I Save Water! Why & Where do you need to?

The Global Water Availability

Water- The elixir of life, right from its creation 4.6 billion years ago has remained that same on our beloved planet, Earth. The actual quantity of water to put a figure on is 1,385,984,000 km^3. Let's simplify this number.

1 km^3 = 1,000,000,000 m^3

1 m^3 = 1000 litres.

Thus, 1,000,000,000 m^3 x 1,000 lts/m^3

= 1,000,000,000,000 per km^3

AND

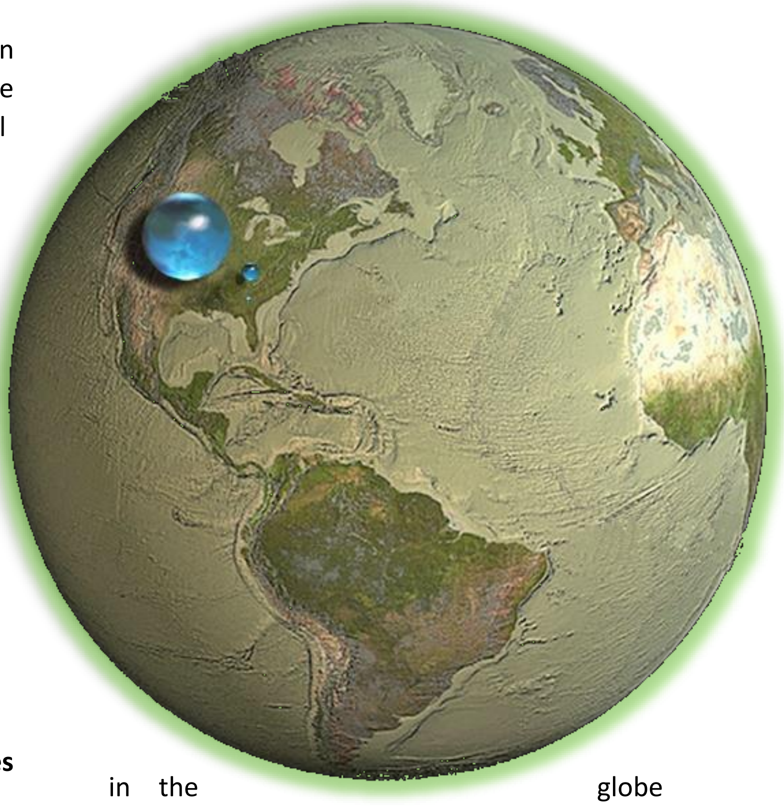
1,000,000,000,000 $ltrs/km^3$ X 1,385,984,000 km^3 =

1,385,984,000,000,000,000,000 litres

A whopping 1,386 Quadrillion Litres
(1 Quadrillion = 1 Billion Trillion)

The image of the globe shown along with (*sourced from USGS*) represents Earth with all its water.

The table breaks up the 1386 Quadrillion litres of water in to actually available freshwater. So,



in the globe image the blue sphere represents the total available water as compared to land mass shown by the green globe, the smaller blue dot represents the freshwater and the almost invisible white dot is the freshwater available to us.

Water source	Water volume, in cubic kilometers	Percent of freshwater	Percent of total water
Oceans, Seas, & Bays	1,338,000,000	--	96.54
Ice caps, Glaciers, & Permanent Snow	24,064,000	68.6	1.74
Groundwater	23,400,000	--	1.69
Fresh	10,530,000	30.1	0.76
Saline	12,870,000	--	0.93
Soil Moisture	16,500	0.05	0.001
Ground Ice & Permafrost	300,000	0.86	0.022
Lakes	176,400	--	0.013
Fresh	91,000	0.26	0.007
Saline	85,400	--	0.007
Atmosphere	12,900	0.04	0.001
Swamp Water	11,470	0.03	0.0008
Rivers	2,120	0.006	0.0002
Biological Water	1,120	0.003	0.0001

Source: Igor Shiklomanov's chapter "World fresh water resources" in Peter H. Gleick (editor), 1993, Water in Crisis: A Guide to the World's Fresh Water Resources (Oxford University Press, New York)

So how much in India?

As per the Ministry of water Resources, 4% of world's freshwater resources are available in India.

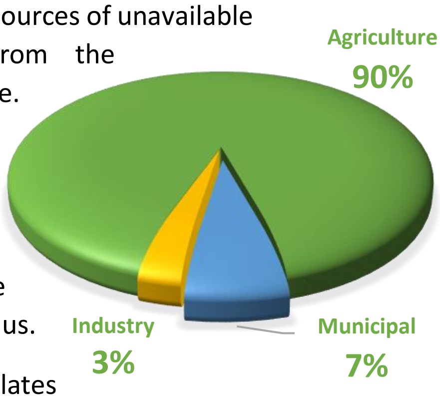
Going back to the Math,

So, 4% of World's freshwater, which is approx. 4% of 47,984,000 km^3

Thus 1,919,360 km^3 or 1,919,360,000,000,000 m^3

So 1,919,360 Billion Cu.m

Of course, this figure does not consider the glaciers, snow in the Himalayas, groundwater, and all other sources of unavailable freshwater from the earlier table. So, let's just go with global average of 0.3% available freshwater to us.



