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Community Participation Framework for Water Utilization in Jammu Region (J&K)

Lessons from Singapore

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Abstract

In the current global scenario water management is the prime mover of economic growth and is vital to the sustenance of a modern economy. Future economic growth also, crucially depends on the long term availability of perennial water sources specially the ones that are affordable, accessible and environment friendly. The analysis of data from the Economic Survey of India, 2012-13, shows that energy and water demand is on the rise in India and this is due to increase in the development efforts and population growth. Therefore, the present study will focus on what has been achieved and what needs to be achieved with reference to water management through community participation in Jammu and Kashmir State by understanding the experiences from Singapore. Therefore, the study will be utilizing the references and applying the research by utilizing the knowledge and generating a viable framework for the Jammu region, which would be a little contribution towards

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proposing a Sustainable Water management policy framework for Jammu and Kashmir State by involvement of community through non government organizations and self help groups. In this regard, the exploration of water renewal through Public Utilities Board (PUB), Singapore's national water agency gives an insight to the study by providing an ideal model of community participation which can be adopted in Jammu region of state of J&K.

Keywords: Water Management, Community Participation, Sustainable Energy

INTRODUCTION

A successful nation cannot operate efficiently in isolation from its environment. It must balance social, economic and environmental needs. A successful nation must offer investors security, infrastructure and efficiency, and should also put the needs of its citizens at the forefront of all its planning activities. Poor planning and management can have devastating results for the economy, the environment and the society. Poorly managed human settlements will be unable to keep pace with the development, and would result in economic inefficiency and low quality of life for the citizens.

Effective environmental and energy management systems can make settlements more competitive, more efficient and lead to sustainable development. Sustainable development is multi-dimensional, it requires an understanding of complex and often conflicting relationships. These issues call for an integrated approach. A variety of strategic approaches to integrating the environment and energy management issues into the urban planning process through a policy framework is required for human resource development. Environmental activities and the energy management systems can be targeted at different levels. Cities can also use different instruments to integrate the environment and energy management systems into urban planning. These management approaches include policy instruments, process instruments, planning instruments and management instruments.

This study investigates how these instruments are applied in Singapore, for Water Management and understands how these management approaches can be proposed in Jammu region of India as a policy framework for integrated planning leading in rural and urban development. The demand management and involvement of the local community through education can lead to emergence of the city as a hydro hub by protecting the natural water resources, regenerating the water by water harvesting and thus, leading to conserving the energy systems. It examines the characteristics, strengths and weaknesses of Integrated Development Plans in Singapore.

Jammu and Kashmir State is diverse with geographical and socio economic backgrounds. The Jammu region can be geologically divided into two main regions i.e. the Kandi Belt and the Sirowal belt. Out of these two regions the Kandi belt has intense water related problems. This paper takes a micro perspective of energy management with respect to water utilisation systems through community participation in Jammu region. Lessons from Singapore

do provide an example for application of the same model with customisation in this region.

The Environment – Energy Management— An Essential Asset for Cities

International recognition of the fact that environmental protection and natural resources management must be integrated with socio-economic issues of poverty and underdevelopment culminated in the 1992 Rio Earth Summit. This idea was captured in the definition of "sustainable development," as defined by the World Commission on Environment and Development, also known as the Brundtland Commission, in 1987 as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." The concept was designed to meet the requirements of both the supporters of economic development as well as of those concerned primarily with environmental conservation. Today, it is recognized that social, economic and environmental considerations are completely interconnected. In the human resource development context, this means that the environment-energy management is not a choice but a necessity for sustainable development.

The justification of the study is based upon the fact that sustainable development of any region or country depends on developing an integrated environmental energy management systems with community involvement. For sustainable development, energy efficiency and energy conservation needs to be improved. In the current global scenario, Energy is the prime mover of Economic growth and is vital to the sustenance of a modern economy (Soparkar, 2008). Future Economic growth crucially depends on the long term availability of energy from sources that are affordable, accessible and environment friendly (Raghuraman and Ghosh, 2003).

Saving Energy is important and effective at all levels of human organizations--in the whole world, as a nation, as companies or individuals (Kent, 2008). Energy demand is on the rise, more so in the case of developing countries like India (Ghose et al., 2008). Because of rise in population as well as increasing living standards of the people, there has been a tremendous increase in the Energy consumption (Mehta, 2009) which, ultimately, has a direct impact on economy as well as environment. Therefore the present study will focus on what has been achieved and what need to be achieved so far as the sustainable human resource development with regard to environmental-energy management system in Jammu and Kashmir State by interlinking energy and water management through understanding the Singapore experience.

