



Sanitation Capacity  
Building Platform

# Faecal Sludge Treatment Technologies in India - Compendium



National Institute of Urban Affairs



# WHY A COMPENDIUM?

Faecal Sludge Treatment Technologies in India - Compendium is an attempt to provide knowledge on a wide range of Faecal treatment technologies without bias and/or agenda, and helped to increase the recognition that a fully functioning sanitation value chain must link toilets to a treatment facility. With the increased coverage of toilets across the country under the Swachh Bharat Mission, it's imperative for the technological interventions for the management of Faecal waste – septage and sludge. It also presented resource recovery and reuse options as a necessary objective for the sustainable management of excreta.

The compendium is a collation of the information on the different Faecal sludge treatment technological options available in India and assessment of their performance considering the operational treatment plants in India. This compendium is a live document with updation as more FSTPs get operational.

For ease of understanding, the treatment technologies in use are broadly categorized based on the process principles: biological and non-biological systems. The technologies based on the treatment mechanism are grouped under the categories listed below:

## **A. Biological treatment**

1. Decentralized wastewater treatment System (DEWATS)
2. Sludge Drying Beds, also with Co-composting (mostly in combination with sludge drying bed)
3. Planted Drying Beds
4. Upflow Anaerobic Sludge Blanket (UASB)
5. Co-treatment with Sewage
6. Sludge settling and MBBR: Jabalpur FSTP

The Compendium presents technological options for treatment of Faecal sludge in India relating to its working principle, features, applicability, performance, strengths and challenges. It also focuses on the details of the installed locations covering the area requirement and costs incurred.

This Compendium plays the role of a reference tool for decision-makers, technologies and relevant stakeholders. Further, this Compendium is primarily focused on the non-sewered urban centres with Faecal sludge treatment being imperative and does not relate to the requirements for sewage treatment. Thereby, the technology information and costing of the technologies cannot be compared with the sewer based systems. Sewer based systems in total comprise of sewer connections and treatment unit. The cost comparison can only be made to the end to end system and not solely on the treatment unit.

## **B. Non-biological treatment**


1. Pyrolysis (thermal process)
2. Mechanized De-watering and MBBR

Status of FSTPs – Completed and Under Construction ( As on Dec. 2018) given in the annexures

## Faecal Sludge Treatment Technology : Devanahalli, Karnataka

Technology	DEWATS – Biological
Working Principle	DEWATS is natural aerobic and anaerobic stabilization of the waste with increased contact time with the active biomass followed by treatment of both remaining sludge and effluent.
Key features	<ul style="list-style-type: none"> <li>• The treatment is biomethanation based treatment with pre-and post-treatment for solid and liquid handling</li> <li>• The solid handling is generally through Stabilization, Sludge Drying Bed and for liquid treatment Anaerobic Baffled Reactor with filter chambers followed by Planted Gravel Filter.</li> <li>• The dried sludge is further co-composted with municipal solid waste.</li> <li>• The entire system is a biological based treatment system with no chemicals used</li> <li>• This is a gravity-based system with low electromechanical equipment depending the layout</li> <li>• The products from the process are treated liquid &amp; compost and biogas as ecofriendly fuel</li> </ul>
Performance	The compost from the process is biosafe only it is co-composted as composting attains higher temperature capable to destruct bacteria & viruses. However, the helminths destruction elevated temperatures > 85 degree C.
Applicability	<ul style="list-style-type: none"> <li>• Suitable for wastewater streams with fluctuating inflows</li> <li>• Applicable for organic wastewater streams, since solids and liquids are treated seperately</li> <li>• Co-composting with other organic solid waste enhances the compostability of the other wastes.</li> </ul>
Operations & Maintenance	<ul style="list-style-type: none"> <li>• Cleaning of pretreatment unit</li> <li>• Regular desludging of biomethanation digester</li> <li>• Removal of sludge from drying bed</li> <li>• Harvesting of plants in gravel filter</li> </ul>
Strengths	<ul style="list-style-type: none"> <li>• Low operation and maintenance cost</li> <li>• No skilled labour required</li> <li>• No direct contact with faecal sludge, allows for safe operations</li> </ul>
Challenges	<ul style="list-style-type: none"> <li>• Further treatment of solids required for higher degree of pathogen removal</li> <li>• Sludge handling requires space</li> </ul>

## Technology Installed Location Details


Location (s)	Status	Technology Provider
Devanahalli, Karnataka	Operational. Commissioned in 2015	Consortium for DEWATS Dissemination Society and Bremen Overseas Research and Development Association (BORDA)
<b>Capacity</b>	<b>Area Requirement</b>	<b>Manpower</b>
6 KLD	108 sq.m./KLD	—
Capital cost and Operational cost	Capital cost: Rs. 11.2 Lacs/KLD Annual Operating Cost: Rs. 1 Lacs / KLD	
Set-up time	Primarily civil works – ranges from 90 days to 150 days	
Snapshots		

## Faecal Sludge Treatment Technology : Bansberia, West Bengal

Technology	Sludge Drying Beds with Co-composting – Biological
Working Principle	<p>This is a simple gravity solid liquid separation using a drying bed followed by co-composting of solids with other organic wastes in a sequential process over a period. The liquid is further required to be treated.</p> <p>This is a process of drying the waste and co-composting with other organic wastes in a sequential process. The Faecal sludge spread is semi dried on the bed and is mixed with other organic waste sequentially over a period.</p>
Key features	<ul style="list-style-type: none"> <li>• This is a simple system of drying and composting adopting sequential process of drying and mixing the different organic wastes over a period</li> <li>• The other organic wastes could possibly include MSW, cow-dung, kitchen waste, etc.</li> <li>• After composting the compost is recovered by the process of sieving</li> <li>• The complete process takes longer duration for the final product bio compost</li> <li>• The liquid from the process is required to be further treated</li> </ul>
Performance	<ul style="list-style-type: none"> <li>• The compost is biosafe considering the composting temperature. However, the helminths destruction happens only at elevated temperature &gt; 85 degree C.</li> <li>• When co-composted with different organic wastes, the compost obtained is nutrient rich and has high saleable value.</li> </ul>
Applicability	Suitable for all types of organic wastes/ sludges including kitchen, market, house wastes, etc.
Operations & Maintenance	<ul style="list-style-type: none"> <li>• Manual application of other organic wastes on to the drying beds</li> <li>• Removal of compost from the drying beds</li> <li>• Mixing of Faecal sludge compost and kitchen waste (other organic waste) compost</li> <li>• Sieving the compost</li> <li>• Bio compost packaging</li> </ul>
Strengths	<ul style="list-style-type: none"> <li>• Nutrient rich bio compost with high saleable value</li> <li>• Co-composting with other organic solid waste enhances the compostability of the other wastes</li> </ul>
Challenges	<ul style="list-style-type: none"> <li>• Labor intensive process requiring manual handling at each stage</li> <li>• Suitable at location where there is land availability</li> <li>• It is location specific customized process where there are easy availability different types of waste</li> <li>• The helminths destruction need to be ascertained</li> </ul>



## Technology Installed Location Details


Location (s)	Status	Technology Provider
Bansberia, West Bengal	Operational. Operational since 2006	Greenery bio-compost and animal study Pvt. Ltd. (Plant operator)
Capacity	Area Requirement	Manpower
Total capacity of Plant - 1500 metric tons/year Faecal Sludge - 12KLD	2.7 Hectares	Not available
Capital cost and Operational cost	Capital cost: Not available Annual Operating Cost: 13.5 Lacs	
Snapshots		
Set-up time	<ul style="list-style-type: none"> <li>Primarily civil; 60 days to 90 days; need the SWM infrastructure, which could take about a year's time</li> </ul>	
Additional features	<ul style="list-style-type: none"> <li>The plant incorporates sequential addition of poultry waste, slaughter house waste and parallelly, vermi composting of kitchen and cow dung. The composts from the processes are mixed together.</li> <li>The system also incorporates lime addition for pathogens removal.</li> <li>The plant does not have liquid treatment facility considering that the liquid is completely evaporated. The studies report that the seepage of liquid coming out from the sludge drying beds find its way into the Hooghly River passing just behind the plant.</li> </ul>	

