Sustainable Approach to Water Management

Dr. M. B. Joshi
General Manager (Technical & Coordination)
Sardar Sarovar Narmada Nigam Limited
dr.mbjoshi@gmail.com

Basic principles of holistic approach especially for water management have been profoundly professed by many ancient Indian scriptures, a classical example of which is the Atharva Veda (2000-1500 B.C.).

४५७०. शं त आपो हैमवतीः शमु ते सन्तूत्स्याः ।
शं ते सनिष्यदा आपः शमु ते सन्तु वर्ष्याः ॥१ ॥

(हे साधको !) हिम से उत्पन्न जल- प्रवाह, स्रोत (झरने) से प्रवाहित होने वाले, अनवरत तीव्रवेग से बहने वाले तथा वर्षा द्वारा नदियों में आये जल- प्रवाह , ये सभी आपके लिए सुखदायक एवं कल्याणकारी हों ॥१ ॥

४५७१. शं त आपो धन्वन्याः शं ते सन्त्वनूप्याः ।
शं ते खनित्रिमा आपः शं याः कुम्भेभिराभृताः ॥२ ॥

हे यजमान ! मरुस्थल के जल, जल सम्पन्न भू-भाग में होने वाले जल, खोदकर प्राप्त किये गए (कुएँ, बावड़ी आदि के) जल तथा घड़ों में भरकर लाये गए जल , ये सभी प्रकार के जल आपके लिए कल्याणप्रद हों ॥२ ॥

One should take proper managerial action to use and conserve the water from mountains, wells, rivers and also rainwater for use in drinking, agriculture, industries etc. ***Atharva Ved 19.2.1***

Water – Vital for Human-centered Development

Water – one of the five basic elements of the universe, is vital to sustenance of human life and its development. Growing pressure on water resources from population and economic growth, climate change, pollution, and other challenges have major impacts on our social, economic, and environmental well-being.

Water is at the core of sustainable development and is critical for socio-economic development, healthy ecosystems and for human survival itself. Water is a finite and irreplaceable resource that is fundamental to human well-being.

Water is the largest natural resource but only 3% of it is freshwater, of which just 1/3 is accessible for use in agriculture and cities. The rest is frozen in glaciers or hidden too deep underground.

Today, the main water source for over 2 billion people are aquifers – underground stores of freshwater. As income levels have risen globally, so has the demand for water-intensive goods such as manufactured, meat, and dairy products, stressing global freshwater resources.

Such increase in global freshwater consumption has led to the depletion of over half of the world's largest aquifers, and is a problem that will likely deteriorate as demand grows. At this pace, available freshwater reserves needed to ensure basic water, food, and energy security are predicted to drop by 40%.

As the world warms, climate change can threaten ecosystems and environments that protect vital water resources, limiting access to them even more.

Growing Demand Threatens Well-Being

By 2050 the global demand for water will increase by 55 percent owing to population growth, urbanization, food and energy security policies, and macro-economic processes such as trade globalization.

Population growth demands more food and energy of the world. Agriculture, the largest consumer of water globally, will have to produce 60 percent more food globally and 100 percent in developing countries to feed the planet from now until 2050. In addition, the manufacturing sector—producing goods for an increased population—will see its demand for water increase 400 percent by 2050.

Meanwhile, 20 percent of the world's groundwater sources are already overtaxed and still not managed sustainably. Intensive crop irrigation, uncontrolled release of pesticides and chemicals into watercourses and the absence of wastewater treatment—which is the case for 90 percent of wastewater in developing countries—are all proof of this state of affairs.

Sustainable Development Goals (SDGs) and Water

The United Nations adopted the 2030 Sustainable Development Agenda on September 25, 2015 just ahead of World Water Day, emphasizing the need for collaboration on a global scale and calls for the water crisis to be made one of the UN's new Sustainable Development Goals (SDGs). This Agenda with its core set of 17 Sustainable Development Goals (SDGs), are the UN's blueprint for achieving a happier and healthier world by 2030.

"Water resources are a key element in policies to combat poverty, but are sometimes themselves threatened by development," said UNESCO Director-General, Irina Bokova in a statement. "Water directly influences our future, so we need to change the way we assess, manage and use this resource in the face of ever-rising demand and the over exploitation of our groundwater reserves."

Out of these 17 SDGs, "Clean Water & Sanitation" finds itself at 6th place. The role of water in achieving these goals is self-evident and it calls for aligning the development strategies with water management to be able to achieve these SDGs by 2030.

SDG No.6: Clean Water and Sanitation – Ensure Availability and Sustainable Management of Water and Sanitation for All

Access to safe water and sanitation and sound management of freshwater ecosystems are essential to human health and to environmental sustainability and economic prosperity. Water and sanitation are at the very core of sustainable development, critical to the survival of people and the planet. Goal 6 not only addresses the issues relating to drinking water, sanitation and hygiene, but also the quality and sustainability of water resources worldwide.

