THE ROBUST SOLAR NETWORK FOR STRATEGIC WATER MANAGEMENT.

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Abstract: India has one of the greatest challenges of ecologically and economically balancing the water resources. Almost 18% of the global populations live with only 4% of freshwater input in 2.4% of the geographical area . This is superimposed by 20% of the global cattle population. The challenge is going to be steeper and steeper as the population rises. This article focuses on how to overcome this situation without stressing the groundwater reserves which are nonrenewable. The paper stresses on the actions and lays on a plan of actions for river network energized by solar sources.

I. INTRODUCTION

Water is crucial for all aspects of life. It defines features of our planet. Ninety seven percent of all water is found in the oceans. Of the remaining fresh water only 0.1% is accessible for extraction and use. Functioning of healthy aquatic ecosystem provides us with dazzling array of benefits. At the beginning of 21st century the world faced the water crisis both of quality and quantity caused by growing population, industrialization, increased food production and poor use strategies. Waste water can be contaminated with myriad of different component, pathogens, organic compound, synthetic chemicals, inorganic material and heavy metals. They are either in solution or carried as particulate matter. Over 70% of the water has been partially used before entering into the urban areas. The quality of water is important for well-being of environment, society and economy. There are, however, ways to become more efficient and reduce our water footprints. Improving water, sanitation services and managing water require investment. It's not just the question of quantity of investment. Large water treatment plant is difficult to operate and manage. These have to be at appropriate location.

II. IMPACT OF CLIMATE IN CHANGE HIMALAYAS:

Impact of climate change on lives of people living and water bodies in Greater Himalayas-The greater Himalayan region "the roof of the world" contains the most extensive and rugged higher altitudes areas on earth and the largest area covered by glaciers and permafrost outside the polar region. The water resource from this area drain through ten of the largest rivers in Asia, in the basins of which more than 1.3 billion people find their livelihood. The region and its water resources play an important role in global atmospheric circulation, biodiversity, rain-fed, irrigated agriculture and hydropower as well as in the production of commodities exported to the market worldwide. The water resources of this region are currently facing threats from a multitude of driving forces. Global warming is having a severe impact on the amount of snow and ice, which has serious implication for downstream water in both short and long term as up to 50% the average annual flows in the river are contributed by snow and glacial melting . The warming in greater Himalayas has been much greater than the global average, for example 0.6 Degree Celsius per decade in Nepal as compared to a global average of 0.74 degree Celsius. Over the last hundred years changesin precipitation are ambiguous. Most studies have excluded the Himalayan region because of its extreme and complex topography and the lack of adequate rain gauge data. There is an urgent need for establishing schemes for snow, ice and water. Downscaled climate models applying hydrological theories to predict water availability may be used for developing basins wide scenarios.

III. WATER A UNIQUECOMPUND:

The Fig.1 shows that the water is vital component of life on the planet. No life, from a single cell creature like ameba to a smart one like human being, is known to have existed without a water molecule. The uniqueness of water is due to its molecular structure. The polar covalent molecule has the following properties:

1. ***Polarity***- Polarity in water means the molecule has both positive and negativecharges.
i.e. hydrogen is ionized positively and oxygen with negative charge.
2. ***Hydrogen Bonding***- When water molecules align with each other, a weak bond is formed between the negatively charged oxygen ion and the positively charged hydrogen ion of a neighboringmolecule.
3. ***Adhesion and Cohesion***- Properties of cohesion and adhesion help in soakingthings.
4. ***Capillarity***- It allows water to move against thegravity.
5. ***Surface Tension***- The tension on the surface of water occurs when water molecules on the boundary align themselves and are held together by hydrogen bond. It gives the ability to insects of moving across thesurface.
6. ***Universal Solvent***- It is almost a universal solvent. This helps in washing and carrying away dirt through rivers and stream.
7. ***States of Water***-It can exist in all three states at the same time: liquid, gas, andsolid.

