, a complex and expensive process of treating water, intensely relies on large energy inputs (The Royal Society, 2012).

Around 8 percent of global water withdrawal is for energy production. Biofuels are the most water-intensive fuel sources, consuming over 1,000 gallons on an average. Hydropower, a renewable source of energy, is entirely water dependent. It is the most widely used form of renewable energy, accounting for 16 percent of global electricity generation. Globally, approximately 3,427 terawatt-hours of electricity got produced using hydropower in 2010 and it is expected to increase by 3.1 percent each year for the next 25 years (WorldWatch Institute, 2012). Fossil fuels constitute a major part of worldwide fuel supply, but with the progress in technological advancements, renewable energy alternatives are rapidly swapping other means of energy source in the worldwide energy mix.

Extraction of fossil fuels, especially extraction of coal, consumes a lot of water. Fossil fuels provide some 80 percent of the world's current energy needs, including most transportation systems (The Royal Society, 2012). Electricity is the energy product that grows fastest on a global level and coal is projected to be the foremost source for electricity generation in the foreseeable future. As mentioned earlier, looking at the growing consumption trend of coal by countries like China and India, IEA has speculated that water consumption for electricity production through coal would jump by 84 percent — from 38 to 70 bcm annually by 2035. Thus coal plants would be solely responsible for half of the total water used for energy production if the consumption levels continue to grow at the existing rates (Lavelle & Grose, 2013).

Energy and Food Linkages

Modern agriculture requires an energy input at all stages of agricultural production. Pre-harvest energy fuels land preparation, fertiliser production, irrigation facilities and the sowing and harvesting of crops. Post-harvest energy use includes energy for food processing, storage and transportation to markets. In addition, there are many indirect or appropriated energy inputs used in agriculture in the form of mineral fertilisers, chemical pesticides, insecticides and herbicides (FAO, 2000).

Energy is a pre-requisite for the production of fertilisers that are used to grow agricultural goods. Most of the industrial farms use synthetic fertilisers, which require fossil fuel inputs (primarily natural gas) to get produced. Other fertilising agents (e.g., potassium and phosphorus) use energy as they are mined and transported. Most of the food produced today is processed and packaged, increasing its energy and water footprints (Hanlon et al., 2013).

The price of oil has a direct relationship with the price of food grains. The links between food and energy have become quite noticeable in recent years as an increase in the price of oil very quickly leads to an increase in the price of food. Modern agriculture uses oil products to fuel farm machinery, to transport other inputs to the farm, and to transport farm output to the ultimate consumer. Oil is often also used as input in agricultural chemicals. Increasing oil prices put pressure on all these aspects of commercial food systems (Heinberg, 2011). The sub-prime financial crisis has escalated the world prices for basic commodities such as cereals, cooking oil and milk, although the trend has risen steadily since 2000. There has been an inflation surge in food commodities from

the beginning of 2006 and eventually the average world price of rice has risen by 217 percent, wheat by 136 percent, corn by 125 percent and soybeans by 107 percent (Steinberg, 2008).

The energy sector can have other negative impacts on the food sector — increased rate of mining for fossil fuels extraction and deforestation for biofuels reduce land for agriculture, ecosystems and other uses. The food that gets squandered also indirectly leads to the wastage of energy that was used to produce it. As per the research conducted by University of Texas in Austin, around 2030 trillion BTU of energy were embedded in wasted food in 2007 in the United States of America. That is approximately 2 percent of the annual energy consumption in the United States based on an estimate that says that food in general used about 8 per cent of the total energy use in the country (Pasolini, 2013).

Food, Water and Energy Security and Risk Analysis

The intricacies between the linkages of food, water and energy securities make this nexus susceptible to numerous risks. The report by World Economic Forum titled "Global Risks, 2011" has lucidly explained this convoluted nexus alongside the risks attached to it. The report states that 'economic growth and population growth are common drivers for all three risks, especially as improving living conditions in emerging economies results in more resource-intensive consumption patterns. Environmental pressures also drive resource insecurity– from climate shifts to extreme weather events that alter rainfall and affect crop production.

Governance failures in terms of managing shared resources – such as trans-boundary water and energy sources and food trade agreements – create tensions that can lead to conflict, as seen recently in Yemen. Economic disparity also often exacerbates this nexus of risks as governments and consumers seek short term, unsustainable solutions to economic hardship such as growing high-value, water-intensive export crops in water-deprived regions. It is at the local level that most opportunities can be found for improving resource efficiency and managing trade-offs between energy, water and food production. However, at the global and regional levels there are few initiatives to raise awareness, share leading practices and motivate consumers in an integrated approach.' (World Economic Forum, 2011)

Figure 1 clearly explains these resources' interrelatedness and associated risks with it. The sub-linkages between these resources have been clearly explained in the previous section. Continual population growth accompanied by variations in climate change and over exploitation of natural resources have pressurised the delicate relationship between food, water and energy. Resource constraints in any of these sectors will directly impact food, water and energy as a whole.

Climate change can be attributed to natural resource scarcity, which in turn can be interlinked to population growth rate. These three pressuring channels can led to food, water and energy scarcities and insecurities. If the scarcity situation stagnates overtime the results could be ghastly, leading to a crisis situation that will most probably cause social, economic and political unrest in various regions. Probable anarchic situation can be controlled if the countries optimally utilise the resources by adopting result- oriented sustainable agenda. This can most likely be possible if the countries/regions cooperate among them and devise mechanisms that can transform a conflict situation to a win-win situation.

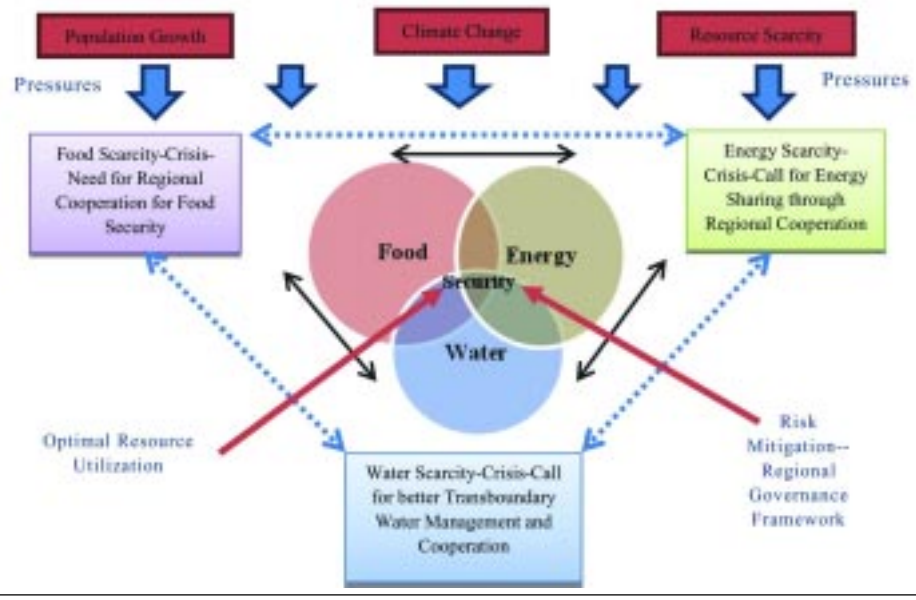
Risk mitigation strategies such as proper governance framework, cooperative regional charter related to food-water-energy security, conflict mitigation stratagems; along with optimal utilisation

of natural resources will help any country/region to achieve the ultimate objective of food, water and energy security.

Emphasis has been placed on the role of governance in any country/region as it directly aids the process of achieving the goal of sustainability. The first edition of AWDO (2007) stated, "If some of the Asian DMCs [developing member countries] face a water crisis in the future, it will not be because of physical scarcity of water, but because of inadequate or in appropriate water governance ... Major and fundamental changes in water governance practices are needed in nearly all the Asian DMCs." Regional cooperation is one of the possible solutions for achieving food-water-energy security and how regions work and cooperate depends upon the existing state of governmental affairs. Stating an example, Krchnak and colleagues (2011, p.3) from the International Conservation Union have argued the importance of governmental policy decisions. "Policy failure drives unsustainability… Policy failure too often leaves ecosystems out of investments made in infrastructure for water, food and energy security, despite the value of the benefits ecosystem services provide to each" (Krchnak, Smith, & Deutz, 2011). It can be inferred that nationalistic policies often overlook the importance of including ecosystem services in the centre stage of food-water-energy nexus (UNESCAP, 2013).

Moreover, not just policy failures degrade the level of economic emphasis of vital resources but sometimes they also over complicate regional issues. To point out stark issues, the Asia Foundation recently concluded a study on political economy of Teesta river basin. Its extensive study apart from other issues also points out that the negotiations on trans-boundary water are state-controlled and the single-track processes have failed to understand the diversity of claims on water and the potential for benefit- sharing of trans-boundary rivers. It recommends a proper trans-boundary water governance framework for India and Bangladesh and stresses upon the need for making the water governance discourse less nationalist in order to achieve reasonable compromises in water negotiations (The Asia Foundation, 2013). Thus, risk mitigation strategies like generating regional cooperation through better governance, can trigger the countries to perform actively in order to reach the most awaited goal of food-water-energy security.

Figure 1: Food-Water-Energy Linkages



Sources: Compiled by the authors

4
Food Security in South Asia

Despite only amounting to 2.4 percent of the world's land surface area, South Asia (comprising of eight nations-Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka) is home to one fifth of the world's population. By 2050, South Asia's population will exceed 2.2 billion with an estimated 600 million people living on less than $1.25 a day. About 70 per cent of the population in South Asia live in rural areas which are home to 75 per cent of the total poor living below the subsistence levels. These 75 per cent of poor are also the most food insecure and in total around 336 million[11] (23 per cent of total South Asia population) people are chronically hungry in South Asia. Among these poor, women and girls are worst fed in South Asia. They contribute a substantial proportion of this 75 per cent of poor unfed people in South Asia. These statistics are among the highest rates of hunger in the world.

Food security does not mean adequacy at aggregate levels but it implies adequacy at an individual or household levels. A household is said to be food secure only if it has protection against chronic food insecurity[12] as well as transitory food insecurity[13] (IFAD). But the poor and marginalised in South Asia has been living (and are still living) under these conditions over the years. Table 2 clearly points out that this region has shown some progress in the reduction of Global Hunger Index. Bangladesh is one of the top 10 countries that have made significant progress in reducing hunger since 1990. The data on GHI clearly indicates that this country has been most successful in reducing the GHI over two decades as compared to other SAC like India, Nepal, Pakistan and Sri Lanka. Average dietary energy supply adequacy and prevalence of undernourishment has also shown some positive results for all the countries in this region. But these positive trends cannot hide the actual prevalent reality in the region.

South Asia also has the highest incidence of malnutrition in the world. Over 33 percent of children in Afghanistan are underweight, followed by 41 percent in Bangladesh, 43 percent in India, 39 percent in Nepal, 31 percent in Pakistan and 22 percent in Sri Lanka (RANGE, 2012). Table 2 shows a positive picture on the food security situation in South Asia, but the ground reality lies in the fact that still millions of people in South Asia are starving to death because of lack of food.

A huge proportion of South Asia's rural poor depend on rainfed agriculture, livestock, fragile forests, and/or casual migratory employment (The World Bank). Agriculture sustains a huge proportion of population in South Asia and approximately 60 percent[16] of the total population is engaged in this sector. Major food supply of this region is provided by the Indo-Gangetic belt which is often referred as the food basket of South Asia as it takes care of the food security in the region. Unlike the western counterpart, the eastern belt is marked with low productivity as the farmers are resource poor and practice agriculture mostly at subsistence level.