## Faecal Sludge Treatment Technology : Leh, Jammu & Kashmir

Technology	Planted Drying Beds – Biological
Working Principle	This is a biological system with combination of sludge treatment and liquid treatment by the natural process. Planted drying bed is an extension of unplanted drying bed (FAECAL SLUDGE TREATMENT TECHNOLOGY 02), but has the added benefit of transpiration and enhanced sludge treatment due to the plants. Filters do not need to be desludged after each feeding/drying cycle. The liquid is further treated in plated gravel filter.
Key features	<ul style="list-style-type: none"> <li>• The end to end system comprises planted drying beds for solids and liquid separation, planted gravel filter and polishing pond for liquids treatment</li> <li>• Gravity based system, based on natural treatment with no use of chemicals or electricity</li> <li>• Minimal and simple operations with no skilled operator required</li> <li>• A nursery within the facility would facilitate in reusing the treated wastewater and sludge</li> <li>• Minimal odor</li> </ul>
Performance	<p>The system capable to meet the prescribed norms for sewage in terms of physical and chemical parameters.</p> <p>The process outputs need to be ascertained for biosafety</p> <p>The pathogens removal in the sludge requires inactivation through chemicals or destruction using heat. The gravel filtration of liquid can only reduce the count and would not remove completely.</p>
Applicability	Suitable for all organic wastewater
Operations & Maintenance	<ul style="list-style-type: none"> <li>• Removal of screenings from screen chamber</li> <li>• Trimming plants</li> <li>• Harvesting plants in drying bed and filter</li> <li>• Sludge removal from the drying beds</li> </ul>
Strengths	<ul style="list-style-type: none"> <li>• Low operation and maintenance cost</li> <li>• No skilled labour required</li> <li>• No human contact with waste</li> </ul>
Challenges	<p>The rate of biological degradation during extreme cold weather takes longer for treatment duration.</p> <p>The biosafe character of the process outputs need to be ascertained.</p>



## Technology Installed Location Details

Location (s)	Status	Technology Provider
Leh, Jammu & Kashmir	Operational	Consortium for DEWATS Dissemination Society and Bremen Overseas Research and Development Association
<b>Capacity</b>	<b>Area Requirement</b>	<b>Manpower</b>
12KLD	60 sq.m./KLD	Not available
Capital cost and Operational cost	Capital cost: Rs 4.5 lacs/KLD Annual Operating Cost: Rs. 83000/ KLD	
Set-up time	Primarily civil works; ranges from 60 days to 120 days	
Snapshots		

## Faecal Sludge Treatment Technology : Brahmapuram, Cochin

Technology	Upflow Anaerobic Sludge Blanket (UASB) – Biological
Working Principle	This is an anaerobic digestion process where Faecal sludge is pumped from the bottom into the reactor, influent suspended solids and bacterial growth lead to the formation of sludge blanket. Bacteria in the sludge blanket break down organic matter by anaerobic digestion, transforming it into biogas. After high volume-reduction, the digested sludge is further dried for reuse.
Key features	<ul style="list-style-type: none"> <li>• The sludge blanket is kept in suspension by the flow regime and formed gas bubbles</li> <li>• A separator at the top of the reactor allows to recover biogas for energy production, nutrient effluent for agriculture and to retain the sludge in the reactor</li> <li>• Sludge accumulation is low and the desludged sludge from the reactor is dewatered and can be dried in drying beds (FAECAL SLUDGE TREATMENT TECHNOLOGY 02)</li> </ul>
Performance	<ul style="list-style-type: none"> <li>• Capable to meet the prescribed norms for sewage for physical and chemical parameters. The biosafety of the process outputs need to be ascertained.</li> </ul>
Applicability	Suitable for high organic load waste
Operations & Maintenance	<ul style="list-style-type: none"> <li>• Excess sludge is required to be removed from the reactor</li> <li>• Feeder pump and control of organic loads requires skilled staff for operation and maintenance</li> </ul>
Strengths	<ul style="list-style-type: none"> <li>• High removal of organics and solids and the possibility to recover biogas</li> </ul>
Challenges	<ul style="list-style-type: none"> <li>• Requires skilled staff and is sensitive to variable flows.</li> <li>• Biosafe nature of the process outputs need to be ascertained</li> </ul>

## Technology Installed Location Details

Location (s)	Status	Technology Provider
Brahmapuram, Cochin	Operational. Commissioned in 2015	Consortium of ABG Group (Kerala) and Ionex (Mumbai)
<b>Capacity</b>	<b>Area Requirement</b>	<b>Manpower</b>
100KLD	12 sq.m./KLD	Not available
Capital cost and Operational cost	Capital cost: Rs. 42.5 lacs/KLD to build & operate for 5 years Annual Operating Cost: Rs. 24000-30000 / KLD	
Features	The UASB is followed by sludge drying beds for handling desludged sludge. The liquid is recycled back into the system	
Set-up time	Combination of civil and mechanical; ranges from 180 to 300 days	
Snapshots		

## Faecal Sludge Treatment Technology : Puri, Odisha

Technology	Co-treatment in STP – Biological
Working Principle	This is a treatment of Faecal sludge and septage in Sewage Treatment Plant (STP) with pre-treatment facilities for Faecal sludge.
Key features	<ul style="list-style-type: none"> <li>• Due to the similarity of the characteristics of the sewage and Faecal sludge co-treatment is considered option</li> <li>• The two options for treating Faecal sludge in STP. It could be treated either as part of liquid stream or sludge handling stream</li> <li>• Addition to either of the stream pretreatment infrastructure in the STP and distribute the sludge into appropriated treatment unit in STP</li> <li>• For addition to liquid stream in STP, Faecal sludge be added at multiple treatment points viz., screening, before primary treatment (primary clarifier) or before secondary treatment (ASP)</li> <li>• Faecal sludge addition to sludge stream may be made either at before sludge stabilization or dewatering stage.</li> <li>• For co-treatment STP need to be equipped with Faecal receiving station, pre-treatment facilities and redistribution facilities in STP</li> <li>• The influent quality requirements for the STP at both liquid and solids addition points must be met during the additions</li> </ul>
Performance	<ul style="list-style-type: none"> <li>• With pretreatment facilities and STP capability to handle Faecal sludge, prescribed sewage treatment norms be met.</li> <li>• The sludge handling system should have pathogens inactivation/ destruction stage.</li> </ul>
Applicability	Faecal sludge and sewage
Operations & Maintenance	<ul style="list-style-type: none"> <li>• Regular cleaning of pretreatment facilities</li> <li>• Monitoring the pretreated Faecal sludge to match to the STP requirements</li> </ul>
Strengths	<ul style="list-style-type: none"> <li>• Faecal sludge and sewage be treated at single location minimizing the maintenance requirements</li> <li>• No separate infrastructure required for Faecal sludge treatment with reduced capital cost</li> </ul>
Challenges	<ul style="list-style-type: none"> <li>• The Regulated flow to the STP needs to be engineered and changes to this can effect the entire performance of the STP</li> <li>• STP capability to handle Faecal sludge is governed by (i) quantity of Faecal sludge and (ii) aeration capacity and solids handling capacity of the plant</li> <li>• The ability of the STP to co-treat Faecal sludge depend on STP type, design capacity and Faecal sludge pretreatment facilities as Faecal sludge is 50 times higher strength than sewage</li> </ul>


## Technology Installed Location Details

Location (s)	Status	Technology Provider
Puri, Odisha	Operational. Commissioned in 2017	—
<b>Capacity</b>	<b>Area Requirement</b>	<b>Manpower</b>
50KLD	20 sq.m./KLD	Not available
Set-up time	Primarily adopting to existing STP; civil works ranges from 45 days to 60 days	
Capital cost and Operational cost	Capital cost: Rs 3.5 lacs/KLD Annual Operating Cost: Rs. 35000/KLD	

