DELHI POLICY GROUP

Advancing India's Rise as a Leading Power

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Roundtable on "Advancing the BBIN Agenda: Energy and Water"

India Habitat Center| New Delhi | November 10-11, 2016

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DPG Roundtable on
Advancing the BBIN Agenda: Energy and Water Cooperation
November 10-11, 2016

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Director Research, Bangladesh Institute of International and Strategic Studies

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Presentation by Dr. Lam Dorji,
Former Executive Director of the Royal Society for Protection of Nature and Managing Consultant, Centre for Environment and Social studies

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"India's Perspective on BBIN Water Cooperation"
Presentation by Prof. Chandan Mahanta,
IIT Guwahati, Assam

"Nepal's Perspective on BBIN Water Cooperation"
Presentation by Mr. Gyanendra Lal Pradhan,
Hydropower Specialist and Executive Chairman Hydro Solutions and Chairman, Energy Committee, Federation of Nepal's Chamber of Commerce and Industries

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Abstract of Proceedings and Power Point Presentations

The Delhi Policy Group (DPG) in partnership with the Asia Foundation organized two roundtable discussions on "Advancing BBIN (Bangladesh-Bhutan-India-Nepal) Energy and Water Cooperation" on November10-11, 2016. Eight distinguished participants, one each from Nepal, Bhutan, Bangladesh and India participated and presented at each of the round-tables. The discussion on BBIN Energy and Water addressed concerns and issues from the perspective of each of the four countries; and brought out ideas and recommendations to advance this cooperation.

The Roundtable on BBIN Energy opened with a keynote by Mr. Sudhakar Dalela, Joint Secretary North at Ministry of External Affairs. Mr. Dalela emphasized that the first step towards a successful implementation of the BBIN cooperation is to understand the fundamental framework. Implementation of the basic framework can be a useful step to foster cooperation between the BBIN nations. While speaking on the BBIN Energy cooperation initiative, Mr. Dalela highlighted that a smart way to optimize energy consumption in the region is to encourage efficient use of multimodal transportation with a major emphasis on use of waterways.

The BBIN roundtable on energy conducted an insightful discussion on the opportunities and impediments of this cooperation. The experts deliberated upon the issues on ground and came up with practical recommendations. The experts agreed that cumulative impact of all developments under the BBIN framework must be studied in a holistic manner, as some of the data recorded from isolated developments give an unrealistic picture. The chair for the session highlighted that recognizing the intrinsic link between energy and climate is important. In terms of energy trade, standardization of regulations among the four nations was important to ensure smooth energy trade; there is also an urgent need to look at the actual power transmission agreements in order to iron out problems related to transmission lines.

The Roundtable on BBIN Water was opened with a keynote address by Mr. T.S. Mehra, Commissioner, Bangladesh and Bhutan Division, Ministry of Water Resources.

Mr. Mehra underlined that water cooperation globally has been a complex issue, however with respect to the four BBIN Nations, and due to the existing cordial relationship, water cooperation should be relatively easy within the BBIN nations. He emphasized that the need of the hour is to devise a system that works well for

all the four nations and can share the existing water resources in an adequate manner.

This session conducted an in-depth discussion on the hurdles and prospects of cooperation in water sharing and management between the BBIN Nations. Experts agreed that major impediments can be overcome by ensuring efficient management of the Ganga-Brahmaputra-Meghna Basin system. In the water management plan, water storage projects should be prioritized.

Programme

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DPG Roundtable on Advancing BBIN Energy and Water Cooperation

Venue: Willow Room, India Habitat Centre
Lodhi Road, New Delhi
10th-11th November 2016

Programme

Rountable I: Advancing BBIN Energy Cooperation

Thursday, 10th November 2016

Venue: Willow Hall, India Habitat Centre

1000-1300 hours

1000-1005 (5 mins)	Welcome: Ambassador Hemant Krishan Singh, Director General, Delhi Policy Group
1005-1010 (5 mins)	Opening Remarks: Ambassador Rajeet Mitter, Chair for Energy Session
1010-1030 (20 mins)	Keynote Speech by Mr. Sudhakar Dalela, Joint Secretary North, Ministry of External Affairs
1030-1100 (30 mins)	Bangladesh's perspective on BBIN Energy Cooperation Speaker: Dr. Enamul Haque, Professor, East West University, Dhaka
1100-1110 (10 mins)	Discussant: Mr. Debajit Palit, Associate Director, The Energy and Resource Institute (TERI)
1110-1130 (20 mins)	Discussion and Q&A
1130-1145 (15 mins)	Tea Break

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1145-1215 (30 mins)	Bhutan's perspective on BBIN Energy Cooperation Speaker: Lyonpo Khandu Wangchuk, Member, National Assembly, Bhutan
1215-1225 (10 mins)	Discussant: Ms. Lydia Powell, Head, Centre for Resource Management, Observer Research Foundation
1225-1300 (35 mins)	Discussion and Q&A
1300-1400 (60 mins)	**Lunch**
1400-1430 (30 mins)	**India's perspective on BBIN Energy Cooperation** *Speaker: Ms. Lydia Powell, Head, Centre for Resource Management, Observer Research Foundation*
1430-1440 (10 mins)	Discussant: Amb. Rajeet Mitter, Chair, Energy Session
1440-1500 (20 mins)	Discussion and Q&A
1500-1515 (15 mins)	**Tea Break**
1515-1545 (30 mins)	**Nepal's perspective on BBIN Energy Cooperation** *Speaker: Mr. Govind Raj Pokharel, Former Vice Chairman National Planning Commission & Executive Director, Alternative Energy Promotions Centre*
1545-1555 (10 mins)	Discussant: Mr. Debajit Palit, Associate Director, The Energy and Resource Institute (TERI)
1555-1615 (20 mins)	Discussion and Q&A

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1615 -1730 hours

1615-1700 (45 mins)	*Additional Comments/ Open Discussion*
1700-1730 (30 mins)	Concluding Session

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Roundtable II: Advancing BBIN Water Cooperation

Friday 11th November 2016

Venue: Willow Hall, India Habitat Centre

1000-1300 hours

1000-1005 (5 mins)	Welcome: Ambassador Biren Nanda, Senior Fellow, Delhi Policy Group
1005-1010 (5 mins)	Opening Remarks: Ambassador Sudhir Vyas, Chair for Water Session
1010-1030 (20 mins)	Keynote speech by Mr. T.S. Mehra, Commissioner (B&B), Ministry of Water Resources, River Development and Ganga Rejuvenation
1030-1100) (30 mins)	**Bangladesh's Perspective on BBIN Water Cooperation** *Speaker: Dr. Shaheen Afroze, Director, Research, Bangladesh Institute of International and Strategic Studies (BIISS)*
1100-1110 (10 mins)	Discussant: Mr.Mirza Zulfiqur Rahman, Senior Research Fellow, IIT Guwahati
1110-1130 (20 mins)	Discussion and Q&A
1130-1145 (15 mins)	**Tea Break**
1145-1215 (30 mins)	**Bhutan's Perspective on BBIN Water Cooperation** *Speaker: Mr. Lam Dorji, Former Executive Director of the Royal Society for Protection of Nature & Managing Consultant, Centre for Environment and Social Studies*

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1215-1225 (10 mins)	Discussant: Ms.Nimmi Kurian, Associate Professor, Centre for Policy Research
1225-1300 (35 mins)	Discussion and Q&A
1300-1400 (60 mins)	Lunch
1400-1430 (30 mins)	**India's Perspective on BBIN Water Cooperation** *Speaker: Prof. Chandan Mahanta, Professor, Indian Institute of Technology, Guwahati, Assam*
1430-1440 (10 mins)	Discussant: Mr.Mirza Zulfiqur Rahman, Senior Research Fellow, IIT Guwahati, Assam
1440-1500 (40 mins)	Discussion and Q&A
1500-1515 (15 minutes)	**Tea Break**
1515-1545 (30 mins)	**Nepal's Perspective on BBIN Water Cooperation** *Speaker: Mr. Gyanendra Lal Pradhan, Hydropower Specialist and Executive Chairman Hydro Solutions and Chairman, Energy Committee, Federation of Nepal's Chamber of Commerce and Industries*
1545-1555 (10 mins)	Discussant: Ms.Nimmi Kurian, Associate Professor, Centre for Policy Research
1555-1615 (20 mins)	Discussion and Q&A

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1615-1730 hours

1615-1700 (45 mins)	Additional Comment/ Open Discussion.
1700-1730 (30 mins)	Concluding Session

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Summary Note:
Advancing BBIN Cooperation
by

Tanzoom Ahmed and Shreyas Deshmukh,
Research Associates, DPG

Summary of Roundtable on BBIN Energy and Water Cooperation

Background:

1. The BBIN Region has a natural potential of producing 200,000 Megawatts of power. The four BBIN Nations have distinct strengths and weaknesses, Bangladesh has Gas, Bhutan and Nepal are rich in Hydropower and India has a mix of energy resources, which are fossil fuels, gas, and considerable renewable resources.

2. The countries of the region share numerous rivers and are part of the same river basin systems and one hydrological landscape.

3. Water is a major driver of regional interaction. Water is intrinsically connected to livelihood issues. There is need to cooperate on water utilization to grow prosperity and share it and ensure ecological stability of the sub-region.

4. While there are vast water reserves in the region, cooperation will be essential for its efficient usage. Consumption of water must be related to sustainability. A large proportion of the groundwater in the region has been found to be polluted and is unfit for consumption. This indicates the lack of proper water management in this region.

5. Bilateral energy ties already exist between the four nations. Bhutan-India share a successful bilateral energy model, which can be emulated. Power-lines carry electricity from India to Bangladesh and new ones are being constructed between India and Nepal. Gas and oil pipelines are also on the anvil.

6. The countries of the region have plans to tap into alternative source of energy such as solar energy and optimize the utilization of the existing energy resources.

7. There is similar water usage in all the 4 countries. Regional water cooperation is required to ensure comprehensive river basin management and best address issues related to irrigation, flood control and forecasting, river transportation, river infrastructure, hydropower, environment protection

and capacity building. There is need to manage regional water resources with inputs from all countries.

8. However, a paradigm shift is needed in order to ensure efficient management of interlinked Water and Energy resources.

9. The BBIN Cooperation framework adds additional value and will enable the region to best realize its potential through a systemic approach optimizing regional benefit in place of limited single country benefit. Sub-regional cooperation on basis of mutual advantage and respect of individual sovereignty is the key for this cooperation. This cooperation should be engendered at a pace comfortable to all.

10. Given the link between energy consumption and climate, this cooperation will also help in protecting regional environment. Cumulative impacts for all developments have to be studied, because when seen as isolated developments the data collected often gives a false impression

11. Some Common BBIN projects need to be identified. There should be consultation with all stakeholders to deal with social and regional issues. Political will be the most important factor to take these initiatives forward.

Energy:

1. There is an explosive growth of demand for power in the sub-region and a need to plan for it. Energy security plays an important role in the development of countries. Cooperation should be promoted to ensure better production, evacuation and transmission of power and collation of data.

2. Petroleum and Electricity are the Major energy consumption sources in BBIN countries. Despite large availability of natural sources such as hydroelectricity and solar energy BBIN countries are still energy deficit countries- Bangladesh 25%, India 10% and Nepal 9% and these countries are still dependent on traditional fuel- Bangladesh 55%, India 25%, Bhutan 90% and Nepal 85%.

3. The BBIN Energy Framework should aim to use the existing energy resources of the four nations and devise a plan to maximize it. BBIN cooperation should be based on a step by step economic approach. There is a need to pool power resources and develop projects on a regional basis. This will help offset dependence on fossil fuel.

4. Government's role must be farsighted, and political will plays a most important role in ensuring implementation of the Energy projects

5. In promoting regional cooperation, it is important to set common goals and integrate the markets. Standardization of regulations is also important to ensure seamless transactions. Energy integration will assist countries like Bangladesh which depend on a single source of energy. Nepal and Bhutan have small markets in comparison to their generation capacity. Hence the BBIN region requires a regional grid.

6. Simplification of electricity trade is necessary to make it more efficient. Electricity trade framework needs to cater to the needs of different consumers. Hence the regulatory framework needs to take this into account. It also needs to address issues with changing energy demands and distinct pricing.

7. Standardization of regulation is required for all electricity purchase agreements

8. It is important to note that Markets do not like borders but nations do, hence there is a need to overcome this dilemma.

9. Affordability of power has been an issue that has been long discussed; a solution to bring down costs must be worked out.

10. In South Asia peak demand market is separate than regular market.

11. Development of energy production has three components: proactive financing, technological schemes, and readymade markets. Hence it is important to address how each of the components can be incorporated.

12. Financing is often an issue when it comes to hydropower projects. Short Term financing is one way to ensure capital flow for Energy development projects.

13. Resources are required to produce energy but more importantly it is necessary to have facilities to evacuate that power. This faces regulatory and navigational problems.

14. Power agreements should include all the costs of producing energy and they should clarify specifically the territorial control over the power plant.

15. The following aspects of energy trade in BBIN countries needs to be considered prior to start working on the projects.

    a. Hardware and Software connectivity
    b. Energy inter-linkages
    c. Removal of subsidy from energy infrastructure
    d. Joint investment in intra-development projects- this will require removal of subsidies in development of infrastructure.
    e. Developments of navigation routes to transport petroleum products across BBIN countries

16. Institutional capacity needs to be developed to enable cross-country private trading of energy, development of spot markets learning from the West African experience and development of primary energy markets learning from the examples of Rotterdam and Singapore.

17. The region must look at a model to increase utilization of solar and alternative forms of energy and gradually decrease the dependence on coal consumption. Renewable energy is the future for the Energy Industry.

18. A model to emulate is Bangladesh's model of Solar Home Systems which is a market based approach. Bangladesh has effectively converted 4 million houses into Solar powered homes. It is the world largest solar energy program. 15 percent of Bangladeshi population uses solar energy. However

much still needs to be done as still 6mn people in Bangladesh do not have access to electricity. The other BBIN Countries could learn from this example.

19. Countries like Nepal and Bhutan depend on Biomass Fuel, which is another source of energy that can be developed.

20. Bhutan, learning from the experiences of other BBIN countries is through the utilization of MSME projects minimizing the dependency on mega projects and increasing energy efficiency.

21. In the International Solar alliance there is need to create a buyers alliance where BBIN can take lead.

22. There is a need to develop energy arteries. India is planning to construct an oil pipeline to Nepal and another from Assam which has excess refining capacity to Bangladesh. Arunachal Pradesh- Assam- Bhutan electricity grid could be considered. Bangladesh could play an important role in energy transmission given that the chicken's neck corridor cannot take much more transmission lines/pipelines.

23. There is a need to explore transport of fuel by river transport which will be much cheaper.

24. With the maritime boundary between Bangladesh and India having been settled there is a good prospect of developing offshore gas reserves.

25. There is also need to recognize the intrinsic link between Energy and Climate. A way to tackle reginal Carbon Offsets should be looked at. Common regional building energy rating system could be developed. Cooperation on promotion of energy conservation and efficiency would be useful.

26. Bhutan can sell its green credits earned by its hydroelectricity projects.

Water:

1. Cross cutting impact of river water utilization is a major driver of the sub-regional cooperation. Bhutan is the highest per capita water country in the

world. The BBIN countries are among the world's top ten water rich countries, but about 70 percent of the water systems in this region are polluted. Comprehensive water resource mechanism and transboundary water resource management is imperative for development

2. The main reason behind pollution and inefficient use of water resources is poor management of the water systems, a paradigm shift is needed in the way things are approached. Sustainable management techniques need to be adopted.

3. Importance of ensuring that e-flows assessments (EFAs) are carried out for effective management of BBIN water resources and mainstreamed into a comprehensive planning process - and this will need to be done on a cumulative, basin-wide approach where BBIN forums can play a vital role.

4. Himalayan integrated assessment plan should be carried out with the consensus of all the countries in the Himalayan region to ensure energy and water security, as it is the perennial fresh water source for most rivers in the subcontinent.

5. Communities, which depend on the river systems for earning a livelihood, should be allowed to participate in decision-making about the conservation and use of the water bodies. While dealing on the water projects we need to focus on common people's livelihood issues. Best Practices should be learnt and a way forward should be sought. Confidence building measures should be a priority to build the trust factor.

6. In terms of water management techniques it is important, a multidisciplinary approach needs to be considered. The BBIN Region has vast resources of water, and some of the resources are yet to be tapped. Due to overall lack of cooperation and coordination most of the water resources are wasted.

7. Trans boundary water management is important is because water is an issue of conflict as it is a critical component and water has also been continuously mismanaged.

8. Water sharing has always been a complex issue all over the world, however, considering the relatively good ties between the BBIN countries, water sharing should be relatively easier

9. Water sharing and management should also involve the idea of hydro ecology

10. Water Systems in BBIN Nations are relatively similar, and hence a common way to manage the overall system can be adopted

11. In this part of the sub-continent, there also exists a pattern where water issues of one country can be addressed with some help from the other country, for an instance, Bhutan and Nepal have a greater abundance of water and requires less water for irrigation as compared to India and Bangladesh.

12. The resources and avenues of the four nations are closely connected, and hence it can be further explored through open dialogue and track discussions.

13. The dialogue conducted by Joint Working Groups could take the discussions forward, and can come up with a system that works well for all the four countries. It should look at basin wide resource management and develop best practices such as developed by Danube, Mekong etc. cooperation models.

14. There are many aspects of Water Resources, which includes irrigation facilities, storage projects, moonsoon water harvesting and interlinking the water resources to optimise usage, and transferring water in a correct manner.

15. One of the major hurdles while addressing water issues can be met by efficient management of the Ganga-Brahmaputra-Meghana Basin.

16. Flood control is another important aspect of the entire water management system, so that accurate flood predictions can be made. Such predictions can help give enough lead time and mitigate destructions. India assists in running hydrological stations in Nepal and Bhutan.

17. In terms of Navigation system, Bangladesh has a well-developed system. India could learn and emulate this model. Waterways will assist in the development of landlocked countries of Bhutan and Nepal

18. Water storage should be done in an efficent manner to compensate for water shortage during lean seasons. Countries providing storage facilities should be compensated. In addition, upper riparian should be assisted in maintaining forest cover.

19. Water sharing agreement is critical mainly for the countries that are the lower riparian.

20. There is optimism that Teesta Agreement will materialise and address the issues of water shortage with Bangladesh and India

21. Drought is an area that needs immediate attention. Basin wide management can be important in addressing such water problems

22. Water is the commodity shared between the countries however in India, States also have constitutional right to participate in the decision making process on the water issues, hence center-state relations needs to be studied carefully from this perspective.

23. Water landscape needs to be considered as a one unit in the sub-region.

24. The Government of Bhutan identifies integrated water resources management (IWRM) as a cross- cutting objective of the environment sector in the Tenth (2008-2013) and draft Eleventh (2014-2019) Five-Year Plans.

25. The payment for ecosystem services is essential where financial market do not consider damage to the ecosystem. To calculate the cost we need to differentiate between intrinsic value and extrinsic value of nature.

26. Further we need to strengthen intangible values which reduces cost of protection of natural resources and we can incentivising on them.

27. BBIN should look beyond the obvious exploit the potential of water resources, for example- issue of sedimentation in different hydroelectricity power projects, where sedimentation can be used for the production of ceramic glass.

28. Bhutan and Nepal, upstream countries do not have sedimentation problem as well they cannot leverage on it as well but downstream can establish ceramic industry nearby river systems.

29. Ground water is the source of fresh drinking water for India and Bangladesh and it originates from Himalayan system. Hence we need to protect that ecosystem to maintain continuous flow of underground river system.

30. We need integrated control room for river management under BBIN initiative and this can be established based on Mekong River Commission.

31. The role of China in BBIN water Cooperation will need to be considered in:

    a. Ganga-Bramhaputra-Meghna management
    b. BBIN-C
    c. Mutual benefit approach

32. Sensors should be installed on all the bridges built on BBIN river system to generate data which will be useful to exploit their actual potential.

33. India should take riparian leadership because it is placed at both sides of the river water geography.

34. A BBIN centre for Brahmaputra should be created. This will be useful in drawing China into the discussions.

35. South Asia should follow Canadian and American experiences in water management, and start building dams not only for power project but water harvesting and conservation.

Recommendations

1. Study economic potential of hydro projects and conduct conceptual and cost benefit analysis of the projects. this will give confidence to the governments for investments.

2. Joint studies needs to be done to find out areas of cooperation

3. Need to introduce academic discourse vis-a-vis the projects and possible areas of cooperation between BBIN countries

4. Cross border transmission lines needs to be established.

5. To understand total potential of demand and supply sub regional study needs to be conducted

6. Joint early warning system needs to be established.

7. JWC at ministerial level should be established to be supported by expert groups.

8. Need to start working on concrete projects to show benefits to the people.

9. Water ways for transportation in BBIN and the MVA could be extended suitably to river transportation.

10. Mountain forum needs to be established.

11. Capacity building sensitization of communities should be conducted.

12. BBIN parliamentarian forum on water issues will provide political support.

Bangladesh's Perspective on BBIN Energy Cooperation

Presentation

by

Dr. Enamul Haque

Professor, East West University, Dhaka

- Abstract "Presentation on Bangladesh Energy Perspective" by Dr. A.K. Enamul Haque

BBIN countries are diverse in their sources of energy. Besides the traditional bio-mass fuel, major sources of primary energy in these countries are: for Bangladesh it is Natural Gas and Petroleum, for India it is Coal and Petroleum; for Nepal it is Petroleum, Hydro and Coal; and for Bhutan it is Petroleum and Hydro. Currently, in Electricity all of the BBIN countries are deficit; in Natural gas, both Bangladesh and India are deficit; whereas in hydro, Nepal and Bhutan are surplus.

Current approach to energy trade is mostly bilateral with India-Nepal, India-Bhutan and India-Bangladesh agreements in terms of petroleum, and electricity. Future outlook for all the countries shows that if the economies of these countries continue to grow at the current rate, the overall demand for energy will exceed that of supply and hence the whole region will be in deficit. This is similar to other regions of the world. This requires a closer cooperation between BBIN nations to ensure that the global energy market is more closely connected with the region. Without energy the regional growth will be a challenge. At the same time, since all BBIN countries share a common ecosystem, common cultural and linguistic heritage, and common border, they also need to cooperate with each other to develop a common strategy against the deficit without which it will be difficult for all of them to sustain growth. This is also a region where 17% of world population lives on 7% land (of the world) and produce only 6% of the world GDP. This means that to alleviate poverty these countries need to deal with energy deficiency.

There are few strategies which could provide a solution to the energy problems of BBIN countries. These are: a) develop inter-linkages between them to trade electricity; b) develop navigation facilities to transport petroleum products at low cost; c) synchronize energy policies including providing subsidies to ensure that a market for energy is developed in the region; d) develop joint investment strategies on energy. In addition, BBIN countries need to build capacity of their regulatory institutions to promote a trading environment by the private sector across the borders to trade energy; and finally they also need to develop an energy spot market for BBIN or for South Asian countries because the overall growth pattern of the region will make them a major energy importing region of the world.

Bhutan's Perspective on BBIN Trade Cooperation

Presentation

by

Lyonpo Khandu Wangchuk

Member, National Assembly, Bhutan

RENEWABLE ENERGY FOR CLEAN, GREEN, PROSPEROUS AND HAPPY BBIN SUB-REGION.

Lyonpo Khandu Wangchuk,

Member of Parliament, Former Prime Minister and Minister for Economic Affairs, Foreign Affairs and Trade and Industry of the Royal Government of Bhutan

Abstract

The BBIN countries are endowed with abundant energy resources and a major portion of these resources are yet to be harnessed. The energy basket of the BBIN region consists of various energy sources including fossil based, renewable and nuclear energy and considerable potential exists to develop the regional renewable energy resources and green the energy network. Since the development of the first micro hydro stations in Bhutan with financial and technical assistance of the Government of India, Bhutan has now become a leader in the region in the development of hydropower and has achieved almost 100% access to energy for its population. Based on the experiences gained and lessons learnt in the development of the hydropower sector in Bhutan spanning over four decades, a set of recommendations are drawn for taking the BBIN cooperation in renewable energy forward.

PRESENTATION AT THE ROUNDTABLE DISCUSSIONS ON ADVANCING BBIN ENERGY COOPERATION ORGANISED BY THE DELHI POLICY GROUP, 10th NOVEMBER, 2016.

RENEWABLE ENERGY FOR CLEAN, GREEN, PROSPEROUS AND HAPPY BBIN SUB-REGION.

Lyonpo Khandu Wangchuk,
Member of Parliament, Former Prime Minister and Minister for Economic Affairs, Foreign Affairs and Trade and Industry of the Royal Government of Bhutan

Contents

Abstract

The Bangladesh, Bhutan, India and Nepal (BBIN) countries are endowed with abundant energy resources and a major portion of these resources are yet to be harnessed. The energy basket of the BBIN region consists of various energy sources including fossil based, renewable and nuclear energy and considerable potential exists to develop the regional renewable energy resources and green the energy network. Since the development of the first micro hydro stations in Bhutan with financial and technical assistance of the Government of India, Bhutan has now become a leader in the region in the development of hydropower and has achieved almost 100% access to energy for its population. Based on the experiences gained and lessons learnt in the development of the hydropower sector in Bhutan spanning over four decades, a set of recommendations are drawn for taking the BBIN cooperation in renewable energy forward.

Cooperation for Peace, Security and Prosperity

A common and timeless aspiration of mankind for their wellbeing and happiness is peace, security and prosperity. From time immemorial, our forefathers have searched for them individually and collectively. Lessons learnt and experiences gained have shown that those individuals, communities and nations who have collaborated with others have had higher successes and have achieved more. The need to cooperate for our collective wellbeing has become more pressing in the globalized world of today.

As a result, there are hundreds of global, regional, sub-regional and other organizations promoting understanding, friendship and socio-economic development through cooperation. Foremost among them is the United Nations and its agencies. At the regional level, among the many bodies, we have the European Union (EU), the African Union (AU), the Association of South East Asian Nations (ASEAN), the South Asian Association for Regional Cooperation (SAARC), the Bay of Bengal Initiative for Multi Sectoral Technical and Economic Cooperation (BIMSTEC) and the Asian Cooperation Dialogue (ACD).

Challenges for the Collaborative Organizations

While the global and regional organizations have made immeasurable contributions to world peace, security and development, they have and continue to face often daunting challenges in fulfilling their mandates.

All nations share the aspirations for peace, security and prosperity. However, perceptions on the ways to achieve them often vary on account of differing interests based on geo-politics, forms of governance, ideologies pursued and levels of development, thus the disagreements and other problems plaguing the global, regional and sub-regional organizations. The recent developments leading to BREXIT is an extreme example. The United Nations with 193 member countries, our body for peace, security and socio-economic development counters difficult negotiations and disagreements on a regular basis. Walkouts and boycotts are not unknown in their meetings and conferences. On the other hand, any agreement of cooperation needs to meet the interest of all nations involved for its success.

However, we can note with satisfaction that despite the challenges, these organizations have played a major role in building friendship, promoting understanding, maintaining peace, providing security and enhancing socio-economic development in our world. Their successes have resulted from the efforts made by the member nations to resolve conflicts and reach agreements through dialogue and peaceful means in the forums provided by the global and regional bodies. As such, if we reflect on the role played and the contributions made by organizations like the United Nations (UN), the EU, the AU, SAARC, ASEAN; there is no doubt that our world is a better place because of them.

Bearing these contributions and the challenges in mind, let us have a closer look at our Association, the South Asian Association for Regional Cooperation, SAARC. Founded in 1985, its launching was hailed as a major diplomatic breakthrough foreboding the challenges ahead for its smooth functioning and success. SAARC was founded to promote regional cooperation by working on commonalities and mutual interests of member countries. However, like in the case of other similar organizations, building consensus on the areas of cooperation have at times been difficult.

It is also to be noted that SAARC has contributed to strengthening relations and cooperation among the eight member countries. Since its founding, many areas of cooperation have been agreed to and they are contributing to socio-economic development of the region. The collaboration is growing and deepening by the year. SAARC has provided a forum for our officials and leaders to meet regularly and build understanding and friendship through dialogue. SAARC has brought us closer. Therefore, we have every reason to believe that SAARC will achieve the goals set out by its Founders.