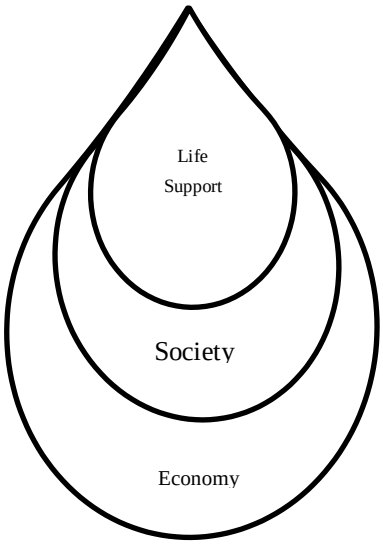

Fig.1 explains the various roles of water.

8. ***Ice floats on surface***- water has a unique property. When cooled below 4°C, it expands, so much so that on solidification at 0°C, it occupies more volume than liquid water. Solidified water i.e. ice floats on liquid water. This helps in floating icebergs which are retrieved as fresh watersource
9. ***Buoyancy***- Water has a density which is more than almost 50% of the materials on the earth. This helps in moving stuff in the form of boats, ships andbarges.

IV. HYDROLOGIC CYCLE:

The Fig.2 and Fig.3 depicts the movement of water on the earth. It goes from one reservoir to another, such as from river to ocean, or from the ocean to the atmosphere, by the processes of evaporation caused solar energy is followed by condensation, precipitation, infiltration, runoff, and subsurface flow. During this, water goes through different phase's liquid, solid (ice), and gas (vapor).

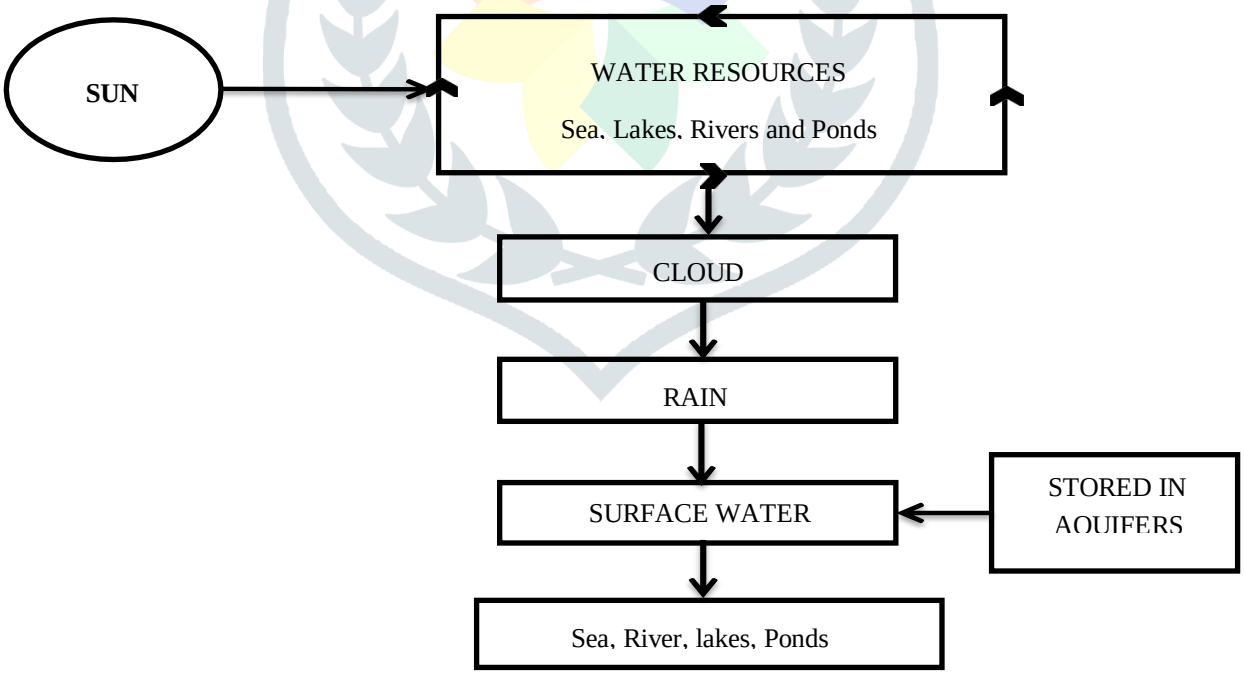

Fig.2 Schematic diagram of Hydrologic Cycle.