## Faecal Sludge Treatment Technology : Warangal (Telangana State), Wai (Maharashtra), Narasapur (Andhra Pradesh)

Technology	Pyrolysis – Non-Biological
Working Principle	The working principle of pyrolysis is thermochemical decomposition of organic material at elevated temperatures in the presence of controlled oxygen (pyrolysis) to efficiently convert sludge to biochar without external power.
Key features	<ul style="list-style-type: none"> <li>• The system comprises of grit removal, pasteurization, solid-liquid separation, dryer, pyrolizer, heat exchanger and dewatered effluent treatment system. These different subsystems integrated together form a complete plant that can process Faecal sludge to biochar.</li> <li>• The counter flow heat exchanger recuperates the heat generated from pyrolysis and is reused back within the system. No external heat source is required enabling sustained operations</li> <li>• The system is equipped with online temperature monitoring systems optimizing the energy consumption and ensuring the pasteurization.</li> <li>• The biochar and pasteurized liquid are the products from the process.</li> </ul>
Performance	<ul style="list-style-type: none"> <li>• The process outputs meet the prescribed Indian norms for sewage and international norms for Faecal sludge.</li> <li>• The process outputs are completely biosafe for use</li> </ul>
Applicability	<ul style="list-style-type: none"> <li>• Applicable for treatment of Faecal sludge, STP sludge or sludges with organic content</li> </ul>
Operations & Maintenance	<ul style="list-style-type: none"> <li>• Cleaning of screening and grit units</li> <li>• Regular removal of Biochar</li> </ul>
Strengths	<ul style="list-style-type: none"> <li>• Automated system with no direct contact with faecal sludge</li> <li>• Suitable for all weather conditions</li> <li>• The products from the process including dewatered effluent are biosafe for reuse including food nursery</li> <li>• Modular System which can be easily scalable</li> <li>• Suitable for installation within the city having unique physical appearance</li> <li>• Fast deployment, with very low footprint</li> </ul>
Challenges	<ul style="list-style-type: none"> <li>• Varied septage characteristics pose depend for external thermal energy needs</li> </ul>

## Technology Installed Location Details

Installed Location (s)	Status	Technology Provider
Warangal (TS), Wai (MH), Narasapur (AP)	Operational	TIDE Technocrats, Bengaluru, Karnataka
<b>Capacity</b>	<b>Area Requirement</b>	<b>Manpower</b>
15 KLD	10,000 sft	3 members/ shift (Two shift operation) (Operator, Helper & Security)
Capital cost and Operational cost	Capital Cost- Rs 8 lacs/KLD Annual Operational Cost- Rs. 65,000 to 1,00,000/KLD	
Additional Features	Sanitation Resource Centre and green house of food and non-food nursery plants for reusing the treated liquid has been planned at all the installed plant locations	
Set-up time	Primarily mechanical; ranges from 90 days to 120 days	
Snapshots		



## Faecal Sludge Treatment Technology : Bhubaneswar, Odisha

Technology	DEWATS – Biological
Working Principle	DEWATS is natural aerobic and anaerobic stabilization of the waste with increased contact time with the active biomass followed by treatment of both remaining sludge and effluent.
Key features	<ul style="list-style-type: none"> <li>• The solid handling is generally through Stabilization, Sludge Drying Bed and for liquid treatment Anaerobic Baffled Reactor with filter chambers followed by Planted Gravel Filter and polishing pond.</li> <li>• The dried sludge from drying bed is further collected and stored for composting/ disposal.</li> <li>• The entire system is a biological based treatment system with no chemicals used.</li> <li>• First-of-its-kind SeTP in India which treats both solid and liquid parts of septage in integrated way.</li> <li>• This is a gravity-based system with low electromechanical equipment depending the layout</li> <li>• The products from the process are treated liquid &amp; compost</li> <li>• Solar plant of 10KW capacity installed at the SeTP as a special feature.</li> </ul>
Performance	<ul style="list-style-type: none"> <li>• The compost from the process is biosafe only it is co-composted as composting attains higher temperature capable to destruct bacteria &amp; viruses. However, the helminths destruction elevated temperatures &gt; 85 degree C.</li> </ul>
Applicability	<ul style="list-style-type: none"> <li>• Suitable for wastewater streams with fluctuating inflows</li> <li>• Applicable for organic wastewater streams, since solids and liquids are treated separately</li> <li>• Co-composting with other organic solid waste enhances the compostability of the other wastes.</li> </ul>
Operations & Maintenance	<ul style="list-style-type: none"> <li>• Cleaning of pretreatment unit</li> <li>• Removal of sludge from drying bed</li> <li>• Harvesting of plants in gravel filter</li> </ul>
Strengths	<ul style="list-style-type: none"> <li>• Low operation and maintenance cost</li> <li>• No skilled labour required</li> <li>• No direct contact with faecal sludge, allows for safe operations</li> <li>• Landscaping, lantation and solar paneling makes the SeTP environmental friendly and appealing</li> </ul>
Challenges	<ul style="list-style-type: none"> <li>• Further treatment of solids required for higher degree of pathogen removal</li> <li>• Sludge handling requires space</li> </ul>

## Technology Installed Location Details

Location (s)	Status	Technology Provider
Bhubaneswar, Odisha	Operational. Commissioned in 2018	Odisha Water Supply and Sewerage Board (OWSSB)
Capacity	Area Requirement	Manpower
75 KLD	133 sq.m./KLD	15 Members (Vacuum truck driver/helper, watchman, electrician, gardener and plant manager)
Capital cost and Operational cost	Capital cost: Rs. 4.72 Lacs/KLD Annual Operating Cost: Rs. 0.26 Lacs / KLD	
Set-up time	Primarily civil works – ranges from 90 days to 150 days	
Snapshots		

## Faecal Sludge Treatment Technology : Phulera-Sambhar, Rajasthan

Technology	DEWATS – Biological
Working Principle	DEWATS is natural aerobic and anaerobic stabilization of the waste with increased contact time with the active biomass followed by treatment of both remaining sludge and effluent.
Key features	<ul style="list-style-type: none"> <li>• The solid handling is generally through Stabilization reactor, Sludge Drying Bed and for liquid treatment Anaerobic Baffled Reactor with filter chambers followed by Planted Gravel Filter.</li> <li>• The dried sludge is further used as compost</li> <li>• The entire system is a biological based treatment system with no chemicals used</li> <li>• This is a gravity-based system with low electromechanical equipment depending the layout</li> <li>• The products from the process are treated liquid &amp; Bio solids</li> </ul>
Performance	<ul style="list-style-type: none"> <li>• The compost from the process is biosafe only it is co-composted as composting attains higher temperature capable to destruct bacteria &amp; viruses.</li> <li>• Treated water from treatment modules are stored in a collection tank from where it can be reused for watering of vegetation within FSTP premises or irrigation purpose in nearby farms.</li> </ul>
Applicability	<ul style="list-style-type: none"> <li>• Organic load from septic tanks</li> </ul>
Operations & Maintenance	<ul style="list-style-type: none"> <li>• Daily monitoring of manholes (DEWATS module), check for obstacles in inlet &amp; outlet pipes to the treatment system and gas vent.</li> <li>• Removal of sludge from drying bed</li> <li>• Harvesting of plants in gravel filter</li> </ul>
Strengths	<ul style="list-style-type: none"> <li>• Low operation and maintenance cost</li> <li>• No skilled labour required</li> <li>• No direct contact with faecal sludge, allows for safe operations</li> </ul>
Challenges	<ul style="list-style-type: none"> <li>• Further treatment of solids required for higher degree of pathogen removal</li> <li>• Sludge handling requires space</li> </ul>