Purpose of Meeting

We are gathered at this roundtable to discuss ways of advancing cooperation in the development of energy in the Bangladesh, Bhutan, India and Nepal sub-region, referred to as BBIN. Let me begin my presentation by touching on the energy situation in the BBIN sub-region.

Energy Situation in the BBIN Sub-Region

It is common knowledge that the region faces serious energy deficit despite being well endowed with resources such as natural gas, coal and renewal energy including hydropower. Figures on the percentage of our population having access to electricity are not satisfactory. In Bangladesh it is 62%, India 81%, Nepal 76% and Bhutan 99%. Moreover, the common thread amongst us is the dependence on a single energy source. India's generation mix is dominantly thermal based, Bhutan and Nepal are dependent on hydropower and Bangladesh is mainly dependent on gas.

Against this backdrop, all the countries in the region are aspiring for vibrant growth. At the same time they are committed to strengthen their energy security and to reduce carbon emissions. Meeting these goals and commitments calls for concerted efforts to enhance production of energy and boost renewable energy generation capacity. Therefore the growth prospects in the energy sector of the BBIN sub-region in terms of supply and demand are likely to outstrip all projections.

With economic growth, the per capita electricity consumption will grow rapidly. Currently against the world average of per capita consumption of 3,065 kWh, Bangladesh's per capita consumption is 279, Bhutan is 2,800, India is 1,010 and Nepal is 119 kWh. From these figures, it is clear that the consumption rates in the region are far below the world average. Given this situation, if we are to move to truly vibrant and sustainable economies, there is urgent need for us to anticipate and prepare for the many fold increase in the demand and consumption of energy as our economies grow and people prosper in the coming years.

As there is abundance of knowledge in this august gathering on energy from fossil fuel, nuclear and other renewable sources such as wind and solar and as my limited knowledge and experience is confined to hydropower, my presentation is on the importance of renewable energy and on the opportunities for cooperation in hydropower development in the BBIN sub-region.

Importance of Renewable Energy

At the outset, it is important to note the differing views on what constitutes renewable energy. There is general agreement that energy from solar, wind, micro hydro, biomass and waste to electricity are renewable. When it comes to hydropower, despite it being renewable, on account of varying policies and support systems for renewable energy, mega or large hydropower plants are often excluded from the renewable energy grouping. It is argued that the large plants are self-sustaining and do not warrant any form of support.

For my presentation, I have assumed all energy from hydropower irrespective of the size of the plants as renewable.

While energy is fundamental for enhancing the quality of life and economic development, the manner in which it is produced and consumed has a direct bearing on the sustainability of our natural environment, economy and society. The International Energy Association Statistics (2015) indicates that 81% of the total global energy production is from fossil fuel and the balance from renewable and nuclear. In the BBIN sub-region, the situation is not different. In the energy basket for Bangladesh; fossil fuel accounts for 97.78%, for India; fossil fuel is 69.52%, for Nepal; renewable is 93.11% and for Bhutan; renewable is 99.32%. Overall for the sub-region; fossil fuel accounts for almost 70%, renewable 28% and nuclear 2%.

As fossil fuels are non-renewable and finite resources, their depletion at an unsustainable pace would not only cause energy crisis leading to social, economic and political problems but will also have irreversible adverse environmental and ecological impact on our planet earth. There is now the unquestionable need to check the consumption of non-renewable energy resources and pursue more sensible and sustainable pathways by investing in and harnessing renewable resources to meet the ever rising demand for the wellbeing of humanity and ecological sustenance. Globally, there is growing consensus that renewable energy is the future energy. The recent convergence of world leaders to sign the Paris Agreement in 2015 validates the urgency in putting acts together to mitigate and adapt to climate change and renewable energy is an integral part of the strategy.

Therefore it is imperative that we accept that renewable energy is truly the future energy and take immediate steps at the national, regional and global level to accord highest priority to the development of this source of energy.

A major concern on renewable energy is their costs. The costs of energy generated from wind, solar and small hydropower plants are higher than from other sources namely; fossil fuel, mega hydropower and nuclear. However, it is to be noted that as a result of the priority accorded, investments made and incentives provided for harnessing this source of energy over the last few decades, the costs have been coming down and are becoming more competitive. This is presently not highly visible on account of the reduction in the price of oil in the last few years. Moreover when fossil fuel resources run out in the not too distant future, we will not have the luxury of comparing costs.

Hydropower

In the renewable energy basket, hydropower has been a major component. It has provided clean, sustainable and affordable electricity globally. Unlike energy from solar and wind which are intermittent, hydropower is a highly reliable generation technology. Moreover the resource is generally stable and predictable over a long timeframe and offers significant operational flexibility to maintain grid reliability and integration of variable generation resources. Hydropower also has a significant benefit that permeates economic and societal benefits including

substantial cost savings in avoided mortality, morbidity and economic damages from air pollutions and avoided global damages from GHG emission.

Currently, of the estimated world hydropower potential of 4000 GW, only 936 GW has been harnessed, which accounts for 23% utilization of the potential. It produces around 16% of the world's electricity and over 80% of the world's renewable energy.

The BBIN sub-region is well endowed with hydropower resources. India's potential is estimated at 148,700 MW, Nepal's at 83,280 MW, Bhutan's at 30,000 MW and Bangladesh's at 330 MW. Against these estimates, India has tapped 42,848 MW (28.8%), Nepal 714 MW (0.86%), Bangladesh 231 MW (69.7%) and Bhutan 1606 MW (6%). It is clear that as in the other parts of the world, the hydropower potential of the sub-region remains largely untapped. This has remained so mainly on account of their capital intensive nature, lack of finances and technology, long gestation periods, rehabilitation and resettlement issues, geological complexities of the Himalayan region where most of the hydropower potential lies, land acquisition issues, delays in obtaining clearance and approvals and access to other more convenient sources.

Need for Cooperation in Hydropower Development

If we are to unlock the hydropower potential of the sub-region, there is need for the countries to arrive at collaborative arrangements for sharing the resource through investments in establishing hydropower projects, inter-grid connectivity and conducive transit and trading systems. Failing to meaningfully cooperate in developing this vital resource will tantamount to it continuing to remain as a mere potential.

In an article of 12th October, 2016 titled, " Balancing the Energy Trilemma ", Ms. Joan MacNaughton, Executive Chair of the World Energy Council which is undertaking the Energy Trilemma flagship study, writes on the advances in balancing the three trilemma goals of energy security, energy equity (including access and affordability) and environmental sustainability.

I quote the following from her article.

- "The complexity of issues facing the globalized energy industry is impossible for countries to tackle in isolation."
- "Those nations making most progress are mainly part of a region characterized by strong collaboration. Nine out of the top ten countries ranked are within the European Economic area. The bottom of the Trilemma Index is dominated by sub-Saharan Africa. The countries in this region have access to an abundance of resources – be it hydropower, other renewable resources such as solar and geothermal or fossil fuel – but the lack of connectivity means that the resources of one country do not benefit the whole region. For example, hydropower provides the region with great potential, but 90% of the available resource is not developed. Doing that would require cross-border schemes and this renders the investment decision difficult without more government-to-government collaboration."

Regional and Sub-Regional Cooperation Initiatives

In view of the criticality of access to reliable energy at affordable prices for improving the quality of life and economic growth, our Governments have accorded priority to the development of the energy sector. They have also been exploring ways to enhance energy production through regional and sub-regional cooperation to supplement their domestic production. Towards this, an Inter-Governmental Framework Agreement for Energy Cooperation has been signed during the 18th SAARC Summit in 2014. The Agreement provides the legal

framework for developing a regional market for electricity, attracting investments for the development of energy resources and enabling the member countries to work towards grid interconnectivity.

Since 2013, the officials of BBIN have been discussing a set of cooperation on the key sectors of water and power, transit and connectivity. For developing the details of the collaboration, a Joint Working Group has been established. Under power, cooperation in hydropower development among other forms of power and inter-grid connectivity are being discussed. Hydropower projects in Bhutan and Nepal for joint participation and development are also being explored.

The initiative of the Delhi Policy Group in Partnership with the Asia Foundation to launch a Project on Bangladesh, Bhutan, India and Nepal (BBIN) Cooperation is therefore timely and will go a long way in supporting the efforts of our Governments. The in-depth analysis being undertaken by the Project on taking the cooperation forward in the four thematic areas of water, energy, trade and transit will reinforce the endeavors of our Governments to collaborate in these key sectors.

Opportunities for BBIN Cooperation in Hydropower Development

For Nepal and Bhutan, hydropower development has been limited mainly on account of lack of finances and technology. This provides the opportunity for sub-regional collaboration to establish hydropower projects in the two countries. India and Bangladesh could provide the finances, technology and the market. Bhutan and Nepal could sell all surplus power to them in return. India and Bangladesh would benefit from the access to clean and renewable energy, save on transmission costs on account of the proximity of parts of their country to Nepal and Bhutan, meet their much needed shortfalls, reduce emissions and strengthen their energy security. For Nepal and Bhutan, their energy requirements would be met, economic growth would be boosted, unprecedented employment would be generated, the environment would be safeguarded and the export of the surplus electricity would provide huge revenues and foreign exchange earnings.

As we are yet to develop hydropower projects through regional or sub-regional cooperation, we do not have the benefit of being inspired by rewarding and beneficial experiences of such collaboration to guide us. However, Bhutan and India have cooperated bilaterally in developing hydropower projects in Bhutan.

I will now share with you the background, relevant details and the experiences gained from this collaboration as they may be of use in the discussions and consideration of cooperation in the development of the hydropower resources of our sub-region.

Bhutan-India Relations and Cooperation

As friendship, good relations and mutual benefits form the basis of meaningful and sustainable collaboration; let me briefly touch on Bhutan-India relations to demonstrate how friendship and close cooperation have benefitted the two countries.

For safeguarding its security and sovereignty, Bhutan had followed a policy of self-imposed isolation for centuries. It was only in the late 1950s that our third King, His Majesty Jigme Dorji Wangchuck, the father of modern Bhutan shed this policy and opened up the country to the world and launched socio-economic development plans. Our visionary Monarch recognized that as a poor country, the support of the world outside was necessary for its development. Towards this, Bhutan laid emphasis on strengthening relations with countries in the region as well beyond. It also took membership of many international as well as regional organizations.

For the success of these farsighted initiatives, the historic visit of India's first Prime Minister, Pandit Jawaharlal Nehru to Bhutan in 1958 on the invitation of our King is noteworthy. While we had good relations with India, the visit of the Indian Prime Minister heralded a new chapter in Bhutan-India relations. The visiting Prime Minister assured His Majesty and the people of Bhutan that the Government of India would support the socio-economic development of the country. This enabled the Royal Government of Bhutan to launch the first Five Year Development Plan in 1961 with the financial and technical assistance of the Government of India.

Over the years, Bhutan-India relations, friendship and cooperation have grown from strength to strength. Today the relationship is considered by many as a model of inter-State relations. It is a relationship in which there is total trust and confidence in each other. The two countries have shown that a large country in every sense and a small country and that too in every sense can co-exist as close friends and collaborate for mutual benefit.

History of Hydropower Development in Bhutan

Hydropower development in Bhutan began in collaboration with the Government of India with the signing of a bilateral agreement in September 1961 for development of a 27 MW Hydroelectric project on the border of the two countries. Thereafter as a part of the assistance to the development plans of the Royal Government of Bhutan, the Government of India financed eight micro hydropower projects which provided electricity for the first time to various parts of the country including the Capital.

The first major project set up by the two Governments was the 336 MW Chukha Hydroelectric Project, the agreement for which was signed in March 1974. The Project was financed entirely by the Government of India on grant and loan basis with agreement to buy all surplus power. Its commissioning in 1988 changed the entire landscape of the Bhutanese economy and provided clean, reliable and low cost energy to India.

The success of the Chukha Project gave the two governments the confidence to take up the 60 MW Kurichu and the 1020 MW Tala Hydroelectric Projects in the late 1990s. The Projects have been successfully commissioned in 2002 and 2006 respectively. The Government of India provided the funds for the financing of the projects on similar terms as that of the Chukha Project. Through these projects, hydropower became the cornerstone of development cooperation between the two countries.

Agreements of Cooperation in the Hydropower Sector for the period 2006 – 2020.

Based on the experience of the fruitful collaboration and benefits accrued from the three projects I have talked of and to further the development of hydropower projects, an Umbrella Agreement of Cooperation in the Hydropower Sector was signed between Bhutan and India in 2006 for development of a minimum of 5,000 MW by 2020. This target was enhanced to 10,000 MW during Prime Minister Manmohan Singh's visit to Bhutan in May 2008. Following this, a Protocol to the 2006 Agreement was signed between the two Governments in 2009 to develop a minimum of 10,000 MW by 2020.An Empowered Joint Group consisting of representatives of the two Governments was established to fast tract implementation of the projects.

In keeping with these Agreements, 10 projects have been identified with a total installed capacity of 10,800 MW. The financing and implementation modalities of the projects have also been agreed upon. Six projects to generate 8,680 MW are to be implemented under the Inter-Governmental mode and four projects to generate 2,120 MW under the Joint Venture mode.

Under the Inter-Governmental mode which has been the modality for all the projects implemented so far, the ownership of the projects are vested fully with the Royal Government of Bhutan and the Government of India

provides the entire financing on grant and loan basis. This modality has been time-tested and proven to be the most suitable as demonstrated by the success of the Projects undertaken to date. This is also the modality that is preferred by Bhutan for the development of hydropower projects in the country. In the more recently introduced modality of the Joint Venture mode, the ownership is vested equally between the public sector undertakings of the Governments of Bhutan and India. This modality has been drawn up to ease the financial burden on the Government of India on account of the huge amount of finances required for the projects to generate 10,000 MWs estimated at INR 530 billion.

Since 2008, three projects under the Inter-Governmental mode; the 1200 MW Punatsangchhu-I, the 1020 MW Punatsangchhu-II and the 720 MW Mangdechhu have been under construction from 2008, 2010 and 2011 respectively and are scheduled to be completed between 2018-2020. The construction of the 600 MW Kholongchhu project under the Joint Venture mode commenced in 2015.

After 2013, though I am not privy to the discussions on the collaboration in the development of hydropower in Bhutan, I have observed that there is notably good progress in the construction of the three projects started earlier. However there have been no visible progress on the commencement of works on the other projects that have been agreed to be implemented.

Capacity for Hydropower Development

For all the projects that have been referred to; the studies, including designing have been carried out by the Government of India undertakings such as WAPCOS, NHPC, CWC, CEA and GSI. They have also been engaged as Consultants for the construction of the projects. The main Electro- Mechanical equipment have been/are being supplied by BHEL and other manufacturers from India. The civil works have been/are being undertaken entirely by Bhutanese and Indian contractors.

I have been personally involved in the construction of the Kurichhu, Tala, Punatsangchhu I & II and Mangdechhu Projects and in the O&M stages of Chukha, Kurichhu, and Tala as the Chairperson of the Project Authorities and of the Corporations. I can say with confidence that sound implementation and management systems have been in place for the construction as well as the O&M stages of the projects. As a result, they have been completed on record time and costs despite their remote locations and endless geological surprises. Though billions have been spent on the projects, there have been no instances of corruption or related scams. The projects have and continue to attract the best contractors and service providers of the two countries.

The Chukha, Kurichu and Tala power plants have now been in operation for over twenty eight years, for over fourteen years and for over ten years respectively. They have been running smoothly without any major shutdowns.

The Chukha and Kurichhu Projects have paid up the loans taken from the Government of India in keeping with the repayment schedules agreed to and the Tala Project will liquidate its loan by 2018.

What I have submitted is a testimony of the robustness and reliability of India's technology and its capacity to study, design and construct hydropower projects.

Benefits Accrued to Bhutan and India from the Cooperation in Hydropower Development

The projects have provided employment to thousands of Bhutanese and Indians during the construction and O&M phases. Today the O&M of all the plants are being undertaken by Bhutanese nationals. The human resources developed are contributing to the development of other hydropower projects in the two countries. They have also provided huge economic opportunities to contractors and other service providers of the two countries.

Bhutan's economy and its growth is now closely linked to the development of hydropower on account of its contribution to industrial growth and revenue from export of electricity to India. Hydropower has contributed significantly to the overall GDP growth both during the construction and operation phases. The share of hydropower of the GDP increased from less than half a percent in the early 1980s to 9% in 1986 on the commissioning of the Chukha Hydroelectric Project and thereafter sustained the growth at an average of 10.8% till the commissioning of Tala in 2007-08 raising it to about 21%. Today though only around 6% of the techno-economically feasible potential has been harnessed, the hydropower sector generates over 27% of the direct revenues to the Government and constitutes 14% of the GDP.

In addition, the hydropower projects have enabled the country to provide electricity to its people. Today 99.6% of the population has access to electricity. Moreover, Bhutan is the only country in the region with surplus power.

For India, through the development of hydropower projects in Bhutan, it has been importing low cost power. Given the slowdown in the development of hydropower in India, projects in Bhutan have contributed in a small way to the hydropower mix in the overall energy basket and in maintaining its human resources and other service providers in the field. And most of all, the hydropower projects have made substantial contributions to the socio-economic development of a friendly neighbor.

Unique Selling Points (USP) for Hydropower Development in Bhutan

Bhutan's impressive achievements in socio-economic development within a short timeframe with limited resources clearly demonstrate the differences good leadership can make to a nation and its people. Bhutan has been and continues to be blessed with selfless and farsighted Leadership of our successive Monarchs.

In this regard, I have already referred to our third King, His Majesty Jigme Dorji Wangchuck who opened up the country and initiated the first development plan in 1961. His son, His Majesty Jigme Singye Wangchuck, who succeeded him as the fourth King established the Chukha, Kurichu and the Tala Hydroelectric Projects. On the abdication of His Majesty the Fourth King in 2006, Bhutan and its people have been once again blessed with yet another great Monarch in His Majesty Jigme Khesar Namgyel Wangchuck. His Majesty oversaw the introduction of Democratic Constitutional Monarchy as the form of Government in 2008. His Majesty is deeply committed and is working tirelessly to enhance the wellbeing of the people and the nation. During the early years of His Majesty's Reign, the development of the 10,000 MWs of additional power was agreed to between Bhutan and India and works on three projects; Punatsangchhu I, Punatsangchhu II and Mangdechhu had commenced.

Since the commissioning of the first major project, the Chukha Hydroelectric Project, Bhutan today has positioned itself as a leading hydropower developing country in the region.

The USP for hydropower development in Bhutan are as hereunder;

- Political stability and good governance.
- A secure and peaceful environment.
- The country's commitment to maintain at the least 60% of its land under forest cover and remain carbon neutral provides a conducive and sustainable environment for harnessing hydropower resources.
- Importance attached and priority accorded by the Royal Government to the development of the hydropower sector.
- Existence of a sound hydropower development culture.
- Given the terrain, the location and nature of the projects and the low population density of the country, there is minimum displacement and resettlement related issues.
- Strong support of local communities as they accrue benefits in terms of economic prospects, access to health and education facilities and employment opportunities from the projects.
- Sound management systems based on the rich experience of implementing projects are in place.
- Availability of a pool of human resource for hydropower development.
- Existence of connection to the Indian energy grid. Moreover a Power Transmission Master Plan for evacuation of power from different parts of the country to India has been prepared.

Recommendations

Based on my experiences in the service of the Royal Government of Bhutan spanning over forty two years as a senior bureaucrat, member of the Cabinet and as Prime Minister, following recommendations which could contribute to successful and sustainable collaboration in general and hydropower in particular are submitted;

- Garnering of the political will of the Governments is of utmost importance.
- Governments need to be farsighted and investments need to be made for the future.
- Governments need to undertake thorough consultations with all stakeholders before collaborations are initiated.
- As the host country faces all the problems associated with hydropower development, its concerns and interests must be respected and safeguarded. Maximum benefits from the projects need to accrue to it and its people.
- All stakeholders must be sensitive to social and environmental issues and incorporate them in the Environment Management Plans.
- Regional and sub-regional inter- grid connectivity needs to be established.
- Conducive cross-border power transit and trading systems needs to be drawn up.
- Collaborating Governments must provide soft term finances as loans and grants to the host country where hydropower projects are being considered for development.

Conclusion

In concluding, I wish our Governments, the Delhi Policy Group, the Asian Foundation and all well-wishers every success in their noble endeavor of advancing cooperation in energy resource development and sharing. I remain deeply committed to this cause and my humble services will always be at your disposal.

Thank you and Tashi Delek which means Good Luck.

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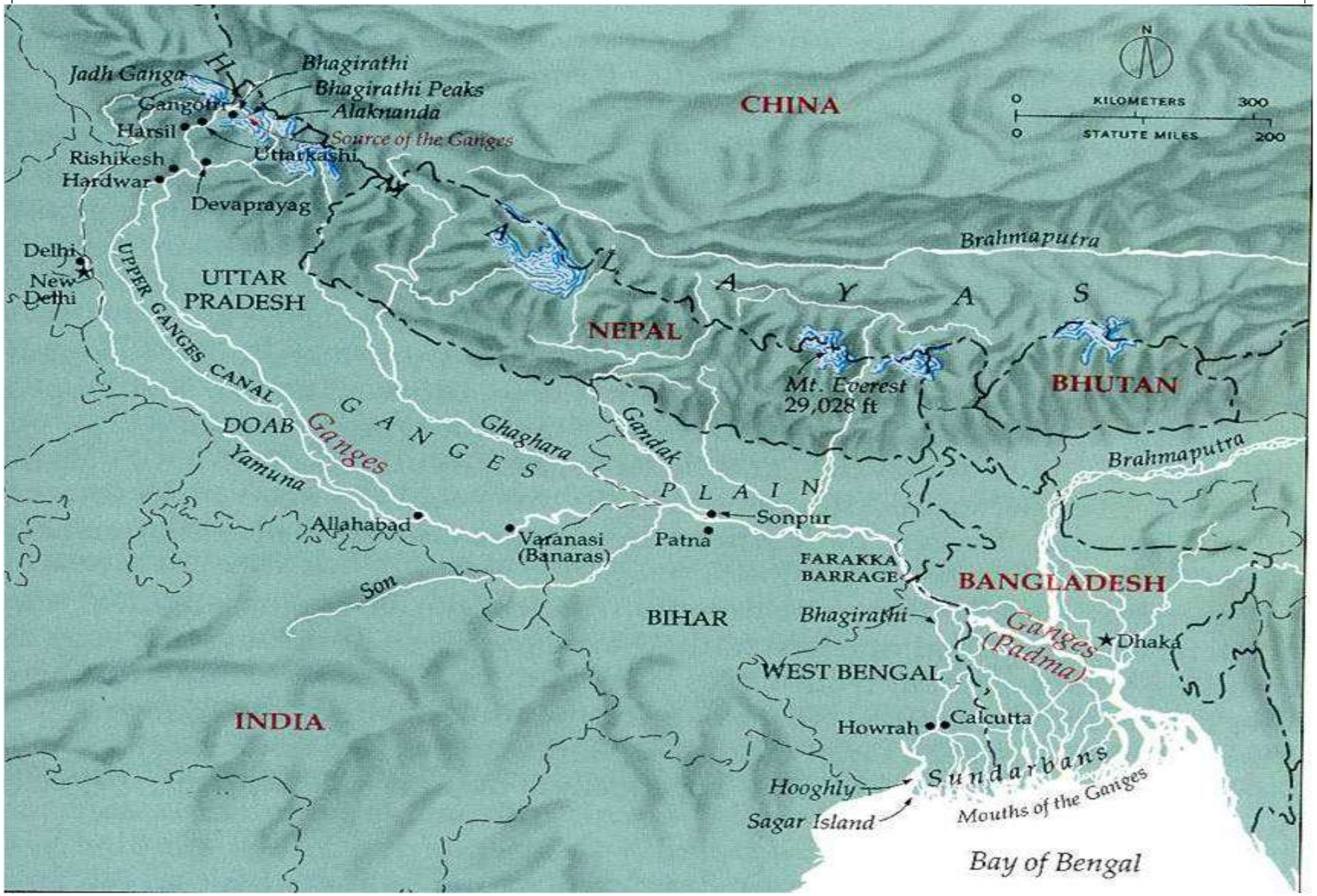
Presentation on
“Nepal’s Perspective on BBIN Energy Cooperation”
by

Govind Raj Pokharel,
Former Vice Chairman National Planning Commission and Executive Director, Alternative Energy Promotions Centre

Nepal's Perspective on BBIN Energy Cooperation

Govind Raj Pokharel

BBIN and Water



Water Resources of Nepal

- Average annual runoff: 200 billion cu. m.GRP1
- Account for about two-thirds of the dry season flow and 40% of annual average flow in the Ganges
- Large, perennial rivers have economically feasible potential of 40,000 MW
  - This is very conservative estimate based on a PhD thesis.
  - Depending on the market, projects with total capacity of over 100,000 MW could be built.

Slide 3

GRP1 Maxwell, Daniel M http://ssrn.com/abstract=2193796

Govind Raj Pokharel, 11/6/2016

Power Generation Scenario

- Only 2/3 of the population connected (!) to grid
- Up to 10-14 hours of power cuts (load-shedding) a day in dry season – even with up to 250 MW of power import from India
  - Comes down to 4 to 6 hours in the rainy season
- Predominance of run-of-river type hydro projects
  - about 750 MW ROR Capacity
  - a 92 MW Reservoir Plant
  - Negligible contribution of thermal energy
- IPPs contributing a significant portion of generation

Power Demand – Present and Future

- Current peak demand: Around 1200 MW !
- 2020 peak demand forecast: 2200 MW
- These data are criticized heavily
  - Lot of suppressed energy demand; being met from other sources
    - Imported petroleum and coal accounted for 15% of energy demand met; on the rise; severely impacting balance of trade
    - 80% of energy demand is being met through traditional sources such as firewood, animal dung and agricultural residue
    - Numerous captive generator sets (total capacity in Kathmandu alone estimated by a study at over 500 MW)

Status of Licenses (Nov 2015)

Type of License	Number	Total Capacity (MW)
Generation Licenses (Already Commissioned)	43	756
Generation Licenses (At various Stages of Development)*	103	2418
Applications for Generation Licenses**	81	6356
Survey Licenses	77	5132

* About 50 are actually under construction with a combined capacity of about 1400 MW; most others are looking for funds.

** Most (except the small projects) will require foreign investments.

Export Oriented Projects

- Arun III (900 MW) being developed by SJVN (India)
- Upper Karnali (900 MW) being developed by GMR (India)
- Tama Koshi-3 (650 MW) was supposed to be developed by SN Power (Norway)
- Upper Marsyangdi-2 (600 MW) being developed by GMR (India)

Storage Projects under Development

(1) Advanced to construction phase:

140 MW Tanahun Hydropower Project

(2) Detailed Engineering Design Complete:

1200 MW Budhi Gandaki Project

(3) Investigations Underway:

400 MW Nalsingad Hydropower Project

(4) MOU with Chinese Company for development:

750 MW West Seti Hydropower Project

Mega Storage Projects
(At Various Stages of Development)

Project Name	Capacity (MW)
Karnali Chisapani	10800
Pancheswar	6480
Sapta Koshi	3000

Factors Hindering Power Development

- Fledgling economy – little industrial demand
- Scattered settlements – need for large transmission network
- Political instability; poor implementation of plans
- Government resources crunch for related infrastructure
- No private sector's participation for storage
- No "clearly defined and implemented" power trading mechanism to motivate investment
- Lack of power Evacuation infrastructure even for internal use

Attractive Environment for Private Sector

- Protection by law against nationalization of projects
- Full foreign ownership permitted
- Very lenient policy and legislation on repatriation of earnings in foreign currency
- Export of power allowed; dedicated transmission lines can also be constructed for the purpose
- Very nominal royalty rates (not increased since 1992/2001)

Concessions Offered

- Exemption from payment of Value Added Tax on plant and equipment.
- Only 1% customs duty levied on equipment; no other fee.
- Income tax exemptions for 10 years.
- Refund benefit @ $50,000/MW for projects to be completed by a given period.

Opportunities for Foreign Investors (1)

- Nepal's future relies on hydropower.
  - only viable economic resource which is in abundance.
- The Government is keen on promoting public-private partnership model in various forms.
- Government is committed to reforms; roadmap already prepared.
- Government is also committed to easing problems and has been devising mechanisms for that purpose from time to time.

