

Water-Energy Nexus: Connecting the Dots

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Water-Energy Nexus: Connecting the Dots

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Table of Contents

TABLE OF CONTENTS.....	III
WATER-ENERGY NEXUS: CONNECTING THE DOTS	2
Introduction	2
Inaugural Session.....	2
Session – I Nexus Perspective- Water and Energy	3
Session – II Water Energy Nexus - bridging the gaps	6
Session – III Policy and Governance Framework for Harmonizing Water Energy Nexus	9
Session – IV Water Energy Nexus in The Context Of Regional Energy Security	13
Way Forward	15
Strategic Action points which could be taken by the Ministry of Water resources to harmonize water-energy nexus.....	15
Annexure 1	17

Water-Energy Nexus: Connecting the Dots

Introduction

As part of the project titled “Water Energy and Climate Interactions” Identifying issues and assessing response capacity at the state level”, two days conference was organized on the theme of ‘Water-Energy Nexus: Connecting the dots’. Stakeholders from different types of organizations including government, research, local institutes were invited to deliberate on the issue on a common platform. Agenda of the conference is presented in Annexure 1.

This proceedings form part of the project under the Programme of Activities, framework agreement between the Norwegian Ministry of Foreign Affairs and The Energy and Resources Institute, briefly referred to as the Norwegian Framework Agreement (NFA). We would like to thanks the Norwegian Ministry of Foreign Affairs for their support.

Inaugural Session

The conference was inaugurated by Mr. Arild Øksnevad, Counsellor & Head of Cooperation, Royal Norwegian Embassy, along with Dr. Leena Shrivastava, Executive Director, TERI. Mr. Anshuman, Associate Director, Water Resources Division, TERI gave welcome remarks and stated about the objectives of the project and its importance. Then after Dr. Leena Srivastava, Vice Chancellor, TERI University delivered key note address and emphasised on the need for bringing energy to water agenda and vice-versa through involving stakeholders. Mr. Arild Øksnevad, Counsellor & Head of Cooperation, Royal Norwegian Embassy gave inaugural address and talked about the concerns of water and energy in Indian and Norwegian context. He emphasised on the need to develop partnership between India and Norway on important issues like this.

After the address, dignitaries launched the set of resource materials produced from the project outcomes along with the Synthesis Report on Climate Change Water Energy Nexus.

Dr. Shresth Tayal, Fellow and Area Convenor Centre for Himalayan Ecology, TERI proposed vote of thanks.



Session – I Nexus Perspective- Water and Energy

This first session of the conference was chaired by **Dr. P G Dhar Chakrabarti**, Distinguished Fellow, Green Growth and Resource Efficiency Division, TERI, New Delhi. He started by emphasising the research needs for the important issue of water and energy. The panel for this session comprised of eminent speakers as listed below.

Dr. Shresth Tayal, TERI

Prof. Sudipta De, Jadhavpur University

Dr. Vishnu Prasad Pandey, Asian Institute of Technology and Management, Nepal

Dr. Athula Senaratne, Institute of Policy Studies, Sri Lanka

Dr. Shresth Tayal gave thematic presentation on the important issue of water-energy nexus.



He started with explaining the interconnections between water and energy production systems. He explained both energy for water and water for energy. With a comprehensive diagram he explained Climate change Water Energy Nexus cycle. He assessed the existing and future water-energy demand, climate change impacts and adaptive capacity in sectoral water supply in four states in India. He also addressed the estimation of water and energy footprints in various water end uses and to develop adaptive management in efficiently using water and energy. He mentioned about the drivers of water demand for state selection and assessment of nexus parameters those of total water demand, total energy demand, water demand for energy and energy demand for water. Further he defined the projections made for the 2020 and 2030, with baseline scenario of 2010-11, for both supply side management and demand side

management. He further described about the water for energy assessment, water demand pattern, energy for water assessment and change in future energy requirement for water. He concluded by saying that his study gives a macro picture of water-energy nexus at the state level and outputs of his study may lead to further and more intensive assessment of nexus at the district level, in future.