## Technology Installed Location Details

Location (s)	Status	Technology Provider	
Phulera - Sambhar, Rajasthan	Under construction	Divija Infrastructure Pvt. Ltd.	
Capacity	Area Requirement	Population Served	Manpower
20 KLD	263 sq.m./KLD	46,402	—
Capital cost and Operational cost	Capital cost: Rs. 14.45 Lacs/KLD Annual Operating Cost: Rs. 0.44 Lacs/KLD		
Set-up time	Primarily civil works – ranges from 90 days to 150 days		
Snapshots			

## Faecal Sludge Treatment Technology : Khandela, Rajasthan

Technology	DEWATS – Biological
Working Principle	DEWATS is natural aerobic and anaerobic stabilization of the waste with increased contact time with the active biomass followed by treatment of both remaining sludge and effluent.
Key features	<ul style="list-style-type: none"> <li>The solid handling is generally through Stabilization, Sludge Drying Bed and for liquid treatment Anaerobic Baffled Reactor with filter chambers followed by Planted Gravel Filter.</li> <li>The dried sludge is further co-composted with municipal solid waste.</li> <li>The entire system is a biological based treatment system with no chemicals used</li> <li>This is a gravity-based system with low electromechanical equipment depending the layout</li> <li>The products from the process are treated liquid &amp; compost and biogas as ecofriendly fuel</li> </ul>
Performance	<ul style="list-style-type: none"> <li>The compost from the process is biosafe only it is co-composted as composting attains higher temperature capable to destruct bacteria &amp; viruses. However, the helminths destruction elevated temperatures &gt; 85 degree C.</li> </ul>
Applicability	<ul style="list-style-type: none"> <li>Suitable for wastewater streams with fluctuating inflows</li> <li>Applicable for organic wastewater streams</li> <li>Co-composting with other organic solid waste enhances the compostability of the other wastes.</li> </ul>
Operations & Maintenance	<ul style="list-style-type: none"> <li>Cleaning of pretreatment unit</li> <li>Removal of sludge from drying bed</li> <li>Harvesting of plants in gravel filter</li> </ul>
Strengths	<ul style="list-style-type: none"> <li>Low operation and maintenance cost</li> <li>No skilled labour required</li> <li>No direct contact with faecal sludge, allows for safe operations</li> </ul>
Challenges	<ul style="list-style-type: none"> <li>Further treatment of solids required for higher degree of pathogen removal</li> <li>Sludge handling requires space</li> </ul>

### Technology Installed Location Details

Location (s)	Status	Technology Provider	
Khandela, Sikar, Rajasthan	Under construction	Divija Infrastructure Pvt. Ltd.	
Capacity	Area Requirement	Population Served	Manpower
10 KLD	295sq.m./KLD	27,800	–
Capital cost and Operational cost	Capital cost: Rs. 21 Lacs/KLD Annual Operating Cost: Rs. 0.42 Lacs / KLD		
Set-up time	Primarily civil works – ranges from 90 days to 150 days		

## Faecal Sludge Treatment Technology : Lalsot, Rajasthan

Technology	DEWATS – Biological
Working Principle	DEWATS is natural aerobic and anaerobic stabilization of the waste with increased contact time with the active biomass followed by treatment of both remaining sludge and effluent.
Key features	<ul style="list-style-type: none"> <li>The solid handling is generally through Stabilization reactor, Sludge Drying Bed and for liquid treatment Anaerobic Baffled Reactor with filter chambers followed by Planted Gravel Filter.</li> <li>The dried sludge is further used as compost</li> <li>The entire system is a biological based treatment system with no chemicals used</li> <li>This is a gravity-based system with low electromechanical equipment depending the layout</li> <li>The products from the process are treated liquid &amp; Bio solids</li> </ul>
Performance	<ul style="list-style-type: none"> <li>The compost from the process is biosafe only it is co-composted as composting attains higher temperature capable to destruct bacteria &amp; viruses.</li> <li>Treated water from treatment modules are stored in a collection tank from where it can be reused for watering of vegetation within FSTP premises or irrigation purpose in nearby farms.</li> </ul>
Applicability	<ul style="list-style-type: none"> <li>Organic load from septic tanks</li> </ul>
Operations & Maintenance	<ul style="list-style-type: none"> <li>Cleaning of pretreatment unit</li> <li>Removal of sludge from drying bed</li> <li>Harvesting of plants in gravel filter</li> <li>Checking and cleaning of blockages in pipes at all inlet chambers, manholes</li> </ul>
Strengths	<ul style="list-style-type: none"> <li>Low operation and maintenance cost</li> <li>No skilled labour required</li> <li>No direct contact with faecal sludge, allows for safe operations</li> <li>Treated end products are reusable in landscaping, soil conditioning etc.</li> </ul>
Challenges	<ul style="list-style-type: none"> <li>Further treatment of solids required for higher degree of pathogen removal</li> <li>Sludge handling requires space</li> </ul>

### Technology Installed Location Details

Location (s)	Status	Technology Provider	
Lalsot, Dausa district, Rajasthan	Under construction	Divija Infrastructure Pvt. Ltd.	
Capacity	Area Requirement	Population Served	Manpower
20 KLD	232 sq.m./KLD	66,427	–
Capital cost and Operational cost	Capital cost: Rs. 19.26 Lacs/KLD Annual Operating Cost: Rs. 0.42 Lacs / KLD		
Set-up time	Primarily civil works – ranges from 90 days to 150 days		

## Faecal Sludge Treatment Technology : Port Blair, Andaman & Nicobar Islands

Technology	Mechanized De-watering and MBBR
Working Principle	Mechanical dewatering is a mechanized process in which solid-liquid separation takes place which is followed by dewatering and MBBR process for solid and liquid part respectively.
Key features	<ul style="list-style-type: none"> <li>• The solid handling is generally through Stabilization, belt press, rotatory drier and for liquid treatment Moving bed bio reactor, tube settler followed by sand &amp; carbon filter and chlorine dosing in the end.</li> <li>• The tumbling process in rotatory drier ensures even distribution of heat in the solids and evaporates the bound water.</li> <li>• Pressurized filter with dual media filter &amp; activated carbon filter for the treatment of liquid part.</li> <li>• The dried sludge is used as manure and treated water is used for landscaping in FSTP premises and parks in Port Blair city.</li> </ul>
Performance	<ul style="list-style-type: none"> <li>• The process outputs meet the prescribed Indian norms for sewage and international norms for Faecal sludge.</li> <li>• The process outputs are completely biosafe for use</li> </ul>
Applicability	<ul style="list-style-type: none"> <li>• Suitable for areas having high humidity and intense rainfall</li> <li>• Co-composting with other organic solid waste enhances the compostability of the other wastes.</li> </ul>
Operations & Maintenance	<ul style="list-style-type: none"> <li>• Procedures for receiving and offloading of FSS at the station</li> <li>• Operation and Maintenance of Specific Technologies in FSTP</li> <li>• Monitoring and reporting procedures for the FSTP O&amp;M activities</li> </ul>
Strengths	<ul style="list-style-type: none"> <li>• Automated system with no direct contact with faecal sludge</li> <li>• Suitable for all weather conditions</li> <li>• The products from the process including dewatered effluent are biosafe for reuse including food nursery</li> <li>• Modular System which can be easily scalable</li> <li>• Suitable for installation within the city having unique physical appearance</li> <li>• Fast deployment, with very low footprint</li> </ul>
Challenges	<ul style="list-style-type: none"> <li>• Require highly skilled staff for operations</li> </ul>



## Technology Installed Location Details

Location (s)	Status	Technology Provider	
Port Blair, Andaman & Nicobar Islands	To be commissioned	—	
Capacity	Area Requirement	Population Served	Manpower
42 KLD	77 sq.m./KLD	1.4 Lacs	—
Capital cost and Operational cost	Capital cost: Rs. 8.83 Lacs/KLD Annual Operating Cost: Rs. 1.83 Lacs/KLD		
Additional Feature	Features like in-house laboratory, solar panels, rain water harvesting system.		
Set-up time	Primarily civil works – ranges from 60 days to 90 days		