Which translates to approx. 5,760 billion cu.m available to us Indians. Did I forget to consider the ever-polluted rivers and lakes we have in abundance. For now, let's just continue ignoring that.

Countries with the Largest Agricultural Water Withdrawals

COUNTRY	AGRICULTURAL WATER WITHDRAWALS (billion m³)	TOTAL WATER WITHDRAWALS (billion m³)	AGRICULTURAL WATER WITHDRAWALS AS PERCENT OF TOTAL WATER WITHDRAWAL (%)	AREA EQUIPPED FOR IRRIGATION (m ha)	AREA EQUIPPED FOR IRRIGATION AS PERCENT OF AGRICULTURAL AREA (%)	AGRICULTURAL WATER WITHDRAWALS PER AREA EQUIPPED FOR IRRIGATION (m)
India	688	761	90	67	37	1.0
China	358	554	65	69	13	0.5
United States	175	486	40	26	6	0.7
Pakistan	172	184	94	20	75	0.9
Indonesia	93	113	82	7	12	1.3
Iran, Islamic Rep.	86	93	92	10	19	0.9
Vietnam	78	82	95	5	42	1.6
Philippines	67	82	82	2	13	3.4
Egypt, Arab Rep.	67	78	86	4	100	1.5
Mexico	62	80	77	7	6	0.9

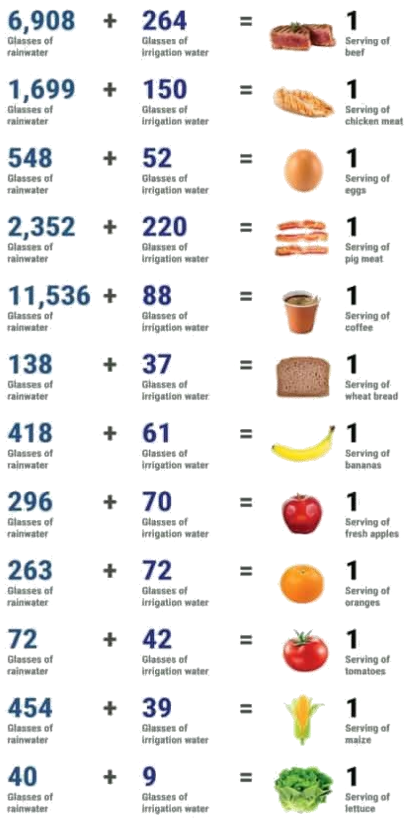
Source: Scheierling and Tréguer 2016b, based on FAO 2016a, 2016b.

The Agricultural Water Consumption

Globally, agriculture or irrigation along with livestock rearing and poultry accounts to an estimated 70% of total freshwater withdrawal. We in India use an enormous 90% of the freshwater. A 688 billion cu.m to be precise from the total withdrawal of 761 billion cu.m from our unpolluted water resources.

The Municipal or household domestic usage, on the other hand, where we strive the most to save water withdraws only 7% from the freshwater supply, a meagre 51 billion cu.m as compared to the 688 billion cu.m of agriculture.

How Much Water do you "Eat"?



The Domestic Conservation Movement

Now, let's assume with all the water conservation propaganda and the water-saving faucets and water efficient star-ratings we can achieve a conservation of 50% of domestic water. We will have conserved around 26 billion cu.m of water.

But wait, how about trying to conserve at least 10% in agriculture. A huge saving of approx. 69 billion cu.m.

A clear surplus of 18 billion cu.m. to be provided to places which still need access to water supply.

While achieving 50% conservation maybe a far-fetched dream, achieving 10% in agriculture is extremely viable and plausible.

The Urban Water Deprivation Scenario

Let's talk about the actual scenario of water supply just for the urban landscape.

We've all heard the famous quote by late APJ Abdul Kalam that "future wars will be for water". A dream he nourished of interlinking the rivers of India to make this country "Water sufficient".

Also being a part of the long-forgotten "Green Plumbers India" program it was very clear to me that depletion of freshwater supplies and resources is a pressing serious matter of concern especially for the future generations.

While we consider the fact of conserving water, in a country like India even the urban scenario suggests there is a vast majority of population which does not even have access to adequate water supply.

