TECHNOLOGIES FOR BIO-TREATMENT OF WASTEWATER FOR AGRICULTURAL USE IN INDIA : Prospects for Application

A PRESENTATION BY:

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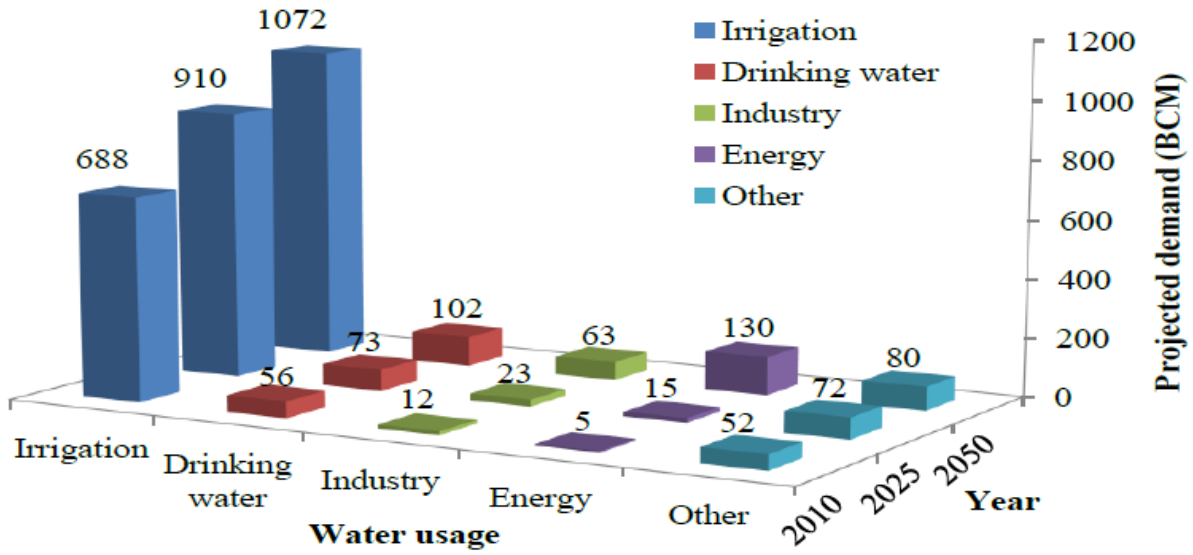
Current and future water use in India by sector



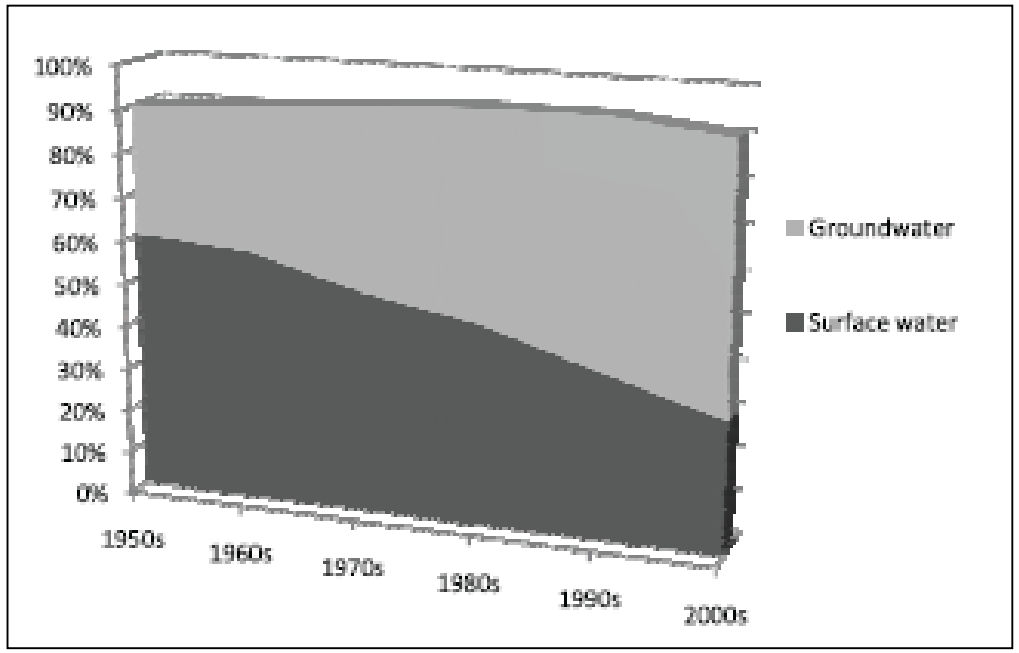
Water usage in India by different sectors

