

Water Conservation, Reuse / Recycle Policy and Reforms in NURM Cities

NURM Capacity Building Programme

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INDIA – Challenges of Water Resources

INDIA has

- 2.5% global land mass
- 4% of global fresh water sources
- 17% of global population

Challenges in Water

- Ensuring adequate potable water supply
- Water for food security, energy
- Water for economic growth thro' Industrial and Service sectors(70-80% GDP)
- Environmental Conservation & Preservation

Problems more acute in Urban areas

Growth in Water Demands

Growth in Demand for Various Sectors in 2025 and 2050

Year / Sector	Base 2010	2025	%Growth 2025	2050	%Growth (Over 2010/2025)	
Irrigation	688	910	32.3	1072	55.8	17.8
Drinking Water	56	73	30.4	102	82.1	39.7
Industry	12	23	91.7	63	425.0	173.9
Energy	5	15	200.0	130	2500.0	766.7
Others	52	72	38.5	80	53.8	11.1
Total	813	1093	34.4	1447	78.0	32.4

INDIA-Water Resources

Total Annual Water Resources	4400 BCM	Per Capita Yardstick
Available WR	1869 BCM	Adequate when > 1500-1700 m ³ ;
Per Capita(m ³) MoWR	1832 (2001) 1544 (2011)	
Utilizable WR	1123 BCM	Water Stressed when <1500 m ³ ;
Per Capita(m ³)	1100 (2001) 928 (2011)	
Surface Water	690 BCM	Water Short when < 1000 m ³ ;
Ground Water	433 BCM	

Need for Water Conservation/Reuse

- India is becoming a water short country
- Several parts already face physical shortage and several others economic shortage
- Urbanization is degrading water resources
- Urban centres biggest “point loads” of pollution
- More Water storages are difficult to add
- Conflicts with agricultural sector; Food security

Hence the need for Water Conservation;
Reuse/Recycling

JNNURM Reform Process

Reforms particular to topic are:-

- Levy of User Charges & 100% recovery of O&M costs
- Bye laws for Rain Water Harvesting
- Bye Laws for recycling/Reuse

Reform Status

- 65 Mission cities accepted the reforms
- 50 Cities made bye laws for RWH & Reuse
- But only bye laws made; implementation has not progressed. RWH has become perfunctory/ornamental while reuse/ recycling for typical urban uses has not happened. Hence the reforms have to be institutionalized and internalized in urban sectors

Water Conservation Measures

Source side

- Preservation(pollution control)
- Augmentation (RWH)
- Reuse /recycle
- Leak reduction
- Storages
- Lining / reducing evaporation

Demand Side

- Metering
- Tariff
- Differential quality & price
- Leak reduction
- Audit
- 24X7 supply

Reuse /Recycling

Quite attractive in urban/industrial setting

Urban Reuse:

- Horticulture use in public parks and recreation centres, athletic fields, schoolyards and playing fields and landscape areas surrounding public buildings, lakes and facilities.
- Dust control and concrete production on construction projects.
- Toilet and urinal flushing in commercial and industrial buildings.

Agricultural Irrigation:

