FACT SHEET

Decentralized wastewater management

Key points

- ***A conventional centralized wastewater management system is critical at regional levels. But the centralized system is generally supply-led and requires massive energy consumption and a high level of technological knowledge.***

- ***A centralized system often does not fit into local wastewater treatment needs. A decentralized system is a supplementary option for making wastewater management more available while reducing costs and resource use.***

Decentralized wastewater management explained

Decentralized wastewater management refers to wastewater collection, treatment and disposition (discharge, reuse and dispersal) by appropriately scaled systems at local levels. As the following diagram illustrates, it can vary from onsite to a cluster to a centralized system. An appropriately localized system can save costs, water and materials.

Figure 1: Various wastewater management systems

Onsite treatment

Household-level treatment. Efficient for sparsely populated areas to supplement the centralized system.

Cluster system

Community-based management. Suitable for sparsely populated areas or low-income communities to share intial costs.

Centralized plant system

Massive energy is required for piping wastewater. Not always susitable or affordable for remote areas and poor communities.

Source: Victor A. D'Amato, PE and J. Trevor Clements, *The Role of Distributed Infrastructure Approaches in Sustainable Water Resource Management* (Research Triangle Park, North Carolina, Tetra Tech, Inc., 2009). Available from www.ncsafewater.org/Pics/Training/AnnualConference/AC09TechnicalPapers/AC09_SpecialTopics/ST_T.PM.5.00_DAmato.pdf (accessed 22 February 2012).

How it works

A decentralized wastewater management system has three primary objectives: 1) improve public health, 2) conserve energy and water and 3) protect the environment.

Community and household wastewater management is critical to reduce waterborne diseases, such as diarrhoea, and improve public hygiene. At the same time, decentralized wastewater management contributes to avoiding water losses and saves energy consumption. In particular, the decentralized system requires less energy than a centralized system, which uses extensive energy for piping. Also, in a decentralized system, the treated water goes to nearby leach fields and possibly back into the stream or is reused within houses and communities, following somewhat the natural water cycle and thus washing in environmental benefits.

The basic concept of a decentralized system is that smaller, more tailored systems can better operate more closely with users' wastewater treatment needs at a local level. Large, centralized plant systems are still impor-

tant. But the addition of decentralized services close to demand reduces costs and the technological requirements. The greater sensitivity to the local context also allows systems to take advantage of low-cost and site-specific opportunities – systems are matched to specific needs.

Strengths with decentralized wastewater management

- **Economic:** A decentralized wastewater system is generally more cost-efficient for sparsely populated or impoverished communities because it does not require massive water piping and high technology. Residents and developers can assess their needs and conditions and thus avoid unnecessary costs, such as effluent piping costs.
- **Health:** Appropriate wastewater management is necessary to reduce waterborne diseases. Such diseases, particularly diarrhoea, which causes 2 million deaths a year among children younger than 5 years,[1] are preventable with a wastewater treatment system. Unlike the centralized system, which requires high investment and technology, the decentralized model more affordably reaches poor communities.
- **Environmental:** The decentralized system treats and discharges wastewater close to the source, thus maintaining a balanced natural hydrological cycle. This circulation is beneficial for conserving ecosystem productivity. It also saves energy consumption because the centralized system needs to pipe huge amounts of water to distant treatment plants, while the decentralized system relies only on small pipes that use less energy.

Challenges to implementing decentralized wastewater management

- **Lack of local capacity:** A community's lack of technical and management capacity is a major issue. Often, uncertainty to new technology stimulates unwillingness to adapt to the system.
- **Lack of institutional arrangement:** Fragmentation and overlapping of systems are critical barriers. Lack of coordination among government and local officials typically causes such problems. This can stem from the poor integration of the wastewater treatment system and the water supply system. An unfavourable regulatory climate does not help either; because wastewater management is closely related to public health, the regulatory framework is particularly significant.
- **Limited financing:** Financial constraints are major hurdles to expanding coverage, especially when it affects the rewards and incentives for engineers and users. Although public institutions provide the wastewater treatment services, local public authorities may not have the financial capacity to install the decentralized system.