## Faecal Sludge Treatment Technology : Rudrapur, Uttarakhand

Technology	Mechanical Dewatering and ABR – Mechanized
Working Principle	Mechanical dewatering is a mechanized process in which solid-liquid separation takes place which is followed by dewatering and Anaerobic Baffle Reactor (ABR) process for solid and liquid part respectively.
Key features	<ul style="list-style-type: none"> <li>The solid handling is generally through Stabilization, Screw press, rotatory drier and for liquid treatment Anaerobic baffle reactor, Anaerobic filter followed by constructed wetlands and chlorine dosing in the end.</li> <li>The tumbling process in rotatory drier ensures even distribution of heat in the solids and evaporates the bound water.</li> </ul>
Performance	<ul style="list-style-type: none"> <li>The process outputs meet the prescribed Indian norms for sewage and international norms for Faecal sludge.</li> <li>The process outputs are completely biosafe for use</li> </ul>
Applicability	<ul style="list-style-type: none"> <li>Bio-solids and treated water can be used in the public parks operated and maintained by Rudrapur Nagar Nigam for flowering and landscaping</li> </ul>
Operations & Maintenance	<ul style="list-style-type: none"> <li>Procedures for receiving and offloading of FSS at the station</li> <li>Operation and Maintenance of Specific Technologies in FSTP</li> <li>Monitoring and reporting procedures for the FSTP O&amp;M activities</li> </ul>
Strengths	<ul style="list-style-type: none"> <li>Suitable for all weather conditions</li> <li>The products from the process including dewatered effluent are biosafe for reuse including food nursery</li> <li>Modular System which can be easily scalable</li> <li>Fast deployment, with low footprint</li> </ul>
Challenges	<ul style="list-style-type: none"> <li>Require highly skilled staff for operations</li> </ul>

### Technology Installed Location Details

Location (s)	Status	Technology Provider
Rudrapur, Uttarakhand	To be commissioned	—
<b>Capacity</b>	<b>Area Requirement</b>	<b>Manpower</b>
125 KLD	65 sq.m./KLD	—
Capital cost and Operational cost	Capital cost: Rs. 4.13 Lacs/KLD	
Set-up time	Primarily civil works – ranges from 90 days to 150 days	

## Faecal Sludge Treatment Technology : Jabalpur, Madhya Pradesh

Technology	Sludge settling and MBBR – Biological
Working Principle	Sludge settling takes place in sludge thickening tank where flocculent is mixed with the sludge for aiding gravity settling followed by treatment of supernatant through MBBR process.
Key features	<ul style="list-style-type: none"> <li>• The solid handling is generally through Stabilization in sludge thickening tank, for liquid treatment MBBR followed by vertical rapid carbon filter.</li> <li>• This is a gravity-based system with low electromechanical equipment depending the layout</li> </ul>
Applicability	<ul style="list-style-type: none"> <li>• Suitable for wastewater streams with fluctuating inflows</li> <li>• Applicable for organic wastewater streams</li> </ul>
Performance	<ul style="list-style-type: none"> <li>• Output is treated water and thickened sludge</li> </ul>
Operations & Maintenance	<ul style="list-style-type: none"> <li>• Regular cleaning of treatment unit</li> </ul>
Strengths	<ul style="list-style-type: none"> <li>• Low operation and maintenance cost</li> <li>• No skilled labour required</li> <li>• No direct contact with faecal sludge, allows for safe operations</li> </ul>
Challenges	<ul style="list-style-type: none"> <li>• Further treatment of solids required for higher degree of pathogen removal</li> </ul>

### Technology Installed Location Details

Location (s)	Status	Technology Provider
Jabalpur, Madhya Pradesh	Operational. Commissioned in 2017	Meco Technologies, Bilaspur
<b>Capacity</b>	<b>Area Requirement</b>	<b>Manpower</b>
50 KLD	0.76 sq.m./KLD	--
Capital cost and Operational cost	Capital cost: Not Available Annual Operating Cost: Rs. 0.27 Lacs / KLD	
Set-up time	Primarily civil works – ranges from 90 days to 150 days	

## Annexure I

## Status of FSTPs: Completed (As on November 2019)

S.No.	Name of FSTP	City	State	Design Capacity (KLD)	Allocated Land Area of the Facility (sq.m)	Brief description of technology	
1	Devanhalli	Devanahalli	Karnataka	6	650	Gravity based biological treatment technology	
2	Bansberia	Bansberia	West Bengal	50	27000	Sludge Drying Beds	
3	Brahmapuram	Cochin	Kerala	100	1,200	UASB + MBBR + Filters and Sludge Drying Beds	
4	Leh	Leh	Jammu & Kashmir	12	1,000	Gravity based aerobic stabilization using Planted Drying Beds	
5	Kanchipuram	Karunguzhi	Tamil Nadu	23.4	8093.71	Screens, Sludge Drying Beds, Horizontal Planted Gravel Filters, Maturation Pond	
6	Adiragatty Town Panchayat		Tamil Nadu				
7	Ketti Town Panchayat		Tamil Nadu				
8	Chamraj Tea Estate	Ooty	Tamil Nadu				
9	Ponampatti		Tamil Nadu				
10	Septage Treatment Plant of Puri (Konark+Pipili)	Puri (Konark+Pipili)	Orissa	50	1000	Liquid Solid Separation (Co treatment with Sewerage Treatment plant)	
11	Sanitation Resource Park	Warangal	Telangana	15	4046.86	Screening, Pasteurization, Dewatering, Thermal drying and pyrolysis, MBBR	
12	Sanitation Resource Park	Narsapur	Telangana	15	4046.86	Screening, Pasteurization, Dewatering, Thermal drying and pyrolysis, Phytorid	
13	Wai FSTP	Wai	Maharashtra	70	1824	Screening, Pasteurization, Dewatering, Thermal drying and pyrolysis, phytorid , KMBBR, ACF, PSF, Ozonation	
14	Sinnar FSTP	Sinnar	Maharashtra	70	1548	Screening, Collection tank, Clarifloculator, Upflow Anaerobic Sludge Blanket Digester (UASB), Anaerobic Baffled reactor (ABR), Ozonation, ACF,PSF and Sludge drying bed	
15	FSTP	Tenali	Andhra Pradesh	15	1000	MBBR	

Total Capital Expenditure (INR crores)	Revenue Model of FSTP	Operated by	Desludging Operator (Informal/ regulated)
0.67	Large advertisement billboard: Rs 2.4L p.a. Sale of Compost: Rs 25-30,000 p.a. Rest paid by CDD (by Govt. once private contractor is appointed)	Private	Town Municipal Council has a truck. The private operator will run the FSTP and truck. Private players in the area are not yet regulated, municipality has passed resolutions to license / regulate them, will act on it in 2018
Not Available	FSTP is operated by private operator and revenue comes from selling of compost.	Private	Desludging trucks are being operated by Bansberia Municipality
4.25	Tipping charges paid by Trucks that discharge sludge there	Private	Informal private operators
0.54	Hotels and HH pay fees for having septic tanks cleaned. This fee covers tank cleaning, transportation and treatment costs.	Private + Public	Same Private Operator also runs the municipal desludging truck and provides scheduled cleaning services across the city. There are no private operators--if any start business, they will be licensed by Municipality
4.93 (including O&M)	Households to pay fees for having septic tanks cleaned.	ULB	Informal Private players
1.74	O&M cost will be subsidised by Govt.	Private	ULB has signed contract with private operator. Also there are other informal private operators
1.2	1 year O&M by private operator and by Municipality thereafter (Proposed)	Private	Regulated (Trucks registered under GWMC. Fitted with GPS tracking)
1.2	1 year O&M by private operator and by Municipality thereafter (Proposed)	Private	Regulated (Trucks registered under Municipality. Fitted with GPS tracking. Consortium of all existing truck operators exists which prevents other operators from entering the market)
1.8	2 year O&M by private operator and by Municipality thereafter (Proposed)	Private	Council is providing scheduled septic tank emptying services to all properties in Wai, which will be at an interval of 3 years as suggested by state and national level policies and guidelines.  For this the council has entered into a contractual agreement with a private sector to provide this service through a performance based contract. These emptying services have started in the city
1.51	Sanitation tax and transfer from property tax to pay the contractor	Private	Council is providing scheduled septic tank emptying services to all properties in Sinnar, which will be at an interval of 3 years as suggested by state and national level policies and guidelines.  For this the council has entered into a contractual agreement with a private sector to provide this service through a performance based contract. These emptying services have started in the city
0.3	Municipal budget	Private	Moving towards scheduled desludging

