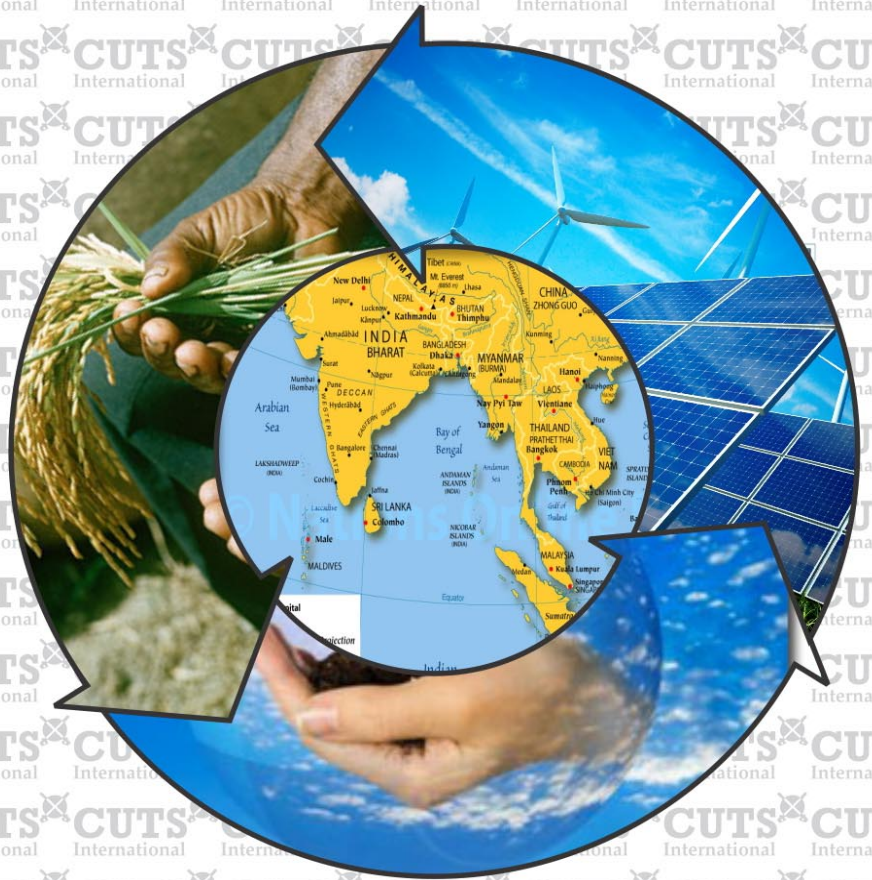


# Mainstreaming Sustainable Development

## A Quick Diagnostic of Key Challenges and Opportunities for Water, Energy & Food Security in South Asia





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# Contents

<i>Acknowledgement</i>	<i>i</i>
<i>Abbreviations</i>	<i>iii</i>
<i>Contributors</i>	<i>v</i>
<i>Foreword</i>	<i>vii</i>
<i>Preface</i>	<i>ix</i>
<i>Executive Summary</i>	<i>xi</i>
<b>1. Introduction</b>	<b>1</b>
From Millennium Development Goals to Sustainable Development Goals	1
Demystifying Water-Energy-Food Nexus	4
Understanding Water, Energy & Food Security in Changing Climate Context	6
Rationale and Focus of the Study	7
<b>2. Water, Energy and Food Security Scenario in South Asia</b>	<b>11</b>
Water Security: An Emergent Crisis	13
Energy Security: A Persistent Crisis	16
Food Security: A Management Crisis	18
<b>3. Insights from Basins</b>	<b>21</b>
Indus	21
Ganges	26
Brahmaputra	29
<b>4. Challenges and Opportunities</b>	<b>33</b>
<b>References</b>	<b>37</b>

## *List of Tables*

Table 1: Field Locations across Countries	8
Table 2: Key Indicators related to Agriculture, Water, and Energy Security in South Asia	9

## *List of Boxes*

Box 1: Millennium Development Goals	1
Box 2: Sustainable Development Goals	3

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Finally, any error that may have remained is solely ours.

(CUTS Centre for International Trade,  
Economics & Environment)





# Abbreviations

CSOs:	Civil Society Organisations
cum:	cubic meters
GWP:	Global Water Partnership
IPCC:	Intergovernmental Panel on Climate Change
km <sup>2</sup> :	kilometres square
MDGs:	Millennium Development Goals
NGOs:	Non-governmental Organisations
pcpd:	per capita per day
SDGs:	Sustainable Development Goals



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# Foreword

The current year is a milestone in global development. While reflecting upon achievements under the outgoing MDGs, the global community is all set to roll out a new development agenda for next 15 years. There has been significant progress over last one and half decade; yet, some of the targets agreed upon by the international community back in 2000 remain unfulfilled. Acknowledging the need to put more and coherent effort to accelerate the progress, the international development community is in process of finalising the post-2015 development agenda, seeking to achieve economic development, social inclusion and environmental sustainability. However, achieving the broader goals of ending poverty and transforming all lives, while protecting the planet, will need a greater understanding of the current situation, past achievements and challenges.

Water, energy and food security for all will be a crucial determinant of the proposed and desired transformation. These three resources are essential for humans as well as for development. While the demand for these resources is rising fast, owing to the rapid population growth, environmental changes are seriously constraining the availability of these resources. The proposed Sustainable Development Goals appropriately recognise the vitality of these resources for human welfare, by setting specific targets for sustainable access to food, water and energy for all.

Despite substantial progress in many areas in the recent years, human development has been inequitable. There are several millions in the sub-continent that still do not have a secure food supply and have only limited access to clean water, sanitation or modern sources of energy. Housing the largest number of global poor and being one of the most vulnerable regions, South Asia needs greater commitment and effort from the international development community, including both government and non-government actors. To better coordinate and target the interventions for a transformative change and development, there is a need to understand current challenges in the sub-continent and stakeholders' understanding and expectations. In this context, it is crucial how the sub-continent manages these resources and ensures sustainable and equitable access to the population for a dignified living and will determine the success of post-2015 development agenda in the sub-continent.

In this backdrop, this CUTS study brings out valuable insights on the key challenges around water, energy and agriculture in three major river basins of the sub-continent (viz. Indus, Ganges and Brahmaputra), spread across five countries (viz. Pakistan, India, Nepal, Bhutan and Bangladesh). The report also discusses the possible solutions to these challenges from the stakeholders' perspective and what role can be played by various actors and agencies.

I congratulate CUTS for this timely analysis of an important issue. I believe this will help the international development community to better focus and coordinate their interventions in the sub-continent.

**Nitin Desai**  
Former Under-Secretary-General, UN



# Preface

As the deadline for Millennium Development Goals are coming to an end, the world is about to be ready with a post-2015 development agenda that seeks to prepare a ‘Road to Dignity’ by 2030. Let us acknowledge that significant progress has been made on many fronts.

Therefore, achieving the broader goals of ending poverty, transforming all lives and protecting the planet over the next 15 years will need an understanding of the current context, past challenges and greater commitments from both government and non-government agencies. All key stakeholders must follow a triple bottom-line approach to ensure human welfare, by seeking to achieve a combination of economic development, environmental sustainability and social inclusion.

On this ‘road to dignity’, water, energy and food security for all will be a crucial determinant of human welfare. Owing to rapid population growth, the demand for these resources is rising fast. On the contrary, the embryonic climate change impacts are already affecting their availability, which will pose significantly to their access.

The proposed Sustainable Development Goals appropriately recognise the vitality of these resources for human welfare, by dedicating three out of 17 goals of sustainable access to food, water and energy.

South Asia being one of most densely populated regions of the world, with population growing at the rate of two per cent annually, is already stressed for water, energy and food. There are millions of people in this region who still do not have a secure food supply and have only limited access to clean water, sanitation or modern sources of energy. It is ranked as the second most undernourished, malnourished and food insecure region in the world.

The teeming millions in the sub-continent will require increased availability of these resources, while being a climate change hotspot jeopardises their availability. In this context, it is crucial how the sub-continent manages these resources and ensures sustainable and equitable access to the population for a dignified living.

In this backdrop, the Department of Foreign Affairs and Trade, Government of Australia, has developed a regional programme for South Asia, called Sustainable Development Investment Portfolio to address the water, energy and food security challenges in five South Asian countries, viz. Bangladesh, Bhutan, India, Nepal, Pakistan, across three river basins: Brahmaputra, Indus and Ganges.

CUTS being a portfolio partner of this initiative conducted this diagnostic study to understand the key challenges of water, energy and food security in these basins. Analysing the stakeholders’ understanding on these subjects, our study finds that broader challenges are similar around availability, access, equity and inclusion. Yet, the local context varies from place to place, even

within the countries. Fortunately, significant part of the solutions to these challenges are known, which needs to be up-scaled fast to contribute meaningfully towards the regional achievement of the post-2015 development agenda.

Our study underlines that both government and non-government agencies have to contribute equally to meet the agenda. It emphasises the potential of regional cooperation towards faster achievement of sustainable access to food, water and energy.

The findings presented in this study are preliminary and drawn on the basis of interviews with key stakeholders. They will be further consolidated with an extensive perception study to be undertaken very soon. We hope that our analysis will be able to guide others in their intervention on this important subject of water-energy-food security nexus.

I thank DFAT, Australia, for taking this initiative and my colleagues for their diligence. It would not have been possible without proactive support of our strategic partners across the three river basins. I thank them and looking forward to consolidate our partnership.

**Bipul Chatterjee**  
Deputy Executive Director  
CUTS International



# Executive Summary

As the deadline for Millennium Development Goals (MDGs) comes close, the global community is reflecting upon the achievements in past one and a half decade, and deliberating upon a post-2015 development agenda. While there has been a significant progress, the global community also acknowledges the need to put more and coherent effort to accelerate the progress and reach the set targets. To finish the job that the MDGs started, the post-2015 development agenda needs to reflect on an integrated view of the triple bottom-line that seeks to achieve a combination of economic development, environmental sustainability and social inclusion. The new development goals need to reflect on a global commitment and approach befitting the global challenge of sustainable development.

Consequently, the global community is converging for a set of Sustainable Development Goals (SDGs), a proposed set of targets relating to future international development that will lay a 'Roadmap to Dignity' by 2030. In achieving these targets, access to water, energy and food is crucial for human wellbeing, and thus, for achieving the post-2015 development agenda. While the demand for these resources is going up across the globe, largely owing to rapid population growth, availability of these resources is being or expected to be seriously compromised by the climate change effects.

South Asia being one of the most populous regions and the most vulnerable one to climate change effects, water, energy and food security in the region emerges as an important concern for the policymakers, development agencies and CSOs. With limited land resources, inadequate energy supply, and growing water stress, South Asia faces the challenge of providing adequate water and energy to grow enough food for the growing population. South Asia region has the highest concentration of poor and undernourished. The poor are invariably the most threatened and severely impacted by water, energy and food insecurity.

In addition, the region is one of the densely populated regions of the world with the population growing at rate of around 2 per cent, calling for an increase in food production and related resources like water and energy in the coming decades. The region faces one of the greatest population pressures on the land. This will result in unprecedented stress on natural resources, causing deforestation, soil erosion, increased pressure on wetlands and rivers. For instance, with a three-fold increase in human population since 1950, South Asia's per capita water availability is down to one fifth of what it was 60 years ago. The region is also experiencing similar situation in land and energy.

Apart from the population pressure, it is projected that in the near future, demand for fresh water, energy and food will increase significantly due to increasing urbanisation, cultural, technological and climatic changes in the South Asia. Almost all the South Asian countries have primarily agricultural economy that employs half of their workforce. Agriculture and other related activities, like forestry and fishery required water and energy in different forms. Apart from these activities growing big cities, industries and other urban users will claim more water, energy and land at the same time which might affect the food production. This will also create environmental degradation and resource

scarcity which could lead to conflict in different areas. Overall, it could be said that the demographic, economic, and environmental changes in South Asia and increasing demand for natural resources could have serious implications for food, water, and energy security in the region.