The Regional "energy security" perspective

- Rate of energy demand increasing at a fast rate
- Low access to electricity
- Continued reliance on biomass to meet most of the energy needs, risk of climate change/Black Carbon
  - Sustained availability at stake
- Increasing dependence on fossil fuel imports/use
  - Vulnerability to external shocks and price volatility
- Development of renewable energy like hydro is a necessity rather than a choice

Dilemma regarding Energy Supply

For Nepal:

- Dependence on hydro only system
- Need to explore possibilities for meeting short to medium term needs (until adequate storage schemes come online)

For other countries in the region (except for Bhutan):

- Over-dependence on thermal energy
- Need to explore possibilities of expanding the solar and wind power base apart from harnessing untapped hydro resources
- Fulfill the commitment of RE (175GW by 2022 by India) target and climate agreement
- India to demonstrate regional leadership in trade policy for everyone's benefit

Why participate in BBIN Energy Cooperation-1

- S. Asia: rich in renewable energy resources
  - hydro, solar, wind are all viable options
- Participating countries can use their comparative benefits in renewable (primarily hydro) and non-renewable (primarily coal and natural gas) energy resources.
- Relatively small markets for power in Nepal and Bhutan vis-à-vis generation potential.
  - Huge market for power in India and Bangladesh
- A small nation like Nepal can also benefit from export of surplus power through an improved balance of trade with economically stronger neighbours

Why participate in BBIN Energy Cooperation-2

- Other nations can also benefit if they are invited to bring in capital and technologies.
- Increased reliability of power supply.
  - Contribute to the goal of energy security.
  - Strong correlation with rural electrification, employment generation, economic growth and poverty alleviation, health and nutrition, agricultural growth, education, tourism, demographics, women empowerment etc.
- Interconnection would improve load factors of the power system of the individual countries.

Why .....BBIN Energy Cooperation (3)

- ✓ Significant complementarities and synergies in the power systems of member states.
  - Hydro systems in Nepal and Bhutan can complement the thermal systems in other member States.
  - Benefits from seasonal differential demands and slightly differing peak times in certain regions.
  - Economy in operation

Why participate in BBIN Energy Cooperation(4)

- Exploit hydro generation potential in the region
  - Watersheds of the Hindu-Kush Himalaya Region have huge potential in the Ganges, Brahmaputra, Indus Basins.
  - Complementary benefits from irrigation, flood management, navigation can also be harnessed.
  - Save the Himalayas the perennial source of sweet water for ~ 1.5 billion people
- The region also has a vast human resource potential, including trained personnel.
  - Participating countries can benefit from technology transfer and human resource development

Major Determinants for the success of BBIN Energy Cooperation(1)

Political/ Administrative

- Political will/ environment
  - Economic interests to prevail over political interests
- Transmission service agreements between concerned entities, authorizing these entities (Both Hardware and Software)

Institutional and communication-related

- Institutional capacity building
- Steady and institutionalized communication between member States; continued sharing of information

Major Determinants for the BBIN Energy Cooperation (2)

Technical

- Interconnection planning; continued updating of plans
- Construction of '**Infrastructure for the Future**'
- Synchronization of grids
- Determination of transmission and open access charges, schedules for trading margin and fees, power wheeling policy
- Simplification of policies and procedures, resolution of operational issues

Regulatory

- Harmonization of regulatory frameworks, codes and standards
- Continuation/ acceleration of sectoral reform in respective member states

Financial

- Mobilizing Investments for domestic power generation and transmission infrastructure

Impediments to BBIN Energy Cooperation (1)

- State policy being driven by narrow national interests and not by regional requirements.
  - Weak political commitments to forge a common strategy.
- Power Asymmetry among the members and the tangible/intangible problems arising from it.
  - Members are unequal in size, resource and capability.
  - Their needs, means and priorities are different.
- Security perception: including fear of supply disruptions.

Impediments to BBIN Energy Cooperation(2)

- Financing crunch hampering investments in power sector's infrastructures.
- State of sectoral reform including the ability to minimize losses and to boost the credibility of utilities for flow of investment into the sector.
- Absence of generalized regulatory mechanisms on cross-border trading.

Impediments to BBIN Energy Cooperation(3)

- Linkage between electricity production and water resources
  - ✓Issues to be addressed:
    - Sharing of benefits and cost on equitable basis
    - Socio-environmental impacts, particularly related to:
      - Displacement of settlements
      - Loss of land, biodiversity
      - Deforestation

Successful BBIN Energy Cooperation Requires

- Demonstration projects
- Long-term commitment
  - Patience towards the length of the process
- Stakeholder participation
  - Involvement of private sector and civil society
- Promotion of joint ventures
- Agreement on a dispute resolution framework
- Understanding on water and its benefits, climate change, and benefit sharing

Positive Developments in Nepal for Power Trade

- Ongoing Development of Nepal-India Cross-border Transmission Lines
- Strengthening of Transmission Network within Nepal
- Nepal-India Power Trade Agreement
  - Mentions sub-regional and regional frameworks, common electricity market
  - Joint technical team and working groups active to operationalize the Agreement
- SAARC Framework Agreement
- Finalization of Transmission Master Plan for Nepal
- Establishment of Transmission Grid Company (yet to be operationalized)
- Announced by GoN to establish many Generations and also Trading companies

Future of Power Trade/ Exchange in the Region (1)

- We cannot remain aloof from similar developments elsewhere.
- Integration is inevitable in the future.
  - We are vulnerable to supply side risks in the absence of coordinated planning and development of projects.
  - These risks can be reduced to a great extent and energy security for people in the region can be ensured.
  - Besides ensuring energy security, an integrated power market would also lead to availability of power at competitive prices.
  - Per capita productive consumption can be increased to uplift socio-economic status of the people, thereby contributing to the goal of poverty alleviation.

A Wayforward

- ✓ There is benefit to be accrued from hydropower development in Nepal and other countries in the region, in terms of,
  - Associated benefits in irrigation, flood control or other uses,
  - Avoidance of environmental impact of thermal projects.
- ✓ Sub-optimal use of available resources and lack of options for fuel has led to much suffering and poverty for people in the region.
  - ❑ This has forced people to over-exploit natural resources, to migrate, or even become the cause of political instability.

Other Needs

- Sharing of costs, benefits, knowledge, skills and technology.
- Public-private partnerships for financing and project management.
- A powerful regional institution/mechanism dedicated for the purpose.

Operationalising the Power Trade Agreement between Nepal and India

Requires policy changes in three areas:

- a) the commercial rules for accessing the Indian market and obtaining power from the Indian market and access to third markets. This change has been promised by India for all neighbouring countries;
- b) technical rules for moving power into and out of the Indian grid, as well as the technical issues associated with interconnections; and
- c) physical interconnections.

Bright future

- Market mechanisms will follow once interconnections are in place and policy/ operational issues are resolved.
- There is great value in avoiding coal-based plants in the region and investing in Nepal's hydro production.
- Connectivity has Skeleton, Mascular and Nervous system, not only hardware and treaty papers
- 'Shared Prosperity' achieved only with "Integration, Connectivity and Peace" in the region

Presentation on
"Water Cooperation among the BBIN countries: Bangladesh Perspective"
by

Shaheen Afroze

Research Director
BIISS

- "Water Cooperation among the BBIN countries: Bangladesh Perspective" by Shaheen Afroze, Research Director, BIISS

The sub-region of South Asia consisting of Bangladesh, Bhutan, Nepal and India's north east possessing vast reserves of water and natural hydro power continues to remain a water stressed region. This is because the resources are yet to be tapped in a collaborative manner for mutual benefit. Growing population, phenomenal increase in economic activities, industrialisation, mismanagement, overall lack of cooperation and the expected effect of climate change are putting ever increasing pressure on water resources. Water is also increasingly emerging as bone of contention among these countries. It is imperative to acknowledge the severity of the situation and conceive a comprehensive water cooperation mechanism under the auspices of BBIN to manage the resources in a manner that maximizes benefit for all users in a sustainable way. The endeavour, therefore, must be to use the trans-boundary water resources as a stimulus for cooperation rather than a cause of conflict.

Against this backdrop, my presentation will be an attempt to answer the following questions: What is the current situation of water availability in BBIN? What are the benefits of trans-boundary water resource management? Why trans-boundary water resource management is important for Bangladesh? What are the current initiatives taken by BBIN countries regarding water and how the member countries can cooperate for an effective water resource management?

Among the BBIN countries, Bangladesh is the lowest riparian country. The confluence of three major rivers i.e. Brahmaputra, Ganges and Meghna occurs in Bangladesh. The life and livelihood of millions of people of Bangladesh has been revolving around waters of these rivers. As a matter of fact, the whole ecosystem of Bangladesh is water based. But overabundance of water during the rainy season resulting in flood and severe scarcity during the dry season resulting in drought contributes to riverbank erosion, agricultural disruption and migration. Due to its flat terrain, Bangladesh neither can store the monsoon water for use in the dry season nor can it use its water resources for hydro power generation. Sustainable planning and development of water resources of Bangladesh virtually depends on equitable sharing and management of these trans-boundary water resources. It may be mentioned that water resource management alone can accrue endless opportunities for this region namely hydro power generation, agriculture and pisciculture development, flow augmentation in lean period, increased navigability

and better flood management etc. As such if 'basin wide' water management plan is developed by the co-riparian countries, in addition to the current approach of sharing the flow available at the border, it will significantly contribute to the overall economy of the region. A holistic approach for the management of water resources of the trans-boundary Rivers is thus the need of the hour. Strong institutional arrangements with well-defined implementing procedures, supported by agreements and clear regulations need to be set up. In this regard, BBIN can follow the best practices of TWM of Danube, Nile and Mekong Rivers to effectively manage water resources.

Overall, focused agenda and greater political will are must for the success of the BBIN initiatives or any other sub-regional grouping in the region.

Water Cooperation among the BBIN Countries: Bangladesh Perspective

Shaheen Afroze
Research Director
BIISS

Introduction

- Vast reserves of water and hydro power in BBIN region; yet water stressed
- Resources are yet to be tapped in a collaborative manner
- Growing population, phenomenal increase in economic activities, industrialization, mismanagement, overall lack of cooperation and the expected effect of climate change are putting ever increasing pressure on water resources

Introduction… contd

- It is imperative to acknowledge the severity of the situation and conceive a comprehensive water cooperation mechanism under the framework of BBIN
- The endeavour must be to use the trans-boundary water resources as a stimulus for cooperation rather than a cause of conflict

Outline

- Current situation regarding water in BBIN
- Benefits of trans-boundary water resource management
- Why trans-boundary water resource management is important for Bangladesh
- Current initiatives by BBIN
- How the member countries can cooperate for an effective water resource management

Conflict over Water in the BBIN Region: Need for Water Cooperation

- Water is the most critical of the natural resources
- No replacements; no substitute for water
- Depletion of water resources - looming crisis in BBIN
- Partly due to climate change and partly - mismanagement of water resources by the countries concerned
- Absence of any effective cooperative management framework based on the principle of ‘equitable and reasonable use and no harm to other party” and individual development activities are the source of conflicts among its riparian countries

Bangladesh-India Water Issue

- India's withdrawals from the Ganges River
- The failed Teesta agreements and diversions
- India's River Linking Project (RLP)
- Out of 57 rivers that flow through Bangladesh down to the Bay of Bengal 54 originate in or flow through Indian territory
- Water sharing agreement on only one - the Ganges River

Bangladesh-India Water Issue..Contd

- That too does not solve all the difficulties faced by lower riparian Bangladesh, but is one of just three water sharing agreements on major rivers in South Asia
- Much expected agreement on Teesta failed to be concluded at the last minute in 2011 due to domestic politics in New Delhi leaving a bad impression in Dhaka

Bangladesh-India Water Issue… *Contd*

- RLP big initiative
- Raised concerns of lower riparian countries like Bangladesh
- It will alter the natural flow of rivers, cause water logging, hamper transportation of silt, affect fisheries, submerge forests and reduce water flow in transboundary rivers in downstream Bangladesh
- India cannot break its formal promises to Bangladesh under the 1996 Ganges Water Treaty that no water would be diverted away from the Ganges above the barrage of Farakka

India-Nepal Water Issue

- Disagreement over Kosi, Gandak and Mahakali Rivers
- Nepal complains that these are unjust and do not perpetrate an equal sharing of waters between the countries

Need for Cooperation

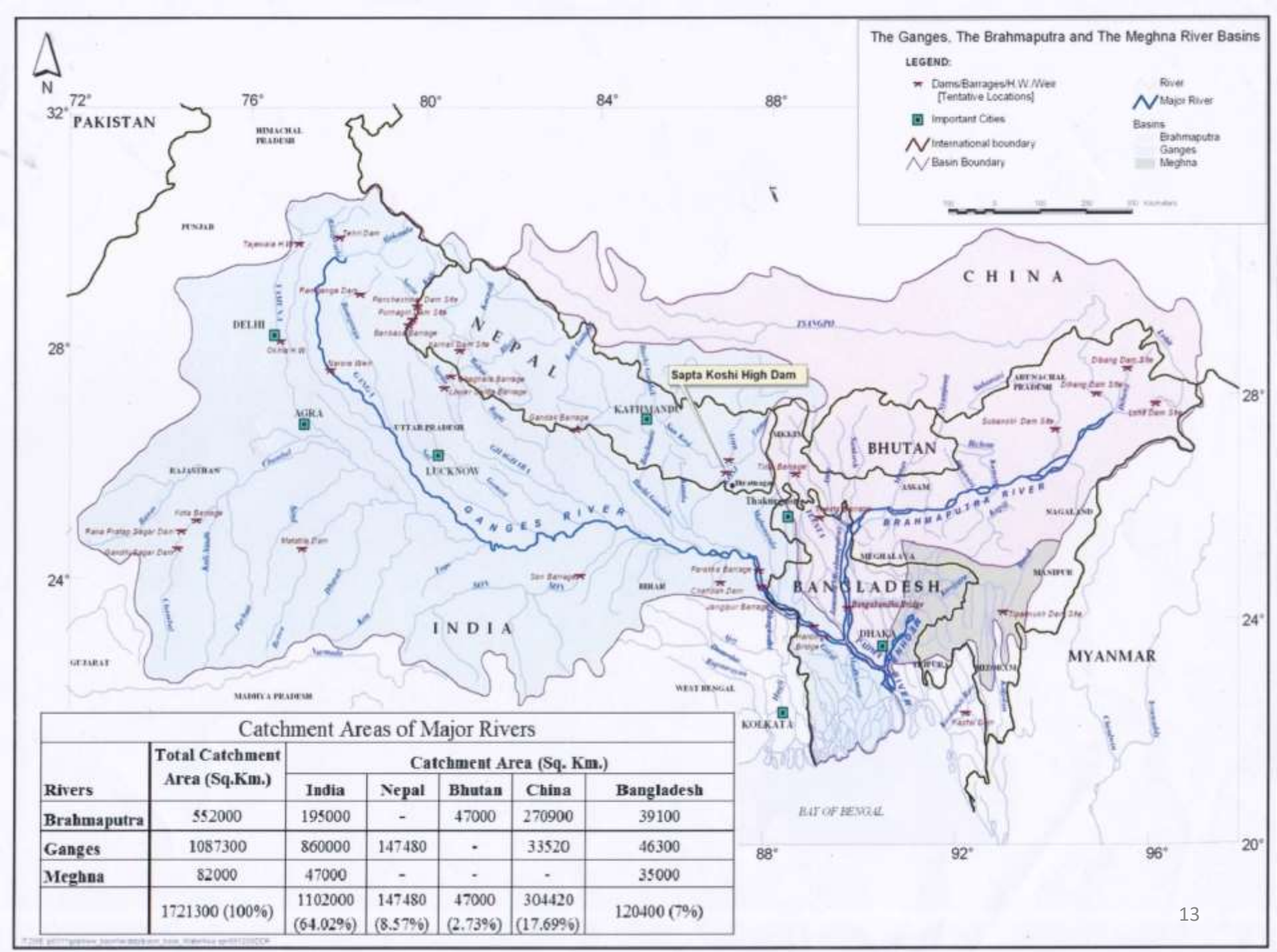
- Cooperation offers distinct additional mutual economic benefit
- Political, mutual trust and a changed mindset is pre requisite
- All international rivers create some degree of tension among the societies that they bind
- Tensions and their responses are catalyzed by many factors - historical, cultural, economic and environmental factors

Need for Cooperation..Contd

- Bilateral relationship -best time ever in history
- Translated into practical action
- “Active, dynamic, wide range with problem solving approach”
- Good and friendly relations with Nepal and Bhutan too
- Idea of evolving sub regional group has been successful and BBIN came into existence
- BBIN has already formed a mechanism for discussing issues of connectivity, trade, energy and water
- Time is ripe and propitious for ironing out differences

Why Trans-boundary Management is important for Bangladesh

- Bangladesh -lowest riparian country
- Shape the live and livelihood of millions of people of Bangladesh
- Whole ecosystem of Bangladesh is water based
- Innumerable number of large/medium and small rivers and their tributaries and distributaries have criss-crossed the country
- The total catchment area of the GBM river system - about 1.75 million square km



Catchment Areas of Major Rivers

Rivers	Total Catchment Area (Sq.Km.)	Catchment Area (Sq. Km.)				
		India	Nepal	Bhutan	China	Bangladesh
Brahmaputra	552000	195000	-	47000	270900	39100
Ganges	1087300	860000	147480	-	33520	46300
Meghna	82000	47000	-	-	-	35000
	1721300 (100%)	1102000 (64.02%)	147480 (8.57%)	47000 (2.73%)	304420 (17.69%)	120400 (7%)

Why Trans-boundary Management …Contd

- Bangladesh accounts for 7%, China 9%, India 63%, Nepal 9% and Bhutan 3%
- The rainwater in Bangladesh accounts for only 7% of the total fresh water flow
- Remaining 93% come from Transboundary river sources fed with rain and ice melting flowing into the riverine system of Bangladesh

Why Trans-boundary Management …Contd

- Excessive - during the rainy season (June to October) resulting in flood
- Severe scarcity during the lean season (November to May) resulting in drought
- Riverbank erosion, agricultural disruption, arsenic contamination, migration
- Flat terrain - neither store monsoon water for dry season nor can it use its water resources for hydro power generation
- Sustainable planning and development depends on equitable sharing and management of these trans-boundary water resources

Why Trans-boundary Management …Contd

- Greatest threat from the poor practices of upstream countries
- Multilateral cooperation would help produce much needed regional economic integration with beneficial results for all the four countries

Recent Initiatives of BBIN regarding Water

- First meeting of BBIN Joint Working Groups (JWG) - Dhaka - April 2013
- Second meeting - New Delhi - January 2015
- Third meeting – Dhaka - January 2016
- The fourth meeting is due by the end of this year
- In the third meeting in Dhaka, Bangladesh categorically proposed for basin wide management of common water resources
- The importance of the approach - recognised by all sides
- But not much substantive response from India
- Ended up in discussion on exchanging best practices on basin wide water resource management and development

Way Forward

- ‘Basin wide’ water management - regional River basin Organization
- Present approach - individually for the management of common river basins
- Each country in the region needs to cooperate with all co-riparian countries
- Total potential of each basin in the region may be assessed
- Developments in the common basins like hydro power, flood moderation, dry season flow augmentation, irrigation, navigation etc. may be recommended

Way Forward…Contd

- Water reservoirs may be built up in the upstream i.e. in Nepal and Bhutan. It will serve multiple purposes, namely flood moderation by storing water in the monsoon season, power generation and use of water in the lean season
- Member countries could set up a “WRM Regulatory Authority” under the auspices of BBIN

Way Forward…Contd

- Information sharing – Important
- Very insignificant exchange of information among the BBIN countries, especially on river flow and flood data
- Integrated Flood Alert System among BBIN should therefore be adopted with latest technology so that flood warning can be issued prior to any flood disaster

Way Forward…Contd

- Setting up strong institutional arrangements - well-defined implementing procedures - supported by agreements and clear regulations

- BBIN can follow the best practices of TWM of Danube, Nile and Mekong Rivers

Conclusion

- The prosperity of BBIN depends - efficient management of trans boundary water resources
- Needs cooperation from all co riparian countries
- Such cooperative management - greater sustainability and productivity

Conclusion….Contd

- Potential benefits of cooperative WRM can serve as catalyst for broader regional cooperation, economic integration, development and even conflict prevention
- Focused agenda - greater political -must for the success of the BBIN initiatives or any other sub-regional grouping in the region

Thank You

Presentation on
“Perspective on Water Security in the BBIN region”
by

Dr. Lam Dorji,

Former Executive Director of the Royal Society for Protection of Nature and Managing Consultant, Centre for Environment and Social studies

- “Perspective on Water Security in the BBIN region” by Dr. Lam Dorji, Former Executive Director of the Royal Society for Protection of Nature and Managing Consultant, Centre for Environment and Social studies

Water security has become the primary global concern as evidences of climate change unfold on communities. This concern essentially pertains to the declining availability of and access to water. The growing pressure from increasing population, lifestyle changes, and associated increase in per capita demands for water are steadily causing deterioration to both quality and quantity of water. This situation is further aggravated with increasing evidence of climate change and associated uncertainties. The Bangladesh, Bhutan, India and Nepal (BBIN) region in particular is blessed by the Himalayas, often referred to as ‘third pole’ for obvious reason of being the largest source of fresh water in the region. The Ganges, Brahmaputra and the Meghna (GBM) river systems support agriculture and economic activities of both rural and urban communities of BBIN region. As the home to conglomerates of large urban populations settled along water bodies (especially in India and Bangladesh) as well as isolated rural communities settled in the harsh Himalayan mountain terrain (such as in Bhutan and Nepal), the deteriorating condition of these water sources have become a major cause for concern especially in the context of the region being home to some of the world’s poorest as well as food and energy deficient population.

Climate change projections suggest that rise in temperature would be more pronounced in the higher altitudes indicating melting of Himalayan glaciers. Under increased intensity of rainfall and increased frequency of extreme hot and rainy days, a situation of too much water when we do not need and less during times of need is eminent.

According to the 2016 AWDO report (ADB, 2016), water security in the BBIN region is assessed to be far from what is desirable with Bhutan and Nepal measuring 2 on the National Water Security Index while Bangladesh and India measuring least on the index. Although the issues and challenges to achieving water security are unique and specific to mountains, deltas and coastal areas of the BBIN region, options to address them at the landscape level lie outside of the ability of any single area or nation. Fostering collective action at the regional level and adopting holistic and integrated approaches to water security are recommended.

Introduction

Water security has become the primary global concern as evidences of climate change unfold on communities. This concern essentially pertains to the declining availability of and access to water – the primary resource around which global civilization and economic development has evolved. Communities across the world are faced with a wide range of impacts that manifest from too much or too less water for drinking, irrigation, industrial use, and ecosystem services. The growing pressure from increasing population, lifestyle changes, and associated increase in per capita demands for water are steadily causing deterioration to both quality and quantity of water. This situation is further aggravated with increasing evidence of climate change and associated uncertainties. With projected rise in average temperature and associated impacts on hydrological cycle, the gap between concerns and actions are widening as competing economic interests prolong climate change negotiations and actions. Future projections depict worsening situations under increased temperature and associated spatial and temporal variations in precipitation. This concern is further exacerbated by the degree of uncertainty about the trajectory of future projections amidst growing population and increasing demand for food and energy. The reality therefore is that regions across the world are increasingly faced with the challenge of managing water for a sustainable future. The BBIN is one such region.

The case of South Asia is unique in the sense that the region has only 3% of global lands that have till date sustained about 25% of global population. This has primarily been possible from its richly endowed water resources and fertile flood plains and delta areas. The Bangladesh, Bhutan, India and Nepal (BBIN) region in particular is blessed by the Himalayas, often referred to as 'third pole' for obvious reason of being the largest source of fresh water in the region. The glaciers and the ecosystem services of Himalayan watersheds provide sustained source of water supply. The physiography of the region that descend from the mighty Himalayas to the delta and coastal areas allow for the Himalayan fresh water to assimilate and become available to both rural and urban communities in the form of lakes, streams, rivers, springs, and ground water. The Ganges, Brahmaputra and the Meghna (GBM) river systems support agriculture and economic activities of both rural and urban communities of BBIN region. As the home to conglomerates of large urban populations settled along water bodies (especially in India and Bangladesh) as well as isolated rural communities settled in the harsh Himalayan mountain terrain (such as in Bhutan and Nepal), the deteriorating condition of these water sources have become a major cause for concern especially in the context of the region being home

to some of the world's poorest as well as food and energy deficient population (Ahmed et al., 2007).

Climate Change Scenario in the BBIN region

Climate change is no more a myth and South Asia is proof to this phenomenon. Evidence of climate change in the region is widespread exposing its vulnerability to the change. The Intergovernmental Panel on Climate Change (IPCC) has confirmed that "*Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased*" (IPCC 2013). This emerging evidence of climate change and its impacts is projected to further worsen under continued global business of dumping more carbon into the atmosphere. Under high emission scenarios, regional climate model simulations project a temperature rise of 4-5°C by 2080. Within the BBIN region, this rise in temperature would be more pronounced in the higher altitudes indicating melting of Himalayan glaciers. The models further project increased intensity of rainfall with no indications of increased number of rainy days. Rather, frequency of extreme hot and rainfall days are projected to be likely. This essentially means that the already wet monsoon will be wetter – a situation of more water when we do not need and less during times of need. Sea level is projected to rise by 0.05–0.25 meters by 2050 and by 0.18–0.80 meters by the end of the 21st century.

The implications of the above changes are that current levels of variability may intensify and alter hydrological systems and water regimes further aggravating the already stressed water sectors. The IPCC 4th Assessment Report states that increased risk of floods and droughts is expected to have severe impacts on South Asian economies that rely mainly on agriculture, natural resources, forestry and fisheries sectors although the sub-region has low GHG emissions. Crop yields are also expected to fall by thirty percent and become more variable in South Asia. At the same time, sea-level rise will threaten farming in the major deltas and low lying coastal areas of South Asia. Mass losses from glaciers and reduction in snow cover are expected to lead to increased water stresses in areas which sources its waters from the Himalayan snow and ice melt (IPCC 2012). Such projections in the regional climate scenario are already evident in manifestations of impacts reported by different countries. Much of the reports relate to water, food and energy nexus (Rasul, 2012).

