

Moderator's Note: Dear members, we had a rich discussion on a Strategy for Improving Urban Drinking Water Supply. David Foster from the Administrative Staff College of India, was the Guest Moderator of the discussion. The first topic was 24/7 Water Supply is Wasteful. Opinion was sharply divided on this issue. Some of you felt 24/7 water supply would lead to water profligacy, while others felt it would simply mean water in taps round the clock and would not lead to higher consumption. Most said a consumer education campaign on water conservation should precede any attempt to supply water 24/7 so people do not waste water. We thank all of you for your inputs and are posting the Consolidated Reply of this topic. We thank David Foster for leading the discussion on improving urban water supply and providing the summary.



Environment

Water Community



Solution Exchange for the Water Community Discussion Summary

Strategy for Improving Urban Drinking Water Supply: Issue 1 - 24/7 Water Supply is Wasteful

Discussion Summary by David Foster, Administrative Staff College of India, Hyderabad

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Issue Date: 17 September 2009

From [David Foster](#), Administrative Staff College of India, Hyderabad
Posted 16 February 2009

Dear members,

The quality of service in urban water supply in most Indian cities remains low, notwithstanding high subsidies and major investments in the sector. Leakage rates are high, most of the poor are not even connected to the water lines, and the rate of water borne disease is among the highest in the world. Further, despite high subsidies, when coping costs are included (household pumps, storage, and treatment, as well as lost time), the real cost to the consumer for this water is often higher than in other Asian countries that offer significantly better service.

To overcome these problems many organizations have sought to increase the water supply available through water tankers and public stand posts. Others have focussed on Point of Use (POU) in-home treatment systems or sought to develop self-sustaining water kiosk systems where residents can purchase 10 litre containers of water at a nominal price. You can read more on the debate at <http://www.solutionexchange-un.net.in/environment/cr/res-16020901.doc> (DOC; Size: 32KB).

The discussion process

The pros and cons of a 24/7 water supply were discussed at the Water Community's Annual Forum held on 23-25 July 2008 (for more details please visit http://www.solutionexchange-un.net.in/environment/resource/annual_forum_2008.pdf; PDF; Size: 600KB) and it was felt that the discussion should be taken up by the Community. As a follow-up this discussion will focus on the role of continuously pressurized (24/7) water supply. No longer a "pipe dream", 24/7 water has been provided in the last few years in Navi Mumbai, Mysore, Badlapur, Hubli-Darwad and Jamshedpur.

Some of the preconceptions I would like to challenge and discuss in response to proposals for 24/7 water supply are:

- "24/7 water supply is wasteful as it requires too much water and would not be sustainable for most Indian cities"
- "24/7 water is too expensive for India. The poor can't afford it and the rich don't need it"
- "24/7 water supply, even if it could be achieved, would be inequitable to the poor, far better to ration water by hours of supply so that rich and poor alike have equal access"
- "24/7 water supply is a needless luxury good, no one needs water 24 hours per day"

I will like to discuss each of the issues around 24/7 water supply, given above, to determine if they are genuine obstacles, major but surmountable challenges, or only simple misunderstandings.

Issue # 1 "24/7 Water Supply Is Wasteful"

In this topic I would like us to discuss the fact that many people regard having a 24/7 water supply as wasteful, because they know that water resources in India are limited, especially drinking water. If pipes were old and leaking, then 24/7, supply would only magnify water losses. The only rational thing to do in situations with limited water resources is to ration those supplies by limiting the number of hours per day, and/or days per week, that water is available to the public.

Given this concern, I would like to seek your inputs on:

1. Will a 24/7 water supply encourage people to conserve or waste water?
2. Does a well-managed continuously pressurized (24/7) water supply system necessarily requires more water than the typical systems seen in most Indian cities?
3. How much water, in litres per capita per day (LPCD), is normally required to operate a 24/7 system?

The results of this discussion will feed into the on-going policy debate at the Administrative Staff College of India and help us to develop a framework on continuously pressurized water supply for cities.

Responses were received, with thanks, from

1. [Satya Prakash Mehra](#), World Wide Fund for Nature - India, Bharatpur
2. [Jasveen Jairath](#), Water Sector Professional, Hyderabad ([Response 1](#)) ([Response 2](#)) ([Response 3](#))
3. [Vishwanath Srikantiah](#), BIOME Environmental Services Private Limited, Bangalore
4. [G.V.K.S.V. Prasad](#), V. R. Siddhartha Engineering College, Vijayawada, Andhra Pradesh

5. Dinesh Kumar, Institute for Resource Analysis and Policy, Hyderabad ([Response 1](#)) ([Response 2](#))
6. [Suneetha D. Kacker](#), Water and Sanitation Programme India, New Delhi
7. [Sikandar Meeranyak](#), Sankalp Rural Development Society, Hubli
8. Johnson Rhenius Jeyaseelan, WaterAid India, India, Lucknow ([Response 1](#)) ([Response 2](#))
9. [Surekha Sule](#), Independent Journalist, Pune
10. [Anurag Mishra](#), CAIRN Energy, Lucknow
11. [Asad Umar](#), WaterAid (UK)-India Liaison Office West, Bhopal
12. [Arunabha Majumder](#), Jadavpur University, Kolkata
13. David Foster, Administrative Staff College of India, Hyderabad ([Response 1](#)) ([Response 2](#)) ([Response 3](#)) ([Response 4](#)) ([Response 5](#)) ([Response 6](#)) ([Response 7](#)) ([Response 8](#))
14. [Himanshu Thakkar](#), South Asia Network on Dams, Rivers and People, Delhi
15. [Atul Rawat](#), DMV Business and Market Research Private Ltd., Hyderabad
16. [Ajay Bhan Singh](#), Society for Promotion of Wastelands Development (SPWD), New Delhi
17. [Nikhil Anand](#), Stanford University, USA
18. [Arshi Mukhtar](#), Centre For Ecological Audit, Social Inclusion and Governance, New Delhi
19. [S. V. Vijaya Kumar](#), National Institute of Hydrology, Deltaic Regional Centre, Andhra Pradesh
20. [Mahesh Kumar](#), Independent Consultant, Bhopal
21. [Shubhang Pandya](#), Sarvangi Vikas, Ahmedabad
22. [Abhishek Mendiratta](#), Independent Consultant, New Delhi
23. [Subhash Verma](#), Soans Envirotech, Faridabad
24. [Ravi Singh](#), Margshree Farm, Agra
25. [Faiz Ullah Khan](#), Consultant, New Delhi
26. [Ajit Seshadri](#), The Vigyan Vijay Foundation, New Delhi
27. [R. Jagadiswara Rao](#), Sri Venkateswara University, Tirupati
28. [Ombeer Singh Tyagi](#), International Development Enterprises, New Delhi
29. [N. Lakshmi Narayana](#), Dakshinaya Institute, Guntur

Further contributions are welcome!

[Summary of Responses](#)
[Comparative Experiences](#)
[Related Resources](#)
[Responses in Full](#)

Summary of Responses

Nearly all cities in India have an intermittent water supply. The reasons are a shortage of water and leaking pipes on the supply side, and ineffective billing and water wastage on the demand side. However, given the experience from cities elsewhere in the world that have 24/7 water supply, giving citizens this facility does not automatically result in higher water consumption. It can, however, result in a more equitable water supply especially for the poor. Effective demand-side management, enforced by accurate metering, appropriate tariffs, efficient billing and complete collection, can also significantly reduce wastage. Suddenly introducing 24/7 water supply can be disastrous as most cities in India have ageing, leaky distribution systems that lose

nearly half the water that is pumped through them. In addition, only a small percentage of all urban water connections are metered, and billing is irregular.

However, a well-managed 24X7 system including the necessary ingredients could work without requiring additional water. Other countries have demonstrated this, and there are new examples within India as well. With proper tariff incentives and public education, organizations and the government persuade people to conserve water even when it is available 24/7.

Of course, there is skepticism despite the growing evidence. There are several sites in India with 27/7 water supply including Navi Mumbai. It is important to bear in mind that public awareness on the importance of conserving water is an important supplement to meters and appropriate tariffs. In Bharatpur, [Rajasthan](#), people have not taken that step even though the area is under a prolonged dry spell; instead, private suppliers provide water 24X7 to those who can pay.

There is confusion over the actual quantity of water required to operate a 24/7 system. Male (in the Maldives) operates 24/7 with only 80 litres per capita per day (LPCD) and Paris, France has long operated with only 150 LPCD. The general perception is, however, that much larger quantities are required, as high as 200 LPCD or more. However, there is no evidence to support this higher figure. In [Singapore](#), water efficiency and reuse has enabled the country to reduce its imports of water substantially.

The issues of quantity, equity, cost and quality are interrelated. The installation of a well-managed and equitable system of 24X7 water supply may lead to an increase in water requirements. This could occur in areas where families living below the poverty line (BPL) previously received little or no water. Once these BPL families start getting adequate water then, of course, the total water supplied may need to increase. This change, it must be noted, results from increasing equity rather than from increasing hours of supply. Even in these situations, however, reducing excess leakage and theft throughout the system can often compensate for any increase in water provided to the poor. Another issue is ensuring the poor get water that meets drinking water standards, and there are instances showing they are willing to pay for this water.

The municipality or panchayat should provide two water lines, one for potable water, and one for non-potable. Although this idea is theoretically appealing, in almost every case it turns out to be cheaper to treat all water rather than have to install and maintain multiple systems.

Rainwater harvesting (RWH) should be developed and maintained wherever practical, because 24X7 water supply is not a substitute for this. There is no reason why families cannot use both 24X7 water and make good use of rainwater. However, availability of both rainwater and municipal supply should not encourage people to waste water.