Dr. Sudipta De started with a positive note by calling water energy nexus should be called as water energy cooperation rather. He emphasized the importance of water-energy cooperation as water- energy cooperation in nature is very useful, existence of life would not be possible without it and further explained that nexus is due to indiscriminate human consumption, violating natural cycle. He introduced the Water-energy cooperation both ways natural as well as manmade. Further he stated the energy water nexus in urban water cycle on both grounds i.e. Energy use in water sector and simultaneously water use in energy sector. He also stated energy input in water sector with a descriptive figure explaining the entire process starting from water extraction from source then its transport to use then its treatment for drinking and other use further waste water disposal and finally its recycling. He stated that as more water pumped out, lower will be the ground water level and for further pumping more power will be required and this way it will become a " vicious nexus". He stated various examples of metropolitan cities facing the scarcity those of Mumbai, Chennai and Hyderabad. From a column diagram he showed that there is maximum water supply loss in million plus cities. He specified water input in energy sector for the production, processing and transport of fossil fuels, bio fuels, nuclear fuels, energy conversions and environmental aspects. He ended by explaining sectoral development versus integrated approach and indicated for an integrated approach towards sustainability and recommended generalized energy conversion and use.



Dr. Vishnu Prasad Pandey from AITM, Nepal presented his views on Operationalizing Water-Energy Nexus in Policies & Practices. He started by stressing the three contemporary policy objectives of Climate Change mitigation, energy security & water security. He stated that about 15% of the world's total water withdrawal is for energy production which is further expected to increase to 20% by 2035. He also was of the view that water & energy has symbiotic relationship. Further he stressed that outfitting the nexus in policies & practices is a challenging endeavour which requires stakeholders' participation. He gave examples of some international initiatives on nexus approach. He spoke about the relevance of Water-Energy nexus in Nepal. He added that with

growth in population, the water - energy demand has also rise. Also he consolidated that for adequate understanding of nexus, research in the area should need to be boost as Nexus

research in Nepal is still a virgin area; although AITM-CREEW-AIT is steering the research in the area. He also introduced that dimensions of Nexus is not limited to just Water-Energy but has more inter-related dimensions i.e. Water Energy Food nexus and Water -Energy - Carbon nexus with an elaborative figures. He shared some international cases of water energy nexus, also mentioned that there has been an improved energy access in Gujarat, India. Dr. Pandey further threw some light on the barriers in operationalizing the nexus and said that the potential synergies between land, water & energy management are not well understood yet. Finally, he ended by recommending some way forwards for coordinated nexus database & research.

Dr. Athula Senaratne, a Research Fellow in Institute of Policy Studies, Sri Lanka shared Sri Lanka's Experience on water energy nexus. He addressed about Sri Lanka's water profile in terms of water physical availability. Sri Lanka has 103 river basin systems out of which few are relatively large perennial rivers. All major rivers originating from central highlands play a critical role for irrigation and energy. He talked about Sri Lanka's hydraulic civilization as there were impressive historical achievements in water management and an advanced water diversion structures that declined around 13th century. He stressed that the heritage should be rediscovered and rehabilitated in present times. He added that share of Hydro Power is 13 % in Energy Supply in Sri Lanka; however it declined rapidly since mid-1990s as of Steep rise in electricity prices. Further he shared the capacity development of some complexes, although absolute capacity of hydro has grown slowly and relative capacity has declined drastically from mid 1990s onwards. He ended by explaining a relationship between Hydro Energy and Climate change and its impacts.



Session – II Water Energy Nexus - bridging the gaps

This session was chaired by **Dr. Sudipta De**, Professor, JadHAVpur University, Kolkata. He stated that it is important to identify the gaps and bridge them at the earliest to ensure water and energy security in the region.