Safe water is one of the most important felt needs in public health in developing countries in the twenty first century. The year 2005 marked the beginning of the "International Decade for Action: Water for Life" and renewed effort to achieve the Millennium Development Goal (MDG) to reduce by half the proportion of the world's population without sustainable access to safe drinking

water and sanitation by 2015. It has been researched that if India's current economic growth rate is to be maintained and if all the people of the country, especially the poor and the vulnerable, are to share the benefits of rapid economic growth, two resource issues need priority consideration: energy and water. Further, if these two issues can be properly addressed, and if all the members of the society can have adequate access to energy and water, many of the existing societal problems can be resolved.

Three pillars of sustainable development are generally accepted. They are social, economic, and environmental development**.** These three aspects are said to lead to the sustainable development. The urgency and complexity of making significant progress in addressing the need of developing countries for adequate and affordable supplies of clean water will require a radical restructuring of institutional arrangements and policies.

Historically, civilizations in India, as around the world have largely evolved and developed around water bodies as most human activities including agriculture and industry depend on water. Water constitutes one of the most important physical environments of man and has direct bearing on health.

The lust for economic development has led to massive industrialization and development with no regard for environmental protection. The increased living standard, increasing water consumption and increasing population is placing stress on water drawls for increased requirement for irrigation, food, industrial, domestic and other needs. The water resources are depleting and water demands are increasing which has led to general belief that next world war shall be fought for water. Therefore, the present paper focuses on the aspects of water management which would help in attaining efficient environmental energy management systems through community participation in Jammu region of the J&K State.

Jammu & Kashmir State Perspective

The state of Jammu and Kashmir is an isolated mountainous area situated in the centre of Asia. It has three well marked physical divisions:

(a) Jammu Region

(b) Kashmir or the Valley region and

(c) Ladakh region

The present paper focuses on the water management systems in the Jammu region.

Jammu region geographically lies in the outer Himalayas, which are also called southern mountain region, this area constitutes districts of Jammu, Kathua, Udhampur, Rajouri, Doda and Poonch. Due to scanty rainfall water scarcity is felt in these areas and is also called Kandi belt of Jammu and Kashmir. Due to acute scarcity of water in Jammu and Kathua districts, the water supply schemes are mostly lift schemes whose source of water is ground water. Numbers of tube-wells have been bored and water is pumped with electric energy. The frequency of water supply ranges from twice a day to twice a

week. As most of water supply schemes are lift schemes, power failure or failure of machinery causes acute hardship to people especially during peak summer months. To the north and northwest Kandi areas are hills of greater height which constitute Rajouri, Poonch, Udhampur and Doda districts. The source of water for water supply schemes in these areas is natural streams and springs. The water is supplied to the people through piped water supply with little or no treatment by gravity. In rainy season, the sources get polluted with mud due to deforestation of the hills. Due to deficient snowfall and precipitation, these natural resources are fast depleting resulting in tapping of new and far-off water sources.

The statistical data of Jammu Region reflects cent-percent coverage with regard to urban as well as rural population, but all the systems are inadequate and grossly mismanaged and need to be improved, upgraded, augmented and adequately managed. The tariff structure of water supply schemes is very poor with a meager charge of Rs. 10 per month per connection in urban areas and virtually no tariff exists in rural areas. The city of Jammu is fast expanding due to migration from rural areas and has also population load of pilgrimage and tourists, thereby leading to acute water shortage. Master plan for water supply to cater to the needs of Jammu city has been framed in which it is proposed to tap river Chenab as potential source of water but the project is not taking off due to absence of adequate phased funding. The quantity and quality of water supplied to rural as well as urban area is very poor. Due to inadequate pressure in pipes, the urban areas in Jammu region have witnessed cent-percent installation of online pumps. The Public Health Engineering Department is the sole agency managing all affairs from projecting, installation, operation and maintenance to collection of tariff. The department has no laboratory facilities for water quality analysis and there is no water quality surveillance system for water quality monitoring. The energy can be managed and conserved by water harvesting and creating of canals and ponds to preserve and conserve water. The model from Singapore can be applied here, with customisation also lessons from the development of Indira Gandhi Canal, Rajasthan can help with engineering solutions as the amount of energy wasted for water lifting and supplying can be conserved. This would provide a environment energy management system for the area.

Water Demand and Availability – Future Challenge

A number of factors like climate, culture, food habits, work and working conditions, level and type of development, and physiology determine the requirement of water. As per the Bureau of Indian Standards, IS: 1172-1993, minimum water supply of 150 -200 liters per capita per day should be provided for domestic consumption in cities with full flushing systems. IS: 1172-1993 also mentions that the amount of water supply may be reduced to 135 litre per capita per day for the Lower Income Group and the economically weaker sections (EWS) of the society and in small towns. Besides domestic

requirement, water is also demanded for agricultural, commercial, industrial, and civic or public use.