One of the most important things is to explain to users that 24X7 water supply is not an invitation to waste water. In fact, the only way in which it can work effectively is if the local service provider addresses water management holistically. This involves:

- Good governance (including transparency, efficiency and accountability),
 - Better management of groundwater supplies,
 - Use of rainwater harvesting and gray water recycling where appropriate,
 - Proactive leak detection and repair,
 - Appropriate tariffs (including block rates and allowances for the poor),
 - Efficient billing and collection, and
 - Strong public awareness programmes.
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Comparative Experiences

Rajasthan

Bharatpur Suffers from Water Shortages as a result of Indiscriminate Usage (from [Satya Prakash Mehra](#), *World Wide Fund for Nature - India, Bharatpur*)

Bharatpur is a flood prone area, and once had abundant. People could draw water from a depth of just 10 feet. In the past few years, the area has not had adequate rain and the water table has gone down. The rich have sunk deep borewells, while several private agencies have set up pipeline networks to supply water. As a result, the state government has been unable to meet domestic demand, and the informal water market has been flourishing for several years.

International Singapore

Singapore Recycles to Provide 24X7 Water (from [Atul Rawat](#), *DMV Business and Market Research Private Ltd., Hyderabad*)

Singapore buys most of its water from Malaysia. Recently, the Public Utilities Board, National Water Agency, decided to take a holistic approach to reduce dependence on external sources. It diversified water sources through water reuse, desalination, storm water storage and supply of quality recycled water to industry. This significantly reduced water losses due to leakages. Alongside, it has reformed water pricing and access to make more efficient use of water.

Related Resources

Recommended Documentation

Economic Losses for Urban Water Scarcity in California (from [Dinesh Kumar](#), *Institute for Resource Analysis and Policy, Hyderabad*; [response 2](#))

Paper; by Marion W. Jenkins, Jay R. Lund, and Richard E. Howitt; University of California, Davis, California, USA; mwjenkins@ucdavis.edu;

Available at <http://cee.engr.ucdavis.edu/faculty/lund/papers/CalUrbanWaterScarcity.pdf> (PDF; Size: 150KB)

It demonstrates the practicality of developing reasonable economic loss functions for urban water supply studies, rather than conventional notions of water supply

City Development Plan - City Water Supply System (from [R. Jagadiswara Rao](#), *Sri Venkateswara University, Tirupati*)

Book; by Department of Urban Development, Government of Delhi; 2006;

Available at http://www.ccs.in/ccsindia/pdf/Ch08_Water%20Supply.pdf (PDF; Size: 750KB)

The book presents an overview of the Delhi National Capital Territory development plan for the water supply sector

Recommended Organizations and Programmes

Sankalpa Rural Development Society, Karnataka (from [Sikandar Meeranyak](#), *Sankalp Rural Development Society, Hubli*)

BVB Engineering College, Vidyanagar Hubli 580031, Karnataka; Tel: 91-9986840730;

sikandar@dfmail.org; Contact Sikandar Meeranayak; Chief Executive Officer

Sankalpa works on issues of water security in Hubli and is committed to providing 24X7 water supply for its beneficiaries

Point-of-Use Water Disinfection and Zinc Treatment (POUZN), USA (from [Anurag Mishra](#), CAIRN Energy, Lucknow)

<http://psp-one.com/section/taskorders/pouzn>; Contact Susan Mitchell; Director, POUZN; Tel: 1-301-3475124; Susan.Mitchell@abtassoc.com

POUZN works to mobilize the private sector for the prevention and treatment of diarrhoea by the introduction of low-cost point-of-use water treatment products

World Health Organization, New Delhi (from David Foster, Administrative Staff College of India, Hyderabad; [response 1](#))

Rooms 533-535, 'A' Wing, Nirman Bhawna, Mauling Azad Road, New Delhi 110011; Tel: 91-11-23061955; Fax: 91-11-23062450; <http://www.whoindia.org/EN/Index.htm>

WHO works on water, sanitation and hygiene in areas where interventions could make a major difference, particularly works on the health impacts of water

PricewaterhouseCoopers, Maharashtra (from [Himanshu Thakkar](#), South Asia Network on Dams, Rivers and People, Delhi)

PwC House, Plot No. 18 A, Guru Nanak Road (Station Road), Bandar, Mumbai 400 028; Tel: 91-22-66891000; Fax: 91-22-66891888; <http://www.pwc.com/in/en/index.jhtml>

PWC works with the government utilities to improve their efficiency and effectiveness in the way they deliver citizen-centric services, including water supplies

World Bank, New Delhi

70 Lodi Estate, New Delhi 110003; Tel: 91-11-24617241; Fax: 91-11-24619393;

smozumder@worldbank.org; <http://www.worldbank.org.in/WBSITE/EXTERNAL/COUNTRIES/>

Source of financial assistance to developing countries, including India and has evolved participatory approaches for water management in both rural and urban areas

From David Foster, Administrative Staff College of India, Hyderabad [response 3](#)

Delhi Jal Board, New Delhi

Room No. 401, Varunalaya Ph-II, Karol Bagh, New Delhi 110005; Tel: 91-11-23556103;

http://www.delhi.gov.in/wps/wcm/connect/DOIT_DJB/djb/home

Delhi Jal Board is responsible for the supply of 678 million gallons a day of filtered water to the capital as well as disposal of its sewage

Public Utilities Board (PUB), Singapore

40 Scotts Road, Environment Building, Singapore 228231; Tel: 65-62358888;

pubone@singnet.com.sg; <http://www.pub.gov.sg/>

As the national water agency, PUB is responsible for the collection, production, distribution and reclamation of water in Singapore

Administrative Staff College of India (ASCI), Andhra Pradesh

Bella Vista, Raj Bhavan Road, Khairatabad, Hyderabad 500082; Tel: 91-40-66533000; Fax: 91-40-23312954; <http://www.asci.org.in/> Contact S. K. Rao; Director General; skrao@asci.org.in

Has pioneered management education in India, to synthesise managerial theory and practice, and is looking at issues of water supply at the policy level

Center for Ecological Audit, Social Inclusion and Governance (CEASIG), New Delhi (from [Arshi Mukhtar](#), Centre For Ecological Audit, Social Inclusion and Governance, New Delhi)

58-C Top Floor, DDA Flats, Ashok Vihar-III, Delhi 110052; Tel: 91-9968345380;

ceasig@gmail.com; Contact Muhammad Mukhtar Alam; Executive Director

CEASIG works on ecological audit and ways to mitigate climate change, as well as ways to reduce water consumption in urban areas

Stanford University, USA (from [Nikhil Anand](#))

Stanford University, 340 Bonair Siding, Stanford, CA 94305, USA;

Tel: 1-6507216530; elsab@bonair.stanford.edu; <http://sustainablestanford.stanford.edu/water>;

Contact Elsa Baez

Stanford practices sustainable water use by managing available resources to meet university needs while preserving ecological systems and maintaining this vital resource

Responses in Full

[Satya Prakash Mehra](#), World Wide Fund for Nature - India, Bharatpur

My input regarding three concerns for the issue are as following:

1. Will a 24/7 water supply encourage people to conserve or waste water?

24/7 will not encourage people to conserve water. To support my views I would like to draw attention of the members to the point that when the people know the importance of water then only they try to conserve it. Once water will start flowing then there will not be care for the water.

Let us take example from Bharatpur: It is flood prone area, once used to be full of water. The mass public could draw potable water even from 10 feet. There was no care for the water as the availability was much easy. Now conditions changed, the flood prone area is now drought prone area. The underground water table has gone down. Getting potable water is hard. People started exploring the options. The rich ones are getting deep (deep bore wells) but the poor are facing acute problem. Since their mentality was not of conserving water, no such measures were taken earlier. Even the structures are not of that level. Therefore, to make the importance of water supply should be checked and regulated at sustainable level.

2. Does a well-managed continuously pressurized (24/7) water supply system necessarily require more water than the typical systems seen in most Indian cities?

I do not think more water is required. If proper management of available quantity is there then no need to get more.

3. How much water, in litres per capita per day (LPCD), is normally required to operate a 24/7 system?

It depends on the need. I think if one has having simple living then the consumption could be lowered. Metro city usually require very high LPCD whereas other cities have lower and even the smaller ones have the minimum. Considering the rural sector or cities (as the case of many areas of Rajasthan) then there need is even low. They do not want to wash their cars or big bungalows. They do not have the high consumptions. In my view, LPCD has the dependence on the standard of living (city type), geographical approach, and lastly the awareness regarding conservation of water.

[Jasveen Jairath](#), Water Sector Professional, Hyderabad (response 1)

The discourse on waste potential of 24/7 supply of treated water has to conducted in the context of pricing policy. This could include:

- 24/7 water supply can be tried with steep graduated pricing - penalizing those who consume beyond agreed reasonable limits
- Base per capita quantum of water can be made available at nominal prices.

However, this creates the possibility for the rich to purchase the right to indulgent water. Pricing policy can discourage wasteful consumption to a limit. Just like exchange of carbon credits - where you purchase the right to generate GHGs. Therefore, a physical limit on volume of water that can be accessed becomes necessary since water cannot be sold to the highest bidder.

24/7 also implies centralized water supply that has inherent limits on non-price regulation strategies. Water violators at a distance are not amenable to social control/accountability since they can pay any price of water.

Decentralised 24/7 water supply mechanisms need to be explored where local user community can reinforce regulation of water use through pricing, local monitoring of local deviations in water wastage/indulgence.