Table 2: Snapshot of GHI, Average Dietary Energy Supply Adequacy, Prevalence of Undernourishment and Malnutrition Prevalence in South Asia								
Country	**Global Hunger Index[14] (GHI)**			**Average Dietary Energy Supply Adequacy[15]**		**Prevalence of undernourishment (% of total population)**		**Malnutrition prevalence, (% of children under 5) weight for age**
	1990	**2000**	**2013**	**2000-02**	**2011-13**	**2000-02**	**2011-13**	**Year**
Afghanistan	-	-	-	-	-	-	-	-
Bangladesh	36.7	24	19.4	107	108	17.2	16.3	36.8 (2011)
Bhutan	-	-	-	-	-	-	-	12.8 (2010)
India	32.6	24.8	21.3	101	106	22.5	17	43.5 (2006)
Maldives	-	-	-	118	125	9.6	5.4	17.8 (2009)
Nepal	28	25	17.3	107	116	24.2	16	29.1 (2011)
Pakistan	25.9	21.6	19.3	108	114	25.4	17.2	30.9 (2011)
Sri Lanka	22.3	17.8	15.6	103	111	28.9	22.8	21.6 (2009)
Sources: GHI- International Food Policy Research Institute 2013; Average Dietary Energy Supply Adequacy- FAO STAT 2013; Prevalence of undernourishment-FAO STAT 2013; Malnutrition prevalence, weight for age- The World Bank								

Even though a huge proportion of population in South Asia depends upon agriculture for subsistence, but over the years the value added by this sector to the overall GDP has declined. This can be noted from Table 3, which clearly shows the falling rate of the value added by agricultural sector to overall GDP from 2001 to 2011. The proportion has considerably decreased for Bhutan, India and Sri Lanka even though a huge proportion of population in these countries still relies on agricultural employment. Although the percentage of people employed in the agricultural sector has declined over time in South Asia but comparatively this proportion in relation to other employment sectors is relatively higher. Population growth rate (in percentage) has declined over the years in South Asia but since this region already has its population in

Table 3: Snapshot of Population Growth Rate, GDP Growth Rate, Agriculture Value Added, Employment in Agriculture Sector in South Asia								
Country	**Population Growth Rate (% age)**		**GDP Growth Rate (%age)**		**Agriculture Value Added (% of GDP)**		**Employment in Agriculture Sector (% of total employment)**	
	2001	**2012**	**2001**	**2012**	**2001**	**2011*/ 12**	**Year**	**Year**
Afghanistan	3.6	2.4	8.4 (2003)	7 (2001)	38	24*	-	-
Bangladesh	1.8	1.2	5.3	6.3	24	18	62 (2000)	52 (2003)
Bhutan	2.9	1.7	8.2	9.4	26	16*	80 (2003)	60 (2011)
India	1.6	1.3	4.9	3.2	23	17	60 (2000)	51 (2010)
Maldives	1.8	1.9	6.1 (2002)	3.4	7	4*	-	03 (2011)
Nepal	2	1.2	4.8	4.6	38	36	14 (2000)	17 (2003)
Pakistan	2.1	1.7	2	4.2	24	20	48 (2003)	42 (2001)
Sri Lanka	-1.6	1	-1.5	6.4	20	12*	35 (2002)	33 (2010)
Sources: FAOSTAT, 2013- Agriculture Value Added; Employment in Agriculture Sector. The World Bank- Population Growth Rate; GDP Growth Rate								

billions, the falling growth rate makes no difference in resolving the issues of food insecurity. With every passing day, the demand for food is increasing with the growing population, which is directly impacting food supply and food access.

The perilous impact from land fragmentation can be seen in the regions' agrarian sector. Majority of the regions' agriculture- dependent population extensively practice the culture of land fragmentation without realising its repercussions on the fecundity of soil and agricultural produce. Land fragmentation has been associated with the growing number of human population and this indirectly leads to inappropriate and destructive farming practices and increased cultivation of marginal land, which often reduces food production, impoverishes and erodes the soil, reduces vegetation and frustrates water resource management (Sadik, 1991).

The proportion of arable land (as a percentage of agricultural area) has comparatively decreased or remained the same for some SAC from 2001 to 2011; whereas it has increased to a certain extent for other countries like Sri Lanka. The falling percentage of arable land (as a percentage of total agricultural area) in Table 4 can to a small extent contributed to the growing population stress (which is indirectly leading to adoption of inefficient farming practices) in South Asia.

Cereals are one of the main sources of minimum dietary requirements — rice and wheat being staple crops of this region are highly rich in this content. The cereal yield has substantially increased for all the South Asian Countries (SAC) from 2001 to 2011. Many climate experts have predicted that the cereal yields of rice and wheat will fall down in South Asia over time as a result of global warming. The preceding section on food security and the cost of climate change elaborates on this mentioned point.

Table 4: Arable Land as a Percentage of Total Agricultural Land and Cereal Yield in South Asia

Country	Arable Land (% of agricultural area)		Cereal Yield (hg/ha)	
	2001	2011	2001	2011
Afghanistan	20.35	20.55	10,066.86	20,720.69
Bangladesh	88.3	83.57	33,110.46	41,851.83
Bhutan	20.75	18.35	14,416.09	26,633.53
India	88.87	87.51	24,230.69	29,536.08
Maldives	30	42.86	17,647.06	26,086.96
Nepal	55.32	55.29	21,769.60	27,193.94
Pakistan	79.12	78.02	22,308.92	28,335.76
Sri Lanka	38.96	45.8	34,249.02	38,616.43

Sources: FAOSTAT, 2013-Arable Land and Cereal Yield.

Price of food commodities plays a pivotal role in ensuring food security for a particular country/ region. South Asia has witnessed an inflationary trend in the agricultural commodity prices over the past couple of years. As per the latest statistics, the regional price index for wheat increased by 11.1 percent annually (2012-13) led by an increase of 14.3 percent and 9.2 percent in South

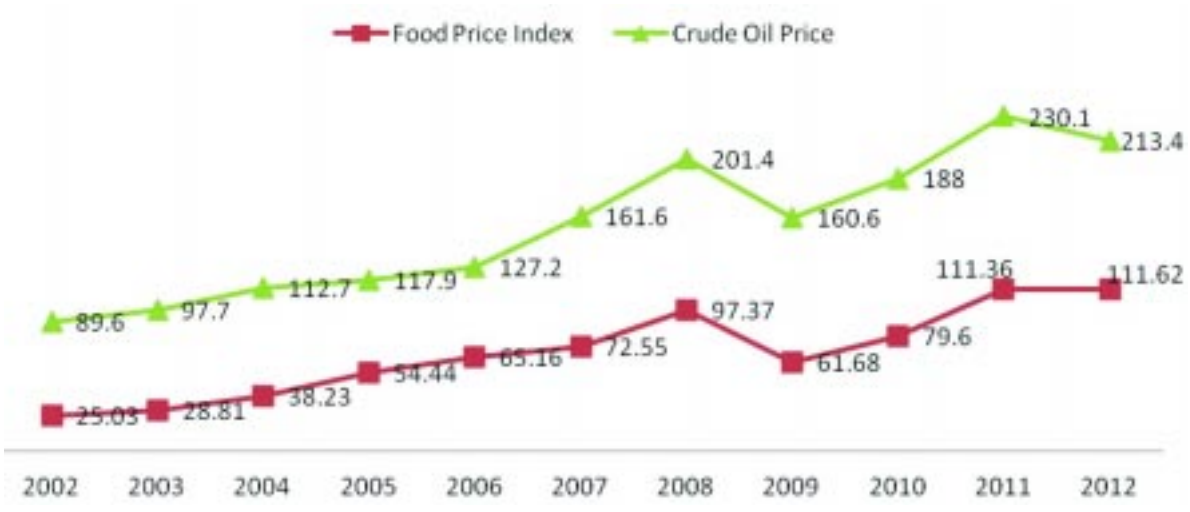
Asia and India. Retail prices for onions and tomatoes in major Indian markets registered historic increases of 258.9 percent and 23 percent from 2012 to 2013 (FAO, 2013). The recent global recession in 2008 has adversely impacted the prices of food commodities throughout the world. Many reasons have been cited by various scholars/researchers for this surge in prices of food commodities that includes rise in the price of oil as one of the reasons (Lustig, 2009). Looking at the interrelatedness of the food sector with other sectors, price of energy is one of the determinants of commodity market that affects agriculture commodity prices (Dev, 2013).

The paper titled "Thought for Food: The Challenges of Coping with Soaring Food Prices" by Nora Lustig has clearly mentioned that "the increase in food commodities prices is both a real and a monetary phenomenon and both market-driven and policy-induced." Even though the largest economies in South Asia, like India, depend less on food grains imports, but their heavy reliance on petroleum imports has not been successful in trading off an increase in the recent food inflation rate. Consequently, the Indian economy is experiencing trade loss that has a direct bearing on the country's current account balance (Dev, 2013).

Increase in the Food Price Index (FPI)[17] is an alarming situation as it will exacerbate food insecurity in developing regions like Asia, specifically in South Asia. 'A 10 percent rise in domestic food prices in developing Asia (home to 3.3 billion people) could push an additional 64.4 million into poverty, or lead to 1.9 percentage increase in poverty incidence based on the US$1.25 a-day poverty line' (Dev, 2013). Figure 2 clearly shows the interactions between Food Price Index and Crude Oil Price (COP). It can be noted that the respective lines for the variables are following the same trend of fluctuations from 2002 to 2012.

In 2008, the steepest increase in crude oil price was witnessed and correspondingly there was a steep increase in the price of Food Price Index. Looking at the yearly differences between the FDI and COP, it can be noted that the increase and decrease in the price of both these variables is not proportionate. In 2004-05, the price of oil increased by US$9.22 per barrel whereas the FPI increased by 16.21 whereas when the COP fell by US$16.7, -FPI remained more or less the same.

Figure 2: Interactions between Food Price Index and Crude Oil Price, Worldwide Overview



Sources: FAO-Sources: Food Price Index < http://www.fao.org/worldfoodsituation/foodpricesindex/en/>; OPEC Annual Statistics Bulletin (p. 84), 2013-Crude Oil Price (Brent). Years are mentioned in the horizontal axis of the graph.

The main staple crops of South Asia are rice and wheat. These crops are vital as they provide nourishment to the people, being extremely rich in carbohydrates content. Most of the water withdrawals in South Asia is extensively used for crop cultivation, especially for rice cultivation. In an average, 90 percent of the water withdrawals in South Asia is used in agricultural sector. Rice cultivation covers 29 percent and wheat covers 30 percent of all harvested irrigated crop area in South Asia. Around 86 percent of harvested irrigated crop area in Bangladesh is occupied by rice, while the statistics for Nepal is 37 percent and India is 36 percent[18]. Even though irrigated agriculture accounts for 60-80 percent of food production in South Asia (about 39 percent of cropland is irrigated)[19] but water scarcity is directly impacting the productivity of this sector.

The 2030 Water Resources Group has estimated that even though 80 percent of Asia's freshwater is diverted to irrigated agriculture, but irrigation effciencies[20] have remained low in the region (ADB, 2010). An analysis made by Asian Development Bank (ADB) states that while food production in Asia has increased by large margins, the irrigation effciencies have increased by less than 1 percent per year since 1990. Over the years, the energy withdrawal for agriculture and forestry has increased in South Asia. Nepal withdraws most of the water for agricultural purposes while Bangladesh comparatively uses more energy for agriculture than other SAC (Table 5).

Table 5: Water and Energy Withdrawals for Agricultural Purposes

Country	Water withdrawal for Agriculture (% of total water withdrawals)	Energy withdrawal for Agriculture and Forestry (% of total water withdrawals)	
	Year	2001	2009
Afghanistan	-	-	-
Bangladesh	87.82 (2008)	3.88	5.08
Bhutan	94.12 (2008)	-	-
India	90.41 (2010)	3.51	3.87
Maldives	-	-	-
Nepal	98.11 (2006)	0.801	1.15
Pakistan	93.95 (2008)	1.39	1.28
Sri Lanka	87.34 (2005)	0.20	0.11

Sources: FAO STAT 2013

Trade plays an important role in determining the extent of cooperation as well as food security in any region. South Asia has been unsuccessful in tapping the potential of intra-regional trade and therefore is considered as the least integrated region in the world, despite its attempts to liberalise trade using various unilateral, bilateral, multilateral and regional arrangements. On the other hand, ASEAN has come up as a strong regional entity that has the capacity to effectively handle (and has handled) food security crisis in its respective region. SAARC contributes to around 3 percent of world GDP and around 2 percent of world exports. The Intra-regional trade as a percentage of total trade stands at around 4.7 percent[21] whereas the same is around 25 percent in ASEAN and 20 percent in Latin America and Caribbean.

Considering that initiatives to improve intra-regional trade were started in 1993, when the South Asian Preferential Trade Arrangement (SAPTA) was signed which later evolved into South Asian Free Trade Agreement (SAFTA), the progress made as far as trade volumes are concerned is minimal. Although the region has significantly reduced tariff barriers (even though many products still fall under sensitive list with high tariff rates), as an effect of these agreements, the prevalence of Non-Tariff Barriers (NTBs) has undermined the effect of tariff reduction. The problems of food insecurity can to a great extent be curbed by efficient food commodity trading activities and therefore, the role of SAFTA is very crucial in the given context.

