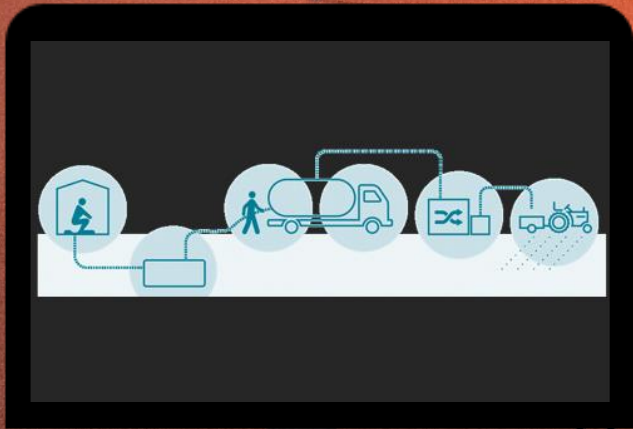
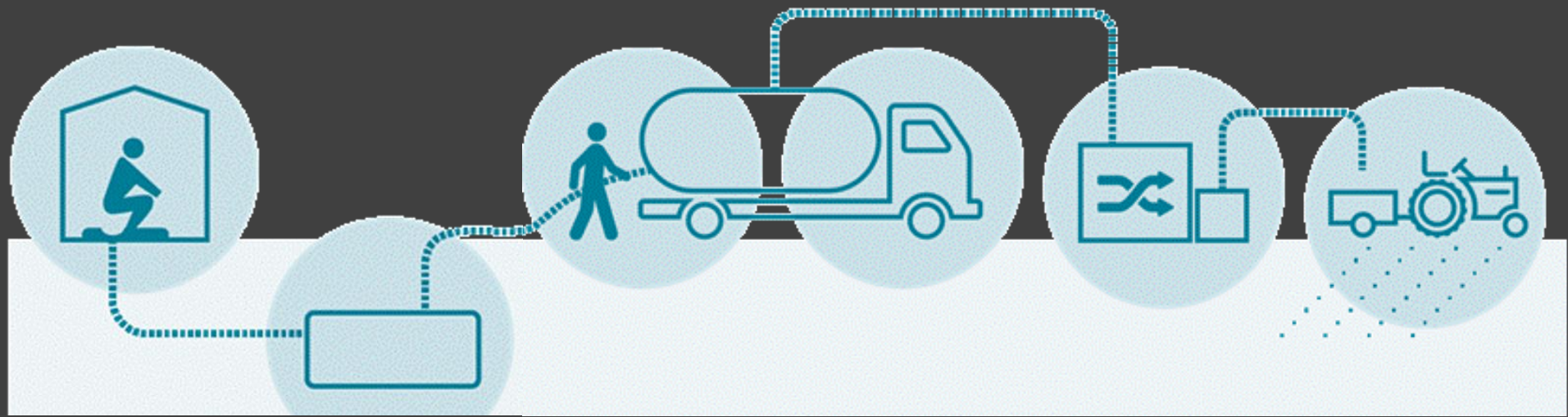