Water, energy and food are interlinked and highly interdependent. Choices made in one domain may have direct and indirect consequences on the other, positive or negative. Meeting the global developmental agenda and ensuring human wellbeing in the subcontinent requires addressing challenges around water, energy and food production. Addressing these challenges needs an understanding of the challenges as felt and perceived by the local stakeholders and their perspective on solutions.

This quick diagnostic study that draws on a range of interviews with key stakeholders, discusses key challenges around water, energy and agriculture in the South Asian subcontinent. It identifies and analyses challenges in access to these resources in three river basins (viz. Indus, Ganges and Brahmaputra) spread across five South Asian countries (viz. Pakistan, India, Nepal, Bhutan and Bangladesh). It also analyses the possible solutions to these challenges from the stakeholders' perspective.

The study finds that water is the most stressed resource across the three river basins. While there are few instances of degrading quality of drinking water, access to irrigation water is declining in most cases. Unreliability in accessing surface water and rain water has led to greater dependence on groundwater sources, contributing to the depleting water table, especially in the western belt. The respondents also noted that the frequency of water related extreme weather events (especially floods and droughts) have increased in the recent years.

South Asia is one of the most energy poor regions globally. The study finds that household access to energy has been improving gradually, through both grid-connected and off-grid initiatives, but it requires much more effort to achieve universal energy access. However, agricultural access to electricity has been deteriorating, with poor quality and unreliable supply, as the demand has gone up owing to greater dependence on groundwater resources for irrigation. Consequently, farmers are depending on diesel to meet their energy needs.

Paradoxically, while agriculture is the major source of livelihood in the subcontinent and the river basins studied, there is little attention being given to sustainability of agriculture across the five countries. While Indus basin is experiencing intensive mechanisation in agriculture, Ganges and Brahmaputra basins lack modernisation in agriculture. Across the basins, agricultural input intensity, especially of energy, water and fertiliser, has increased in the recent years. With the rising inputs costs, higher use of these inputs has contributed to decline in agricultural income. Fragile agricultural value chain in the subcontinent has further contributed to the agrarian crisis, by restricting farmers' access to inputs and market for their products. As a result, there is an observed decline in agricultural activity across the basins in recent years; the younger generation seems to be less interested in agricultural livelihood and more interested in migrating to urban areas in search of jobs.

These vital resources are under stress in the subcontinent, owing to population growth, urbanisation, industrialisation, and more recently for the changes in climate. The challenges are big, but not unsurmountable. Local authorities and concerned stakeholders are well aware of the challenges and their possible consequences. The study finds that all these problems have solutions, but need implementation.

The water challenge can be addressed by better managing resources and ensuring rationed and equitable access to all through better governance mechanisms. Water sharing across nations and subnational units need to be improved to ensure water security. Similarly, the energy challenge can be addressed through regional cooperation. Tapping the hydro power potentials (especially in Nepal and Bhutan) and trading the power through a proposed regional power grid would be the most ideal solution for region's power crisis. Though there have been some developments in recent years, the prospects appear bleak, at least from stakeholders' perspective. Off-grid renewable energy could also address the energy challenges, if it becomes affordable. Technology sharing and trading across the countries could also help in upscaling.

Much of the challenges in agriculture could also be addressed through a regional agricultural value chain. It will not only provide access to agricultural inputs, but also better market for agricultural products, thus, contributing towards achievement of food security goals. In addition, the countries also need to provide better infrastructure facility as well as take measures to make farmers resilient to extreme weather events.

While the solutions are there, the public expects the state to deliver these solutions. States need to act on two fronts: first, developing the domestic infrastructure and ensuring sustainable consumption through better regulation; second, engaging with neighbours for regional sharing of resources to ensure supply security and equitable access. Although public expectation from private sector and its engagement is limited in these domains, private players can complement the state initiatives through greater investment and providing additional inputs and infrastructure facilities.

Development agencies and CSOs have a strong role to play in local demonstration of sustainable practices, local capacity building and awareness. The study argues that the change agents, both state and non-state, need to consolidate and coordinate their intervention for faster achievement of the shared goals of energy, water and food security in the subcontinent.



# Chapter 1

## Introduction

### From Millennium Development Goals to Sustainable Development Goals

*MDGs played an important role in against poverty, hunger and disease and it will continue beyond 2015*

In the Millennium Summit in 2000, all the United Nations' member states and 23 international organisations agreed to achieve eight MDGs by 2015 (See Box 1). Over the last 14 years, although some developing countries have made substantial progress, the MDGs are not fully achieved and some others have not taken off well. MDG report 2013 and 2014 pointed out that there is a greater need to accelerate the progress and much more effort is needed to reach the set targets (United Nations, 2013; United Nations, 2014). With the 2015 deadline reached, it is clear that some of the targets agreed upon by the international community back in 2000 remain unfulfilled.

Dialogues on a new developmental agenda are underway. However, it would be a mistake to simply replace the MDGs and start afresh. There is a widespread consensus among the policy-makers and civil society that MDGs played an important role against poverty, hunger and disease and will continue beyond 2015. As agreed at Rio in 2012, new goals and targets need to be grounded in respect for universal human rights, and finish the job that the MDGs started (Sachs, 2012; Griggs, 2013; United Nations,

#### Box 1: Millennium Development Goals

1. Eradication of hunger and poverty
2. Achieving universal primary education
3. Promote gender equality and women empowerment
4. Reduce child mortality
5. Improve maternal health
6. Combat HIV/AIDS, malaria and other diseases
7. Ensure environmental sustainability
8. Develop a global partnership for world

*Accelerated progress and bolder action are needed in many areas (United Nations, 2013: 4).*

*Substantial progress has been made in most areas, but much more effort is needed to reach the set targets (United Nations, 2014: 4).*

2013a). Simultaneously, in a world undergoing dangerous climatic and environmental changes, there is a widespread understanding that environmental objectives need a higher profile alongside poverty-reduction objectives.

*The post 2015 goals need to reflect an integrated view of the triple bottom line that underlies the concept of a sustainable development*

The post 2015 goals thus need to reflect an integrated view of the triple bottom line that underlies the concept of a sustainable development.<sup>1</sup> In addition, the new set of goals need to better reflect a global commitment and approach befitting the global challenge of sustainable development (Sachs, 2012).

In the United Nations Rio+20 summit in Brazil in 2012, all the member countries agreed to launch the process to develop a set of SDGs, which will build upon the MDGs and converge with post 2015 development agenda. The process of arriving at this new framework is Member State-led with broad participation from external stakeholders (such as civil society organisations, the private sector and businesses, academia and scientists) and overall facilitation by the United Nations.

The idea of the SDGs quickly gained ground because of the growing urgency of sustainable development for the entire world. The urgency of this shift was because of the present human activity pushing crucial global ecosystem functions past a dangerous threshold, beyond which the earth might well encounter potentially devastating outcomes for human wellbeing (Sachs, 2012).

*The world is facing not only one but many overlapping crises of environmental sustainability including climate change, deforestation, degradation of land, air and water resources, biodiversity loss and the depletion of fossil resources like energy and ground water*

The present era is distinguished by the fact that these pressures are both global and local. The world is facing not only one but many overlapping crises of environmental sustainability including climate change, deforestation, degradation of land, air and water resources biodiversity loss and the depletion of fossil resources like energy and ground water. Apart from the depletion of the resources, the rising population, urbanisation and industrialisation has threatened the basic usable items like water, energy and food in the world. In view of the above challenges, the need for urgent, high-profile, and change-producing global goals should be obvious (Griggs, 2013; Sachs, 2012).

SDGs are mainly based upon the principle of sustainable development. Although specific definitions vary and reinterpreted over time, sustainable development mainly talks about intergenerational equity and embraces a combination of economic development, environmental sustainability, and social inclusion (Sachs, 2012; Brundtland Commission Report, 1987; Kites, 2005).

---

<sup>1</sup> Most societies have embraced a triple bottom line approach to human wellbeing, by seeking to achieve a combination of economic development, environmental sustainability, and social inclusion. Any international development agenda must build on these broad development objectives.

*SDGs are integrated sets of voluntary, universally applicable global goals, with time-bound quantitative targets, that aim to catalyse sound pathways to sustainable development, and to balance economic, social and environmental dimensions, and reflect the interconnections between them*

Apart from the sustainable development issues, the SDGs also plan to address issues related to governance, environmental sustainability and unequal access to resources which leads to both poverty and conflict. Thus, in other words, SDGs are integrated sets of voluntary, universally applicable global goals, with time-bound quantitative targets, that aim to catalyse sound pathways to sustainable development, and to balance economic, social and environmental dimensions, and reflect the interconnections between them.

The proposal of SDGs contains 17 goals (See Box 2) with 169 targets covering a broad range of sustainable development issues. The proposal on goals will be considered by the General Assembly as part of the broader post-2015 development agenda that world leaders are expected to adopt at a Summit in September 2015. This is an ambitious long term sustainability agenda to succeed the MDGs. The new agenda will address the unfinished business of the MDGs, beginning with the eradication of extreme poverty. It will also address pressing global sustainable development challenges like environmental degradation and promote sustained and inclusive economic growth in poor countries (UN Department of Public Information, 2014).

#### **Box 2: Sustainable Development Goals**

1. End poverty in all its forms everywhere.
2. End hunger, achieve food security and improved nutrition, and promote sustainable agriculture.
3. Ensure healthy lives and promote well-being for all at all ages.
4. Ensure inclusive and equitable quality education and promote life-long learning opportunities for all.
5. Achieve gender equality and empower all women and girls.
6. Ensure availability and sustainable management of water and sanitation for all.
7. Ensure access to affordable, reliable, sustainable, and modern energy for all.
8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.
9. Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation.
10. Reduce inequality within and among countries.
11. Make cities and human settlements inclusive, safe, resilient and sustainable.
12. Ensure sustainable consumption and production patterns.
13. Take urgent action to combat climate change and its impacts.
14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development.
15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.
16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.
17. Strengthen the means of implementation and revitalise the global partnership for sustainable development.

## Demystifying Water-Energy-Food Nexus

Water, energy and food are essential for human being as well as for development. In many parts of the world growing population, economic development and urbanisation has created an alarming situation for the water, energy and food (Lele, 2013; Hoff, 2011).

*At present, agriculture is the largest user of water, accounting for 70 per cent of total fresh water withdrawal globally. Water is used for production as well as along entire production and supply chain*

The demands for freshwater, energy and food have increased significantly over years and will further increase to a greater extent. At present, agriculture is the largest user of water, accounting for 70 per cent of total fresh water withdrawal globally. Water is used for production as well as along entire production and supply chain. In addition to this, global food and supply chain are also consumers of 30 per cent of total global energy, as energy is required to produce, transport and distribute food as well as to extract, lift and collect water (Hoff, 2011; Food and Agriculture Organisation, 2014; Lele, 2013).

Access to clean drinking water, energy and food is presently the key global agenda. Due to rising incomes, demographic shifts and consumption patterns, global demand for water, energy and food are bound to increase. This is in long run endangering water-energy-food security and putting in jeopardy the development goals of improved human well-being, economic development and poverty eradication (Hoff, 2011).

Water, energy and food are connected in some obvious ways, along with some less obvious links between them. Water is crucial limiting factor for food production, but also plays a central in energy production. The need to increase the demand for food production would lead to considerable increase in the demand of irrigated water as well as of energy. However, the manner in which the increased demand for food would drive the demand for water would also be affected by efficiency of use of water in future for agricultural production. In the similar manner, the manner in which increased crop production would lead to increase in the demand for energy would also be influenced by the technical efficiencies in the energy use sector in future (Shah, 2011; Lele, 2013; Bizikova, 2013; United Nations Economic and Social Commission for Asia and the Pacific, 2013).