India, holding the advantages of central geographical location along with strong economic background, is at the helm of the region's trade facilitation. India also accounts for a majority proportion of intra-regional exports (78 percent) whereas the remaining countries have intra-regional trade-deficit (intra-regional imports > intra-regional exports). But a vast list of its food commodities that are listed under SAFTA fall under the category of sensitive trade commodities[22] with high tariff rates. In the total list of India's 865 commodities, a huge proportion of commodities are agricultural along with livestock products.

Same is the case with other SAC, where food commodities mostly fall under the ambits of sensitive lists. Apart from trade barriers, some NTBs have also restricted the flow of trade. Spurt in the use of Technical Barriers to Trade (TBTs) and Sanitary & Phytosanitary (SPS) measures has been a matter of trade concern in the SAR, specifically with regards to cumbersome rules and procedures underlying these trade barriers. A recent study on TBTs and SPS measures under SAFTA has outlined some complexities that are being caused by the mentioned trade barriers.[23]

The study found out that mainly for agricultural and animal-related products, India does not accept pre-shipment test certificates from the exporting countries and the exporters have to get quarantine certificates from the test labs located in India, which is time-consuming and adds to the cost of the exporter. This case is more prevalent for food products being imported by India from Nepal and Bangladesh.

A recent study by CUTS International, 'Enhancing Trade and Regional Economic Integration between India and Pakistan (Phase 1)' has revealed that inter- regional trade between India and Bangladesh through the Land Custom Stations (LCSs) is severely hampered because of several concerns. The study points out that apart from dilapidated road infrastructure, cumbersome and different regulations regarding SPS measures and Plant & Animal Quarantine directly impact the transit of perishable food commodities (agricultural and livestock). SPS measures of both the countries are not harmonised and food commodities coming from Bangladesh to India (and vice-versa) have to go through the respective testing labs for obtainment of certificates from the quarantine office.

To worsen this situation, paucity of plant and animal quarantine offices in the respective countries and relying on a few testing labs have intensified the quality control issues. The negative impact from infrastructural and trade regulation issues were seen in the trade of marine products, specifically on the trade of Hilsa fish. Due to delays in procedures at respective LCSs, fish exporters from Bangladesh have reduced the export intensity of Hilsa fish and the reduced trade has severly impacted the traders to a large extent. Such practices, if not curtailed soon, will eventually aggravate the problems of food insecurity.

An ongoing study on "Addressing barriers to rice seed trade between India and Bangladesh"[24] by CUTS International has revealed that in spite of there being a huge potential for rice trade between India and Bangladesh, specifically high-yield variety (HYV) rice seeds, bilateral trade is hampered by inadequacies in the formal trading system. Inefficiencies in the use of available resources, excessive use of NTB and inappropriate pricing of the agricultural inputs and outputs have delimited the earning potential from rice seed trade between these two countries. The study has been beneficial in understating the sensitive and concealed facets of bilateral trade and dynamics of bilateral trade relations. The recommendations have laid down a path for improving Regional Cooperation that can serve as a vanguard against food insecurity.

5
Food Security and the Cost of Climate Change

Climate change has already shown its disastrous impacts throughout the world. Latest data by various research organisations[25] claims that South and South East Asia are most vulnerable to climate change. Anthropogenic climate change causes long- term shift in weather conditions, causing extreme events (flooding, draughts, extreme monsoon variations, etc.) and this has a direct impact on the poor, marginalised and the excluded. Severe flooding in 2007 along the Ganges and the Brahmaputra basins affected over 13 million people in Bangladesh; flooding in Pakistan in 2010 severely affected 20 million people. India has likewise suffered numerous events of extreme rainfall, flooding and droughts and the recent Uttarakhand disaster in India is a proof of this (Grobicki, 2011).

The economic cost of the 2007 floods in Bangladesh was over US$1 billion; in Pakistan it was nearly US$10 billion. Apart from losing millions of tonnes of food grains, this region has also seen deaths due to food insecurity which has been further aggravated by spread of various types of diseases.

ICIMOD's report[26] states, 'Climate change will likely shorten the growing season and alter conditions; higher temperatures will enhance the transpiration of plants which will lead to increase in water demand; soil texture and the organic content of soil can change; and the incident of diseases and trans-boundary movement of species will introduce new challenges.' Other scientists (Hanjra & Qureshi) note that climate change may threaten agriculture and food security by altering the spatial and temporal distribution of rainfall, and the availability of water, land, capital, biodiversity and terrestrial resources. It may heighten uncertainties throughout the food chain, changing yield to trade dynamics, and ultimately have an impact on the global economy, food security and the ability to feed nine billion people by 2050.

The Human Development Report (HDR) 2006 has pointed out that in South Asia around 2.5 billion people will be affected by water stress and scarcity by the year 2050. It further adds that rise in temperature will negatively impact rice and wheat yields in the tropical parts of South Asia where these crops are already being grown close to their temperature tolerance threshold (Mittal & Sethi, 2009). The report prepared by the 'Indian National Initiative on Climate Resilient Agriculture' projects that rice yields in India will see a decline of 4 percent till 2020, 7 percent till 2050 and 10 percent till 2080. Wheat yield is projected to decline by 6 percent till 2020 and maize yield by 20 percent till 2050 and by 23 percent till 2080. The major cause for the decline in

the yield of the country's staple cereals has been attributed to the rise in temperature (The Financial Express, 2013).

The region's massive population largely depends upon agriculture for subsistence but this sector emits out huge amounts of methane, nitrous oxide and CO_2 that pollutes the ecosystem and is one of the major causes of variations in the global mean temperature.[27] Methane is the principal greenhouse gas emitted from agriculture, primarily from rice cultivation and livestock, with India being the largest source.[28]

Prominent culture of practicing land fragmentation along with deforestation is also one of the major causes of GHG emissions. In most part of rural South Asia, people practice the inexplicable culture of burning forests to grow crops along with unsustainable logging practices which have further aggravated the damaging impact of climate change. In Pakistan, excessive land fragmentation along with deforestation contributes to 3 percent of the country's GHG emission (Mahbub ul Haq Centre, 2013). Table 6 clearly shows the growing amount of GHG emissions from the cultivation of rice as well from the entire agricultural sector. CO_2 emissions from the agricultural sector of India and Pakistan have drastically increased from 2001 to 2010.

This situation signals the urgency for adoption of sustainable climate- resilient agricultural practices in South Asia in order to save its population from food scarcity and crisis. Adoption of organic farming with bio-manure and herbicides usage, crop residue management, adoption of no-till farming, precision farming, adoption of proper mulching techniques to retain soil moisture and reduce CO_2 emissions, appropriate cultivation of oil seeds that can used as biofuels for reducing GHG emissions and educating the rural farmers about the benefits of using these techniques and making them understand the deleterious impact of land fragmentation and deforestation, can prove to be beneficial for countering the disastrous impact of climate change on our agricultural system.

Table 6: Emissions from Rice Cultivation (CO2eq) (Giga grams) and all Green House Gas (GHG) Agricultural Sector Emissions (CO2eq) (Giga grams) in South Asia

Country	Rice Cultivation		Total Agriculture	
	2001	2010	2001	2010
Afghanistan	355.74	611.52	7,757.97	10,699.48
Bangladesh	22,253.77	24,065.31	63,313.15	73,869.74
Bhutan	55.58	55.14	475.02	490.3
India	99,532.52	95,015.65	5,35,896.04	6,09,101.99
Maldives	-	-	0	0.07
Nepal	3,336.02	3,257.53	17,276.08	19,615.39
Pakistan	6,215.75	6,953.98	97,134.18	1,30,934.51
Sri Lanka	1,713.90	2,375.50	4,817.69	5,865.36

Source: FAOSTAT, 2013

6
Water Security in South Asia

Water has been exposed to numerous pressures such as population growth; extensive resources extraction; concretisation of forests; exploitation of this resource for food and energy generation; and rapid systematic change in climate variability. The per capita availability of water in South Asia has drastically come down to one- fifth of what it was 60 years ago, whereas there has been a three-fold increase in the region's' human population since 1950.

As the definition says, water security includes five different components that ensure water security in any region. These include water access, water quality, water quantity, water affordability and water reliability. The report Human Development in South Asia 2013 by Mahbub ul Haq Centre points that rural areas have limited and low water access as compared to urban areas in different SAC. The report also states that South Asia is facing water stress and the current water provision is insufficient to meet the growing demand for water. In terms of water quality, water in some areas of South Asia has been exposed to microbiological contamination and chemical contamination.[29]

Commodification has made water a much more expensive source to be accessed and this has directly impacted the marginalised communities in South Asia. Interrupted supply of water has worsened the situation of water access in South Asia. In many areas, water supply is unreliable and irregular due to poor infrastructure of piped water system (Mahbub ul Haq Centre, 2013).

The proportion of people using improved sanitation facilities has increased from 2000 to 2011. Countries like Maldives and Sri Lanka have done exceptionally well in making water reach a vast majority of population (for sanitation purposes) but when it comes to countries like India, Bangladesh and Pakistan, the statistics shows that these countries are lagging far behind (refer to Table 7). Only 35 percent of the total population of India and Nepal have access to improved sanitation facilities. The coverage rates of water have drastically improved in all the countries, especially in the urban areas.

People need safe drinking water and improved sanitation facilities as these have a direct impact on the physical and emotional well-being of men, women and children. Access to safe drinking water is fundamental to health as per WHO's Guidelines for Drinking Water Quality. Poor management of water often leads to mass outbreak of water-borne diseases that plague the nation. South Asia has witnessed some of most gruesome epidemics caused by improper water management. Around 280 people lost their lives in Nepal due to diarrhoeal outbreak in 2009. The village Jajarkot had the highest number of deaths and the main reason for this outbreak was water contamination as a result of open defecation (World Health Organisation , 2010). Women

Table 7: Population using Improved and Improved Sanitation Sources and Total Improved Water Sources in South Asia

Country	Population (x 1000)		Improved Sanitation Facilities (as a %age of population)		Unimproved Sanitation Facilities (as a %age of population)		Improved Water Sources (as a %age of population)	
	2000	2011	2000	2011	2000	2011	2000	2011
Afghanistan	22,856	32,358	23	28	40	45	22	61
Bangladesh	1,29,592	1,50,494	45	55	13	14	79	83
Bhutan	571	738	39	45	24	26	86	97
India	10,53,898	12,41,492	25	35	5	6	81	92
Maldives	273	320	79	98	5	0	95	99
Nepal	24,401	30,486	21	35	5	6	77	88
Pakistan	1,44,522	1,76,745	37	47	22	24	88	91
Sri Lanka	18,745	21,045	79	91	8	1	79	93

Source: World Health Organization and UNICEF 2013
Report: Progress on sanitation and drinking-water - 2013 update.

and girls are most vulnerable in South Asia as they get harshly impacted by lack of access to water and sanitation. Generally in rural areas women and girls have to travel long distances to fetch water for the entire family's needs. Eventually, many girls are forced to miss school and this also worsens the absenteeism situation because most of the schools in rural areas of South Asia lack proper sanitation facilities. This situation is more prominent in rural areas of Rajasthan in India.

Box 1: Sanitation Can Increase Cognition in Children

The latest study, Effects of Early-Life Exposure to Sanitation on Childhood Cognitive Skills, by the World Bank has proved that access to improved sanitation can increase cognition in children. The study contributes to a growing body of research linking stunting and open defecation. Water and Sanitation Program Unit of the World Bank carried out a research study in India, called India's Total Sanitation Campaign (TCS), to study the effects on childhood cognitive achievement of early life exposure. The quantitative analysis presented in this study shows that children who live in districts in which more TSC latrines had been constructed by their first year of life are more likely to recognise letters and numbers when they are six years old. The study suggests that even a low capacity government can implement a relatively inexpensive programme that will cause an important improvement in cognitive skills, given the context of widespread open defecation.

Source: (Spears & Lamba, 2013)

Water is required to produce food as well as electricity. Water-food and water-energy linkages (section 3.1 & 3.2) clearly points out the interrelatedness of all these three sectors. Agricultural sector, as a whole, is the largest consumer of water in South Asia (refer to Table 5). This highlights the region's critical dependence on this important source (around 90 percent of water withdrawals in South Asia is for agricultural purposes), whereas on an average the global dependence on this sector is around 70 percent (Mahbub ul Haq Centre, 2013).

The worrisome situation lies in the fact that the agricultural sector in South Asia uses water with low efficiency and productivity. Water productivity is to a great extent lower in South Asia than in countries like Brazil and China. Some of the reasons behind increasing inefficiency in the use of water in South Asia are attributed to the archaic nature of irrigation system and over-exploitation of groundwater (Mahbub ul Haq Centre, 2013).

