APPLYING SANITATION VALUE CHAIN APPROACH TOWARDS APPROPRIATE WASTEWATER AND FAECAL SLUDGE MANAGEMENT IN THAILAND

This Policy Brief is jointly prepared by the Institute for Global Environmental Strategies (IGES), National Institute for Environmental Studies (NIES) and Asian Institute of Technology (AIT).

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KEY MESSAGES

- It is important to define "sanitation" more broadly considering the whole sanitation service chain. This is because it is not only downstream populations, but the entire community that must be protected from discharge of untreated waste, including wastewater (both black and grey) and faecal sludge (FS) generated from on-site sanitation systems (OSS).
- Cesspools (about 90% of OSS) are the major contributor of domestic wastewater pollution, due to leaching of liquid effluent. Therefore, upgrading these existing cesspool systems by sealing the bottom, introducing a proper faecal sludge management (FSM) system or by fully replacing them with reinvented toilet technologies are strategic and long-term solutions not just from the management and technological point of view but also for monitoring and containing the COVID-19 pandemic.
- It is reported that only about 27% of generated wastewater (black and grey combined) is safely treated at 105 centralised wastewater treatment plants across Thailand, whilst the remaining 73% is discharged into receiving water bodies. One of the main reasons for this low ratio of wastewater treatment is the requirement of huge investment costs for construction of centralised wastewater treatment plants, which are often not financially viable for the short and medium term.
- Closing the gap requires a solution that is less capital intensive. Decentralised wastewater treatment systems can be integrated as an effective way to supplement the centralised system, due to their competitive advantages of cost, area availability and just-in-time nature, thereby improving wastewater management, especially in urban and peri-urban settings.
- There should be zoning of areas for different on-site sanitation system schemes with FSM i.e. decentralised, and centralised or a combination of these, considering various local factors such as population density and land availability.
- Overlapping institutional roles should be resolved through proper capacity building of the institutions and frequent policy dialogues among responsible ministries and governmental agencies.
- Community involvement is encouraged in determining the appropriate treatment systems based on local capacity and reuse options. Periodic surveys should be carried out to check willingness to pay and streamline the stepped tariff increment, while policy stimulus is required to establish standards for FSM and to streamline tariff collection process for both wastewater treatment and FSM services.
- Private sector involvement should be encouraged, while the government needs to create an enabling environment for private investment and ensure good returns.

OVERVIEW

- Thailand is at the heart of Southeast Asia with nearly 64 million inhabitants. Although there has been significant improvement in sanitation in terms of limiting direct human contact with excreta and achieving 99.8% coverage for safe sanitation by 2017, the country still faces drawbacks in terms of second-generation waste management, that is, management of faecal sludge (FS) and wastewater. This is due mainly to the lack of effective government administration and limited treatment facilities. Therefore, policy intervention is required to establish standards for wastewater and faecal sludge management (FSM), as well as to streamline the tariff collection process. Apart from institutional improvements, it is important to raise awareness among the public to ensure their fullest cooperation in implementing sanitation-related legislation and practices.

Wastewater Sector's Performance in Thailand

- In Thailand, Decentralized Wastewater Treatment Systems (DEWATs) are usually comprised of on-site and clustered systems. However, the size of community or area of catchment is not specifically defined for clustered systems so there is no specific definition of DEWATs. Clustered wastewater treatment systems obtain their name or status based on treatment capacity of different organisations. For example, based on the list of treatment technologies provided by Thailand's Pollution Control Department (PCD), under the Ministry of Natural Resources and Environment (MONRE), the capacity of clustered treatment technology is less than 1000 cubic meters/day. However, the National Housing Authority's clustered treatment system has a capacity of less than 5000 cubic meters/day. In Thailand, DEWATs are miniature forms of centralised systems and the technologies used are: activated sludge, oxidation ditches, waste stabilisation ponds, and aerated lagoons. These clustered systems depend on the capital cost, area availability and ease of operation and maintenance.