*Water is crucial limiting factor for food production, but also plays a central in energy production. The need to increase the demand for food production would lead to considerable increase in the demand of irrigated water as well as of energy*

Water, energy and food are interdependent and not easily disentangled. In recent decades, researchers and policy-makers have increasingly emphasised the importance of the complex relationships that are often overlooked or narrowly focussed in investments and policies (Bizikova, 2013). The World Economic Forum brought the issue of risk correlation between these three sectors to full political attention at the Davos Summit through the Global Risks 2011 report (World Economic Forum, 2011).



*Water and energy are interdependent and they are major consumers of one another. Energy is a major consumer of water and water is required for the extraction, mining, processing, refining and many other stages for generation of electricity*

*Challenges in balancing elements of the water, energy and food nexus will be exaggerated by climate change and it will have a significant impact on the availability of water for drinking, food production and energy consumption*

The interaction across the sector shows that each sector heavily depends on others and change in one sector could influence others. Water and energy are interdependent and they are major consumers of one another. Energy is a major consumer of water and water is required for the extraction, mining, processing, refining and many other stages for generation of electricity. For instance, oil and gas production require about 1-10 litres of water per gigajoule of energy, whereas oil sands about 100-1000 litres (Hoff, 2011).

On the other hand, water system is an energy user mainly through electricity consumption for pumping fresh water as well for irrigation in agriculture. Apart from that other forms of energy such as, biofuels are the most water-intensive fuel sources.

Similarly, there is strong linkage between food and energy. For food production and processing we use energy and it varies widely between food production, production systems and region. In addition, the oil and gas used for transport and cooking have a significant impact on the food production and supply. Thus, energy sector itself can negatively impact food production by reducing available land through deforestation for biofuels, diversification of food crops to production of biofuels have also contributed to higher market prices for food products in the markets (Hoff, 2011).

Finally, if we look at the water-food linkages we will find that food production is the largest consumer of water and it is responsible for around 80 per cent of water. Due to rising population and degradation in ground water levels, the world is facing water scarcity challenge. On contrary, food production is also responsible for water over exploitation. Due to the absence of the proper irrigation system, in several areas people use ground water for the irrigation. Apart from that the use of high-yielding varieties to meet the food challenges are more water and energy intensive in most of the cases (Mohtar, 2012; John, 2011; Lele, 2013).

Scholars have emphasised that the world's food, water and energy resources are already experiencing significant stress and yet we are expecting more demands for these resources in the coming years (Hoff, 2011; Bizikova, 2013; Rasul, 2010; Rasul, 2014). This demand will come with significant challenges to security issues because the resources in water, energy and food nexus are fundamental to the functioning of society (Bizikova, 2013). Apart from this, the challenges in balancing elements of the water, energy and food nexus will be exaggerated by climate change and have a significant impact on the availability of water for drinking, food production and energy consumption.

## Understanding Water, Energy and Food Security in Changing Climate Context

As discussed above, climate change is one of the major threats to water, energy and food security. It is becoming increasingly clear that, climate change could have an impact on rainfall patterns and increase the frequency of climate-related shocks, which in turn will put pressure on food, energy and water supply. The impact will be amplified through the interconnections and interdependence of these sectors. Agriculture and water are among the most climate-vulnerable sectors. Climate change affects food availability and accessibility and the stability of the food system through changes in productivity, quality of yield, crop failures, loss of livestock, farming costs etc. (Carter, 2014; Shah, 2011; Rasul, 2014).

*The Inter-governmental Panel on Climate Change (IPCC) predicts that freshwater availability in many parts of the world is likely to decrease due to climate change, along with population growth and rising standards of living*

Changes in temperature and frequency levels and intensity of rainfalls lead to increased risks of droughts and floods. Rising temperatures are raising irrigation requirements for crops, and increasing rainfall variability will place rainfed agriculture at severe risk (Shah, 2011). If we analyse each sector briefly we will find that climate change will have an adverse effect on the quality, quantity and accessibility of water resources. The Inter-governmental Panel on Climate Change (IPCC) predicts that freshwater availability in many parts of the world is likely to decrease due to climate change, along with population growth and rising standards of living. It is also likely to have serious implications for water availability in the dry season in water-stress areas (Rasul, 2014; Bizikova, 2013).

To manage this problem there will be a need for more energy as it will need to purify water of lower quality and polluted water or pump water from greater depths or distances. This would intensify the competition between the energy and food sectors for the existing water resources (Shah, 2011; Carter, 2014; Rasul, 2014).

Specifically if we talk about impact of climate change on food, it is projected that climate change will seriously affect food security. It may affect all four aspects of the food security system (the availability, sources, access and the quality of food) of any region. The decrease of any of the four dimensions could cause a situation of food insecurity. However, the impact will be more on the poor and populated regions of the world.

*Climate change will seriously affect food security. It may affect all four aspects of the food security system (the availability, sources, access and the quality of food) of any region.*

Climate change has a potential impact on agricultural productivity because of water scarcity, rising temperature and radiation and extreme climatic conditions like flood and cyclone. Evidence indicates that more frequent and intense extreme weather events, rising sea levels and increasing irregularities in seasonal rainfall patterns are already having an immediate impact not only on food

*South Asia being one of the most populous regions and most vulnerable to climate change effects, water, energy and food security in the region emerges as an important concern for the policy makers, developmental agencies and the CSOs*

*Quick diagnostic analysis, aim to identify and analyse the key challenges around water, energy and agriculture in three river basins (viz. Indus, Ganges and Brahmaputra) spread across five South Asian countries (viz. Pakistan, India, Nepal, Bhutan and Bangladesh)*

production but also on food distribution infrastructure (Carter, 2014; Food and Agriculture Organisation, 2014; Shah, 2011; World Economic Forum, 2011). In addition, climate change would also affect food security in several ways ranging from direct effect on crop production, to changes in markets, food prices and supply change infrastructure. Further, this could also have an impact on livestock yields which might leads to many economic consequences. Thus, with changes in climate, agricultural production, prices and infrastructure will change, limiting the amount and quality of food produced (Bizikova, 2013; Shah, 2011; Carter, 2014).

As far as energy is concerned there are few direct impacts which can be counted. Rising temperatures will result in increased evapotranspiration rates which could affect the hydro power and several other energy projects where water is used for the cooling (Rasul, 2014).

Changes in wind patterns, cloud cover and rainfall can impact renewable energy production. On the other hand climate change can increase the energy requirement. For instance, hotter temperatures will increase the demand for air-conditioning. Apart from the hydro and thermal electricity this will also have an impact on oil and gas (King, 2013).

## **Rationale and Focus of the Study**

From the above discussion, it is evident that access to water, energy and food is crucial for human wellbeing, thus, for achieving the post-2015 developmental agenda. While the demand for these resources is going up across the globe, largely owing to rapid population growth, availability of these resources is being or expected to be seriously compromised by the climate change effects. South Asia being one of the most populous regions and most vulnerable to climate change effects, water, energy and food security in the region emerges as an important concern for the policy makers, developmental agencies and CSOs. Meeting the global developmental agenda and ensuring human wellbeing in the subcontinent requires addressing the challenges around water, energy and food production. And addressing these challenges needs an understanding of the challenges as felt and perceived by the local stakeholders and their perspective on solutions.

This quick diagnostic analysis aims to identify and analyse the key challenges around water, energy and agriculture in three river basins (viz. Indus, Ganges and Brahmaputra) spread across five South Asian countries (viz. Pakistan, India, Nepal, Bhutan and Bangladesh). The study also analyses the possible solutions to these challenges from the stakeholders' perspective. With that

objective, we have interviewed a range of stakeholders, including public agencies, private sector players, CSOs, subject experts and local communities, in 10 locations across the three river basins (See Table 1).

In the following sections, the study discusses current state of water, energy and food security in South Asia and future projections, drawing from the existing literature. The next section discusses the challenges across the three domains, as perceived by the local stakeholders from varied fields/sectors. The section also analyses the divergences and convergences in challenges faced in each of the sectors. The concluding section pulls out broad challenges and opportunities. It also tries to identify the role for both state and non-state actors.

<b>Table 1: Field Locations across Countries</b>		
<b>Country</b>	<b>State/Province/Division</b>	<b>District</b>
Pakistan	Punjab	Rahimyar Khan
	Sindh	Sukkur
India	Punjab	Chandigarh, Amritsar, Faridkot
	Uttar Pradesh	Lucknow, Sultanpur, Barabanki
	Bihar	Patna, Gaya, Katihaar
	Assam	Guwahati
	West Bengal	Jalpaiguri
Bangladesh	Rajshahi	Chapainawabganj
	Rangpur	Kurigram
Nepal		Kathmandu, Biratnagar
Bhutan		Thimphu, Paro

<b>Table 2: Key Indicators related to Agriculture, Water and Energy Security in South Asia</b>					
<b>Indicators</b>	<b>India</b>	<b>Pakistan</b>	<b>Bangladesh</b>	<b>Nepal</b>	<b>Bhutan</b>
<b>Population (millions)</b>	12521,39,596	1821,42,594	1565,94,962	277,97,457	7,53,947
<b>Population density (per km<sup>2</sup>)</b>	421	236	1,203	194	20
<b>Annual population growth rate (%)</b>	1.2	1.7	1.2	1.2	1.6
<b>Poverty ratio (below USD 1.25 a day)</b>	23.6	12.7	43.3	23.7	2.4
<b>Per capita GDP growth (%)</b>	5.6	2.7	4.7	2.6	0.4
<b>Undernourished population (%)</b>	15	22	17	13	
<b>Improved water source (% of population with access)</b>	93	91	85	88	98
<b>Total land area (km<sup>2</sup>)</b>	32,87,590	7,96,095	1,47,570	1,47,181	38,394
<b>Agricultural irrigated land (% of total agricultural land)</b>	35.2	70.2			
<b>Total rainfed area (% of total cultivated area)</b>	57	24			43
<b>Annual growth rate in irrigated area (%)</b>	2.65	2.05	5.45		
<b>Agriculture growth rate (%)</b>	4	3.3	3.11	4.51	2.9
<b>Crop production growth rate (%)</b>				1.2	
<b>Annual freshwater withdrawals, total (billion cubic meters)</b>	761	183.5	35.9	9.5	0.3
<b>Annual water withdrawal for agriculture sector (%)</b>	90	94	88	98	94
<b>Total water consumption in agriculture sector (km<sup>3</sup>)</b>					
<b>Total water withdrawal for irrigation(km<sup>3</sup>)</b>			35.87		318
<b>Per capita water withdrawal (m<sup>3</sup>)</b>					
<b>Agricultural use (% of total withdrawal)</b>					
<b>Total irrigated area (million ha)</b>	169	21	10	4	0.2
<b>Total irrigated area (%)</b>	44.9	70.17	56	44	
<b>Irrigation</b>					
<b>Energy use per capita (kg of oil equivalent)</b>	614	482	205	383	
<b>Household with no access to electricity (%)</b>	25	8.6	44.8	23.7	28
<b>Electricity consumption in agriculture sector per tube well (kWh)</b>					



## Chapter 2

# Water, Energy and Food Security Scenario in South Asia

*There are several millions in South Asia that still do not have a secure food supply and have only limited access to clean water, sanitation or modern sources of energy*

*The World Bank Agricultural Development Report (2007) ranked South Asia as the second most undernourished, malnourished and food insecure region in the world*

Water, energy and food are essential for human well-being, and socio-economic development. The world's poor are invariably the most threatened and severely impacted by water, energy and food insecurity. Despite substantial progress in many areas, human development has been inequitable. There are several millions in South Asia that still do not have a secure food supply and have only limited access to clean water, sanitation or modern sources of energy (Hoff, 2011; Bizikova, 2013; Food and Agriculture Organisation, 2014).

With limited land resources, inadequate energy supply, and growing water stress, South Asia faces the challenge of providing enough water and energy to grow enough food to the growing population (Rasul, 2014). South Asia region has the highest concentration of poor and undernourished. The World Bank Agricultural Development Report (2007) ranked South Asia as the second most undernourished, malnourished and food insecure region in the world (World Bank, 2007).