The research studies done by McGill University in Montreal, Canada and Utrecht University in the Netherlands have suggested that about 1.7 billion people, mostly in Asia, are living in areas where underground water reserves and the ecosystems that rely on them are under threat (Wickham, 2012). India is the largest groundwater user in the world (mostly used by the northern agricultural states of India like Punjab, Haryana and Uttar Pradesh), with an estimated usage of around 230 cubic kilometres per year, and this country has already overexploited the use of this natural resource. More than 60 percent of irrigated agriculture and 85 percent of drinking water supplies are dependent on groundwater in India (The World Bank, 2012).

Water is also used by the energy sector for electricity generation and continued supply of water is vital to supply energy to fuel the expanding economies of South Asia. Hydropower is often termed as the battery of South Asia and this region has untapped potential for both large and small-scale hydropower projects. Bhutan is the only country in South Asia with surplus power generation capacity and a power sector that contributes a significant share to its national economy. The power sector of Bhutan contributed around 40 percent of government revenues and 25 percent of gross domestic product (GDP) in 2009. Bhutan's economy is thriving to a large extent on hydropower exports, especially to India. Overall, hydropower export contributed to about 45 percent of total exports by Bhutan in 2008 (ADB, 2010).

Since the country's electricity generation significantly surpasses domestic electricity demand, approximately 70 percent of electricity generated is exported, mostly to India (ADB, 2009). On the contrary, Nepal has not been successful in effectively tapping its hydropower potential even though this country is identified as one of the top potential hydropower-producing nations in the world by the World Bank. Nepal only produces 450 MW of energy from water whereas experts have estimated that it has a profound capacity to produce around 42,000 MW of power through water (Meeking, 2013).

On the whole, South Asia has not been able to capture the enormous hydropower potential which sits untapped in the mountains of the region. The region has only been able to utilise around 29 percent of its hydropower potential (Mahbub ul Haq Centre, 2013).

The debate on water stress has conflagrated throughout the world and South Asia will most certainly have to deal with this situation as it will get worsened if left ignored. Even though this region has satisfactory endowments of water resources, but the region's growing population coupled with its growing demand for food and energy will be central to the decreasing availability

of water in South Asia. More than 750 million of the world's poorest people depend upon the three major river basins fed by the monsoons (the Ganges, the Indus and the Brahmaputra) and the Himalayan glaciers for sustenance. But climate change is affecting the timing and intensity of monsoon in the SAR coupled by glaciers melting.[30] Water scarcity is challenging food and energy securities in the SAR as demand for these resources surges with growing population while production is hindered by fast depleting water resources.

Table 8 provides the statistics on the total availability of renewable water resources in South Asia. From the data it is evident that India, Pakistan and Maldives clearly show a sign of water stress since water availability per occupant is already below the threshold limits. Bhutan is the only country in South Asia that is most likely to be saved from extreme water stress situations for some couple of years. Bangladesh can be said to be water sufficient to some extent but since about 91.44 percent of its water comes from its upper riparian neighbours, like India, it is always under constant fear as the policies and actions taken by upper riparian for water management and control directly has an impact on the country's water situation. Pakistan is most affected by water politics and natural water dynamics as this country majorly depends upon the upper riparian for water access. Moreover, the water availability per inhabitant is relatively less in this country.

All these conditions have severely impacted the water situation in Pakistan. India being the largest country in South Asia, both economically and geographically, also faces water issues and never-ending conflicts on trans-boundary water sharing. South Asia is least integrated when it comes to management of trans-boundary water sharing and cooperation. Climate change is likely to elevate existing tensions over water resources across borders and within communities. The following subsection illustrates the conflicts on trans-boundary water within four major countries sharing rivers — India, Pakistan, Nepal and Bangladesh.

Table 8: Availability of Water in South Asia and Dependency Ratio of South Asian Countries

Country	Total Renewable Water Resources (cubic kilometres)		Total Renewable Water Resources (per capita) in cubic metres	Dependency Ratio[31]
	Natural	Actual		
Afghanistan	73.85	65.33	2,019	28.72
Bangladesh	1,227	1227	8,153	91.44
Bhutan	78	78	105,691	0
India	2,081	1,911	1,539	30.52
Maldives	0.03	0.03	94	0
Nepal	210.2	210.2	6,895	5.709
Pakistan	320.1	246.8	1,396	77.71
Sri Lanka	52.8	52.8	2,509	0

Source: FAO AQUASTAT 2013

7

Issues Surrounding Trans-border Water Sharing in South Asia

Sharing of river water that crosses international borders has been plagued by claims and counter-claims by different users and as a result, several issues on trans-border water sharing are cropping up in South Asia. Trans-border water sharing in South Asia has been harried by the following issues: excessive water flow during the monsoon and moderate water flow in the dry season, construction of dams/embankments in the upstream water. Climate change has exacerbated the situation of water stress in the region and this has been the foremost reason for upper riparian countries to come up with water sustenance mechanisms that are not acceptable to the downstream riparians. Perpetual growth in the demand for energy has forced India to come up with innumerable hydroelectricity projects (some of them on western rivers[32]) that have received severe criticism by countries like Pakistan and Bangladesh on account of burgeoning threat of water scarcity in their respective countries.

Nepal, Bangladesh and Pakistan have a preconceived notion that India acts as a regional hegemon in controlling the water of international rivers. Hydro-politics along with division of the river basin waters continues to be a catalyst for water-sharing conflicts in South Asia. Political tensions and animosity issues have travelled a long way since the 1990s in worsening the trust deficit and making individual nations more paranoid about the rivers. History has been proof of innumerable events[33] that have fettered political upheavals in this region that have harmed the already strained relations of the SAC.

Wilson John in the paper titled 'Water Security in South Asia: Issues and Policy Recommendations' writes, 'Despite the looming threat of water scarcity staring at many of the countries in South Asia, there has been a persistent reticence, often deliberate, in working together to reduce the impact of the impending crisis on the people of the region. Most of the blame should squarely lie on the political and bureaucratic leadership of these countries which has treated water strictly as a sovereign issue, ignoring the fact that many of the rivers and river systems that feed billions in the region transcend political boundaries. Water is treated as a political feature with the corresponding shorthand on rights, volumes and ownership describing the narrative. Petty squabbles, feudalistic approach and plain obduracy among the policymakers in the region have considerably accentuated the possibility of a 'water war' not only between two countries but within the countries themselves'. (John, 2011).

Even though South Asia is endowed with substantial amount of water resources but all these water resources are unevenly distributed within the sub- region. Bangladesh is completely

dependent upon the Ganges river water that comes from India. Pakistan's water needs are to a great extent dependent on Indus water that also flows from India to Pakistan. India's water needs are to some minor extent fed by the water that comes from Nepal and China (refer to Table 8 for the data on dependency ratio). Bhutan and Nepal are the only two countries in South Asia that have adequate amount of water resources and does not depend upon external water resources. Even though Maldives's dependency ratio is negligible, but this country is not water self-sufficient.

To tackle the water stress problem, Maldives has adopted innovative mechanisms to suffice the water requirement in its country. As a result of successful rainwater harvesting, Maldivians have made a shift of their dependency on freshwater from groundwater to harvested rain water. It has been estimated that 25 per cent of its population currently depends on groundwater for drinking, while the rest of the population uses rainwater and desalinated water for this purpose, and groundwater for other purposes. Sri Lanka's water-rich tag may be lost as research results states that the per capita water availability in Sri Lanka will decline from 2,400 m^3 to 1,900 m^3 in 2025 (Babel & Wahid, 2008). Afghanistan, though an arid region, has plentiful of water resources because the mountain ranges in this country have enough snow to sustain the life of people.

India and Pakistan

The famous Indus Water Treaty (IWT) between India and Pakistan has travelled a long distance since 1960 amidst several hiccups and is considered to be one of the most successful bilateral water-sharing frameworks in the region. But there are certain issues that still fall outside the ambits of the treaty, making the already hostile relations between these two countries more complicated. Pakistan has raised several issues on hydropower projects that India is planning to build on western rivers. The major concern areas and apprehensions from Pakistan's side lies on the control potential of dams; design and other technical aspects of dams; concerns on storage component (a clause in the Indus Water Treaty forbids construction of storage, except in limited amounts for the purpose of flood control); and sharing and exchange of data on dam construction (Mahbub ul Haq Centre, 2013).

IWT has several clauses pertaining to the construction of dams. One of the most important clauses of this treaty is that India is not permitted to build dams on the western rivers (Chenab, Jhelum and Indus) for storage purposes but relaxation is provided if dams are built for non-consumptive purposes. Moreover, India is allowed to build 'run-off-the-river' hydroelectric power projects with limited amount of water storage.[34]

Both the nations have their own explanations for arguments raised on international and national fora on the above mentioned issues and clauses under IWT. Pakistan has from time to time accused India of acting like a hegemon in controlling the trans-boundary rivers and exacerbating Pakistan's water woes. India, on the other hand, dismisses these accusations stating them as Pakistan's paranoia and claims that have no scientific backing.

Construction of dams by India on the western rivers has raised concerns in Pakistan. Till date, the following major Indian projects are overhung by the clouds of controversy:- Wullar Barrage and Tulbul Hydropower Project on the river Jhelum; Kishenganga Hydroelectric Plant on the Kishenganga River; Salal, Baglihar, Sawalkot, Pakuldul, Bursar and Dul-Hasti on river Chenab. All these dams, especially on river Chenab and Jhelum, are a matter of deep concern for Pakistan. Pakistan's main concern regarding these gigantic power projects is that if these dams get fully operational, India will be in a stronger position to restrict huge flows of water to Pakistan, thereby having an adversative impact on river morphology.

India and Pakistan have been mulling over the construction of 330 MW Kishenganga Hydroelectric Plant, which is a run-off-the-river hydroelectric scheme by India. India began the construction of this project in 2007 but India had to halt the construction in October 2011 because of Pakistan's protests of fear concerning reduced water flow to Kishenganga River. This has been the first dispute matter under the IWT which has been referred to the International Court of Arbitration. Pakistan had put forward various arguments against the construction of the project, stating that India is violating the IWT. But the Permanent Court of Arbitration at The Hague in February, 2013 has allowed India to divert the waters of the Kishanganga River for its hydroelectricity generation, subject to ensuring a minimum flow of nine cumecs (cubic metres per second) into the Kishenganga/Neelum river at all the times (Kumar, 2013; The Economic Times, January 1, 2014).

Other than Kishenganga Hydroelectric Plant, Pakistan in the past, has also sought help from neutral experts to adjudicate the matter of the construction of Baglihar Hydropower Project (450 MW) on the Chenab River in the state of Jammu and Kashmir (J&K) of India. In February 2007, the neutral expert verdict acknowledged India's right to construct 'gated spillways', but asked India to lower the dam height by 1.5 metres, raise the power intake tunnels by 3 metres and reduce the storage capacity from 37.5 million cubic metres to 32.58 cubic metres (Siwakoti, 2011).

Stage I of this project has been completed by India and now construction of stage II is proposed to commence shortly in J&K. It is proposed that around 1,302 MW of clean and green power[35] will be generated by India from phase II of the project but looking at the history of conflict between India and Pakistan, it will not be a surprise if Pakistan again opposes the project's phase II construction.

The Tulbul Project at the mouth of Wullar Lake in Kashmir has long been disputed since 1987, when Pakistan raised objections on its construction fearing it will divert the waters of the Jhelum. This issue has been discussed a number of times but has not been resolved. In March 2012, India indicated to Pakistan that it will most likely seek international arbitration for this case which has been pending since the last two decades (The Hindu, February 24, 2012).

India and Bangladesh

India and Bangladesh shares 54 small and big rivers but the only water-sharing treaty that exists between these two countries is the Ganga Treaty of 1996 (High Commission of India). Existing and anticipated hydropower generation projects are likely to be the main source of ongoing disputes between these two countries. Most of the water-sharing conflicts between these two neighbours are entangled in sub-regional politics. Various hydrologists' points out that such issue should not acquire political overtones. Rather, the policy makers should deal with the issues in the lights of international water sharing protocols, logic and technical aspects (The Economic Times, October 24, 2013).

One of the major conflicts that covered in the bilateral relations of the countries was over the construction of the Farakka Barrage. Bangladesh raises several issues on the construction of this barrage, the major one being that it will adversely impact Bangladesh's water supply. Post-construction, India and Bangladesh has had several conflicts over the sharing of the Ganges water through this barrage. Internal politics in India has recently brought this barrage into the limelight.