- Thailand produces about 9.8 million m3 of domestic wastewater per day. Black water is preliminarily treated using on-site sanitation systems (OSS) installed in each household, while grey water is directly channelled into the sewers or drainage network. Despite the universal coverage of toilet facilities and on-site sanitation systems, the OSS perform poorly, due to leaching of liquid effluent with limited treatment (about 90% of OSS are cesspools). Of the total volume of wastewater produced, only about 27% is safely treated at 105 central wastewater treatment plants and less than 1% at clustered wastewater treatment plants. The remaining 73% is untreated and is discharged to receiving water bodies, putting public health at risk. This situation can also be attributed to households having a poor connection to the sewer network. Similarly, 40,000 m3 of FS is collected from OSS every day, of which only 12% undergoes treatment at the FS treatment plants while 88% is either dumped into open drains or waterways, and/or onto farmlands. Treatment plants are usually designed at 200 mg/liter BOD (Biochemical Oxygen Demand), but influent BOD concentration is found at lower than 80 mg/liter, as wastewater undergoes primary treatment in septic tanks and is diluted in the ageing sewer network due to groundwater intrusion. Furthermore, the landscapes around Bangkok and most urban cities in Thailand have a low gradient which requires wastewater to be continuously pumped into treatment plants, making them energy intensive and expensive to operate.

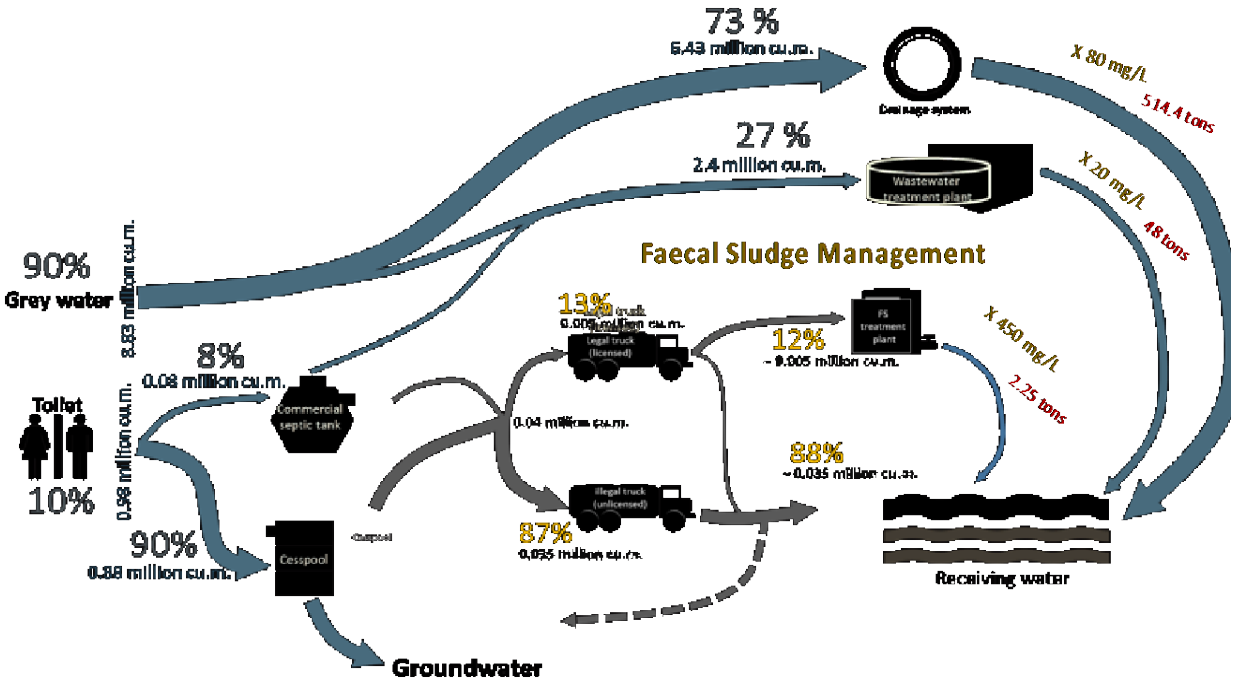
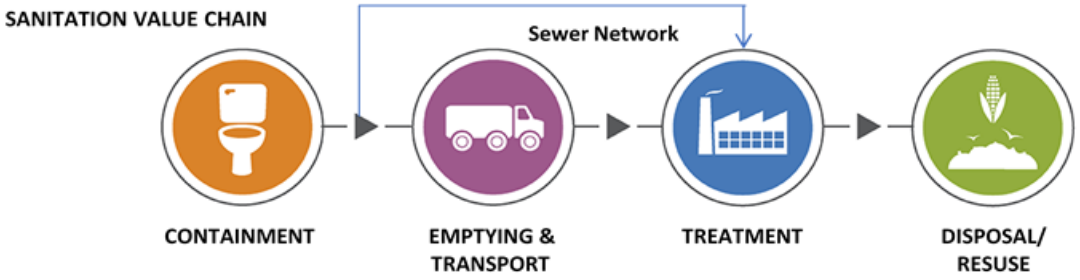


