Sustainable Water Management in India.

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Abstract: *Water resources in India is depleting day by day due to indiscriminate use of surface water and uncontrolled abstraction of ground water which will also lead to deterioration of quality also. Water scarcity and deteriorated quality has becoming a challenging matter to the water management in India by the passage of time. Hence, judicious use of water and reclamation of wastewater will be a solution for sustainable water management. Use of modern technology in water treatment plants and distribution system and proving of smart water metre may minimize the water loss. Emerging trends of water treatment technology like Desalination of sea water, recycling of wastewater, Rainwater harvesting, use of SCDA based technology in all the treatment plants may lead to sustainability of water management both in quality and quantity. India has only 4% of world's water resources but 16% of total world's population. More than 60% of agricultural lands are irrigated land and 20% ground water have been overexploited. So, water efficient paddy and crops have to be sown that will require minimum water.*

Keywords: SCADA, ICT, IoT, NRW,

Introduction: Our planet is fast running out of fresh water, due to our increasing demand of "Liquid Gold" thousand more people are now compelled to survive at Water Stressed Condition. The corporate sector treats water as "Commodity", but actually it is human needs. Out of total available water in the earth, only 2.5% is fresh water. But most of the fresh water is in the ice caps, snow or inaccessible condition, leaving only 0.97% fresh water in the stream or river or canals. As per UNICEF, more than 2000 children under the age of five die every day because of water borne diseases.

Around 780 million of earth's population lack access to safe drinking water. More than 25% of the earth's population has to rely on water from contaminated source. The per capita water availability in India has declined from 1816 m^3 in 2001 to 1545 m^3 in 2011. As per the UNITED NATIONS, any region with annual water availability below 1,700 m^3 per person is considered as water stressed region. 302 river stretches on 275 rivers across the Country have been polluted due to discharge of both municipal and industrial wastewater. At present about 20 % ground water have been overexploited. Freshwater abstraction by industries will be 8.5% in 2025 and 10.1% in 2050 respectively which will create an immense pressure on the water resources in India.

More than 60% of India's agriculture land depends on Irrigation and 85% of drinking water supplies based on ground water supply. In this evolving hydrological context, climate change is also expected to play a vital role. Some parts of India suffer from Drought and some parts are suffering from huge rainfall. The rainfall anomaly in India is the most serious challenges for water management.

We are in the midst of a severe unprecedented water crisis as India has only 4% of world's water resources but 16% of world's population. Efficient and sustainable water management is one of the key areas of focus. Increasing efficiency of water use entails key activities such as:

- recycling of treated water,
- adoption of water efficient technology,
- mandatory water audit,
- development of eco-friendly water system.
- and improvement in efficiency of urban water systems.

Present status in Water Sector: The current infrastructure in water sector insufficient to meet with going social economic development. Climate change and environmental pollution will also lead to source contamination. Though significant efforts have been made to provide safe drinking water to the community but due to poor infrastructure maintenance, lack of rehabilitation and retrofitting, contamination and depletion of ground water sources the utilities are not working properly. With all the challenges revolving the O&M of water system it creates many opportunities for innovative technological approaches through transfer of technology knowledge, experiences and best practicing water system.

Agriculture is the lifeline of India. It requires 800 Billion Cubic Metres of water annually out of which 60% is depended on rain. Out of 4000 Billion Cubic Metres specification every year only 18-20% is actually used for recharging the ground water sources and other is wasted away through run off to the water bodies. Due to lack of storage facility and water management frame work the irrigation system suffers to a great extent.