Mamata Banerjee[36] has been raising her voice against the central government of India over the sharing of water between India and Bangladesh. In February 2012, the West Bengal Chief Minister pointed out to the Indian Prime Minister that the Centre has shown its apathy in repairing two damaged sluice gates of the Farakka Barrage which has led to release of Ganga water to Bangladesh much above what the neighbour is entitled to during the dry season[37] (The Times of India, February 16, 2012). Banerjee has indicated on more than one occasion that she is concerned about her state and to her West Bengal's welfare comes first, and strengthening Indo-Bangla ties comes second. Being located in one of the most politically sensitive states of India, Farakka Barrage has been a field for various reservations that frequently vitiated relations between these two neighbouring countries.

Apart from Farakka, the Teesta river conflict between India and Bangladesh has/had created tension across the borders. India constructed the Gazoldoba Barrage in 1980s to divert water towards northern West Bengal for irrigation purposes. Bangladesh constructed the Teesta Barrage in 1998 to increase agricultural production through supplementary irrigation, and thereby creating employment opportunities. But water shortfall in Teesta Barrage is the major concern for Bangladesh[38] and to resolve this issue Bangladesh wants India to sign the Teesta water sharing treaty.

As per the proposed treaty, Bangladesh had initially demanded a 50 percent share of the Teesta water but looking at India's cold response the country has agreed to a 25 percent share of its water. But the West Bengal ruling government had refused to sign this agreement stating their water scarcity concerns on the highly irrigation-sensitive northern areas of West Bengal (The Times of India, July 14, 2013).

The recent row over the construction of Tipaimukh Dam on Barak River in the Indian state of Manipur has created tension within and outside India. Bangladesh has pointed that India never notified the construction of this dam[39] and since its construction is being undertaken in one of the most seismically volatile areas on earth, it will adversely impact the northern region of Bangladesh. Bangladesh fears that this dam, if built, will completely choke its North-eastern states as it will virtually dry up the country's Surma and the Kushiara Rivers (International Rivers, 2013). The paper "Mega Dams in the Himalayas: An Assessment of Environmental Degradation and Global Warming" has clearly pointed out the environmental hazards from the construction of dams on the Himalayan sub-continent for the thirst of electricity, particularly the construction of Tipaimukh Dam (Elahi & Sikder).

India and Nepal

Since the beginning of the 20th century, a number of agreements have been signed between India and Nepal. The Sarada Agreement (1920), The Koshi Project Agreement, (1954), The Gandak Irrigation and Power Project Agreement (1959), The Mahakali Integrated Treaty (1996) are some of the major water-sharing treaties between India and Nepal. Out of all these agreements, India and Nepal has been successful in generating three bilateral water-sharing agreements to date. All these water- sharing treaties have a clause of hydropower sharing between both the countries. Since India is facing persistent energy deficits, Nepal's rivers are one of the major solutions to feed the growing demand for energy in India. But the growing disparity between the thinking of Nepal's national government and the general public has steamed up conflicts within the nation. The Nepalese people are of the opinion that all the water treaties between these two counties are favouring India more and Nepal's interests are considered to be secondary (Singh, 2008).

8

Energy Security in South Asia

Energy resource endowments are inequitably distributed throughout this region. India (90,085 mt; 39 tcf) and Pakistan (17,550 mt; 33 tcf) have major endowments of coal and natural gas while Bhutan (30,000 MW) and Nepal (42,000 MW) have vast hydropower potential in relation to their size. All the countries in this region are sufficiently rich in renewable energy resources as compared to hydrocarbon reserves. The share of fossil fuels (coal, oil and gas) in the region's total energy supply has relatively increased in recent years on account of India's increasing dependence on coal and Bangladesh's dependence on natural gas. On the other hand, renewable energy production has a significant proportion to total primary energy supply (TPES)[40] for Nepal and Sri Lanka. This proportion has been decreasing during the last decade for all the countries in South Asia.

The energy resource mix in various SAC, except for India and Pakistan, is predominantly dependent upon a single form of commercial energy. Around 77 percent of Afghanistan's energy requirements are met by oil; Maldives is entirely dependent on oil; along with Nepal whose 78 percent of Nepal's energy needs are primarily dependent upon oil. Bhutan to a large extent (82 percent) relies on hydro-electric power and Bangladesh's major energy needs are fulfilled by natural gas (74 percent) (SAARC Secretariate, 2010). The recent study by ADB on South Asian regional

Table 9: An Overview of Renewable Energy Production, TPES Imports and Exports in South Asia

Country	Renewable energy production[41] [% of TPES]		TPES balance: Imports [Million tons of oil equivalent (MTOE)]		TPES balance: Exports [MTOE]	
	2001	2010	2001	2010	2001	2010
Afghanistan	-	-	-	-	-	-
Bangladesh	39	29	4.4	5.9	00	0.2
Bhutan	-	-	-	-	-	-
India	34	26	102.3	244.1	11.1	62.7
Maldives	-	-	-	-	-	-
Nepal	88	88	1.1	1.3	0.8	1.7
Pakistan	40	37	17.2	22	0.1	00
Sri Lanka	57	56	3.7	4.1	0.1	00

Sources: (UNESCAP, 2012)

energy cooperation has projected a Compounded Annual Growth Rate (CAGR) of 5.3 percent in the fossil- based commercial energy supply, including 5.5 percent and 5 percent increase in the growth rate of natural gas and petroleum. India's energy requirements to a certain extent are met by coal consumption but although it is one of the top coal-producing nations in the world, this country has recently increased its coal imports. Low quality of coal is one of the main reasons that are compelling the SAC to import huge amount of coal from the outside world. The data from Table 9 shows that most of the SAC are importers of primary energy source. India, Pakistan, Maldives, Sri Lanka and Nepal to a large extent depend upon oil imports from other countries.

The accelerating pace of economic growth in South Asia has also led to an increase in the demand for energy. But the major resources contributing to the region's energy needs are not able to meet the persistently increasing energy demand, thus leading to demand-supply deficit. Natural gas supplies are falling short in Bangladesh and statistics shows the country's natural gas demand has already surpassed 2,700 MCF whereas only 2,287 MCF per day of natural gas is being supplied (PetroBangla, 2012). Oil as compared to coal and natural gas is the primary source of energy supply in the entire region.

ADB's report on South Asia's Energy Outlook (ADB, 2009) has projected that oil demand will increase at an annual rate of 3.6 percent through 2030. South Asia's oil import dependency is expected to increase substantially from 73 percent in 2005 to 90.9 percent in 2030. The demand for natural gas is likely to increase at the fastest rate among fossil fuels, which is projected to grow at an annual rate of 4.9 percent through 2030. Overall, South Asia's primary energy demand (as per the report) will increase from 582.1 MTOE in 2005 to 1,264.3 MTOE in 2030 at an annual growth rate of 3.2 percent.

In Bangladesh (95 percent) and Sri Lanka (54 percent) most of the electricity generation is derived from oil and gas-powered sources respectively. In Bhutan and Nepal, hydropower generated 99 percent and 92 percent of electricity for these respective countries. Around 54 percent of electricity in India is derived from coal whereas Maldives is totally dependent on oil and gas for electricity generation (Shrestha, et al., 2012).

Hydropower and nuclear power are coming to the forefront for supplying a satisfactory amount of the region's electricity demand, basically in India and Pakistan, but on the whole most of the electricity demand presently is supplied by coal, oil and natural gas. Hydroelectricity contribution in India is estimated to grow from 29 MTOE to 58 MTOE over the period 2010- to 2020. In Pakistan, the contribution from hydroelectricity is estimated to grow from 7.5 MTOE to 22 MTOE over the period 2010-2020. Sri Lanka's hydroelectricity contribution is estimated to grow from 1.1 MTOE to 6.5, 1.5 MTOE over the same period from 2010-2020 and Bhutan's is estimated to grow from 1.6 MTOE to 13 MTOE. On the whole, South Asia's electricity demand is projected to increase by 7 percent by 2020 (Wijayatunga & Fernando, 2013).

Huge proportion of population residing in other SAC is still without access to electricity, particularly the ones in rural areas. As per the IEA data, the current proportion of electricity dispersion in rural areas of South Asia is approximately 60 percent. Every two out of five people in these areas are without access to electricity (IEA, 2011). The data from Table 10 shows that about 70 percent of population in Afghanistan and more than 50 percent of population in Bangladesh and Bhutan are devoid of electricity, thus making the rural population heavily dependent on traditional fuels comprising of fuel woods, animal dungs and agricultural residues. Most of the energy needs for

Table 10: An Overview of South Asia's Projected Electricity Demand and People with Access to Electricity					
Country	**Access to electricity [% of population]**	**Population without electricity [Millions]**	**Projected Electricity Demand (GWh)**		
	2010	**2010**	**2010**	**2020**	**CAGR (%age)***
Afghanistan	30	22	-	-	-
Bangladesh	46	88	-	-	-
Bhutan	-	-	1,749	3,430	7
India	75	293	9,38,000	18,45,000	7
Maldives	100	0	800	1,300	5
Nepal	76	7	3,200	6,910	8
Pakistan	67	56	95,000	2,46,000	10
Sri Lanka	77	5	10,718	21,040	7
*Sources: (UNESCAP, 2012); * (Wijayatunga & Fernando, 2013)*					

cooking, lightening and heating in rural parts of India (90 percent), Bhutan and Nepal (85 percent) are met by these traditional energy fuels. Owing to huge gaps in electricity supply, most of the countries have to heavily rely on electricity imports that have become quite costly in the recent times. Data shows that Nepal imported electricity of 1,381 million KWh from India, whereas it exported 676 MWh of electricity in 17 years and has spent INR 70,438.51 million for importing whereas has only earned INR 3,605.82 million from exporting electricity to India.

The energy sector of South Asia suffers darkness in several issues relating to energy access and supply; energy trade infrastructure; region's high dependence on crude oil and petroleum imports for sufficing energy needs; inefficient and limited utilisation of renewable energy resources; lack of financial capabilities to lead forward energy generation projects with lumpy capital investments; and cumbersome legal and regulatory framework for energy trade (SAARC Secretariate, 2010).

The problems related to energy deficits have been persistent in most of the countries with electricity shortages, ranging from 9 percent in Nepal to 28 percent in Bangladesh. To wrestle with the deficit, all SAC, with the exception of India and Pakistan, are totally dependent on petroleum and crude oil imports. But this sheer dependence on oil imports also makes the countries susceptible to macroeconomic fluctuations in the international oil price. Extremities in oil dependence only raises concerns about energy as well as food security in the near future and therefore, SAC need to explore cheaper and sustainable energy production mechanisms that would help to satisfy their electricity demand. Streamlining their internal consumption towards a viable energy resource along with engaging in regional energy trade to overcome power shortages during the dry seasons can boost the energy sector of South Asia.

Energy trade market in South Asia has not been able to capture energy comparative advantages as compared to Southeast Asia. All the SAC being energy-deficient hardly view electricity as a commodity for trade, with the exception of India-Bhutan hydropower energy trade. Energy trade is South Asia is also hampered because the respective SAC's national energy systems are autarchic

and highly politicised. Apart from these issues, the biggest flaw in the existing energy trade market of South Asia is lack of adequate infrastructure. Dilapidated electricity transmission/grid lines, inadequate number of gas and oil pipelines along with complex geographical landscape have tapered the efficiency of South Asia's energy market. The ordeal of energy infrastructure has intensified due to lack of large financial outlays. Financial deficiency has been the major reason for Nepal's underdeveloped hydropower energy generation systems. Cumbersome legal and regulatory policies for regional energy trade have lowered the potential of electricity trade in South Asia. Lack of initiatives by the respective national energy authorities for harmonising the legal and regulatory frameworks in the SAC is an obstacle in the development of energy trade within this region (TERI, 2013). Regional initiatives on cross-border private-public partnerships in energy trade is also lacking in this region.

Green and clean energy benefits from renewable energy resources have not been tapped by South Asia. The region has a total of 223 million tonnes of biomass[42] that can potentially be used for electricity generation. Hydropower and solar power generation will profoundly benefit the SAC if tapped properly. The rich hydro-resources in the sub-region call for countries to invest in small hydro projects that allow the harnessing of hydropower without the environmental and social externalities associated with large hydropower projects. Countries in South Asia, specifically India, have a huge potential for solar energy generation but its potential has not been tapped successfully. Nonetheless, India has shown some progress in garnering the green benefits from solar energy and biomass with the help of The Energy and Resource Institute (TERI).[43]

9
Climate Change and Energy Security

Among all the energy-consuming sectors-residential, industrial and transport sectors are key energy consumers in South Asia. Since energy is directly linked with industry and transport sectors, climate change is a major matter of concern for the entire region due to high rate of GHG emissions by these sectors. Table 11 clearly shows that the energy withdrawals for industrial and transport purposes have increased from 2001 to 2010 whereas this proportion has decreased for residential purposes but still this sector is the highest consumer of final energy in South Asia. This has a direct impact on the rate of GHG emissions and statistics shows that around 4 percent[44] of total GHG emission in South Asia is contributed by the industrial sector that are heavily energy dependent.