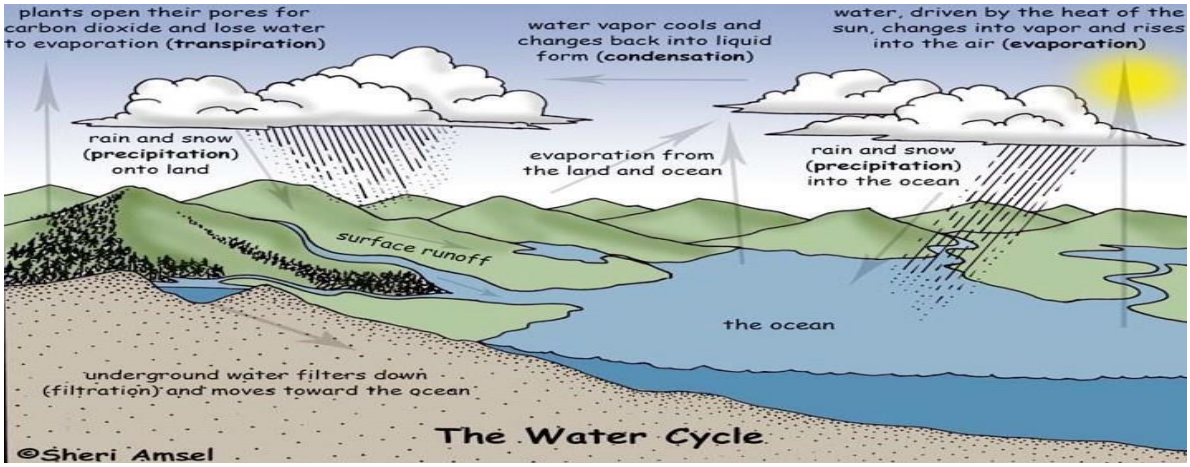

Fig. 3 Hydrologic Cycle. Courtesy-Amsel.Sheri. "Rain Making Activity-The Water Cycle" Exploring Nature Educational Resources ©2005-2016.March 9, 2016<http://www.exploringnature.org/db/view/1343

V.WATER ISSUES:

5.1The erratic distribution of rainfall leads to drought and flood-The extreme shift in precipitation patterns in different regions of the country results in flood and drought at different places like recent examples of Chennai and Kashmir of heavy precipitation and drought in Bundelkhand in U.P., Marathwada inMaharashtra.

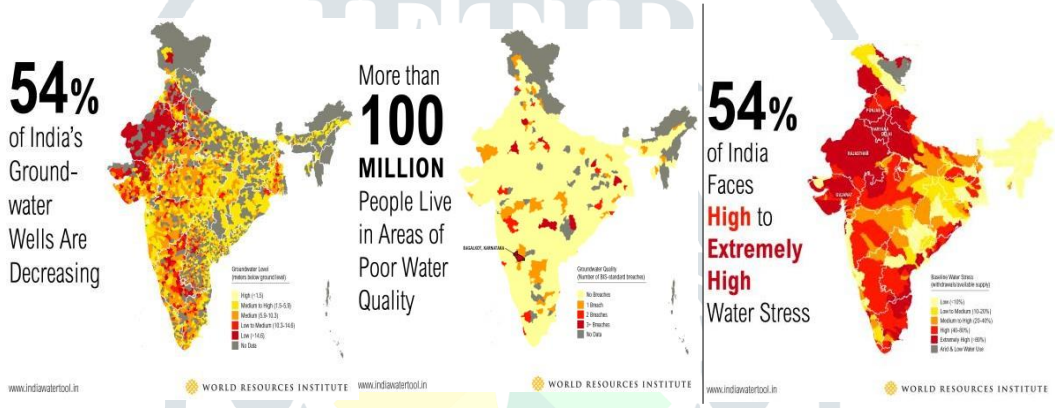

Fig. 4 Different situations of ground water, degraded quality water and water deficit regions of India. Courtesy: World Resource Institute.