India is one of the largest groundwater users in the world, accounting for more than a quarter of the global usage. Therefore, there is a need to focus on efficient groundwater management technologies. With increase in population and water demand, depleting groundwater sources and outdated treatment technologies, there needs to be a long-term planning for identifying alternative sources of water coupled with adoption of efficient water treatment technologies. Desalination is one such technology, which could be useful in developing alternative source of water in India. Rain water harvesting will be another alternative source also in the water stressed area in India.
The energy sector is inextricably linked with water since almost all forms of energy production rely on the supply of water. In India, the power sector is expected to account for 98 per cent of additional water withdrawals and 95 per cent of additional consumption between 2010 to 2035. Hence, reuse of treated water is essential for sustainable water management. Pricing is a key factor affecting the water situation in India. Water services – irrigation, domestic and industrial water supply, and wastewater treatment– are heavily subsidized by most governments, leading to more consumption and wasteful utilization.

Adoption of Emerging Technology: One of the biggest challenges in the water utility space in India is the lack of data pertaining to the water source and user consumption, which effects governance and decision making. For understanding the problem and to provide solution to the customer there is a need of smart and technology aided water management system.
Apart from the technology aspects efficient water management practices are also required which focus reuse and recycling and enhancing water use efficiency.
At present, most of the data about water management is obtained manually. There exist very few automated system and communication media through which site data

could be transferred to the centralized location for online controlling and decision making. SCADA or Supervisory Control and Data Acquisition is a technology solution widely used in the water and waste water system and distribution to automated control process and assist operators increase decision making. SCADA system allows to function the plant uninterruptedly and hence reduce labour cost, energy cost and improve system efficiency.

Navi Mumbai Municipal Corporation implemented SCADA system through which NMMC can now perform all operations remotely from a central control room (CCR) located in Belapur (Navi Mumbai). NMMC has also developed a real time dashboard for monitoring water transmission and its distribution to all eight wards in NMMC. NMMC has also installed real time alarms in CCR to monitor any unexpected drop in water pressure and levels. NMMC successfully operates the radial gates(~ 2 tonne) at Morbe Dam Morbe dam remotely through CCR. As a result of the SCADA interventions, the NRW (Non-revenue Water) (The Lost Water which earn no revenue) has been reduced from 23% to 18.50%.

Information, Communication and Technology (ICT) aided intelligent systems have proved to be highly effective in water conservation and asset management across the globe. The application of Internet of Things (IoT) based smart water networks has the potential to become the future of effective water utility management. Smart systems can significantly assist government and private utility service providers by:

- Providing smart techniques to access and measure data across the distribution system.
- Deconstructing complex data to identify problem areas and aid in informed decision making.
- Improving overall revenue by strengthening system efficiency.
- Real time monitoring of GW levels Technology aided GW locator and aquifer identification.
- Smart Meteorological stations for real time rainfall, soil moisture and forecasting hydro-geological risks.
- Flood Forecasting and Early Warning System
- Green infrastructure and smart storm water management
- Smart metering of piped water supply systems – remote monitoring and detection of non-revenue water loss, automate meter reading and billing
- Pressure management, Leakage detection and management.

Smart Meters help a measuring the non-revenue water level in the system. Non-revenue water is the water lost in the system which do not give any revenue. So reduction in NRW to acceptable limit of 15% is vital for technical financial sustainability.

Installation of smart meters helps in optimizing the water network to regulate and monitor different parameters such as hydraulic pressure and flow, water quality, head losses, water and energy consumptions. Application of smart meters reduces extra water usage, tracking water consumption, flow patterns and allows equitable distribution to all consumers by better managing distribution. Smart meters also come with features such as automatic billing, leakage and tampering detection. as well as water quality monitoring along the distribution network. An integrated approach is required to holistically bridge the gaps in water management. Nagpur municipal corporation under the AMRUT scheme implemented extensive household level metering to curb non- revenue water loss from 50 per cent to below 25 per cent

and provide 24-hour safe drinking water to 100 per cent population including slum dwellers.

Desalination is a promising technology with a potential to bridge the ever-rising demand-supply gap of fresh water. Around 97 per cent of the total water available on Earth are in the oceans and is saline; and provides for a virtually unlimited stock of raw material for desalination. In addition to saline water from sea, brackish water found in river estuaries, is also used for desalination. Desalinated water is consumed for industrial, domestic and agricultural purposes.