Under this broad goal, meticulously defined sub-goals cover the entire range from achieving universal and equitable access to safe and affordable drinking water, achieving access to adequate and equitable sanitation and hygiene, improving water quality, increasing water-use efficiency, implementing integrated water resources management and finally protecting & restoring water-related eco-systems.

Water in India – A vital resource for Agricultural Growth and Food Security

India is endowed with a rich and vast diversity of natural resources, water being one of them. The country with about 18% of the global population has just 2.4% of the world's geographical area and about 4% of the utilizable water (690 BCM Surface water and 431 BCM Ground water). Water development and management, therefore, plays a vital role in agriculture production. Integrated water management is vital for poverty reduction, environmental sustenance and sustainable economic development. However, since its independence in 1947, the per capita availability of water in India has been declining at an alarming rate i.e. from 6,042 cubic meter to 1,816 cubic meter in 2001 and further to 1545 cubic meter in the year 2011. It is further projected to decline to 1,340 cubic meter by 2025 and 1,140 cubic meter by 2050, which makes the water management more challenging.

National Water Policy

The right to water is not specifically mentioned in The Universal Declaration of Human Rights. However, without access to water, other rights could not be exercised such as the "right to a standard of living adequate for the health and well-being."

And finally in 2010, the General Assembly declared access to water as a human right in a landmark resolution *"Everyone has the right to water, no matter where he/she lives"*.

While Indian Constitution does not declare Right to Water as a fundamental human right, our National Water Policy (originally declared in 1987 and then revised in 2002 as well as finally in 2012) envisages that the Union, the States and the local bodies (governance institutions) must ensure access to a minimum quantity of potable water for essential health and hygiene to all its citizens, available within easy reach of the household. It also emphasizes that the water resources of the country should be developed and managed in an integrated manner.

National Water Mission – Climate Change

India is faced with the challenge of sustaining its rapid economic growth while dealing with the global threat of climate change. This threat emanates from accumulated greenhouse gas emissions in the atmosphere, anthropogenic ally generated through long term and intensive industrial growth and high consumption lifestyles in developed countries. While engaged with the international community to collectively and cooperatively deal with this threat, India needs a national strategy to firstly, adapt to climate change and secondly, to further enhance the ecological sustainability of India's development path.

The main objective of the National Water Mission (NWM) is "conservation of water, minimizing wastage and ensuring its more equitable distribution both across and within States through integrated water resources development and management."

Desalination

Desalination technologies have been used rapidly over the past few decades throughout the globe to produce clean drinking water from groundwater, seawater and brackish, to improve the quality of already existing supplies of fresh water for human consumption, commercial applications or to treat industrial and municipal wastewater prior to reuse or discharge.

Globally, the total installed capacity of desalination plants was 61 million m3 per day in 2008. Seawater desalination is the most common, accounting for 67 percent of production, followed by brackish water, at 19 percent, river water, at 8 percent and wastewater, at 6 percent.

Attempts are also being made by Researchers to create "Sarovar Mala" a coastal garland by Interlinking of number of Sea Based Fresh Water Reservoirs, through pipelines in shallow ocean waters.

Gujarat Water Management Model – Policies & Institutions

Water and Energy are important resources for sustainable development. Gujarat State has just 2.2% of country's water resources though it has got 6% of geographical area and 5% of population. Further, intra-state distribution of surface water resources is also skew – southern part having one fourth area has three fourth water! This makes it imperative to transport water to the water stressed areas of the State. Optimally harnessing the whole range of feasible options from macro to micro, Gujarat State has always been at the centre of any debate on the water management policies and institutional interventions.

As per the NITI Aayog's Report published in June 2018 on "Composite Water Management Index" based on 9 themes, Gujarat has been reported consecutively for the second year, to be the highest performer in the country with Water Index of 76, followed by MP & Andhra Pradeash. Also, Gujarat has performed better in 7 themes out of 9. The things which are going well for Gujarat are (i) **On-farm use** with 100% segregation of

power feeders and the highest proportion of area under micro-irrigation at 35% (ii) **Rural drinking water** by covering 100% of its rural habitations and (iii) **Urban Water** by providing access to 100% urban population with 87% being charged for water supply. However, performance in the themes like the **Ground-Water regulation** and P**articipatory irrigation** needs further improvement.