[Vishwanath Srikantaiah](#), BIOME Environmental Services Private Limited, Bangalore

Though I believe that 24/7 is the gold or even the platinum standard for our water supply utilities/service providers let me try to answer what I think are rather direct questions:

1. Will a 24/7 water supply encourage people to conserve or waste water?

In the absence of a well-defined tariff structure, which will ensure higher bills of higher consumption, 24/7 will simply encourage people to consume a lot more water than with limited supply. What are the standards or averages based on which we can decide whether water is being conserved or wasted?

2. Does a well-managed continuously pressurized (24/7) water supply system necessarily require more water than the typical systems seen in most Indian cities?

If well-managed means fully metered, leak reduced and well priced water, then 24/7 may not require more water than the typical systems. However if typical systems supply water for an hour every 3 days then 24/7 will require more water. I also know town after town which simply does not have water as a resource to supply more than what it does howsoever inefficiently

3. How much water, in litres per capita per day (LPCD), is normally required to operate a 24/7 system?

About 250 LPCD in our estimate and work even with a tariff system, which also means that those who can afford will consume even more, up to 600 LPCD. In addition, I would contest David Foster's claim that water has been provided 24/7 in Mysore. A project may be under implementation but definitely, Mysore is not getting water 24/7. Even in Hubli-Dharwad water is purportedly 24/7 only in a portion of the city. The cost of this investment is unfortunately not in public domain so it would be interesting to note what it has cost and what it would mean if a full cost recovery paradigm were to be put in place (which would mean the recovery of full capital cost, O&M and a sinking fund).

[G.V.K.S.V. Prasad](#), V. R. Siddhartha Engineering College, Vijayawada, Andhra Pradesh

Without proper means of pricing, this leads to wastage. There should be metering system and consumer should be based on consumption. Then there will be control on consumption and we may think of 24x7 supply. Another aspect is quantity of unaccounted for water, i.e., water that goes through leaks and unauthorized connections. The technology and care that is taken in jointing; refilling the trenches is the main reason for pipe joint leaks. Time to repair is another factor in quantifying the wastage. Unless we improve on these factors, 24X7 supply works out to be very costly.

[Dinesh Kumar](#), Institute for Resource Analysis and Policy, Hyderabad (response 1)

I appreciate David Foster's efforts in raising this important issue to the water community. I also fully agree with [Vishwanath Srikantaiah](#) on the two points he made on 24/7 water supply and its pricing. In nutshell, it is not whether water supply is regulated or not, but whether there is opportunity cost of using excess water or wasting water, that matters.

Often regulated supply under flat rate pricing (also heavily subsidized) only leads to the rich and the powerful appropriating more water (using pumps) leading to great inequity in access and use of water, thereby cornering the lion's share of the subsidy benefits. This phenomenon has been observed in electricity pricing in agriculture also where though power supply is for a few hours, the rich farmers manage to use large amount of electricity and water using high capacity pump sets.

One is not to say that just metering would solve the problems. The pricing structure, and the effectiveness with which metering is done, and the preventing tampering of meters would matter a lot. Research from US shows the price elasticity of water demand is high under incremental block rate.

While in Australia, the experience with restricted water supply during droughts in some large cities has been extremely positive (with incremental block rates), it is not likely to be same in most of the Indian cities due to inefficient pricing. The rich will get away with illegal tapping, and will manage to have large systems for storing the water.

[Suneetha D. Kacker](#), Water and Sanitation Programme India, New Delhi

In response to the query I have the following points to make:

I believe a 24 x 7 water supply will influence people's attitude towards water use (conservation) only if it is accompanied by metering and pricing. In the absence of these, there is little incentive, in users, to change their behaviour towards water use, which, currently, is highly wasteful. To an extent, the habit of emptying / draining "old" water that has been stored, to fill up new water will be eliminated, since "fresh" water will be available on tap.

This would again depend upon metering and pricing to curb wastage. In addition, 24 x 7 may require marginally more water (10 - 15%) than typical systems seen in most cities - although this also would have to be verified against change in user's behaviour (elimination of water storage; no draining of old, stored water, etc). Have any studies been conducted on this aspect?

[Sikandar Meeranyak](#), Sankalp Rural Development Society, Hubli

I appreciate your query on 24/7 water supply. My suggestion is to attempt rooftop rainwater harvesting in all cities. In Hubli, Dharwad, people waste water. The domestic supply is around 150 LPCD that means about 750 LPCD for a household of five people, or 273,750 litres per year.

The rainy season lasts for four months, and for the balance eight months, people use 189,750 litres of water; therefore we save the remainder if we implement rainwater harvesting. It costs Rs 20,000-25,000 per house to set up a rainwater harvesting system. My organization Sankalp Rural Development Society has a vision of no water scarcity by 2020 and you can contact us on sakalpa2020@gmail.com.

Johnson Rhenius Jeyaseelan, WaterAid India, India, Lucknow (response 1)

In urban 24/7 water supply in cities one can see that water for purpose of drinking is wasted and there is no recycling of the same water for domestic use. 24/7 supply will not be wasteful, if:

- There are two separate supply - one for drinking and domestic use
- Water for domestic use can be treated, recycled and reused
- Water for drinking should be based on a price tariff of different slabs
- Water for domestic use need not be priced if the same is recycled

Barring this there will be wastage of water as crores of money is spent on filtration of the same and it is a waste of resources if the same is not used for domestic purposes.

Surekha Sule, Independent Journalist, Pune

I am totally against the 24x7 water supply norm. As it is our water usage pattern is wasteful. We wash/bathe under running taps instead of using it judiciously from filled pot/bucket. Our belief that clothes are washed clean with running water ("*khulle pani mein*") wastes precious water - sufficient for four other households. Instead, conservation and recycling as suggested can ensure adequate supply.

We get water for only one hour and have to fill it up for daylong use. With this, we have learnt to use it sparingly and in fact, it does not leave us any unclean in any sense. I have no complaints about water availability for 2-3 hours a day. Once a family in our neighbourhood was out of station and the tank water ran for three hours instead of the usual one hour. This means just one family out of 12, uses 2/3 of the water filled up in then huge overhead tanks. Therefore, equitable distribution is the issue and not 24x7 supply.

Anurag Mishra, CAIRN Energy, Lucknow

I perceive this query in a different way as one of the basic underlying fact for water is that it has always been a free commodity with no adequate regulatory laws for its proper management. From time we have been using water for what so ever purpose without any restriction and control and thus whether it is 24X7 supply or its just 8 hrs supply we have been exploiting the resources at its maximum.

Look at the domestic power scenario, recently in all the urban slums of Lucknow insulated power cables has been laid and thus has prevented unauthorized usage as well as illegal connections. Within months the slum dwellers also get used to appropriate usage as well as have legalized their connections where you "pay as you use". It is now immaterial whether electricity is for 8hrs or 24X7 hrs since appropriate usage has been inbuilt within the system. I do believe that increased awareness as well as apt regulations for water supply could help in its sustained use.

Regarding the paying capacity of poor, I have totally different experience where the poor families in both rural and urban areas have resorted to best water purification technologies (commercially available water purifiers and other improved POU techniques under POUZN project, www.pouzn.com) in their houses as they believe that disease burden due to water contamination is much higher than affording a low cost technologies for safe drinking water.

To sum up:

- Inbuilt regulations within the system towards appropriate usage of water
- Heightened awareness towards fast depleting resources and inclusion of same in school curriculum

- An idea floated earlier by one of our colleagues for having separate supply lines for drinking water/domestic use (as more than 75% of fresh water is being put to use for other domestic chores and is also not recycled) would also be of great help in conserving the resources.

Asad Umar, WaterAid (UK)-India Liaison Office West, Bhopal

In my opinion 24/7 water supply norm can't be a viable option in our country when most urban areas have depleted, polluted or destroyed their local sources of water like rivers, lakes and tanks and in many cases even groundwater. To meet their growing water requirement many urban bodies source freshwater from distant locations. This has only proved to be cost-ineffective, environmentally unsustainable and increases conflicts over water in different states across the country.

Over dependence of big cities on mega supply side solutions in terms of large dams/rivers as answer to urban water needs are already causing huge burden on the exchequer of urban bodies e.g. Once dependent on tanks and lakes, Bangalore city now depends on the Cauvery Water Supply scheme for 83% of its demand, making it one of the costliest cities in the subcontinent. Against this backdrop can we really afford 24/7 water supply nor? Further an assessment of water supply status in Class I cities indicate that about 37% of them receive less than 100 LPCD water supply, followed by 31% between 100-145 LPCD and rest 32 %, which is more than 145 LPCD. With these statistics can we really go for 24/7 water supplies?

Apart from the whole issue of huge cost involved in ensuring water supply to urban dwellers the other major concern is the substantial loss of water (>30%) during transmission. And if we opt for 24/7 models then it is for everyone to guess the amount of water loss during transmission.

Instead of going for 24/7 water supply norm it is more important to augment water supply by harvesting rainwater, conserving the available water and recycling wastewater wherever possible, and by evolving demand management options for efficient utilisation and distribution of water.

Arunabha Majumder, Jadavpur University, Kolkata

I think, every Municipal Authority must look for 24/7 water supply in future. It will definitely ensure safe water supply as chances of post contamination will be less. In India, UFW in cities/towns ranges between 32% and 42%. Wastage through pipe leakages constitutes major UFW.

Again in India, water supply through public stand posts are very common and especially in slum areas. Intermittent water supply is common in India and consumers are habituated with the supply. 24/7 water supply, though will be excellent but will require radical change with respect to water distribution system, traditional habits of the people, inequality in per capita water receipt etc. The pipe line leakages need to be reduced considerably. UFW should be restricted to less than 15%. I like that at present, every municipality must give thrust on the following before taking up 24/7 W/S scheme in future.