S.No.	Name of FSTP	City	State	Design Capacity (KLD)	Allocated Land Area of the Facility (sq.m)	Brief description of technology	
16	FSTP at Sircilla	Sircilla	Telangana	18	1970	Screen chamber, stabilisation reactor, sludge drying beds, settler - anaerobic filter, Planted gravel filter , co-composting unit	
17	FSTP	Jhansi	U.P.	6	4046.86	Planted drying beds with Integrated Settler & Anaerobic Filter and Horizontal Planted Gravel Filter	
18	Unnao FSTP		U.P.				
19	Bhubaneswar FSTP	Bhubaneswar	Orissa	75	10117	Liquid solid separation with DEWATS	
20	Sambalpur FSTP	Sambalpur	Orissa	20	6070	Liquid solid separation with DEWATS	
21	Brahmapur FSTP	Brahmapur	Orissa	40	6475	Liquid solid separation with DEWATS	
22	Rourkela FSTP	Rourkela	Orissa	40	8094	Liquid solid separation with DEWATS	
23	Dhenkanal FSTP	Dhenkanal	Odisha	27	6070.28	Screen and Grit Chamber, Stabilisation Reactor, Sludge Drying Bed, Integrated Anaerobic Baffled Reactor & Anaerobic Filter ( ABR & AF), Planted Gravel Filter (PGF), Collection Tank, Sand and Carbon Filter, Pasteurization Unit.	
24	Cuttack FSTP	Cuttack	Orissa	60	10117	Liquid Solid Separation (Co treatment with Sewerage Treatment plant)	
25	Baripada FSTP	Baripada	Orissa	50	6070	Liquid solid separation with DEWATS	
26	Shahganj FSTP	Shahganj	Madhya Pradesh	8.2	460	Liquid Solid separation in settler+Sludge drying bed+leachate sump+Planted gravel filter+Polishing pond	
27	Adhartal FSTP	Jabalpur	Madhya Pradesh	50	50	Moving Bed Biofilm Reactor (MBBR)	
28	Garha FSTP	Jabalpur	Madhya Pradesh	50	50	Moving Bed Biofilm Reactor (MBBR)	
29	Polipathar FSTP	Jabalpur	Madhya Pradesh	50	50	Moving Bed Biofilm Reactor (MBBR)	
30	Ambikapur FSTP	Ambikapur	Chattisgarh	5	75	Hybrid(Bio Treat+ MBBR)	
31	Rajnandhgaon FSTP	Rajnandhgaon	Chattisgarh	100	280	DEWATS(Gravitational Technology)	
32	Nashik		Maharashtra				

Total Capital Expenditure (INR crores)	Revenue Model of FSTP	Operated by	Desludging Operator (Informal/ regulated)
1.6	O&M cost is being funded by ULB.		Private operators responsible for desludging services
2	Municipal Budget; Combined Contract for O&M of Desludging vehicles (Emptying, transportation) and O&M of FSTP; Operator also collects Rs 1500 / trip for desludging	Private	Private operator also responsible for Emptying & transportation; Vehicle provided by ULB
3.54	O&M cost will be subsidised by Govt.	Private	ULB has signed contract with private operator. Also there are other informal private operators
1.92	O&M cost will be subsidised by Govt.	Private	ULB has signed contract with private operator. Also there are other informal private operators
2.48	O&M cost will be subsidised by Govt.	Private	ULB has signed contract with private operator. Also there are other informal private operators
2.15	O&M cost will be subsidised by Govt.	Private	ULB has signed contract with private operator. Also there are other informal private operators
2.85	O&M cost will be funded by State Govt.	Private	Regulated
1.76	O&M cost will be subsidised by Govt.		ULB has signed contract with private operator. Also there are other informal private operators
2.41	O&M cost will be subsidised by Govt.		ULB has signed contract with private operator. Also there are other informal private operators
0.08	O&M cost will be funded by ULB.	ULB	ULB owned vehicles
0.69 (including O&M)	O&M cost is being funded by ULB.	Private	ULB owned vehicles
0.69 (including O&M)	O&M cost is being funded by ULB.	Private	ULB owned vehicles
0.69 (including O&M)	O&M cost is being funded by ULB.	Private	ULB owned vehicles
0.235 (inclusive of 1 year O&M)	Desludging Fee of Rs 500 -1000 per trip from households/property tax(which includes sanitation fees)		ULB provides desludging services on demand, no private operators involved
0.105	Desludging Fee of Rs 500 per household + sale of composted sludge in market	ULB	ULB provides desludging services on demand, no private operators involved

As on November 2019 AMRUT TSU(KPMG), MOHUA, Govt. of India



## Annexure II

## Status of FSTPs: Under Construction (As on November 2019)

S.No.	Name of FSTP	City	State	Expected Month/Year of Commissioning	Capacity in KLD	Allocated Land Area of the Facility (sq.m)	Number of Households covered by FSTP	
1	Kohima Septage Treatment Plant	Kohima	Nagaland	August 2018	95	600	26,242	
2	Periyanaickenpalayam	Periyanaickenpalayam	Tamil Nadu	October 2019	25	2023	12400	
3	Trichy	Trichy	Tamil Nadu	To be decided	32	6700	10756 out of 2.31 lakhs	
4	Bhadrak FSTP	Bhadrak	Orissa	Work not started due to land dispute	40	-	15370	
5	Baleswar FSTP	Baleswar	Orissa	Work not started due to land dispute	60	-	17825	
6	Unnao FSTP	Unnao	Uttar Pradesh	December 2019	32	10400	18633	
7	Angul FSTP	Angul	Odisha		18			

Brief description of technology	Total Capital Expenditure (INR crores)	Source of Capital (public funds with scheme name, private grants with donor name, private investment with company name)	Estimated Operational Expenditure (in INR lakhs per year)	Operated by	Revenue Model of FSTP	Desludging Operator (Informal/regulated)
Upflow Anaerobic Sludge Blanket Digester (UASB) + Moving Bed Bio Reactor (MBBR)	32.22	(includes cost of approach road, desludging trucks,garage for tankers, staff quarters etc)	5	ULB	-	Regulated
Bar screen chamber,Raw fecal storage tank, Ballon Bio-digester, ABR, Screw Press, Sludge composter, MBBR, Filtration and Electro-oxidation	2.28	funded by BMGF under Tamil Nadu Urban Sanitation Support Programme (TNUSSP)	20-22	Private	Yet to be decided.	Informal private players and ULB services
Anaerobic stabilization of FS followed by natural solar sludge drying beds for the solid stream; planted gravel filters, sand and carbon filters with UV disinfection for the liquid stream. After drying sludge it is co composted with Municipal Solid Waste	3.81	funded by BMGF under TNUSSP	19.8	Private	To be decided	Registered private operators
Liquid solid separation with DEWATS	3.14		19.68	Private	O&M cost will be subsidised by Govt.	ULB has signed contract with private operator.
Liquid solid separation with DEWATS	2.55		18.8	Private	O&M cost will be subsidised by Govt.	ULB has signed contract with private operator.
Thickening tank, anaerobic digester, screw press and DEWATS	4.93		21.5	Private + Public	O&M Cos to be borne by the Govt.	The ULB owns 2 cess pool vehicles one of which is operated by a private operator.
Screen and Grit Chamber, Stabilisation Reactor, Sludge Drying Bed, Integrated Anaerobic Baffled Reactor & Anaerobic Filter ( ABR & AF), Planted Gravel Filter (PGF), Collection Tank, Sand and Carbon Filter, Pasteurization Unit.						