The poor are invariably the most threatened and severely impacted by water, energy and food insecurity. In addition, the region is one of the most densely populated regions of the world with population growing at the rates of around two per cent calling for increase in food production and related resources like water and energy in the coming decades to feed teeming millions. The region faces some of the greatest population pressure on the land in the world. This has resulted in an unprecedented stress on natural resources, causing deforestation, soil erosion, increasing pressure on wetlands and rivers. For instance, with a three-fold increase in human population since 1950, South Asia's per capita water availability is down to one fifth of what it was 60 years ago. The region is also experiencing similar problem in land and energy (Shah, 2011; Lele, 2013).

Apart from the population pressure, it is projected that in the near future the demand of freshwater, energy and food will

increase significantly due to increasing rates of urbanisation, cultural and technological changes and climate change in the South Asia (Food and Agriculture Organisation, 2014; Bizikova, 2013; Hoff, 2011; Rasul, 2014).

*Demographic, economic, and environmental changes in South Asia and increasing demand for natural resources could have serious implications for food, water, and energy security in the region*

Almost all the South Asian countries have primarily an agricultural economy which employs half of their working population. Agriculture and other related activities like forestry and fishery require water and energy in different forms. Apart from these activities growing big cities, industries and other urban users will claim more water, energy and land at the same time which might affect the food production. This will also create environmental degradation and resource scarcity which could lead to conflicts in different areas (Tripathi, 2011; Food and Agriculture Organisation, 2014; Lele, 2013).

It is also pointed out in several reports that the challenges in balancing elements of the water, energy and food nexus will be more affected by climate change. Further, it will have significant impact on the availability of drinking water, food production and ecosystems and also on energy consumption (Bizikova, 2013; Shah, 2011).

Overall, it could be said that the demographic, economic, and environmental changes in South Asia and increasing demand for natural resources could have serious implications for food, water, and energy security in the region (Rasul, 2014).

*Food production is the largest user of water globally. Water, however, is also used to generate electricity. Energy, in turn, is needed to transport and fertilise crops*

Water, energy and food are interlinked and highly interdependent. Choices made in one domain may have direct and indirect consequences on the other, positive or negative. A macro argument is in order here. Food production is the largest user of water globally. It is responsible for the water use from surface- and ground-water. Water, however, is also used to generate electricity. Energy, in turn, is needed to transport and fertilise crops. Food production and supply chains are required energy for the production and supply (Hoff, 2011; Food and Agriculture Organisation, 2014; United Nations Economic and Social Commission for Asia and the Pacific, 2013).

Water, energy and food insecurities are obstacles to social stability and economic growth. For sustainable development there is a need to address externality across these three sectors and its nexus very carefully. Scarcity is rapidly escalating due to increasing demand, resource degradation and pollution. Unless there are significant changes towards more sustainable production and consumption patterns and reduced rates of population growth. Therefore, there is a need to address the policy issues of efficient use and management of these limited and declining resources. The World Economic Forum brought the issue as a part of global



risk in its *Global Risk 2011* report. It described the “water-food-energy” risks as follows:

*“A rapidly rising global population and growing prosperity are putting unsustainable pressures on resources. Demand for water, food and energy is expected to rise by 30-50 per cent in the next two decades, while economic disparities incentivise short-term responses in production and consumption that undermine long-term sustainability. Shortages could cause social and political instability, geopolitical conflict and irreparable environmental damage. Any strategy that focuses on one part of the water-food-energy nexus without considering its interconnections risks serious unintended consequences” (World Economic Forum, 2011: 7).*

*Water-energy-food nexus is a useful concept to describe and address the complex and interrelated nature of our global resource systems, on which we depend to achieve different social, economic and environmental goals*

As a region, South Asia is also vulnerable to flood, typhoons, cyclones etc., and has suffered numerous instances of extreme rainfall, flooding, droughts, cyclones in recent years. Therefore, it is a challenge for South Asian countries to achieve water, energy and food security. Water, energy and food security have moved to the top of the global agenda. Several scholars are of the opinion that in this context, the Water-energy-food nexus is a useful concept to describe and address the complex and interrelated nature of our global resource systems, on which we depend to achieve different social, economic and environmental goals (Bizikova, 2013; Food and Agriculture Organisation, 2014; Hoff, 2011; United Nations Economic and Social Commission for Asia and the Pacific, 2013).

## **Water Security: An Emergent Crisis**

Water is one of our most essential natural resources without which survival is not possible. Alongside natural forces affecting the world’s water systems, human activities are also constantly putting pressures on water resources, for which there are no substitutes. These pressures are in turn affected by a number of factors such as technological development, political, institutional and financial conditions, and climate change (UNESCO, 2014). In the context of South Asia, water is going to be one of the critical drivers of peace and stability in the second decade of the 21<sup>st</sup> century (John, 2011).

*According to an estimate, by 2030, 60 per cent of world population will be left without fresh water supply and areas like South Asia might experience water stress and the region could experience water related conflicts*

As discussed above the region is home to one quarter population of the world but the available fresh water resources are not ample to meet the need of such huge population. In addition, rapid increase in population, urbanisation, industrialisation and lack of water resources management has posed a serious challenge for the region as far as water resource is concerned. According to an estimate, by 2030, 60 per cent of world population will be left

without fresh water supply and areas like South Asia might experience water stress and the region could experience water related conflicts (John, 2011; Khalid, 2014; Ahmed, 2014).

As mentioned above, countries in the South Asian regions are mostly agricultural and these countries have also to produce food grains for its large population. Water in this regard is considered as one of the most important resources since a considerable percentage of the available fresh water supplies are utilised for agricultural activities for producing food grains (John, 2011; Lele, 2013; Tripathi, 2011).

The depleting water availability will put emphasis on food in this region. Water is already an extremely contentious, and volatile, issue in South Asia. The amount of water available, at present as well as for future, has reduced dramatically. This is due to water-fertiliser intensive farming, overexploitation of groundwater for drinking, industrial and agricultural purposes, large scale contamination of water sources. Agriculture is the largest consumer of water resources globally, using an average 70 per cent of the total water consumer and in South Asia agricultural water use is as high as 91 per cent (John, 2011; Lele, 2013; Food and Agriculture Organisation, 2014).

*The growth in the extraction of groundwater in India is a web of public policy and private sector behaviour. There was a failure of the initial large scale irrigation strategy which leads to lack of access to canal water in several areas*

The growth in the extraction of groundwater in India is a web of public policy and private sector behaviour. There was a failure of the initial large scale irrigation strategy which leads to lack of access to canal water in several areas. The introduction of the affordable pumps and drilling equipment has transformed irrigated economies. Groundwater resources now account for almost 80 per cent of the recent growth in irrigation in South Asia and they are reaching the limits of exploitation. However, groundwater over extraction has accelerated the depletion of water resources (Food and Agriculture Organisation, 2014; Lele, 2013; Price, 2014).

Apart from the agricultural sector, water is also going to be one of the scarce resources for the growing urban centres and industrial towns of South Asian region. Growing urban centres and their increasing population generally lead to higher energy and water consumption for domestic and commercial uses (UNESCO, 2014; Food and Agriculture Organisation, 2014; Hoff, 2011; Price, 2014).

In India for example, the government's norm for rural water supply schemes is 40 litres per capita per day (pcpd) but for towns without sewers it is 70 pcpd for cities with sewers it is 135 pcpd and for metropolitan and mega cities, with populations over 1 million, it is as high as 150 pcpd. While these are design standards, the actual demand for water in these cities could be higher. For instance,

water demand in Mumbai is claimed to be 300 pcpd (UNESCO, 2014). Fresh water scarcity is a common problem in the whole region because the countries have a high rate of population growth, wide-spread poverty, declining food production and a rapidly rising demand of water for domestic, agricultural as well as industrial users. For instance, in India per capita water availability has fallen from 1986 cubic meters (cu m) in 1998 to 1731 cu m in 2005. The situation is likely to worsen in the next few decades with the population growth (John, 2011).

In the recent decades the concept of water security has received increased attention in both policy and academic debates. Multiple definitions of this concept exist, promoted many international organisations. The Global Water Partnership (GWP 2012) has defined water security as:

*“Ensuring the availability of adequate and reliable water resources of acceptable quality, to underpin water service provision for all social and economic activities in a manner that is environmentally sustainable; mitigating water-related risks, such as floods, droughts and pollution; addressing the conflicts that may arise from disputes over shared waters, especially in situations of growing stress, and turning them into win-win solutions” (Global Water Partnership, 2012).*

*One of the major concerns of all the countries of the region is the gap between policies and their implementation. The policy-makers have overlooked the water losses due to theft, defective pipelines, unsustainable agricultural practices, irrational pricing and populist policies like free power to run tube-wells drawing underground water*

In the present condition water security is the single most important factor regarding the future sustainability of our planet. The connection between water and politics requires a delicate balancing by decision-makers to ensure that policy is well-informed and science is well communicated. The paradox of the region is poorly integrated, yet linked together by water co-dependencies (Biggs, 2013; Kugelman, 2011). Scholars have pointed out that there are three most important issues of the debate on water security and insecurity in the region (Price, 2014; John, 2011; Bandyopadhyay, 2007).

Firstly, water management issues. It is well evident from these above studies that across the region water management is very poor. There is a gross mismanagement that can be seen in agricultural sector as well as in big urban centres (John, 2011; Price, 2014). One of the major concerns of all the countries of the region is the gap between policies and their implementation. The policy-makers have overlooked the water losses due to theft, defective pipelines, unsustainable agricultural practices, irrational pricing and populist policies like free power to run tube-wells drawing underground water (John, 2011; Lele, 2013). Study shows that water scarcity in urban centres is mostly due to theft and leakages in the pipelines. In addition to that, lack of coordination between different departments is one of the major

problem. Countries lack a coherent water management strategy as well as under investment in water infrastructure.

The second issue is attitude towards trans-boundary water. Many of the region's countries depend on the same rivers and, by extension, neighbouring upper riparian for their water supply. However the current trans-boundary cooperation is negative. The sharing of water by states without a joint mechanism makes this issue more complex. These all factors have challenged the water security of South Asia the issue of water has assumed a prominent position in politics and often trans-boundary water debate are set around the impact of the construction of the infrastructure like dam on downstream population rather than future water security (Iqbal, 2009; Baqai, 2005; Price, 2014; Kugelman, 2011; Khalid, 2014; Crow, 2000).

Finally, the issue is the impact of climate change on the water resources of the region. Climate change impacts the hydrological cycle and consequently impacts water resources. It may affect water supplies directly and potentially increase the water demand for agriculture and energy. Climate change adaptation is primarily about water, as stated for example by the Intergovernmental Panel on Climate Change (IPCC), which identifies water as the fundamental link through which climate change will impact humans and the environment (UNESCO, 2014).

It is believed that South Asian countries' water management ability will determine the impact of climate change in the region. The preliminary assessments of United Nations Framework Convention on Climate Change have revealed that the severity of droughts and intensity of floods in various parts of India and other neighbouring countries is likely to increase. The report pointed out that rise in sea levels and melting of glaciers will adversely affect the water balance in different parts of India and the subcontinent (UNESCO, 2014).

### **Energy Security: A Persistent Crisis**

Energy is one of the key ingredients for the socio-economic development of any region. South Asia as one of the fastest growing regions in the world puts energy at the very heart of the developmental process in the region. Energy security is considered to be one of the important issues in South Asian region (Vinodan, 2013; Srivastava, 2007). South Asia is home to 22 per cent of the global population of which nearly half do not have access to electricity. In addition, this region consumes only four per cent of the total commercial energy produced in the world, which is extremely low per capita energy consumption (Wickramasinghe, 2001; Dhungel, 2008).