Experts who presented insights on the subject included

Mr. KV Rupchand, Former Chief Engineer, Tamil Nadu Electricity Board

Dr. Vaibhav Chaturvedi, CEEW, Delhi

Mr. Anshuman, TERI, Delhi

Dr. Anoop Singh, IIT, Kanpur



Mr. K.V. Rupchand stated that Water-energy nexus is one of the most important and urgent issues to be resolved for ensuring sustainable development. He added that it is important to decouple and quantify linkages of the intricate nexus for informed policy decisions and to help prioritizing resource use. He further defined the concept of sustainability and relevance of Water-Energy Nexus for Sustainable development. He quoted Kautilya's saying while addressing the need of Security of Water-Energy-Food for adverse climatic conditions. He raised the issue of adverse climatic conditions and further added that, we must safeguard against adverse effect of Climate Change. He stressed over the problems caused due to water and need for water and its scarcity and also the impacts of shortage of Water – Energy – Food. He also added the concept of bulk generation of energy using conventional and non-

conventional sources. He mentioned about integrating wind and solar generated energy into grid. He favoured the process of Interlinking of Rivers in India to make an Indian River Grid (IRG) network, that will enhance water availability and hence the water security and have other importance also. He concluded by explaining the fact of energy generation from IRG method.

Dr. Vaibhav Chaturvedi primarily addressed that his institution, Council on Energy, Environment and Water is practicing to address the global challenges through an integrated approach. He mentioned about some key nexus issues and elaborated the perceptiveness of understanding the nexus using a diagram explaining an analytical framework. He mentioned about Irrigation - Energy nexus, Electricity - water nexus and Bio energy - Climate - Water nexus. He raised an issue of subsidies that distorts markets and leads to waste of energy and water. He stated that India's electricity generation in future has huge water implications. There will be a shift toward more water intensive technologies. He ended up by raising the issue of integrating energy water climate nexus research along with integrated energy water plans at the local level.



Mr. Anshuman emphasized on major water issues across the country such as water stress, per capita availability of water, and urban water supply etc. He addressed inequitable access to water as a major problem in urban water supply. Across the country, the percentage of the total population, which lack access, to water in urban and in rural areas is 10% and 26.8% respectively. He presented on the studies done in power plant related to water audit and water use efficiency. He gave some strategic recommendations which included strategies like water metering, water auditing, leakage detection and control.

Dr. Anoop Singh, Associate professor at the Department of Industrial and Management Engineering, IIT Kanpur, India has shared some important issues which epitomizes between water energy nexus and their impacts on present and future demand of water and energy in agriculture sector of India. He addressed some critical issues which affect the electricity supply to agriculture because of limited availability of electricity and indicate the major point which responsible for this problem i.e. high pricing, tariff design and growth of demand. He is also talked about the initiatives taken by state government to resolve this problem by providing some subsidy budget every year to agriculture sector. According to him, water energy nexus in the context of electricity which is insufficiently used of water to electricity and electricity to water because of pricing, change in agriculture practices and more water intensive crop grown by people. He indicated some solution for improving the electricity efficiency for water pump sets. He has introduced the number of policy framework which implemented by government from 2001 and also discussed about the reason behind program failure. Further he discussed about some governmental and institutional criteria to design the policy in the right direction to manage the demand of electricity in agriculture sector.



Session – III Policy and Governance Framework for Harmonizing Water Energy Nexus

Water and energy are essential requirements for an economy's development. While they contribute independently to development, the two are inextricably linked. Understanding this linkage is extremely important to explore possible solutions for sustainable development and security of both the resources. Demand for one affects the other resource. Energy is vital for enabling the water value chain, and is needed whenever it is extracted, moved, treated, heated, pressurized, reused or discharged. Similarly, water is needed throughout the energy supply chain sometimes as a direct input as in the case of hydropower or geothermal energy, as a coolant in thermal power plants or more often for the extraction and processing of energy fuels.

Policy and institutional arrangement plays a significant role in regulating the demand for water and energy uses. Moreover, on account of existing dependence of water and energy on each other, policies formulated for water and energy governance, influence each other. One of the biggest growing challenges of our times is water scarcity, and energy production inevitably depends on availability of abundant water supply thus, meeting water needs depends on wise energy policy decisions. Another problem is the impact of water use for energy generation on its availability for other uses, and on the quality of the water resource in terms of material or heat pollution.