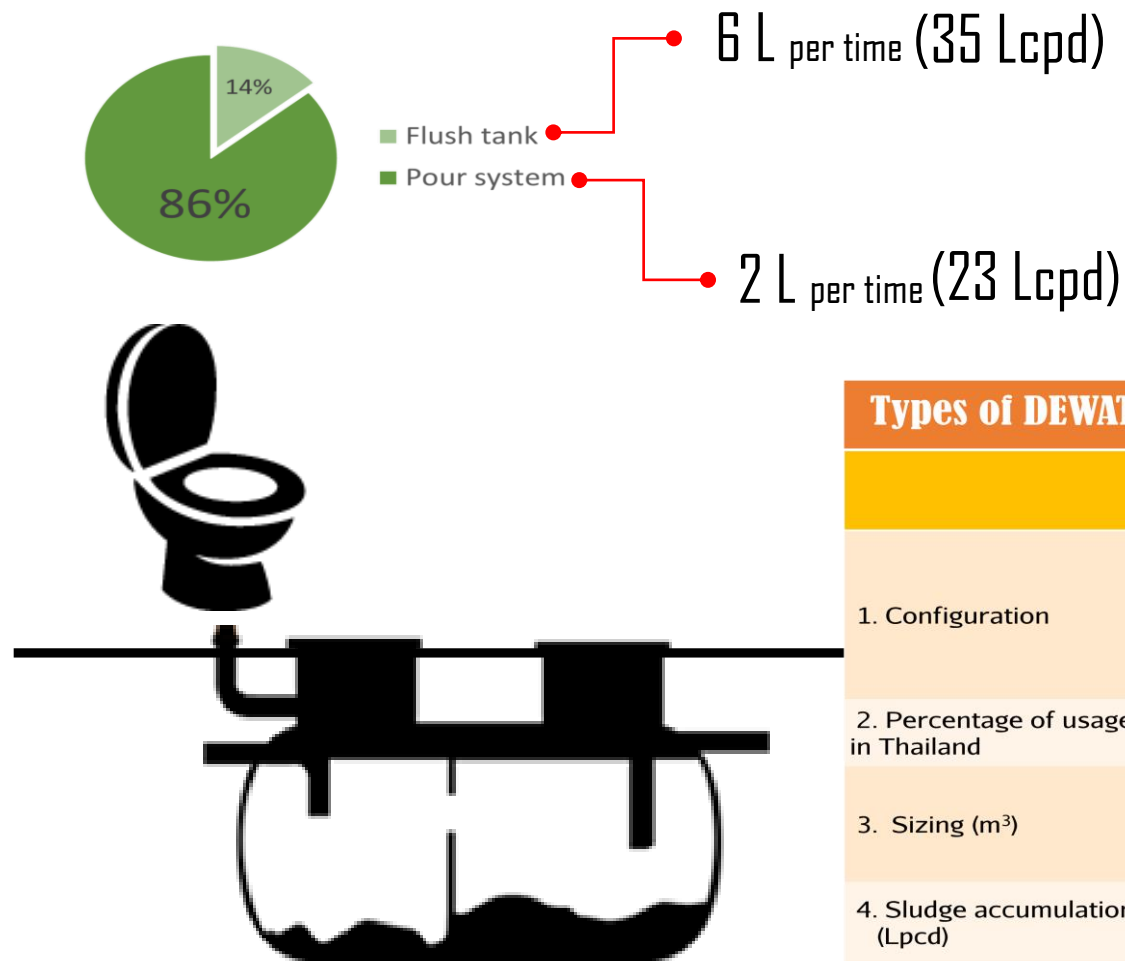
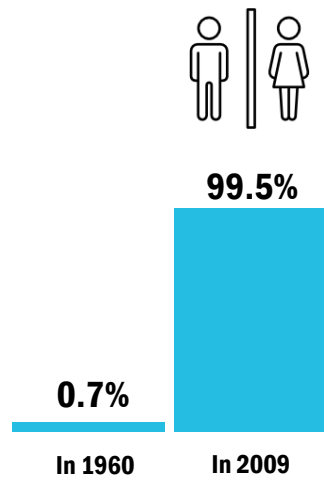
# Toward Sanitation Challenges in Thailand





