Wastewater, is a valuable resource

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Wastewater is a global concern!

**Poorly managed wastewater:**
- Loss of ecosystem services & of economic opportunities
- Affects climate change - Wastewater-related emissions of methane (CH4) & nitrous oxide (N2O) more harmful than CO2.

**Properly managed wastewater:**
- Huge source of water and nutrients for crop production-
- Wastewater sludge can be used as:
  - soil conditioner/fertiliser/construction materials,
  - to generate biogas & biofuel
- But, there is a common perception that managing wastewater is a waste of energy and money.
- Or **Wastewater: a resource not a waste**
Why is it a need for reuse?

Worldwide, the new environmental paradigm is to eliminate the concept of throwing away waste and replace it with the concept of considering waste as a resource.

Focus on “Reduce, Reuse, Recycle” paradigm.

Considers both solid waste and wastewater:
- Solid waste
- Wastewater
- Feacal sludge
1- Some facts
Many drivers to resource recovery...

Water scarcity —— reuse

Water availability in decline, while agriculture accounts for more than 70% of global water use.

By 2025, half of the world population will live in water stressed areas, which makes reuse important.

Particularly in water stressed areas, an integrated water resources management is needed that involves considering waste water reuse as an important opportunity.
Wastewater --- opportunity

- An approximate estimate of global wastewater production is **1,500 km³ per day**

- **Recycling wastewater** for peri-urban agriculture already **happens around 4 of 5 cities** across the developing world

- Wastewater is estimated to directly or indirectly irrigate **about 20 million hectares** of land globally—almost **7%** of total irrigated areas

“Wastewater: tomorrow a resource rather than a problem - *Rationale for a shift in thinking*” *(Malin Falkenmark)*

Source: UN World Water Development Report 2003; Malin Falkenmark 2011; Pay Drechsel 2010
Wastewater reuse

Involves: direct use of untreated wastewater; indirect use (diluted wastewater); direct use of treated wastewater; planned wastewater reuse; unplanned wastewater; controlled or uncontrolled wastewater reuse

Wastewater reuse Advantages

- Reliable source of water (not seasonal)
- Nutrient content; reduce of demand of chemical fertilizers
- Contribution to food production; food security
- Economics gain
- Many direct and indirect beneficiaries in the chain (farmers; transporters; vendors; processors; inputs suppliers; consumers)
Wastewater --- opportunity

- Cost-recovery/ income generation
- Food security
- Environmental benefits/ ecosystem services
- Social benefits

Worldwide
Informal, private,
Traditional, modern, ...

Informal waste pickers at scattered collection points
Urban and peri-urban agriculture ...

Several options....

- **Reduce**: reduce the amount
- **Reuse**: someone’s waste used else
- **Recycle**: use in another way or process
- **Recover**: handle, keep, clean, transform, improve, return to the economy

- Many other R's: reduce, reuse, recycle, recover, repair, rethink
- **Repair**: take old and little defected things and repair them
- **Rethink**: environmentally sound management of waste
Ecological Sanitation (EcoSan) Stages (or Phases)

Waste segregation and possible utilization options. (UNESCO/IHP & GTZ, 2006)
Composting Toilets

- A composting toilet system contains and processes excrement, toilet paper, carbon additive, and sometimes, food waste.
- As a nonwater-carriage system, a composting toilet relies on unsaturated conditions where aerobic bacteria break down waste.
Integrated approaches....

Electricity generator by Biogas

Swine waste

Food

Methane Combustion = CO₂

Duckweeds Lagoon

CH₄ → CO₂
Some examples......

Decentralized Wastewater Management at Adarsh College - India

This School Project is a Pilot Project demonstrating alternative decentralized sanitation solutions to the Badlapur Municipality Council. The Council plans to replicate the concept in other areas after evaluating the findings of decentralized reuse-oriented school sanitation project.

The number of students attending Senior and Junior College is about 1,400 and 1,200 per day, respectively.

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- pour-flush toilets
- urinals
- biogas settler; anaerobic baffle reactors; up-flow filter; constructed wetland; pond
- storage
- kitchen garden, irrigation, cooking
- liquid fertilizer

Applied sanitation components
Decentralized Wastewater Management at Adarsh College, India

- Urine from boys waterless urinals 300l/d
- Black-and-Greywater 400 user x 20 l = 8m³
  - BOD 1500mg/l
  - COD 3000mg/l
- Anaerobic Baffled Reactor
  - Biogas → cooking or lighting: 6.8m³/d
  - Fail-safe overflow
- Anaerobic Filter
  - 8m³/d
  - BOD out: 22mg/l
  - Gas production: max. 20cm WC
- Anaerobic Filter
  - 8m³/d
  - BOD out: <20mg/l
  - Gas production: max. 3m³/d
- Biogas Settler
  - 8m³/d
  - BOD out: 900mg/l
  - Gas production: 3m³/d
  - Gas pressure: max. 45cm W.C.
- Horizontal Flow Wetland
  - 8m³/d
  - BOD out: <20mg/l
  - Capacity: 12m³
- Water Landscaping: 5.6m³/d
- Feecal sludge for co-composting → Agriculture 9.75m³/y
- Urine as N-rich fertilizer → Agriculture 300l/d
Some pioneers...

- Potable water use.....Namibia, Singapore
- Groundwater recharge........Iran, Namibia
- Irrigation..................Israel, many African countries
- Industrial reuse............UK
- Energy production...........India
Better wastewater management at the local and national levels needs updated national data and wastewater management strategy and national and local levels.

Wastewater is a valuable resource that needs:

- Implementation of collection, treatment, and regulated use of treated wastewater
- Monitoring systems and implementation of WHO guidelines
- Skilled human resources and institutional capacity
- Pertinent and flexible policy frameworks
Thank you for your attention