Water Security in the BBIN region

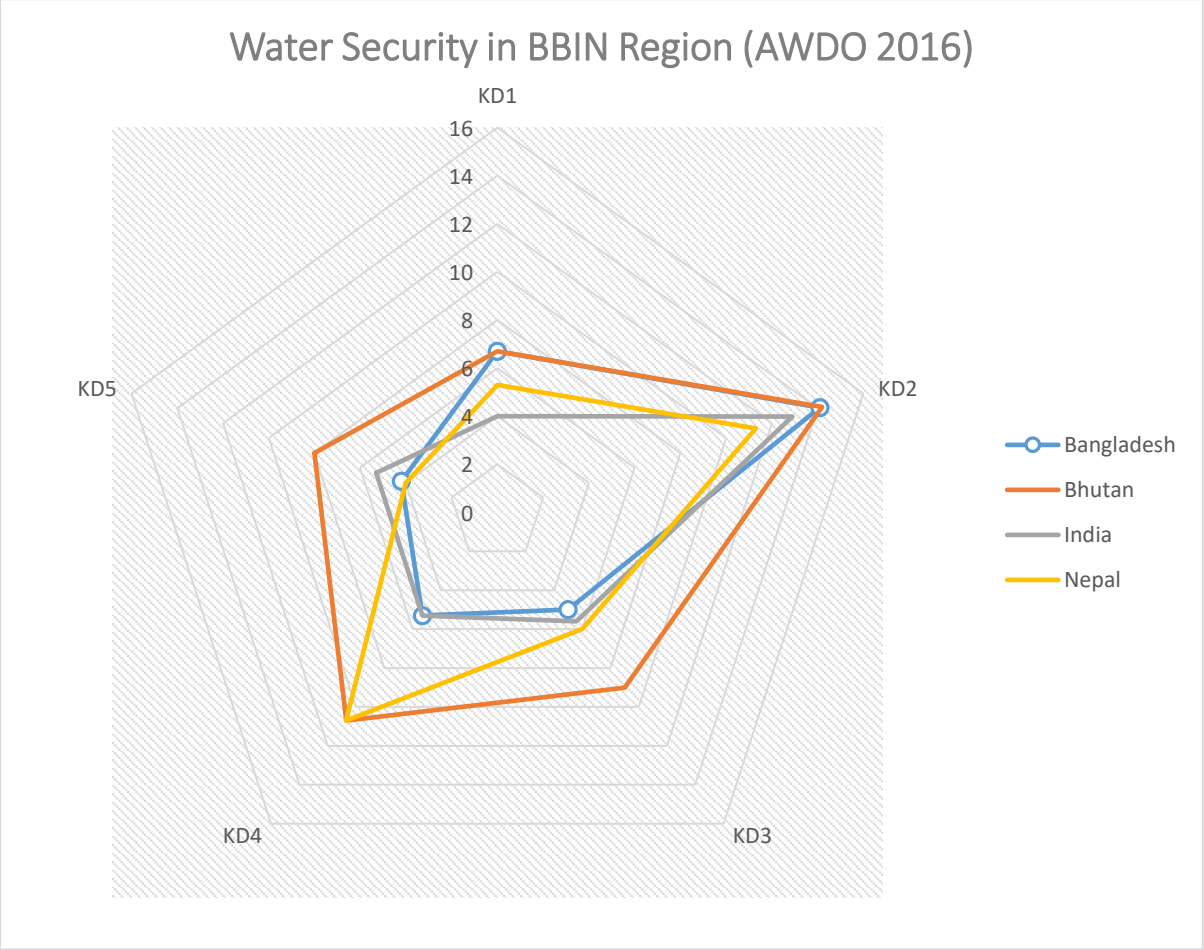
The Asian Water Development Outlook (AWDO) of ADB provides a country-wise snapshot of the status of water security in Asia and the Pacific region. According to the 2016 AWDO report (ADB, 2016), water security in the BBIN region is assessed to be far from what is desirable. On a scale of 1 to 5, the National Water Security (NWS) Index for Bangladesh and India are assessed to be hazardous meaning drinking water and sanitation facilities are limited and impose serious health risks; water service delivery is mostly informal and a constraining factor for economic activities and development; water quality is poor and dangerous for people; serious damage to aquatic ecology is present; and droughts and floods drive people into poverty. Bhutan and Nepal have NWS index of 2 (*engaged*) meaning more than half the people have access to modest drinking water and sanitation facilities; water service delivery is starting to develop, supporting economic activities; first measures are taken to improve water quality; and first attempts are being made to address water-related risks (see Table 1 and Figure 1 below).

Table 1: National Water Security Index (Source AWDO, 2016)

	KD1	KD2	KD3	KD4	KD5	NWS Score	NWS Index
Score	*1-20*	*1-20*	*1-20*	*1-20*	*1-20*	*1-100*	*1-5*
Bangladesh	6.7	14.1	5.0	5.3	4.2	35.3	1.0
Bhutan	6.7	14.2	9.0	10.7	8.0	48.5	2.0
India	4.0	12.9	5.6	5.3	5.3	33.1	1.0
Nepal	5.3	11.3	6.0	10.7	4.0	37.3	2.0

NWS Index: 1 - Hazardous; 2 - Engaged; 3 - Capable; 4 - Effective; 5 - Model

Figure 1: Water Security in BBIN region (Source: AWDO 2016)



Water security issues and challenges

Considering that water is the primary ingredient for production of food and energy - hence attaining water security is key to food security. The BBIN region is one of the most dynamic regions of the world in terms of economic progress, urbanization, and industrialization and population dynamics. The sub-region has experienced a long period of robust economic growth that has translated into declining poverty and impressive improvements in human development. However, with a large and rising population, limited land resources, inadequate energy supply, and growing water stress, the region is faced with the common challenge of meeting its food requirements with less land and less water. Rice and wheat, the staple foods of the region, require huge amounts of water and energy. Freshwater, once abundant, is undergoing stress due to the increased demand for competing uses, and climate change is creating additional uncertainties (Eriksson et al., 2009). About 20% of the population of South Asia lacks access to safe drinking water (Babel and Wahid, 2008). The increase in water stress and water demand raises questions about how

to ensure enough water for growing food without losing hydropower for energy security. Different areas within the region are faced with distinct issues.

Mountain regions

The most distinctive feature of water security in the Himalayan regions of Bhutan, Nepal and parts of India is that most communities are settled along steep slopes practicing subsistence agriculture. The most common issues faced by mountain communities include:

- limited accessibility to water: With limited space for agriculture, the viability for irrigation is low. Although the areas may be known to have high per capita availability of water, difficulty of access to this available water is the most common issue. In reality, available water is in the deep river valleys and gorges that are difficult to tap. Hence the small lakes, streams, and springs are the major source of water for agriculture and drinking. With climate change, communities are already reporting declining quantity and drying up of water sources. Lack of technology and storage are primary deficiencies in these higher altitudes. The available water in the gorges and river valleys are tapped for run-off the river hydropower generation. Owing to this, countries such as Bhutan are net food importers. In addressing the issue of enhancing water for food production, countries like Bhutan are faced with the question of the extent to which water for agriculture should be compromised for energy production given that the cost of food production is higher than what is available off the shelf in the market.
- GLOF and flash floods: Communities in the mountain regions of BBIN are often faced with threats of glacial lake outburst floods and flash floods. Several lakes in the higher altitudes of Bhutan and Nepal are gaining more volumes of water from melting glaciers. When the volumes can no more be sustained, the resulting outbursts floods cause destruction to life and property downstream. Mitigation and disaster risk reductions efforts require huge investments especially in lowering of lake levels and installation of early warning systems. During the monsoon, the runoff and associated soil erosion undermine soil fertility and increase sedimentation in rivers that have negative impact on hydropower plants.

  Likewise, mountain regions of BBIN are also vulnerable to flash floods during the monsoon. With increasing infrastructure development such as farm roads and service facilities, the mountainsides are increasingly exposed to the denuding effects of the monsoon sometimes lending the entire mountainsides to slide

causing damage to life and property again. For example, thousands of lives and property were lost in devastating floods and mudslides in Nepal, Uttarakhand (India) in the period 2010 to 2014.

Flood plains and Delta region

The delta regions of India, Bangladesh, and the Terai areas of Nepal represent another set of issues. These areas represent the once food bowl of the region, now faced with ground water depletion, floods and drought:

- Groundwater depletion is one of the serious issues in many parts of these parts of South Asia. The agrarian boom in the period from 1975-1990 had seen rapid growth in groundwater irrigation in the lowlands of Bangladesh, India and Nepal. On one hand groundwater development has provided sustenance to agrarian economy, on the other hand it has created chronic problem of depletion as well as quality deterioration (Shah et. Al 2004). Currently, three problems afflict groundwater use - overuse, water logging and salinization and pollution due to agricultural, industrial and human activity.
- Floods: This issue results primarily from the monsoon rains where the low lying delta areas are submersed under water from overflowing river banks and increased accumulation of rainwater. This phenomenon particularly occurs in the flood plains of India (Assam, West Bengal) and Bangladesh. 20 to 30 percent of Bangladesh territory is flooded every year causing severe damage to infrastructure, crops and overall economy (World Bank, 2011). River bank erosion is an ongoing process and increased climate change induced peak discharges from the GBM river systems will drive even more productive land under water.
- Drought: The contribution of rain-fed areas to food security in the region is significant both in the mountains as well in the delta areas. Agricultural productivity of such areas are dependent on timely arrival rainfall. For example, rainfall in India is concentrated in less than forty days per year (IWP, 2014), the spatial and temporal variations make such areas vulnerable to droughts.

Coastal areas

India and Bangladesh have long stretches of coastal areas along which both farming and urban communities are settled. Apart from being faced with the direct impact of depleting ground water resources emanating from extensive withdrawal of ground water, communities are also faced with specific coastal area related water issues.

- Ground water pollution: With decline in ground water table, seawater intrusion and salinization severely undermine the quality of land for agriculture in the coastal areas. In Bangladesh, arsenic contamination of water is a major concern. 20% of Bangladesh's drinking water wells and around 8,000 villages mostly in North Western parts are reported to put 30 million of 160 million Bangladeshis at risk from arsenic-related health hazards (Haq, 2014).
- Sea level rise: The most threatening impact of global warming is the transformation of glaciers to freshwater that will ultimately find its way into the ocean thereby causing sea level to rise. This rise in sea level rise has manifested in increased seawater intrusion and submergence of coastal areas that worsen the already limited agricultural land productivity.

From the above issues faced by the region and on the basis of challenges identified by Rasul (2012) and Mishra et al. (2013) the most common water and food security challenges of South Asia may be summarized as below:

- The population of South Asia is expected to double by 2025 with proportionate demand for water and food.
- Per Capita agricultural land has been declining sharply
- The ration of agricultural land to total land is high with limited scope for additional cultivable land – 70% in Bangladesh, 8% in Bhutan and 35% in Nepal. Higher agricultural production has to come from same amount of land.
- Scope for increased supply is limited under existing water scarcity and projected glacial retreat and rainfall variability under changing climate. Water demand increasing rapidly in the face of existing scarcity.
- Increased exposure to cyclones, storm surges, floods, landslides, and other extreme events
- Coastal inundation and groundwater salinization due to sea level rise
- Inadequate collective global and regional action to address cumulative impact on shared ecosystems.

Given the above issues and complexities involved in addressing them, ensuring water security remains a key challenge for South Asia.

Way forward

While the issues and challenges of meeting water security seem specific and unique to particular areas in the BBIN region, efforts to address them at the landscape level lie in 1) collective action at regional level and 2) adopting holistic and integrated approach attaining water security.

Collective action at the regional level

Because options to address issues and challenges lie outside of the ability of any single nation, the need for collective action at the regional level is evident. BBIN nations should foster cooperation based on the principles of reciprocity and mutual understanding to realize the potential and advantages of each BBIN nation to offset the disadvantages and issues of the other nations. For example, Bhutan and Nepal as upper riparian nations present enormous potential for addressing local off season needs while addressing downstream flooding and off season water scarcity by:

- optimizing the economic value of water for agriculture, industry and hydropower development through increased capacity for retention of monsoon water to supplement the flow deficit of winter season.
- incentivizing watershed management in upper riparian countries and communities therein through Payment for Ecosystem Services (PES).
- investing in and promoting transfer of technology for increased community level storage capacity through i) scattered small scale storage instead of large reservoirs and ii) restoration of fresh water lakes while ensuring resilience to water related disasters.

Adoption of common water security framework

Water security for one sector must not undermine the water security need of another sector. Rather, water security must be addressed holistically and in an integrated manner without which water security for a specific sector may jeopardize the security of another. In this context, all countries in the region must agree on common principles of managing water with common measures of progress. The Asian Water Development Outlook (ADB, 2013; ADB 2016) that integrates five key dimensions provide a holistic framework for national water security. Adopting and adapting this framework for water security (see Figure 2) will not only allow the individual countries to chart their own progress in achieving water security but also assess the cumulative regional progress toward water security. Bhutan has already adapted the AWDO framework for development of Bhutan Water Security Index based on which the National Integrated Water Resource Management Plan (NIWRMP - NEC, 2016), Wangchhu Basin Management Plan (WBMP - NEC, 2016) and National Irrigation Master Plan (NIMP - DOA, 2016) have been prepared for integration in the five year plans.

Figure 2: AWDO Framework: Key Dimensions of Water Security (ADB, 2013)

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India's Perspective on BBIN Water Cooperation

Presentation

by

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BBIN Water Cooperation: An Indian Perspective

Chandan Mahanta

A 21st Century Water World

Finite Resources

Demographic Shifts

Climate Change

Water Quality

Global Economy

Ecological Economics

Governance & Institutions

Water Quantity

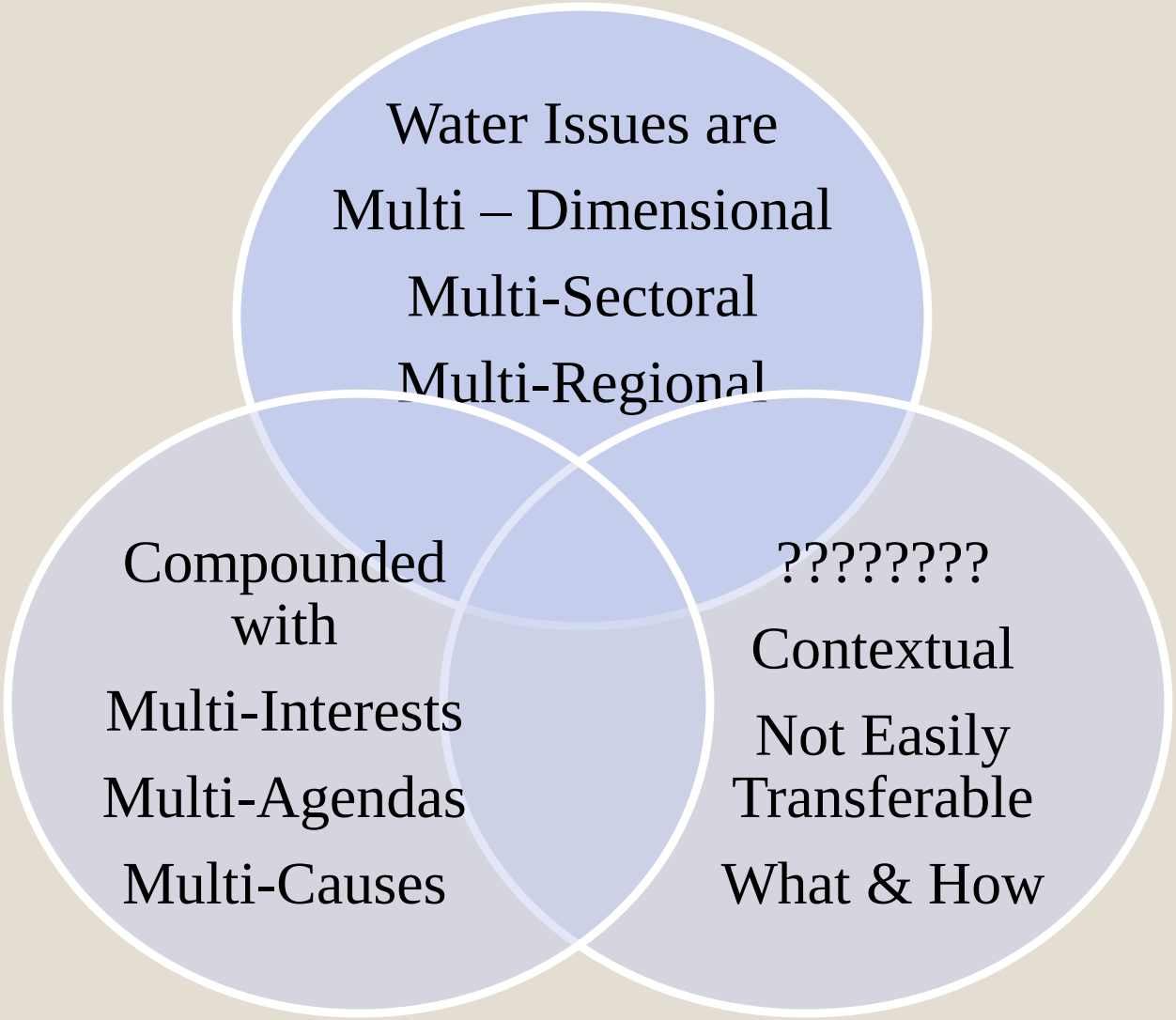
Culture & Values

Water Wars

Hydro-politics Hydro-diplomacy

Environmental Sustainability

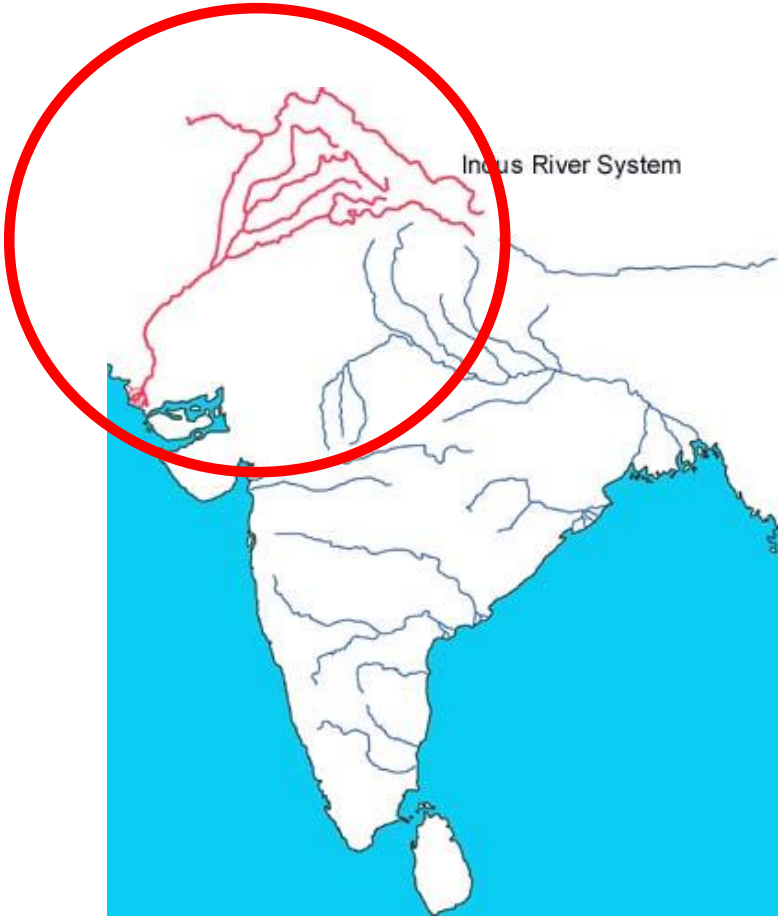
Source: AquaPedia.Tufts. edu



Source: AquaPedia, Tufts. edu

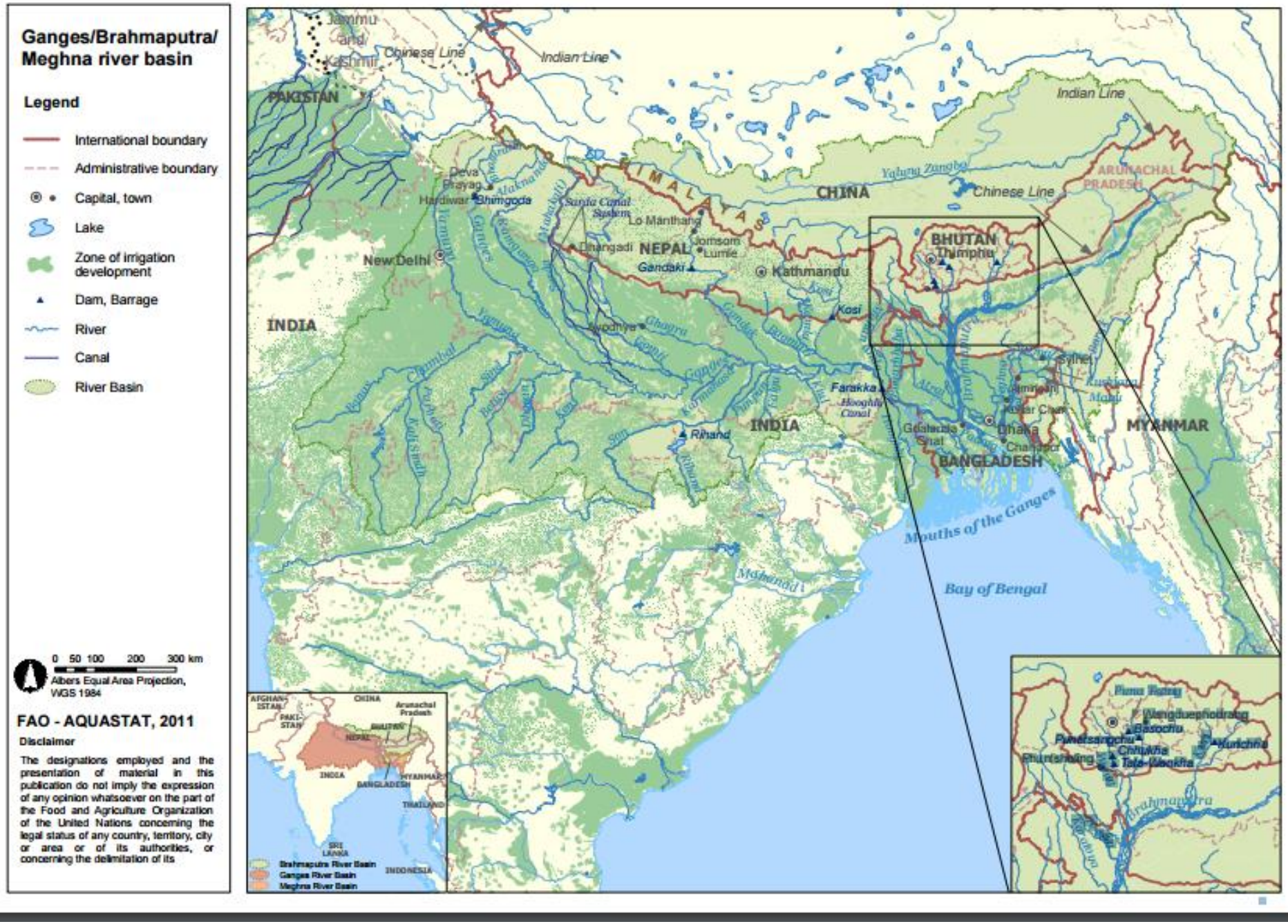
India's historical approach towards water cooperation

- Indus Water Treaty (September 1960)
- Ganges Water Treaty
- River Teesta Negotiations
- Kosi agreement between India-Nepal (April, 1954)
- Mahakali Treaty (1996)
- Sharada Dam Construction (1927)
- Kosi Agreement (1954)
- Gandak Agreement (1959)
- Tanakpur Agreement (1991)
- Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC)



 # India water cooperation has been bilateral so far

http://www.sju.edu/cas/theology/Courses/2141/Topics/Indus/



Ganges Brahmaputra Meghna (GBM) Basin

Source: FAO AQUASTAT, 2011

Ganges Water Treaty

Basic principles of Ganges Treaty that forms the benchmark for Indo-Bangladesh water sharing,

- to arrive at a permanent sharing arrangement
- to revive joint river water commission to work out the modalities for water sharing.
- to jointly monitor the flow at Ganges at selected points

Provisions for water sharing of Ganges at Farakka border during dry seasons, operational between January 1st and May 31st each year

1996 Ganges Water Treaty		
Flow at Farakka (m^3/s)	India's share	Bangladesh share
< 70,000	50 %	50 %
70,000 – 75,000	Balance of Flow	35,000 (m^3/s)
> 75,000	40,000	Balance of Flow

Source: Salman and Uprety, 2002

River Teesta Negotiation

- Teesta issue first raised in 1974 during second meeting of the Joint River Commission, acquired additional attention due to shortfalls in Teesta waters.
- Barrages on the Indian (2000) and Bangladeshi (1990) sides designed for 20,000 cusecs and 10,000 cusecs respectively.
- Flow of water in Teesta stands at 5,000 cusecs, provides less water for Bangladeshi crops evoking criticisms. Bangladesh demanded 80 per cent share of Teesta with remaining 20 per cent to India.
- India wanted a more equitable distribution of 39-36 per cent in its favour.
- Wanted to keep remaining portion as natural flow and for common usage by both countries. Not agreeable by Bangladesh.

Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC)

- Sub-regional organization initiated on 6th June 1997 through Bangkok Declaration
- Seven Member States: five from South Asia - Bangladesh, Bhutan, India, Nepal, Sri Lanka, and two from Southeast Asia - Myanmar and Thailand
- Established a platform for intra-regional cooperation between SAARC and ASEAN members

The goals of Treaties/Water Policies

- Supply-demand balance
- Standard of provision
- Economic importance of water sector
- Water quality indicators, including salinity, waterlogging and pollution
- Future supply options
- Efficiency of use
- Financial performance of sector
- International sensitivity and commitments
- Symptoms of conflict
- Structural and institutional change

Treaties often don’t deliver – why?

- Bilateral treaties many but often hostage to prevailing political perspectives with no agreed definitional conflict.
- Frictions in bilateral relations likely to increase if mutually acceptable bilateral or multilateral frameworks for cooperation to deal with integrated development of water resources not effectively reworked – a BBIN opportunity.
- Conflicting interests, particularly the distributive issues of river waters - getting more of what is in dispute - is clearly critical and immediate concern.
- Inadequate clear-cut strategy for cooperation
- Unsatisfactory implementation of commitments
- Inadequate mutual trust and confidence among the co-riparian countries

What is needed

- Promising potential of regional cooperation in GBM basin on a number of issues often jeopardised by lack of mutual trust and confidence among co-riparian countries.