*It is believed that South Asian countries water management ability will determine the impact of climate change in the region*

*South Asia as one of the fastest growing regions in the world puts energy at the very heart of the developmental process in the region*

*The concept of energy security has shifted from a state-centric and traditional thinking to recent security concerns in the light of resource scarcity and climate change*

Biomass in the form of fuel-wood, agricultural and animal waste remains one of the primary fuels for domestic energy consumption for a majority of the poor households in this region. Apart from that, hydrocarbons (petroleum, gas, and coal) are also main sources of energy in South Asia. The commercial energy mix in 2003 comprised 44 per cent coal, 35 per cent petroleum, 13 per cent natural gas, 6 per cent hydroelectricity, 1 per cent nuclear energy and 0.3 per cent other energy. The pattern of energy mix, however, varies from country to country within the region (Chaudhury, 2009: 139; Rasul, 2014).

There is a growing imbalance between energy demand and its supply from indigenous sources resulting in increased import dependence. With rising international oil prices, the concern for energy security should be on the top of the policy agenda. Energy security has not yet attained a foremost or precise definition but it is broadly understood, connotes the capacity of a nation to satisfy the energy needs of current and future generations (Singh, 2013; Pandey, 2006; Kurian, 2013).

The United Nations Advisory Group on Energy and Climate Change (2010) defines energy security as “access to clean, reliable and affordable energy services for cooking and heating, lighting, communications and productive uses” (United Nations Economic and Social Commission for Asia and the Pacific, 2013:25). The concept of energy security has shifted from a state-centric and traditional thinking to recent security concerns in the light of resource scarcity and climate change. The recent thinking focusses on availability, accessibility and affordability and environmental sustainability (United Nations Economic and Social Commission for Asia and the Pacific, 2013).

As mentioned, in the past couple of decades energy production and consumption in South Asia has grown and it is set to grow further due to faster rate of population growth, economic growth, urbanisation, industrialisation as well as rural electrification. In addition to that, these countries are trying to meet ambitious poverty reduction goals while their growing industrial, commercial, and transport sectors and urban and middle-income consumers are using energy at unprecedented rates. To meet the growing demand all the South Asian countries are under immense social and political pressure to secure reliable, sustainable and affordable priced energy supply. Therefore, energy security is a vital socio-economic development issue throughout the region (Sankar, 2000; Kurian, 2013).

*To meet the growing demand all the South Asian countries are under immense social and political pressure to secure reliable, sustainable and affordable priced energy supply. Therefore, energy security is a vital socio-economic development issue throughout the region*

On the other hand, energy is related to water and food. Increased extraction of groundwater for the food production has increased the demand for energy and lowered the groundwater table in many parts of the South Asian region (Lele, 2013; Rasul, 2014). The

diversion of animal wastes from fertilisers fuel use has serious consequences in the food, energy, and water. For instance, in the South Asian countries the diversion of cattle dung from farm manure to fuel has accelerated the use of chemical fertilisers, whose production is highly energy intensive and it is having an impact in the food, energy, and water resources of the region (Rasul, 2014).

*Energy security will remain a high priority issue for South Asia. Access to clean, reliable and affordable energy sources would help the South Asian countries in attaining higher growth at lower costs of production*

The countries in the region are independently pursuing policy options to mitigate energy security risks. However, much more needs to be done to sustainably meet the growing demand for energy to fuel their economies. It is expected that the energy deficiency situation can be overcome with regional energy cooperation and through the exploitation of available resources optimally such as river waters in the high Himalayas, wind energy along coasts, natural gas and other hydrocarbons (Srivastava, 2007; Wickramasinghe, 2001; Sankar, 2000; Kurian, 2013; Singh, 2013).

In addition, pipelines from neighbouring energy surplus regions will need to be cooperatively developed (Dhungel, 2008; Sankar, 2000; Kurian, 2013). The process of globalisation encouraged the liberalisation of energy markets which contributed greater options for cross boundary energy trade to enhancing energy security in the region, but not much has progressed on this front over the last two decades.

The region also has a huge potential for renewable energy and could overcome the risks of energy security by exploring the renewable energy sources like solar, wind etc. In the process of exploring and using renewable energy sources through regional cooperation and knowledge sharing is vital to its energy security. This cooperation needs to have a coordinated, legal and regulatory framework. An ecologically oriented energy policy gives new prospects for renewable energy as well energy security and in the long run will also lead to and sustainable development (Pandey, 2006; Kurian, 2013; Singh, 2013).

*Food security is a complex issue and the concept has undergone substantial changes during nearly two decades starting with the World Food Conference of 1974*

Energy security will remain a high priority issue for South Asia. Access to clean, reliable and affordable energy sources would help the South Asian countries in attaining higher growth at lower costs of production.

### **Food Security: A Management Crisis**

Food security is a complex issue and the concept has undergone substantial changes during nearly two decades starting with the World Food Conference of 1974. It is now being recognised that the aim of food security is not only provision for the physical availability of adequate amounts of food grains for the entire population on a stable basis throughout the year, but also to assure

that all population including the poor and vulnerable sections have social and economic access to sufficient, safe and nutritious food grains to meet their dietary needs and food preferences for an active and healthy life (Food and Agriculture Organisation, 2014; George, 1994; Mittal, 2009). According to FAO, the concept of food security has four major elements: (a) food availability, (b) access, (c) stability of supply and (d) utilisation (Food and Agriculture Organisation, 2014).

*South Asian region has largest number of poor and malnourished people in the world and almost all the South Asian poor populations depend on agriculture for their livelihood*

In the context of South Asia, food security is a serious and multidirectional problem. In the South Asian countries it is a complex phenomenon and involves a number of factors ranging from availability to access and utilisation of food. Food security is going to be a major challenge for all South Asian countries in future. As stated above, South Asian region has largest number of poor and malnourished people in the world and almost all the South Asian poor populations depend on agriculture for their livelihood. As the population grows in the coming decades, more and more crop production will be needed for consumption. This will escalate the pressure on land and water for food. Although some South Asian countries made some progress in food production during the green revolution, recently that dynamic growth in agricultural sector has been lost (Rasul, 2010).

In addition to the declining agricultural productivity, the degradation of the resource like increasing soil salinity, land quality, depleting water resources and water logging, as well as expanding biotic and abiotic stresses has added to the food problem of South Asia. Apart from that, the declining man-land ratio also has put serious pressure on food security in South Asia (Rasul, 2010; George, 1994). Some scholars have also noted that the present demand-supply scenario and the future prospects of major commodities also have important implications for food security in the South Asian region (Sekhar, 2012).

*Climate change has both direct and indirect effects on the food security. It has direct impact on water, soil and indirectly it will have an effect on cropping system, harvest and land use*

Apart from the several challenges of food security like high population growth, depleting natural resources, climate change poses a serious threat to the food security of the region. The South Asian region is very diverse in climate regimes. These varying climatic conditions have a direct impact on food grain production patterns and livelihoods of the different communities (Rasul, 2010). Climate change has both direct and indirect effects on food security. It has direct impact on water, soil and indirectly it will have an effect on cropping system, harvest and land use (Lal, 2013).

The impact of climate change will be on rainfall pattern and sea level rise which will also affect the livelihood and food security of most of the countries in the region. In addition, most of the South Asian countries are prone to natural calamities and

projected climate change may also exacerbate the extreme climatic events like cyclone, flooding, drought which will aggravate the food security in the region (Lal, 2013; Rasul, 2010; Shah, 2011; United Nations Economic and Social Commission for Asia and the Pacific, 2013). The recent IPCC assessment report also claims that projected rise in temperature will also have a serious negative impact on food production in the region.

*It is also necessary for the South Asian countries to work towards strengthening regional trade relations*

As stated above, food security is a function not only of the availability of food, but also of the purchasing power of the people. It is therefore important that every household should either have capacity to produce adequate food for all the members, or have the economic ability to acquire it. There is a need to strengthen the policies which can manage the food supply where and when there is shortage. There is also a need of safety net programme to provide low cost food to the poor and marginal communities.

Apart from the measures like control over population growth, agricultural mechanisation and buffer stock, it is also necessary for the South Asian countries to work towards strengthening regional trade relations. Further, it is also necessary to develop rural infrastructure like irrigation, rural connectivity, storage facility, market facilities and development of non-farm sector in rural areas to achieve food security in this region (Mittal, 2009; George, 1994).



## Chapter 3

# Insights from Basins

*The trans boundary Indus river basin is spread across four countries, viz. Pakistan, India, China and Afghanistan*

In this section, key challenges and opportunities in water, energy and agriculture sector in the three river basins are discussed. Based on interviews with selected relevant stakeholders in each basin, we have tried to identify the challenges in each of the three domains, as perceived by the stakeholders; how those challenges are being addressed by the governments; who are the other key players; what alternative solutions could be considered; and whom do they expect to deliver those solutions. Key insights from each basins are discussed separately below.

### Indus

The trans boundary Indus river basin is spread across four countries, viz. Pakistan, India, China and Afghanistan. Pakistan has the major share of the basin (47 percent), with 65 percent of total area of the country lying in the river basin, followed by India (39 percent) which has 14 percent of total area of the country in the basin. The climate in the Indus plains, our focus area, is arid to semi-arid. The river flows are comprised of glacier melt, snowmelt, rainfall and runoff. The catchment area for the basin is unique in the sense that it contains seven of the world's highest peaks after Mount Everest. Simultaneously, the basin represents an extensive groundwater aquifer, covering a gross command area of 16.2 million ha. The river basin in both Pakistan and India, covering major food producing zones, is of strategic importance for both the countries and their respective economies.

*The river basin in both Pakistan and India, covering major food producing zones, is of strategic importance for both the countries and their respective economies*

Even with abundance of water resources, the region in both the countries is increasingly facing crisis of irrigation water. Indus basin compared to the other two basins has a better network of surface irrigation system. While Pakistan part of the basin has a wide network of rivers and tributaries, India part has a network of canals. Yet, the region is increasingly being dependent on groundwater for irrigation owing to unreliability and failure of the surface irrigation systems.

*Studies suggest if the current water usage patterns continue, drinking water availability will also be affected in coming decades*

On the Pakistan side, there is a prevailing perception that India is responsible for the dried rivers and channels as it blocks the water through the dams set up on the borderlines. However, failure of surface irrigation on Indian side is largely recognised as a failure to manage and maintain the canal system. At the same time, over consumption of canal water by the head-end farmers leaves the tail-end lands in despair and more dependent on groundwater and rain water. The respondents on both the sides also noticed significant change in rainfall pattern in recent years. There is a shift in rainy season, with delayed arrival of monsoon as well as concentrated rainfall affecting the crops.

In recent years, as respondents noted, there is an increasing shrinkage in access to and reliability of both surface and rain water for irrigation purpose. Consequently, the dependence on groundwater has significantly increased. While the region has most affluent aquifers, over withdrawal of groundwater, without adequate recharging has resulted in steep fall in water table. The aquifers in the region are noted to be receding at the fastest speed. As the water table goes down, the cost of water withdrawal (and the cost of energy used for drawing water) is becoming an increasing burden on the farmers and creates a widening inequality in access to irrigated farming, making the small and marginal farmers more vulnerable.

However, access to drinking and sanitation water in the region is not a major challenge, except in few pockets. On both sides of the border, there are few pockets where availability and quality of drinking water has been poor. Nevertheless, studies suggest if the current water usage patterns continue, drinking water availability will also be affected in coming decades.

While water access is emerging as a burning issue and received public attention, both Pakistan and India do not have any serious policy measure to rationalise irrigation water consumption. Especially in case of groundwater, the landowners have unrestricted access to groundwater. Moreover, government policies like free power to farmers in Punjab, Indian side, have detrimental effect on water resources. Governments have introduced schemes to promote micro-irrigation systems to tame water demand. Micro-irrigation systems have limited success among horticulture farmers, but not for the farmers growing rice, wheat and other seasonal crops.