[Source: Central Water Commission, 2010. Water and Related Statistics. Water Planning and Project Wing]

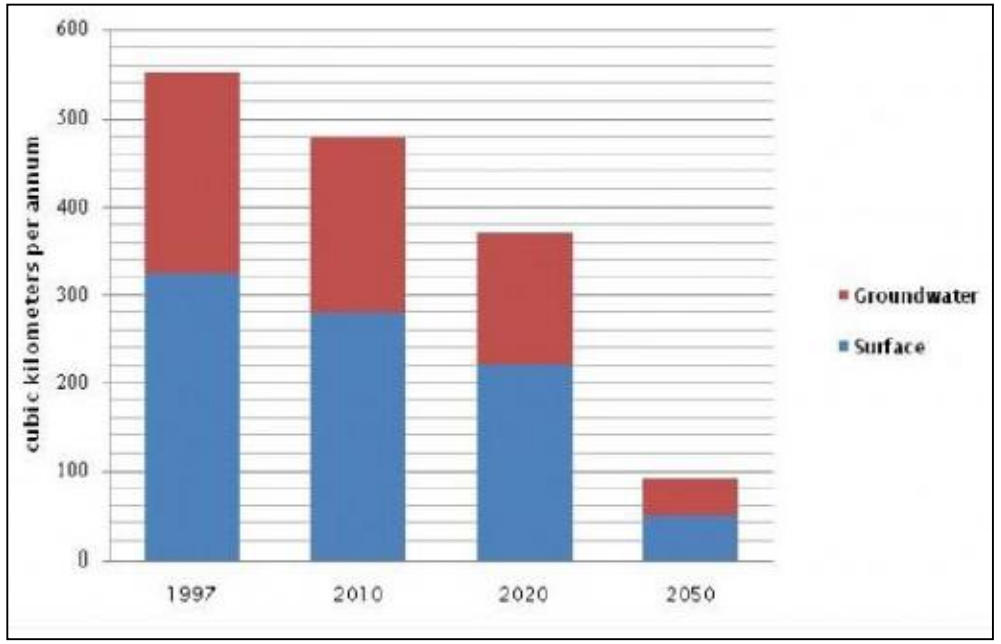
Water availability concerns

- Per capita water availability: 1545m^3/yr (estimated)*
- It will decrease to 1140m^3/yr by 2050. ……India will be in water stressed condition

(less than 1,700 m^3 is considered water stressed and less than 1,000 m^3 is considered water scarce)