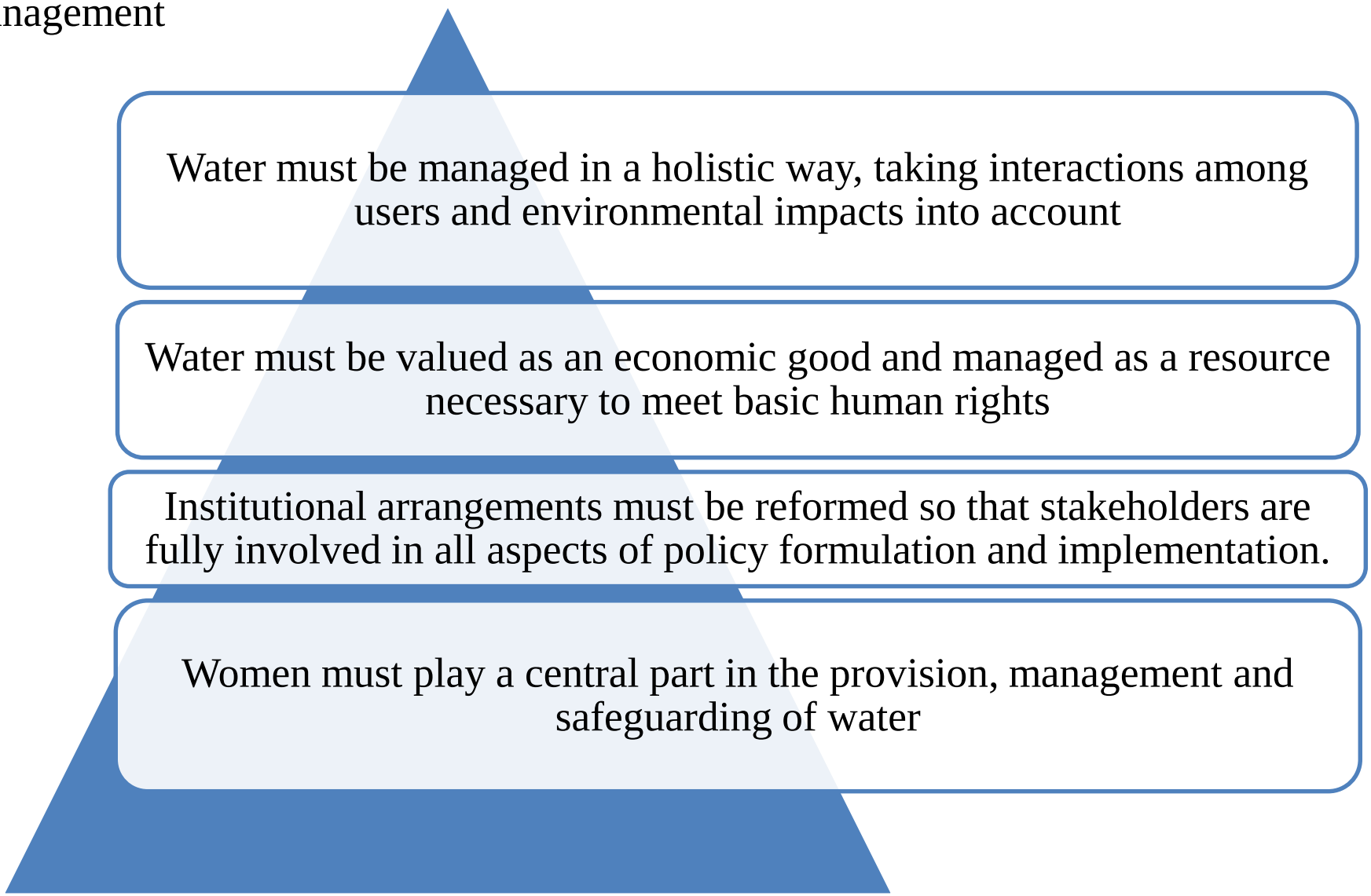
- GBM countries have much to learn from experiences of international treaties and river basin organizations, which underscore the importance of common or shared interests of nations, the perception of large mutual benefits, usefulness of sharing of benefits, and importance of basin-level management. Some important aspects for mutual benefit are:

  - Water resources development opportunities
  - Sharing of benefits
  - Multi-lateral cooperation
  - Basin-wide approach
  - Resilient Institutions
  - Participatory fact finding mission
  - Multi-track diplomacy

Source: Salehin et al., 2011

Principles for water planning and allocation

Dublin Statement listed four principles to be applied in Water Resources Management



Equity and distributional effects

Effectiveness

Efficiency

Environmental Impact

Sustainability

Public Health

Fiscal Impact

Political

Public Acceptability

Administrative Feasibility

Water Diplomacy Framework

ACKNOWLEDGE KEY ASSUMPTION

- Water is a flexible resource
- Science, policy and politics combine to create water networks
- Water networks are complex

Assumption # 1

- Water networks are open and continuously changing

Assumption # 2

- Water network managers must take account of uncertainty, nonlinearity and feedback

Assumption # 2

- Water networks needs to be managed using a non-zero sum approach to negotiation

THEORY: CHARACTERIZE WATER NETWORKS PROPERLY

- Distinguish among simple, complex and complicated water networks
- Identify appropriate domains , levels and scales
- Recognize that national , societal and political domains are interconnected
- Locate problems on the certainty- uncertainty , agreement-disagreement continua
- Understand what it means to operate in the Zone of complexity

MANAGE WATER NETWORKS PROPERLY

- Recognize that simple, complex and complicated water networks require different management approaches
- Ensure appropriate stakeholder representation
- Engage in scenario planning and joint fact finding
- Mediate informal problem solving and seek consensus
- Commit to and adaptive management and organizational learning

Source: Resources for the Future, 2012

Status of transboundary water cooperation

- Track I: mostly bilateral
  - India- China: Data sharing, Expert level mechanism, emergency response
  - India-Bangladesh: Joint water committee, data sharing, navigation, ongoing process for Teesta agreement
  - Bangladesh-China: Data sharing
  - India- Bhutan: Cooperation through hydropower
- Track II/III
  - Ecosystems for Life (IUCN)
  - Brahmaputra Dialogue (Saciwaters)
  - Abu Dhabi dialogue/SAWI (World Bank)
  - Collaboration of scientists through ICIMOD (i.e. Brahmaputra-Salween landscape)
  - The BRIDGE Project (IUCN)

Source: Yumiko Yasuda, presentation at 19th International River Symposium (2016)

The BRIDGE Project (IUCN)

Building River Dialogue and Governance

The BRIDGE (Building River Dialogue and Governance) Project aims to build water governance capacities through learning, demonstration, leadership, and consensus-building, in particular in transboundary river basins.

BRIDGE works through 5 key implementation strategies:

- Demonstration
- Learning
- Dialogue
- Leadership
- Advice and Support

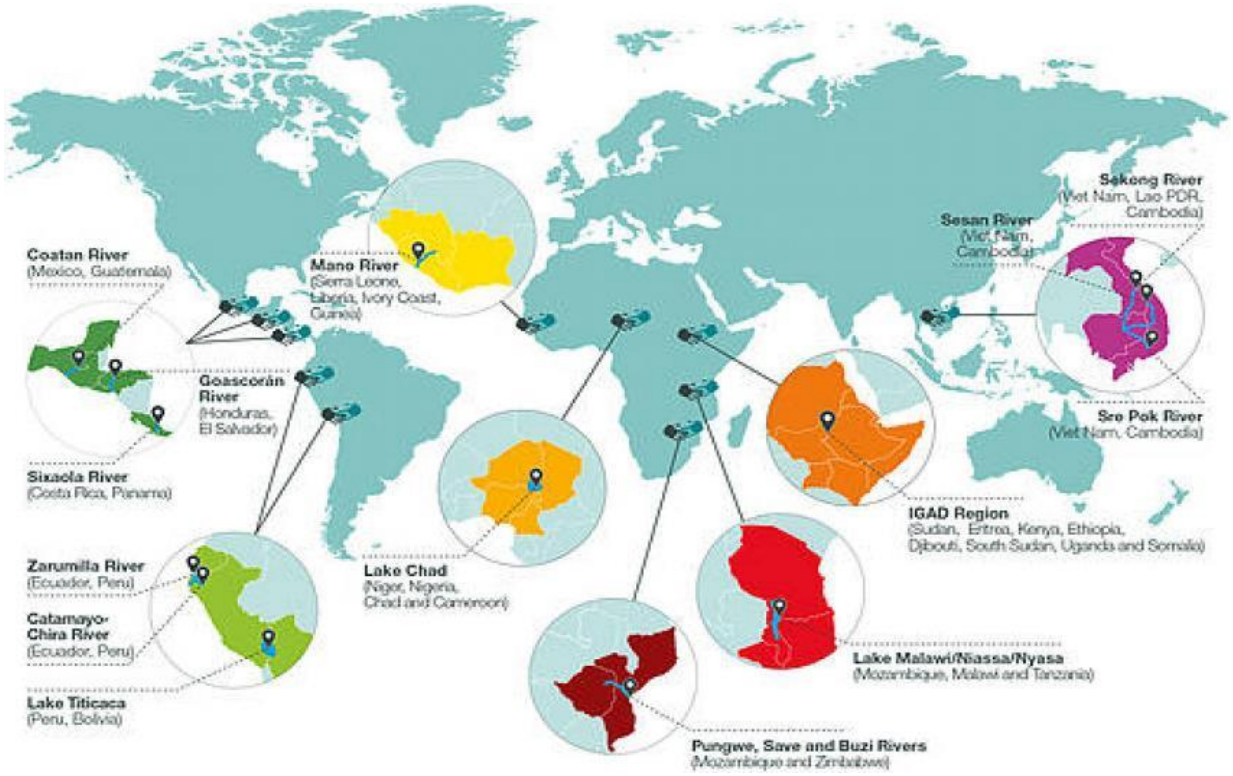
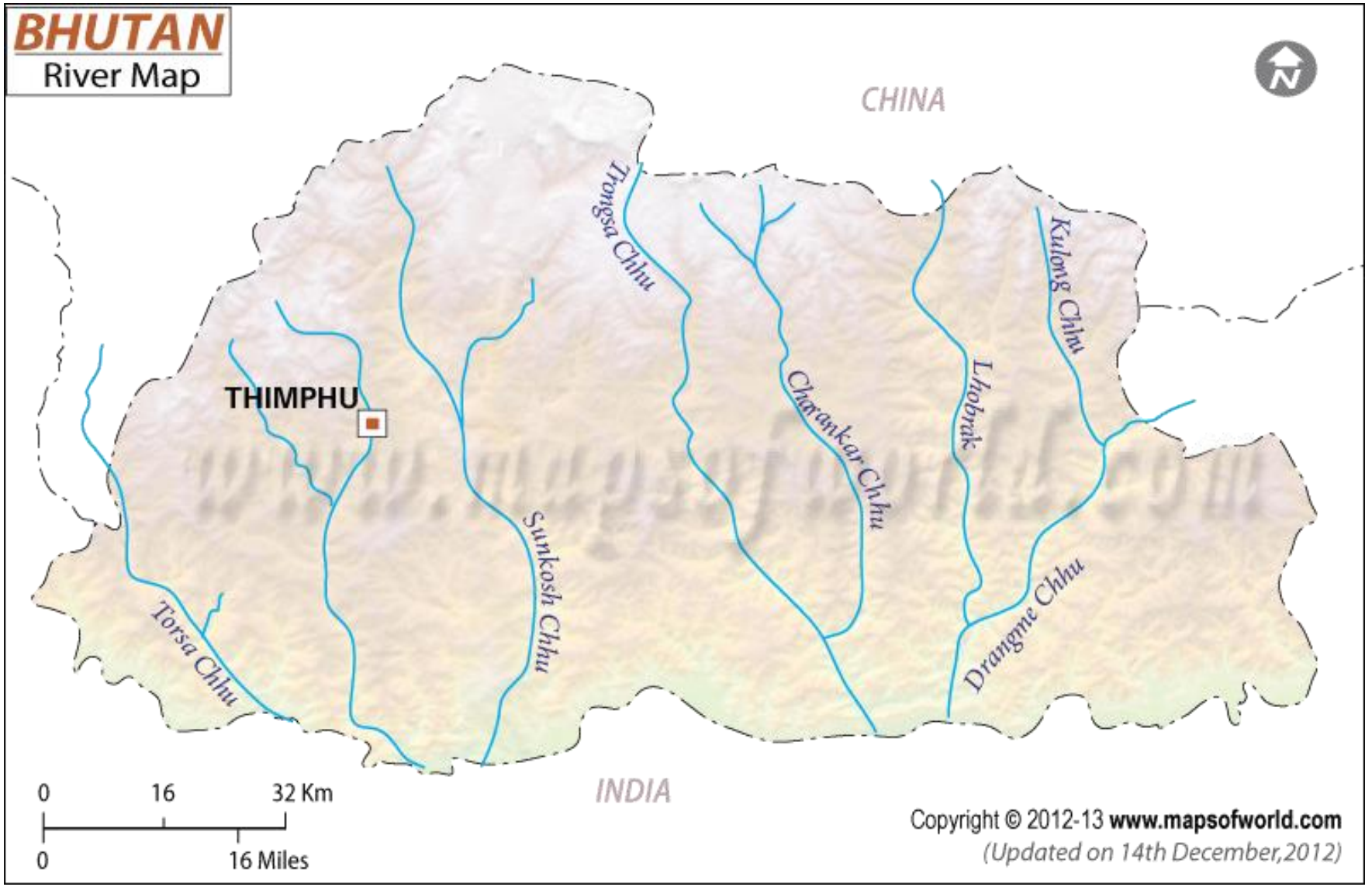
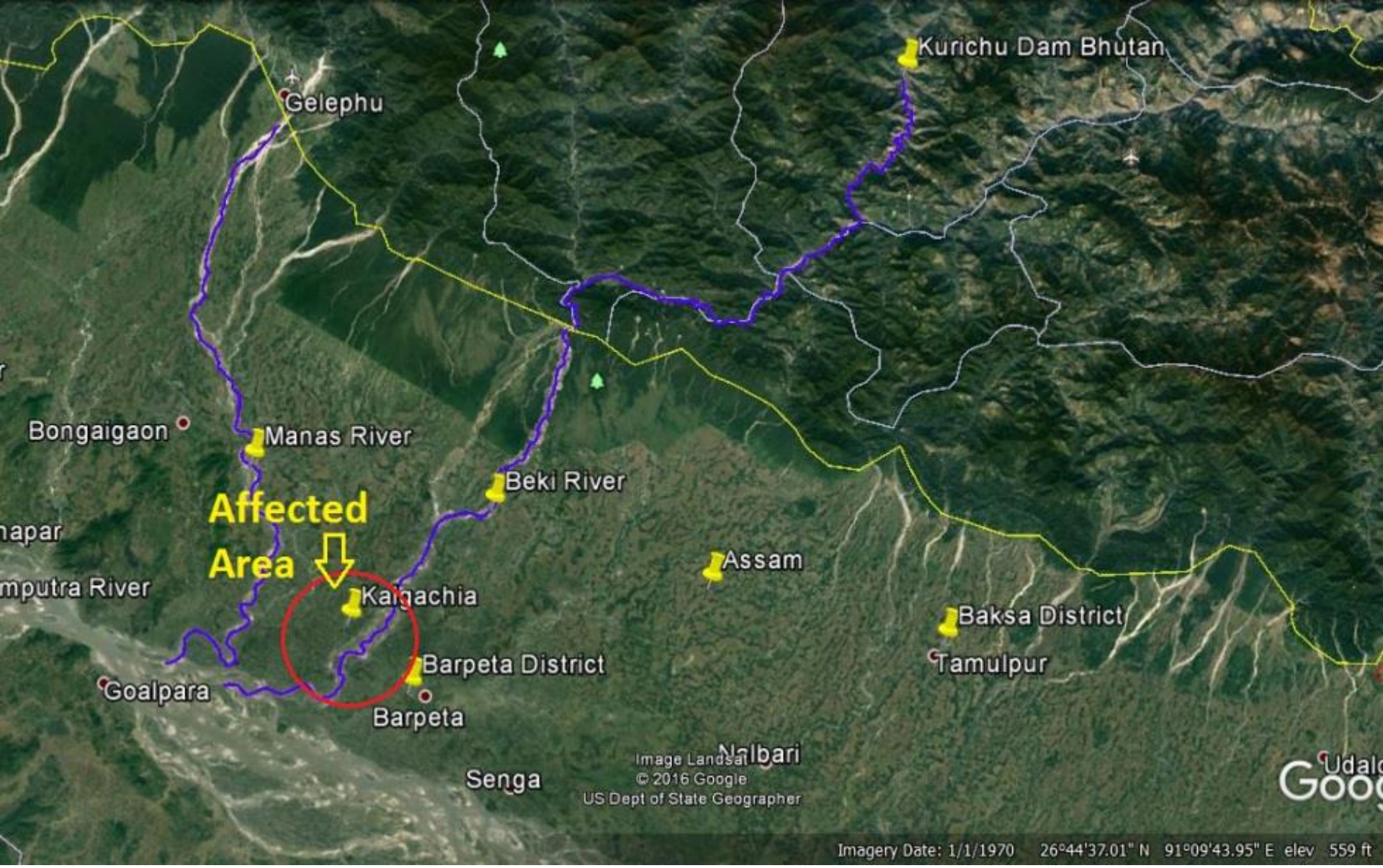


Photo: © IUCN Water Programme



- India aids and assists the construction of hydro projects in Bhutan and also buys power.



Release of water from Kurichu Dam reportedly causing floods in northern Assam

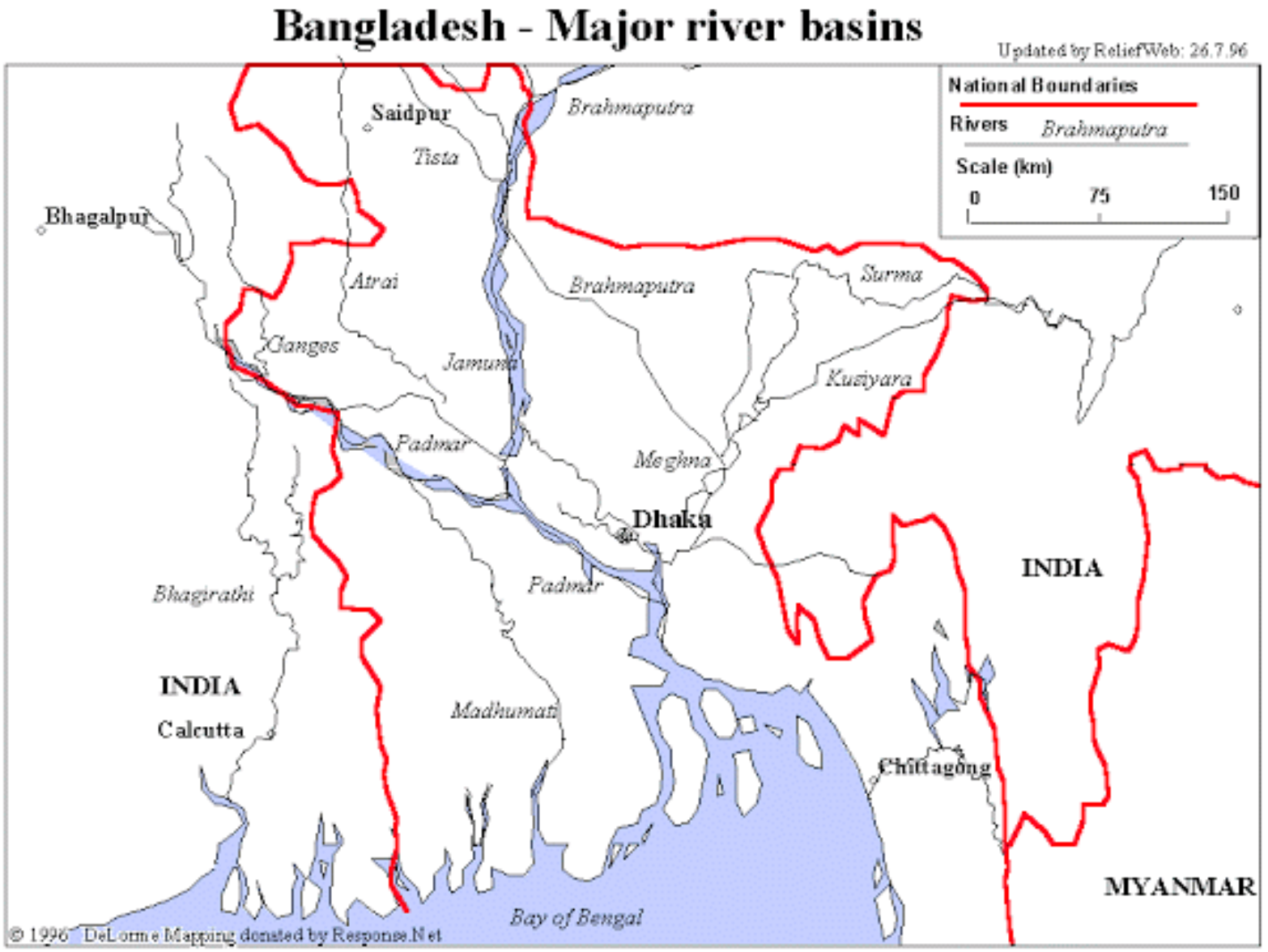
Source: https://sandrp.wordpress.com

The message was received through the External Affairs Ministry of Govt. of India on 27th May 2004 to the effect that there has been a huge artificial lake formation at upstream of a hydel power project of Bhutan (Kurichu Power Project) in the month of Sept 2003 due to landslide. May, is a month of the flood season in Assam. The message carried further information that the said artificial dam forming the lake may burst at any moment of time causing devastation. The message carried further information to take precautionary measures. To this date of 27th May, 2004, the riparian state of Assam was never been informed that a power has been constructed and that there after there has been an artificial lake formation in the winter (dry) season of 2003 (September). Such a late message left no other alternative than only to alert the population likely to be affected in a stretch of no less than 40 to 45 km.

The warning came true. The lake got lake burst on 10th July at 5 pm. the message from Bhutan at that moment was that the flood water was rushing down at unimaginable speed more than 3.00 meter above the highest flood level and that it was on the increase to be added by rising flood of other major sub-tributaries of Manas in upper & middle Bhutan territories.

Extract from the Report from Manas Forest official in Feb 2011 describing the impacts of Kurichu induced floods in July 2004

Source: https://sandrp.wordpress.com



Source: http://defence.pk/threads/indias-plan-to-divert-ganges-brahmaputra-rivers-alarms-bangladesh.431360/

Bangladesh, Bhutan, India, Nepal (BBIN)

- The **Bangladesh, Bhutan, India, Nepal** (**BBIN**) Initiative, a sub regional architecture of countries in South Asia.

- A multilateral initiative for regional cooperation on water resources management, connectivity of power, transport, and infrastructure.

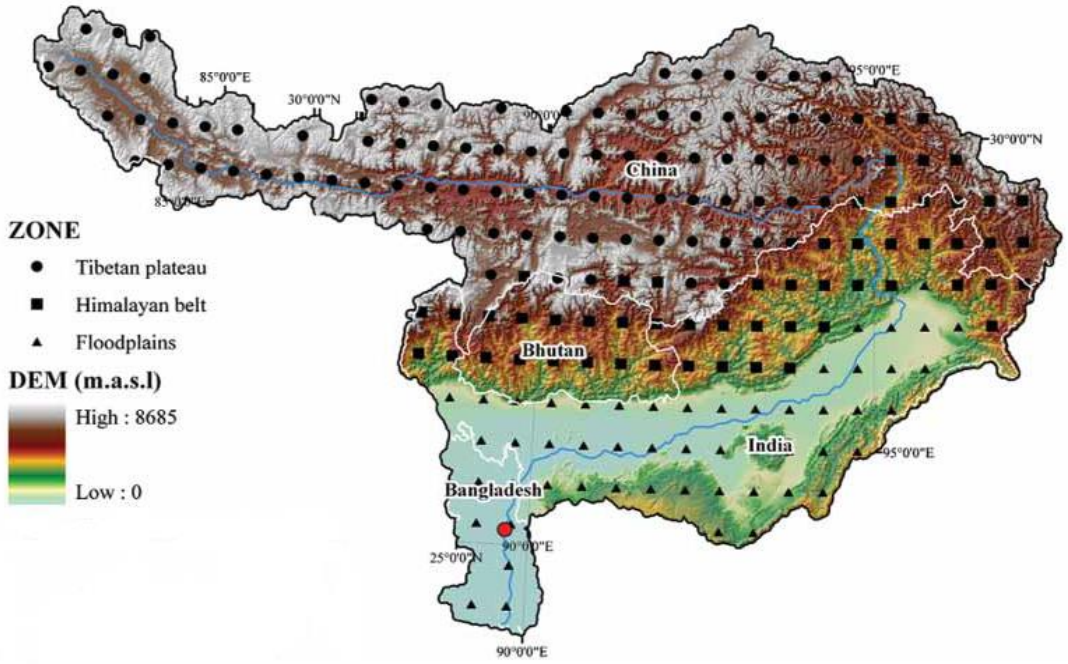


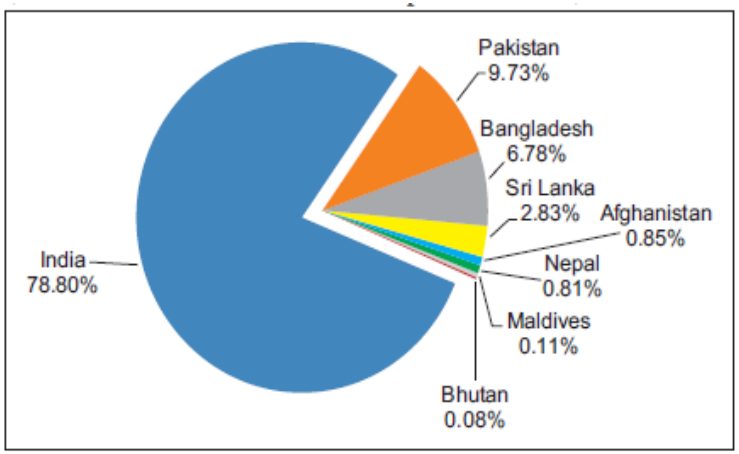
Table: Meetings of Joint Working Groups

Date	Host	Representation
April 18–19, 2013	Dhaka, Bangladesh	Ambassador, Ministry Directors
January 30–31, 2015	Delhi, India	Joint Secretaries
January 19–20, 2016	Dhaka, Bangladesh	Foreign Affairs Joint Secretaries

Source: Wiki

Opportunities for BBIN water cooperation

- Scope for power trade and inter-grid connectivity and potential for closer cooperation in future power projects.
- Opportunities for establishing proper coordination on hydropower development and sharing at the regional or sub-regional levels
- Scope to explore the possibility of using multi-modal transport for commercial as well as tourist needs
- With the signing of the **Bangladesh-Bhutan-India-Nepal Motor Vehicles Agreement** (BBIN-MVA) on 15 June 2015, potential scope for waterway connectivity among the BBIN countries got enhanced
- For India, BBIN integrates well with its "Look East Policy"



Source: International Monetary Fund, World Economic Outlook Database, October 2015

Fig. Figure 1. Share of GDP of Countries in Total GDP of South Asia (%)

Source: Pal, 2016; The Asia Foundation

- BBIN can be a platform for Hydropower Concern Mitigation discourse
- Can take up a strong footing for navigation based trade

Source: https://pixabay.com/en/trade-dealer-handshake-globe-earth-453011 /http://www.livemint.com/Leisure/xfI02USvElPBR7A9At5q1N/Majuli-Assam--An-isle-of-feasts.html; BBC

- Opportunity to facilitate trade linkages by investing on better infrastructure, addressing issues with non-tariff barriers/ non-tariff measures, creating value chains by enhancing relations within private sector.

- Establishment of BBIN economic corridor will help landlocked countries of Bhutan and Nepal to a great extent.

- Opportunity to develop waterway connectivity among the BBIN countries

"Implementation of BBIN Motor Vehicle Agreement (MVA) could potentially increase intraregional trade within South Asia by almost 60% and with the rest of the world by over 30%" – World Bank Study

Source : DPG Roundtable Reports, Vol. 1, Issue 2

Recent developments in Maritime connectivity

- Delimitation of the Indo-Bangladesh Maritime Boundary in July 2014,

  welcomed by both countries
- Agreement on Coastal Shipping in June 2015 and Standard Operating Procedure (SOP) signed in November 2015
- Coastal shipping started from March 2016. Earlier freight charges (via Colombo or Singapore) between USD 1,700 to USD 2,400 (per container of 4,000-5,000 tonnes) with transit time of around 30 to 40 days, expected to be reduced to around USD 400 and 8-10 days respectively
- MoU between India and Bangladesh on the use of Chittagong and Mongla Ports to majorly benefit Nepal and Bhutan as well via transit
- Letter of Exchange between Nepal and India to provide for transit facilities for Nepal through the Vishakhapatnam port
- India launched the Sagarmala project in July 2015 comprising of 150 projects with plans to invest Rs. 12 lakh crores under various programmes

Source : DPG Roundtable Reports, Vol. 1, Issue 2

Coastal shipping routes

Source : DPG Roundtable Reports, Vol. 1, Issue 2

Recent developments in Inland Waterway connectivity

- Protocol on Inland Waterways Transit and Trade (PIWTT) between India-Bangladesh, renewed and now provisions for automatic renewal every 5 years.
- India plans to invest INR 25 lakh crores in a phased manner to improve Inland Waterways and to increase share of coastal/ IWT mode in the country's total transportation volumes from 6-7% to 10% by 2019-20
- Bangladesh Regional Inland Water Transport Project initiated to improve the navigability of 900 km of Inland Waterways along Dhaka-Chittagong and Dhaka-Ashuganj river corridors

Source : DPG Roundtable Reports, Vol. 1, Issue 2

Challenges of BBIN regional water cooperation

Significant Challenges

- Uneven poverty reduction
- Uneven progress on social indicators
- Complexity of issues
- Need for strengthened institutions, infrastructure, policies, programs
- Poor intra-regional investment, and even poorer intra-regional factor movements (Pal, 2016)
- Non-alignment of priorities among BBIN countries (Source : DPG Roundtable Reports, Vol. 1, Issue 2)
- Political problems and issues of trust deficit within BBIN countries
- Significant heterogeneity in terms of economic size and level of economic development

Possible role of China in BBIN Water Cooperation

- Huge potentials of regional cooperation exists in Ganges Brahmaputra and Meghna (GBM) basins, yet lack of mutual trust and confidence among the co-riparian countries played a major role in long-standing disputes or conflicts surrounding trans-boundary rivers

- Multi-lateral cooperation (BBIN-C ?) has the potential of coming up with basin-wide approaches to dispute resolution, where all the riparian countries organize a mechanism for use of the waterway

- Experiences from Mekong and Nile elucidate the urgent need to stimulate a participatory process to allow, facilitate, and support stakeholder involvement in water resources planning process in the GBM region. (Source: Salehin et al., 2011)

- Although BBIN-C looks elusive, but a common understanding for a basin-wide corporation and hazard mitigation can go a long way in the overall development of the riparian nations.

Way Forward

- Even in the backdrop of such growing uncertainties and complexities, both South Asia and Southeast Asia must seek to manage their water and environmental resources for obvious benefit of addressing the fundamental problems of under-development and environmental degradation including those of water shortage, flood and rural poverty.