On the other hand, in case of India, provision for better and realisable minimum support price for rice and wheat has promoted continued and intensified farming of these water intensive crops in the region for a reliable income. Similarly, a stable market and reliable price for rice, wheat and sugarcane in Pakistan work as incentives for the farmers to grow these water guzzling crops.

*In case of India, provision for better and realisable minimum support price for rice and wheat has promoted continued and intensified farming of these water intensive crops in the region for a reliable income*

*While farmers' behaviour needs to change, as pointed out by respondents, the governments have not done much to inform the farmers*

However, a positive measure taken by provincial governments on both sides has been adoption of regulations to preserve sub-soil water. Such a regulation was first introduced by Pakistan, followed by Punjab and Haryana in India that restricts sowing of rice seed before onset of monsoon, with the objective to reduce dependence on groundwater.

Simultaneously, behaviour of water users is also recognised as a major contributor to the water crisis. While proven water efficient technologies (like micro-irrigation systems) and practices (like System of Rice Intensification) are available, most farmers follow the traditional flood irrigation pattern, which is requiring increasing amount of water with rise in temperature. It also contributes to other problems like waterlogging and salinisation in the basin making lands uncultivable. While farmers' behaviour needs to change, as pointed out by respondents, the governments have not done much to inform the farmers.

There is a crisis, but it is not unsurmountable. There are solutions and the stakeholders are aware of them. First, proven water efficient technologies and practices are available and suitable for the region. But such technologies and practices are not adopted largely because of lack of awareness and in some cases due to lack of affordability, especially for the small and marginal farmers. A key part of the solution would be popularising such technologies and practices and scaling up adoption at a larger level.

Second, better management and improvement of the surface irrigation system could significantly reduce the stress on groundwater. But this will require increased intervention from the respective governments and public agencies. Third, respondents have a great hope on water conservation measures like rainwater harvesting and groundwater recharge. But again they expect the state to take these initiatives. While CSOs and authorities recognise the potential of community intervention here, they also acknowledge the collective action problem in such interventions. Fourth, on Pakistan side, the expectation also rely on better terms and practice of river water sharing from India to address local water scarcity.

*There is a crisis, but it is not unsurmountable. There are solutions and the stakeholders are aware of them*

Finally, while there is a consensus on regulating water usage, but not much clarity on how do it. Although there is some voice for rational pricing of water and energy, as expressed by the public authorities, the farmer community is largely opposed to it. To sum up, water crisis in the region is well noticed and felt, some possible solutions are known, but intervention is expected largely from the state. In case of irrigation water, there is no significant participation of private player, except few water sellers who are largely local landed farmers. Participation of NGOs and international development agencies is seen in few pockets,

promoting water efficient measures, but there intervention is much localised.

Energy access is an equal challenge in the region and more so in the part of Pakistan. While household access to commercial energy is relatively better in the Indian side, Pakistan side has larger population without access. But when it comes to agricultural access to energy sources, the situation is equally bleak on both sides. A significant difference is free of cost electricity supply to farmers in India, which is not prevalent in Pakistan. Yet, the supply is equally unreliable on both the countries. Farmers complain that they do not get electricity when they need it and in a stretch of duration required. Consequently, they end up drawing more water to irrigate their land on several instalments, contributing to the water problem. At the same time, the dependence on other forms of energy (especially diesel and kerosene) is also increasing to arrange for backup power. It not only contributes to local air pollution, but also adds to the cost of farming.

Although the general access to energy scenario has been improving in recent years, there is no significant improvement for the agricultural supply. However, the proposed solutions for the energy problem are not much focused. Respondents had a varied opinion.

First, farmers expect access to cheap and reliable energy as an entitlement, if surface water sources are not provided. But we must remember that cheap energy supply without accountability mechanism has contributed to groundwater depletion in India. Second, a related solution is to enhance electricity generation capacity to make energy available for the farmers. But generation is a much more complex issue that requires other inputs like investment fuel etc. Third, there is a hope on renewable energy and recognition of the potentials of solar and wind energy in the region. Pilot cases are visible on both the countries. But affordability, investment and scalability remain a concern. However, the respondents in the region did not show much hope on cross-border energy trade and potentials of a regional energy market. While part of this may be due to lack of awareness on the issues, but failure of decades of effort to promote a regional energy market may have contributed to the low trust.

Agriculture is a major source of livelihood in the region, employing a larger share of the workforce. Yet, paradoxically, sustainability of agriculture has not been on policy priority of either of the countries. Consequently, both the countries, including the river basin, are faced with an agrarian crisis and identical problems. While agricultural input costs are steeply rising, net income from the activity is going down. As pointed out by the respondents, the

*Although the general access to energy scenario has been improving in recent years, there is no significant improvement for the agricultural supply*

*Agriculture is a major source of livelihood in the region, employing a larger share of the workforce. While agricultural input costs are steeply rising, net income from the activity is going down*

younger generation is less interested in agricultural activity and migrating to the cities in search of work.

*Heavy dependence on chemical fertiliser is blamed on farmers' misperception that higher the fertiliser usage better the yield and poor extension service on this*

A researcher in Pakistan shared his observation that “farmers’ children leave the rural area when they grow up to work in cities for other trades. The older generation is left behind to take care of the lands. This means lower levels of motivation, energy and innovation... Agriculture is being taken care of by middle aged or older generation.” Subsequently, traditional practices and crops are continued at large. Both the regions have a predominance of rice and wheat which is not anymore suitable for the agro-climatic zone. In addition, inefficient practices like flood irrigation and on field burning of crop residues are being continued. This pattern of cropping and practices are further incentivised by government inducements and market demand.

India part of the basin was early introduced to resource intensive high yielding varieties through Green Revolution, which had initial success in raising productivity and farm income. The Pakistan side is increasingly shifting toward these seed varieties. In both cases, consumption of chemical fertiliser is significantly high and skewed. Both the regions are facing problems of soil nutrition imbalances, affecting productivity negatively. Heavy dependence on chemical fertiliser is blamed on farmers’ misperception that higher the fertiliser usage better the yield and poor extension service on this.

While technologies are available for improving resource use efficiency, affordability of such technologies is a challenge. However, the richer farmers are adopting such technologies and machineries. In general, access to finance is a challenges, especially for the small and marginal farmers, who in turn depend on local money lenders and ‘commission agents’. Besides shrinking resource base for agriculture, availability of farm labour is also emerging as a challenge in both the regions.

*In general, access to finance is a challenges, especially for the small and marginal farmers, who in turn depend on local money lenders and ‘commission agents’*

The crisis situation is further aggravated by changing climate. The major climate effect observed in the region is variability in the onset of monsoon and untimely rainfall affecting crops. In addition, declining water table, rising temperature and occurrence of extreme water events (like heat waves, frost and terminal heat stress) are being felt in the regions. On India side, respondents pointed to changes in pest ecology requiring higher usage of chemical pesticides.

Again here, stakeholders have a range of solutions. First, crop diversification is considered to be the most suitable option for making agriculture and agricultural livelihood resilient. At the same time, crop diversification would help to reduce dependence on shrinking resource base. However, the current policy

incentives and market conditions do not support diversification. Secondly, rational pricing of resources is also considered an option by some stakeholders to cope with declining resource availability and to improve efficiency. Third, improvement in agricultural extension service and promotion of sustainable practices has a huge potential. This will need consolidation and expansion of extension facilities.

*Respondents pointed that cross-border trade will not only improve the market for their produce but also reduce the cost of food items by reducing storage and transport needs*

Fourth, a major concern raised is the lack of coordination between scientific research done on agriculture and its farm applicability. Though both the countries have set up several agricultural research institutes and universities, the research carried out by them is not reaching to farmers. Linking research to farm practices could significantly improve the situation. Fifth, improved market conditions, with a demand for diversified agri-products, could motivate farmers to diversify cropping and thus help to reduce the risks. This would, however, require investment on infrastructure facilities like storage, processing, packaging and transport. While the agricultural input market is well developed on both the sides, largely driven by the private players, the market for agri-products is limited and has a demand for traditional crops.

Finally, on both sides, there are high hopes on opportunities in cross border trade. Respondents pointed that cross-border trade will not only improve the market for their produce but also reduce the cost of food items by reducing storage and transport needs. However, the respondents also recognise the political realities that affect free trade across the border. In recent years, there has been limited trade of agri- produces across the border, but much more controlled.

## Ganges

*Respondents also recognise the political realities that affect free trade across the border. In recent years, there has been limited trade of agri-produces across the border, but much more controlled*

The Ganges river basin is spread across four countries, viz. China, Nepal, India, and Bangladesh. India has the largest share of the basin (79 percent), with 26 percent of total area of the country, followed by Nepal with 14 percent (and 100 percent area of the country lying in the basin) and Bangladesh with 4 percent share has 32 percent of total area of the country in the basin. Headwaters of the Ganges river originating in the Himalayan Mountain range in China flows southwest into India, through Nepal, and then turns south east, being joined by many tributaries. The river basin is characterised by low precipitation in the northwest of its upper region and high precipitation in the areas along the coast.

Unlike Indus basin, water availability is not a problem in the Ganges basin. Rather management of the water resources is considered as the greatest challenge. All the five locations covered for the study reported problem of access to clean drinking and sanitation water. When it comes to access to irrigation water,

the basin is largely dependent on river water, in some cases channelled through illegal canals and rain water. Each location has its unique challenge. Nepal reported the challenge of accessing irrigation water throughout the year. Consequently, the farmers are restricted to single cropping. Bihar is prone to frequent floods. But the flood management system is not effective, neither have they had arrangements to utilise flood water for irrigation purpose. Uttar Pradesh region is increasingly depending on groundwater resources, owing to unreliability of river water and monsoon.

*Consequently, waterlogging, salinisation and groundwater depletion are emerging as new challenges*

Consequently, waterlogging, salinisation and groundwater depletion are emerging as new challenges. Ganges basin lying in Bangladesh is on the other extreme being drought prone. Bangladesh also reported unavailability of water throughout the different cropping seasons, restricting multiple cropping. In addition contamination of water sources is another phenomenon that affects both drinking and irrigation water sources.

In recent years, the region has also experienced erratic rainfall, further aggravating the water problem. The region is experiencing delay in onset of monsoon as well as high level of precipitation over few days. Declining reliability of surface water sources and rain water has resulted in increasing dependence on groundwater sources. Except in Uttar Pradesh, groundwater is available at shallow depth in most regions. But farmers also complain about water contamination.

On the Ganges basin, there is a greater realisation that water resources need to be better managed at local level as well as regional level to improve equity of access to the vital resource. First, an oft-proposed solution is to manage the demand better through water efficient technologies and practices. Throughout the region, there are several instances of pilot cases where demand management have been successfully experimented. Use of micro irrigation systems, system of rice intensification and water harvesting are some common practices.

*NGOs have some presence in irrigation water management and greater presence in ensuring clean drinking water*

In most cases, these interventions are made by locally active Non-governmental Organisations (NGOs) and supported by international development agencies. But scalability of these initiatives remains a challenge. Second, there is strong voice for regulating water resources to improve efficiency and equity. But what would be the right approach to do so is unclear. Third, at the macro level, there is demand for better management and sharing of cross-border water resources. Stakeholders have high expectations from such water sharing initiatives. However, limited success of previous initiatives between Nepal & India and India & Bangladesh emerges as a deterrent for success of any future initiative.

Finally, much of the expectation is relied on the respective governments. Private sector participation is almost absent, except few local pump owners and water sellers. NGOs have some presence in irrigation water management and greater presence in ensuring clean drinking water.

*Bangladesh and West Bengal are considered to be the pioneers of off-grid solar model. Similarly, Nepal has been putting significant effort on developing micro and mini hydro systems*

Ganges basin is one of the most energy poor regions. Household access to commercial energy is not only low in Nepal and Bangladesh, but also lowest in Bihar, Uttar Pradesh and West Bengal in India. Agricultural access to electricity further dire the situation. While access is limited, cost of agricultural electricity is significantly high compared to other regions, except in Uttar Pradesh where it is highly subsidised. For example, West Bengal charges time of the day tariff to farmers on the basis of actual consumption.