Shares of ground water and surface water to net irrigated area in India

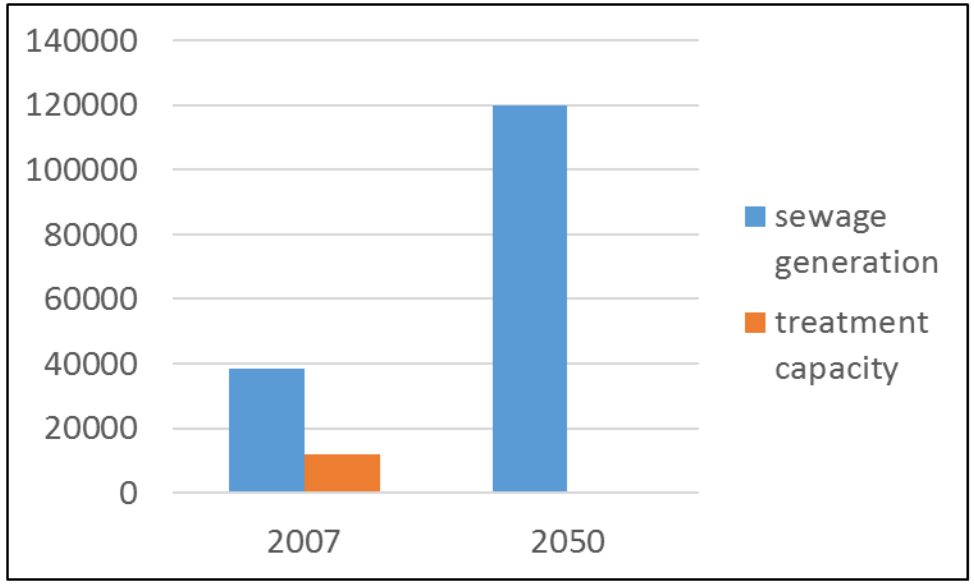


Availability of unused water resource in India

[Source: Water in India: Situation and Prospects, UNICEF, FAO and SaciWATERs, 2013]

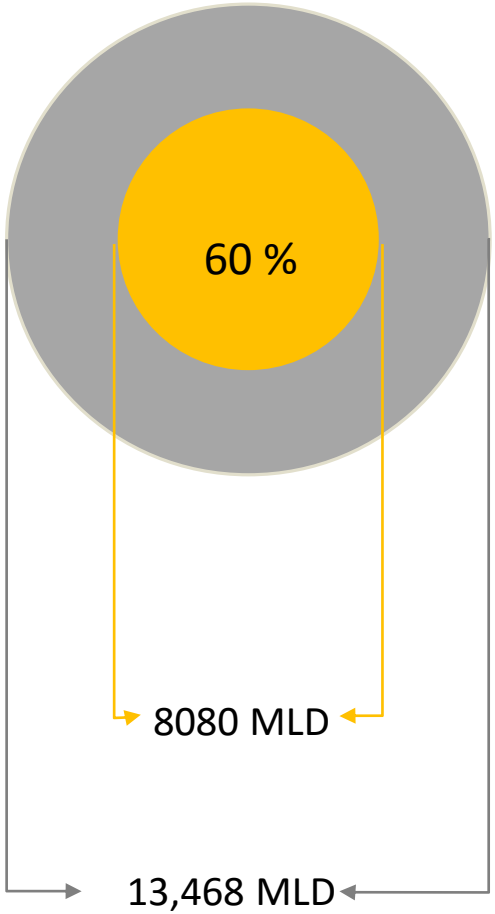
Municipal sewage generation and treatment situation

- Estimated sewage generation (Class I cities & Class II towns) : 38,524 MLD
- Existing treatment capacity : 11,787 MLD (about 30%)
- Only five metro cities have treatment capacity close to 100% of their sewage generation, these are **Hyderabad, Vadodara, Chennai, Ludhiana and Ahmedabad**.



[Source: UNICEF, FAO and SaciWATERs, 2013. Water in India: Situation and Prospects]