Presently, the installed capacity of desalination plants across the world is around 86,572 MLD. Desalinated water is used by 1 per cent of the global population on a daily basis. By 2025, around 14 per cent of the world population is expected to start using desalinated water. In India, desalination can be a suitable technology for coastal regions and port cities.

Interestingly, India too ranks reasonably high in the use of desalination, particularly for industrial use. At present, India has around 182 desalination plants located in different states. Gujarat has the maximum capacity for production of desalinated water in the country with plants located at Kutch, Jamnagar and Metapur. Tamil Nadu is the country's second highest desalinated water producer with plants at Minjur and Nemmeli, each with a capacity of 100 MLD.

it is evident that power, membrane replacement and chemical costs contribute to more than 70 per cent of the total operating cost. The unit cost of producing water through desalination is several times more that of conventional water treatment technologies. High investment requirement and operating cost is a hindrance to adoption of desalination technology.

- Significant research and development are currently devoted to the development of better materials and efficient design for thin membranes that will reduce energy intensity of the desalination process.
- Some of these trends include use of graphene (consisting of a single layer of atoms) an ideal 'RO membrane', Low Temperature Thermal Distillation (LTTD) and use of a "water chip" which creates a small electric field to separate salts from the seawater.
- The dramatic fall in the price of solar power also helps well for desalination plants, which can now easily switch to solar power to reduce operating cost. The world's first solar powered desalination plant was set up in Surat, India in 2012.

- **Sustainable Wastewater Management:** One of the key components of the sustainable water management approach is to efficiently manage wastewater.
- With the depletion of fresh water resources, it is high time focusing on recycle and reuse of treated waste water for non- potable purposes. With a reduction in consumption pattern and optimum utilization of treated water, the 3R (reduce, reuse and recycle) of waste water can play a prominent role in sustainable water management. The Government needs to focus on drafting a policy for wastewater recycle and reuse at the national level, which then may become a guiding document for water boards and utilities.
- **Modelling of water resources – River basin management approach:** Sustainable water management is critical for the development of humanity. It is a finite resource and needs to be managed judiciously.

- Rivers and their basins including the related groundwater bodies are important sources for water use including drinking water supply and agricultural activities in India. Water in India contributes for socio-economic development, livelihoods and serve as ecosystem.
- Efforts to restore and rejuvenate rivers should follow integrated river basin management approaches, good governance, collaborations, projects and investments. Water resources management in India does not follow the catchment approach and human pressures and impacts on water resources are not assessed holistically but in a rather selected way. Planning and management approaches are largely water-use oriented and, hence, emphasis is often given to the assessment of water quantity as basis for water use and to urban wastewater pollution.

- **Conclusion:** For sustainable water management in India water efficient technology has to adopted in all the water treatment plants. All the water treatment plants to be modernized with installation of SCADA which will reduce water loss both in plant area and also distribution main and Govt. will earn more revenue from the unaccounted water. Water metering will not only increase the revenue but also the tendency of water unnecessary misuse and wastage will be minimized. However, some water ATM could be installed in Slum area from where the poor people will take their water for need.
- India needs a wastewater re-use policy to reduce pressure on fresh water sources and progress towards sustainable water management. Government of India has started taking steps towards the same by signing an MoU between, ministry of water resources (MoWR) and Ministry of Power (MoP), wherein any thermal power plant in vicinity of Km from a STP, will use treated water before extracting fresh water from source. Similar initiatives are required for commercial and industrial bulk users.
- The government needs to encourage sustainable solutions of water management such as rehabilitation of existing infrastructure, wastewater reuse and river basin management, which closes the loop in the circular economy for water.
- Circular Economy as a comprehensive approach to effective Water Management in India inferred from cases. Successful implementations of circular economy can lead to better sustainable development than many existing solutions.
- The Circular Economy represents the most recent attempt to conceptualize the integration of economic activity and environmental wellbeing in a sustainable way. CE gives emphasis on the redesign of processes and recycling of materials, which contribute to more sustainable business models.

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