- Leak detection in pipe lines and repairing in an organized manner.
- Leakages from the valves are to be stopped as maximum as possible.
- Water meters are to be installed for the consumers.
- All underground storage tanks in the consumer-premises must be fitted with float valves. It will reduce wastage.
- Bibcock in street taps will ensure release of water only through hand pressure; else water will not come out. Wastage from street taps is to be reduced to maximum extent.

- To ensure equality in water distribution system.
- Slum dwellers are to be rehabilitated in buildings. Slums are to be abolished.
- To take up awareness, motivation and sensitization program on water conservation, wastage minimization, water quality surveillance in ULBs.

My comments on the specific questions are:

- It will encourage people to conserve water since s/he will be aware, motivated and sensitized to practice that.
- Yes, it may require more water, but within an additional 25% of water.
- I think 200 LPCD (minimum) will be required to operate.

Criteria for implementation of 24/7 water supply need to be developed for Urban Local Bodies. Action should be taken by the ULBs to fulfill the criteria. Only after that 24/7 water supply can be implemented.

David Foster, **Administrative Staff College of India, Hyderabad** (*response 1*)

This discussion is focused on the impact of continuously pressurized (24/7) water supply on overall water requirements and I am very pleased at the level of response and the quality of the comments. Before trying to respond to individual questions and comments I would like to first review some basic principles.

Although one of the first questions regarding 24/7 water supply is inevitably the issue of water availability, many people fail to recognize that the quantity available for use by the consumer is based on at least four factors:

1. Quantity of production
2. Water leakage or theft during distribution
3. Wastage of water by the consumer and
4. Inefficient and/or inequitable allocation.

Unfortunately, almost all the focus is usually placed on the presumed need for source augmentation with very little attention paid to the other 3 equally important factors. In fact, for most Indian cities it is not the total quantity of water available that it is most important but the quality of management.

While water systems in Japan and Singapore, for example, lose less than 5% of their water during distribution, most cities in India have loss rates of 40% or higher. Worse yet, many have not even taken the basic steps of calculating their water loss and some who guess that their UFW (Unaccounted For Water loss) is only 40% later find that it is as high as 70%.

Interestingly, reducing UFW not only saves water but it also dramatically reduces the cost of pumping, one of the biggest costs of water supply, and yet almost no Indian city puts leak detection and repair as their highest priority. As [Jagadiswara Rao](#) rightly points out, there is no sense in trying to provide 24/7 water if we are not going to do a better job of fixing the leaks.

Another area rarely receiving attention is the waste of water within the home. Indian toilets, even when properly maintained, typically use far more water than those in industrialized countries. Many homes still have no shut-off valves on their water tanks so that they overflow on a regular basis. And, as [Suneeta Kacker](#) indicates, it is still common practice in many homes to needlessly throw out "yesterday's water" when fresh water arrives.

Finally, as most of our readers have noted, in the absence of properly functioning water meters and appropriately designed water tariffs, it is impossible to allocate water efficiently or equitably.

Flat rate systems with no meter, as [Dinesh Kumar](#) emphasizes, inevitably encourage misuse by providing the greatest subsidy to those who consume the most. And, even with meters, unless the tariffs are set properly there will be no way to protect the poor or to provide adequate incentives to avoid profligate use.

Fortunately, the newly established continuously pressurized and properly metered 24/7 systems throughout Asia clearly demonstrate that water can be made available 24 hours per day 7 days per week without excessive water requirements. In Singapore, even though water is so scarce that they have to buy water from Malaysia and desalinate seawater, they still provide water 24/7. In Male, in the Maldives, even though there is only enough water for 80 LPCD (Liters Per Capita per Day), they still provide water 24/7. And in Navi Mumbai, when the system was improved to provide 24/7 supply the water requirements actually went down from an average of around 200 LPCD to about 160 LPCD.

One interesting finding from several 24/7 demonstrations is that during the first couple of months after water becomes continuously available, household consumption of water does increase. Then, after people learn to read their meters and carefully turn off the water valves when not in use, the consumption falls back down again if the tariffs are set appropriately.

While [Vishwanath Srikantaiah](#), rightly points to an error in my introductory remarks and Mysore does not yet have 24/7 water, Hubli has recently completed a demonstration providing 24/7 water to 10% of the population. Most impressive is the demonstration that even though these people previously only received water for a few hours every 3rd day, they now receive water 24/7 with no increase in water requirements.

While there is a lot of variation worldwide in water consumption, Paris France receives an average of 150 LPCD and the WHO (World Health Organization) recommends 140 LPCD. While more than 140 LPCD is not necessarily wasteful (depending on water availability) it certainly is not necessary for health and sanitation. The important thing to realize is that under the current intermittent supply system with water rationed by hours per day, many poor people receive only 20 LPCD or less. However, in systems in Jamshedpur, and in the still incomplete systems in Hubli, Badlapur and Navi Mumbai, rich and poor families both receive 24/7 water supply.

[Jasveen Jairath](#), while recognizing the value of 24/7 water and the importance of proper metering and tariff setting, still has some concerns that even with high tariffs on high volume users that wealthy people could still indulge in wasteful consumption. Obviously, Jasveen is theoretically correct but if we examine the situation world-wide we generally see that good meters and appropriate tariffs go a very long way toward discouraging waste. In addition, as Jagadeshwara Rao points out, cities can certainly require large volume users to pay the capital cost as well as the operating cost of providing this water. In addition, many cities charge even higher rates to very high volume consumers and use this revenue to provide cross subsidies for the poor. Other measures that should also be encouraged include public awareness and building and appliance codes that promote greater water efficiency.

On balance, we conclude that trying to ration water by means of limiting hours of supply is a very inefficient approach. It typically is actually associated with higher leakage rates, inequitable allocation and wasteful household use. In fact, we are not aware of a single well-managed water supply system anywhere in the world that relies on intermittent water supply.

[David Foster](#), Administrative Staff College of India, Hyderabad (*response 2*)

Responding to the note from [Asad Umar](#) presents a special challenge because I agree with most of what he says and yet I still disagree with his conclusion. Please read along and see if you can understand why:

First, I must emphasize that I fully agree with Asad that the solution to India's water problems will depend primarily on protection of water resources and conservation of supplies rather than on source augmentation.

Second, where I disagree is on the all too common assumption that intermittent supply is an effective means of conserving those precious water supplies. In fact, I believe that we can clearly demonstrate that a properly managed 24/7 system is by far the most efficient means of providing safe, sustainable and affordable water for all:

- Most intermittent water supply systems in India waste an appalling 40% of the water during distribution and waste far more.
- Testimony from consumers of intermittent supply water throughout India that gives evidence to routine wasteful practices such as throwing out one day's water to make room for the next, allowing tanks to overflow, and leaving valves unclosed or not repaired.
- Demonstrations from around the world proving that properly managed 24/7 systems (including good leak detection, good meters, appropriate tariffs, and great public awareness programs) not only require less water than the typical intermittent supply system but also often require even less.
- Proof that safe, sustainable, and affordable 24/7 water supply does not require immense quantities of water:
 - Many European cities like Paris provide 24/7 water supply with only 150 LPCD,
 - Singapore relies on 24/7 supply despite the fact that it is severely water stressed, and
 - Male (in the Maldives) provides 24/7 supply with only 80 LPCD

Finally, while many 24/7 systems routinely reduce leakage rates down to 10%, 5% or even lower; I challenge all of our readers to help me any identify cities in India with proven non-revenue water levels below 40%.

In later discussions we will carefully review the health, equity and economic advantages of 24/7 water but in this discussion I want to clearly emphasize that one of the most important reasons for supporting continuously pressurized 24/7 water is precisely because of the water scarcity in India.

[Himanshu Thakkar](#), South Asia Network on Dams, Rivers and People, Delhi

Most of the problems of the urban water supply can be generally classified as governance problems. Suggesting that 24/7 pressurized water supply systems will solve the governance problems does not sound very logical.

In fact, we need to invest our resources in making an analysis of the governance problems around the urban water supply systems, and then looking for solutions to address them. For example, when the 24/7 water supply proposal was made (the consultant then were now infamous price water house coopers, and they were selected through dubious process by the World Bank, which shows, among other things, that the governance problems can plague the 24/7 proponents too!), it turned out that the Delhi Jal Board does not have functioning and monitored bulk water meters at most required locations. If these bulk water meters were in

place, working and its readings made available publicly, then people can see where the losses are. That situation has not changed even today.

The choice between the 24/7 and the intermittent water supply options seem to be entirely different issue. Both may have their advantages and disadvantages, and that needs to be addressed in an informed, participatory way, separately. Unfortunately we do not have credible picture of costs, benefits, governance structures, issues of sustainability, etc for the "successful" examples of 24/7 water systems in India. Unless we have them, I am not sure if we can arrive at useful answers.

I was struck by the statement of David Foster, "In fact, we are not aware of a single well managed water supply system anywhere in the world that relies on intermittent water supply." I am not sure if this shows some bias. I do not have an answer on that, but would like to know if that is indeed the case that there are no such well-managed systems. Intermittent water supply systems have been known to work well for decades when the local water sources like the lakes, rivers, etc were in better state than they are today. However, may be more work is required to answer that one.