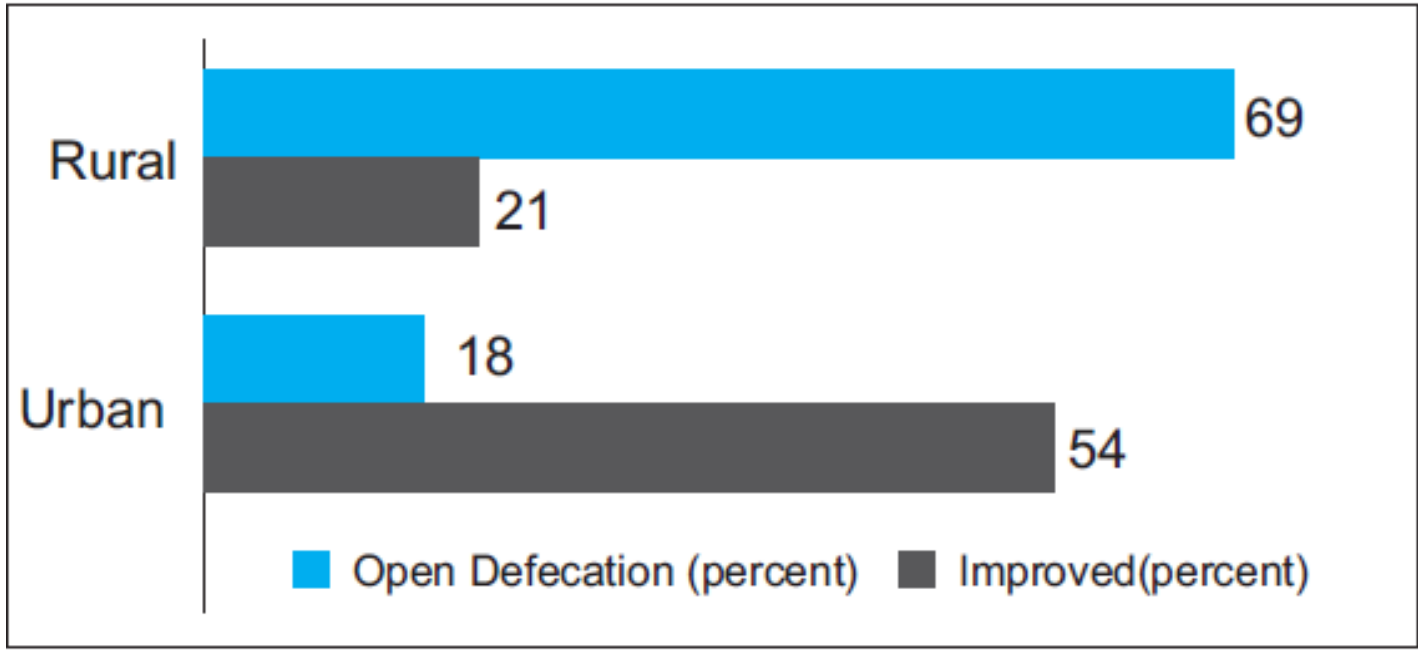
Industrial wastewater generation and treatment situation



[Source: Central Pollution Control Board, 2005. Performance Status of Common Effluent Treatment Plants in India. Central Pollution Control Board, India]

