

## WATER RESOURCES DEVELOPMENT -An INDIAN PERSPECTIVE

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### ABSTRACT

With a population of one sixth of mankind India today is showing a steady growth in economy. If things go right, some experts believe, India's economy may overtake that of the US by 2050 to be the second largest in the world just behind China. But by then India's population will have grown to 1.6 billion, making it the most populous nation in the world. Although the present economy is largely agro-based with majority of population living in rural areas the ongoing development pattern shows a clear trend towards rapid urbanization. The country is heading towards a rapid transition in habitation pattern whereby over 50% of the Indian population will perhaps be living in cities and urban conglomerates in the near future. This will give rise to many infrastructure problems, the most important being the supply of clean water and nominal sanitation to its fast growing population. These are prime needs and high priority with adequate budgetary support should be provided to achieve these objectives. Also, this is the topmost priority in UN Millennium Development Goals and needs to be treated differently from the other resources problems keeping it above the rules of the marketplace.

**Keywords:** Urbanization, Population density, Safe water, UNMDG, Climate Change, Conservation, Desalination, Recycling, Reuse

### INTRODUCTION

As a nation of population close to 1.2 billion, the second most populous in the world, India is maintaining a steady growth of its economy. Although it has an economy based largely on agriculture there is a trend towards rapid industrialization and urbanization. Water is a key element in all kinds of development planning. A recent estimate shows that about 70% of its population lives in rural areas as against 30% in metropolitan cities and urban centres. Of the urban population about 25% live in slums and squatters. About 60% of the urban population is not connected to sewerage system and about 20% are without safe drinking water. India's urban population has grown from 17% in 1951 to 33% in 2001. This trend is likely to continue in the coming few decades.

The problem of providing safe water to India's masses is getting a new dimension due to the galloping rise of population in the urban centers. The impact of global climate change is making the prediction of rainfall pattern quite uncertain. Long term holistic planning is a must but is becoming all the more difficult due to uncertainties in forecasting the oncoming weather pattern. India's water crisis particularly in the cities is mainly due to poor management. Water management in the urban areas of India is said to be one of the worst in the world.

Planning and implementation of water resources projects involve multi-dimensional problems like, Inter-state, Legal and Socio-political issues; Land acquisition; Relief and Rehabilitation of the project affected people and overall Food security of the country. The problem of India is somewhat unique in nature because of its very high population density and its well established democratic set-up. India and China together constitute about one third of mankind. They are frequently compared as both are having mega population, little realizing that China has three times the area with a marginally higher population hence, a much thinner population density. Also China has strict state laws governing land acquisition for national projects. Such laws are yet to be enacted in India.

### 1.0 INDIA 's WATER SCENARIO

The UN Charter of year 2002 accepts the Rights to Safe Water with respect to safety, affordability and accessibility as a basic human right. Water is the most precious natural resource and is a critical element in any kind of development planning. We should aim at providing adequate water supply at suitable pressure for various uses such as, domestic, irrigation, drinking, sanitation, industrial, commercial, construction and other uses and at the same time protecting the environment.

With an area of 3.29 million sq. km, a coastline of 7,156 km and a population of about 1.2 billion India is the second most populous country. However, considering the present rate of population growth it is destined to surpass China and be the most populous country in a few decades. The ongoing development pattern shows a clear trend towards rapid industrialization and urbanization. The habitation pattern is showing a sea change whereby it appears logical that in the days ahead about half of its population will be living in the urban centers.

The status of safe water and sanitation in India is quite unsatisfactory. In a world wide survey conducted in 2005 India ranked 133 out of 180 nations in availability of water and 122 out of 130 nations in water quality. While the monsoon (rainy season) extends for about 3 to 4 months, over a large part of the country, it rains only for about one month or less in a year. Hence, there is a fairly large requirement of storage of rain water for use during the long dry months.

Irrigation activities alone consume about 80% of available water as the practices adopted are outdated and largely wasteful. Improved methods of irrigation are available today whereby the same amount of crops can be grown using only about 20% of the irrigation water presently being used. So, water conservation is an urgent necessity with enough storage by rain water harvesting, economizing on water use, reducing waste to the minimum, recycling and reusing of used water.

The major problem in India's water sector apparently are : Interstate issues; Legal issues; Political interest; Lack of public awareness; Improper and inadequate mass communication and, Lack of Management skill and efficiency particularly amongst the technical and administrative personnel handling the water projects.