Figure 1: Estimated daily production of domestic wastewater in Thailand
[Source: developed by Dr. Yuttachai Sarathai (AIT), 2017]

WHAT BARRIERS DOES THAILAND FACE TO IMPLEMENTING DEWATs AND FSM?

- FS emptying services are not regulated
- There is no regular emptying mechanism – service is on-call only
- FS transport services are informal so local governments are unable to track and formalise
- There are poor sewer connections and an ageing sewer network
- Cities have low gradient and require continuous pumping

- Reuse of treated wastewater is still not a priority or at scale
- There is no monitoring on the quality of dried FS for use
- There is no assessment on the market potential of treated products



(Design: International Water Management Institute, 2016)

- Cesspools are predominant – leaking bottoms lead to water pollution
- Households operate and maintain their OSS without a monitoring mechanism - resulting in impaired functionality
- No enforcement are available for operation and maintenance of septic tanks or cesspools
- Cesspools are cheaper to operate and do not require frequent emptying. This is seen as an additional burden and people are not willing to upgrade

- Guidelines and FSM are still not a priority for National Government and Local Government Authorities (LGAs)
- LGAs lack capacity and skills to build and operate wastewater and FS treatment plants
- Stringent effluent standard considering the level of treatment required to meet the prescribed effluent standard – independent of the nature of locality, receiving water bodies and reuse potential of wastewater
- No available monitoring programmes on effluent and solid standards for FSM
- Limitations on the implementation of discharge fees have resulted in insufficient funds to operate and maintain treatment plants

- Additionally, the decentralised approach is relatively new and is not yet part of Thailand's city sanitation plan at scale despite its cost effectiveness, coverage, end-product reuse, etc. Private sector involvement is still limited to operation and maintenance as contracted by the government. The enabling environment for private sector involvement is lacking as the government has failed to ensure the mechanisms for cost recovery. Recently, Thailand Industrial Standards Institute (TISI) issued a standard for a method of testing the performance of a packaged wastewater treatment in residential buildings and for polyethylene tanks in domestic wastewater treatment, which also helps to ensure quality products and a healthy competitive market.

Box 1. Good practice in Thailand: Case of Nonthaburi

A treatment plant with capacity to treat 40 m3 of faecal sludge (FS) per day, serving roughly half the population of the municipality of Nonthaburi, uses anaerobic tanks (30 tanks), sludge drying beds (30 beds) and an oxidation pond (one pond) to transform FS into organic fertilizer. This is a batch type culture where the FS is kept in the tanks for 28 days. After the anaerobic process is complete, the sludge is released onto sand drying beds through which the liquid drains and the solid part dries. The plant treats about 50% of the FS emptied from cesspools.

There are two products that come from the FS treatment plant – dried sludge and treated effluent. Approximately 80 tonnes of dried sludge is generated each year and this is sold to farmers for about THB3000 /tonne. The liquid from the plant is drained and collected into an effluent storage pond with aerators which is used for watering greenery within the treatment plant. The products from each step of the FS treatment plant are checked for quality.

KEY POLICY RECOMMENDATIONS – "Shifting the Sanitation Paradigm"

Consider a full range of sanitation options

- It is crucial to redefine sanitation to encompass the entire sanitation chain, thereby ensuring public and environment safety for the community and for downstream settlements.
- The service chain in terms of the sewerage system encompasses increased sewer connections, regular maintenance of the ageing sewers, gravity flow mechanisms or alternative pumping systems (solar pumping) wherever possible.
- Similarly, for FSM, this involves regular maintenance and frequent emptying of the OSS, as well as safe handling during emptying and transportation.
- Zones should be defined for "centralised", "decentralised" and "OSS" as well as combinations of these, while introducing environmentally sustainable technologies (e.g. nature-based solutions for wastewater treatment), targeting the urban poor, and ensuring low greenhouse gas (GHG) emissions.