Extract from a study conducted by *Mr. Abdul Sharan & Mr. R.N. Sharma of Tata Institute of Social Sciences*, in seven major Indian cities: Delhi, Kanpur, Kolkata, Ahmedabad, Mumbai, Hyderabad and Madurai, paints a grim picture.

The Municipal Corporations were selected based on the population, which exceeds one million and totalling 2374 households. The cities were categorised according to five different areas, (a) high income group (HIG) areas with well-planned buildings, (b) middle income group (MIG) areas with well-planned buildings, (c) low income group (LIG) areas with well-planned housing, (d) slum areas and € mixed areas. Within these identified clusters, a random sampling of households from electoral rolls was undertaken.

In each of these cities, several clusters of the same kinds of areas can be found, hence from each cluster at least eight interviews were conducted. The data was collected through a structured schedule and the target respondents were housewives. The volume of vessels in which households stored water was measured and the number of vessels of water used in different activities was ascertained. Where running tap or piped water was used in some activities, the duration for which the tap was used was arrived at and the quantity of water per minute coming out from the tap was measured. By multiplying the time with the quantity of water per minute, the volume of water used through running taps was estimated. The quantity of water used in a toilet was assessed by volume of bucket used, and flush tank capacity.

Water requirement per section per activities and location too varies. Several factors like climate, culture, food habits, work and working conditions, level and type of development, and physiology determine the requirement of water. As per the Bureau of Indian Standards, IS:1172-1993, a minimum water supply of 200 litres per capita per day (lpcd) should be provided for domestic consumption in cities with full flushing systems. IS:1172-1993 also mentions that the amount of water supply may be reduced to 135 lpcd for the LIG and the economically weaker sections (EWS) of the society and in small towns [Modi 1998]. Besides domestic requirement, water is also demanded for commercial, industrial, and civic or public use. The IS:1172-1993 gives the total requirement of water in industrial and commercial towns with full-flushing system as 280 lpcd. The Ninth Plan (1997-2002) had advocated the requirement of water in urban areas as 125 lpcd in cities with planned sewerage systems; 70 lpcd in cities without planned sewerage systems; and 40 lpcd for those collecting water from public stand-posts.

The National Commission on Urbanisation (1988) recommended that a per capita water supply of 90-100 litres per day is needed to lead a hygienic existence and emphasised that this level of water supply must be ensured to all citizens [quoted in Ramachandraiah 2001].

Notwithstanding the IS:1172-1993 and the Five-Year Plan recommendations, we find that almost every municipal corporation/ municipality has defined the requirement of water per capita per day in its own way. One agrees that industrial and commercial development of towns and cities may differ and hence the amount of water required will also vary, but the requirement for domestic use seems unlikely to vary so much. The Municipal Corporation of Greater Mumbai (MCGM) advocates 135 lpcd as the domestic requirement of water, but the Delhi Development Authority (DDA) considers 225 lpcd per day as the water required for domestic use. The DDA further assess as a water requirement of another 75 lpcd for industrial, commercial and civic or public use, thus making the total requirement of water in Delhi 300 lpcd. This wide variation in recommendations/ prescriptions for domestic use of water seems inexplicable, particularly when both the megacities have well-developed sewerage/flushing systems.

The World Health Organisation (WHO) classifies the supply and access to water in four service categories. These categories are: (i) no access (water available below 5 lpcd); (ii) basic access (average approximately 20 lpcd); (iii) intermediate access (average approximately 50 lpcd); and (iv) optimal access (average of 100-200 lpcd) [WHO 2003; see also Bartram 2003]. Considering the fact that various agencies recommend different quantities of requirement of water for domestic use, we have taken 100 lpcd consumption (or availability, as consumption is determined by availability) as a benchmark for identifying water deficient households. It must be noted here that there is no strong basis for this benchmark but it is a rough average requirement in order to maintain a minimum standard of health and hygiene. The adjoining tables shows the results.

Table 1: Domestic Water Consumption Per Household and Per Capita Per Day
(in litres)

Cities	Per Household		Per Capita	
	Mean	Std Deviation	Mean	Std Deviation
Delhi	377.7	256.8	78.0	49.9
Mumbai	406.8	158.6	90.4	32.6
Kolkata	443.2	233.6	115.6	64.9
Hyderabad	391.8	172.0	96.2	43.8
Kanpur	383.7	286.2	77.1	58.2
Ahmedabad	410.9	224.1	95.0	54.6
Madurai	363.1	182.1	88.2	44.4
Total	398.3	220.20	91.56	51.51

Source: Calculated using data from field survey.