Reliability of power supply is also significantly poor; farmers complain about unavailability during the time they need it. With the rising demand for groundwater and unreliability of power supply, farmers are increasingly sifting towards alternative sources like diesel and kerosene.

On the positive side, to cope with the energy poverty, the region has made significant progress on off-grid renewable energy systems, especially solar. The Ganges basin has a huge potential for solar energy. Though it has not been tapped well, significant efforts have been made to promote off-grid and micro-grid solar as an alternative source. Bangladesh and West Bengal are considered to be the pioneers of off-grid solar model. Similarly, Nepal has been putting significant effort on developing micro and mini hydro systems. Among the stakeholders, there is a greater hope on potential of renewable energy in alleviating their energy poverty. However, stakeholders also expect state support to subsidise the cost, which has been provided at varying level at present.

*Stakeholders have a great expectation from a potential regional energy market and energy trade. Recent developments between India and Nepal and India and Bangladesh on energy trade seem to have raised the expectations*

At the same time, there is a greater demand on the state to invest on generation capacity to meet the growing demand. Finally, the stakeholders have a great expectation from a potential regional energy market and energy trade. Recent developments between India & Nepal and India & Bangladesh on energy trade seem to have raised the expectations. Considering Nepal's hydro energy potential, stakeholders also expect that investments on hydro energy in the country coupled with development of a regional energy market could address the energy crisis in the sub-continent.

Agriculture is the major source of livelihood in the river basin. However, most of the farmers in the region are small or marginal farmers. A key challenge to agriculture is the small size of the landholdings that does not allow modernisation and



mechanisation of agriculture. Consequently, much of the farming involved in the area is traditional. However, with the desire to increase productivity, there is a growing usage of high yielding varieties and chemical fertilisers. After a certain point, this has produced detrimental effects. At the same time, in the absence of innovation and modernisation, crop diversification and rotation is restricted. This is further affected by limits of access to irrigation water and unavailability of water throughout the farming seasons.

Consequently, many farmers rely on single cropping in a year. The region also experiences shortage of manpower as alternative occupations are better remunerative and more reliable. The stakeholders understand the limitations of the landscape, yet see a range of possible solutions. Better extension service responding to the local challenges is considered to have a huge potential. Much of the challenges can be substantially addressed by better informing the farmers about low costs solutions and better resource management practices. On the other hand, improved agricultural value chain is crucial to ensure timely available of agricultural inputs and better market for agri-products. In that regard, the respondents have high expectations from a potential cross-border market.

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### **Brahmaputra**

Half of the river basin lies in China and another half is spread across Bhutan, India and Bangladesh. India has 36 percent of the basin covering 6 percent of total area of the country. Both Bhutan and Bangladesh have 7 percent of the basin each; 100 percent of total area of Bhutan lies in the basin, while Bangladesh has 27 percent of its total area under the basin. Like Ganges, the headwater of Brahmaputra River originates in the Himalayan Mountain range in China. The basin includes high precipitation zones and dry rain shadow areas. The river basin represents a varying hydro-ecology and landscape from north to south.

The low lying Ganges-Brahmaputra delta is highly vulnerable to climate change impacts. IPCC fourth assessment report predicted that about 1 million population in the area will be severely affected by coastal erosion and land loss, primarily as a result of the decreased sediment delivery by the rivers, but also through the accentuated rates of sea level rise. The effects are already visible. As a result of soil erosion caused by deforestation in the northern part of the basin has caused frequent flooding of the delta region in Bangladesh on a massive scale.

The river basin has an abundance of water resources, yet the region is not free from water problems. Interestingly, the region has very localised issues with water access, and the type and degree of problems vary from locality to locality. In Bhutan, at the top

end of the basin, annual water flow far exceeds the estimated consumption demand. However, with population growth, socio-economic development, urbanisation and climate change, water issues are becoming prominent in the country. The challenges are equally felt for both drinking and irrigation water. Localised shortages are felt in some communities due to uneven distribution of the water resources across the landscapes and seasons.

For example, settlements in eastern part of the country depend upon rainwater for all purposes, which is now getting dried up during March-May. Consequently, the rural population have to spend a significant amount of time and energy in fetching water. Poor operation and maintenance of water supply infrastructure is also another problem that is contributing to dysfunctional drinking water supply in urban areas. Urban centres are also experiencing problems related to water quality due to poor management of wastes and surface runoff.

The water challenges are different further down in the basin. In the Indian state of Assam, the major challenge is around access to irrigation water. The respondents believe that it is largely due to poor management and governance of water resources. One systemic problem has been lack of coordination between concerned government departments and also between the states and centre. The North-East region in India, falling into the Brahmaputra river basin, has smaller states.

Consequently, inter-state water sharing is an important aspect of ensuring water security in the region. Moreover, lack of maintenance of canals and other irrigation infrastructures further affects access to irrigation water. The reason for poor maintenance of irrigation resources is considered to be lack of adequate funding with the irrigation department. On the other hand, urban infrastructure develops have significantly stressed on groundwater resources.

The part of Brahmaputra basin located in Bangladesh is vulnerable to seasonal vagaries. While flooding is very common during the rainy season, water availability during summer declines. Consequently, the cost of irrigation is rising for the farmers. In addition to declining water flow in the rivers, high level of iron and arsenic contamination of groundwater is emerging as a challenge for drinking water access. However, the challenge of water access is relatively low compared to the Ganges basin in the country and Brahmaputra basin lying in other countries.

Considering high water availability but low access in the region, many of the respondents feel that the region can address the water problem through better management. Integrating conservation measures to water management strategy could ensure long term

*Poor operation and maintenance of water supply infrastructure is also another problem that is contributing to dysfunctional drinking water supply in urban areas*

*The reason for poor maintenance of irrigation resources is considered to be lack of adequate funding with the irrigation department*

sustainability in supply of this vital resource. Secondly, better sharing of water across the borders, both sub-national and national borders, could address many of woes. Third, especially in the Indian part, many respondents argued that the local communities can have significant impact by contributing through water conservation and efficiency in practice. But this would require formulating policies with a participatory approach in order to reach the grassroots communities. Finally, the data gap in water sector needs to be addressed to improve the water management. Currently, as in other parts of the subcontinent, accurate water availability data does not exist. To better plan the interventions for water security, some stakeholders claimed, the water data needs to be compiled and made available in public domain.

*The Brahmaputra river basin has one of the best hydro-power and renewable energy potential in the region. Yet, it is not free from the energy poverty-demand surpasses the availability*

The Brahmaputra river basin has one of the best hydro-power and renewable energy potential in the region. Yet, it is not free from the energy poverty-demand surpasses the availability. Agricultural energy demand is significantly low in the basin, compared to the Indus basin, owing to the traditional farm and irrigation practices. However, many households in the region still do not have access to the modern energy. The respondents feel renewable energy could be a potential solution for the energy poverty. There has been significant push from the respective governments in recent years. But economy of scale is missing and cost remains unaffordable.

Secondly, some respondents believe that tapping the hydro potential and cross-border trade could be a potential solution. It will not only address the energy crisis in the region, but also generate surplus energy for other areas and generate several economic benefits. However, they are also aware of the political economy constraints that hinder investment in hydro projects and laying of transmission lines.

Proposed SAARC grid, if materialises, would be instrumental to ensure energy security in the basin and beyond. Some respondents also raised concern over environmental and social consequences of big hydro power plants. Those respondents argued small hydro projects could be a win-win situation, without much social and environmental resistance. Finally, initiating political dialogues between the countries on energy trade agreements, as respondents pointed out, would be crucial to bring in much needed political will for regional cooperation.

*Proposed SAARC grid, if materialises, would be instrumental to ensure energy security in the basin and beyond*

Brahmaputra river basin is largely relying on traditional agricultural practices, although some of the modern agricultural inputs (especially, high yielding varieties, chemical fertilisers and pesticides) are being adopted in few pockets. However, the region is not free from agricultural vulnerabilities. Representing the variations in water access and problems, the challenges for

sustaining agriculture in the region varies from location to location. On the positive side, Bhutan is moving progressively towards fully-organic country by 2020.

The major challenge in the country is the hilly terrain that restricts farm mechanisation and agricultural intensification. Poor quality of soil, with low level of nitrogen and phosphorous content, coupled with poor irrigation infrastructure compromises agricultural productivity in the country. The farms are particularly vulnerable to diseases and wildlife destruction. Though a major part of the population is engaged in agricultural activities, the country is still dependent on food imports. Some respondents also pointed out that stringent environmental law in the country sometimes hamper agricultural growth.

*In Bangladesh, the farmers have tried to adopt high yielding varieties which are very much resource intensive and requires modern inputs. As result, the major challenge in the region is access to adequate inputs, including on time irrigation water*

The North-Eastern parts of India also largely follow organic methods. Even after efforts by state governments to introduce mechanisation, the result has not been satisfactory. Agriculture in the region is plagued by poor infrastructure and irrigation facility. There has not been adequate emphasis and valuation of organically produced food items, which could have tapped a better market price.

Consequently, the farm income has been on constant decline and farmers are not adequately incentivised to sustain the occupation. In Bangladesh, the farmers have tried to adopt high yielding varieties which are very much resource intensive and requires modern inputs. As result, the major challenge in the region is access to adequate inputs, including on time irrigation water.

The region also shows some general trends. There has not been adequate effort put to diversify agricultural activity to make farming and farmers resilient. Consequently, people are shifting toward non-agricultural activities, which may reduce agricultural activity in future compromising food security in the region. Owing to the terrain and lack of accessibility, agricultural input and output value chain is fragile in the region. Farmers neither get adequate access to required inputs, nor have proper access to market for their products.

## Chapter 4

# Challenges and Opportunities

South Asia, especially the five countries in consideration for this study, houses about a quarter of the global population, with much limited share of the resources. The available resource base is further stressed with rapid rise in population and also by the effects of climate change. Consequently, water, energy and food security is emerging as a major challenge for the subcontinent and will subsequently affect achievement of the post-2015 development agenda.

Looking into perception of key stakeholders in the three major river basins of the subcontinent, in this study, we have tried to analyse the current state affairs across the three domains. While the macro challenges remain same across the basins, predominantly around access and equity, micro challenges vary not only between basins but also between locations.

*South Asia, especially the five countries in consideration for this study, houses about a quarter of the global population, with much limited share of the resources. The available resource base is further stressed with rapid rise in population and also by the effects of climate change*

As observed, water is the most vulnerable resource. Across the three basins, there is a trend of declining access to water, especially irrigation water. Changes and emergent unreliability in rainfall patterns have affected rainfed agriculture, forcing the farmers to make alternative arrangements. Most regions are experiencing delayed onset of monsoon and concentrated rainfall. Consequently, water flow in the rivers is also affected, compromising timely access to water. Another effect of the erratic monsoon is higher instances of water related extreme events like flood and drought felt across the basins.

Another reason for increasing failure of surface water sources is poor management of the canal systems and overuse of water at the head of the canals. While the rise in temperature has fuelled greater demand for water, erratic monsoon and failing surface water systems have pushed the farmers in region towards groundwater dependence. As observed in the study, groundwater dependence and withdrawal has increased significantly in the recent years. Especially, in case of Indus basin, the water tables have already reached a stress level.

*While there is increased emphasis on household access to energy in recent years, agricultural access to energy is somewhat ignored and/or compromised*

Similarly, South Asia is one of the most energy access deprived regions of the world. The subcontinent houses about a third of the global population without access to electricity. However, energy access scenario has incremental improvements in recent years. But the progress on access to clean energy is far from desired and if continued at business as usual speed it will compromise achievement of the post-2015 development goals. While there is increased emphasis on household access to energy in recent years, agricultural access to energy is somewhat ignored and/or compromised.