RESEARCH METHODOLOGY

Research Design

Strong theoretical framework based on literature review and industry evidences, this study attempts to understand the framework to guide the design and implementation of sustainable Water management policy for Jammu and Kashmir State.

In order to understand strategy adopted by Singapore to secure alternative sources of water and model of community participation, authors visited Singapore in 2010 to take an insight into the successful water management model adopted by Singapore. In this regard, primary data was collected by authors through direct observations and Interviews.

Knowledgeable Arguments were developed with Premise as Evidences from Public Utilities Board (PUB), Singapore's national water agency.

LESSONS FROM SINGAPORE

Many people get amazed at the beauty of Singapore and her progressiveness. Way before becoming the cosmopolitan city of today, Singapore was just a humble fishing village.

Located in Southeast Asia, Singapore has a land area of about 700 square kilometers, making her one of the smallest countries in the world and the smallest in the region. Although small in size, Singapore holds an massive presence in the world today with its free trade economy and highly efficient workforce. Also, her strategic location in the region has enabled her to become a central sea port along major shipping routes.

Singapore is a city- state which has been looked upon internationally as a role model for water management. The city-state, which has no natural aquifers or groundwater, has made tremendous progress from facing challenges in water supply to setting the standards in sustainable water management.

The Singapore Water Story: A Background

With 4.5 million people living in an area of just 700 square kilometers, acquiring a few fresh water resources and managing the country's water resource is not a easy task.

In the 1960s and 70s, the island faced numerous water problems, most of them associated with accelerated urbanisation: water shortages, flooding, and pollution in its rivers.

But the situation is vastly different nowadays. This has happened due to a dynamic and diversified strategy to secure alternative sources of water known as the 4 national taps. The 4 national taps refer to water from four different sources of water: water from local catchment areas, imported water, recycled water (branded as NEWater) and desalinated water.

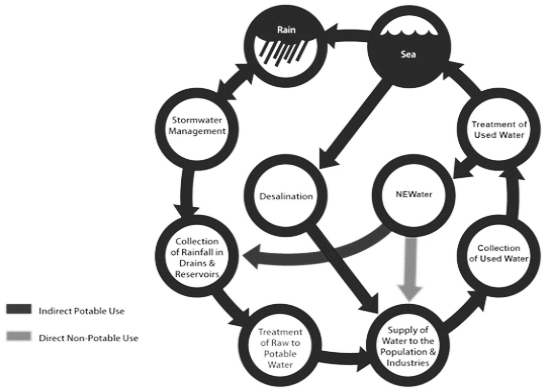

Figure 1: The Water Loop

Source: Public Utilities Board Singapore (PUB), 2014

About half of Singapore is comes under a water catchment system, with 14 reservoirs as well as an extensive network of canals and drains to harvest rainwater. This is set to increase to two-thirds by 2009 with the completion of several new reservoir schemes, including a unique "reservoir in the city", the Marina Reservoir.

Today, the nation has built a robust, diversified and sustainable water supply from four different sources known as the Four National Taps (water from local catchment areas, imported water, reclaimed water known as NEWater and desalinated water). By integrating the system and maximising the efficiency of each of the four taps, Singapore has ensured a stable, sustainable water supply capable of catering to the country's continued growth.

From rainwater collection to used water treatment, the entire water loop is managed by PUB.

A New Beginning

Introduced in 2003, NEWater marked a new era in Singapore's water history. Produced using state-of-the-art membrane technologies involving microfiltration, reverse osmosis and ultraviolet disinfection, the result is an ultra-clean product that has been vetted by more than 30,000 scientific tests, surpassing even the World Health Organisation standards for drinking water.

NEWater is supplied primarily for non-domestic use in wafer fabrication parks, industrial estates and commercial buildings, where it is used for industrial and air-cooling purposes. A small percentage is mixed with raw reservoir water before being treated as drinking water.

There are at present four NEWater plants, which can meet 15% of Singapore's water needs, with plans for a fifth plant underway that will boost the total capacity to 30%.

Demand Management

Putting the infrastructure in place alone is not sufficient to secure Singapore's water supplies. Demand management is also imperative for sustainability. Singapore is constantly looking at its demand and supply management. The holistic approach of this country has enabled it for proper handling of transmission and distribution network to minimise losses and the implementation of water conservation measures.

This has brought about a considerable reduction in unaccounted-for water, from 11

per cent in the 1980s to 5 per cent today, one of the lowest levels in the world.

Involving and Educating People

Singapore considers its people as joint stakeholders of their water resources and also actively seeks to engage the community in its water management efforts.