Various countries around the world are exploring their energy options and developing sustainable policies which include use of economically feasible technologies and also encourage sustainable energy production. But most of the times water is missing from this agenda and in particularly this also miss on the fact how the trade-offs between water and energy should be managed to sustain local communities at various levels.

There are limited studies and data available for comprehensively understanding the linkage but there exists quite a few evidences from across the world which shows both negative and positive trade-off between the water and energy nexus.

The panel discussion on "Water-Energy Nexus: policy and governance framework" aimed to bring together experts from various sectors to present their perspectives on the subject and brainstorm the likely governance and institutional structure which could smoothen the trade-offs in policies regulating the water-energy governance. The panel discussion explored the related solutions and way forward through addressing following questions:

Question 1: What should be the governance model and allocation strategies to resolve intersectoral competition for water? How would it work at the national, State and local levels? Is there a role for other mechanism such as demand management and supply augmentation?

Question 2: What are the trade-offs influencing the water and energy consumption across different sectors? How can these be made mutually harmonizing? How does a joint incentive mechanism can be developed that may encourage both the water and energy conservation simultaneously?

Question 3: How significant is the potential for energy or water use efficiency in helping manage intersectoral competition, and how can this be embedded in governance structures?

This session was chaired by **Mr. S Vijay Kumar** – Distinguished Fellow- Water Resources Division, TERI, New Delhi. He mentioned the need for dovetailing policies based on the research experience

Experts who presented insights on the subject included,

Dr. M P Ram Mohan, TERI, Delhi

Prof. Ramaswamy Iyer, Centre for Policy Research

Dr. Amarjeet Singh, Ministry of Water Resources, GoI

Dr. Manish Kumar, The World Bank

Dr. Sanjeev Ahluwalia, Observer Research Foundation



Dr. M P Ram Mohan gave a thematic presentation on institutional and policy aspects of climate change water energy nexus. He focussed on the four states in four geographical zones of country. These states were Tamil Nadu, Gujarat, West Bengal and Uttar Pradesh. State-wise examination of the institutional, legal and policy framework with respect to the water-energy nexus was presented. Based on the analysis he emphasised on some key issues like, updation of state water policies and other relevant policies. He also stressed on the current lack of coordination between departments and need for inter-departmental and inter-sectoral cooperation to achieve the goal of nexus harmonization. Besides these two issues, other

recommendations he made based on the analysis were, establishment of Information Management System, promoting community participation in decision making and project implementation, promotion of water-energy efficiency enhancement in big scale projects. He also exemplified the successful case of Jyotigram Yojana of Gujarat and suggested to replicate it in other states as well.

Mr. Ramaswamy Iyer, a Research Professor in Centre for Policy Research, New Delhi, India shared some important issues and their impacts on present and future demand of water and energy in India. He addressed about imbalance in demand and supply of water and energy. According to him demand is culprit for this crisis; and competitive demand of water and energy thus creates a problem. He has talked about nexus between water and energy as a neutral thing which have good and bad impact. He also mentioned about some issues



regarding distribution network in urban area, use of water for irrigation and water transfer for long distance which needs the electricity. He also talked about the need of water for industrial purposes i.e. cooling, steam generation and so on. Further, he acknowledged some issues which concern with hydropower projects. According to him it is worst form of human intervention to kill the river and indicated towards the major impact on climate, as a result. Further he discussed of some governmental initiatives and ended up by explaining Low Water Economy.



Dr. Manish Kumar started with the institutional aspect of water energy nexus. He addressed the important issues of water-energy demand and supply. Further he stated about resource utilization and growth of demand, water consumption and how water effect the economy of the country. He introduced some important point to reform institute which takes initiatives for managing the demand of water and energy at village level. He stated that technology plays an important role in term of how we save the things. He stated various examples of Gujarat state where former use the communication technology to save the water

by using the messages. He described that there is maximum water loss in irrigation. He suggested that there is a need of incentive structure including every individual using the water and energy and this created institution should ensure the participation of local community at different levels. He ended by recommending water delivery to the different purposes and suggested the power tariff for former; according to their cropping pattern and water use for agriculture.