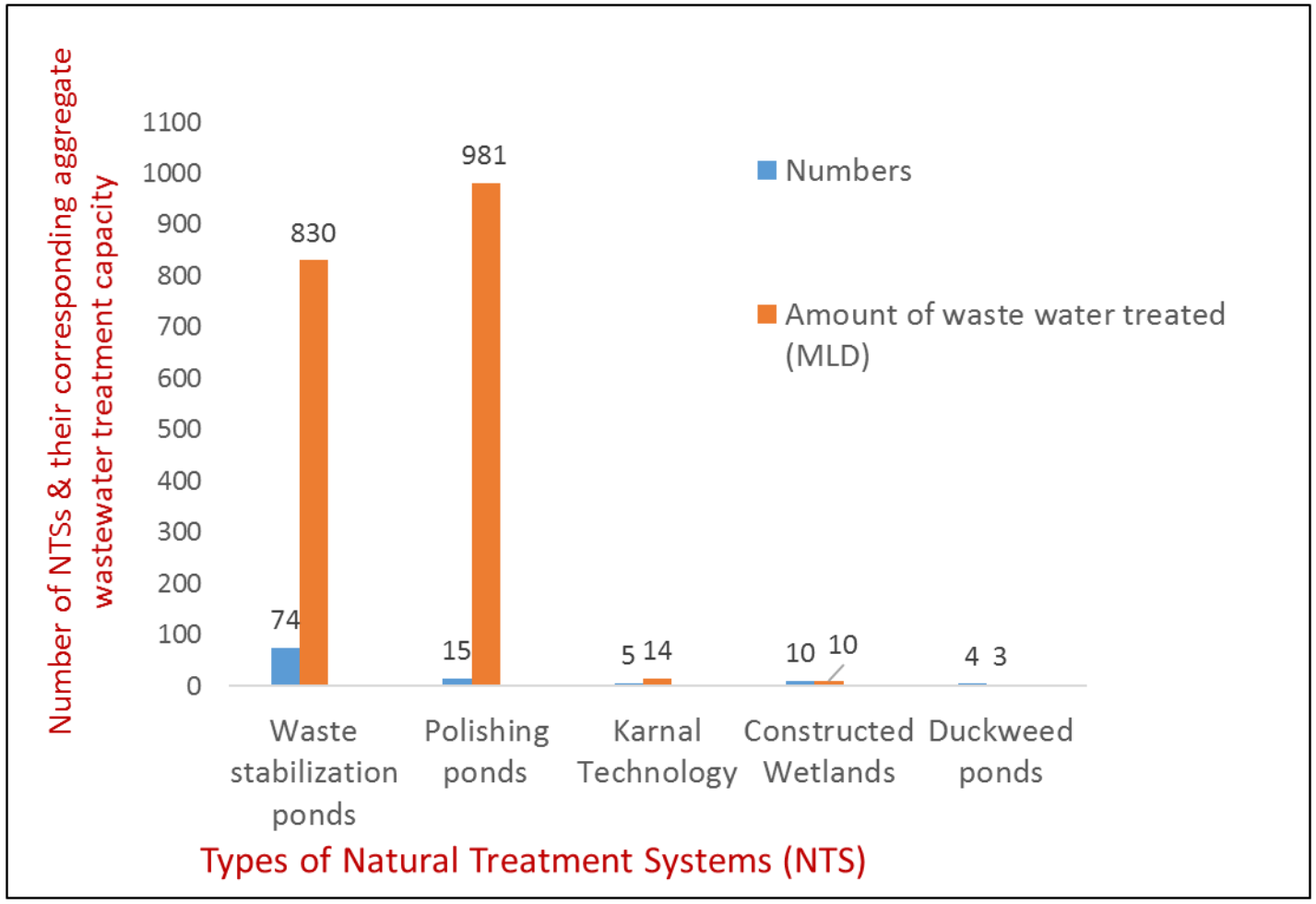
Rural sanitation situation

Estimated sanitation Coverage in urban and rural areas*



*[Source: Water in India: Situation and Prospects, UNICEF, FAO and SaciWATERs, 2013]

NATURAL TREATMENT SYSTEMS FOR WASTEWATER IN INDIA



Currently, about **1,838 million litres per day** (MLD) of wastewater is being treated using NTSs.

Of all the 108 Natural treatment systems in operation,

- 23 systems are producing treated effluents for irrigation;
- Effluents from 48 systems are being discharged into river or lake

[Source: D.Kumar et. al. , Post-treatment and reuse of secondary effluents using natural Ltreatment systems: the India practices, Environ Monit Assess (2015)]

Performance of Natural treatment systems for removal of different pollutants (in %)

Type of NTSs/ Pollutant	Constructed Wetland	Waste Stabilization Pond	Sewage Fed Aquaculture	Polishing Pond	Duckweed Pond
BOD	90	80	90	48	90
COD	78	75	78	18	65
TP	60	15	8	8	50
TKN	75	18	22	10	58
TSS	82	45	75	15	40
TCC	99	95	98	70	98
FCC	99	95	95	80	98

[Source: D.Kumar et. al. , Post-treatment and reuse of secondary effluents using natural Ltreatment systems: the India practices, Environ Monit Assess (2015)]

Advantages of CWs and NTS

- Low cost
- Simple enough to be operated by the local community while also providing employment opportunities.
- Does not require electricity
- Treated wastewater has the potential to increase farm productivity and profitability.
- Can be a potential source for reliable irrigation water supply for farmers.
- Such approaches have the potential to meet the rural sanitation goals.
- Also widely applicable for small townships, institutional campuses, small industries, etc.