Since 2004, a series of public education programmes has been launched to encourage water conservation through daily habits. It has worked: the per capita consumption of water in households has inched downwards, from 165 litres a day in 2003 to 157 litres a day now.

PUB (Singapore's national water agency) also actively promotes recreational activities at its reservoirs such that they are now a haven for water sports such as kayaking and wakeboarding.

To better integrate water with the urban environment, PUB has revealed a new long-term initiative called **Active, Beautiful, Clean Waters Programme**, which will transform the country's drains, canals and reservoirs into vibrant streams, rivers and lakes, creating beautiful new spaces for the community's enjoyment. This programme is also called ABC Waters Programme.

- **Active**

– Providing new community space

– Bringing people closer to our waters

– Developing a sense of ownership of our waters

- **Beautiful**

– Integrating reservoirs and waterways with theurban landscape

– Going beyond flood control and water storage

– Creating aesthetically pleasing lifestyle attractions

- **Clean**

– Improving water quality

– Public education

– Building people-water relationships

In addition, PUB also launched a new lifestyle magazine called PURE to interest and educates the public on water issues. A mascot named Water Wally helps to spread the water messages to the young in a lively and interactive way.

The goal of these initiatives is to bond Singaporeans more closely with water, so that they will cherish and better appreciate this precious resource.

Emerging as a Global Hydrohub

Over the years, Singapore has managed to turn its water woes from a vulnerability to a strategic advantage, and more recently, a growth industry for the country.

With the water industry projected to be worth about US$400 billion by 2015, the Singapore government has identified it as a new growth sector for the country's economy. As such, about US$330 million will be invested in

water R&D over the next five years to develop Singapore into a hub for water technologies.

The country is now a hotbed for water technologies, home to a thriving cluster of more than 50 Singaporean and international water companies like CH2MHill and Black & Veatch, both of whom chose Singapore as the location for their regional headquarters. In addition, industry bigwigs like Siemens Water Technologies, GE Water, Delft Hydraulics, Keppel Corporation and Hyflux have set up R&D facilities in Singapore.

In line with this strategy, Singapore has also hosted several international water conferences, which include the International Desalination Association's World Congress on Desalination and Water Reuse, and the International Water Association – Asia-Pacific Regional Group Conference and Exhibition. For its outstanding efforts in this area, PUB was given the 2007 Stockholm Industry Water Award – one of the highest accolades in the industry. The agency was also recognised by Global Water Intelligence with the 2006 Water Agency of the Year prize at its annual awards.

The Stockholm Water Award Committee praised PUB for putting in place a complex yet effective water management framework that is widely accepted by both the public and the industry. PUB has worked hard over the last 40 years to overcome water challenges and it is through strong political will, good governance, effective implementation and a motivated workforce that a robust and sustainable supply of water is maintained in Singapore.

Integrated Water Resource Management (IWRM) Programme

In Singapore water is a scarce resource and it is required to ensure its management in a proper way. Forward planning, careful management of water resources and putting together adequate investment in infrastructure and effective technology are critical in ensuring the long-term sustainability of our water resources.

There are five main challenges in Water Resource Management faced by Singapore:

- protecting water resources,
- processing safe drinking water in a cost-effective manner,
- minimizing wastage in water supply system,
- water conservation, and
- closing the water loop.

Singapore has faced up to these five challenges through a comprehensive integrated water resource management programme; and has achieved 100% access to basic sanitation as well as safe drinking water for the population.

The success of the IWRM programme can be attributed to the efforts of all sectors of the population; from the political will and infrastructure provided by the government, the collective commitment of the community, to the technological expertise and innovation from the private sector.

The water demand in Singapore is currently about 400 million gallons a day, with homes

consuming 45% and the non-domestic sector taking up the rest.

Singapore has planned that by 2060, total demand could almost double with the non-domestic sector accounting about 70%.

On the supply side, the ramping up of desalination and by tripling NEWater capacity, these will be capable of meeting 80% water demand in 2060.

LESSONS LEARNT FOR JAMMU REGION

Jammu district of Jammu and Kashmir, as per the 2011 census, has 1192 villages out of which 1054 are inhabited and 138 uninhabited. The Jammu District has an area of 3097 square kilometers with population density of 653 per square kilometer and decadal growth rate of 28 percent. The population of the District as per 2011 census is 1,529,958. The district has the largest livestock population of 1,100,000. The urban population is 29.64 percent 20 percent of the district is located in the Kandi belt which is foothill zone of Shivalik and 80 percent area is in the Sirowal belt. The variation in altitude is between 300m and 490 m above Mean Sea Level and transition line called spring line which divides zone of Kandi and Sirowal belt. National Highway, RanbirCanal and near along PratapCanal to the actual line of control on the Munnawar Tawi.