**Prof. Thammarat Koottatep**  
Environmental Engineering & Management  
Asian Institute of Technology, Thailand



# Sanitation Situation



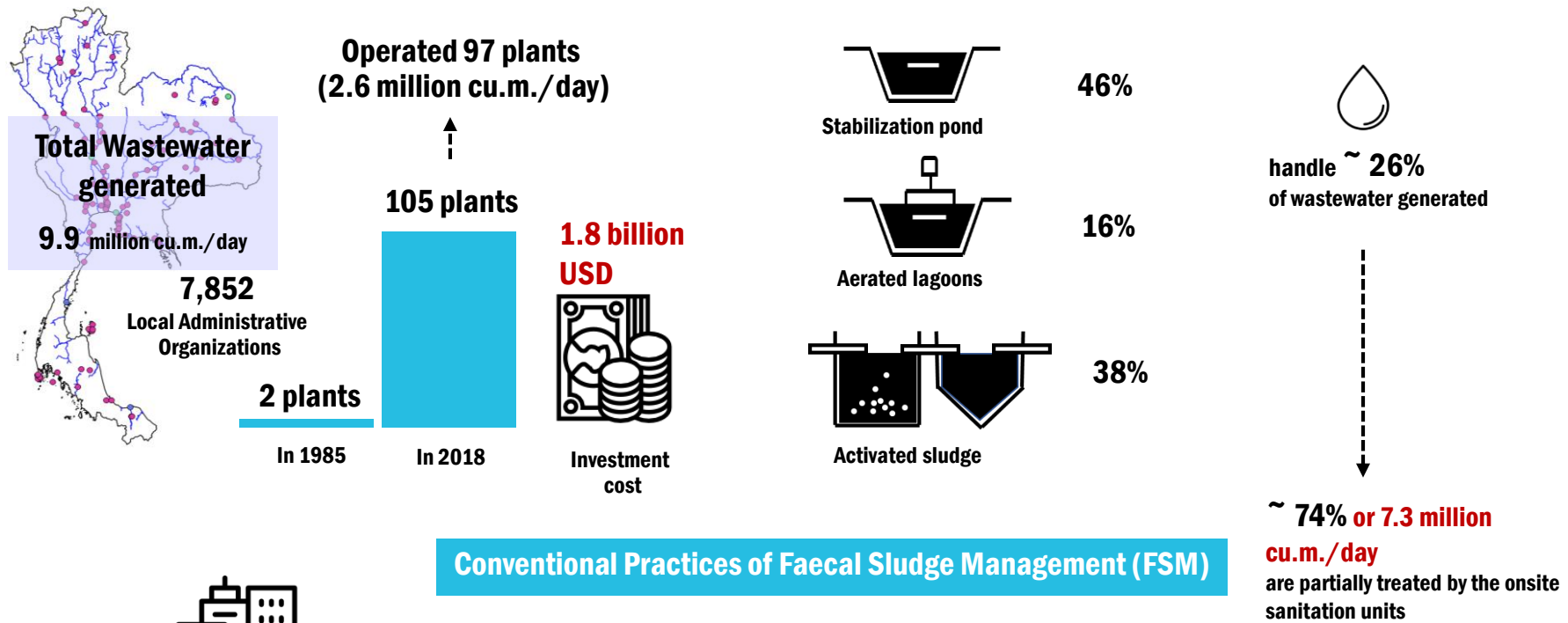
Types of DEWAT system in Thailand		
	Cesspool	Commercial package
1. Configuration		
2. Percentage of usage in Thailand	94%	6%
3. Sizing (m <sup>3</sup> )	0.6–1.7	1.2-2 m <sup>3</sup>
4. Sludge accumulation rate (Lpcd)	49.3	42.5
5. Construction cost (USD)	160-330	400-650
6. Effluent		
- BOD (mg/L)	152-666	132-952
- TSS (mg/L)	127-1,064	135-325
- Faecal coliform (MPN/100mL)	10 <sup>5</sup> -10 <sup>7</sup>	10 <sup>5</sup> -10 <sup>7</sup>
- E. coli (MPN/100 mL)	10 <sup>3</sup> -10 <sup>7</sup>	10 <sup>5</sup> -10 <sup>7</sup>