- The natural resource development plans so far projected only national perception making little provision to the concerns of neighbouring countries. There has been little appreciation that trade-off might achieve greater benefits for all. Distribution of the transboundary resources has been perceived as potentially providing advantage to one side while depriving the other. Not surprisingly, co-operation has been elusive.

- Opening discussions on a mutual benefit approach beyond national governments to include institutions, local governments and non-governmental organizations, has lead to new possibilities with far reaching implications for entire South Asia and Southeast Asia.
- A multilateral exchange incorporating private economic actors and a new form of regional resource policy of shared-management, linking institutions with national decision making, can facilitate significant progress in transforming human living conditions in one of the most densely populated impoverished river basins of the world.
- Some of the important aspects that need to be considered,

  - Future policies or treaties should take into account the updated figures of demand and supply,
  - Incorporate modern water management methodologies and conservation technologies
  - Water security requires to be viewed through the lens of "rationality", which entails, for the main part, prudent national water management and sensible-riparian relations so as to secure freshwater supply and all allied benefits in the long-term.

BBIN: A common future

- BBIN region will continue to grow fast with high investment
- Risk of a benign and cruel vision for BBIN GBM must be overcome
- What is a mere trade protocol must extend to advantage creation beyond national interests with common priorities
- A water centric perspective of rich geographical and natural resources to foster rewarding partnership

BBIN: A common future

- A trans-boundary system integrating all physical and ecosystem services through an inclusive governance framework operating within environmental threshold without compromising any of its functions towards all living entities through a process of mutual trust, transparency, consensus, knowledge and innovation targeted at multiple comprehensive benefits.

Thanks

Bhutan Perspective on BBIN Water Cooperation

Delhi Policy Group
Roundtable on Advancing BBIN Water Cooperation
11 November 2016
New Delhi

Context

- Water security: primary global concern
  - declining availability of and access to water
  - too much or too less water for drinking, irrigation, industrial use, and ecosystem services.
- deterioration to both quality and quantity of water
  - growing pressure from increasing population and lifestyle changes
  - associated increase in per capita demands for water
- aggravated with increasing evidence of climate change and associated uncertainties
  - projected rise in average temperature and associated impacts on hydrological cycle
  - Widening gap between concerns and actions

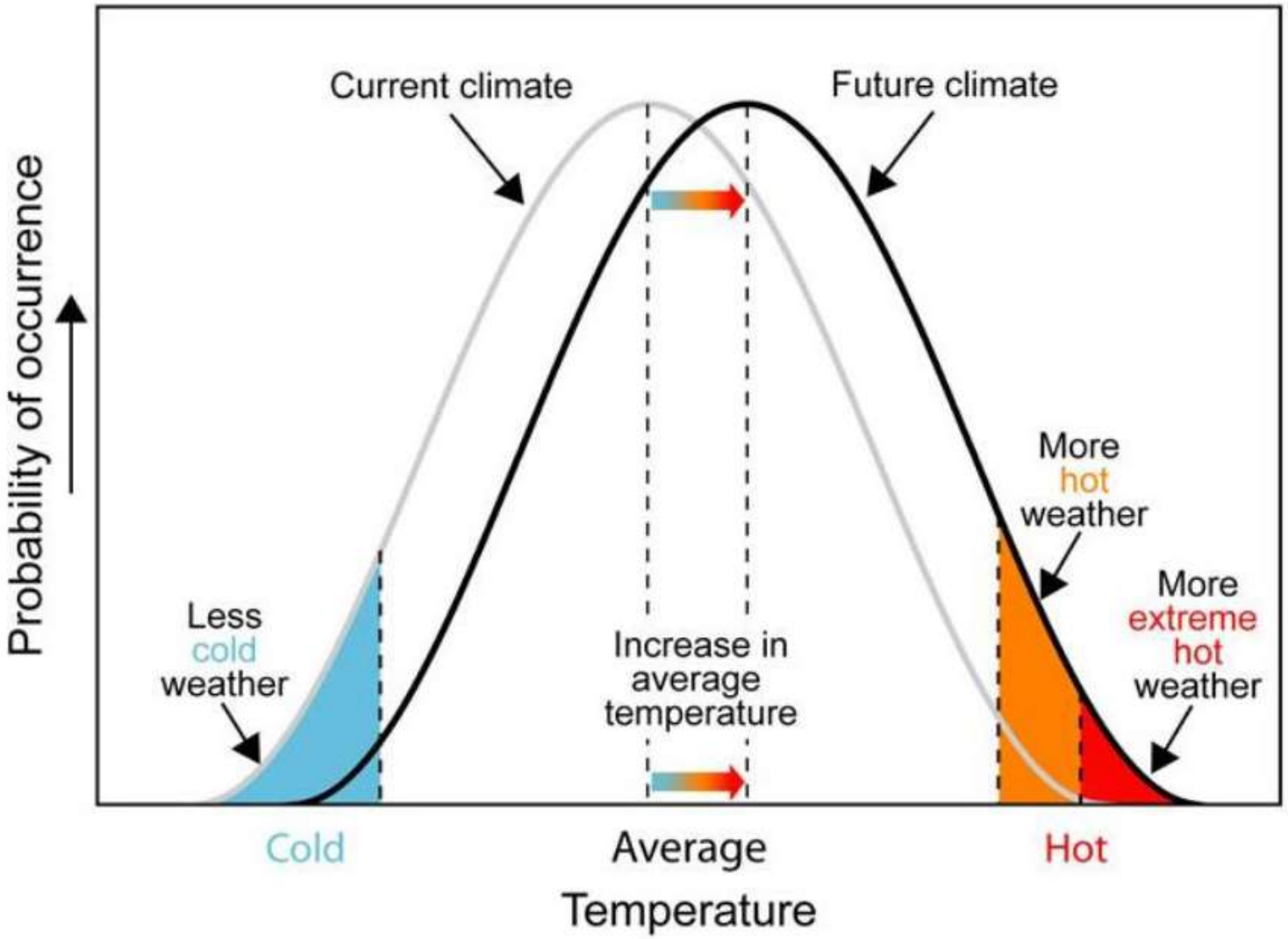
BBIN Region

- Sustains 17% of global population with just 6% of global land
  - richly endowed water resources
    - The Himalayan glaciers and the ecosystem services
  - Fertile flood plains and delta areas
- Physiography allows availability of fresh water to both rural and urban communities
  - GBM support agriculture and economic activities
- deteriorating condition - a major cause for concern
  - home to urban conglomerates as well as isolated rural populations

Climate Change Scenario

- Projections under high emission scenario:
  - temperature rise of 4-5°C by 2080.
  - Sea level rise of rise by 0.05–0.25 meters by 2050 and by 0.18–0.80 meters by the end of the 21st century.
- In BBIN region
  - Temperature increase - more pronounced in the higher altitudes
  - melting of Himalayan glaciers.
  - increased intensity of rainfall

Concern with Extremes



Implications on water, food and energy

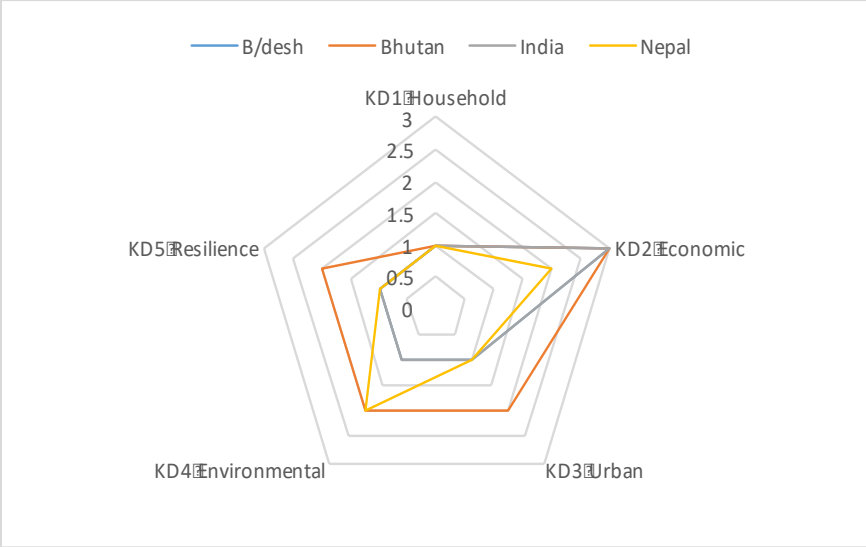
- Intensification of current levels of variability
- Alteration of hydrological systems and water regimes
- increased risk of floods and drought
  - fall in Crop yields
- Threats to agriculture in delta and coastal areas from sea level rise
- increased water stresses from glacial melt and reduction in snow cover

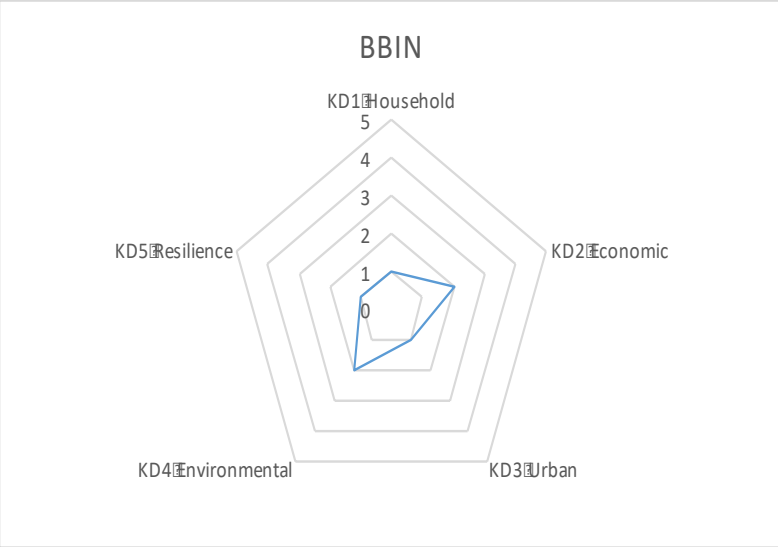
Water Security Status

	KD1 Household	KD2 Economic	KD3 Urban	KD4 Environmental	KD5 Resilience	NWS Score	NWS Index
Score	1-20	1-20	1-20	1-20	1-20	1-100	1-5
B/desh	6.7	14.1	5.0	5.3	4.2	35.3	1.0
Bhutan	6.7	14.2	9.0	10.7	8.0	48.5	2.0
India	4.0	12.9	5.6	5.3	5.3	33.1	1.0
Nepal	5.3	11.3	6.0	10.7	4.0	37.3	2.0
BBIN	5.7	13.1	6.4	8.0	5.4	38.5	1.5

NWS Index: 1 - Hazardous; 2 - Engaged; 3 - Capable; 4 - Effective; 5 - Model

Water Security: far from desirable



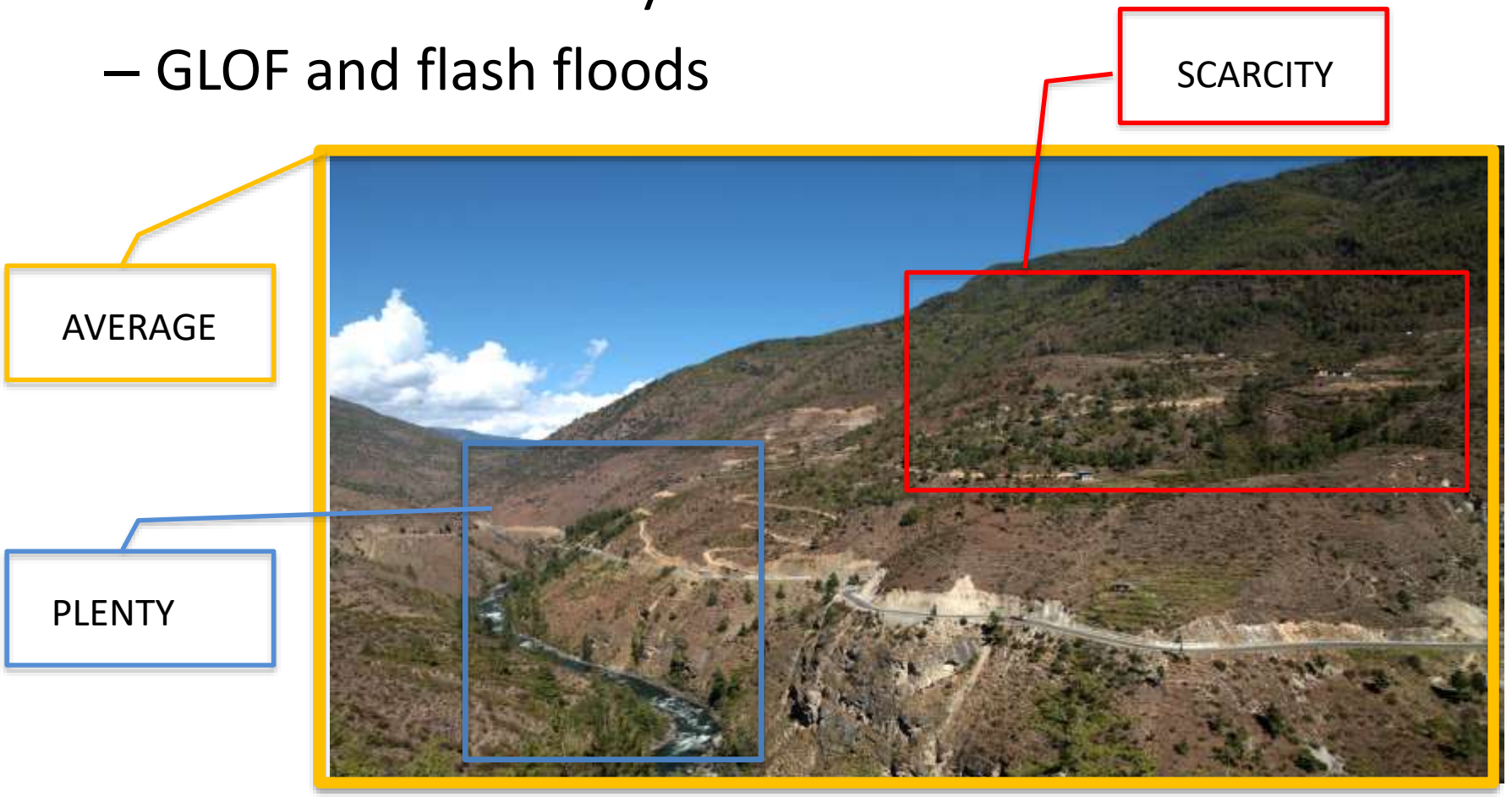


Water security issues and challenges

- water - primary ingredient for production of food and energy
- water security is key to food and energy security
- BBIN progressive but challenging future
  - in meeting food and energy demands under declining water resource
  - Uncertainty of climate change
- Question of how to ensure enough water for growing food without compromising hydropower for energy security

BBIN-Different areas - distinct issues

- **Mountain region – problem of plenty**
  - Limited accessibility to water
  - GLOF and flash floods



- **Flood plains and Delta region**
  - Groundwater depletion
  - Floods
  - Droughts
- ***Coastal areas***
  - Ground water pollution
  - Sea level rise

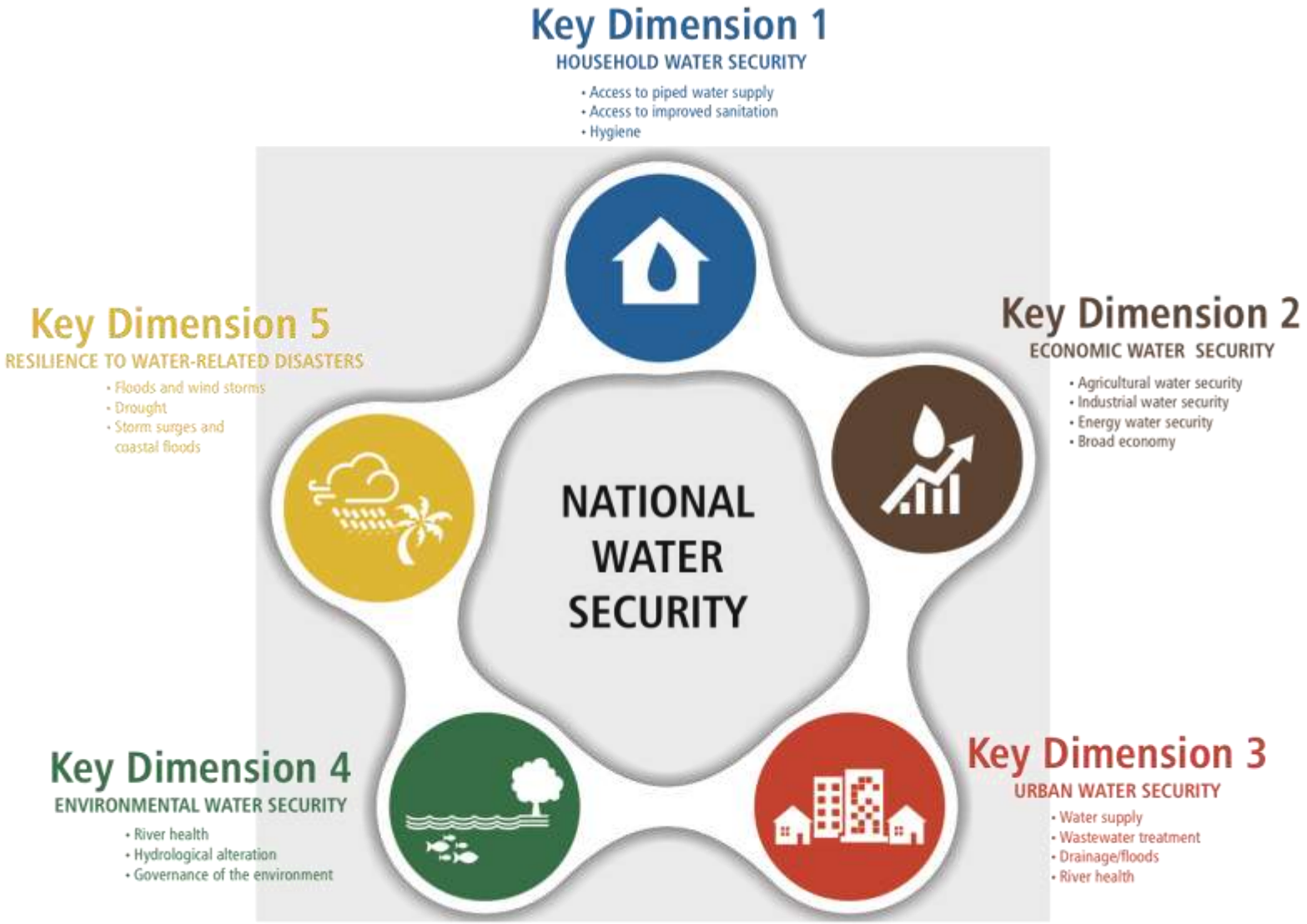
Way Forward

- options to address issues and challenges lie outside of the ability of any single nation
- the need to look at the region as one hydrological landscape
  - Requires collective action at the regional level
- realize the potential and advantages of each BBIN nation to offset the disadvantages and issues of the other nations through:
  - cooperation based on the principles of respect for sovereignty, mutual benefit, and reciprocity

- Realize the potential of Bhutan and Nepal as upper riparian countries to address
    - Local off season needs
    - Downstream flood and off season scarcity
- optimizing the economic value of water for agriculture, industry and hydropower development
  - increased capacity for retention of monsoon water
- incentivizing watershed management in upper riparian countries and communities therein
  - Payment for Ecosystem Services (PES)
  - Mitigating air pollution (addressing SLCPs - Black carbon)
- investing in and promoting transfer of technology for increased community level storage capacity
  - i) scattered small scale storage instead of large reservoirs
  - ii) restoration of fresh water lakes while ensuring resilience to water related disasters.

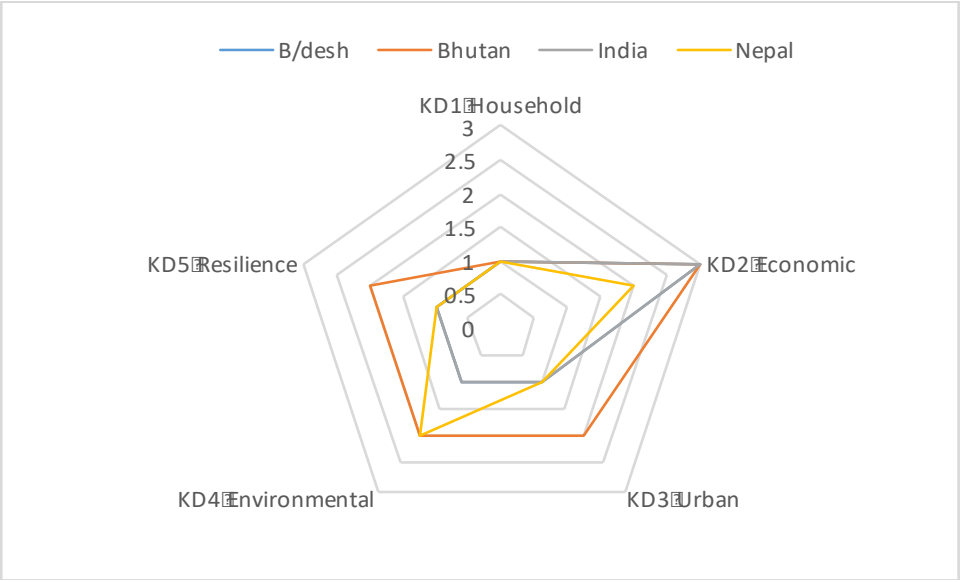
Adoption of common water security framework

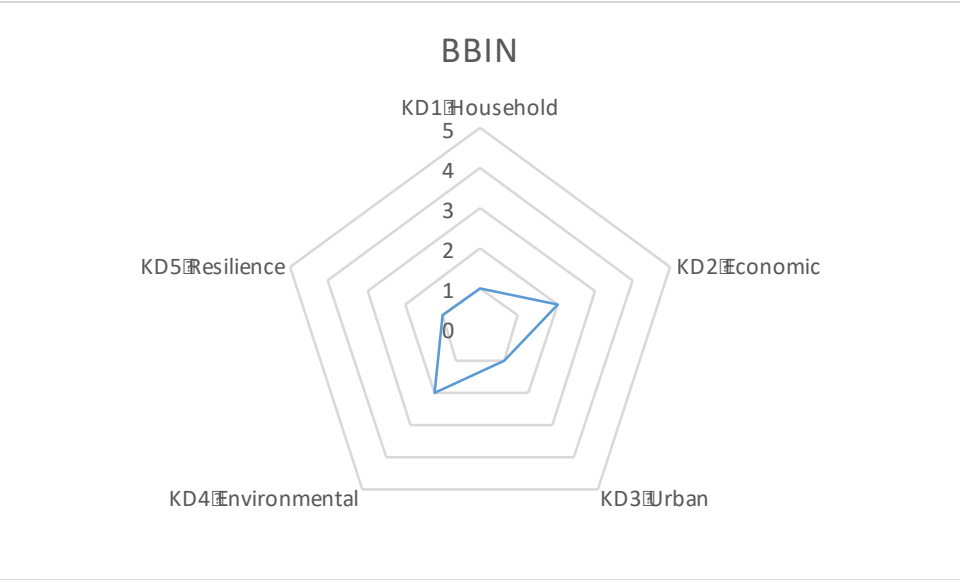
- Water security for one sector must not undermine the water security need of another sector
  - holistic and integrated approach
  - must agree on common principles of managing water with common measures of progress
- Adopt and adapt the AWDO framework for water security


Key Dimension 1
HOUSEHOLD WATER SECURITY
• Access to piped water supply
• Access to improved sanitation
• Hygiene
Key Dimension 2
ECONOMIC WATER SECURITY
• Agricultural water security
• Industrial water security
• Energy water security
• Broad economy
Key Dimension 3
URBAN WATER SECURITY
• Water supply
• Wastewater treatment
• Drainage/floods
• River health
Key Dimension 4
ENVIRONMENTAL WATER SECURITY
• River health
• Hydrological alteration
• Governance of the environment
Key Dimension 5
RESILIENCE TO WATER-RELATED DISASTERS
• Floods and wind storms
• Drought
• Storm surges and coastal floods
NATIONAL WATER SECURITY

Source: ADB.

Charting progress





THANK YOU!

Presentation on
"Water, Energy and Food Security: Nepal's Role"

by

Er. Gyanendra Lal Pradhan,

Chairman,

CACCI Asian Council on Water, Energy and Environment

Energy Committee, FNCCI

Hydro Solutions

- "Water, Energy and Food Security: Nepal's Role" by Er. Gyanendra Lal Pradhan, Chairman, CACCI Asian Council on Water, Energy and Environment, Energy Committee, FNCCI, Hydro Solutions

South Asia, including Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka, is a region of stark contrasts. One of the most populous regions of the world, it has a relatively small land mass and a high incidence of poverty and environmental degradation. The countries of the region range in size from India, with a population of over 1 billion, to the Maldives with a population of just 340,000. The per capita GNP ranges from over $1,800 in the Maldives to less than $186 in Afghanistan. Globalization has brought the region to a crossroads. While growing populations have kept the per capita income in the countries of South Asia stubbornly below the world average, (ranging around 563kWh per capita as compared to developed economies (13,246kWh per capita in the USA, China 4000kWh, and with the developed countries averaging around 15,000 kWh of per capita consumption), their economies are expanding and the demand for energy has soared. These nations 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 unleash the region's economic potential, every country in South Asia are and will be facing critical decisions, ranging from depleting indigenous energy resources to developing long–term plans to secure national and regional energy needs.

South Asian countries are highly dependent on imported crude oil and petroleum products. The imports range from 25% of commercial energy consumption in the case of Bhutan to 100% in the case of Maldives. The recent volatility and sharp increase in world oil prices has placed an unexpected and enormous burden on foreign exchange reserves, to the detriment of national economies. While countries like Sri Lanka and Maldives, which lack indigenous fossil fuel sources, are especially hard hit, even countries like India, Pakistan, and Bangladesh now meet less of their demand with indigenous fuel sources and face mounting energy import bills. ENERGY SECURITY IS AN INDISPUTABLE REALITY FOR VITAL ECONOMIC DEVELOPMENT THROUGHOUT SOUTH ASIA. Over the last two decades, South Asia has been one of the fastest growing regions in the world, with an average annual growth rate of six percent as measured by GDP per Capita. To sustain high level economic growth in the long run, it is imperative that the electricity sector grows in a sustainable manner, as power is one of the fundamental inputs to the economy. However, despite this impressive macroeconomic growth, the power

sector in the region has not been able to keep pace. The existing power shortages and growing import of fossil fuels impose a high cost to energy insecurity to the region. *Thereby, the need to ensure energy security in today's economic climate is imperative and urgent as the gap between the latent demand and supply of energy is a major concern for the South Asian Region.*

Here Nepal's role deserves a special mention. Known as the "Water Towers of South Asia", Nepal's water bodies include about 200 lakes, 3,252 glaciers, 2,315 glacial lakes, and over 6000 rivers. In the context of world's population rapidly expanding, economies growing and the competition for limited energy supplies intensifying, Nepal stands rich and tall with an annual 224 billion cubic meter of surface run-off. As per Hydro Solutions' estimate, the total hydropower potential of Nepal stands at around 200,000 MW against the popularly assumed figure of 83,000MW. With more than 6000 rivers and rivulets, around one million GW hour of electricity can be generated. This potential is adequate to meet the total domestic and part of the regional energy demands for many years. Nepal- the fourth in richest hydroelectric rich country in the world and the second in Asia after China is the golden investment gateway to enter the huge energy craving and emerging power markets with the highest market price.

NEPAL IS THE WATER AND ENERGY TOWER FOR THE WORLD.