The energy needs of these respective sectors are majorly supplied by petroleum and crude oil, which are one among the foremost sources of environment pollution. The growing number of vehicles used in South Asia is not only having a disastrous impact on the climate but even on the health of the people. In 2010, more than 2.1 million people in Asia died prematurely from air pollution, mostly from the minute particles of diesel soot and gasses emitted from cars and other heavy motor vehicles. Out of these 2.1 million sufferers, around 7,12,000 people from India lost their lives (The Guardian, December 17, 2012).

Table 11: Final Energy Consumption by Different Sectors in South Asia

Country	Final energy consumption: Residential use [% of total final energy consumption]		Final energy consumption: Industry [% of total final energy consumption]		Final energy consumption: Transport, total [% of total final energy consumption]	
	2001	2010	2001	2010	2001	2010
Afghanistan	-	-	-	-	-	-
Bangladesh	59	53.1	13.1	17.8	7.6	13
Bhutan	-	-	-	-	-	-
India	46	37.7	27.3	33.2	10	12.1
Maldives	-	-	-	-	-	-
Nepal	89.5	87.4	5.1	3.6	3	6.2
Pakistan	52.5	48.3	22	25.3	15.9	16.3
Sri Lanka	44.7	41.7	21.4	25.1	23.7	25.9

Sources: UNESCAP STATISTICS, 2012.

Carbon dioxide, which is mainly emitted out from fossil fuel extraction and widely used by South Asia's energy sector, is primarily responsible for 80 percent of the increase in the GHG emissions in 2012 (Mint, November 6, 2013).

India and Pakistan heavily emit out GHGs, specifically $CO_{2,}$ since electricity production is heavily dependent on coal and natural gas respectively. These countries are among the top 10 CO_2 emitters in the world (culmination of all economic sectors). Coal-based power production accounted for a major share (around 70 percent) of all India's carbon dioxide emissions which have grown by 13 percent in 2012 (Business Line, November 18, 2013).

Total GHG emissions of energy-using activities across South Asia increased by 98.2 percent during 1990–2005, while global emissions increased by only 30.8 percent (Table 11). Nepal (233.3 percent) along with Sri Lanka (228.9) has drastically increased GHG emissions during the last two decades. Even though India's GHG emissions are the highest in quantitative terms but this country has the lowest percentage change of GHG emissions in this region. Overall, the region's contribution to global GHG emissions from energy-using activities increased from 2.9 percent in 1990 to 3.7 percent in 1995 and 4.4 percent in 2005 (Shrestha, Ahmed, Suphachalasai, & Lasco, 2012). If the countries in South Asia continue to follow the same emission trend it will be no surprise to witness acute food-water-energy insecurities in the coming future.

Table 12: GHG Emissions by Energy-using Activities in South Asia (million tonnes CO_2)

Countries	1990	1995	2000	2005	% Change 1990–2005
Bhutan	-	0.09	-	-	-
Bangladesh	13.6	20.5	25.2	36.3	166.9
India	586.9	779.6	968.4	1147.5	95.5
Maldives	-	-	-	-	-
Nepal	0.9	1.74	3.1	3	233.3
Pakistan	-	-	-	-	
Sri Lanka	3.74	5.5	10.8	12.3	228.9
South Asia	605.1	807.6	1007.5	1191.1	98.2
World	20,783.3	21,810.0	23,455.1	27,136.0	30.6
South Asia as a %age of the world	2.9	3.7	4.3	4.4	

Source: (Shrestha, Ahmed, Suphachalasai, & Lasco, 2012) pg. 17

10
Rationale for Regional Cooperation

Intensifying food, water and energy insecurities in South Asia not only needs to be resolved at a micro level (individual country) but requires greater interventions at a macro level (regional level). Regional Cooperation has long been viewed as a solution to tackle the scarcity and insecurity situations in the ambits of food, water and energy but till date nothing significant has been accomplished by South Asia's existing regional framework. The benefits of Regional Cooperation are numerous, including: i) reaping economies of scale, ii) resolving trans-border issues in relation to trade, regulatory frameworks and policies, regional infrastructure and other cross- border issues; and iii) administration of shared natural resources.

These benefits are particularly relevant to SAR because of the nature of its growing economies, complementarities in agricultural production (but lack of complementarity in bilateral trade), feasibility with respect to geographical access, commonalities regarding food-water-energy insecurities and commonalities in demographic characteristics (the number of poor, gender disparity and dependence on employment sector). Institutional cooperation at the regional level will necessitate efficient functioning of regional administrative bodies, thereby surmounting constraints that hinder economic and social well-being of the region's citizens. A regional approach facilitates a more comprehensive, cost-effective, and sustainable set of solutions to the challenges of food, water and energy securities.

Millennium Development Goals (MDGs) achievement is a paramount policy concern for all the SAC and their linkages with food, water and energy are very evident. Regional Cooperation in the ambits of food, water and energy along with synergies between different but interdependent regional and sub-regional institutions will enhance the efficacy of individual countries in the achievement of the MDGs. One of the MDGs is to develop a global partnership for development. This goal can only be achieved if the countries come together, understand the benefits of Regional Cooperation and start cooperating in the areas of food, water and energy for reaping its benefits.

The present context of food, water and energy in South Asia, as explained in the previous sections, clearly points out the need for broader solutions that the respective countries should most certainly adopt in order to save themselves from facing adverse situations in the future. Food, water and energy sectors of South Asia have been the captives of inter and intra-regional politics apart from climate change. The long negotiating history of formation of a single South Asian regional charter (SAARC-South Asian Association for Regional Cooperation) stands as a proof of the trust deficit that the countries in South Asia have for each other.

Formation of SAARC was a path-breaking achievement in the history of Regional Cooperation but this regional charter has not be able to give out what is and has been expected from it. Today

many debates hover around the need to make SAARC a very strong entity for resolving various issues faced by the region, mostly in the sectors of food, water and energy. SAARC, over the years, has been characterised as an inefficient regional framework on account of lack of strong institutional structure that is dependent on heavy bureaucratic set-up with several layers of decision-making (Kelegama, 2013). SAARC has come up with a regional charter for food (SAARC Food Bank) and energy (SAAC Energy Centre) but no regional governance framework controls the management and sharing of trans-border waters. Even though this regional framework has become weak on account of lack of political willingness to cooperate across borders, but sub-regional groupings and scientific organisations like ICIMOD and TERI are stronger and more efficient in South Asia.

For ensuring regional food security, the SAARC Food Bank has been established with the basic aim of preventing hunger in this region. The failure of SAARC Food Security Reserve (SAFRS)[45] did raise several apprehensions and arguments against the re-implementation of this food reserve but despite of all the negativity, the SAFRS was re-implemented as SAARC Food Bank in 2007 and is seen a stepping stone in the history of 'not-so regionally cooperative' South Asia. The main objectives of the Food Bank are: i) to act as a regional food security reserve for the SAARC member countries during normal time food shortages and emergencies; and ii) to provide regional support to national food security efforts; foster inter-country partnerships and regional integration, and solve regional food shortages through collective action.

Notwithstanding its formation, this regional framework has not been able to achieve strong positive outcomes and is still moving at a snail's pace. Till date, this regional food reserve system has not been able to reserve adequate amounts of food reserves that are enough to feed countries in crisis. The total 4,86,000 MTs reserves of food grains in this food bank will not be able to meet the consumption demands of the any of the SAARC members if any serious food scarcity calamity befalls upon them.

The failures of the SAARC Food Bank were highlighted during the extreme food insecurity events that adversely impacted Bangladesh in 2007. Cyclone Sidr caused huge devastations in Bangladesh and apart from claiming lives of around 4,000 people it also caused salination of crop lands and fresh water sources which adversely impacted the production of rice. This Food Bank was unfortunately unable to deliver adequate amounts of food supplies to this country and the U.S. food aid ultimately came to rescue the famished population of Bangladesh (Robinson, 2011).

Another reason for SAARC Food Bank's inefficiency has been attributed to the existing practices in the food distribution system. National food distribution is a limiting factor and a major challenge for most of the SAC. Internal mismanagement in the supply of grains to the needy is harshly hampered by corruption, leakages and hoarding of goods. This case is more conspicuous in India, where the loopholes in the country's sprawling but dysfunctional Public Distribution System (PDS) has been highlighted because of shown inadequacy to supply subsidised food grains to the actual beneficiaries (i.e. people living below the poverty line). Thus, operational effectiveness of this food bank to a large extent also depends upon supportive, effective and transparent national public distribution systems (Robinson, 2011). Regional integration at the national and regional level will ensure that the weakness of the distribution systems in respective SAC is effectively tackled.

SAFTA's role has been very crucial in the entire region's' economic growth but the SAR has not successfully tapped the potential of gains from this regional trade framework. SAFTA can play a meaningful role in solving the region's food security problems if it reduces the items in on the sensitive list and reworks on the NTB mechanisms. As explained in the previous sections, food security in South Asia is vulnerable to food price inflation and recent studies have explored the potential mitigation of regional food price inflation through a simulated full implementation of the SAFTA. The results suggest that SAFTA can stabilise domestic food prices in South Asia only if the respective countries reduce the products in their sensitive list, specifically food commodities, reduce the usage of NTB and make rules of SAFTA less cumbersome and more export- friendly through the removal of para-tariffs and surcharge for exports (Carrasco & Mukhopadhyay, 2012).

The continued contention on sharing of river water between different countries has harried the much-anticipated economic and social well-being of the entire region. Regional Cooperation is urgently needed in the ambit of trans-boundary water sharing and management considering the agrarian nature of most economies in the region and growing energy demand that are heavily dependent on water. A regional institutional framework constrains countries in dispute to adhere to the principles of international law by providing verdicts that are transparent and mutually beneficial. South Asia can emerge as a world leading economy in the coming years and this can be made possible only if all the stakeholders develop a mutually acceptable framework with respect to water sharing and management. The ever-growing number of conflicts on water sharing is only leading to deterioration of the economic, social, political and environmental growth and well-being of this region.

Water has been a pioneer in accelerating the economic growth of this region and more growth can be harnessed through this resource if internal as well external conflicts are sorted out, which is possible only if the countries start trusting each other. SAR needs a formalised multilateral arrangement apart from bilateral water treaties and issue-based organisations. The Indus River Commission and Indo-Bangla Joint River Commission are not efficiently used to resolve water conflicts and have been weakened due to political pressures.

Taking the case of IWT and the Ganges Treaty, these treaties have no clause on sharing of hydrological information between both the countries. Paucity of data on water sharing and hydro power generation projects coupled with absence of clear dispute resolution and arbitration mechanisms have repeatedly created ruckus in these countries.

A strong regional governance institutional framework for water can implicitly help in resolving trivial issues that hampers international trade between countries. For example, India and Bangladesh renewed the Protocol of Inland Water Transit and Trade (IWTT) till 31st March, 31, 2014 but many sceptics fear that India and Bangladesh will have a tough time in renewing this protocol again in 2014 since the debate on Teesta river treaty has heated up rows between these neighbours. For example, the Inland Water Transport Authority of Bangladesh refused to allow Indian vessels through Ashuganj port[46] in 2012.

The river transport operators stated that the real reason for Bangladesh's reluctance was West Bengal's hindrance in signing of the Teesta river treaty (Business Line, December 04, 2012). Stacking up of such issues has negatively impacted the trade potential between India and Bangladesh. Thus, if South Asia has an operative regional water governance framework, the countries can be assured that such minor issues will not crop up as such a framework would have already dealt with the bigger problems.

South Asia's falling agricultural productivity, low Global Hunger Index, low access rate of improved sanitation facilities, growing electricity deficit accompanied by perilous impact of climate change have an element of water attached to it. Consequently, water management and sharing has to be viewed as a matter of national and regional important. Effective river basin management internally and externally can curtail the issues of water stress to a great extent. The benefits of good watershed management can effectively reduce water wastage by minimising soil erosion, maximising water infiltration into the soil, adequately storing water to buffer monsoon fluctuations, etc. Regional watershed management and storage on Ganges tributaries in Nepal could generate hydropower and irrigation benefits in Nepal and flood mitigation benefits in Nepal, India and Bangladesh.