About 70 percent of the population of Jammu District is dependent on agriculture with only 8 percent cultivated area with irrigation and 29percent area unirrigated and 19.5 percent area under forests.

The District has sub tropical climatewith very hot summer and cold and during winters with maximum temperature of 45 degree Celsius and minimum temperature of less than 1 degree Celsius recorded in 2011.The average annual rainfall is 1400 m with 70 percent from June to September.

Domestic Water Availability in Jammu City

Historically, the water demand and availability of Jammu city is increasing and is remarkably influenced by

(a) Population growth/increase

(b) Increase in demand due to increase in living standards and economic growth

(c) Increase in area of city and institutional/ industrial growth

(d) Undisciplined and inefficient water management.

Increase in Population

Besides natural growth in population of Jammu city, the city witnessed growth in population due to migration of rural areas, migration from disturbed areas, migration from other states for employment and labor. The population of city grew from 1.67 lac in 1961 to 7.32 lac in 2001 and is expected to increase to 17.37 lac (2021) and 28.96 lac (2036) which is increase of 4.5 times in 50 years. The Jammu city also accommodates

tourist visiting Kashmir, Ladakh, Mata Vaishno Devi and other shrines and they need water and sanitation of world class keeping in mind the tourism potential of Jammu And Kashmir State at present and also in the future.

Increase in Living Standards and Economic Growth

In 1961, the city was having few dwellings with modern amenities and the water supply was depended on one water filtration plant established by Maharaja, having installed capacity of 5.4 million liter per day (MLD), at Dhounthly whose source of water is River Tawi. The demand for domestic water fifty years back was little as it constituted only for drinking and bathing. People used to go to river Tawi and Ranbir canal on weekends for washing and bathing etc. The system of sanitation was dry latrines with scavengers collecting human excreta on their heads and requirement of water for ablution was only one or two liter. There was mostly one toilet and bathroom serving each household. There was no house storage except baskets and drums. The people from the old city and also those who migrated for one reason or the other to Jammu city were inhabited in open/barren areas around Jammu, and this lead to increase of area of Jammu city. The new construction on modern lines added to living standards with toilets in each house ranging from two to even up to eight in posh area with increase in tap/fixtures and water closets. Each consumer with every flushing consumes 10 liters of treated clean potable water. People have started using underground/ over ground individual storages, pumping equipment, washing machine, coolers, lawns and gardens, water filters, cars and scooters and possess bigger house to wash and clean.. This led to increase in water demand on one hand and increase in wastage of water on the other hand.

From 5.4 million liters per day water installed capacity in 1961, the installed capacity of water has increased to 227 million liters per day in 2007 which is 42 times in 50 years. About 100 tube wells will be added to the system by the end of year 2009 end to augment the water supply to the inhabitants of Jammu city under ADB assistance for the Rehabilitation of urban sector.

Increase in Area and Institutional/ Industrial Growth

From about 23 square kilometers in 1961 the city grew to 35 square kilometers in 2011 and is expected to go to 287 square kilometers in 2011 which is 12.5 times in 50 years. It is expected that increase in industries in future shall have significant impact on water demand.

The city which was having couple of schools, colleges, hospitals, hotels and industries has grown tremendously in last 50 years from 1961 to the present. This has also put enormous pressure on the water demand in the city.

Undisciplined Water Management

Water Distribution System in Jammu city has been expanded haphazardly. Few decades ago distribution system was designed on the rules of thumb, as the systems were small due to less population and small area of the city. The department providing drinking water was initially called Water Works Department and there were only 5.4 million liters per day Dhounthly Filtration Plant to feed population of 1.67 lac in 1961.

With rise in population and increase in area of Jammu city and also with the passage of time water demand increased and hydraulics of network got disturbed with haphazard improvements and extensions, and the supply driven approach to meet the water demand created from time to time. This resulted in inequitable flow and the systems became undisciplined. The systems are as old as the Dhounthly Filtration Plant established in 1954 and also the old pipes/storage tanks laid/constructed as back as sixty year.

The institution managing the water supply to Jammu city from one Water Works Division has become a full-fledged Public Health Engineering Department, managing water supply to the entire population of the state, rural and urban both. The department runs practically on 100 percent subsidy. Tremendous coverage has been achieved both rural and urban as far as provisions of systems but in reality the operation and maintenance scenario is grim as regards to quality and quantity of water supplied.

There is no consumer faith in quality of water supplied and consumer resort to some kind of affordable way of treating the water they consume.