Mr. Amarjit Singh started the panel discussion by reminding an orientation came to his career from a very old campaign of TERI's management of electricity which he said was a major intervention in his job. He shared the experience of Gujarat, he added that hoardings have been placed in Gujarat to aware people to use water like oil and people do use that efficiently as it is a water scarce state. He also stressed on 'good governance' as a key issue which do make a difference. He shared two instances of Gujarat and Madhya Pradesh. He admitted that the large numbers of blocks are under stress in Andhra Pradesh and Tamil nadu



as withdrawal is higher that the annual recharge in the aquifers. With efforts made by state government situation in Tamil nadu has improved however in case of Andhra Pradesh it has deteriorated. He added that major source of irrigation in India for agriculture is groundwater, which is mainly pumped out which needs energy to run. Since the total food

grains required to meet the demand of population is likely to increase in future, it will lead to higher energy demand also. He mentioned that we need to look at the Agricultural sector that consumes 70% of water and more than 20% of electricity in present. He supported the concept of Mr. Iyer of 'more crop for each drop', further he suggested that we should shift to low on water and energy crops. He added that policy should be based on actual data and added that in days to come rainwater harvesting will be very critical. In the various source of energy production; requirement of water is immense. He concluded by saying that water and energy sector are inextricably linked and need policies that look water energy and climate in a systematic and integrated manner.



Mr. Sanjeev Ahluwalia in his key note addressed water energy nexus and policies and governance frame work related to it. He further shared his experience of South Sudan and related it to governance issue. He shared some real time examples of policies. He also mentioned that he is of the view that we don't need policy in India. He added that the problem is not the resource constraint but the crux of problem is the principles copied from context abroad which cannot be transposed to India. He stated India as highly centralized, poorly governed and its institutions are out of date along with the system which is inefficient. He suggested that scarcity approach to both water and energy needs to be discarded. He concluded by saying that solution are not complex but simple and right decisions must be taken from the people in power.

Session – IV Water Energy Nexus in The Context Of Regional Energy Security

Energy security refers to the ability of a nation to secure sustainable energy supplies to meet its energy needs at reasonable prices. The energy security situation in South Asian countries is especially acute due to limited availability of conventional energy fuels and soaring energy demand due to their expanding economy. Growing industrial, commercial, and transport sectors along with increasing urban and middle-income consumers are using energy at unprecedented rates. Also, these countries are highly dependent on imported crude oil and petroleum products. Limitation of financial resources required for expanding the energy production capacity in these countries presents another bottleneck in the path to energy security.

Water-energy nexus – signifying the inextricable interdependence between water and energy- has the potential to affect the regional security in the perspective of shared water resources and prevailing conflicts. Water plays a key role in energy security of a country due to its use in production of electricity, and mining and refining of fuels. Thermal power production through coal and nuclear fuel is directly dependent on readily available water to be used as coolant in boilers, while sufficient flowing water in streams or as reservoir storage is necessary to ensure continuous hydropower production. Numerous instances of temporary closure of power plants, especially due to shortage of water available have been witnessed in the news media in recent past. Thus, water and energy security are complementary to each other, and impact on one influences the other.

Climate Change and its impacts on melt response of Himalayan glaciers have impacted the runoff patterns in regional rivers. Climate change has been projected to further aggravate the water scarcity scenarios in the region, adversely affecting the hydropower generation potential of the region.

However, as South Asian countries have similar economic set up and share challenges for sustainable development of their society, opportunities exist to explore solutions which could address the problems related to water and energy security of the region, in a mutually beneficial manner.

The panel discussion on “Water-energy nexus in the context of regional energy security” aimed to bring together experts from various sectors to present their perspectives on the subject and brainstorm a way forward to address the problem of regional energy security. The panel discussion explored the related solutions and way forward through addressing following questions:

Question 1: What is the water-energy nexus scenario in the region? How does it influence water and energy security perspectives of the region? What should be the framework for a holistic assessment of water-energy nexus in the region?

Question 2: What are the opportunities of cooperation to manage water-energy nexus in the region? How significant is the potential for energy or water use efficiency in helping manage regional stress for water allocation, and how can this be embedded in ambit of cooperation among the countries?