David Foster, Administrative Staff College of India, Hyderabad (*response 3*)

I fully agree with [Himanshu Thakkar](#) that most of the problems of urban water supply are generally governance problems and that providing 24/7 water supply is in no way a substitute for solving problems of governance. Furthermore, Himanshu rightly criticizes Price Waterhouse Coopers and the Delhi Jal Board for their lack of bulk meters and their lack of transparency in sharing information with stakeholders.

At the same time, however, I believe that we can also clearly show that improving governance while continuing intermittent supply will not solve the water problems. In fact, I believe that in most countries, where you find well governed cities you will also find well managed 24/7 supply systems. As we have discussed at length, in most cases a properly managed 24/7 system (including working meters, good leak detection & repair, appropriate tariffs and bill collection and good public awareness programs) does not need to have more water than an intermittent supply system.

In addition, while we will discuss these issues in more detail in the following weeks, properly managed 24/7 supply is generally found to be more equitable, more affordable, and the only way to assure that contaminated water will not enter the water supply system. With this in mind, we need to carefully identify and evaluate the perceived advantages of intermittent supply:

- Where and under what circumstances is intermittent supply employed in a city currently meeting the highest standards of governance?
- Where and under what circumstances does intermittent supply provide more equitable distribution than under a properly managed 24/7 system?
- Where and under what circumstances does intermittent supply really cost less than 24/7 supply when all costs are considered?
- Where and under what circumstances does intermittent supply really provide better protection the water quality (and the health of the consumer) than 24/7 supply?

In addition, I will reiterate my earlier challenge: **Please help me identify a well-managed urban water supply system anywhere in the world that relies on intermittent supply and does that system really provides safe, sustainable and affordable water.**

Finally, Himanshu rightly points out that many communities once received water supply through intermittent supply systems but we have no data regarding the safety or equity of that supply and the fact that most such systems have since fallen into disrepair raises serious questions as to whether that water was sustainable or affordable. It is also true that many Indian cities (including Bangalore, Goa, and parts of Hyderabad, Mumbai, Kolkata and Delhi) once had 24-hour supply but with poor maintenance and poor governance these systems gradually fell into disrepair, thus proving Himanshu's thesis that good water supply also requires good governance. On this critical point Himanshu and I fully agree.

Atul Rawat, DMV Business and Market Research Private Ltd., Hyderabad

In a country like India, it is practically impossible to provide 24/7 water supply to 120 crore people. Some parts of India are heavenly dependent on the monsoon to fulfil its water supply. Water supply in urban areas is depended on the distant areas and groundwater supply. The quantity and quality of water supply is also poor. Water is supplied only for few hours of the day which leads to lot of waste as taps are kept open. There is a need to use well-planned water supply network and techniques, as groundwater is not an everlasting supply option. Water 24/7 water supply would definitely encourage people to waste water in large quantity. Generally, people use water with care if they are getting limited water supply. Some areas in the metro cities like Mumbai, Delhi etc. are facing supply crunch and not getting minimum limit of water supply (40 litres) ,therefore it would not be advisable to provide 24/7 water supply.

The steps which can enhance the quality and quantity of water supply:

- Desalination
- Water harvesting and recycling
- Implementation of water resources development plan
- Reduction in loss of water during transmission

PUB Singapore

PUB is the National Water Agency in Singapore providing water, wastewater and storm water management in the city state. The public agency services a number of major industries with intensive water use. PUB's holistic approach has resulted in a lower dependence on external water sources by diversification of water sources including water reuse, desalination, storm water storage in new water storages and supply of very high quality recycled water to industry with some internal reuse of this supply.

In its own operations, PUB has significantly reduced water losses due to leakage in pipes and inaccurate meters. It has 100% servicing of its population with water and waste water services. It has been accompanied by a major change in water pricing and access policy, which aims to use the rate structure to encourage the more efficient use of water. Reclaimed water branded NEWater in Singapore is recognised for its high quality. Its household directed campaign of "Water efficient homes" helps residents to save water at home and reduce their water bills. The PUB story would fit well as a study example in the education of water managers. PUB has won the prestigious 2007 Stockholm Industry Water Award.

Ajay Bhan Singh, Society for Promotion of Wastelands Development (SPWD), New Delhi

Kindly correct if I am wrong, by 24/7 you mean assured quantity be it 10, 80,100, 120 or whatever LPD depending on the availability from all resources and keeping long-term sustainability of these resources. In this case probably the 24/7 supply will be efficient because

you are fixing the quantity at the first place itself and addressing the needs for upgradation with the increase of users.

However, in Indian conditions neither fixed supply based on availability nor upgradation of the water resources is being done in a systematic manner. The water distribution norms are governed mostly by the socio economic profile of the area and not by the principles of equity and right of access to water. The high profile population of even worst water scarce areas has access to more water than the low profile water rich areas. Probably the intermittent supply is more equipped to promote a kind of distribution system in lines with the principle that, rich have right to use more water even after paying equal or less.

In my view if the quantity is fix then 24/7 may be an efficient option. The urban water governance needs a complete reform.

[Nikhil Anand](#), Stanford University, USA

Thank you very much for hosting a very interesting conversation on 24/7 water supply. Over the last two years of researching Mumbai's water supply, I did indeed come across various propositions and oppositions on the subject. At the outset I would like to confess that I am largely agnostic on the subject. While I am interested to learn how 24/7 water supply has become an 'issue' or goal for water departments and policy experts all over the country, I am still unsure of the case that is being made around this distribution paradigm.

If I understand the issue correctly, those proposing 24/7 water are making the case that 24/7 water is (a) less wasteful, (b) more equitable, (c) safer. In line with the discussion this week, I wish to take up the first two questions- specifically, would a 24/7 water supply for Mumbai be more inclusive and less wasteful?

As many who work with urban water systems already know, intermittent supply is, among other reasons, a way of reducing leakage in a system. Pipes leak less when there is not water in them for 24 hours. While intermittent supply certainly should not be a strategy of dealing with a leaky system, I am a little unclear how it is being argued that intermittent supply leads to **more** leakage. I would expect the reverse to be true. Nevertheless, to reduce 'waste', it would appear that the question is **not** one of choosing between intermittent and 24/7 supply, but between allowing leaky pipes leak and fixing them.

Second, just a couple of thoughts about equitable distribution: When I was doing fieldwork in Mumbai, the inequities between those connected to the legal water supply system- between the Department's rich and poor customers for example- were not as stark as those between those who had legal water connections and those that did not. Because of state government directives, and water department rules, large numbers of Mumbai's residents (typically those in slums who do not have documents proving tenancy before 1995) cannot get access to water legally. This is a major issue, and one which the question of 24/7 supply simply does not address. To achieve the goal of equitable distribution, it is the Department Water Rules, and not the daily water schedule that has to be changed.

Of course, the fact that these residents are still living in Mumbai means that they do get water, oftentimes outside of the legal system, oftentimes through the 'help' of powerful people. This tapping of the system often gets counted in estimations of 'leakage'- water that is not counted, measured and billed by the state. Nevertheless, it is still being used. There are no estimations of this figure. If leakage reduction means cutting off such users from the paralegal system, then it stands to reason that leakage reduction may also *increase* inequality.

I am not arguing that there is any glamour in paralegal or illegal use. Nor am I suggesting that physical (as opposed to social) leakages be ignored. However, given the state of Mumbai's water system, I suggest that the most pressing requirements should be (a) for the department to recognize and grant legal connections to all households and (b) to simultaneously fix the leakages in the distribution network. These most essential steps neither require a 24/7 supply nor require we be opposed to it.

David Foster, Administrative Staff College of India, Hyderabad (*response 4*)

I was very pleased to note that [Atul Rawat](#) referenced the **Singapore PUB** (Public Utilities Board). I first had the opportunity to visit this system over 30 years ago and the Singapore PUB operates one of the most efficient best-managed water supply systems in the world. For this reason ASCI has maintained an active partnership with Singapore PUB for many years and many of the leading Indian water managers have accompanied ASCI faculty on trips to Singapore to meet with the PUB.

Interestingly, what Atul Rawat fails to mention is that Singapore, despite having far less water per capita than India, has long provided continuously pressurized water 24 hours per day, 7 days per week, and 52 weeks per year. In fact, it is precisely because Singapore is so water stressed that it has chosen 24/7 as the most efficient means of managing its limited water supply. In short, Singapore PUB knows that intermittent supply is not an effective way to provide safe, sustainable and affordable water.

Furthermore, while Singapore does employ some desalinization, it was first careful to reduce its water leakage as low as possible before embarking on such an expensive venture as desalinization. Today Singapore's leakage rates are less than 5% while most Indian cities still have rates of 40% or higher.

I should also point out that Singapore is blessed with very efficient management in part because many of the senior managers in Singapore are of Indian origin. Furthermore, we need to continuously remind ourselves that it is not only highly developed countries like Singapore that have achieved this level of performance. Today 24/7 water supply can also be found in Phnom Penh, Cambodia; Kampala, Uganda; and even in Herat, Afghanistan. Efficient 24/7 systems can be found in rich and poor countries as well as in countries with both severely limited and abundant water supply.

While I believe that desalinization is too expensive for most Indian cities and inappropriate before all other reasonable measures of water management and conservation have been first fully implemented, I fully agree with many of Atul Rawat's other comments including the need for:

- A holistic approach to water management,
- A water resources development and management plan,
- Appropriate use of rainwater harvesting and recycling, and
- A comprehensive approach to leak detection and repair.

Finally, while Atul Rawat is absolutely correct that a poorly managed 24/7 system would be wasteful, the growing evidence, from all over Asia and now from within India itself, clearly demonstrates that a well-managed continuously pressurized 24/7 system (including good leak detection and repair, working meters, appropriate tariffs and efficient billing & collection, and a strong public awareness program) is far less wasteful of water than every intermittent supply system we have seen.