## 2.0 GLOBAL CLIMATE CHANGE

India has always been fairly rich in water resources despite the fact that of late, some experts have been calling India a water scarce country. Over the centuries the common people in India have taken water for granted. The age old philosophy has been, water is a gift of nature and is available free to all. But the people have been using what is available at a rate much faster than the rate at which it can be replenished. The problem will intensify as the population grows further and the impact of global climate change with possible disastrous effect on the Indian Sub-continent makes rainfall pattern totally unpredictable. Melting of glaciers in the Himalayas and reduced crop yield and cholera outbreak are predicted in South Asia which is at risk of flooding from the sea as well as from the rivers. By the year 2050 these totally unpredictable events may affect more than a billion people. Low lying coasts, mangroves and coral reefs are likely to be especially vulnerable. India and Bangladesh in particular, are susceptible to increasing levels of salt in ground water as well as in surface water. The ravages of AILA of May 2009 hitting the coastal belt of West Bengal have made existence of the Sunderbans the largest mangrove in the world in doubt. The recent deluge in Mumbai (Bombay) and Chennai (Madras) due to heavy rainfall and, flooding in the desert towns of Rajasthan are clear indications of the oncoming climate change.

As a consequence of global warming, climate change and various other factors the availability of water in the rivers and lakes is diminishing at an alarming rate. Due to excessive pumped withdrawal of ground water and corresponding negligible recharge by natural process the ground water table is steadily dropping. Also, contamination

of ground water due to arsenic, various salts and saline water intrusion in the coastal areas is a great hazard to public health.

## 3.0 URBAN WATER SUPPLY

Some of the major factors causing non-availability of adequate water in the urban areas are leakage in pipe lines; overflow from overhead tanks; use of filtered water where it is not really necessary, such as, construction, industry, sewage flushing, gardening, car washing, leakage and wastage from taps and, other wastages due to lack of public awareness. Water pressure in pipe lines frequently drops due to some users installing on line pumps to draw more water for them depriving the other residents in the vicinity. Good quality water at adequate pressure cannot be supplied free of cost for round the clock. The consumers need to bear a part of the water cost hence; water pricing has to be introduced. This calls for a change in mindset for the Indian people.

The major problems on water quality in Indian cities consist of:

- Microbial contamination of drinking water supply systems
- Geogenic and anthropogenic contamination of ground water
- Pollution of surface water sources.

Some of the essential actions necessary to ensure that the piped water supply remains safe and sustainable include preventing contamination and minimizing water losses.

- Contamination in pipelines may occur due to -
- + Intermittent supply,
- + Low water pressure and,
- + Leakage in pipelines.

Water loss up to fifty percent or more may be accounted for by:

- ++ Leakage in pipelines, joints and valves
- ++ Overflowing service reservoirs
- ++ Illegal tapping of water from pipelines, non metered house connections and roadside public water taps kept open 24 hours.

## 5.0 URBAN WATER REQUIREMENT

Various water needs in urban community may be classified as domestic namely, drinking, cooking, bathing, washing, flushing toilets, gardening, washing cars, cattle and pets, hospitals, educational institutions, sports complexes, transport terminals and railway stations, commercial and entertainment centers, industry, fire fighting, roads and pavement washing, public bath and swimming pools etc. Besides these requirements, a large provision should be made for various water losses which work out to at least 10% of the estimated consumption.

Urban water management policies should include the political will to make it happen, full involvement of the consumers, and monitoring and implementation of the

projects with full support and co-operation of the stake holders.

Amongst all the domestic uses, toilet flushing and bathing consume well over 50% of water and there is scope to economize on these water uses. The used water with some treatment can be re-used in gardening, fire fighting and, toilet flushing etc. The major components in water management system should include assessment and optimization of supply, demand management, participatory and transparent management operating system, market-based regulatory mechanism, and combining authority with responsibility. The Urban Water Resources Management System should be a coordinated effort of Central Government, State Government, local bodies, autonomous agencies, Government Undertakings, NGOs, and community organizations. A number of such projects are coming up under the Jawaharlal Nehru Urban Renewal Mission (JNNURM).