S.No.	Name of FSTP	City	State	Expected Month/Year of Commissioning	Capacity in KLD	Allocated Land Area of the Facility (sq.m)	Number of Households covered by FSTP	
8	Virudhachalam	Virudhachalam	Tamil Nadu	December 2019	40	6800	18209	
9	Melur	Host ULB : Melur Cluster ULB : A.Vellalapatti	Tamil Nadu	December 2019	20	3400	11853	
10	Tirumangalam	Tirumangalam	Tamil Nadu	December 2019	40	6800	13564	
11	Paramakudi	Paramakudi	Tamil Nadu	December 2019	40	6800	23504	
12	Keelakarai	Keelakarai	Tamil Nadu	December 2019	20	3400	7448	
13	Kulithalai	Host ULB : Kuli- thalai Cluster ULB : Marudur	Tamil Nadu	December 2019	20	3400	10224	

	Brief description of technology	Total Capital Expenditure (INR crores)	Source of Capital (public funds with scheme name, private grants with donor name, private investment with company name)	Estimated Operational Expenditure (in INR lakhs per year)	Operated by	Revenue Model of FSTP	Desludging Operator (Informal/regulated)
	Screen chamber, Anaerobic stabilization of FS followed by natural solar sludge drying beds, sludge storage and co-composting for the solid stream; Integrated settler anaerobic filter, planted gravel filter and Maturation pond for liquid stream	4.25	(funded by State Government; scheme under IUDM share 67% and SBM share 33%)	Yet to be decided.	Private	Yet to be decided.	Informal private players and ULB services
	Screen chamber, Anaerobic stabilization of FS followed by natural solar sludge drying beds, sludge storage and co-composting for the solid stream; Integrated settler anaerobic filter, planted gravel filter and Maturation pond for liquid stream	2.17	(funded by State Government; scheme under IUDM share 67% and SBM share 33%)	Yet to be decided.	Private	Yet to be decided.	Informal private players and ULB services
	Screen chamber, Anaerobic stabilization of FS followed by natural solar sludge drying beds, sludge storage and co-composting for the solid stream; Integrated settler anaerobic filter, planted gravel filter and Maturation pond for liquid stream	4.3	(scheme under IUDM and SBM, cost share 67% and 33% respectively)	Yet to be decided.	Private	Yet to be decided.	Informal private players and ULB services
	Screen chamber, Anaerobic stabilization of FS followed by natural solar sludge drying beds, sludge storage and co-composting for the solid stream; Integrated settler anaerobic filter, planted gravel filter and Maturation pond for liquid stream	5.65	(scheme under IUDM and SBM, cost share 67% and 33% respectively)	Yet to be decided.	Private	Yet to be decided.	Informal private players and ULB services
	Screen chamber, Anaerobic stabilization of FS followed by natural solar sludge drying beds, sludge storage and co-composting for the solid stream; Integrated settler anaerobic filter, planted gravel filter and Maturation pond for liquid stream	3.4	(scheme under IUDM and SBM, cost share 67% and 33% respectively)	Yet to be decided.	Private	Yet to be decided.	Informal private players and ULB services
	Screen chamber, Anaerobic stabilization of FS followed by natural solar sludge drying beds, sludge storage and co-composting for the solid stream; Integrated settler anaerobic filter, planted gravel filter and Maturation pond for liquid stream	2.85	(scheme under IUDM and SBM, cost share 67% and 33% respectively)	Yet to be decided.	Private	Yet to be decided.	Informal private players and ULB services

S.No.	Name of FSTP	City	State	Expected Month/Year of Commissioning	Capacity in KLD	Allocated Land Area of the Facility (sq.m)	Number of Households covered by FSTP	
14	Tiruchengode	Tiruchengode	Tamil Nadu	December 2019	40	6800	26508	
15	Jayamkondam	Host ULB : Jayamkondam Cluster ULB : Udayarpalayam	Tamil Nadu	December 2019	20	3400	11819	
16	Pattukottai	Pattukottai	Tamil Nadu	December 2019	30	5100	18437	
17	Thuraiyur	Thuraiyur	Tamil Nadu	December 2019	20	3400	8674	
18	Mannargudi	Mannargudi	Tamil Nadu	December 2019	30	5100	17372	

	Brief description of technology	Total Capital Expenditure (INR crores)	Source of Capital (public funds with scheme name, private grants with donor name, private investment with company name)	Estimated Operational Expenditure (in INR lakhs per year)	Operated by	Revenue Model of FSTP	Desludging Operator (Informal/regulated)
	Screen chamber, Anaerobic stabilization of FS followed by natural solar sludge drying beds, sludge storage and co-composting for the solid stream; Integrated settler anaerobic filter, planted gravel filter and Maturation pond for liquid stream	4.41	(scheme under IUDM and SBM, cost share 67% and 33% respectively)	Yet to be decided.	Private	Yet to be decided.	Informal private players and ULB services
	Screen chamber, Anaerobic stabilization of FS followed by natural solar sludge drying beds, sludge storage and co-composting for the solid stream; Integrated settler anaerobic filter, planted gravel filter and Maturation pond for liquid stream	2.5	(scheme under IUDM and SBM, cost share 67% and 33% respectively)	Yet to be decided.	Private	Yet to be decided.	Informal private players and ULB services
	Screen chamber, Anaerobic stabilization of FS followed by natural solar sludge drying beds, sludge storage and co-composting for the solid stream; Integrated settler anaerobic filter, planted gravel filter and Maturation pond for liquid stream	3.6	(scheme under IUDM and SBM, cost share 67% and 33% respectively)	Yet to be decided.	Private	Yet to be decided.	Informal private players and ULB services
	Screen chamber, Anaerobic stabilization of FS followed by natural solar sludge drying beds, sludge storage and co-composting for the solid stream; Integrated settler anaerobic filter, planted gravel filter and Maturation pond for liquid stream	3.2	(scheme under IUDM and SBM, cost share 67% and 33% respectively)	Yet to be decided.	Private	Yet to be decided.	Informal private players and ULB services
	Screen chamber, Anaerobic stabilization of FS followed by natural solar sludge drying beds, sludge storage and co-composting for the solid stream; Integrated settler anaerobic filter, planted gravel filter and Maturation pond for liquid stream	3.1	(scheme under IUDM and SBM, cost share 67% and 33% respectively)	Yet to be decided.	Private	Yet to be decided.	Informal private players and ULB services

S.No.	Name of FSTP	City	State	Expected Month/Year of Commissioning	Capacity in KLD	Allocated Land Area of the Facility (sq.m)	Number of Households covered by FSTP	
19	Colachel	Host ULB : Colachel Cluster ULBs : Reethapuram, Kallukuttam, Palappallam, Mandaikadu, Thingalnagar, Karunal, Neyyoor, Manavalakurichi, Kappiyarai	Tamil Nadu	December 2019	40	6800	41533	
20	Kovilpatti	Kovilpatti	Tamil Nadu	December 2019	40	6800	25099	
21	Kadayanallur	Kadayanallur	Tamil Nadu	December 2019	40	6800	21076	
22	Sengottai	Host ULB : Shenkottai Cluster ULBs : Ilanji, Pudur, Courtalam	Tamil Nadu	December 2019	20	3400	13847	