TYPE OF TECHNOLOGIES BEING DEVELOPED IN W4C AND THEIR APPLICATIONS

Institution	Technology	Benefits/ Application
NEERI	Wetland at Pandherkawada (Capacity; $6m^3$)	• Farmers get treated water in all seasons. • Rural sanitation problem is solved.
ICRISAT	A CW based wastewater treatment system was established at Kothapally village of Telengana, India to treat the wastewater from 500 households	• Decentralized CW can solve the rural India sanitation problem • Provide employment for women/men self-help group in villages
MSSRF	Treating sugar mill effluent in Constructed Wetland and utilizing in an Integrated Agro Aqua Farming system (IAAF)	• Increased farm productivity and profitability without any net increase in water consumption • Aquaculture will add nutrients in organic form which may subsequently reduce the additional inorganic fertilizers application in agriculture. • Income from both aquaculture and agriculture
MSSRF	Distillery Effluent treatment by sequential biological treatment (bacteria followed by algae), followed by adsorption over activated charcoal and then polishing in constructed wetland.	• Novel and low cost approach • Bio treated DE is potential source of irrigation for edible crops without affecting crop and soil health

Implications for Nationwide rollout of CW for Rural Sanitation

- Total Rural Population of India : 884 million
- Rural Population without sanitation : 600 million (68 %)*
- One CW of capacity 6m^3 caters to : 200 people (Approx. 40 households)
- No. of CWs required to achieve total rural sanitation: 3 million
- Cost of one CW : INR 40,000**
- Total cost to construct 3 million CWs : INR 120 billion (12,000 crores)
- 2016 Budget Allocation for SBM : INR 9000 crores***
- Assuming 10 year commitment to achieve total rural sanitation, annual expenditure necessary: INR 1,200 crores
- Funding sources: Swachh Bharat Mission, NREGA, Panchayat, CSR, international donors and NGOs

**Water in India: Situation and Prospects, UNICEF, FAO and SaciWATERs, 2013*
*** Presentation by NEERI in 2nd INNOVA platform Meeting,2015*
****http://sbm.gov.in/sbm_new/*

Potential of treated wastewater for peri-urban agriculture in India

Irrigation potential with municipal wastewater from Class I and II cities in India*

Type of Wastewater	Volume of Wastewater (MLD)	Potential Irrigable Land (ha)
Treated	11,787	70,722
Untreated	26, 467	1,032,213

- Currently, untreated wastewater is widely used for peri-urban agriculture which has negative health and environmental impacts.
- Potential wastewater resource may appear negligible compared to total agricultural water use in India, but CAN BE IMPORTANT RESOURCE FOR PERI-URBAN AGRICULTURE.
- **Example from Hyderabad :**
  - Total agricultural land in greater Hyderabad region : ~ 4000 ha**
  - Potential Irrigable land from sewage generated : ~ 9000 ha ***

*Amerasinghe, P., Bhardwaj, R.M., Scott, C., Jella, K., and Marshall, F. 2013. *Urban Wastewater and Agricultural Reuse Challenges in India*. International Water Management Institute (IWMI) Research Report

** Morla Raja Krishna Murthy , S.Bindu Madhuri. *Changing Land Use pattern & Impact of Peri - Urban Agriculture in Greater Hyderabad region, Telangana State. IOSR Journal of Agriculture and Veterinary Science, Volume 8, Issue 9 Ver. I (Sep. 2015)*

*** Amerasinghe, P.; Jampani, M.; Drechsel, P. Cities as sources of irrigation water: An Indian scenario. IWMI-Tata Water Policy Res. Highlight 2012,

Potential for Industrial Applications of CW

- Breweries : ~ 70 *
- Sugar mills : 642 **
- SEZs in India : 200 ***

**All India Brewers Association www.aiba.co.in]*
*** Indian Sugar Mills Association http://www.indiansugar.com/SugarMap.aspx*
**** Ministry of Commerce & Industry http://sezindia.nic.in/writereaddata/pdf/ListofoperationalSEZs.pdf*

THANK YOU

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- Average size of household: 5 persons
- Average daily water use per person : 40 litres
- Wastewater generation per household : 160 litres (80% of water use)
- Say for 40 households :
  - Water requirement : 8,000 litres per day
  - Wastewater generation : 6,400 litres ~ 6 m^3 per day