If you study these issues and you are concerned about the serious water shortages in India I believe that you will ultimately conclude that a well-managed 24/7 system is the most efficient

way to manage India's limited water supplies. If, however, you can find efficient well-managed intermittent urban water supply systems providing safe, sustainable and affordable water, please bring them to our attention as soon as possible.

Dinesh Kumar, Institute for Resource Analysis and Policy, Hyderabad (*response 2*)

The discussion on "24/7 water supply: to be or not to be" is assuming interesting dimensions. The following points might be useful to those who argue for intermittent supply:

1. It is quite natural that if water supply is rationed, the **average** per capita water use from the particular supply system has to come down. However, the question is who has to compromise on the use to achieve this lower per capita use. The rich would try and overcome the constraint by doing the following: (1) illegally tapping directly from the main/distribution line using pump sets (**as found in Rajkot, one of the most water-short city**); (2) using large storage systems in the houses; and, (3) tapping bore well water; and (4) purchasing water from private tankers (at Rs.50/m³). Hence, their per capita water use may not even come down. Instead, most of them act with a vengeance to use more water. Whereas for many others, the per capita use can come down drastically, as water will not even reach them.
2. We should not confuse "**intermittent supply**" with "**rationed supplies**".
3. Volumetric rationing will have a negative impact on average per capita use, and positive effect on wastage reduction. **However, scientific rationing across socio-economic segments, to distribute scarcity and to avoid negative equity effects, is not easy.** The desired outcomes would be realized only if everyone has individual tap connections connected to the public system with adequate pressure maintained in the system. Again, it is simply not possible in large multi-storied apartment blocks (with several dwelling) where bulk supply is provided through a single connection, and water is distributed from an overhead tank.
4. Impact of intermittent supply (which only refers to number of hours for which supply is provided) may be counter-productive as everyone would try and store a lot of water. It is common practice to empty the storage to fetch freshwater in households.
5. There could be huge economic losses induced by water scarcity affected by supply rationing and therefore should be resorted to if the opportunity cost (financial and environmental) of supplying more water exceed such losses. A research on California's urban water scarcity for a projected population of 2002 (38.4 million people) showed an estimated economic losses of 1.6 billion dollars (**8,000 crore rupees annually**) (Source: Economic Losses For Urban Water Scarcity In California, by Marion W. Jenkins¹, Jay R. Lund¹, and Richard E. Howitt). This works out to be Rs. 2080 per capita per annum on an average. In certain cases, the estimated cost was in the range of 50-100 USD per capita. Therefore, we need to understand who would actually bear the cost of such induced water scarcity before we arrive at allocation decisions.
6. This means, a decision to ration water supplies during scarcity would be pragmatic, if the environmental costs of creating new sources are large, provided we find resources to either subsidize systems that would help improve efficiency; or invest in leakage reduction technologies. A recent analysis for the city of Bangalore showed that UFW (unaccounted for water) reduction would cost Rs. 7.2/m³ against a cost of production & supply of water of Rs. 10.2/m³ in that city. It is important to remember that the city has one of the highest unaccounted for water among many metropolis.

[David Foster](#), **Administrative Staff College of India, Hyderabad** (*response 5*)

[Dinesh Kumar](#) has raised some excellent points below regarding “**24/7 water supply: To be or not to be?**” I will make just two small additions:

- 1) Dinesh compares the cost of reducing leaks (UFW or Unaccounted for Water loss) at Rs. 7.2/KI with the cost of production at production at Rs. 10.2/KI and rightly concludes that water conservation and leak reduction is a bargain by comparison. In fact, it is even more of a bargain than Dinesh shows because the Rs. 10.2/KI is probably only the O&M (Operation and Maintenance) cost of production. When the capital cost is also included, the real cost of water in Bangalore would be far greater and it would be obvious that water conservation is an even greater bargain. Furthermore, as energy costs increase (as they inevitably will) the cost of production will rise even further. In fact, this is a great “trick” question to ask your friends: Just ask them what is the least expensive source of good quality water in most Indian cities. The answer (you know by now) is: LEAK REDUCTION. Fortunately, the worse the situation is (i.e. the more leaks there are) the cheaper it is to achieve a significant reduction. The question remains, however, if leak reduction is such a bargain, why do not more cities initiate comprehensive leak detection and repair programs?

- 2) Unfortunately, many managers of urban water supply really do not know just how bad the UFW situation is in their cities and without that knowledge they cannot have an effective leak detection program. They may tell you: “It’s about 30% or 40%” but if you ask just how they arrived at that estimate you will often find that it is pure guesswork. Most cities do not have working meters on all their customers and many do not even have accurate measurement of the production. If this is the case in your city, you can still come up with a rough estimate by following the following steps:
 - a. Get the best available estimate of water production either from bulk meters or operating data for the pumps installed.
 - b. Calculate all the known metered water that is provided to customers.
 - c. Estimate the amount of water that is provided through tankers and public standpipes or fountains.
 - d. Conduct a sample survey of the consumers with un-metered (flat rate) connections at their homes and estimate the total amount of water they receive.
 - e. Subtract the totals delivered in (b), (c) & (d) from the estimated production in (a) and this will represent the total lost through leaks or theft.
 - f. Divide your number in (e) by the number in (a) (multiplying by 100) and this will represent the percentage UFW (Unaccounted for Water).
 - g. Please let me know if you ever find a percent lower than 40.

[Arshi Mukhtar](#), **Centre For Ecological Audit, Social Inclusion and Governance, New Delhi**

Responding to the argument for intermittently supply and reduction in leakage, I would like to note that leakage could be addressed with better maintenance of the supply system. 24x7 supply is ecologically safe as it substantially reduces the energy consumption for filling the tank. Every day, in my neighbour in Ashok Vihar people are using electricity for pumping water and storing in the tanks. 24x7 supply ensures elimination of Green House Gas emitting energy. As people would be sure of water, they would not run motors for pumping water in tanks. We could consider this

as part of ecologically safe strategy for water supply and making cities ecologically safe, secure and sustainable.

This would be in addition to the measures to reducing the consumption of water in day-to-day practices.

Center for Ecological Audit, Social Inclusion and Governance is communicating for Carbon-Neutral Neighbourhood Discussions for ecologically sustainable consumption, production, transport, habitats.

[S. V. Vijaya Kumar](#), National Institute of Hydrology, Deltaic Regional Centre, Andhra Pradesh

A very important series of issues on 24/7 water supplies is put fourth for discussion by Foster. Being associated with studies in water supply systems, my discussion is like this.

Will a 24/7 water supply encourage people to conserve or waste water?

Theoretically, it will lead to water conservation on long run, if the billing system is slab based. Practically, to answer this is challenging from our socio political system, definitely initially. However, if a powerful regulator is allowed to manage it systematically, public should be fond of such a system. Initially, the efficiency of water use may be less in such systems but on long run, these systems can be managed very efficiently.

Does a well-managed continuously pressurized (24/7) water supply system necessarily require more water than the typical systems seen in most Indian cities?

Yes, as the design criteria of existing systems is for intermittent use, the designed source capacities per capita are less. However, for 24/7 as the water use may increase with change in life style as the society develops. To start with, the source capacities should be doubled if the supplies at present are 1 to 2 hours per day; they must be increased by at least 50% if the supplies are for 2 to 4 hours per day in the present system. If the present supplies are for more than 4 hours then the existing capacity of source may be sufficient for a 24/7 system.

How much water, in litres per capita per day (LPCD), is normally required to operate a 24/7 system?

To start with, 270 to 340 LPCD may be sufficient for systems in towns to cities excluding losses from source to delivery point.

[David Foster](#), Administrative Staff College of India, Hyderabad (response 6)

I would like to commend [Anurag Mishra](#) for raising some excellent points regarding 24/7 water supply, particularly for using the analogy to electric power. While we all recognize the important differences between power and water supply there are some very valuable lessons to be learned.

One of the most important lessons is that when governments make it difficult to obtain power or water legally then theft rates inevitably increase. Conversely, when governments charge for these services but make it easier to obtain legal connections, then the theft rates rapidly go down. This has been demonstrated in the power sector not only in Lucknow but in Ahmedabad and in the water sector in Vijayawada.

In most cases we find that if subsidies are to be provided, the first priority should be to subsidize the connection cost (the biggest obstacle for the poor) rather than subsidizing the monthly

tariffs. Ironically, the only one who seems to benefit when connections are too difficult to obtain are the local mafias and corrupt officials.

Another lesson learned in both water and power sectors are that increasing public awareness of how to read meters and the importance of reporting leaks and illegal connections.

Anurag Mishra also raises the possibility of having separate supply lines for domestic potable and non-potable water supply. While this concept is initially appealing, almost every city that has investigated it has found that it is usually much cheaper and safer to treat all water distributed for residential use rather than to try to install and maintain two separate water supply lines in the same area. Even if the two lines were installed in the same trench at the same time, two small pipes will inevitably be more expensive than one large one and putting the two lines close together will always increase the likelihood of contamination.

[Mahesh Kumar](#), Independent Consultant, Bhopal

The fundamental assumption of this discussion seems to be that "there is no 24/7 water supply now". It might be true from the perspective of the supplier. In this case Corporations or water boards. However, for a consumer who actually stores water in his overhead tanks, its 24/7 supply any way. They do it precisely to ensure such supply. This is not limited to rich. Even poor as a matter of tradition and practice store "needful water" for 24 hrs. However, will it be available throughout the week will depend on the supply. So, who are we promoting this 24/7 for - consumers or service providers?