Sardar Sarovar Project (SSP), the mega multi-purpose water resources project in Gujarat is recognized one of the "Eight Modern Wonders Abuilding" from TIME magazine, way back in 1994. This Project is a mission to harness the untapped waters of river Narmada for the survival of millions of people and environmentally sound sustainable development of the western India by providing the essence of life-Water and Energy. Basically it is one of the largest human endeavors to transport 11.7 billion cubic meter of water every year to a distance up to 700 kilometers to quench thirst of the water scarce areas.

Narmada is the first river basin in the country to have integrated development and Sardar Sarovar Dam is the terminal dam on the river Narmada along with 30 major dams, 135 medium dams and 3000 minor dams. It is one of the largest water resources projects of India benefitting four major states - Maharashtra, Madhya Pradesh, Gujarat and Rajasthan. Out of the 28 MAF water available as per hydrological assessment made by the Narmada Water Dispute Tribunal, the share of Madhya Pradesh, Gujarat, Rajasthan and Maharashtra is 18.25 MAF, 9 MAF, 0.5 MAF and 0.25 MAF respectively. Hydropower is shared amongst Madhya Pradesh, Maharashtra and Gujarat in the ratio of 57%:27%:16%.

Sardar Sarovar Project (SSP) plans to offer benefits of assured drinking water supply to 9490 villages and 173 towns, irrigation to a vast command are of 18 lakh hectares, eco-friendly hydropower generation, flood protection to 30,000 hectare area and creating about 1 million jobs in rural areas.

SSP has been a pioneer in finding out many innovative ways to deal with the situation and the Underground Pipeline (UGPL) has emerged as a technically feasible and acceptable alternative. The Policy adopted for construction of Sub-minors is flexible to offer various technically feasible options including UGPL and improves scope for speedy implementation with active participation of the Associations/Groups of Water Users. It has received an overwhelming response from the beneficiary farmers and till date more than 29,000 km length of sub-minors have been completed as UGPL, benefitting a command area of more than 11 lakh hectare. Even if a strip of 1.5 m width is considered, this UGPL work has mitigated acquisition of precious 4,350 hectare land! And saving of precious water is an additional benefit.

It is heartening to note that each drop of Narmada water through SSP is first utilized for hydro power generation before its use for drinking, irrigation or industrial use. In addition to that the Project also harnesses the feasible opportunities for eco-friendly renewable energy through 35 mega watts canal top and canal bank solar power projects to save

precious natural resources like land and water; and 85 mega watts small hydro power plants at vertical drops on branch canals.

Wherever technically feasible and necessary, infrastructure has been created to facilitate water grid. One such classic example is installation of 16 pumps to lift 600 cusecs of water from Mahi right Bank canal and putting it into flowing Narmada Main Canal to augment its flow. Needless to say that an Escape structure has already been constructed to release Narmada water from Main Canal to Mahi right bank canal through gravity. Thus two major canals are linked in such a way that shortage of water in one can be met with from excess in the other!

The Importance of Managing Sewage

The scope of sewage management has evolved throughout history with changes in socio-economic conditions, city structures, and the environment. Today, sewage infrastructure that is well planned and operated supports urban sanitation and related activities. Effective sewage management is essential for nutrient recycling and for maintaining ecosystem integrity.

In May 2018, Gujarat State announced a Policy for use of Treated Waste Water (TWW) with a vision to maximize the collection & treatment of sewage generated and re-use of treated waste water fully by 2030 on a sustainable basis, thereby reducing dependency on fresh water resources and to promote treated waste water as an economic resource.

Solar Harvests Changing Lives

In June 2015, Raman Parmar, 48, a farmer of Thamna village in Gujarat's Anand district had become the country's first solar power farmer. Inspired by Raman, six farmers from Dhundi village in Kheda district of Gujarat formed what was known as the country's first solar irrigation co-operative – Dhundi Saur Urja Utpadak Sahakari Mandali (DSUUSM), in December 2015. These six farmers began drawing water using solar-powered pumps and later three more farmers joined DSUUSM.

IWMI, working closely with MGVCL and the Gujarat Energy Research & Management Institute estimated that a solar pump can generate 13,000 units of power per year worth Rs. 65,000 on just $1/25^{th}$ of a hectare. Accordingly, 10 million solar farmers can grow 130 billion units of solar power and earn up to Rs. 65,000 crore per year net of input costs.

Taking the Dhundi model further, 11 farmers of Mujkuva village of Anklav Taluka, in Anand district, have foregone their power subsidy and instead, began using solar power. This has been done through the Mujkuva Solar Pump Irrigators Cooperative Enterprise (SPICE) – India's first grid-connected solar enterprise which Hon'ble Prime Minister Shri Narendra Modi launched during his visit to Anand on September 30.