Apart from Bhutan, no country in the SAR is energy sufficient which makes regional integration essential. The region's growing energy demand cannot be met by the existing regional bilateral energy trade arrangements and therefore larger commercial intra- and inter- regional energy cooperation can offer viable options to South Asia for supplementing its energy supply. The benefits of an integrated energy market in South Asia are estimated to be enormous as per many international, regional and national organisations. SAARC Energy Centre has estimated that the potential total revenue from energy trading in South Asia through power grid interconnections could amount to US$3,917mn annually. Economic benefits from bilateral regional cooperation between India and Bhutan on hydropower sharing (the Chukha and 1020-megawatt Tala hydroelectric projects) have proven to be successful model of regional cooperation in South Asia.

Consequently, India and Bhutan has collaborated on other successive hydropower generation projects (Chukha II and III, Kuri Chu). But the scope for a larger plan to systematically tap the vast hydro potential of the rivers of Nepal and Bhutan in order to meet India's energy demands remains limited due to limited willingness to cooperate along with oppositions from the general public and various environmentalists who see India as a greedy nation.

The regional development model on energy trade holds vast potential to transform South Asia from an energy deficit region to a regional hub of profitable energy trade like ASEAN. The merits of fashioning new approaches of multi-level governance will augment regional energy trade in South Asia, which along with filling the gap of energy deficiency will also render positive spill over effects by benefiting an array of sectors ranging from agriculture, to industry, to households, etc. The rationale for regional cooperation on energy sector has been explained in detail by several existing literatures.

The report, 'Energy for All', summaries that a strong regionally integrated energy market in South Asia is necessary for increasing economic and human productivity; improving people's welfare; reducing transaction costs; providing employment; and 'connecting communities to economic, trade, and information networks and resources that can lead to self-sustaining growth' (Masud, et al., 2007).

A World Bank study (World Bank, 2008) on the social and economic impacts of power trade in the South Asian Growth Quadrangle (SAGQ) demonstrates the positive effects of power trade on the quadrangle's (Bangladesh, Bhutan, India and Nepal) industrial production, finance, revenue, GDP, foreign exchange and rural electrification. Furthermore, it notes that the use of traded electricity is going to benefit farmers, rural assets, health, education, and even help in women empowerment. The study also predicts the creation of new employment opportunities due to economic growth, rural electrification and new power projects.

11
Augmenting Regional Cooperation

Strengthening the Roles of Institutions

Weak institutions weaken the scope for growth and development. Stronger the institution, better are the rewards. This notion has been transformed into action-based reality and its rewards are evident from the success of regional institutions like the European Union and ASEAN. Institutionalisation of cooperation is the key to regional integration in the domains of food, water and energy in South Asia. One of the main reasons for creating a regional organisation is the shared conviction among neighbours-stronger the regional links, better is the economic health of respective countries. The traditional narrative of pessimism and lack of trust have paralysed the efforts of SAARC to harness more economic growth and better social well-being through regional integration.

Regional politics has been exacerbating the already formidable task of getting the SAC to cooperate and work together. Political players have a huge influence on determining the nature and scope of Regional Cooperation and it is evident that SAARC is a prisoner of negative politics that has weakened its working efficiency. The turbulent history of this region and the fluctuating relations between India and Pakistan is beset by persistent fear that SAARC might further weaken. SAARC's role is pivotal in enhancing Regional Cooperation in the ambits of food, water and energy and also stimulating the working efficiency of organisations like SAARC Food Bank and Energy Centre that are working under its aegis.

Strengthening of SAARC as an efficient regional institution will foster economic prosperity and lessen the drift between the unfriendly neighbours. SAARC has always been viewed as an institution that can, to a large extent, ease out the relations between all the countries in this region, specifically between India and Pakistan. On the contrary, this institution has become vulnerable to the dynamic relations between India and Pakistan. Sound health of SAARC also depends upon congenial relations between India and Pakistan which have lately improved as a result of some positive efforts. The proposed granting of Most Favoured Nation (MFN) status to India by Pakistan for bilateral trade is a great leap forward in writing a new narrative of engagement between the two neighbours. This building block approach, which looks to strengthen bilateral relations first, will eventually strengthen the efficacy of SAARC in the long run.

SAFTA's role in making trade policies more favourable for the entire region can foster better regional integration. SAFTA can play a pivotal role in alleviating the trade of agricultural commodities with the SAC by harmonising the trade standards, reducing the products in their sensitive list, specifically food commodities and by reducing the usage of NTB.

SAARC Food Bank's efficiency depends largely upon the effectiveness of national PDS. A stronger and more transparent PDS would facilitate better procurement and dissemination of food grains to the countries in need. Apart from that, the food bank has to come up with sustenance mechanisms to adequately fill the central pool of its grains. Storage facilities have to be revamped and can be decentralised to some extent for better and more feasible outreach.

Agricultural Research Institutions needs to be strengthened for making the region more food secure by using sustainable agricultural practices. India, Pakistan and Bangladesh have a strong National Agricultural Research System (NARS) that can collaborate and conduct research on agriculture, specifically on climate resilient agricultural practices. Food security can be improved through this collaborative agricultural research and technology transfer.

SAARC Energy Centre can effectively transform challenges into opportunities if the region understands the potential gains from energy trade. Energy is the only sector under SAARC that has shown some positive results from Regional Cooperation through energy trade, despite some discrepancies. A more integrated and stronger SAARC will stimulate the working of this energy centre and the countries can adequately harness the potential benefits from more efficient regional energy trade, especially in renewable energy.

Roles of CSOs and International Donor Agencies

Civil Society Organisations (CSOs) are important conduits of knowledge flow and these organisations thrive to make a positive change in the society. There are a number of regional non-governmental organisations (NGOs) dedicated to the cause of one South Asia. Their efforts have proven to be successful by making the general public and the government understand the nuances and benefits of increased regional cooperation. These organisations have a valuable repository of knowledge that is used to educate the public from the grassroots to the national level. Having a strong hold on the grassroots of different societies, these organisations have a numinous power of influencing positive change in any country.

Many CSOs in South Asia work across borders, engage with a range of stakeholders and support informal dialogue processes to support formal negotiations. CSOs can work in collaboration with international donor organisations that involve them in research, advocacy and networking, so that they support and influence policy reforms in any country or region.

Recently, some international donors like the Australian government's Department of Foreign Affairs and Trade (DFAT) has shown their interest in helping South Asia achieve the goal of Sustainable Development in South Asia. Through its South Asia Regional Aid Programme, this agency has formulated the Sustainable Development Investment Portfolio (SDIP). For the same, CUTS International has collaborated with DFAT to carry forward the longitudinal research on sustainable development in South Asia in the domains of food, water and energy.

Given the complexities and the risks of non-cooperation in the ambit of trans-boundary water sharing, South Asia has not been successful in attracting adequate amount of funding from international donor agencies for this particular sector. Nonetheless, initiatives by different international donor organisations related to water in South Asia have been rewarding and the results speak out for their performance. One of such initiative, currently carried by multi-donor organisations, is called The South Asia Water Initiative (SAWI).[47]

The results from the phase 1 of this project have been significant. Their efforts and research helped in enabling environment for regional water cooperation in South Asia by cultivating a platform for high- level multi-stakeholder dialogue (Kolas, 2013). Such projects are proof of the growing level of water-sharing cooperation in the region and it will be advisable to get in more such projects that can appropriately reshape the disfigured level of water sharing and management in South Asia. Thus, a better integrated region is 'most likely' to attract more funding and aid from international donors for regional issues on food, energy and water (specifically). The Asian Development Bank (ADB) and the United States Agency for International Development (USAID) are actively engaged in projects related to energy cooperation in South Asia. USAID has a project titled South Asia Regional Initiative for Energy (SARI/E) which has three focused areas viz., cross-border energy trade, regional energy market formation, and regional clean energy access partnerships.

A fairly recent study by TERI under UNESCAP has laid down an impressive model for enhancing Regional Cooperation in the energy sector of South Asia by identifying five core areas where the countries of the sub-region can collaborate. These includes utilising energy resources effectively and efficiently, improving and upgrading energy infrastructure for efficient functioning of regional energy market, promotion and access to the use of renewable energy and creation of sub- regional energy markets for achieving economies of scale and demand-supply complementarities. It further adds that the countries in this region should indulge in collection and sharing of energy data; enhance power inter-connections; develop a central knowledge repository of best practices in energy access improvement and renewable energy development; developing a clean energy fund and technology incubation centre; promoting cross-country energy investments; and institutionalise energy cooperation by involving multiple stakeholders (TERI, 2013).

Lessons from International and Regional Organisations

Better the Regional Cooperation, the lower is the incentive to use force to resolve conflicts. ASEAN has proved to be a more successful and integrated regional institution as compared to SAARC. Some have suggested that SAARC should follow the working model of the European Union and ASEAN by following their approaches of resolving problems through uniform thinking. ASEAN has been successful in forming a regional institution that particularly deals with the issues of political diplomacy and bilateral as well as multilateral conflicts on food, water and energy.

ASEAN member States and other regional and international stakeholders created in 1994 the ASEAN regional forum[48] (ARF) to promote confidence-building and develop preventive diplomacy in the region. ARF has established a diplomatic forum to address these specific concerns. A SAARC Regional Forum to discuss disputes would be a proper way to take political pressure away from SAARC Summits but the creation of such a mechanism seems unlikely as long as SAARC lacks a common vision of regionalism (Choquier, 2010).

AFTA (ASEAN Free Trade Area) along with ASEAN Emergency Food Reserve System have time and again proven their efficacy as compared to SAARC on account of increasing political cohesion and economic coordination among the member countries. SAARC should learn lessons from ASEAN and should adopt their practices that are feasible within it limits.

With regards to water governance, the Mekong River Commission (MRC) or the Nile Basin initiative that effectively covers all the aspects of water governance with a robust binding dispute resolution mechanism, can serve a good model for South Asia for working towards better management and governance of trans-border water sharing (Mahbub ul Haq Centre, 2013).

Moreover, MRC collects and manages a range of data and information with its member countries and other regional stakeholders which is available through their data portal. South Asia can form a similar kind of river commission for shared water resources that have mechanisms and processes for exchange of data and information; dispute redressal mechanisms; mechanisms to address and tackle the problems of water pollution and degradation; and floods and construction of numerous hydropower generation projects (Mahbub ul Haq Centre, 2013).

The ASEAN Energy Centre is more organised and energy rewarding as compared to SAARC Energy Centre. ASEAN has effectively modified its policies for sustainably producing clear energy through renewable resources. ASEAN already has an operative energy market that is working efficiently and recent concerns over climate change have made this organisation emphasises strategies to further strengthen renewable energy development, such as bio-fuels, as well as to promote open trade, facilitate and cooperate in the renewable energy industry. SAARC can learn a lot from the working model of ASEAN and should incorporate positive changes as far as it is possible.

Enhancing Regional Trust and Integrity

India has been looked upon as a hegemon by its immediate neighbours and this perception[49] has hijacked the unilateral efforts of all the SAC for achieving effective and efficient regional governance mechanism. Rather than perceiving India as a road block for regionalism, this country should be viewed as a big brother that can smoothen the process of advocating regional harmony and to do so, India has to demonstrate the magnanimity of a big power and show a spirit of camaraderie in accommodating the wishes of its smaller neighbours without putting on stake the sentiments and well-being of its own citizens. Building trust and confidence among the countries is imperative to come up with fruitful engagements between nations in SAC. Lack of political will of the governments has resulted in the non-implementation of various signed agreements. Given the scope of trans-boundary water resources in addressing the water security concerns of SAC, Regional Cooperation seems to be the only resolution.

Growing population and poverty in the region amidst its abundance in natural resources shows the urgent need for better resource management and knowledge sharing. Being clustered around the fragile Himalayan ecosystem, the SAC are vulnerable to the impact of climate change. Apart from facilitating trade in the region, there is great scope for collaborative research in the fields of agriculture, weather forecasting, pest and disease management and sharing of technology and best practices among the countries in South Asia.

12
Conclusions and Issues for Future Discussion

Conclusions

South Asia is in many terms a region of extremes. On one hand, it is one of the fastest growing economies in the world, whereas on the other hand, it is home to the largest number of poor population in the world (about 400 million people in the region live below the minimum level of subsistence). This region is among the most vulnerable areas that is and will be adversely impacted by the deleterious impact of climate change. South Asia's food, water and energy sectors are under immense scarcity stress owing to population growth rate, rapid urbanisation, growing consumerism, concretisation of forests, climate change and political risks. The precise estimates on food and water scarcity are elusive but still they point to the fact that the region will face severe food, water and energy crisis in the forthcoming time.