A. *Inefficient usage of water*

Leakage-30% of water is lost in developed countries due to faults in pipeline using sensors can help pinpointleakages.

Toilets-2.6 billion people have nowhere to go fortoilet**.**

B. *Agricultural life affected due towater.*

C. ***Drought***-*Only .07% is potable . Today 7 billion of us share this preciousresource.*

D. ***Over Irrigation***-*Heavy and unscheduled rainfall results in disturbing lives and crops which finally increase the demand and supply gap of that seasons specificcrop.*

E. ***Extraction of ground water***- Exploitation of ground water for meeting the needs of industries, agriculture and domestic purposes is not desired in the normal circumstances. Concept of river networking can fulfill the entire requirement by surface water without stressing the aquifers. India is supposed to face severe water crisis up to year 2025[3]. Even the most populous country china is consuming 28% less water from earth as compare to India. Punjab, Haryana, Uttar Pradesh and Rajasthan in northern part of India and Telangana, Andhra Pradesh, Tamilnadu and Karnataka in southern peninsular are in critical situations. The Shastras warn that deep wells are foolish to dig. At eight arm-lengths depth, the well is *manohar*, or beautiful. At thirteen arm-lengths it becomes *Rudrakupa*, a well that causes fear.

F. ***Wars for water***- The strategic dissonance and rivalry show that till date 367 scuffles has taken place.

G. ***Earth's rising temperature***- The Himalayan glaciers covering an area of the present 500,000 to 100,000 km^2may shrunk by the year 2035 . The Ice on Kilimanjaro has shrunk 85% in 100 years .The Aral Sea once Asia's second largest lake is now one tenth the size it was 50 years ago.

H. ***Criminal and Social impacts of water availability***-Women and children lose 125 million hours' time in fetching water for the daily needs. Children lose study hours. An innumerable numberoftimesteengirlsandwomen'shavetofaceeveteasing,harassment,molestation

and sometime even rape. Every second a child dies from water related disease call diarrhea, AIDS, Malaria, Measles almost 4000 lives every day .

VI. WATERPOLLUTION:

The contamination of water bodies over and under the ground by the human activities negatively affects organisms causing bacteria spread and diseases. Non-biodegradable plastics, sewage discharge in rivers results in stressing and suffocating the aquatic life due to the lack of dissolved oxygen. Plastic disturbs ecosystem for decades killing snails and fishes who consume it by mistake as food. Water pollutants are mainly of four types human and animal waste, inorganic substance, organic compounds and non-chemical pollutants[17].

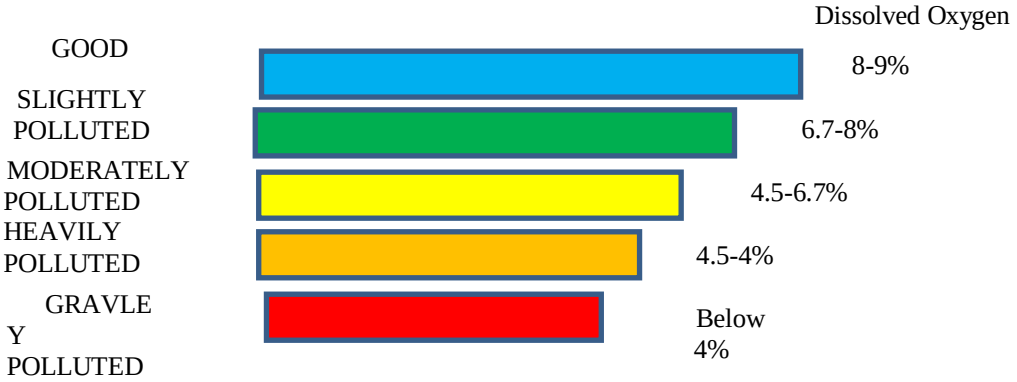

Fig. 5 Water quality measures in terms of dissolved oxygen

The bar chart in Fig. 5 grades water in terms of dissolved oxygen by volume percentage.