- Treated wastewater used for irrigation application on land

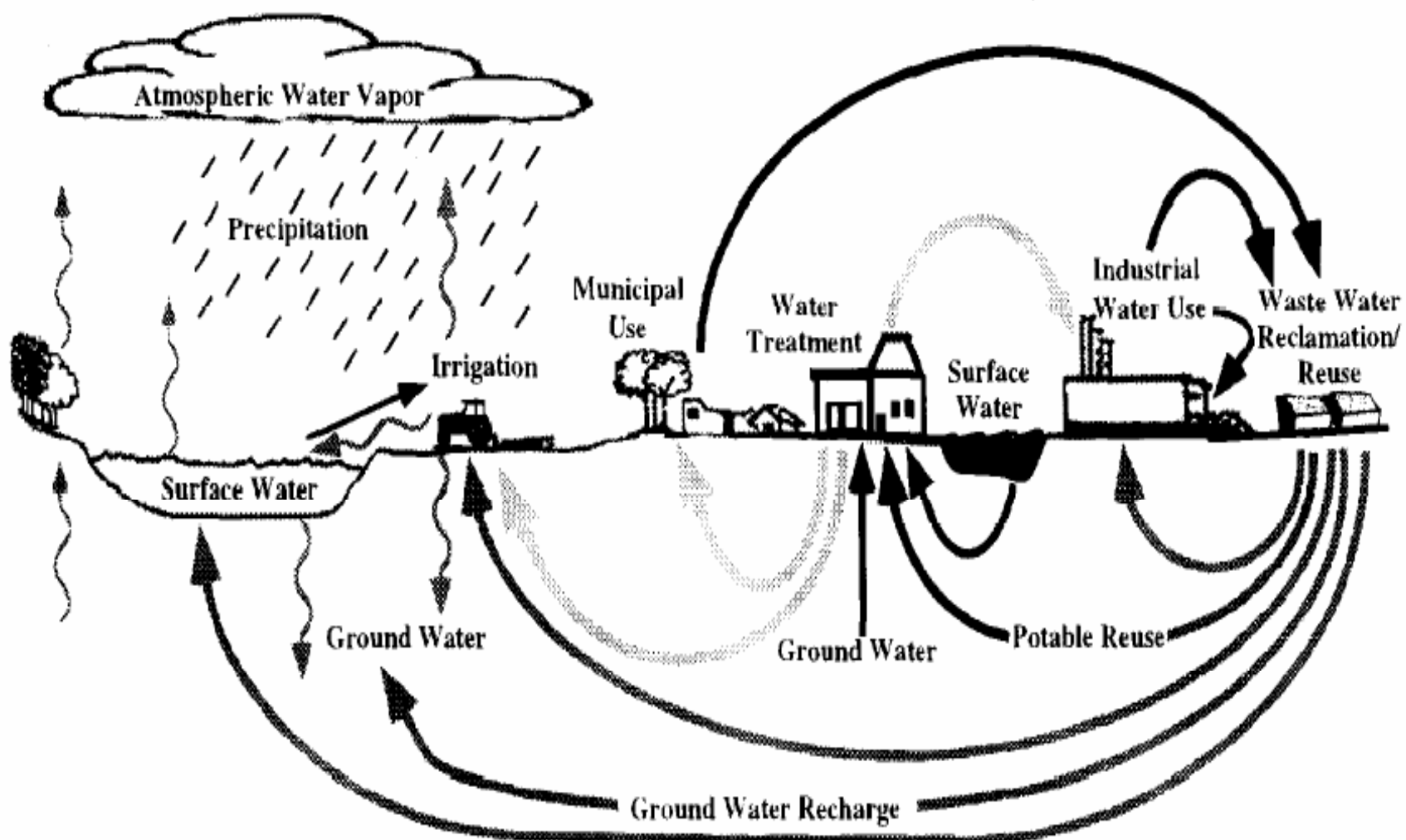
Industrial Reuse:

- Evaporative cooling water.
- Boiler-feed water.
- Process water, and
- Horticulture and maintenance of plant grounds.