The State Government has launched Suryashakti Kisan Yojna (SKY) to enable farmers generate their own power for captive consumption and make an extra buck by selling the surplus power. According to this scheme, which is first in the country, farmers having existing electricity connections are given solar panels according to their load requirements. Of the total cost of installing solar system, farmers have to bear only 5% cost and rest comes through state and central government subsidy (60%) and affordable loan (35%). It is estimated that a farmer with metered connection of 5 HP earns Rs. 11,612 per annum during the loan period of 7 years and after that the amount goes up to Rs. 26,900 every year.

From Regional Imbalances to Long-term Water Security – the inclusive approach of Gujarat Water Management Model

For achieving Sustainable Development Goals, the role of Water Management is becoming increasingly important. Still today more than 2.8 billion people worldwide live in areas of high water scarcity. Gujarat State of India has been figuring in almost every international debate on water, for its unique challenges due to regional imbalances in availability of surface and ground water. One of the fastest growing economies in Indian states, Gujarat has got more than 6% of the country's geographical area and more than 5% of its population. It is however naturally underprivileged in terms of water and has got just 2.2% of the country's water resources. This is further constrained by the highly skewed intra-State availability pattern, with almost three fourth parts having just one fourth of water resources, making this western State a classical example of water management. This is further compounded with the fact that out of 185 rivers in the State, only 8 are perennial and water quality management is also important. It is more so when all the recognized projections are showing it to be subjected to physical water scarcity by the year 2025. Against the total 50 BCM utilizable water, the total water demand is estimated to increase to 57 BCM by 2050, due to rapid urbanization and industrial growth.

337 km long unlined spreading channel constructed under "Sujalam-Sufalam" project is conveying water from southern part of the State to water stressed areas. State-wide drinking water supply grid with 3,250 km long bulk pipelines has become complementary to the open canal network has been implemented to meet the challenge of an average daily transfer of 2,766 MLD.

The whole range of available options i.e. from Macro to Micro has been successfully explored by the State to ensure long-term water security for the millions of people. Astounding experience of rain water harvesting and conservation by constructing 1,58,843 Check-dams (micro structure built to check the flow in a natural stream), 2,61,785 Farm Ponds and 1,22,035 Bori Bundhs (micro dams constructed with sand bags), with active participation of people, has put the State in the limelight in the water management sector. All-round efforts also included deepening of 23,000 village ponds to enhance their storage capacity and revival of more than 1,000 step wells (ancient underground structure to harness and conserve rain water). Such a multi-pronged approach has not only checked the

rapid decline of ground water levels, but has also helped in reversing the trend in some parts of the State. Between 2001-02 to 2012-13, electricity consumed in the State for agricultural use i.e. mainly to pump the groundwater, has drastically come down from awesome 45% to about 21% of the overall electricity consumption. Recognizing the fact that agriculture is playing a dominant role in water demand, the State has already brought 16,39,079 hectares of land under micro irrigation i.e. drip/sprinkler etc. by the end of November 2018.

Human Resources – the key to Water Future

One important point which is generally neglected is Human Resources Development for Water Management. While we are focusing our debate on the water demands and availability in the year 2030, 2050, 2100 and so on, we also need to have a definite road map of our manpower requirements for water management in general and operation & maintenance of the already created infrastructure in particular. Unless this is done, we won't be really able to develop next cadre of Water Managers in the country.

The Way Forward

While sustainability occupies the central stage of any debate on development, there is not a crystal clear unanimity about what is to be sustained? Why? How long? For whom? By what means? And so on. Perhaps our pursuit to obtain answers to these questions can lead us to the out-of-box solutions.

In our country, where the agriculture is still the main stem of livelihood for billions of people and where the most of water (about 90%?) is consumed, water use efficiency is not even at the level of 60%, leaving a wide scope for improvement by adopting compatible merger of "Demand" and "Supply" management options.

Former President of India, APJ Abdul Kalam, presenting a new dimension of Urban Development, while speaking on the "Dynamics of Urban Development" at the Inaugural Session of Vibrant Gujarat Summit 2007 (February 15, 2007) called for "Development of urban oriented infrastructure in such a way that it will support the socio-economic activities of the surrounding rural clusters extending up to 20-30 km radially without causing additional urban pressure in the existing urban agglomeration in addition to the planned growth of the cities." Here it is pertinent to mention that in India, if 1% of its population move from rural to urban, its water demand increases by 875 million liters per day!

On the eve of this grand event, we need to review our path of development in light of the talisman given by Mahatma Gandhi – to think of the poorest and weakest of the society. Human-centric broadening of the base of development through employment intensive and environment friendly development path is needed. Water has a key role in achieving rapid poverty reduction and thereby rapid human development. But its management is deeper and hotter than it appears on the surface! Let's starve together to ensure that water once again becomes our savior….a cause for cooperation and not for conflict. Thank you...