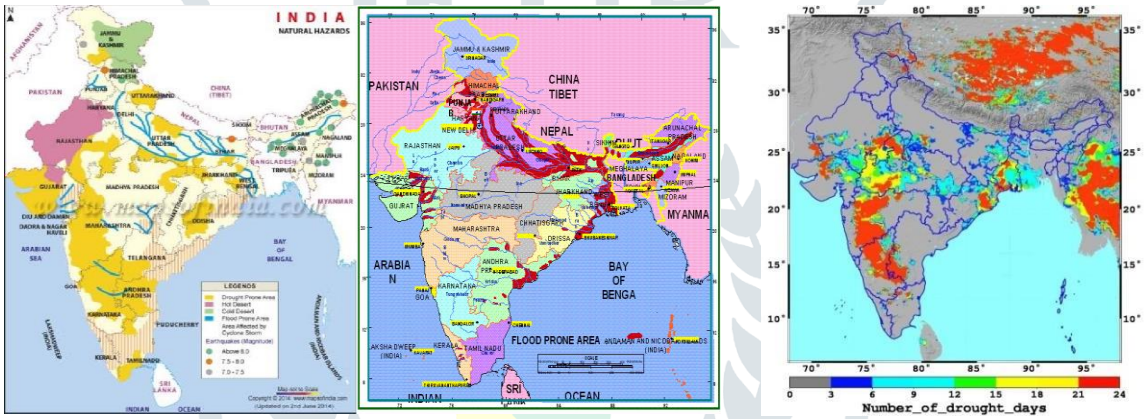

Fig. 6 Natural hazards maps of (a) drought, (b) heat waves and (c) flood prone zones of India.

Courtesy-(a)http://webgms.iis.u-tokyo.ac.jp/DMEWS/India/img/DAYS2015_India.jpg, http://blog.mapsofindia.com/india-map/natural-hazards-in-india(b)http://india-wris.nrsc.gov.in/wrpinfo/index.php?title=Flood_Management

VII. SOLAR ENERGY FOR OVERCOMINGSCARCITY:

Scarcity of water is in fact an energy issue. The total quantity of water on the earth does not change significantly, what changes is the availability of water at the desired place. This requires energy to lift water at different levels through which it has fallen . The energy supplement can come from solar sources. The newly designed solar thermal siphon pump can make up for the loss efficiency without damaging the environment. Purification of water is another issue which requires energy. This can also be imparted through solar energy. In summary water security depends on energy availability which can be obtained from the sun shine. In the paragraph below we are proposing specific solution to contain the potable water problem and provide irrigation for agriculture. ***7.1Solar assisted river links***-The entire Indian peninsular from Himalayas to Bay of Bengal and Arabian Sea is fed by a network of rivers. Some of these, rivers particularly those originating from Himalayas are glacier emanating and are hydrated throughout the year. Many others are rain fed and dry up during the drought time. Theses river basins can be used to utilize our surface water we dump over 1260 $km^3$of fresh water into sea . There is considerable scope for increasing the fresh water resource of Ganga, Brahmaputra basins to avoid lifting of ground water and meeting water scarcity of the country . This requires building a series of dams and reservoirs at appropriate location, using solar energy wherever the water is to be lifted and storing it at higher altitudes for ultimate draining into lower river basins. In the process we also generate hydroelectricity.

7.1 The following major actions are stipulated for rivernetworking.

1. Building a dam across Ganges after Kosi meets the Ganges inBihar.
2. Digging canal to linking the Ganges stored wat to river Damoder inJharkhand.
3. Damoder in West Bengal is linked through a dam and a canal to Brahmani River in Orissa. This saves around 10 $km^3$of freshwater.
4. The downstream Brahmani is linked toMahanadi.

5. Mahanadi is linked to Indrāvati. This saves around 16 $km^3$of freshwater.
6. Indrāvati is linked to krishna saving 11 km^3ofwater.
7. Krisnha is linked to Cauvery using Pennar to Ponnaiyar saving 2okm^3.
8. On the western front we need an agreement with Pakistan for building a dam across Indus at Hyderabad of Pakistan .This will save almost 27 $km^3$of freshwater.
9. Linking Indus at Hyderabad to Sabarmati inGujrat.
10. The Huge water storage i.e. 27 km^3may be used to irrigate parts ofkucch.
11. The Sabarmati points of water transferred from Indus need to be linked to Godavari via Narmada.
12. The transfer from Godavari to Bhīma, Krishna and Cauvery for meeting the irrigation requirement of Maharashtra, Karnataka.

