Water management: Here's how most cities in India can meet domestic needs

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Singapore is the world's foremost city in rainwater harvesting. It gets abundant rainfall, about 2400 mm/year, but has very small landmass to harvest rainwater.

Direct Potable Reuse: The term was coined by Namibians to describe the conversion of domestic sewage into drinking water.! (Reuters)

As Chennai was reeling under acute water scarcity and people were fighting over a bucket of water, two water-constrained cities 10,000 km apart were peacefully supplying water to their

citizens. I have visited both these cities and seen how a combination of traditional practices and cutting-edge technologies can solve the water crisis in even the most water-scarce areas.

From sewage to drinking water: I heard the term Direct Potable Reuse (DPR) for the first time in August 2018 in Windhoek, capital of Namibia. The term was coined by Namibians to describe the conversion of domestic sewage into drinking water. The city of Windhoek has been treating domestic wastewater for reuse as clean water for more than half a century.

Windhoek is located in one of the driest parts of Africa. In a good year, it gets about 300-400 mm of rain annually. But most of this water evaporates and very little percolates into the ground. So, this city, with a population of over 300,000 people, has to live with a very limited supply of water. The only way they can meet their water requirement is by recycling sewage. They commissioned their first recycling plant in 1968. The older plant was closed and a new, bigger plant, the New Goreangab Reclamation Plant, was commissioned in 2002. This new plant, which I have visited, produces 21,000 m3 of potable water/day. That is, it supplies 60 litres of water every day to each inhabitant of this desert city. This is sufficient to meet the basic needs of the citizens.

One of the key features of Windhoek is its practise of separating industrial and other toxic wastewater from the domestic wastewater stream. Domestic wastewater is taken through a separate drain and pretreated to obtain a consistent quality. The pretreated waste is then treated through a 10-step treatment plant. The treatment steps are similar to the conventional technologies that we use in our country—coagulation, flocculation, gravity filtration, activated carbon filtration, ultrafiltration, ozonation, disinfection etc. The difference is that while we use three or four steps, the New Goreangab Reclamation Plant uses 10 steps sequenced in such a way that it produces drinking water that meets the Switzerland water quality standard, the most stringent in the world. Since 1968, not a single case of negative health effects has been detected due to the use of recycled water. Amazingly, the cost of treating sewage to reuse it as drinking water is highly affordable. The New Goreangab Reclamation Plant sells water at Namibian $11 per 1000 litres. This is equivalent to 60 paise per litre of clean drinking water.

Make every drop count: Gardens by the Bay is a famous tourist spot in Singapore. It comprises of three beautifully crafted waterfront gardens made on reclaimed land. But many don't know that the water body abutting the gardens is Singapore's largest rainwater reservoir, called Mariana Reservoir. Rainwater falling on one-sixth of the land area of Singapore is collected in this reservoir, and treated and used in homes and factories. Singapore is a water-scarce city. Apart from the water it imports from Malaysia, its only source of water is rainwater. Still, it provides its citizens with 140 litres of clean water every day by combining traditional practices with modern technologies.

Singapore is the world's foremost city in rainwater harvesting. It gets abundant rainfall, about 2400 mm/year, but has very small landmass to harvest rainwater. It also doesn't have the kind of aquifers that can store rainwater underground. So, it pioneered storm-water harvesting and above-surface storage. Today, two-thirds of Singapore is used as a water catchment, with the rainwater being collected in 17 reservoirs through storm-water drains, canals and rivers. One of the key features of Singapore is its strict land-use regulations to keep water catchments clean by

removing polluting farms and factories near catchments. In addition, it has separate drains for sewerage and storm-water. A combination of clean catchment areas and separate storm-water drains ensures that clean rainwater is collected in the reservoirs.

But even this extensive rainwater harvesting is not sufficient to meet Singapore's water requirement, as its industrial and commercial demands far exceed its domestic demand. So, it recycles its sewage and produces NEWater, the brand name for reclaimed water produced by Singapore's Public Utilities Board. Using advanced membrane technologies and UV disinfection, Singapore recycles its sewage into ultra-clean water. This water is supplied mainly to industries and commercial establishments. Currently, 40% of Singapore's water needs are met by NEWater.

Singapore has also set-up desalination plants. Currently, it has three desalination plants that can meet up to 30% of its current water demand. So, a combination of rainwater harvesting, recycling of sewage, imported water and desalination plants makes Singapore a water-surplus city. Today, Singapore calls itself a "Global Hydrohub". It has more than 180 water companies with more than 20 water research centres that are developing cutting-edge technologies in the water sector.

The question we need to ask is that if Singapore, the world's most modern city, can harvest rainwater and recycle sewage, why can't Bengaluru, the hi-tech city of India? In fact, Bengaluru was built by harvesting rainwater in its lakes, ponds and tanks. But, most of these lakes and ponds have vanished or are polluted. But these can be revived. A study recently by TV Ramachandra and his colleagues from the Indian Institute of Science shows that by harvesting rainwater and treating sewage, Bengaluru can easily supply 135 litres of water per day to all its citizens. But will Bengaluru do this? It is most unlikely as the city has decided to commission its Rs 5,500 crore Cauvery Water Supply Project, Stage V, to get an additional 775 million litres of water/day from the Cauvery.

But, is it more sustainable and affordable to get water from hundreds of kilometres away, as most Indian cities are planning, or to implement rainwater harvesting and wastewater recycling? If Windhoek and Singapore can convert sewage into potable water, why can't Delhi, Chennai or Bengaluru? If Singapore can harvest rainwater, why can't Nagpur, Ranchi or Bhubaneswar? Indian cities should be asked these hard questions when they come up with multi-crore water supply schemes.

The bottom line is that even the most water-deficient Indian city has more water than Windhoek and all major Indian cities have much larger water catchments than Singapore's. If Windhoek and Singapore can meet their water requirement by adopting traditional rainwater-harvesting practices and using cutting-edge technologies, why can't our cities? I don't see any reason why we can't.