## 6.0 WATER SUPPLY AND DISTRIBUTION

Management of water distribution system poses numerous challenges to the metropolitan cities in India. These include;

- \*\* Identification of customer needs and perception
- \*\* Use of performance assessment tools
- \*\* Improvement of reliability and efficiency
- \*\* Development of tools to assess the conditions of water mains
- \*\* Development of pro-active, cost –efficient water main renewal programs
- \*\* Development and use of new technologies for water main renewal schemes
- \*\* Adopting new, innovative materials for pipelines
- \*\* Optimum use of database management and information technology
- \*\* Use of Integrated GIS with hydraulic and water quality models
- \*\* Improving the operating efficiency of the entire water system

During the coming few decades large sum of money is going to be invested in the Indian metropolitan cities on water distribution renewal schemes. Large numbers of these projects are coming under Jawaharlal Nehru National Urban Renewal Mission (JNNURM). The main action plans will include:

- ++ The customer will play an important role in Water Distribution System Management
- ++ The need to use tools to develop a cost effective renewal program.
- ++ The need to use an efficient information system management.
- ++ The need to use computerized tools to monitor performance of the water distribution system.
- ++ The need to improve efficiency in energy consumption and utilization of human resources.

++ The need to use benchmarking techniques to improve the operating efficiency of the entire distribution system.

## 7.0 POSSIBLE SOLUTIONS

The problems in India's water sector are many. However, there are a number of possible solutions to the problem of safe water. Some of the solutions are:

Water conservation; Technological up-gradation; Innovation; Making more water available by finding new sources; Recycling and Re-using used water; Equitable access and distribution; Desalination of sea water; Eliminating contamination in storage and distribution network; Growing awareness amongst the common people and developing a change in mind set; privatization in selected areas; Decentralization and Government intervention.

India is a peninsula with a long coast line. Getting fresh water desalinated from the sea is a viable option. In the years ahead this option is likely to become cost effective. 97% of the water on earth is sea water and 96.5% of sea water is really fresh water in disguise, the other 3.5% being the dissolved solids that make it unusable for human beings. Desalination eliminates these solids from the sea water and makes it usable. The various processes of desalination commonly known are:

Reverse Osmosis (RO); Distillation; Electrolysis and, Vacuum Freezing

Of these processes of desalinating sea water RO and Distillation are commercially feasible.

## 8.0 WATER CONSERVATION

Rain water harvesting is useful for effective water conservation and management. The process consists of capturing and storing rainfall to minimize the runoff, evaporation and seepage for its efficient utilization and conservation. The most feasible option is to harvest the rain water at the place where we get the rain water namely, streams, storm water drains, roof tops, pavements, gardens etc and store it in the natural sub-surface for subsequent recovery and use. This is an efficient method to utilize a large quantity of water which otherwise goes to the sea as waste.

Harvesting rain water is essential for the following reasons:

- = Rain water is perhaps, the best source of fresh water
- =The rain comes only during a limited period in the year and, if not conserved this fresh water may not be available for the rest of the year.
- = If not harvested most of the precipitation will run off and literally go waste
- =Failure to harvest the rain water will increase flooding of the low lying areas

Some of the benefits of rain water harvesting are:

- + Ground water table will rise, thus improving water quality and yield of aquifers

- + Salinity of ground water will reduce
- + Very useful for gardening, landscaping and other uses where filtered water is not needed.
- + Augmentation of water supply system and sustainability of drinking water source.

The major policy issues involved in implementation include:

- \*\* Government organizations should come forward for providing technical and financial support.
- \*\* Proper coordination between Central Government, State Government and concerned local bodies.
- \*\* Granting incentives to individuals and agencies adopting approved rain water harvesting schemes. Municipalities in some of the cities have already initiated such incentives.
- \*\* Creating public awareness through nation wide campaign to adopt the schemes in individual and public interest.

Some more conservation measures suggested are:

- ++ Irrigation, the largest consumer has a huge potential for water efficiency improvement through furrow dyke; land terracing; direct seedling, drip irrigational; micro sprinkler irrigation; using treated effluent and / or sewerage; Using brackish water and reclaimed municipal water wherever possible.
- ++ It is not wise to presume that technology will provide all the solutions. Efforts must be made in the first place to avoid problems rather than trying to solve them after they have come to the surface.
- ++ Forest is an intricate device for catching, holding, using and recycling water. The forest wealth must be preserved and protected and expanded through planned large scale plantation.
- ++ Existing wetland must be preserved and protected and new ponds, lakes and reservoirs created in a planned manner. These help in aquaculture, fishery and raising the sub-soil water table apart from generating employment for the local people.
- ++ Introducing a water pricing structure would be effective in motivating water conservation. Since, a large section of the Indian people are still well below the poverty line the water tariff should take into account the social benefit aspects considering the affordability of the weaker section. A balance should be struck by charging relatively more to the affluent class.
- ++ The place to begin water conservation is the home with adequate awareness created amongst the women folk aiming at, Reducing consumption, Recycling and Re-using water used once.