Capital cost of ground level storage, roof top storage, pumping equipment, filtration equipment adds to the coping costs to meet their domestic water need, in addition to maintaining water closet or bathroom ranging from 2 to eight in one household depending upon the affordability. The PHE Department charges Rs. 30 per month from each household for providing water through 0.12 mm connection.

There is one classification of consumer who pays Rs 30 per month, and can also afford coping costs to install gadgets to convert in-house water supply to continuous and safe, and are supplied water by public water utility daily for couple of hour at low pressure and of unacceptable quality..

There is second class who pays Rs 30 and can also afford coping cost to install gadgets to convert in-house water supply continuous and safe, but are supplied less water by public water utility i.e. ranging from alternate day to once a week or through tanker.

There is third class of consumers who pays Rs 30 per month but get water ranging from alternate day to once a week or through tanker services and cannot afford to meet other coping costs for safe water.

There is fourth class who neither has safe water nor affordability.

The state which owns the responsibility to provide safe water to all is casual in this regard. The Government should provide safe water to people by taxing those who can afford and by subsidizing the poor who cannot afford the coping cost. In the present scenario the poor get less water at more price and the rich get more water with less price. This needs to be reversed to make the system self-sustained.

With passage of time, just in past 60 years the population grew 4.5 times and area 12.5 times and installed capacity of water supply system expanded 42 times, and with increasing education and employment, economic status of the city grew tremendously, with the supply of water from Tawi river fully exploited. Some 200 tube wells mostly located in Sirowal belt are failing to meet water supply need, because of increase in population and modern living lifestyle with multi-storied houses with modern sanitation amenities coming up in all localities.

People resort to illegal connections, install pumps on public service lines and virtually suck them with increased risk to contamination. Consumers have installed in-house water treatment devices, constructed/ installed underground/overhead tanks in their houses to make water supply continuous 24*7. This is the story of those who are well employed, educated and can afford. Some of them can manage free water tanker by using official/political influence and some can afford to pay for a water tanker, and this group of people has created in house continuous 24* 7 safe water supplies. They pay the public water utility (PHE Department) Rs 30 per month and in addition pay for electricity to pump water besides cost of installation and maintenance for pumping equipment, underground/storage, branded filters etc as other coping costs to meet their potable and domestic water need.

Out of present installed capacity of 227 million liter per day, 50 percent is wasted or is non revenue water and only 50 percent is available to the consumer due to decreased efficiency of the system and also leakage through old and corroded pipelines. The consumer wastes water up to 20 percent through negligence and in-house leakage. The water audit is not practiced by public water utility and supply driven approach is being implemented by drilling more and more tube wells with every pinch of water scarcity.

The manpower handling the system from top to bottom is not given due recognition for their duties and responsibilities resulting in lack of motivation among employees due to absence of autonomy, financial discipline, accountability, and training coupled with mismanagement, political interference, and corruption. The water supply utility needs effective and appropriate institutional reforms to meet challenge of water demand in the future. This calls for an efficient energy management system which starts from water management in Jammu region the action research for the implementation of lessons learnt from Singapore can be listed as follows:

Action is Required for the Following Aspects for Conserving Energy by Water Management:

- To control and check the flow of pollution to the rivers, lakes and ponds through appropriate measures/action.
- Treatment of effluent up to the appropriate standard before discharging into the rivers.
- Proper maintenance and uninterrupted operation of the sewage treatment plant.
- System of incentive and dis-incentive for discharging pollutants / untreated waste into the rivers.
- Adopting remedial measures in the particular river stretch where the problem is acute.
- Adopting appropriate technology for removal of pollution from lakes and reservoirs.
- Declaring particular site/location as water heritage site and adoption by different organizations / departments for maintaining the same to the desired standard.
- Use of organic fertilizers should be encouraged to protect ground water from pollution due to excessive use of chemical fertilizers. Ground water vulnerable zones may be identified by preparing vulnerability maps for physical, chemical and biological contaminants for the whole country.
- Notification on banning industries, landfills and disposal sites of industrial effluents and sewerage, which are hazardous to ground water aquifer systems.
- Devising ground water solute transport model for contaminants plume migration studies.
- Research and Development studies for corrective action techniques on polluted aquifers based on the Singapore Model.
- Capacity building and education of the community for its participation in the efforts for water conservation practices in urban areas can reduce the demandas much as by one third, in addition to minimizing pollution ofsurface and ground water resources.
- Watershed programmes tended to concentrate on harvesting rain water through surface structures. There is a need to look at surface and ground water holistically and prepare a conjunctive use plan.
  - o Construction of sub-surface dams.
  - o Watershed management.
  - o Treatment of upstream areas for development of springs.
- Action towards reduction of losses in conveyance in water distribution systems.
- Management of supply through proper meter as per rational demand.
- Realization of appropriate water charges so that the system can be sustainable and wastage is reduced.
- Evolving norms for water use for various activities and designing of optimum water supply system accordingly.