On the contrary, agricultural demand for energy has been steadily increasing owing to swelling dependence on groundwater in the sector. Interestingly, limits of grid based access to electricity have spurred experiments with various off-grid models in the region. But the high cost of renewable energy technologies remains a challenge for scalability.

Although food production has seen some improvement in the recent past, the subcontinent has a significant undernourished and food insecure population. With the rising resource stress and extreme weather events, food production in the region is expected to decline while the population will see a 2 percent annual rise demanding more food. Paradoxically, the subcontinent is experiencing an agrarian stress, which may decline agricultural activity and food production. The challenges faced by the sector largely vary across locations. Yet, at macro level, while farming is becoming input intensive, agricultural income has seen a constant decline. At the same time, available resource base for the sector, especially water and energy, is also declining. The situation is further aggravated by a fragile value-chain for the sector. As discussed earlier, the challenge for South Asia's food security is largely a management challenge, where food produced does not reach the demand area. On the other hand, in many locations, farmers even do not receive quality inputs required for agriculture.

*While agriculture is the major source of livelihood in the region, sustainability of agricultural practices has hardly received any policy attention across the countries*

These vital resources are under stress in the subcontinent, owing to population growth, urbanisation, industrialisation, and more recently for the changes in climate. The challenges are big, but not unsurmountable. Local authorities and concerned stakeholders are well aware of the challenges and possible consequences. Many of the stakeholders even aware of solutions required to overcome the challenges. However, required action is hardly taken.

While water is one of the most stressed resources, there is hardly any regulation governing water demand and usage. In fact, in most cases, there is no water policy. In case of energy, there is gradual progress in access, but not at a desired level. Alternative models of energy access, based on off-grid renewable energy, are being

*The water challenge can be addressed by better managing the water resources and ensuring rationed and equitable access to all through better governance mechanisms*

tried out. But affordability and thus scalability is limited. On the other hand, while agriculture is the major source of livelihood in the region, sustainability of agricultural practices has hardly received any policy attention across the countries.

As pointed by the respondents, all these problems have a solution. The water challenge can be addressed by better managing the water resources and ensuring rationed and equitable access to all through better governance mechanisms. At the same time, South Asia as a whole has abundance of water resources that can easily cater the demand. Water sharing across nations and subnational units need to be improved to achieve the objective. Similarly, the energy challenge can be addressed through regional cooperation. Tapping the hydro power potentials (especially in Nepal and Bhutan) and trading the power through a proposed regional power grid would be the most ideal solution for region's power crisis.

Though there have been some development in recent years, the prospects appear bleak, at least from stakeholders perspective. Off-grid renewable energy could also address the energy challenges, if it becomes affordable. Considering the cost of renewable energy, scaling up would require state subvention. On the other side, technology sharing and trading across the countries could also help in upscaling.

Much of the challenges in agriculture could also be addressed through a regional agricultural value chain. It will not only provide access to agricultural inputs, but also provide better market for agricultural products, and thus, will contribute to achievement of food security goals. In addition, the countries also need to provide better infrastructure facility as well as take measures to make farmers resilient to extreme weather events.

In most cases, the stakeholders expect the state to deliver on these accounts. States need to act on two fronts: first, developing the domestic infrastructure and ensuring sustainable consumption through better regulation; second, engaging with neighbours for regional sharing of resources to ensure supply security and equitable access. Private participation, however, is limited across the domains and mostly localised. Although stakeholders do not have high expectations, private players can complement the state initiatives through greater investment and providing addition inputs and infrastructure facilities.

Development agencies and CSOs have a strong role to play in local demonstration of sustainable practices, local capacity building and awareness. CSOs have been already playing a role in creating evidence and raising bottom up voice for regional cooperation. All the agencies and actors need to consolidate their

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intervention for faster achievement of the shared goals of water, energy and food security. As called by the UN Secretary General, all the actors, both state and non-state, need to come together for achievement of human wellbeing, transformative economy and the broader post-2015 development agenda. As claimed by him, South-South cooperation would play a strong role in this path.



## References

- Bandyopadhyay, J. (2007). "Water Systems Management in South Asia: Need for a Research Framework." *Economic and Political Weekly* 42(10): 863+865-887.
- Baqai, H. (2005). "Water-related Issues in South Asia: Conflicts in the Making." *Pakistan Horizon* 58(3): 77-88.
- Biggs, E. M., et al. (2013). "Plenty of water, not enough strategy How inadequate accessibility, poor governance and a volatile government can tip the balance against ensuring water security: The case of Nepal." *Environmental Science & Policy* 33(2013): 388-394.
- Bizikova, L., et al. (2013). *The Water–Energy–Food Security Nexus: Towards a practical planning and decision-support framework for landscape investment and risk management.* Winnipeg, Manitoba, Canada, The International Institute for Sustainable Development.
- Chaudhury, A. B. R. (2009). "The Energy Crisis and the South Asian Security: An Indian Perspective." *India Quarterly: A Journal of International Affairs* 65(2): 137-151.
- Crow, B. and N. Singh (2000). "Impediments and Innovation in International Rivers: The Waters of South Asia." *World Development* 28(11): 1907-1925.
- Dhungel, K. R. (2008). "Regional Energy Trade in South Asia: Problems and Prospects." *South Asia Economic Journal* 9(1): 173-193.
- Food and Agriculture Organization (2014). *The Water-Energy-Food Nexus: A new approach in support of food security and sustainable agriculture.* Rome, United Nations
- George, P. S. (1994). "Food Security in South Asia: Performance and Prospects." *Economic and Political Weekly* 29(18): 1092-1094.
- Global Water Partnership (2012). *Increasing water security – a development imperative. Perspective paper.* Stockholm, Sweden, GWP.

- Hoff, H. (2011). Understanding the Nexus. Background Paper for the Bonn 2011 Conference. The Water, Energy and Food Security Nexus. Stockholm, Stockholm Environment Institute.
- Hossain, M. (2014). "Building Responsible Social Protection in South Asia: India's Food Security Act as a New Direction." *South Asia Research* 34(2): 133-153.
- Iqbal, M. M., et al. (2009). Assessment of Food and water security in South Asia under Changing Scenario using crop Simulation and Water Management Models and Identification of Appropriate Strategies to Meet Future Demands, Asia-Pacific Network for Global Change Research.
- John, W. (2011). Water Security in South Asia: Issues and Policy Recommendations. O. R. Foundation. New Delhi, ORF. 26.
- Kessides, I. N. (2013). "Chaos in power: Pakistan's electricity crisis." *Energy Policy* 55(2013): 271-285.
- Khalid, I., et al. (2014). "Water Scarcity in South Asia: A Potential Conflict of Future Decades." *Journal of Political Studies* 21(1): 259-280.
- Kugelman, M. (2011). Safeguarding South Asia's water security. Seminar. October.
- Kurian, A. L. and C. Vinodan (2013). "Energy Security: A Multivariate Analysis of Emerging Trends and Implications for South Asia." *India Quarterly: A Journal of International Affairs* 69(4): 383-400.
- Lal, R. (2013). "Food security in a changing climate." *Eco-hydrology & Hydrobiology* 13(2013): 8-21.
- Lele, U., et al. (2013). "Good Governance for food, water and energy security." *Aquatic Procedia* 1(2013): 44-63.
- Mittal, S. and D. Sethi (2009). Food Security in South Asia: Issues and Opportunities. New Delhi, Indian Council for Research on International Economic Relations.
- Pandey, R. (2006). "How Can India Achieve Energy Security?" *Economic and Political Weekly* 44(4): 303-306.
- Price, G. (2014). Attitudes to Water in South Asia. London, UK, Chatham House Report.
- Rasul, G. (2010). "The Role of the Himalayan Mountain Systems in Food Security and Agricultural Sustainability in South Asia." *International Journal of Rural Management* 6(1): 95-116.

- Rasul, G. (2014). "Food, water, and energy security in South Asia: A nexus perspective from the Hindu Kush Himalayan region." *Environmental Science & Policy* 39(May): 35-48.
- Sankar, T. L., et al. (2000). *Regional Energy Security for South Asia*, USAID.
- Sekhar, C. S. C. and Y. Bhatt (2012). *Food Security in South Asia- Prospects For Regional Integration*. New Delhi, Institute of Economic Growth. RVC 6.
- Shah, T. and M. Giordan (2013). "Himalayan Water Security: A South Asian Perspective." *Asia policy* 16(July): 26-31.
- Shah, T., et al. (2011). *Climate Change, Food and Water Security in South Asia: Critical Issues and Cooperative Strategies in an Age of Increased Risk and Uncertainty*. A Global Water Partnership (GWP) and International Water Management Institute (IWMI) Workshop, 23-25 February 2011, Colombo, Sri Lanka. Stockholm, Sweden, Global Water Partnership.
- Singh, B. K. (2013). "South Asia energy security: Challenges and Opportunities." *Energy Policy* 63(2013): 458–468.
- Srivastava, L. and N. Misra (2007). "Promoting regional energy co-operation in South Asia." *Energy Policy* 35(2007): 3360–3368.
- Tripathi, N. K. (2011). "Scarcity Dilemma as Security Dilemma: Geopolitics of Water Governance in South Asia." *Economic & Political Weekly XLVI(7)*: 67-72.
- UNESCO (2014). *World Water Development Report: Water and Energy*. Paris, France, UNESCO, United Nations. 1.
- United Nations Economic and Social Commission for Asia and the Pacific (2013). *Water, Food and Energy Nexus in Asia and the Pacific*, United Nations publication.
- Wickramasinghe, U. (2001). "Energy for Economic Development in South Asia: Present Status, Future Requirements, and Potential for Regional Cooperation? ." *South Asia Economic Journal* 2(2): 221-251.
- World Bank (2007). *World Development Report 2008: Agriculture for Development*, the International Bank for Reconstruction and Development. Washington DC 20433, The World Bank.
- World Economic Forum (2011). *Global risks 2011*. 6th Edition. Cologne/Geneva., World Economic Forum.



## About CUTS

With its headquarter in Jaipur, India; Regional Centres, in Lusaka, Nairobi, Accra and Hanoi; and an International Centre in Geneva, CUTS International has three verticals: Trade, Regulations and Governance. Through policy- and action-research, advocacy, networking and capacity building, it has established its relevance and impact in several policy-making areas and among the larger development community.

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### CUTS Centre for International Trade, Economics & Environment

#### Mission

Pursuing economic equity and social justice within and across borders by persuading governments and empowering people

#### Goals

Enable and empower representatives of the civil society, from developing countries in particular, to articulate and advocate on the relevant issues at the appropriate fora

Create a questioning society through empowerment of civil society representatives thus ensuring transparency and accountability in the system

Promote equity between and among the developed and developing countries through well-argued research and advocacy on the emerging and relevant issues

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### About the Study

CUTS International is a portfolio partner of Sustainable Development Investment Portfolio (SDIP), a regional programme for South Asia developed by DFAT (Department of Foreign Affairs and Trade), Australia. The SDIP focuses on the three major Himalayan river basins, the Indus, Ganges and Brahmaputra, which span North-East India, North-East Pakistan and the bordering countries of Bangladesh, Nepal and Bhutan. The overall goal of SDIP is to increase water, food and energy security in South Asia to facilitate economic growth and improve livelihoods, targeting the poorest and most vulnerable, particularly women and girls. The specific objectives of the program are transboundary water resource management, increased agricultural productivity through the adoption of sustainable agricultural practices and better developed value-added market chains and increased access to and cooperation on energy. SDIP is based on a 12-year design with three phases.

Under SDIP, CUTS International has extended its network across the three basins with 9 strategic partners to facilitate and work towards enhancing the value of SDIP by linking its interventions with key actors and stakeholders in the region through policy research and advocacy. This study was conducted to identify, understand and analyse the key issues and perceptions of various stakeholders around water, energy and agriculture and the possible solutions from their perspective.

*For details, please visit: <http://www.cuts-citee.org/SDIP/>*