Question 3: What solutions exist to assess and reduce the vulnerability of energy production installations of the region with reference to climate change and likely variability in runoff of the rivers?

This session was chaired by **Mr. K. Ramanathan** – Distinguished Fellow- Industrial Energy Efficiency Division, TERI, New Delhi.

Experts who presented insights on the subject included

Dr. Ritu Mathur, TERI, Delhi

Mr. Gopal Saxena, Director, BSES Rajdhani / Yamuna Power Ltd.

Dr. Ritu Mathur introduced the water - energy nexus in the context of regional energy security. She explained that there is a two -way interaction between water and energy and increase in demand of any leads to stress on both. Energy is required for water desalination, treatment, supply and contrary water is needed for energy production and various other sectoral uses. She added that there is variability in river flows in India which increases the risk to sector-wise water demands. She also gave instances of specific water stress. She finally concluded by recommending that there should be identification of specific issues in localised contexts first, further the role of technology along with an Integrated thinking, planning & decision making.



Mr. Gopal Saxena, Director, BSES Rajdhani/ Yamuna Power Ltd, started from the importance of water energy nexus, availability of water and energy and their demand. He addressed that the problem of high consumption of water and energy has risen because of population growth. He has talked about aquifer level depletion caused by water pumping. He introduced the number of water scarce country and water demand in different sectors. He suggested constructing the coal based power generation station at regional level. Further he shared the suitable transmission linkage across the various countries and mainly focused on Indo - Nepal

initiative to exchange the power by transmission linkage and also added some point to enhance the capacity of wind and fossil fuel power generation. He ended by explaining the importance of solar water pump along with its limitations and uses.

Way Forward

Strategic Action points which could be taken by the Ministry of Water resources to harmonize water-energy nexus

1. To modify National Water Policy 2012, to explicitly mention about water-energy nexus and set targets for improving energy efficiency of water utilities. To initiate specific programme to support research on nexus issues, incentives for energy efficient water utilities, awards etc.

Justification: An analysis of international water related policies (USA, Canada, Germany and Australia) indicate the existence of statutes that recognize the nexus between water and energy nexus. As a token initiative, it promotes need for new approaches to address the interconnections within the water, energy and food security. Also, research support from ministry will help in development of innovative integrated solutions for water and energy security.

2. To set up a panel or conduct a study to identify the policies/ programmes across different ministries especially power, and categorize them as antagonistic or synergistic towards water conservation.

Justification: Several policies and programmes related to different sectors have negative influence on water both in terms of availability as well as quality of water. It is necessary to identify such policies, flag them and float necessary checks which could protect the resource. Relevant amendments could be further taken up on the identified and categorized policies and programs to harmonize the nexus.

3. To make it mandatory for thermal power plants to undertake Water resource Impact Assessment (WIA), and develop Source Water Protection Plan (SWPP) for the hydrological unit of their location.

Justification: Availability of/ closeness to fuel resource is the primary consideration for setting up of thermal power plants. These plants need continuous water supply, and influence the hydrological balance of the area. Hence, it is necessary to develop Source Water Protection Plan and taken necessary measures to reduce the impact due to their operation in the adjoining hydrological setup.

4. To make it mandatory for municipal corporations to undertake energy efficiency audit of both water and waste water systems.

Justification: 15-25% of total electricity consumption is for the provisioning or use of water. The situation is more alarming in urban areas, with higher piped water connectivity, treatment and purification of water as well as wastewater treatment put additional pressure on electricity availability. A major portion of annual budget of water utilities is for paying the electricity bills. Moreover, leakages in distribution

system relate to equivalent energy losses. Hence, it is necessary to promote the energy efficiency in water sector.

5. Water-energy labeling: making it mandatory for packaged food and other industrial products to display water and energy footprint (supply chain and product embedded). Promotion of low water-energy intensity products could be taken up further.

Justification: This will sensitize consumers and promote resource use efficiency.

