

Selection of Environmentally Sound Technologies (ESTs) for Wastewater Management

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International Environmental Technology Centre

Brief Introduction of UNEP IETC

1. Established in Japan in 1994

- ✓ Part of the UNEP Division of Technology, Industry, and Economics: located in Shiga and Osaka, Japan
- ✓ Facilitates the adoption of environmentally sound technologies (ESTs) and management approaches through field projects (pilot demonstrations), capacity building, policy dialogue
- ✓ Innovative and effective initiatives: 2007 UN21 Award Commendation for carrying out one of 15 top projects in the UN family

2. Three pillars of activities:

- ✓ Water and Sanitation
- ✓ Sustainable Consumption and Production with a special focus on waste management / 3R initiative
- ✓ Disaster Prevention and Management

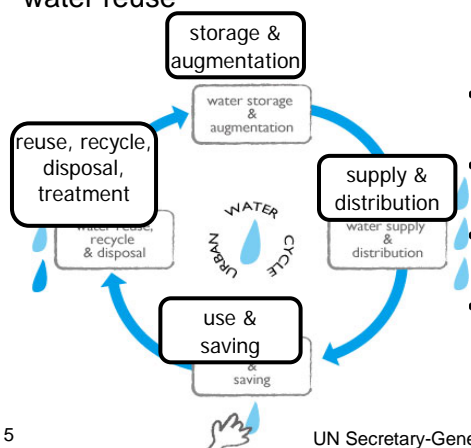


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Different Ways, Choices and Impacts

- Different methodologies for selecting and assessing options
- Choices have impacts on water cycle, nutrient cycle, ecosystem
- Choices have impacts on equity: how many are served? how much?
- Key elements of sanitation still “forgotten”: waste water treatment & water reuse



Sanitation/WW management choices can be influenced by:

- Technologies for water storage and augmentation
- Technologies for water supply and distribution
- Technologies for water use and saving
- Technologies for water reuse, recycling

References:

UNEP, Every Drop Counts: Sourcebook (2008)

UN Secretary-General's Advisory Board on Water and Sanitation (2009)

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Key Criteria for Technology Selection

Different methods and tools for technology assessments and selection have different criteria. Main ones may include:

- **Technical criteria:** pollutant removal efficiency, process stability, construction requirements, operation and maintenance requirements, monitoring and evaluation needs, scalability and replicability
- **Environmental criteria:** impacts on water cycle, impacts on nutrient cycle, resource usage, risk levels for workers and communities, biodiversity and ecosystem impacts, climate change concerns and opportunities
- **Socio-cultural criteria:** community demand and involvement, gender concerns, hygiene practices, labor needs
- **Institutional criteria:** compliance with local/national laws, linkage with multilateral environmental agreements (MEAs), policy constraints and opportunities
- **Economic/financial criteria:** capital and maintenance costs, financing, cost recovery potential, incentives, benefits

References:

UNEP, Environmental Sound Technologies in Wastewater Treatment (2001)

Brikke and Bredero, Linking Technology Choice with Operation and Maintenance in the Context of Community Water Supply and Sanitation, for WHO and IRC Water and Sanitation Centre (2003)



How to Facilitate Technology Selection and Assessment?

Key concern: stakeholders may not be familiar with available alternatives and their applicability

- Decision-making support resources: needed to make informed and effective choice and to assess local suitability of options for replication
- Many available decision-making support resources: over 120 water-sanitation resources identified and recently analyzed, categorized as evaluation tools, process guides and documents, technical briefs and references, policy papers
- None of them is perfect: while there are effective resources, there is no single all-purpose decision-support system
- Frequently missing or limited elements: wastewater treatment, effective user interface, social implications, regional characteristics, cost and financing information, hygiene approaches, replicability, evaluation and monitoring

References:

Palaniappan, Lang, and Gleick, A Review of Decision-Making Support Tools in the Water, Sanitation, and Hygiene Sector (2008)



UNEP's Efforts in Environmentally Sound Technology Decision-Making Support

Tool development: Sustainability Assessment of Technologies (SAT)

- To help assess implications of using a technology and ensure consideration of alternative options
- To enable technical, environmental, and social evaluations
- To facilitate selection of possible or feasible technology options
- Tier 1: Compliance screening with yes/no questions
- Tier 2: Scoping based on qualitative and quantitative data to rank
- Tier 3: Detailed assessment encompassing qualitative and quantitative indicators

Publications and guidelines for decision-making support

- International Source Book on Environmentally Sound Technologies (ESTs) for Wastewater and Stormwater Management, UNEP/WHO/UNHABITAT Water Supply and Sanitation Collaborative Council (WSSCC), etc.

Pilot projects:

- Brazil, Iraq, Jamaica, etc. to identify suitable ESTs and assess their performance

Training courses

Policy support



UNEP's Example in Technology Assessment: Iraqi Marshlands Sanitation Pilot Project

Objectives of pilot project:

- To assess environmentally sound technology options for sanitation provision in rural areas of the Iraqi marshlands

Situation:

- No specific sanitation method used in 61% of marshland villages surveyed (others used pit latrines and/or have access to sewerage)
- Residents use areas near homes to dispose of human feces and wastewater
- More than 1/3 of surveyed villages use nearby marshes to get drinking water
- Limited availability of electricity

Technology assessment used:

- To conduct preliminary comparison of technology system options
- To conduct in-depth analysis of selected technology system (SAT methodology)

3 pre-conditions for local implementation:

1. Demonstrated demand and support for intervention from communities and leaders
2. Pledge of security provision by communities
3. Endorsement by all stakeholders from local, state, and national levels