- Possibility for recycling and reuse of water for purposes like gardening, flushing to toilets, etc. may be explored; Wastewater of certain categories can be reused for other activities as per feasibility.
- Reasonable water tariff based on quantum to check the overuse/wastage of water.
- Stress on the use of organic manure in agriculture as it consumes less water.

Water is becoming an increasingly contested resource in semi-arid areas of India. During the last 25 years, a dramatic increase in groundwater use by the agricultural sector has led to declining groundwater levels with the result that, in many areas, water service delivery is constrained by lack of absolute resources rather than solely by lack of well-maintained water-supply infrastructure. The challenge of ensuring that water is where we need it, when we need it and of an acceptable quality has never been greater. Meeting this challenge requires inter-sectoral planning procedures and regulatory measures that ensure needs are met on an equitable and sustainable basis. It has become increasingly difficult to find engineering solutions to bridge the gap between water supply and demand. This creates a need for shifting the emphasis of water policy from managing water supply to managing water demand. Also, the energy consumption for the supply of water is quite high. The core challenge therefore, is to reduce the energy consumption by developing natural way outs for water supply.

The figures reflected in Table 1 obtained from survey carried by the department of ecology environment and remote sensing J&K show that the major energy consumption in J&K is

Table 1

S. No.	*Customer Category*	*2009-10*		*2020-11*		*2011-12*	
		Energy Consumption (in MU)	*%age*	*Energy Consumption (in MU)*	*%age*	*Energy Consumption (in MU)*	*%age*
1	Domestic	1380.00	36.00	1255.93	31.08	1431.98	33.56
2	Non-domestic Commercial	295.00	7.70	349.10	8.64	333.26	7.81
3	Industrial	856.00	22.33	816.54	20.21	849.53	19.91
4	Government						
	Irrigation/Agriculture	295.00	7.70	198.10	4.90	140.67	3.30
	Public Lighting	14.00	0.37	29.07	0.72	35.66	0.84
	Public Water Works	383.00	9.99	586.04	14.50	636.14	14.91
	State Central Dept.	532.00	13.88	711.20	17.60	695.65	16.30
	General Purpose Bulk Supply	78.00	2.03	95.10	2.35	144.1	3.38
		3833.0	100.00	4041.0	100.00	4266.0	100.00

Source: Department of ecology environment and remote sensing J&K 2014.

in the domestic sector followed by industrial sector. Also agriculture and irrigation utilize major percentage of energy .This shows the relevance of water management system in Jammu region . The energy management can be integrated into the landscape in such a way that it meets irrigation requirements, drinking water requirements without using the conventional energy. The development of water harvesting reservoirs and turbines is feasible in Jammu region. Further, the community can be trained for in situ cost effective methods of water treatment. In this way the Singapore experience would lead to total reformation of the water management systems in Jammu region, which would be a small effort towards attaining energy efficiency systems. Water Supply options from different sources in the KandiBelt as is illustrated below in Table 2.

Table 2: Water Supply Options from Different Sources in the Kandi Belt

Sources of Water Supply		
Surface Water	*Ground Water*	*Surface + Ground Water*
• Rainwater harvesting • Streams • Ponds	• Tube wells • Lift from springs	• Village ponds • Lift from streams • Check dam and reservoirs on stream
Canals	Tube wells	Gravity flow from: • big ponds • lift from steams • check dam and reservoirs on stream

From Table 2, it can be argued that how a changed can be brought about in terms of identifying different options for water supply in Jammu region, especially in kandi belt. The energy consumption can be reduced by increasing rain water harvesting and using engineering solutions to conserve energy by developing the gravity flow. The infiltration level and the terrain needs to be checked by the specialists and engineering solutions need to be worked out. The Singapore model cannot be replicated in Jammu region due to the terrain and the percolation levels. But the energy consumption level can be reduced by developing the water reservoirs and using the water management systems. Further the Community Participation Framework can be developed in the region by the policy makers of various utility service agencies by structuring stakeholder dialogue, managing information and assessing the status of water resources, water supply infrastructure and often competing demands for water. A suggestive frame work model for improved water governance is proposed in the diagram given below:

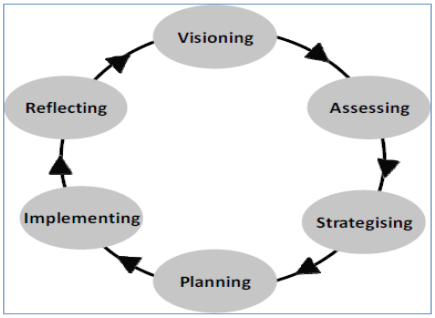

Figure 2 : Framework for Improved Water Governance

Above framework emphasizes that following parameters need to be factored in a holistic perspective model to address to the ever growing requirements for water consumption. This type of model requires that different stakeholders are bought in to synergistic

functional relationship to evolve an effective delivery system for the consumers.