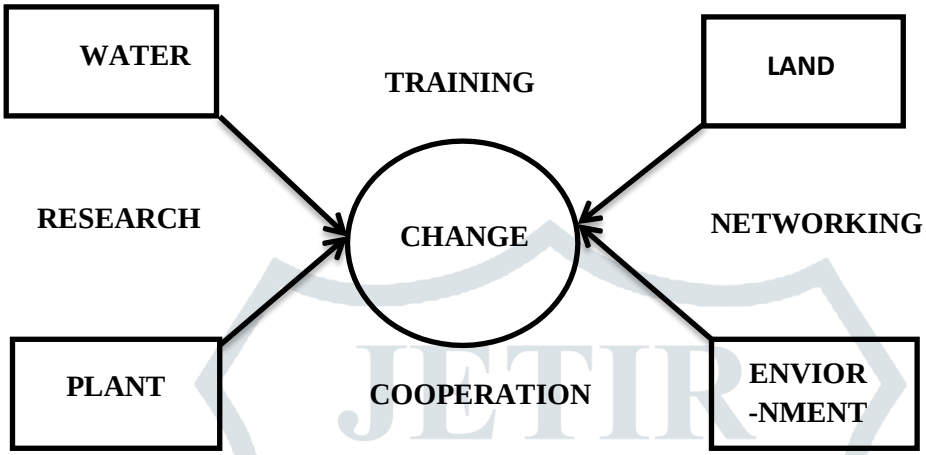

Fig. 7 Illustration of activities for managing the water resources

VIII. ROLE OF YOUTH IN CLIMATE CHANGE: Climate change is one of the most critical global challenges of our times. Recent events have emphatically demonstrated over growing vulnerability to climate change. Climate change impacts range affecting agriculture, future endangering food security to sea level in the accelerated erosion of coastal zones increasingthe intensities of natural disasters species extinction and spread of Vector borne disease. This issue is an immense importance for every global citizen. Hence it's required an initiative against it globally. A series of trainings, applied scientific research projects, Master of Science and PHD programs, thematic research network in collaboration with the experts of different fields like soil, agriculture, water and earth sciences should be launched by the government and young minds specially those who wants to pursue their career in fundamental research should take the part and support the nation in coping up with real timechallenges.

Fig.8: The proposed river network.

IX. RIVER NETWORK: India has great diversity of in terms of water availability. while some of our areas are drought prone some others are flood affected and cannot utilize sweet drinking water due to flood. those areas are forced to dump sweet water in to the sea. the solution thus lies inproper distribution of potable water . This can be achieved through a network of river which criss-cross the Indian Peninsular. A Broad schema of river linking is shown below in the diagram. The Ganges discharges 27000 million cubic meters (MCM) of good quality water into the sea. Similarly Brahmaputra 28000 MCM of usable water into the sea. While rest of the India are struggling under scarcity of water. The proposed linking will make water available to the needy areas . This would involve huge amount of energy for lifting of water from lower reservoir to the upper reservoir like in the Vindhya region for providing water to the southern peninsular. The initial feeding of energy can be obtained from solar sources. In the next phase the upper reservoir feed to rivers like Krishna, Cauvery, Godavari, Narmada and Tapti to irrigate the fields of the southern India and provide drinking water. This would also ensure food security to the public and prosperity to the farmers.

X. CONCLUSTION:

The steps mentioned above need to be taken at political, administrative and technical levels to manage the fresh water resources of the sub-continent for its benefit. This will solve the problem of drought on one hand and the flood on the other hand . A huge amount of solar energy is required for lifting water from the river basin level to the upper penstock. A considerable amount of electricity would be available throughout the year. Over exploitation of groundwater will be avoided utilizing the widespread and abundant solarenergy.

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