[Shubhang Pandya](#), Sarvangi Vikas, Ahmedabad

So long as water supply is not metered and priced appropriately, its augmentation would certainly lead to wastage. Examples abound when one looks at community water posts where taps are stolen, non-functional or always left open; another example is the Indian Railways system, where water valves on refilling (into coaches) lines profusely leak, or are just open! Restricted supply (in terms of time duration) is appropriate in given circumstances.

I would even go to the extreme: water should be supplied into underground storage tanks, with tank size reflecting number of users (to allow equitable per capita water quantity) with overflow linked to trigger a stop valve. Users would be responsible to pump it up for internal distribution. Large users could be covered first, to be followed by wider adoption as one gains experience.

[Abhishek Mendiratta](#), Independent Consultant, New Delhi

The 24/7 water supply neither encourages nor discourages people to conserve or waste water. It is the awareness among people to use or misuse water. Hence, we should solve the problem by increasing awareness on water use and conservation. We should treat the disease not the symptoms.

[Subhash Verma](#), Soans Envirotech, Faridabad

24/7 water supply is not wasteful if there is a proper tariff and the total water supply is metered with minimal unaccounted for water (both commercial & technical). 24/7 water supply properly metered and with a correct tariff actually would help in achieving the LPCD. I know of many cities in Europe where 24/7 water supply is a norm and with the correct education and tariff has reduced water demand to figures as low as 125 – 135 LPCD.

24/7 water supply is not wasteful with a proper realistic tariff, not a political tariff will reduce water demand, one should be taught that water is not free it costs and one has to pay for the same. 24/7 water supply is not wasteful nor does it increase the demand all one needs

- A correct tariff
- Low NRW
- Education & institution change in delivering the message that there is no free lunch – not even especially the water – one must pay for water now or our future generations will not have water to pay for.

David Foster, **Administrative Staff College of India, Hyderabad** (*response 7*)

I am very pleased at the great number of excellent comments we are receiving regarding 24/7 water and I want to stress that we welcome them all whether they come from advocates of 24/7, opponents or, as in the latest case, from, “agnostics.”

While **Nikhil Anand** professes to be agnostic with regard to 24/7 water, we should point out that Palo Alto, California, where his Stanford University is located, has long enjoyed 24/7 water supply, as does every other city in California. Furthermore, Palo Alto, like most cities in India has major seasonal variations in water supply. In fact, I recall when I visited Palo Alto that I was amazed to find that the dry streambed where I had played as a child during the dry season was 5 feet deep in water during the wet season.

Therefore, the real issue is not whether 24/7 is possible, even in a monsoon area, but whether it is the most efficient means of providing safe, sustainable and affordable water. Obviously, 24/7 water is not a substitute for reducing leakage. Given the cost of collecting, treating, piping and pumping water today it is also very clear that the UFW (Unaccounted for Water loss) and NRW (Non-Revenue Water) must be reduced in all Indian cities whether they employ intermittent supply or 24/7 supply. Furthermore, as pointed out by Dinesh Kumar and other members, a good leak detection and repair program is usually cheaper than producing more water.

In this regard, Nikhil is right in saying that reducing the hours of water supply is one way of reducing water loss from a leaky water system. The question is: Is it the most efficient means of reducing leakage? As we will discuss in later weeks intermittent supply actually increases the cost (by imposing additional coping cost on the consumer) and decreases the safety (by causing infiltration of contaminated water into the water supply system). What I would like to describe here is how intermittent supply also increases the number of leaks, wastes additional water and, over time, leads to the inevitable decay of the water supply system.

While the initial reaction of most observers is to fear the wastage of water from a 24/7 system, as we have shown in previous discussions, well managed 24/7 systems (including proper metering, good leak detection and repair, appropriate tariffs, efficient billing and collection systems and good public awareness programs) all over the world have been proven to be very effective in minimizing waste of water. By contrast I believe that we can show that even a well-managed intermittent supply system will lead to increases in the number of leaks in at least three ways and I suspect that our readers can help identify even more:

1. The process of intermittent supply (turning the water mains repeatedly off and on) creates a “water hammer” effect that shakes the pipes and valves, increasing the number of leaks at every joint and decreasing the useful life of the system.
2. Intermittent supply also makes it more difficult to find leaks in the system. Note: the standard way of identifying leaks in Singapore and other well-managed systems is to send inspectors out at night to LISTEN for small leaks. This is impossible in an intermittent supply system.

3. Customers are less likely to value the water they receive through an intermittent system (because reduced quality and convenience) and therefore less likely to pay their bills on time or report leaks.

Of course, as Nikhil accurately points out, the choice is not simply between 24/7 supply and intermittent supply but between whether to fix the leaks or not. However, there is an interesting correlation between these two decisions: The world over, cities that put a high priority on leak detection and repair seem to put a high priority on providing continuously pressurized 24/7 water. Once again, I challenge our readers to help us identify and efficiently managed intermittent supply system providing safe, sustainable, and affordable water.

Nikhil Anand also raises some very interesting questions regarding equity in water supply. Therefore, while we will address this issue in detail in the coming weeks, equity and the issue of illegal vs. legal water connections also have a major impact on water quantity so they will need to be briefly addressed here as well.

First, intermittent supply inevitably favors the rich over the poor because it is the rich who can afford the pumps, storage tanks and treatment systems needed to cope with intermittent supply. Furthermore, during intermittent supply many APL families will employ illegal suction pumps to drain as much water as quickly as possible from the water mains, thus leaving less water for the poor who do not have such pumps. Interestingly, even though the use of these pumps is illegal in most cities, their use is so pervasive that there is a major surge in the demand for electric power every time new water supplies reach a given area.

Second, there is also a high correlation between water theft (illegal connections) and water leakage. Frankly speaking, the plumbers making illegal connections are more concerned about being reported to the authorities than they are about making sure that the new illegal connections are properly installed. In fact, when someone is making one new illegal connection, they may often shake loose several of the earlier legal and illegal connections in the process. Furthermore, illegal connections mean that there will be less revenue for the water supply system and less money available to repair leaks.

I also fully agree with Nikhil that one of the biggest problems has to do with the inability of some families to obtain legal water connections. This can result either because the charges for connections are entirely too high for a BPL family (often Rs. 5,000 or higher) or because legal connections are completely forbidden in certain slum areas. In either case the consequences are terrible for both the individual families and the city itself. Such a situation will inevitably result in increases in theft and corruption, increases in water leaks and decreases in water revenues and water safety. Fortunately, whether we are talking about theft of water or theft of electric power, one of the most efficient ways to reduce such theft and increase revenues is to increase the number of legal connections.

Finally, let me conclude with Nikhil Anand, and many other members of this solution exchange, that simply providing water 24/7 is not a recommended strategy. What we have been saying all along is that although you cannot achieve a safe, sustainable, affordable and equitable system through intermittent supply; you can do so with a properly managed 24/7 system providing it includes:

- operating meters
 - good leak detection & repair
 - appropriate tariffs
 - efficient billing & collection and
 - Good public relations & awareness.
-

Kulwant Singh, Water for Asian Cities Programme Regional Office, New Delhi

There seems to be a misunderstanding that 24x7 means more water consumption, which is not true. Even cities like Phnom Penh of Cambodia have 24x7 water supplies. The main challenge is to garner administrative and political will. No doubt it will require some more investments in replacing old pipes and reducing non-revenue water by attending to leakages. Presently we are losing water by 40-60 percent. It is most unfortunate.

Part of the strategy has to be to create awareness and understanding among the people that 24x7 should be the norm for a healthy and most viable water management system in our cities. Intermittent water supply is the cause of several water diseases and therefore not so healthy.

Jasveen Jairath, Water Sector Professional, Hyderabad (response 2)

24/7 water supply has been tried only in two localities of Hyderabad but it is unclear whether water from the mains is supplied on a preferential basis at the cost of other localities that don't get 24/7 water supply. Therefore, this cannot be proof of the viability of a general city-wide 24/7 water supply.

It is absolutely necessary to regulate the use of water, but the method of regulation often becomes contentious. While we all recognize that water is a fast-depleting resource, the awareness of the depletion has to be accompanied by an analysis of why the depletion is happening. This should include the causes, policies that have contributed and practices that have caused it. These will pin-point the cause, since it is now regarded as a divine calamity.

Water consumption can be reduced if the diagnostics are better informed.

My question back to the community is, are any places in India where 24/7 water supply has been applied across the board, and what are the water bills for the poor.

Ravi Singh, Margshree Farm, Agra

I am curious to know the cost per household in terms of new shared infrastructures versus the cost of a more localized solution like rainwater harvesting. Is 24/7 moving us towards expensive infrastructure when we should be looking at more decentralized solutions? Alternatively, maybe we need both. Also one of the issues that affects new infrastructure is that maintenance and repair is not budgeted for by most state departments. At least here in Agra it is unheard of!

Faiz Ullah Khan, Consultant, New Delhi

Yes I agree that 24 x 7 is very useful and efficient for the users. The point is if the supply is not 24x7 which is happening, users are make their own arrangement by digging bore wells or similar kind of things to meet the demand. So if we should control those unauthorized diggings of bore wells and make arrangements for 24 x 7 supply. If it is centralized only government agencies will have the permission of digging bore wells than there is no harm in supplying 24/7 water.