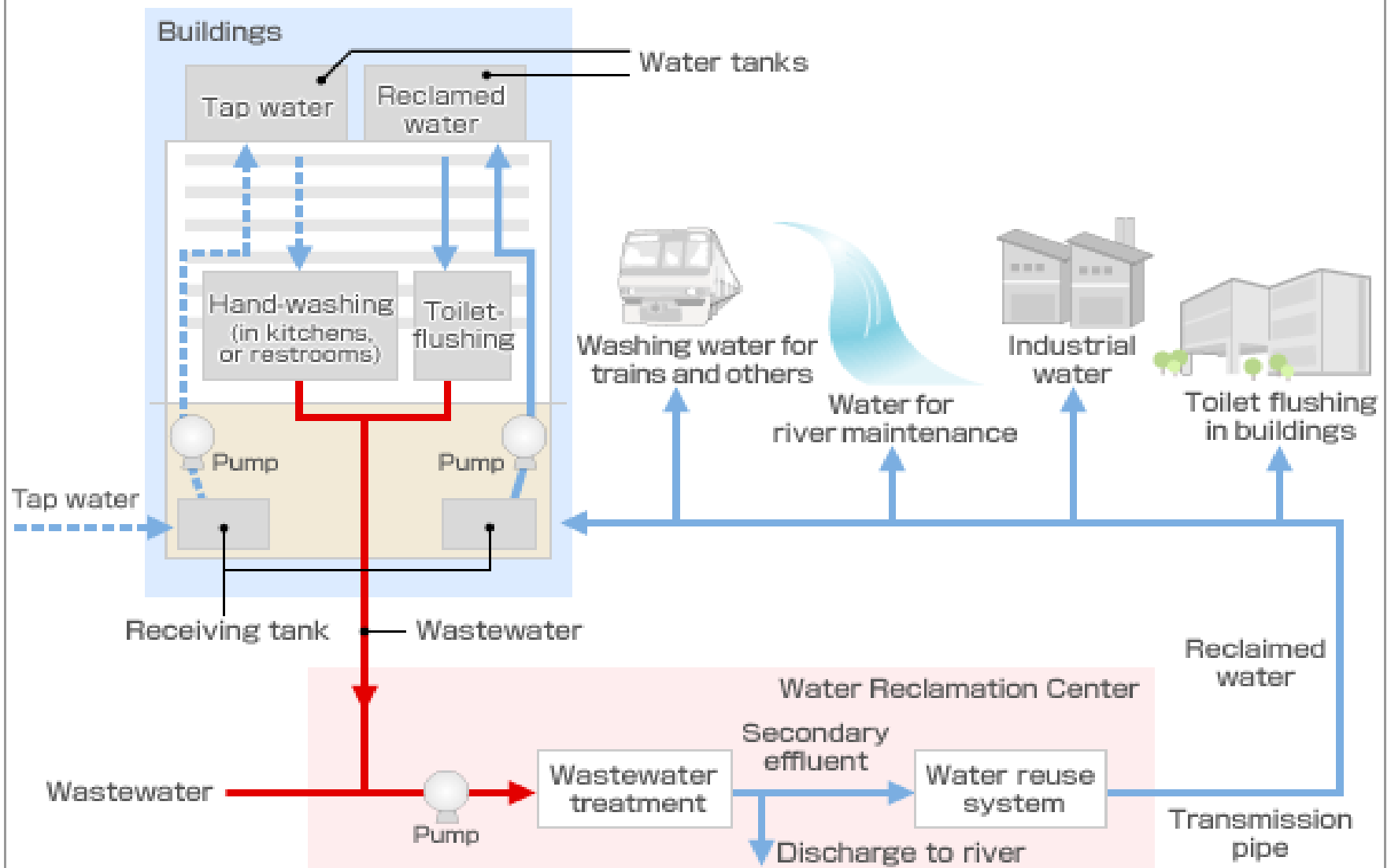
Reuse / Recycling

Attractiveness of reuse in Urban & Industrial settings:

- High volume of wastewater generation, and a large number of potential applications and large volume for water reuse, which may benefit from the economy of scale;
- Reduction in the wastewater volume to be treated by municipal wastewater treatment plants, which are energy intensive, may be over-extended and in need of expansion, which can be effectively postponed.
- The continued growth of cities is creating a double challenge putting greater stress on water resources and sanitation systems. Water reuse provides a single solution beneficial to both water supply & sewerage.
- Growing environmental concerns have impeded other solutions to water scarcity, such as long-distance water transfer, the construction of large dams, and desalination.
- Pressure on the world's water resources has been growing at rapid inexorable pace. Climate change is accentuating the pattern of droughts and floods. More communities around the world have to develop strategies to cope with scarcity.



Schematic diagram of supplying reclaimed water

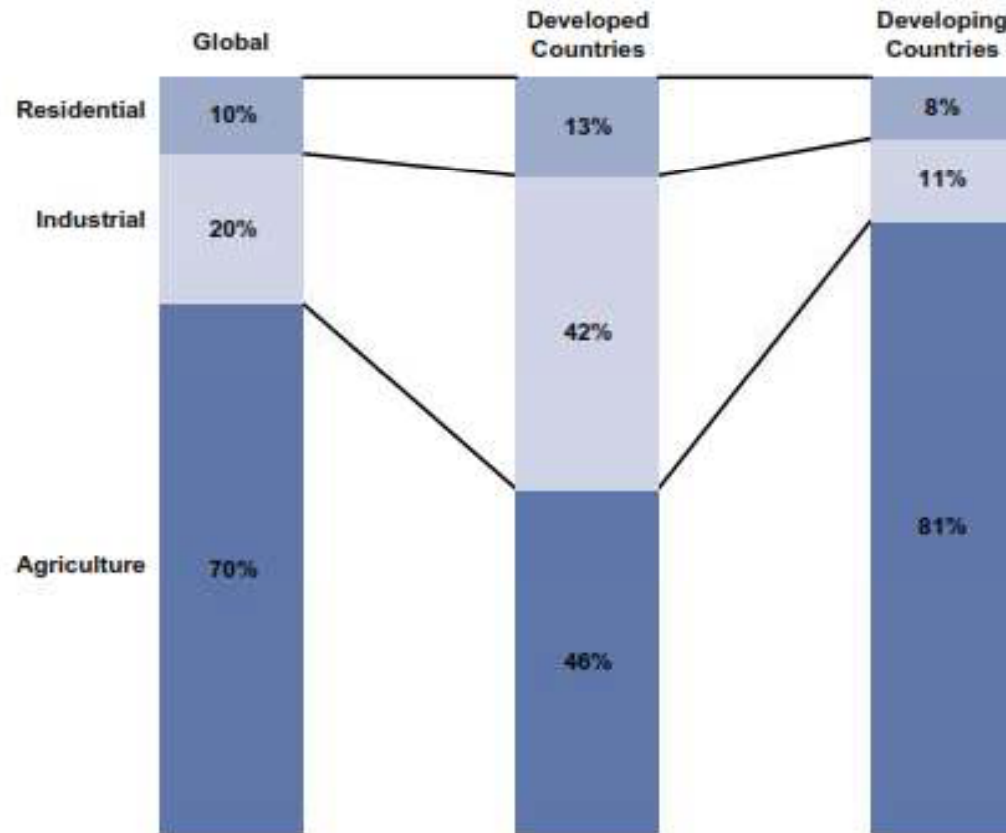


Reuse/Recycling

- **Key drivers**
- – Demand-Supply gaps
- – Urbanization
- – Regulations

Typical Water Utilisation:

Typical Water Utilisation:



Source: UN Water Development.