Glaciers of the Himalaya Mountain Range are an enormous reservoir of fresh water and their melt water is an important resource for much of the region. Due to global warming, the storage capacity of clean water needs to be augmented. Let alone the cumulative potential of the SAARC Countries, Nepal alone has a storage capacity of over 140 bil. m3 which is outstanding in the region. Changes in water levels in rivers and lakes, in ice sheets and even under the ground has been one of the key consequences of global warming. It is said that effect of global warming on hydropower is seen in the form of dry month's flow going down and wet months flow increasing. Nepal is lucky on this. Due to its huge storage capacity, dry month production can be significantly augmented if properly regulated. This is also associated with other multiple benefits such as flood control, increased regulated flow facilitating navigation and increased area under irrigation in lean season for regional benefit. Thus in case of Nepal, global warming has minimum impact on hydropower. With giant population neighbors like India with around 1.2 billion population across the Gangetic basin, without sustainable water management and global warming considerations, the situations can be remarkably chaotic for all. Not to forget, the multipurpose, secondary and tertiary benefits of hydropower

development is colossal. For example, India and Nepal have finalized the Pancheshwar Multipurpose Project (6400MW), a bi-national hydropower project. Pancheswor project being successfully implemented would irrigate about 15 lakhs hectares of agricultural land, 3400MW of produced energy will be going to India's side and another 3400 MW of surplus energy can be traded by Nepal to illuminate India. Nepal will have sufficient capital from the revenue of sale of power from Pancheswor Project, to invest in other large infrastructural projects. The countries will also benefit from power production, fishery, irrigation, navigation and tourism

Instead of going for expensive Thermal Plants, storage projects like Koshi High Dam (3500MW), Karnali (Chisapani) 10800MW are attractive options. Similalry constructing high dams in the Northern Nepal valleys will significantly increase dry months water supply and electricity generation. Focusing on export projects will optimize the usage of Nepali rivers and decrease the cost per unit which is beneficial for those sharing it, i.e., both India and Nepal. This will also ensure food security like the Bhakra Nangal Dam Project located in Bilaspur district of Himachal Pradesh that changed the whole economy of Northern India. In a country blessed with Himalayan mountains and rivers, Hydropwer is a natural energy source. But when the dry season sees river-flow diminish, reliability of power supply is an issue since most existing or under construction HP projects are of run-of-river type. Budhi Gandaki (+/- 600 MW storage dam and HPP) has long been foreseen as the answer and provide seasonal water regulation. This project would result into multiple benefits downstream in India. Nepal can also be able to reap downstream benefits. We can irrigate an additional 100,000 hectares of land in Chitwan and Nawalparasi districts in the dry season from the water coming out of the project. Not to forget, the potential commercial renewable energy hydropower generation facilities and projects have the potential to create carbon credits thus contributing to renewable energy and greenhouse gas emission reduction markets and effectively combating global warming.

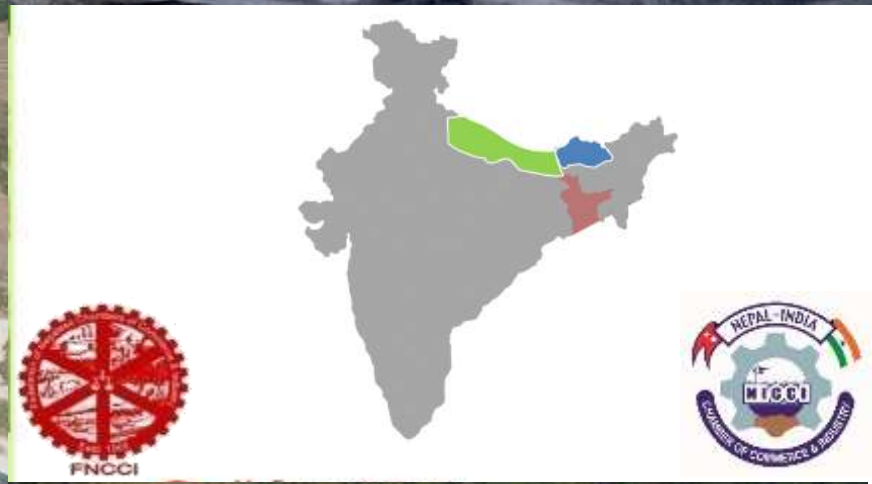
The Government of India has earmarked Rs 20,000 crore for the Ganga Cleaning Project. This popular project to develop Varanasi-Haldiya Waterways, if successfully implemented is believed to ameliorate the lives of more than 10,000 populations across the Gangetic basin. This cannot be achieved without mutual resource sharing and building high dams in the Nepal Rivers. When Nepal releases water into India during the lean flow period, it would help in cleaning / diluting the polluted waters of downstream Ganga River up to Farakka barrage.

In recent years, the notion of the Water, Energy, Food and Climate nexus has gained immense traction in the domain of natural resource governance. With the growing desire to diversify energy production to renewable realm, the South Asian Countries is showing an increased vigor. The Indian Government is planning to significantly boost the renewable energy capacity addition target for the medium term as part of its national climate change policy. India aims for 350 GW renewable energy capacity by 2030. Although this is promising, there are a number of challenges and setbacks in the government's way to achieving these targets, including land acquisition, grid infrastructure, and financing and peaking power complexities. But these alternative sources cannot be a long term sustainable solutions to the power woes in the region, rather they may serve as an adjuvant. Hydro power development of Nepal can contribute to the long term energy security of India and on the regional front, and reduce dependence on fossil fuels that put a strain on foreign reserves and the ecology as well

As energy demand increases year after year, there is a need to promote scaling up of investments in renewable energy in the South Asian region. Nepal could be a good start. The resources of the South Asian region pooled together through an interconnected grid could help South Asia secure its energy supplies. Cross border energy cooperation can be seen in the context of efficient management and use of resources. This will help economies to meet domestic demand as well as it is a good revenue option for countries like Nepal and Bhutan. Cross border energy collaboration can also boost regional trade.

Energy in today's world is recognized as the most essential staple food for a nation's economic growth. As the accepted formula goes – for 1% growth in gross domestic product to occur, a 1.5% energy infusion is required. Maybe this is the reason why the paradox of energy strategy can be found omnipresent. Energy is the engine of growth, and can play an important role to reverse the trend of import-based economy to export-based economy, which is not possible without enough power supply for industrialization. Nepal's hydropower holds colossal promise and hope to achieve this.

Enhancing BBIN Water & Clean Energy Cooperation : Nepal's Perspective



Er. Gyanendra Lal Pradhan. (*Chairperson*)

Energy Committee, FNCCI

Energy, Nepal India Chamber of Commerce & Industry

CACCI Asian Council on Water, Energy and Environment, Taiwan

Member Electricity Tariff Fixation Committee

Ex Member : Prime Minister's Economic Advisor Council

South Asian : Regional Cooperation

BBIN

SAARC

BIMSTEC

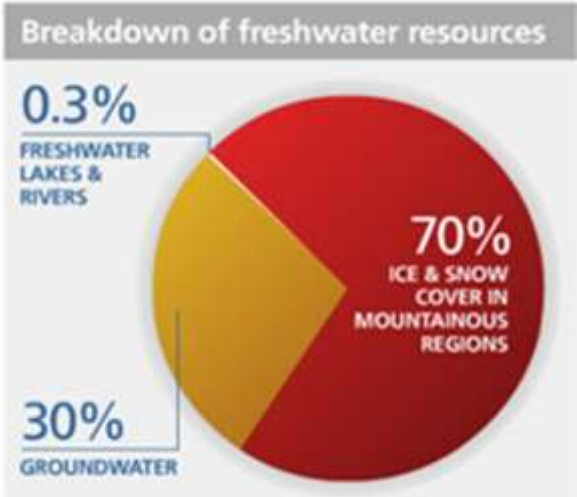
BBIN

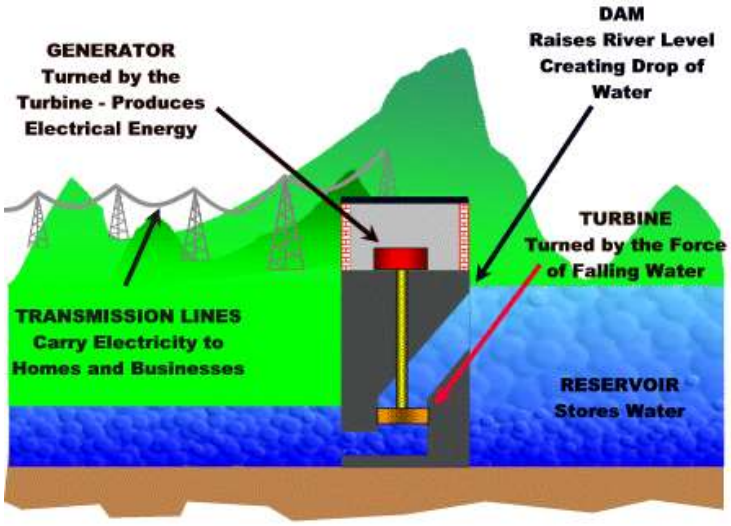
"South Asia – The Garland Countries"

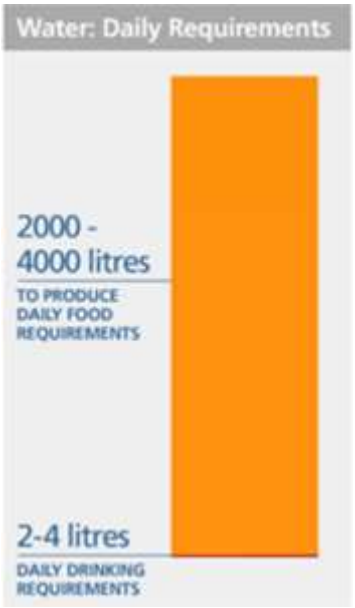
W A T E R

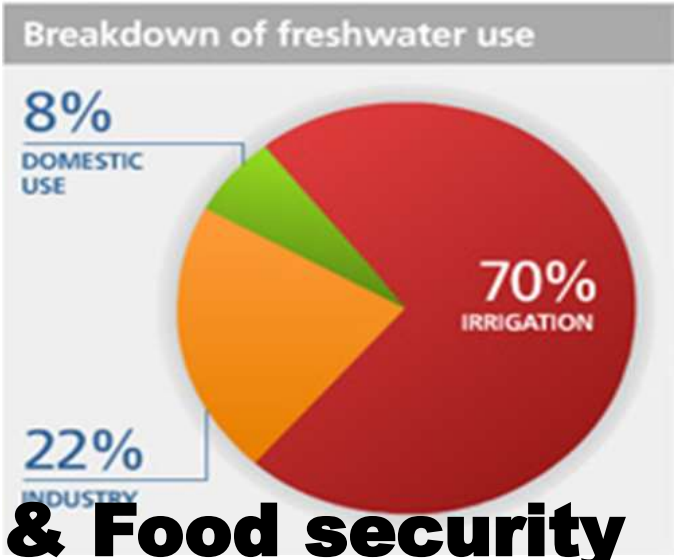
Water Resource & Consumptions

- Water is life-line for all living beings, foundation for the overall development of human society.
- **Hydropower makes water use cheaper and efficient**









Hydropower for Water, Energy & Food security

Comparing the world's energy resources*:

Where should we invest
For the long haul?

finite

2010 World Energy Use

Natural Gas

Petroleum

Uranium

COAL

WIND

SOLAR

HYDRO

Waves

Biomass

OTEC

TIDES

Geothermal

Energy : South Asia (Reserve)

- **COAL 63,036 Million tonnes**
- **GAS : 2,308 Billion cubic m**
- **OIL : 785 Million tonnes**
- **Hydropower : over 3 LakhMW**

Yearly potential is shown for the renewable resources. Total "use it lose it" reserve is shown for the finite fossil and nuclear resources. World energy use is annual

1350 litres water

1 kg wheat

16000 litres water

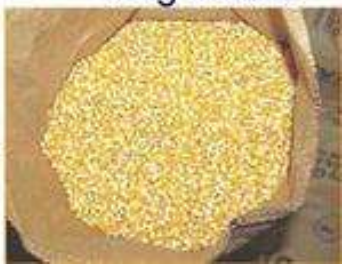
1 kg beef

140 litres water

1 cup of coffee

900 litres water

1 kg maize



1000 litres water

1 litre milk

3000 litres water

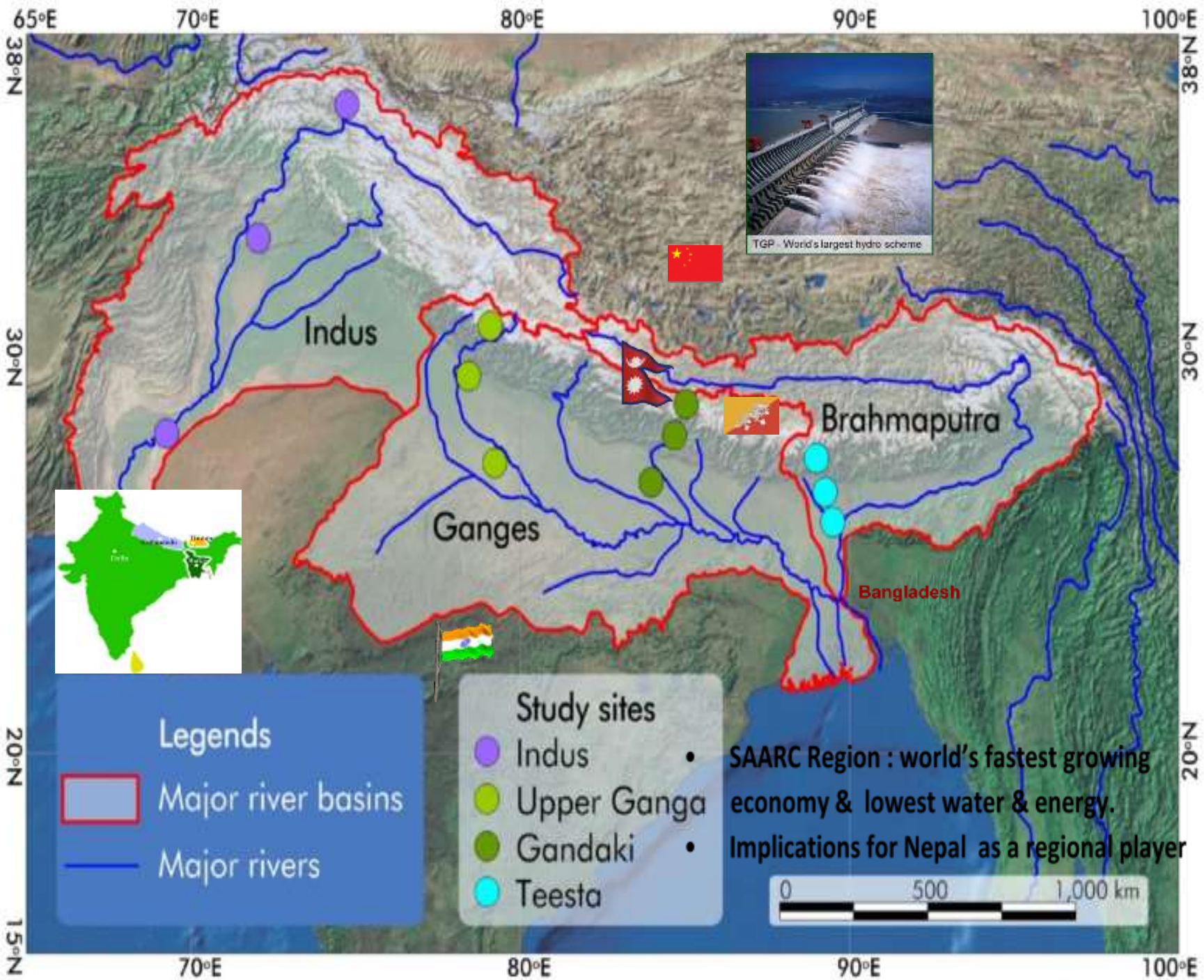
1 kg rice

People residing in Ganges basin are highly vulnerable to

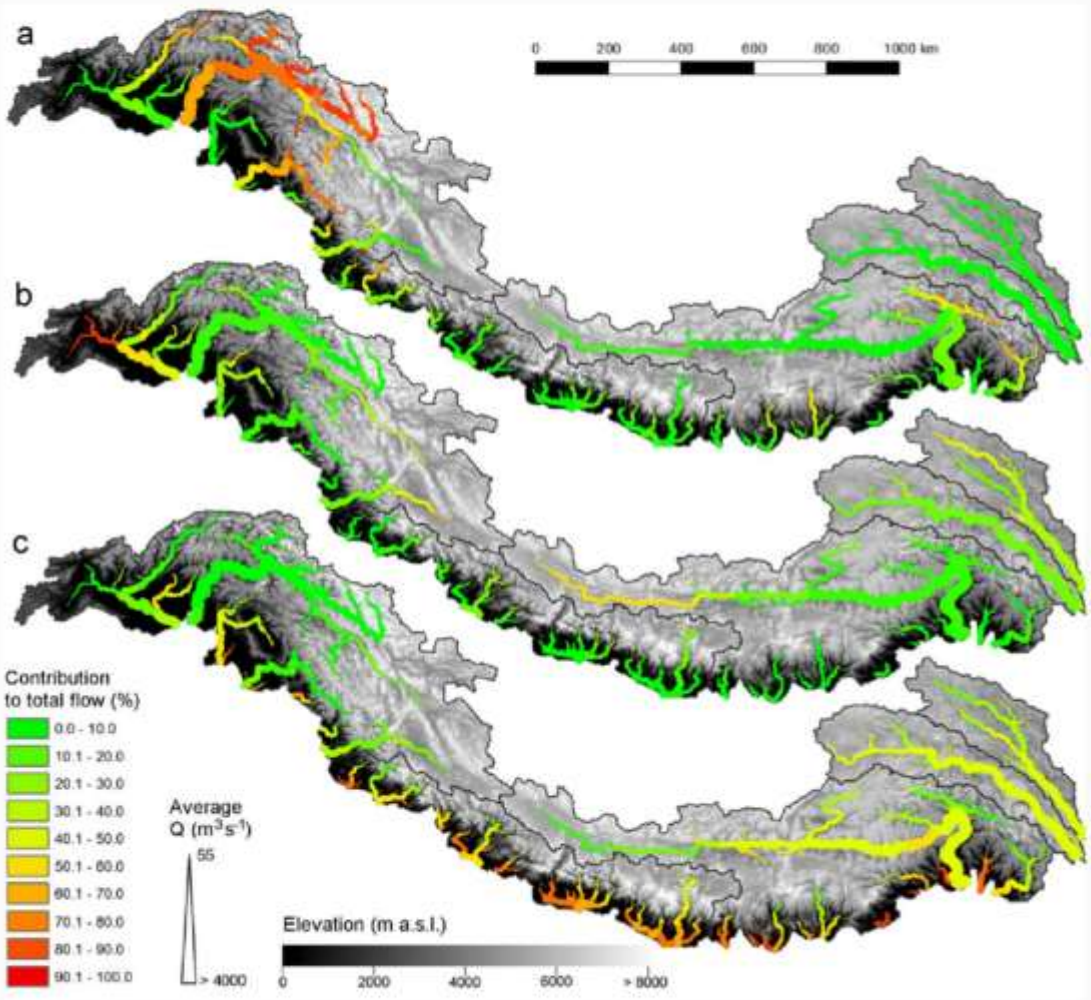
climate change

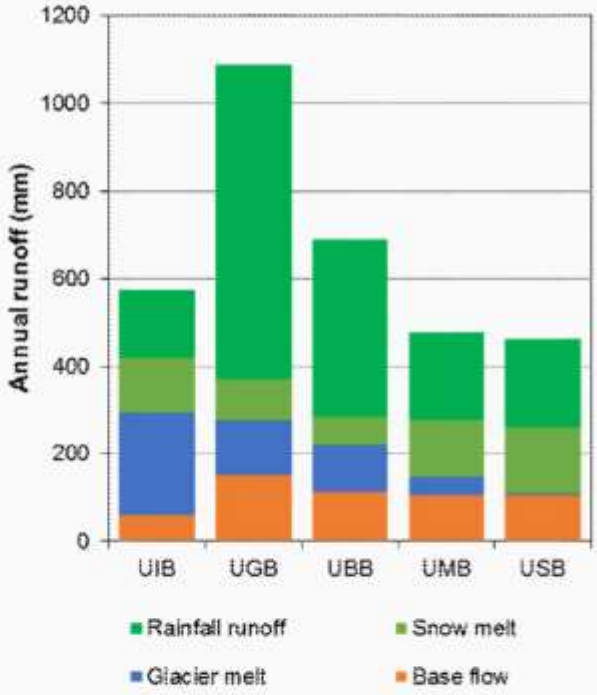
"If Himalayas live we can live"

- **The Indo-Gangetic Plain –**
- 255 million hectare fertile land. **Ganges provides water to 600 million people, largest in the world.**
- **The seasonal distribution of flow is extremely variable.**
  - **Snow fed : 1.5 - 2.4 % of the total runoff (Jan-March) & as high as 20 - 27 % in July & August.**
  - **Purely rain fed rivers : 0.5 - 3 % (March – May) & 19 - 30 % in July & August.**


65°E
70°E
80°E
90°E
100°E
38°N
30°N
20°N
15°N
Indus
Ganges
Brahmaputra
Bangladesh
TGP - World's largest hydro scheme
Legends
Major river basins
Major rivers
Study sites
Indus
Upper Ganga
Gandaki
Teesta
SAARC Region : world's fastest growing economy & lowest water & energy.
Implications for Nepal as a regional player
0
500
1,000 km

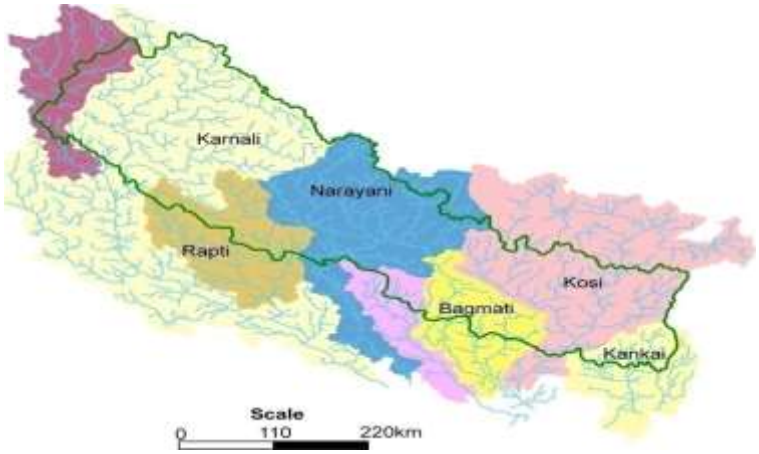
Understanding the Water Tower





Lutz, Immerzeel, Shrestha, Bierkens, Nature Climate Change, 2014

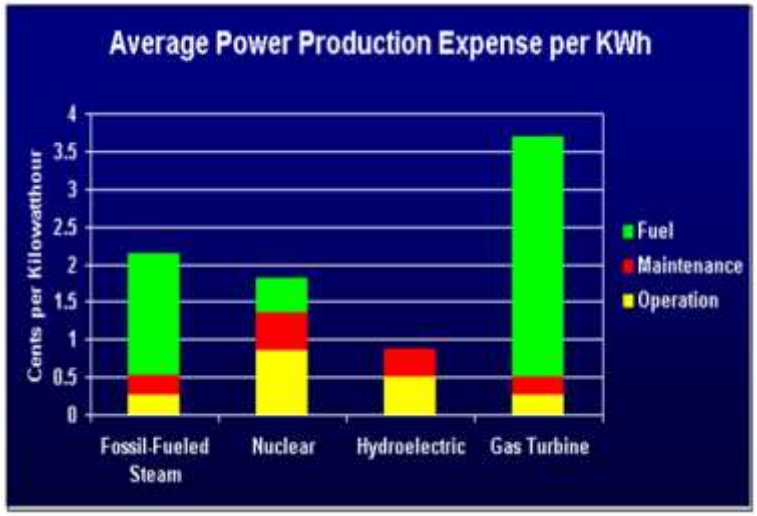
Third Pole : Nepal



Nepal Himalayas enjoy the possession of 7 mountain peaks higher than 8,000 meters

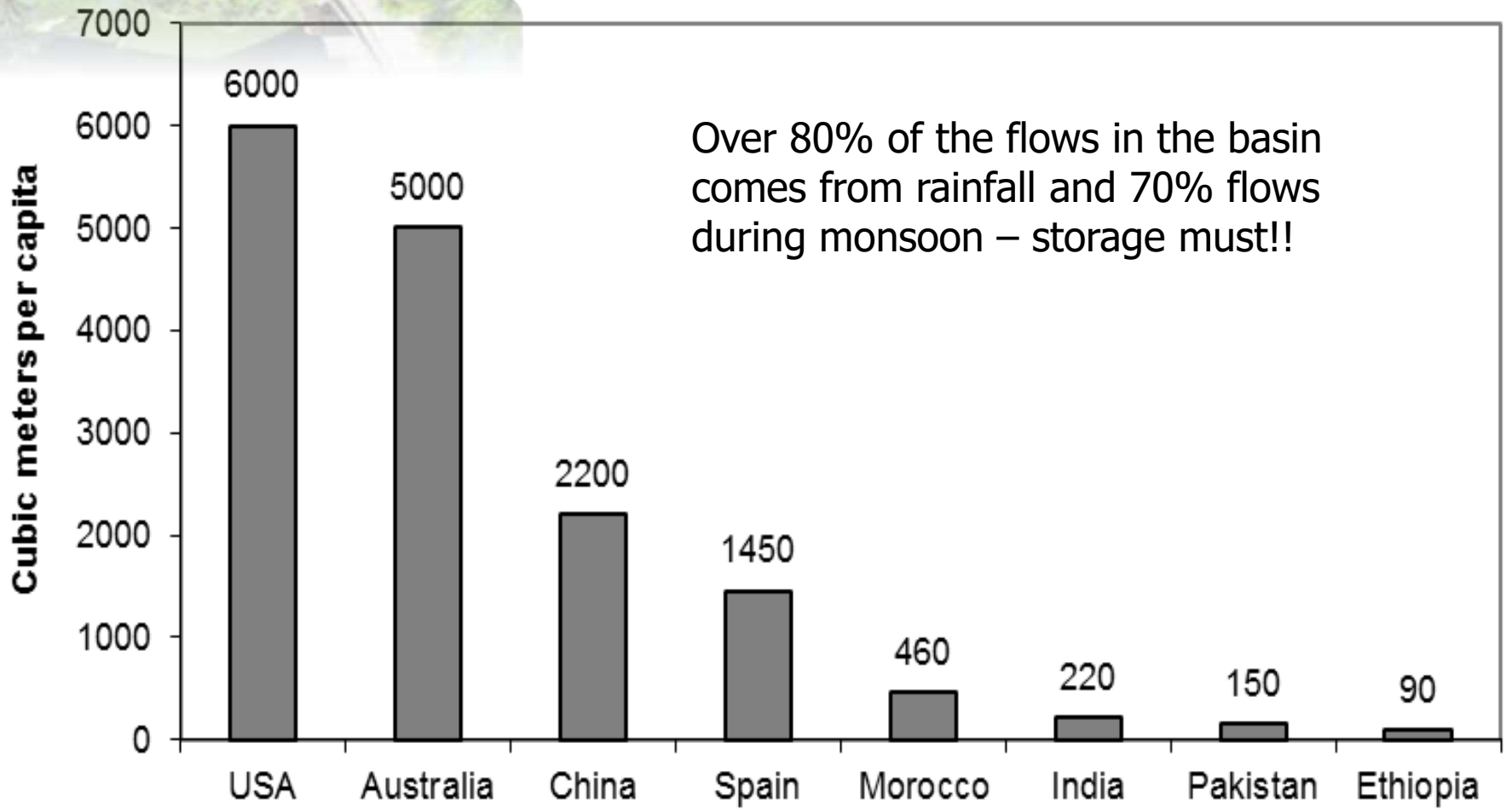
3,252 glaciers covering an area of 5,323 sq. km and ice-reserve of 481 cubic km 2,323 identified glacial lakes covering an area of 75.7 sq. km.

225 billion cubic meter of water that flows from the rivers in Nepal to India, contributing to over 70 % of fresh water to north India.