Example: Iraqi Marshlands Sanitation Pilot Project

- Implemented in Al-Chibayish community, facing health hazards from untreated wastewater discharge

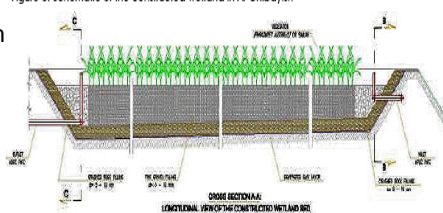
Sanitation system:

1. Uses "constructed wetlands" EST
2. Regulates flow of wastewater through gravel beds planted with reeds
3. Removes organic nutrients and pollutants through biochemical processes in the root zone and plant uptake

Key system features:


- Provides sanitation for approximately 170 inhabitants, with surface area of 540 m²
- Utilizes plants available from nearby marshes
- Has simple operations and maintenance
- Handed over to local university for research and training

Figure 5: Schematic of the constructed wetland in Al-Chibayish



UNEP SAT Application Detail

Tier 1 screening	<p>4 criteria total</p> <p>Compliance with local environmental laws or guidelines, compliance with national environmental laws, compliance with MEAs, meeting project objectives</p>
Tier 2 Scoping	<p>5 components, 32 criteria total</p> <p><u>Technical suitability:</u> compatibility with local conditions (geographical and climate, including settlement patterns and density), local material usage, availability of expertise, track record on performance, technical knowledge requirements, compatibility with existing situation, adaptability to future situations, process stability, estimated useful life, pollutant removal efficiency</p> <p><u>Environment – health & safety risks:</u> risk levels for workers, communities, biodiversity...</p> <p><u>Environment – resources and emissions:</u> resource usage, energy consumption, renewable energy, water consumption, resource augmentation capabilities...</p> <p><u>Economic/financial aspects:</u> capital investments, O&M costs, benefits</p> <p><u>Sociocultural aspects:</u> acceptability, extent of resettlement/rehabilitation, etc.</p>
Tier 3 Detailed assessment	<p>3 components, 18 criteria total</p> <p><u>Environment – resources and emissions:</u> land/space requirement, labor requirement, energy consumption,, emissions, etc.</p> <p><u>Economic-financial aspects:</u> capital costs, O&M, benefits (nutrients and energy reclaimed, carbon credits, etc.), financial incentives</p> <p><u>Economic viability:</u> NPV, payback period...</p>



SAT Applications for Iraqi Marshlands Sanitation Pilot Project

SAT applied for in-depth analysis of applied technology to inform future decision-making on EST selection and replication in Iraq


[Snapshot of SAT applications](#)

for each criteria, indicators and ratings are given, with descriptions

Overall performance of the selected EST system:

- It met local environmental needs and was suitable for socio-economic conditions
- It produced positive environmental and socio-economic benefits, particularly through the reduction of health risks, reduction of wastewater discharge and increased employment opportunities (for further detail, see: <http://marshlands.unep.or.jp>)

GROUP HEADING	CRITERIA	INDICATORS	RATING	NOTES
Tier 1: Screening				
Compliance	Compliance with local environmental laws	Yes / No		Not applicable (no specific local laws)
	Compliance with national environmental laws	Yes / No	Yes	Comply with effluent standards of MOE
	Compliance with Multilateral Environmental Agreements (MEAs)	Yes / No	Yes	Not applicable
Other Requirements	Meeting the objective (RO)	Yes / No	Yes	
Tier 2: Scoping				
Technical suitability	Compatibility with local natural conditions (geographical, climate)	Low / Medium / High	High	Suitable technological solutions for small rural communities Native species of seeds used for nutrient removal, growing in optimal conditions
	Extent of local materials usage	Low / Medium / High	Medium	Construction materials coming from other locations inside Iraq Pumps and generators procured from outside Iraq Native species of seeds used for nutrient removal
	Availability of local expertise	Low / Medium / High	Low	Installation and start up performed by contractors Operational training provided to local personnel to increase availability of local expertise
	Track record on performance	Low / Medium / High / Not available	Low	First time application of technology inside Iraq for pilot/demonstration purposes Regular monitoring of water quality/ outflow to accumulate performance records for Iraq
	Technical knowledge requirements (qualifications / special knowledge needed)	Low / Medium / High	Medium	Operation and maintenance: UG (inadequate level)
	Compatibility with existing sanitation technology	Low / Medium / High	High	No existing wastewater management system prior to the installation of this system, no compatibility problems



Where to Go from Here...

Technology selection/assessment is integral to improve sanitation

But more is needed:

- Decisions are not made based solely on guidelines and assessment tools
- Technology selection and assessments need to address key criteria, including environmental, socio-cultural, technical, institutional and economic/financial issues
- Options must suit local conditions and enable recycling/reuse of water and nutrients
- Partnerships are crucial to share experiences and learn about promising technologies, tools, and support mechanisms
- Linkages with other technology transfer frameworks (i.e., MEA technology needs assessments) merit further insight



Where to Go from Here...

Technology selection/assessment is integral to improve sanitation

Our focus for 2010-11 and beyond:

- Focus on Environmentally Sound Technologies (ESTs) that enable nutrient and water recycling, esp. decentralized approaches
- Develop a partnership platform for water and sanitation ESTs
- Assess successful and challenging examples of water and sanitation technology implementation using the refined Sustainability Assessment of Technology (SAT) tool
- Facilitate EST transfer through methods that are MEA-relevant, including climate change
- Help countries assess role of trade for EST access
- Support municipal level water and sanitation initiatives to advance best practices through capacity building and demonstration projects on use of appropriate tools



Thank you

For more information, please access:

www.unep.or.jp

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