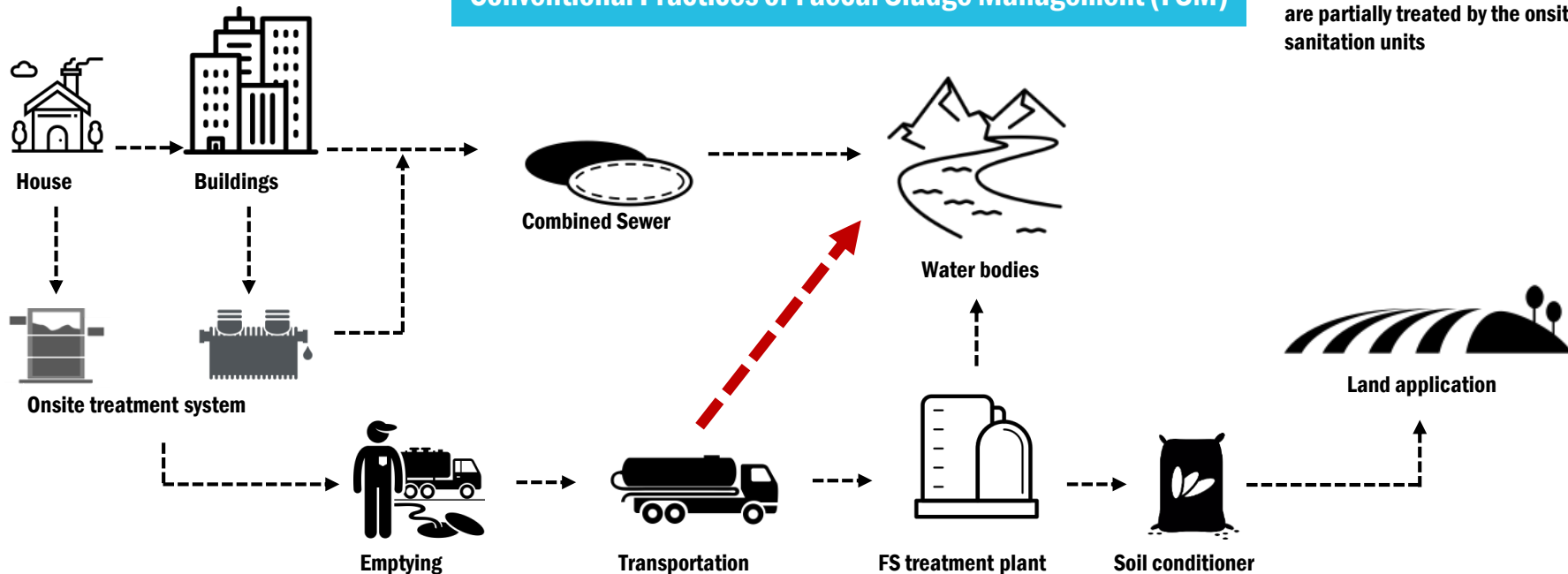




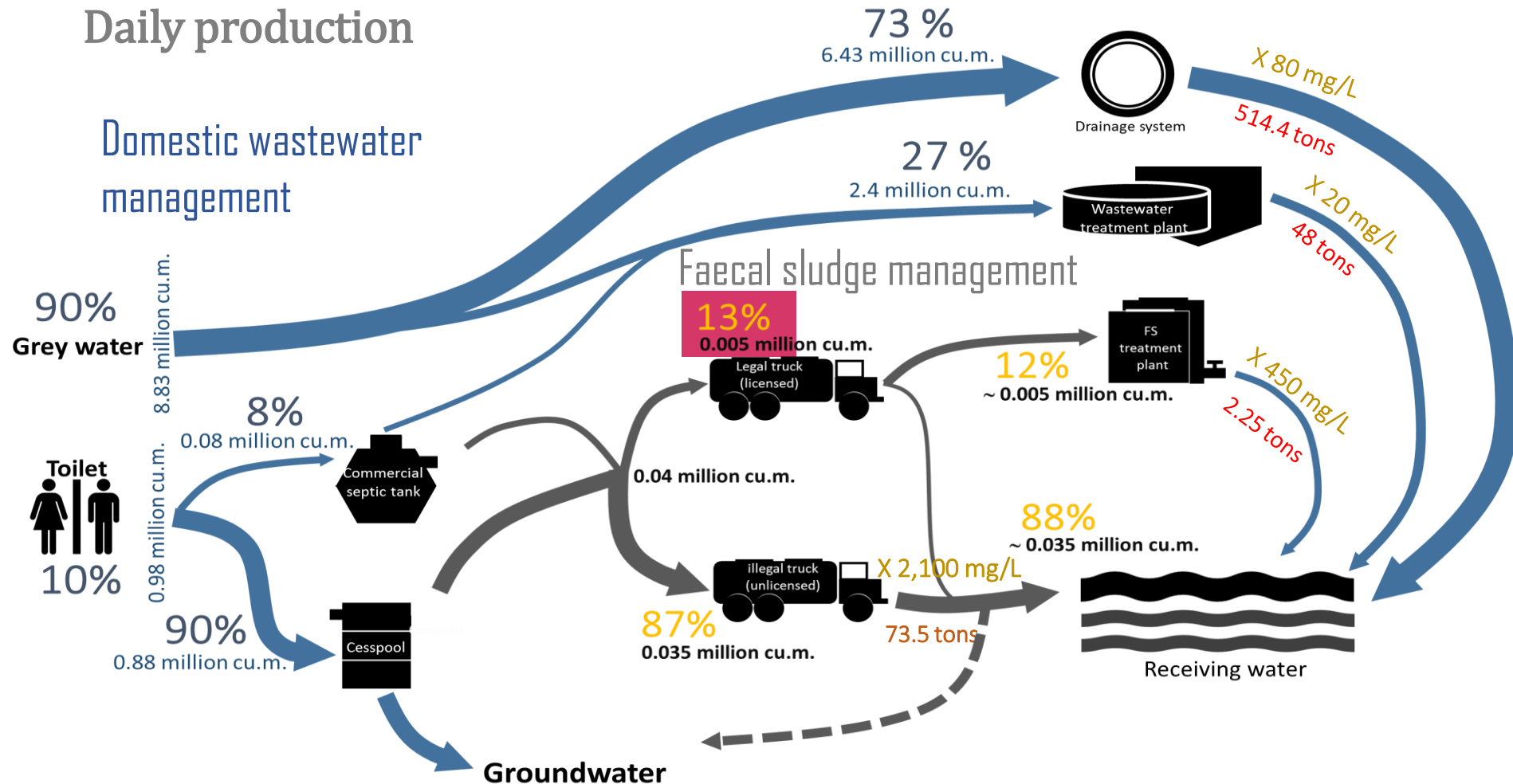
## Domestic Wastewater Management



## Conventional Practices of Faecal Sludge Management (FSM)



# Unveiled Sanitation Issues in Thailand



# Reinvented Toilet Technology

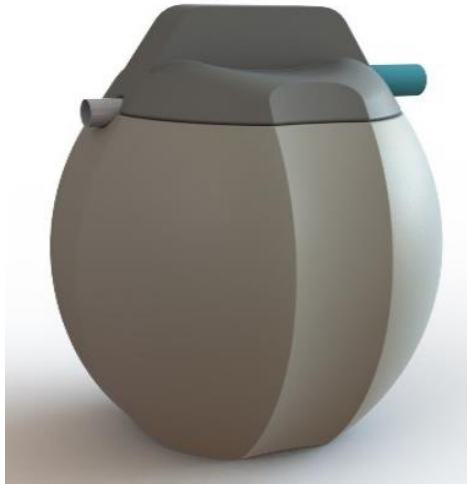
The Reinvented Toilet is a modular, transformative technology that offers a non-sewered sanitation solution, eliminating the need for a piped collection system. The aim of the Reinvented Toilet is to: destroy all pathogens onsite and recover valuable resources, operate **without sewer, water or electricity connections** and cost less than **\$0.05/user/day** in a sustainable business model.