## 9.0 WASTE WATER RECLAMATION

Rapid rise in demand, fierce environmental opposition to new sources and drought have given a new urgency to the

search for dependable water supplies in the arid western states of the USA. While California suffers from persistent drought, in Los Angeles alone large quantity of tertiary –treated water gets dumped into the ocean everyday. That water could be used to irrigate agricultural crops, landscaped areas, golf courses, and flush toilets in high rise buildings. The US western states could no longer afford to continue “wasting” its wastewater. There is a lot of interest among the western cities of USA in making use of their treated wastewater.

Reclaimed water is an uninterrupted supply. That is why it has become a powerful incentive in the California area for reclaiming and reusing the wastewater. In water-short urban areas of California, as well as in cities like Denver, Colorado and Phoenix, Arizona that face similar problems, substituting reclaimed waste-water where potable –quality supplies were not needed was found to be an attractive alternative. Comparison with existing supplies may make look reuse more expensive, but developing new freshwater sources would almost always cost a lot more. Reuse would look better and better as the marginal cost of new supplies increased, because all the low cost supplies have already been developed.

### 10.0 CASE STUDY ON GREATER KOLKATA (Calcutta)

The Metropolitan city of Kolkata (Calcutta) is the second largest urban conglomeration in India with an area of 1,380 sq. km. a population of over 12 million, having 3 Municipal corporations, 38 municipalities and a large number of non-municipal urban units. Kolkata city proper has an area of 187 sq. km and a population of 4.5 million and in addition a floating population of 2 million. Till 1910 Kolkata was the capital of British India and had the distinction of having the first major water supply and sewerage scheme next only to the city of London in the United Kingdom.

Over the coming few decades large amounts are going to be spent in distribution system renewal. The customers have to play an important role in management of the water distribution systems. A need has been felt to use effective computerized tools to implement and manage cost effective renewal programs. The implementation of the plan is being taken up in several phases. The operating and maintenance costs must be met by revenue earned through user charges. Future programs till 2015 include utilizing existing systems, renovation of the old mains, integration of systems, replacement of ground sources by surface systems, reducing wastage by adopting appropriate technology and developing public awareness and better quality surveillance. Ground water cannot be taken any more as a long term solution as in many areas iron and fluoride are found exceeding the permissible limits. Arsenic contamination is common in shallow aquifers.

Over extraction of ground water with insufficient natural recharging of the aquifer is a positive public health hazard.

Main problems confronting better water management are:

- + Adequate and timely cash flow for scheme implementation and operation,
- + Sustainability and cost recovery from the operating system
- + Inter-institutional coordination for implementation and smooth operation.
- + Complicated and often conflicting rules and regulations and multiplicity of development agencies with their ill-defined scope.

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The way forward is possible with adoption of the following steps:

- \*\* Harmony between political will and sound technical approach,
- \*\* Improved revenue collection, introduction of rational water rates safeguarding the interest of the weaker sections of the society.
- \*\* Preparation of realistic database using GIS and other appropriate high tech applications,
- \*\* Decentralized planning and implementation, transparency along with involvement and support from the community.

## 11.0 CONCLUSION

The main problem in the Indian water sector is not so much the development of new water sources but the management of developed resources and using the established assets judiciously and efficiently. The challenge of fresh water scarcity is second only to the global climate change. The phenomenon is closely linked with desertification and deforestation. Hence, the aim should be to **reduce** water consumption, **reduce** water wastage in supply and distribution and, **recycling** and **re-using** water to the fullest extent possible. Efficient use of water in irrigation without affecting the crop yield should be adopted. Rain water harvesting and waste water reclamation should be used effectively to augment the existing water supply system. Sea water desalination should be adopted in the coastal areas. India’s main problem is lack of education and awareness amongst the masses as well as poor water management. The technical and managerial personnel in India are apparently not well exposed in legal aspects and public communication. Hence, on many occasions they are unable to address the main issues. India needs personnel efficient in technical and managerial skill, legal aspects and communication with the common people to handle water related projects.

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