Annexure 1



‘Water-Energy Nexus: Connecting the Dots’
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Agenda

2 nd September 2014 (Day 1)		
9:30-10:00	Registration	
10:00-10:05	Welcome Remarks	Mr. Anshuman, Associate Director, Water Resources Division, TERI
10:05-10:15	Key Note Address	Dr. Leena Srivastava, Vice Chancellor, TERI University Executive Director (Hon), TERI
10:15-10:25	Inaugural Address	Mr. Arild Øksnevad, Counsellor & Head of Cooperation, Royal Norwegian Embassy
10:25-10:30	Release of set of resource material on Climate change-Water-Energy nexus	
10: 30-10:35	Vote of Thanks	Dr. Girija K Bharat, Fellow and Area Convenor - WRPM, TERI
10:35-11:00	Tea	
TECHNICAL SESSION 1: Nexus Perspective- Water and Energy		
Chair: Dr. P G Dhar Chakrabarti, Distinguished Fellow, TERI		
11:00-11:25	Technical Presentation	Dr. Shresth Tayal, Fellow and Area Convenor - CHE , TERI
11:25-11:50	Water-Energy Nexus: Searching the dots	Prof. Sudipta De, Professor, Jadavpur University Kolkata
11:50-12:15	Operationalizing water-energy nexus in policies and practices	Dr. Vishnu Prasad Pandey, Research Faculty, Asian Institute of Technology & Management (AITM), Nepal
12:15-12:40	Water-Energy Nexus: Sri Lanka's Experience	Dr. Athula Senaratne, Head, Environment Economics Policy Division, Institute of Policy Studies of Sri Lanka
12:40-1:00	Open Discussion	
1:00-2:00	Lunch	
TECHNICAL SESSION 2: Water Energy nexus- bridging the gaps		
Chair: TERI		
2:00-2:25	Water to Watts	Mr. K.V. Rupchand, Former Chief Engineer, Tamil Nadu Electricity Board
2:25-2:50	India's Food-Energy-Water nexus: Thinking about analytical frameworks	Dr. Vaibhav Chaturvedi, Research Fellow, CEEW Delhi
2:50-3:15	Water for Energy: Opportunities in thermal power generation	Mr. Anshuman, Associate Director, Water Resources Division, TERI
3:15-3:40	Missing dots in Energy – Water Nexus: Designing Effective	Dr. Anoop Singh, Associate Professor , IIT-Kanpur

	Agricultural DSM programmes	
3:40-4:00	Open Discussion	
4:00 onwards	Tea	

3rd September 2014 (Day 2)		
TECHNICAL SESSION 3: Policy and governance framework for harmonizing water-energy nexus		
Chair: Mr S Vijay Kumar, Distinguished Fellow, TERI		
10:00-10:30	Thematic Presentation	Dr. M P Ram Mohan, Fellow, TERI
10:30-10:45	Tea	
10:45-1:00	Panel Discussion by Eminent Panellists Prof Ramaswamy Iyer, Honorary Research Professor, Centre for Policy Research Shri Amarjit Singh, Additional Secretary, Ministry of Water Resources Dr. Manish Kumar, Senior Institutional Development Specialist – Water and Sanitation Program, The World Bank Mr. Sanjeev Ahluwalia, Advisor, Observer Research Foundation	
1:00-2:00	Lunch	
TECHNICAL SESSION 4: Water-energy nexus in the context of regional energy security		
Chair: Mr K Ramanathan, Distinguished Fellow, TERI		
2:00-2:30	Thematic Presentation	Dr. Ritu Mathur, Professor – TERI University & Senior Fellow, TERI
2:30-4:00	Panel Discussion by Eminent Panellists Mr. Gopal K Saxena, Director, BSES Rajdhani /Yamuna Power Ltd. Dr. Ritu Mathur, Professor – TERI University & Senior Fellow, TERI Sh. S. K. Chatterjee, Jt. Chief (Regulatory Affairs), Central Electricity Regulatory Commission Sh. S. D. Dubey, Hydro Planning & Investigation, Central Electricity Authority	
4:00-4:15	Valedictory note	
4:15 onwards	Tea	