Issues in Reuse/Recycle

Opportunities

- Efficiency in water supply
- Wastewater reuse
- Energy from waste

Technical Challenges

- Lack of raw water
- Changing water use patterns
- Lack of adequate technical expertise

Financial Challenges

- Capital intensive (but less than desalination)
- Tariffs are too low; GW not regulated

Social Challenges

- Water is a state subject
- Water is a highly political subject (wastewater is not)

What is Wastewater Reuse?

Terminology

Water reuse

- The beneficial use of treated wastewater for agriculture, domestic, industry, etc.

Water reclamation

- Reclamation involves all processes used to treat wastewater so that it can be beneficially reused.

Water recycling

- Recycling generally means reuse of wastewater back in the same cycle where it is generated.

Considerations for Water Reuse

The foundation of successful water reuse programs:

- Providing reliable treatment to meet water quality requirements and environmental and other regulations for the intended reuse
- Protection of public health and the Environment
- Gaining public acceptance.
- Economic viability

Public Health and Water Quality Issues

Physical water quality considerations

- Turbidity, color, etc.

Chemical water quality considerations

- Chemical constituents including solids, metals, nitrogen, phosphorus, etc.

- Biological water quality considerations
- Pathogens including bacteria, helminths, virus, etc.

Emerging water quality considerations

- Pharmaceuticals, hormonal products, personal care products, other EDC's.

Water Reuse Design Criteria

- Water quality requirements
- Monitoring requirements
- Treatment process requirements
- Treatment reliability requirements
- Operational requirements
- Cross-connection control provisions
- Use / User area controls

Regulatory Water Reuse Criteria

- International Guidelines (WHO Guidelines)
- Country Guidelines and Requirements (Eg. U.S.,Canada):
 - – U.S. EPA guidelines
 - – State agency requirements and guidelines
 - – Local (county and municipal) requirements
 - – Other Guidelines
- ***India has no specific water reuse guidelines at present***
- ***Need to form specific guidelines/regulations***

WHO Guidelines

The WHO Guidelines provide for an "integrated *protective management*

- *framework for maximizing the public health benefits of wastewater, excreta and greywater use in agriculture and aquaculture."*

WHO Guidelines....

Health Component

- Establishes risk level associated with each identified health hazard
- Defines a level of health protection
- Identifies health protection measures

Implementation Component

- Establishes monitoring and assessment procedures
- Defines institutional oversight
- Requires system documentation
- Confirmation by independent surveillance

Cont'd...

U.S. EPA Regulatory Guidelines

- Disinfected tertiary effluents
 - Typical uses: *urban, crop irrigation, recreational*
 - BOD = 10 mg/L; E.C. = none, etc.
- Disinfected secondary effluents
 - Typical uses: restricted access irrigation, landscape uses, construction, wetlands, etc.
 - BOD = 30 mg/L; TSS = 30mg/L; E.C. = 200/100 mL;etc.
- **Challenges in Wastewater Reuse**
 - Funding
 - Sustainable Operations
 - – Adopting “***right or appropriate***” technology
 - – Energy Efficiencies

Canadian Two-tier proposal for reuse...

Parameter	Units	Low risk	High risk
		toilet flushing, subsurface irrigation	Landscape, laundry
BOD	mg/L	≤ 30	≤ 10
TSS	mg/L	≤ 30	≤ 10
Turbidity	NTU	$\leq 5^*$	$\leq 2^*$
Fecal coliforms†	CFU/100 ml	≤ 200	< 1
<i>E. coli</i>†	CFU/100 ml	≤ 200	< 1
Total coliforms	CFU/100 ml		<1 median 23 maximum
Cl residual	mg/L		

* Turbidity standard (continuous measurement using instrumentation) in replacement of TSS standard

Challenges in Wastewater Reuse

- Sustainable Operations
- Adopting “*right or appropriate*” technology
- Energy Efficiencies
- Lack of successful case stories
- Overcoming cultural barriers
- Funding
- Regulatory concerns
- Lack of affirmative public support

Conclusion

- Reuse/Recycle & RWH inevitable
- Business as usual is not an option
- Need to progress carefully in calibrated steps
- Reuse/recycle program is not a silver bullet but an experiment of gold standard
- Be prepared for derision & dooms day prophets
- Always have a Plan B

Thank You