Table 2: Area-wise Consumption of Water Per Household and Per Capita Per Day
(In litres)

Area	Per Household		Per Capita		N
	Mean	Std Deviation	Mean	Std Deviation	
High income group (HIG) areas with well planned building	402.5	230.3	99.9	59.8	551
Middle income group (MIG) areas with well planned building	396.4	248.6	94.2	57.6	571
Low income group (LIG) areas with well planned building	393.5	176.4	90.2	40.6	552
Slum areas	398.7	216.8	81.9	41.1	530
Others (mixed areas)	400.5	222.0	91.3	53.1	530
Total	398.3	220.2	91.6	51.5	2734

Source: As for Table 1.

Table 3: Socio-economic Class-wise Consumption of Water Per Household and Per Capita Per Day
(in litres)

Socio-economic Class	Per Household		Per Capita		N
	Mean	Std Deviation	Mean	Std Deviation	
SEC- A	407.1	233.3	102.1	62.8	639
SEC- B	399.2	239.0	95.2	56.7	684
SEC- C	399.9	213.9	88.4	42.0	619
SEC- D	390.0	198.7	84.9	41.1	461
SEC- E	387.9	192.5	78.9	39.3	331
Total	398.3	220.2	91.6	51.5	2734

Source: As for Table 1.

Table 4: Water Consumption Category-wise Distribution of Households
(Per cent)

Litres/ Capita/ Day	All 7 Cities	Cities						
		Delhi	Mumbai	Kolkata	Hyderabad	Kanpur	Ahmedabad	Madurai
Below 50	17.5	29.8	5.4	11.8	9.0	33.7	19.4	17.0
50 to 75	22.6	22.1	29.4	13.5	21.6	24.4	20.8	26.4
75 to 100	25.3	20.7	34.2	22.0	32.4	17.2	21.9	26.0
100 to 135	20.2	17.2	23.6	24.3	23.4	14.2	18.8	17.4
135 to 175	8.7	5.3	5.0	15.0	8.3	6.9	12.7	10.2
175 to 200	2.2	2.2	1.4	4.8	2.3	1.3	2.2	.8
Above 200	3.4	2.8	1.0	8.8	3.0	2.3	4.2	2.3
Total	100	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: As for Table 1.

Table 5: Area and Consumption Category-wise Distribution of Households

(Per cent)

Litres/ Capita/Day	Area				
	High Income Group Area with Well Planned Building	Middle Income Group Area with Well Planned Building	Low Income Group Area with Well Planned Building	Slum Area	Others (a Mixed Area)
Below 50	19.8	17.7	13.2	21.3	15.5
50 to 75	16.3	20.5	23.4	27.0	26.2
75 to 100	21.2	26.4	31.0	24.2	23.8
100 to 135	19.2	20.0	21.4	17.9	22.5
135 to 175	12.9	8.4	7.6	6.2	8.5
175 to 200	3.8	2.1	1.4	2.3	1.3
Above 200	6.7	4.9	2.0	1.1	2.3
Total	100.0	100.0	100.0	100.0	100.0

Source: As for Table 1.

Table 6: Socio-economic and Consumption Category-wise Distribution of Households

(Per cent)

Litres/Capita/ Day	Socio-economic Category				
	SEC-A	SEC-B	SEC-C	SEC-D	SEC-E
Below 50	18.0	17.7	14.1	15.2	25.7
50 to 75	17.7	19.3	25.5	27.5	26.6
75 to 100	22.2	24.9	27.8	29.1	22.7
100 to 135	18.8	21.9	21.6	20.0	16.9
135 to 175	13.1	9.6	7.6	5.4	5.1
175 to 200	2.8	3.4	1.1	1.1	2.1
Above 200	7.4	3.2	2.3	1.7	.9
Total	100.0	100.0	100.0	100.0	100.0

Source: As for Table 1.

Table 7: Asset and Consumption Category-wise Distribution of Households

(Per cent)

Litres/Capita/ Day	Asset Class				
	Very Poor	Poor	Lower	Middle	Upper
Below 50	28.1	16.7	13.1	21.5	21.7
50 to 75	23.1	25.9	25.3	18.8	15.8
75 to 100	24.0	28.4	25.9	24.1	22.2
100 to 135	15.7	19.5	22.6	18.8	16.3
135 to 175	5.0	6.2	8.6	9.5	13.1
175 to 200	1.7	1.7	1.9	2.6	3.6
Above 200	2.5	1.5	2.6	4.8	7.2
Total	100.0	100.0	100.0	100.0	100.0

Source: As for Table 1.

Conclusion

While there still exists disparity on the fact how much water an individual is entitled to; to provide a population of approx. 134 crores with at least a 100 litres of water per day, a daily supply of 134 billion cu.m is required. Compare that to the 51 billion cu.m being currently withdrawn.

Undoubtedly, every drop saved will only go to fill up this gap. Question is what would be easier to conserve? Half of 51 billion cu.m or a tenth of 688 billion cu.m? Or both?

- Chintan Daiya