	Brief description of technology	Total Capital Expenditure (INR crores)	Source of Capital (public funds with scheme name, private grants with donor name, private investment with company name)	Estimated Operational Expenditure (in INR lakhs per year)	Operated by	Revenue Model of FSTP	Desludging Operator (Informal/regulated)
	Screen chamber, Anaerobic stabilization of FS followed by natural solar sludge drying beds, sludge storage and co-composting for the solid stream; Integrated settler anaerobic filter, planted gravel filter and Maturation pond for liquid stream	5.48	(scheme under IUDM and SBM, cost share 67% and 33% respectively)	Yet to be decided.	Private	Yet to be decided.	Informal private players and ULB services
	Screen chamber, Anaerobic stabilization of FS followed by natural solar sludge drying beds, sludge storage and co-composting for the solid stream; Integrated settler anaerobic filter, planted gravel filter and Maturation pond for liquid stream	3.9	(scheme under IUDM and SBM, cost share 67% and 33% respectively)	Yet to be decided.	Private	Yet to be decided.	Informal private players and ULB services
	Screen chamber, Anaerobic stabilization of FS followed by natural solar sludge drying beds, sludge storage and co-composting for the solid stream; Integrated settler anaerobic filter, planted gravel filter and Maturation pond for liquid stream	4	(scheme under IUDM and SBM, cost share 67% and 33% respectively)	Yet to be decided.	Private	Yet to be decided.	Informal private players and ULB services
	Screen chamber, Anaerobic stabilization of FS followed by natural solar sludge drying beds, sludge storage and co-composting for the solid stream; Integrated settler anaerobic filter, planted gravel filter and Maturation pond for liquid stream	2.6	(scheme under IUDM and SBM, cost share 67% and 33% respectively)	Yet to be decided.	Private	Yet to be decided.	Informal private players and ULB services



S.No.	Name of FSTP	City	State	Expected Month/Year of Commissioning	Capacity in KLD	Allocated Land Area of the Facility (sq.m)	Number of Households covered by FSTP	
23	Vickramasingapuram	Host ULB : Vickramasingapuram Cluster ULB : Alwarkurichi	Tamil Nadu	December 2019	30	5100	16351	
24	Aruppukottai	Aruppukottai	Tamil Nadu	December 2019	40	6800	23803	
25	Srivilliputhur	Srivilliputhur	Tamil Nadu	December 2019	30	5100	21411	
26	Dharapuram	Host ULB : Dharapuram Cluster ULB : Kolathupalayam	Tamil Nadu	December 2019	30	5100	21299	
27	Kangayam	Kangayam	Tamil Nadu	December 2019	20	3400	9449	

	Brief description of technology	Total Capital Expenditure (INR crores)	Source of Capital (public funds with scheme name, private grants with donor name, private investment with company name)	Estimated Operational Expenditure (in INR lakhs per year)	Operated by	Revenue Model of FSTP	Desludging Operator (Informal/regulated)
	Screen chamber, Anaerobic stabilization of FS followed by natural solar sludge drying beds, sludge storage and co-composting for the solid stream; Integrated settler anaerobic filter, planted gravel filter and Maturation pond for liquid stream	3	(scheme under IUDM and SBM, cost share 67% and 33% respectively)	Yet to be decided.	Private	Yet to be decided.	Informal private players and ULB services
	Screen chamber, Anaerobic stabilization of FS followed by natural solar sludge drying beds, sludge storage and co-composting for the solid stream; Integrated settler anaerobic filter, planted gravel filter and Maturation pond for liquid stream	4	(scheme under IUDM and SBM, cost share 67% and 33% respectively)	Yet to be decided.	Private	Yet to be decided.	Informal private players and ULB services
	Screen chamber, Anaerobic stabilization of FS followed by natural solar sludge drying beds, sludge storage and co-composting for the solid stream; Integrated settler anaerobic filter, planted gravel filter and Maturation pond for liquid stream	3	(scheme under IUDM and SBM, cost share 67% and 33% respectively)	Yet to be decided.	Private	Yet to be decided.	Informal private players and ULB services
	Screen chamber, Anaerobic stabilization of FS followed by natural solar sludge drying beds, sludge storage and co-composting for the solid stream; Integrated settler anaerobic filter, planted gravel filter and Maturation pond for liquid stream	2.975	(scheme under IUDM and SBM, cost share 67% and 33% respectively)	Yet to be decided.	Private	Yet to be decided.	Informal private players and ULB services
	Screen chamber, Anaerobic stabilization of FS followed by natural solar sludge drying beds, sludge storage and co-composting for the solid stream; Integrated settler anaerobic filter, planted gravel filter and Maturation pond for liquid stream	2	(scheme under IUDM and SBM, cost share 67% and 33% respectively)	Yet to be decided.	Private	Yet to be decided.	Informal private players and ULB services

S.No.	Name of FSTP	City	State	Expected Month/Year of Commissioning	Capacity in KLD	Allocated Land Area of the Facility (sq.m)	Number of Households covered by FSTP	
28	Vandavasi	Vandavasi	Tamil Nadu	December 2019	20	3400	7326	
29	Walajapet	Host ULB : Walajapet Cluster ULB : Ammoor	Tamil Nadu	December 2019	30	5100	14261	
30	Pilot FSTP	Phulera	Rajasthan	October 2019	27	2300	55413	
31	Pilot FSTP	Khandela	Rajasthan	December 2019	10	1315	28000	
32	Bhalki FSTP	Bhalki	Karnataka	December 2019	12	4100	53350	

	Brief description of technology	Total Capital Expenditure (INR crores)	Source of Capital (public funds with scheme name, private grants with donor name, private investment with company name)	Estimated Operational Expenditure (in INR lakhs per year)	Operated by	Revenue Model of FSTP	Desludging Operator (Informal/regulated)
	Screen chamber, Anaerobic stabilization of FS followed by natural solar sludge drying beds, sludge storage and co-composting for the solid stream; Integrated settler anaerobic filter, planted gravel filter and Maturation pond for liquid stream	2.5	(scheme under IUDM and SBM, cost share 67% and 33% respectively)	Yet to be decided.	Private	Yet to be decided.	Informal private players and ULB services
	Screen chamber, Anaerobic stabilization of FS followed by natural solar sludge drying beds, sludge storage and co-composting for the solid stream; Integrated settler anaerobic filter, planted gravel filter and Maturation pond for liquid stream	3	(scheme under IUDM and SBM, cost share 67% and 33% respectively)	Yet to be decided.	Private	Yet to be decided.	Informal private players and ULB services
	Screen and Grit Chamber, Stabilisation Reactor, Sludge Drying Bed, Integrated Anaerobic Baffled Reactor & Anaerobic Filter ( ABR & AF), Planted Gravel Filter (PGF), Collection Tank	2.8		8.6	Private + Public	ADB loan to state - RUIDP	ULB + Private sector
	Screen, planted drying bed, DEWATS	2.08		6.5	Private + Public	ADB loan to state - RUIDP	ULB + Private sector
	Screen and Grit Chamber, Stabilisation Reactor, Sludge Drying Bed, Integrated Anaerobic Baffled Reactor & Anaerobic Filter ( ABR & AF), Planted Gravel Filter (PGF), Collection Tank	1.72		16			

As on November 2019: AMRUT TSU(KPMG), MOHUA, Govt. of India

## Way forward

The compendium is prepared based on the secondary data available on the technologies in India. As stated earlier, this is a living document, and as we visit more FSTPs, interact with the key stakeholders, the data provided will be more refined. At present, only limited technologies are available for treatment of Faecal sludge.

The costing and area requirements of the technology vary distinctively from location to location. Various factors influence the costing, which are being analyzed to establish common bench-marks to help rapid adoption across the country.

### PROJECT

Sanitation Capacity Building Platform

### DEVELOPED BY

National Institute of Urban Affairs, New Delhi

Tide Technocrats, Bengaluru

### DISCLAIMER

While every effort has been made to ensure the correctness of data/information used in this compendium, neither the authors nor NIUA accept any legal liability for the accuracy or inferences drawn from the material contained therein or for any consequences arising from the use of this material.

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