CSE Regional workshop on
Energy and Resource Efficiency in
Urban Water Management

Water and Sanitation in Urban Centers: *Land and Energy Nexus*

Organized by:

- Centre for Science and Environment, New Delhi
- Kolkata Metropolitan Development Authority [KMDA]
  West Bengal

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Water Management in Urban Centers:
*Energy and Footprint Nexus*

June 20, 2013
Kolkata, WB
Practices and Choices

Open Defecation/Dry Toilets, EcoSan Toilets, and Flush (Water) Toilets

Onsite and Offsite (Sewerage) Treatment

Water Management in Urban Centers: Energy and Footprint Nexus

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Sanitation

Provision for defecation with privacy, dignity and safety while preventing the environmental contamination

Isolation of human excreta from water bodies (Surface or Under Ground)/air/soil until the same is converted into safe and usable product

Toilet is a Solution

Toilet poses a biggest Challenge

Water Management in Urban Centers:

*Energy and Footprint Nexus*
Sanitation and Waste Management

Precious drinking water is used to transport excreta into the water cycle misusing our rivers, oceans and aquifers as a sink for untreated waste.

“Drop and Store” or “Flush and Forget” Practice

Retention of solids
Infiltration of liquids

Pathogens
Nitrates
Viruses
Polluted groundwater

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Is this the right way?

Economy of Water Based Sanitation

- Consider first the large amount of water that is used just to carry away a small quantity of human excreta.
- Big Dams and tube-wells are needed to bring this water home leading to enormous environmental problems.
- Then large quantities of water that get flushed down the toilet pollute rivers and large water bodies.

Sewerage systems constitute an ecologically mindless technology.
Encourages Water Consumption

Does Not Reduce Nutrient Pollution

Requires Expensive Piped Infrastructure and Treatment Facilities

Pollutes the Earth and/or Bodies of Water with the Concept “Solution to Pollution is Dilution”

Unsustainable

Chemical Fertilizer

Present Sanitation Model

As organic fertilizer

Agriculture

Food

Chemical Fertilizer

Directly used as soil-conditioner

Wastewater Treatment Plant

Sludge

Wastewater (Blackwater + Graywater)

Untreated Wastewater

Partially Treated Effluent

Composting (2%)

Land-Filling (95%)

POLLUTION

Surface Water

Ground Water

Water Supply

Energy and Footprint Nexus

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Water Management in Urban Centers:
Issues and Concerns

• Acceptability of Dry Toilets → User Interventions; Unhygienic Conditions
• Soak Pits → Ground water pollution
• Septic Tanks/DEWATS → Septage Management (No regulations or best practices); Overflow; Pathogens!
• Sewage flow in Open Drains/Ponds/Overland
• Sewerage → Discharge in open drains/ponds/lakes/rivers with partial treatment or no treatment
Methods Adopted

- Short term measures to remedy problems superficially
- Medical Terms:
  - Giving Asprin tablet to a patient with a deadly disease, which may relieve the pain but?
  - Preventative Methodologies are necessary for long term cure
    - Depends on diagnosis
  - Understanding and Vision
Thirteen actions must be prohibited on arrival at the sacred water of the Ganga, namely: Defecation, ablutions, .......

- This doctrine has been misunderstood/inappropriately followed!

Brought the concept of BOD/COD limits → 30 mg/l/250 mg/l.

Legalized defecation in water bodies

A Paradigm Shift in Human Excreta Management Practices: Blend of Advanced Technologies with Traditional Wisdom

“The illiterate of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn.”