Upgrade the existing on-site sanitation system

- Considering the outbreak of the global pandemic (Covid-19) and detection of traces of the virus in wastewater and FS samples with a lifespan of 3 - 4 days, it is of utmost importance to contain the FS and wastewater safely. Upgrading cesspools in older households by sealing the bottom is paramount to prevent pollutants leaking into the environment. A septic tank with a sealed bottom is similar in design to a cesspool, and moreover, is comparable in terms of cost with a better treatment performance.
- Innovative technologies like solar septic tanks should be employed where applicable and affordable as they are easy to install and readily available.
- The government has plans to address the housing problems of Thailand's three million urban poor by scaling up two projects launched in 2003 namely "Baan Mankong (Affordable Housing)" and "Baan Ua Arthorn (We Care)" and by implementing the 20-year housing development master plan (2017-

2036). The policy must extend beyond just housing to cover sanitation as well as sewerage connections.
- It is necessary to mandate a TISI standard for DEWATs in terms of quality product and a healthy market.
- Households should be encouraged to carry out proper operation and maintenance (O&M) of OSS
- There should be checks on sludge accumulation every two years, with a regular desludging service implemented every 3-5 years.

Employ a mixed sanitation approach

- Citywide sanitation planning should be carried out covering the intricate mosaic comprising "Centralised, DEWATS and OSS" as well as FSM. Alternatively, there could be a blend of these technologies, based on their suitability considering population density, local capacity as well as sensitivity of the area. However, a mixed sanitation approach is not suitable as a one-size-fits-all solution.

Bridge sector gaps while adopting a utility approach for effective wastewater management

- Effective co-ordination with frequent policy dialogue is required to avoid gaps or overlaps in policies and responsibilities.
- It is vital to synchronise water supply utilities, wastewater/FS – with related agencies gathered into a single authority.
- It is important to raise political will and simplify mechanisms to tap into funds from central government with aided or minimal documentation requirement.
- Regulatory instruments (related laws and effluent standards) and economic instruments (EI), such as polluter pays principle, beneficiary pays principle and wastewater tariffs, should be enforced to the extent possible.
- Special provision of a wastewater-based epidemiology (WBE) mechanism into wastewater monitoring provides a key tool in identifying and containing the pandemic at the community level. WBE measures chemical signatures in sewage, such as fragment biomarkers from viruses like COVID-19, by applying a type of clinical diagnostic testing (designed for individuals) to the collective signature of entire communities.
- Reuse-based technology choices and effluent standards
- Under proper operation, wastewater stabilisation ponds (WSPs) could serve as fish farms, using the treated water as a cheap source of irrigation water. Similarly, several resource recovery mechanisms at FS treatment plants are already in practice in Thailand (Nonthaburi – biofertilizer, Thongtawil – electricity). The revenue from the sales of the recovered products can partly compensate for O&M costs at the plant.
- There are plans to construct 741 wastewater treatment plants from 2020-2040 and an additional 100 treatment plants five years beyond that. However, it is not clear what type of treatment system will be built and how it will carry out treatment. This must be made clear to local authorities so that they can incorporate the approach into their own action plans or city sanitations plan for smooth implementation.
- Effluent standards must be devised based on reuse options, sensitivity of the area and assimilative capacity of the receiving water bodies. It is necessary to develop standards for liquid effluent and treated solid matter for FSM.

Promote public awareness and encourage participation

- Public involvement in decision-making ensures greater acceptance of the policy and end products.
- Public awareness campaigns and surveys should be carried out frequently to ensure public participation.
- For the treatment systems to be sustainable, it is vital to implement economic instruments with periodic surveys, ensuring a willingness to pay so that the stepped tariff increments can be streamlined. The success of the economic instruments largely depends on public participation and understanding.

Encourage private investment beyond contract-based services

- It is necessary to ensure tariff implementation according to O&M requirements.
- Private sector must be incentivised to avoid economic spillover in the long run.
- An enabling environment should be created for private investment and return.
- A water resources master plan is likely to channel major investment into wastewater treatment

plants, so it is necessary to find ways to encourage and involve the private sector.

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