CONCLUSION

The estimated potential of renewable power in J&K is 5311 MW for winddpower,1418 MW for small hydro power 43 MW for bio mass power as on 31st March 2012 (MOSPI). The data shows 6772 MW as estimated reserves .Further out of total power demand of 17323 Million units, current availability is 2562.7 million units.Percapita energy consumption as shown from the factors discussed above has increased from 849.98 KWH in 2010-11 to 882.82 KWH 2011-12. The discussion above reveals that the energy demand has gradually increased. This has been substantiated by the figures from MOSPI as an annual growth rate of 5-6% for last 5 years. The need of the hour is to conserve energy for the supply of water resources to the irrigation land as well as the domestic use. According to the 16th All India Power Survey, the power requirement of the state is expected to reach 19,500 million units during 2020-21 (MOSPI). The per capita use of energy for this purpose can be effectively managed by developing a viable framework of water management.The typical Build Operate and Transfer system of Public Private Partnership can be applied in Jammu region along with community education for attaining effective Environment Energy Management Systems pertaining to Water Conservation and Management as the lessons learnt from Singapore this will help in building an institutional mechanism of a new water supply and conservation system which will help in developing the effective environmental energy management systems in Jammu region. This will result in creation of a special purpose vehicle by transfer of risks and accountability to the private sector for mobilization and financing of the project. The efficiencies would result in by long term system performance as the coverage would increase and the service delivery would improve. Above all the target of achieving effective environment friendly, sustainable and green practices for energy management system will be attained as the conservation would lead to generation of energy in future. Also, commercial viability would increase due to accountability and transparency through metering and billing systems. Quality assurance an integrated part of effective energy management system would be brought about by Public Private Partenership Model. The penalties for non-performance would be fixed and the quality would therefore improve. Government regulation of tariffs and quality standards would help in bringing in accountability and transparency. Governmental role is reduced as it becomes purchaser of services rather than the provider of services. The viable model has therefore been worked out after studying the Singapore Model.

The Community participation can be generated initially by the involvement of the NGO's like TARAA, New Delhi, a Non-Governmental Organization, which may act as the nodal agency for developing the water management system in collaboration with the Harbans Bhalla Charitable Trust, a local Non-Governmental Organisation. Various Self Help Groups can also be included for the different regions of the Jammu Municipal Corporation. NGOs within the wider civil society sector play an important role

in promoting sustainable water resources management. This includes their active participation at localand national level in all phases of management planning and implementation (design, implementation in the field, operationalization, monitoring and evaluation). The Proposed framework is as follows:

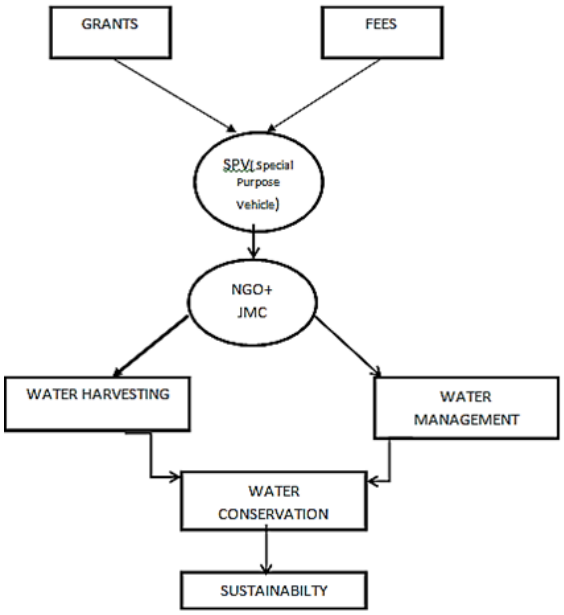

Figure 3

Source: Developed by authors, 2015.

The participation of NGO's and community based organization will help in monitoring the roaster for every colony covered under the jurisdiction of Jammu Municipal Corporation. The transparent mechanism of monitoring will help in proper metering and billing of water utilization .Apart from afore said benefits the model will help in Increasing public awareness on water management ,making use of knowledge, experience, learn-how initiatives of different Stakeholders and thus, improving the quality of plans, measures, policies, etc The future implication of the paper is that he viability of the proposed research framework can be worked out by conducting survey and testing the model by using statistical techniques.

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