Ajit Seshadri, The Vigyan Vijay Foundation, New Delhi

Some ULBs can aspire to have 24/7 water supply in future this will not only take care of quantity by ensuring adequate water and also quality by having fairly safe water. The challenges would be having adequate supplies and to reduce T&D- Transmission and Distribution losses and

conservation practices in communities. The present mode of UFW is that regularly water-supply is given to communities for say 1 hour in the morning, and 1 hour in the evening. All are habituated with this routine and the day-routine is planned around this timing. 24/7 supplies would upgrade the quality of living in communities, but with added costs, which not are inclined to pay for.

Can we make a distinction of UDW for drinking and UFW for all other uses. That is to attempt dual supply, this would make a lot of sense, after-all having to supply all water at potable standards, is a phenomenal waste of resources as is being done. How does an ULB accomplish this dual supply? In addition, to spread awareness to communities on the water-mantra of 4 Rs- Reduce, Reuse, Recycle and Recharge to make the optimal use of available water resources.

Adopt decentralised STPs, WWT to orient recycled water for lower-end uses. To explain to common-man, through concepts on eco-water literacy, one could explain that when you desire to wear your clothes, you wear it, it gets dirty and you wash it, and its cycle goes on till the end of the dress. Similarly for water, it is recycled and used and then re-cleaned and used for lower uses, etc. Also attempt dual wastewater lines to facilitate recycling, etc. There are pilots of urine-harvesting used for fertilization in farms. All these could be employed to get more value from available water in communities ultimately get to a 24/7 status.

[David Foster](#), Administrative Staff College of India, Hyderabad (response 8)

While I respectfully disagree with [Surekha Sule's](#) conclusion regarding opposition to 24/7 water supply, I think that you raise some very valid points that all of us need to take into consideration.

I believe that all of us are in agreement regarding the need for judicious use of water for all purposes and you have provided some excellent examples of how water is often wasted in the home. I also agree that equitable distribution, strong community involvement and public awareness programs are critical to correct bad water habits for any community that is considering conversion from intermittent supply to 24/7 supply.

I further believe, however, that the evidence clearly supports the premise that continuously pressurized (24/7) water with reliable meters, appropriate tariffs and public awareness programs requires no more water than many intermittent supply systems. This evidence is derived not only from places such as Singapore and Japan but from recent demonstrations in Navi Mumbai and Hubli. In addition, many cities in India currently produce over 170 LPCD (liters per capita per day) while cities in other countries have clearly demonstrated that they can adequately provide 24/7 supply with 140 LPCD or less.

In fact, several of our readers have recently commented on the all too common practice under intermittent supply of people throwing out yesterday's water as soon as new water becomes available. Furthermore, it is a very common practice in many homes with intermittent supply not even to have working valves on the water pipes and just to let the water run when it is available. In addition, as to the question of household storage tanks running over, one of the important advantages of 24/7 supply is that for most single family homes no household storage would be required.

Finally, intermittent supply places a special burden on the poor, particularly in cities without working meters, because the rich readily install booster pumps and storage facilities to get far more than their share of water while the poor cannot afford that equipment.

In future weeks we will go on to discuss the health, financial and equity issues associated with 24/7 supply but on the basis of quantity of supply alone we find that intermittent supply is not an

effective technique for conserving water. Thank you very much for your comments and I look forward to discussing this with you again.

R. Jagadiswara Rao, Sri Venkateswara University, Tirupati

As advocated by David Foster, there is no doubt of the superiority of 24/7 system over intermittent system of water supply to achieve a safe, sustainable, affordable and equitable water supply in the urban areas of India. Presently only a small minority of urban dwellers spread all over India get this facility. While the vast majority of urban dwellers do not get 24/7 water supply, those who get can be broadly grouped into the following three categories.

1. Dwellings where highly important people live get continuously pressurized 24/7 public water supply identical to that provided in any urban area in developed countries.
2. Dwellings where important people live get abundant intermittent public water supply, which is modified as adequate 24/7 piped water supply through ground-level and overhead reservoirs of adequate capacity.
3. Dwellings of upper and upper-middle class people receiving inadequate public water supply, which is modified as adequate 24/7 piped water supply through supplementation of water supply through wells, tankers and rainwater harvesting, and creation of ground-level and overhead reservoirs of adequate capacity.

Delhi is one of a few cities with the highest aggregate per capita daily water supply of around 255 litres. Continuous piped water supply to some localities in Delhi is made possible by the Delhi Jal Board by distributing the available water in the most inequitable manner possible and in the process causing great inconvenience to a vast majority of the population. The webpage at http://www.ccs.in/ccsindia/pdf/Ch08_Water%20Supply.pdf gives the details. Thus, the per capita per day water supply is 509 litres in Cantonment, 462 litres in NDMC, 337 litres in Karol Bagh, 277 litres in City, 274 litres in Civil Lines and Rohini, 202 litres in West Delhi, 201 litres in Paharganj, 148 litres in New/South Delhi, 130 litres in Shahdra, 74 litres in Najafgarh/Dwaraka, 31 litres in Narela and 29 litres in Mehrauli.

What is true with Delhi is equally true with other urban areas of India. There is need to bring drastic reforms in the present methodology to evolve a mechanism by which all urban dwellers irrespective of their economic, social and political status get 24/7 water supply.

Ombeer Singh Tyagi, International Development Enterprises, New Delhi

It is an interesting discussion on 24/7 water supply. It may be possible to some of the cities/town/villages while it will always remain a dream to most of them. Moreover, slogan looks more political and away from the realities. It will be purely a luxury and willful waste of water. More rational would be provide access to water to the large population, which still have to walk miles to fetch potable water. Providing cities 24/7 access to water, most of us will misuse it in the watering garden, washing streets, cars, etc., moreover value of this precious natural resource will be decreased which will prove disastrous in the long run.

N. Lakshmi Narayana, Dakshinaya Institute, Guntur

I am sending my responses as follows:

"24/7 water supply is wasteful as it requires too much water and would not be sustainable for most Indian cities"

This depends on who is asking for 24/7 water supply? Is it a luxury or a real need?

"24/7 water is too expensive for India. The poor can't afford it and the rich don't need it"

The poor don't want it, but the rich do.

"24/7 water supply, even if it could be achieved, would be inequitable to the poor, far better to ration water by hours of supply so that rich and poor alike have equal access"

I feel it is the quantity and quality that matters more than the duration of supply. Further, nobody needs 24 hours' water supply a day as it is a luxury.

The whole concept of development/rehabilitation is "need based". The participation of stakeholders from conceptualization and implementation, including evaluation & monitoring, certainly gives better results. Based on my experience from meetings with people living in villages in different parts of India, I feel nobody wants 24/7 water supply. Instead, they want the government to address their basic needs.

I therefore conclude that as 24/7 water supply is not needed and cannot be managed, it is better for us to concentrate on more important issues.

[Johnson Rhenius Jayaseelan](#), WaterAid India, Lucknow (response 2)

The discussion is really interesting and useful.

While we are advocating for 24*7 supply there are suggestions that tariff should be according to the usage.

In intermittent water supply one can see the following issues:

- Poor always pay more for water because the water doesn't reach till their point and the rich through pumps suck out the water
- In slums where intermittent supply is there and only community tap connections the fight for water is more
- Industry pays less for its usage - what will be tariff for industry consumption?
- Privatization vs. pricing
- Water loss – leaked pipes, contamination
- What is the min and max requirement? Min requirement is a right but after that it is not right but selfishness
- Metered?
- Pricing – slabs. The first slab should be free (40 litres per person* 5 persons* month) – say 6000 litres
- Lack of transparency in setting water tariff – the government should not set the same but a committee
- What if people turn to alternate water sources when water is priced?
- Political hot potato – will political class take the risk to increase water tariff if needed?
- In an un-metered water supply scenario, across the board subsidy of water charges benefits the richer consumers more than others since they have more availability of water due to more storage capacity on the same monthly fixed charge per connection.
- Elected bodies lack the willingness to increase charges since they are afraid of backlash affect of the decision on their vote bank. The public is willing to pay provided reasonable

services are made available to them and reasons for the water charges increases explained to them.

The discussion on water should include:

- Equity, access and cost recovery
- Conscious conservation of water
- Willingness to pay
- Advocating water conservation
- A fair pricing policy will ensure that the rich cough up the true cost of receiving their services, and the poor are subsidized
- Ceilings on water availability, managing sewage adequately, preparing a sinking fund to replace old pipes and machinery, becoming democratically accountable, managing the catchment of its water source
- But tariff revision is politically and socially the most challenging decision... yes every votes counts

Jasveen Jairath, Water Sector Professional, Hyderabad (response 3)

Large apartment complexes can ration water supply internally with the proper planning by the residents. It is possible to both stop leakages and water rationing through a combination of approaches including price and volumetric measurement. However, the leakages that Nikhil refers to are not only from pipes but include water for regular use through illegal connections by the poor who cannot access the government water supply. While there is no disagreement over the need for subsidized water connections and plugging leaks to stop wastage, these are not linked to a 24/7 water supply. It is more about an efficient technical water delivery system followed by regulation of water use.

The following alternatives exist for the regulation of water:

- a. 24/7 with price control
- b. Volumetric rationing with graduated pricing

I feel non-price mechanisms may not be able to regulate 24/7 water use and access. This regulation is necessary as those with greater buying power will be able to get more water for indulgent use, even if it means paying more. This will definitely affect water supply to those who are less well off. The issue here is volumetric regulation of water in addition to a price-based one.

Many thanks to all who contributed to this query!

If you have further information to share on this topic, please send it to Solution Exchange for the Water Community in India at se-wes@solutionexchange-un.net.in with the subject heading "Re: [se-watr] Discussion: Strategy for Improving Urban Drinking Water Supply. Issue 1: 24/7 Water Supply Is Wasteful. Additional Reply."

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