Already this region has seen a decline in the endowments of natural resources and if the trend of over exploitation continues at the same pace, South Asia will not be able to sustain resources for their forthcoming generations. Providing sustainable solutions to overcome present challenges in the ambits of food, water and energy is the crying need for the entire region.

The sectors of food, water and energy have shown some deteriorating trends with respect to their respective determinants. Apart from some indicators, most of the indicators and facts on food, water and energy sectors of South Asia are a proof of the fact that the well-being of the region is at stake. Due to inter-relatedness of food, water and energy, deterioration in any one of these resources puts pressure on the others.

Climate change is imposing severe threats on all the three sectors, specifically on the level of water in the region. Water is indistinguishably linked with food and energy production but the fury of nature has cracked down the container of water (the Himalayas) and the water content in this region is depleting day by day. This has seriously impacted the level of food and energy security and the much- needed increase in food and energy production is not happening in the region. Population increase with rapid urbanisation has lifted the demand graph for food, water and energy in the region but the demand is falling short of the supply on account of several reasons, as discussed in the paper.

The existing bilateral trans-boundary water sharing treaties between different SAC are concealed by the clouds of political animosity and trust deficit. Due to variable geographical landscape, the downstream riparians are left to the mercy of upper riparian countries for trans-boundary water sharing and as a result many conflicts has and have been cropping up in this region.

Strong and effective regional governance framework in the ambits of food, water and energy is the key to protect this region from the brunt of insecurities and climate change. Regional Cooperation holds the potential for considerable gains in growth and increased security for South Asia. Being composed of developing sub-regions, South Asia has enormous potential for sustainable development and this can be achieved if this region is effectively able to capture the benefits from the existing regional governance frameworks as well as by incorporating new governance framework, specifically for water governance.

Therefore, the role of SAARC is pivotal in encouraging the SAC to come together to resolve issues related to food, water and energy security. A stronger SAARC can effectively stimulate the working potential of organisations like SAARC Food Bank, proposed SAARC Seed Bank, Energy Centre and SAFTA. Regional Cooperation can be enhanced through the strengthening of institutions, strengthening the role of CSOs and international agencies and building more trust among the respective countries.

Issues for Future Discussion

- How will food, water and energy sectors in South Asia face further challenges due to climate change?
- What will be the way by which cooperation can be improved among the South Asian countries for the solution of water conflicts?
- What is the role of political economy factors in determining the type and magnitude of government support to three important sectors, i.e., food, water and energy security?
- How can countries come together on a common platform to enter into multilateral agreements related to food, water and energy security, specifically trans-boundary water sharing?
- How are the governments of SAARC countries advancing their programmes to fulfil the commitment for regional water and energy cooperation?

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Endnotes

1 The term has been taken from report titled Sustainable Development: From Brundtland to Rio 2012 (p. 2)

2 Chair, Governing Council Asia-Pacific Water Forum

3 Latest report by Asian Development Bank (ADB) on Asian Water Outlook - 2013

4 Ch. 2 Food security: concepts and measurement-http://www.fao.org/docrep/005/y4671e/y4671e06.htm

5 Zero Hunger Challenge means- 100% access to adequate food all year round; zero stunted children less than 2 years; all food systems are sustainable; 100% increase in smallholder productivity and income; zero loss or waste of food (United Nations).

6 For more information visit: http://www.unwater.org/UNW_ABWS_launch.html

7 Please visit : http://www.un.org/wcm/webdav/site/climatechange/shared/Documents/AGECC%20summary%20report%5B1%5D.pdf

8 (Solomon, 2010)

9 (World Water Assessment Programme, 2009)

10 Data from http://www.worldcoal.org/resources/coal-statistics/

11 Figure from the World Bank-http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/SOUTHASIAEXT/0,,contentMDK:22818531~pagePK:146736~piPK:146830~theSitePK:223547,00.html

12 Chronic food insecurity means when a household is unable to meet its food requirements over a long period of time, which has a deleterious impact on their health and keeps the household entangled in the vicious circle of poverty (IFAD).

13 Transitory food insecurity refers to a situation when a household is not able to cope with short-term vicissitudes (like crop failure, seasonal scarcities, temporary illness or unemployment) which makes the household sacrifice it's the nutritional needs over a short course of time (IFAD).

14 GHI is computed as an average of three indicators, namely prevalence of undernourishment in the population, prevalence of underweight children under five years, and under-five mortality rate (International Food Policy Research Institute, 2013).

15 This indicator measures Dietary Energy Supply as a percentage of the Average Dietary Energy Requirement (ADER) of the country. FAO STAT.

16 Data from http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/SOUTHASIAEXT/EXTSAREGTOPAGRI/0,,contentMDK:20750711~menuPK:452772~pagePK:34004173~piPK:34003707~theSitePK:452766,00.html

17 The FAO Food Price Index is a measure of the monthly change in international prices of a basket of food commodities. It consists of the average of five commodity group price indices, weighted with the average export shares of each of the groups for 2002-2004 (FAO).

18 Figures-FAO AQUASTAT, 2013

19 Figures have been taken from World Bank website: http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/SOUTHASIAEXT/0,,contentMDK:22023566~pagePK:146736~piPK:146830~theSitePK:223547,00.html

20 Irrigation efficiencies: Not all water taken from a source (river, well) reaches the root zone of the plants. Part of the water is lost during transport through the canals and in the fields. The remaining part is stored in the root zone and eventually used by the plants. In other words, only part of the water is used efficiently, the rest of the water is lost for the crops on the fields that were to be irrigated. FAO, 2013

21 Figures computed from the data taken from International Trade Map (ITC)

22 For details on the sensitive list under SAFTA please visit http://commerce.nic.in/trade/safta.pdf

23 (Taneja , Prakash , & Kalita , 2013) The study has been conducted by ICRIER, New Delhi.

24 Longitudinal research on this study is being conducted by CUTS International with the support of Bill and Melinda Gates Foundation. To know more about the project, please refer the following link: http://www.cuts-citee.org/RISTE/

25 Scientists from the Wildlife Conservation Society, the University of Queensland, and Stanford University have produced a roadmap that identifies the world's most vulnerable and least vulnerable areas in the Age of Climate Change. Read more at: http://www.firstpost.com/living/southeast-asia-most-vulnerable-to-climate-change-report-1114963.html?utm_source=ref_article

26 Singh, et al., 2011, November.

27 Averaged over all land and ocean surfaces, temperatures warmed roughly 1.53°F (0.85°C) from 1880 to 2012, according to the Intergovernmental Panel on Climate Change (IPCC).

28 South Asia's greenhouse gas footprint from the World Bank site

29 For more information on the statistics and other details on water quality of South Asia please refer to the report "Drinking Water Quality in the South-East Asia Region by World Health Organisation.

30 The receding rate of Himalayan glaciers have been unprecedented, ranging from 10 to 60 m per year and most of the small glaciers (<0.2 sq. Km) have already become extinct. About 67 per cent of the nearly 34,000 km^2 (12,124 mi^2) of Himalayan glaciers are reported to be receding (Bajracharya, et al., 2007).

31 This indicator expresses the percentage of total renewable water resources originating outside the country. This indicator may theoretically vary between 0% and 100%. A country with a dependency ratio equal to 0% does not receive any water from neighbouring countries. A country with a dependency ratio equal to 100% receives all its renewable water from upstream countries, without producing any of its own. This indicator does not consider the possible allocation of water to downstream countries. (FAO AQUASTAT)

32 As per the Indus Water Treaty, Western Rivers comprises of The Indus, The Jhelum and The Chenab taken together; whereas the Eastern Rivers comprises of The Sutlej, The Beas and The Ravi taken together (Indus Water Treaty 1960).

33 India-Bangladesh water talks have been strained because of several territorial issues on illegal immigrations, Chakma refugees and border demarcation. India-Nepal is grappling with land disputes over the land in Kalapani, which was occupied by India after the Sino-Indian war. India-Pakistan dispute over the Kashmir has been a catalyst in exacerbating the trans-boundary river disputes as water flows to Pakistan from Kashmir.

34 Article III (4)[4] of Indus Water Treaty specifically prohibited India, from 'storing any water of, or construct any storage works on, Western Rivers'. According to sub-paragraph 8(h)[5] of the Treaty, India is entitled to construct an 'incidental storage' on Western Rivers on its side: a) only after the design has been scrutinised and approved by Pakistan; and b) its storage capacity should not exceed 10,000 AF. As per the Treaty, India is only allowed to construct a small run-of-the-river plant with a maximum discharge of 300 ft^3 /sec through turbines (Ahmad , 2010).

35 Press Trust of India (PTI), 2013.

36 Presently she is the Chief Minister of the Indian state of West Bengal.

37 Under the Indo-Bangla Ganga Water Sharing Treaty, the water flows are regulated during the lean season from January to May. Because of the broken gates, the flows have been not been regulated during January and February. The Centre has ordered a probe into the causes behind the breaches in the gates of Farakka Barrage on the Ganga (The Hindu, 2012).

38 The Dalia barrage that was constructed along the Teesta River, in an attempt to revive cultivable land during the dry season, has been adversely impinged upon due to the erroneous construction of the Gazoldoba barrage by the upper riparian state on its part of the Teesta River (Hukil, 2013). Bangladesh opposes that India is diverting more water to the Gazoldoba at the expense of its downstream riparian.

39 An article by Medha Bisht titled "Tipaimukh Dam: Some Myths, Some Facts" from The Institute of Defence Studies and Analysis has laid down a very factual description of the dam based on current and historical events. The authors voids the Bangladesh's claims on India for non-notification of construction of dam along with some other details (Bisht, 2012)

40 Total Primary Energy Supply (TPES) is composed of production + imports - exports - international marine bunkers - international aviation bunkers ± stock changes. It includes coal, crude oil, natural gas liquids, refinery feed stocks, additives, petroleum products, gases, combustible renewables and waste, electricity and heat (UNESCAP, 2012)

41 Renewable Energy as a percentage age of TPES - The proportion of renewable energy production (from hydro, geothermal, solar, wind, tide and wave, solid biomass, bio gasoline, biodiesel, other liquid biofuels, biogas, and municipal waste) to the total primary energy supply (TPES) expressed as a percentage. TPES includes fuels such as coal and gas that are subsequently transformed into other energy forms, such as electricity (UNESCAP, 2012).

42 Figure from South Asia Subregional Cooperation (SASEC) website.

43 TERI has pioneered the smart mini-grid system in India. It has designed and commissioned the first-of-its-kind Smart Mini-Grid (SMG) in 2011. The SMG combines wind generator, solar PVs, and biomass gasifier.

TERI is the pioneer in developing 10–20 kWe, 100% producer gas engine-based power systems for rural electrification and tailor-made systems for micro, small, and medium enterprises such as silk reeling, dyeing, food processing, plaster of Paris, and non-ferrous melting applications, besides institutional cooking.

Biomass - solar hybrid systems have also been designed by TERI scientists for providing decentralized cold storage facilities in rural areas along with electricity supply.

TERI has also set up eight biomass gasifier-based rural electrification plants in Chhattisgarh, Orissa, and Rajasthan. This rural field experience helped in identifying the future technological development aspects (TERI) .

44 Data from the report Human Development in South Asia (Mahbub ul Haq Centre, 2013) pg. 51

45 As per a CUTS study, the main reason for the failure of SAFRS was because members neglected to fulfil their respective obligations to contribute grains (Robinson, 2011).

46 Ashuganj is a port city in B-Baria district in Chittagong division of Bangladesh

47 It is a multi-donor partnership between the World Bank and the governments of Australia, Norway and the United Kingdom. SAWI's goal is to increase Regional Cooperation in the management of the Himalayan River systems and support sustainable, fair and inclusive development, and climate resilience. It supports activities related to the management of the Greater Himalayas trans-boundary water systems in Afghanistan, Bangladesh, Bhutan, China, India, Nepal, and Pakistan (SAWI).

48 The objectives of the ASEAN Regional Forum are outlined in the First ARF Chairman's Statement (1994), namely: to foster constructive dialogue and consultation on political and security issues of common interest and concern; and to make significant contributions to efforts towards confidence-building and preventive diplomacy in the Asia-Pacific region.

49 A more philosophical explanation by Dr Bhasin states that perception can be misperception due to numerous perceptual modifications. Perceptual variants can either be simple exaggerations or more stubborn prejudices. Not every overblown generalisation is a prejudice. Some are simply misconceptions wherein wrong information is organised (Bhasin). This explanation aptly defines the way other countries in South Asia look on India. There have been the misconception that outages in Nepal were due to electricity transfer to India.

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