-Alvin Toffler

“Rethinking the Future”
The Imminent Challenges in Management of Water Resources

- Pollution due to disposal of untreated (or partially treated) sewage and sullage into natural watercourses
One usually encountered solution is to treat the sewages and wastewaters to regulatory standards and then dispose them off into receiving bodies!
The other less favored solution is to treat the sewages and wastewaters to much HIGH standards and then reuse / recycle them!
Reclamation of Wastewaters for Recycle and Reuse: A New Horizon

- The treated effluent is used as a water resource for beneficial purposes
  ------ *New and assured* water source

- The effluent is kept out of streams, lakes, and beaches;
  ------ *Reduces* pollution of natural water reservoirs
Let us Understand

- Sewerage Systems and STP
- Capital and Recurring Expenditure
- Land (Footprint) and Energy
Sewerage & Sewage Treatment (5 Lac Population) Centralized and Decentralized Systems

- **Sewerage:** Rs 500 Crores or Rs 10,000/Person or 55 Paisa/person/day
- **Pumping:** 12 Paisa/person/day (4 MW)
- **STP:** Land (5 – 7.5 Ha or 0.1 – 0.15 m²/person)
- **STP:** Energy (0.5 MW)
- **Cost:** Rs 10 Lac/day or Rs 2/day/person
- **STP:** Land (30 – 35 Ha or 0.6 – 0.7 m²/person)
- **STP:** Energy (0.025 MW)
- **Cost:** Rs 2.5 Lac/day or Rs 0.5/day/person

- Rs 3/person/day
Sewerage & Sewage Treatment (5 Lac Population) (Septic Tanks)

- Sewerage: Rs 250 Crores or Rs 5,000/Person or 28 Paisa/person/day
- Pumping: 12 Paisa/person/day (4 MW)
- STP: Land (5 – 7.5 Ha or 04 – 0.55 m²/person)
- STP: Energy (0.5 MW)
- Septic Tanks: Rs 1/day
- Cost: Rs 10 Lac/day or Rs 2/ day/person
  
  • Rs 3.28/person/day
Sewerage & Sewage Treatment (5 Lac Population)
(DWWTS or Modified Septic Tanks + Root Zone Treatment)

- Sewerage: Rs 250 Crores or Rs 5,000/Person or 28 Paisa/person/day
- Pumping: 8 Paisa/person/day (2.4 MW)
- STP: Land (5 – 7.5 Ha or 04 – 0.55 m²/person)
- STP: Energy (0.5 MW)
- DWWTS: Rs 2/day
- Rs 2.08/person/day

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Alternative Mode: EcoSan
EcoSan: A Philosophy, and not a Specific Technology

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Waste → Wealth

Modern Night Soil Industry

Compost

Employment
Agriculture boost
Environmental Protection

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Characteristics of an Ideal Toilet

- Hygienic
- Easy To Use
- Not many usable parts
- No odors
- Should be aesthetically pleasing
- No insect menace
- Require minimum user intervention
- Waste should be processed to a usable form
A Simple Device

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A Simple Device: Solid-Liquid Separator

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Start: First Toilet at IITK Campus

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Community Zero Discharge Toilet
@ Delhi Gate Police Station - Aligarh

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First Prototype Mounted on SR 08224

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Paradigm Shift

- Energy from waste (as electricity from biogas) is waste of energy
- Use human feces for producing quality Organic Manure than Biogas
- Get Urea, Ammonia, Potash and Phosphate from Urine than Fertilizer Industries

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Treatment Plant or Humanure Plant!

Mixing and Pre-composting

Excess Source Separated Flush Water
- Enhanced Solar Evaporation Pond
- Microbial Treatment
- Chemical Treatment
  - Struvite (Ca, Mg) (K, NH₄) (PO₄)
  - Co-precipitation of montgomeryite, brucite, epsomite

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Model Zero Waste House
@ Aligarh

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Model Zero Waste House @ Aligarh
Zero Discharge Toilet System
@ Maha-Kumbh – 2013, Allahabad

• Unit of 10 Toilets

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Zero Discharge Toilet System for Maha Kumbh 2013

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Zero Discharge Toilet System for Maha Kumbh 2013
Components below the Toilet

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Zero Discharge Toilet System for Maha Kumbh 2013

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Thank You!

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