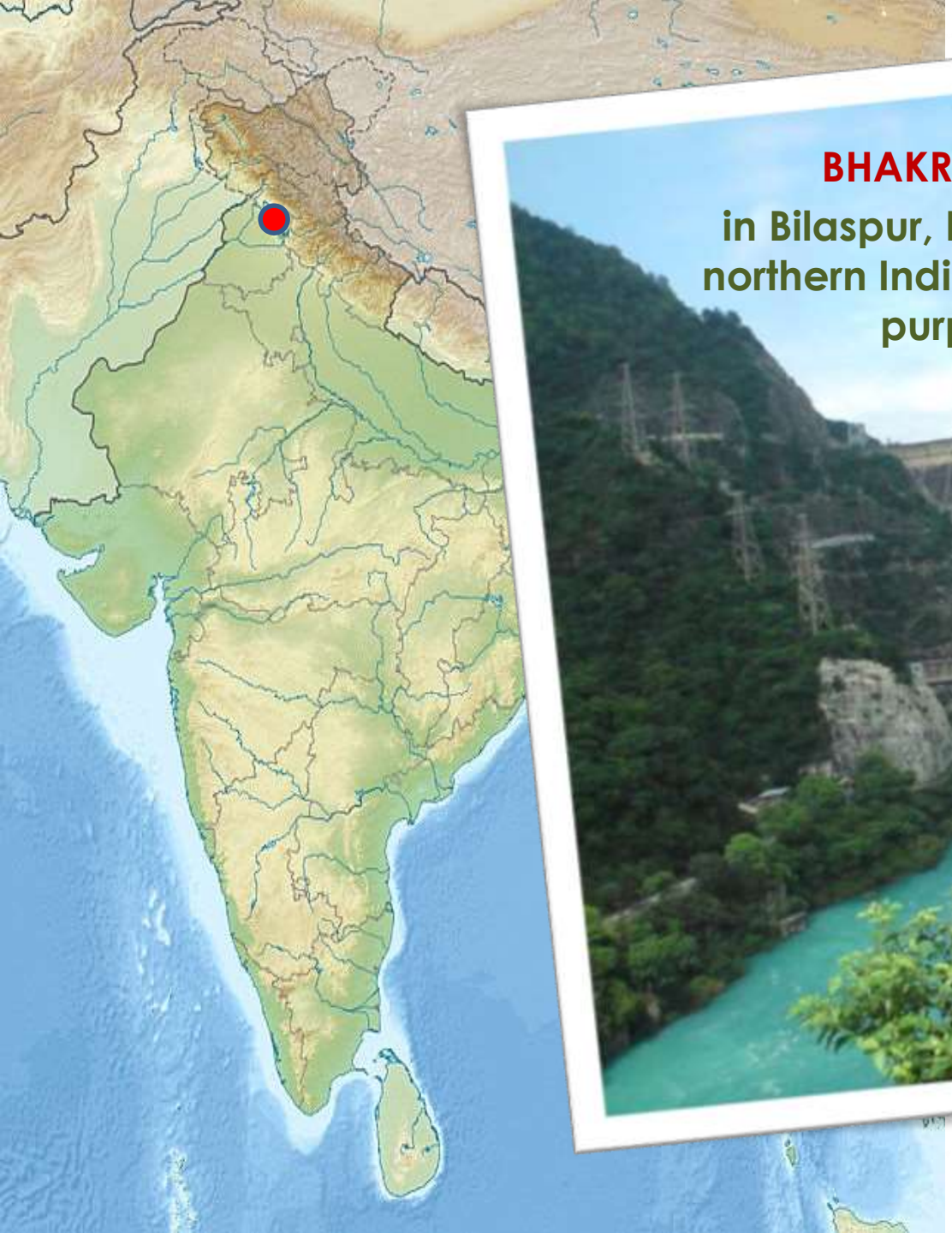


Increase storage capacity

(30% of the river flow for 8 months- over 20% will be lost by 2025)

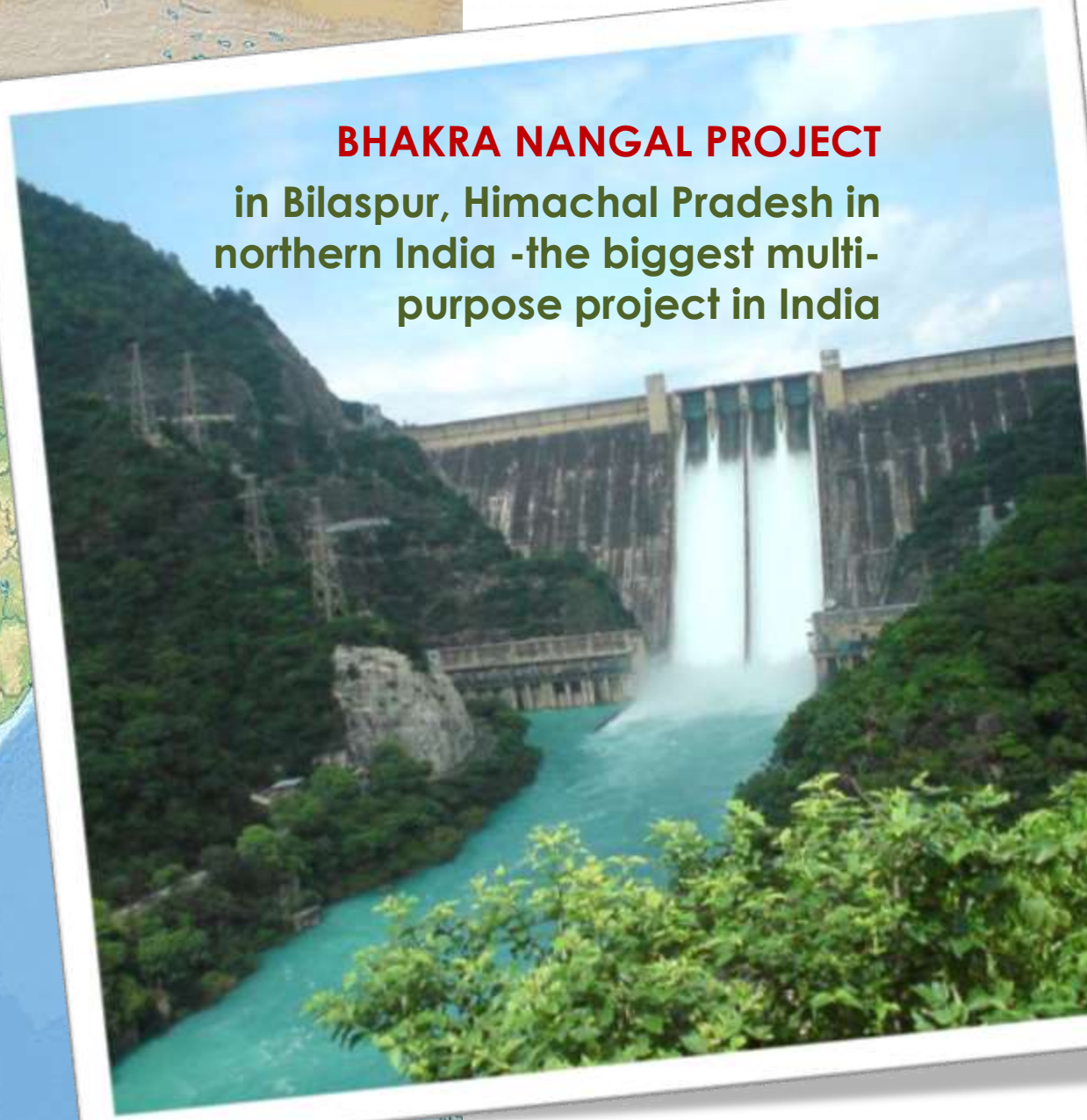


Over 80% of the flows in the basin comes from rainfall and 70% flows during monsoon – storage must!!



BHAKRA NANGAL PROJECT

in Bilaspur, Himachal Pradesh in northern India -the biggest multi-purpose project in India




KOSHI Barrage


NEPAL
Triveni Road
Tribeni Gandak Barrage
© 2013 Google
US Dept of State Geographer
Image © 2013 DigitalGlobe
Imagery Date: 11/2

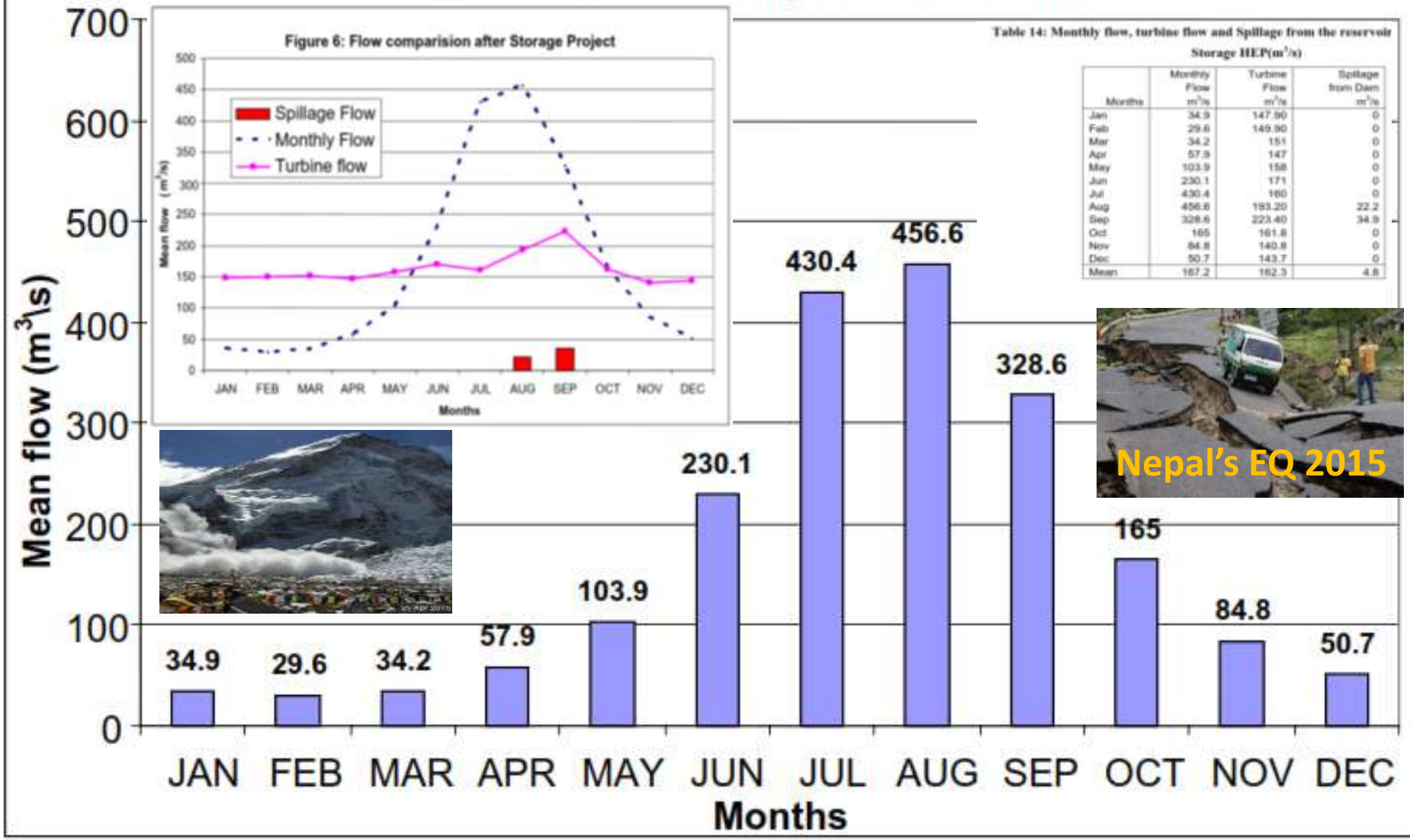
Budhi Gandaki - 1200 MW

Water Storage : Hydro power Feasibility

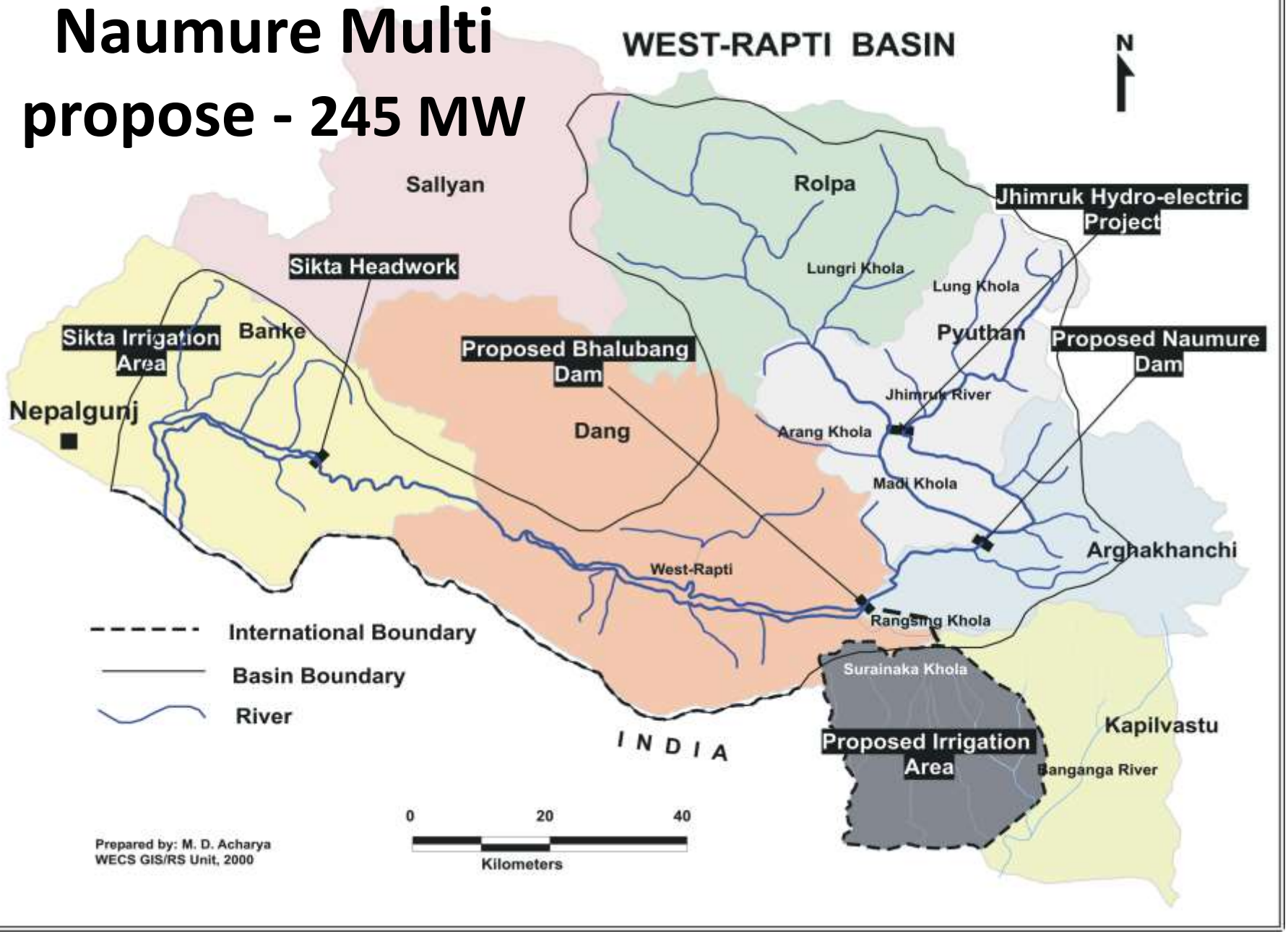
Figure 4: Mean monthly flow at dam site

Table 14: Monthly flow, turbine flow and Spillage from the reservoir Storage HEP(m^3/s)

Months	Monthly Flow m^3/s	Turbine Flow m^3/s	Spillage from Dam m^3/s
Jan	34.9	147.90	0
Feb	29.6	149.90	0
Mar	34.2	151	0
Apr	57.9	147	0
May	103.9	158	0
Jun	230.1	171	0
Jul	430.4	160	0
Aug	456.6	193.20	22.2
Sep	328.6	223.40	34.9
Oct	165	161.8	0
Nov	84.8	140.8	0
Dec	50.7	143.7	0
Mean	167.2	162.3	4.8



Naumure Multi propose - 245 MW



AGREEMENT BETWEEN THE GOVERNMENT OF NEPAL AND THE GOVERNMENT OF THE REPUBLIC OF INDIA ON ELECTRIC POWER TRADE, CROSS-BORDER TRANSMISSION INTERCONNECTION AND GRID CONNECTIVITY

Pancheswar Multipurpose – 5,000 MW

PDA SIGNED FOR 1800 MW PROJECTS

1: Pancheshwar Dam
2: Rupal Gad Re Regulating Dam
3: Poornagiri High Dam
4: Tanakpur Barrage

India – Nepal : Future

- **Hydro Potential** : about 83,000 MW
- **Future Hydro Projects :**

Karnali	- 10,800 MW (Upper Karnali - 900MW)
Tamakoshi III	- 880 MW
U. Marsyangdi – 2	- 600 MW
Pancheshwar HEP	- 5,600 MW
Sapta Koshi	- 3,300 MW
Arun HEP	- 1,100 MW
West Seti HEP	- 750 MW
Lower Marsyangdih	- 300 MW

- **High capacity transmission** interconnection between Nepal and India need to planned for evacuation and transfer of power from future hydel projects in Nepal.

Table 7

Existing and Proposed Dams in the Ganges Basin over 100m High, with Global Comparators

Dam	River	Total height (m)	Gross Storage Capacity (BC
Existing			
Tehri	Bhagirathi	261	3.5
Marsyangdi	Marsyangdi	240	6
Lakhwar *(Under construction)*	Yamuna	204	0.6
Utyasu *(Under construction)*	Alaknanda	175	3.7
Kalagadh	Ramganga	128	0.3
Kulekhani	Bagmati	107	0.1
Proposed			
Budhi Gandaki	Budhi Gandaki	300	3.2
Upper Karnali	Karnali	260	7
Bheri 4	Bheri	260	15.8
Kali Gandaki A	Kali Gandaki	260	6.9
Pancheshwar	Sarda	250	6.8
West Seti (Seti 6)	West Seti	240	3.1
Chisapani	Karnali	240	28.2
Sapta Koshi High	Koshi	220	13.5
Seti 1	West Seti	195	1.5
Sun Khosi	Sunkoshi	180	1.5
Kali Gandaki 2	Kaligandaki	160	5.1
Purnagiri	Sarda	150	3.4
Tamur Mewa	Tamur	150	1.9
Seti	Seti	145	4
Trisuli	Trisuli	140	11.0
Andhi Khola	Kali Gandaki	110	0.9

Nepal Agriculture Water Need – At a glance

Particulars	Area in ha
Total area of nation	14,718,100
Cultivable Area	2,641,000 – 18%
IRRIGABLE AREA	1,766,000 – 12%
IRRIGATED AREA	1,331,521 – 75%
Surface irrigation	734440
Underground irrigation	359556
Farmer managed irrigation	237525

Water & Irrigation status of northern India

Uttarakhand

- The major irrigation are tube wells 58% canals 28%.

Uttar Pradesh

Net cultivated area: 167.50 lakh hectares. Poorly irrigated

Bihar

- 47.98 lakh hectares 54 % area is irrigated mainly through private tube wells

Delhi – Water Supply :

- Requirement of water in Delhi is nearly 11 million MGD, availability not more than 700 MGD per day.

River Ganga Cleaning Project

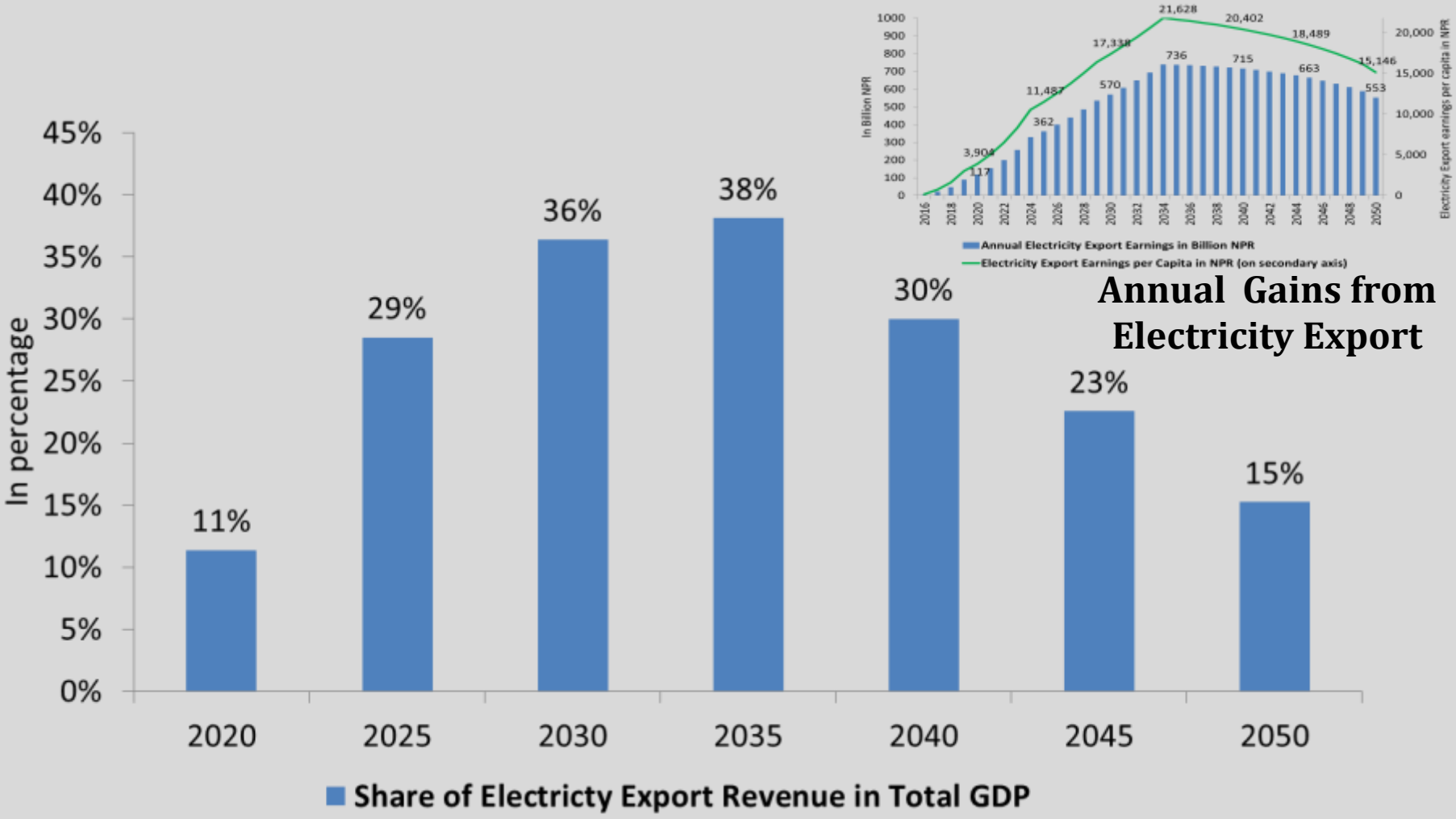
- Has earmarked Rs 20,000 crore for the project.

Households in every 1,000 do not have drinking water available throughout the year in India
Source: (Census 2011)

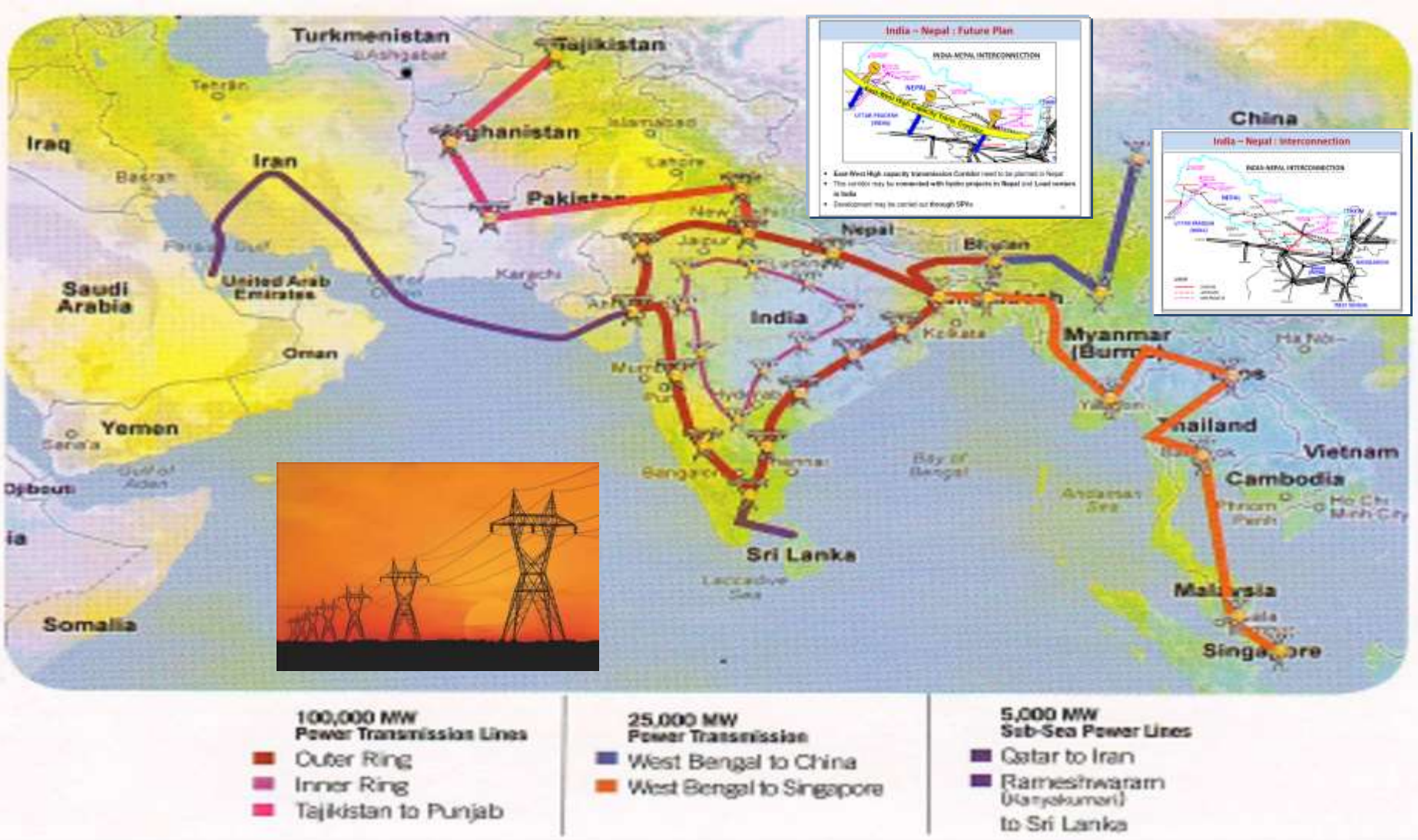
State	Rural	Urban	% of NOT getting sufficient drinking water
Uttarakhand	877	900	88.85
Punjab	931	908	91.95
Uttar Pradesh	971	966	96.85
West Bengal	880	935	90.75
Sikkim	730	951	84.05
Bihar	924	952	93.8
Himachal Pradesh	768	959	86.35
Jharkhand	703	793	74.8
Haryana	958	913	93.55
Andhra Pradesh	865	876	87.05
Arunachal Pradesh	803	783	79.3
Assam	961	945	95.3
Chhattisgarh	804	841	82.25
Delhi	703	844	77.35
Goa	917	950	93.35
Gujarat	863	961	91.2
Jammu & Kashmir	744	848	79.6
Karnataka	750	795	77.25
Kerala	860	916	88.8
Madhya Pradesh	762	762	76.2
Maharashtra	735	931	83.3
Tripura	834	987	91.05

Electricity Export Revenue share in GDP (at 2005 constant price)- Nepal

- Average electricity export price for year 2005: NPR 5.21 per kWh



Way forward : South Asian Grid could act as backbone for Central and South East Asia



What is Stopp
us…..????

Thank You

DPG Roundtable Reports, Vol. 1, Issue 3

Roundtables on "Advancing the BBIN Agenda: Energy and Water"

India Habitat Center| New Delhi | November 10-11, 2016

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