Implementing strategies

Focus on local capacity development: Because the system is decentralized, communities are more integral to the management, and their capacity to install and maintain the system is paramount. Capacity development includes technical training, workshops and educational campaigns. It is also imperative that communities choose technically, economically and socially appropriate technologies that respond to their needs. Simple and affordable technology is favourable for the sustainable use of the system. For example, the green school project in the Republic of Korea underscores the importance of ensuring social acceptance for an onsite water recycling system by offering environmental education to students through the installation of an eco-friendly water system in schools.[2]

[1] United Nations Children's Fund website "Diarrhoea: Acute Diarrhoea Still a Major Cause of Child Death" (6 May 2008). Available from www.unicef.org/health/index_43834.html (accessed 2 February 2012).

[2] Soon-Myung Hong, "Integrated rainwater & wastewater recycling system: Green school projects", a paper presented at the Third Regional Workshop on Development of Eco Efficient Water Infrastructure for Green Growth in Asia, Bangkok, 23-25 November 2010. Available from www.unescap.org/esd/Energy-Security-and-Water-Resources/water/projects/eewi/workshop/3rd/documents/Presentation/Session%202-part2/Green%20School%20-%20EREDE.pdf(accessed 2 February 2012).

Secure the institutional arrangements: Although the system is decentralized, public authorities remain responsible for the comprehensive management. This includes a favourable institutional arrangement to regulate and monitor local activities. Setting appropriate criteria and monitoring schemes are critical for protecting the quality of treated water. Because wastewater management critically matters to public health, the regulatory framework has to achieve greater uniformity. In the institutional arrangement, it is beneficial to integrate the wastewater management into other water sector planning, especially water supply and resource management. The minimizing of wastewater is an effective first step for wastewater management.

Seek innovative financial mechanisms: Innovative financial strategies create financially enabling conditions, such as a multi-sourced financing scheme or public-private partnerships. Because wastewater management involves a variety of actors, including the business sector, multiple funding from several agencies is possible, and cooperation between the public sector and private sector is beneficial.

A decentralized system does not replace the centralized wastewater treatment. Its application is based on the condition-specific consideration in terms of system appropriateness and sustainability.

Examples

In the town of Hill End in New South Wales, Australia, significant amounts of effluent were piped about 3 kilometres over a mountain to the distant evaporation ponds. The surcharged wastewater then flowed into the surrounding areas from the evaporation ponds during rainstorms and consequently contaminated the groundwater. To prevent the wastewater from discharging into the environment and to minimize the export of wastewater from the town, the Hill End city authority installed a local wastewater treatment system and a water reuse scheme at low cost.[3]

Further reading

Alternative Waysof Providing Water: Emerging Options and Their Policy Implications, by X. Leflaive (Paris, Organisation for Economic Co-operation and Development, 2007). Available fromwww.oecd.org/dataoecd/53/38/42349741.pdf

Decentralized Wastewater Treatment Systems: A Program Strategy (Washington D.C., United States Environmental Protection Agency, 2005). Available from http://cfpub.epa.gov/owm/septic/septic.cfm?page_id=263&sort=name&view=doctype_results&document_type_id=2.

Guidelines on Municipal Wastewater Management (Hague, United Nations Environment Programme, World Health Organization and United Nations-Habitat, 2004). Available from http://esa.un.org/iys/docs/san_lib_docs/guidelines_on_municipal_wastewater_english.pdf

The Role of Distributed Infrastructure Approaches in Sustainable Water Resource Management, by Victor A. D'Amato, PE and J. Trevor Clements (Research Triangle Park, North Carolina, Tetra Tech, Inc., 2009). Available fromwww.ncsafewater.org/Pics/Training/AnnualConference/AC09TechnicalPapers/AC09_SpecialTopics/ST_T.PM.5.00_DAmato.pdf

[3] United Nations Economic and Social Commission for Asia and the Pacific, *Genetic Guidelines to an Eco-efficient Approach to Water Infrastructure Development* (Bangkok, UNESCAP and KOICA, 2011).