## ELIMINATE PATHOGENS

- Eliminate safety concerns via handling
- Reduce disease burden
- Improve environmental safety

## OPERATE OFF GRID

- Eliminate need for external inputs such as water and energy
- Make portable and easy to install

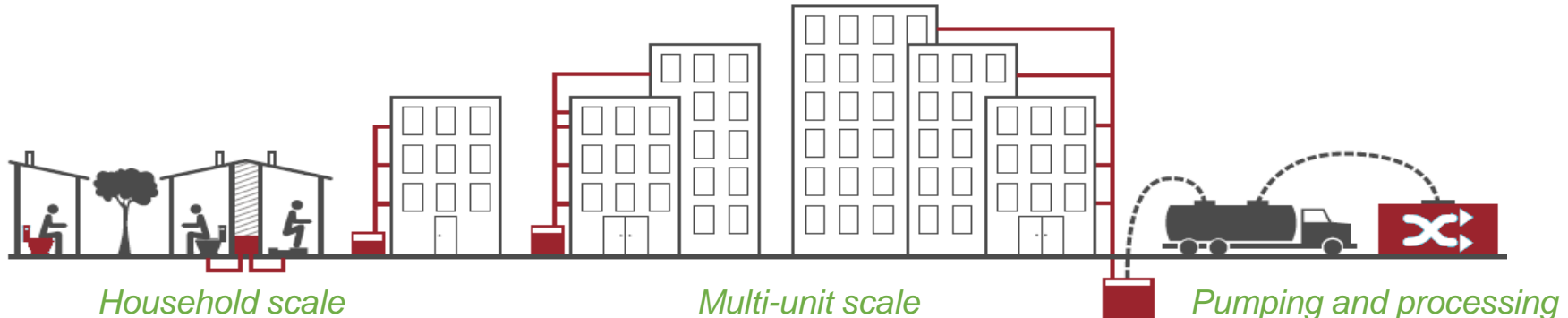


## CONVEY LOW LIFE-CYCLE COSTS

- Reduce need for pit emptying
- Ensure a sustainable business model, including maintenance via service providers

## PRESENT MODULAR, ATTRACTIVE INTERFACE

- Reduce / eliminate construction costs
- Provide clean and dignified product
- Eliminate odors and waste



# Transformative Technologies Commercialization (TTC) core processing technologies

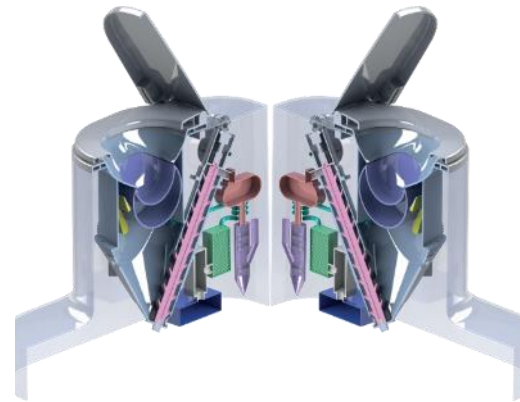
## ■ ELECTROCHEMICAL



## ■ WET OXIDATION

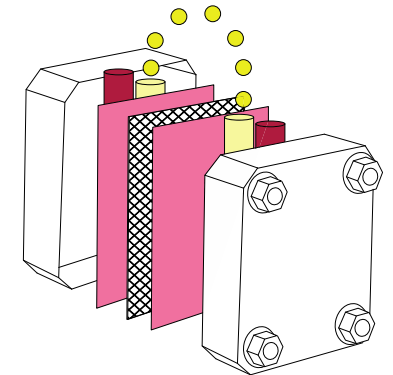


## ■ DRY COMBUSTION



**JANICKI BIOENERGY**

## ■ BIOLOGICAL



*Credits: Bill & Melinda Gates Foundation*

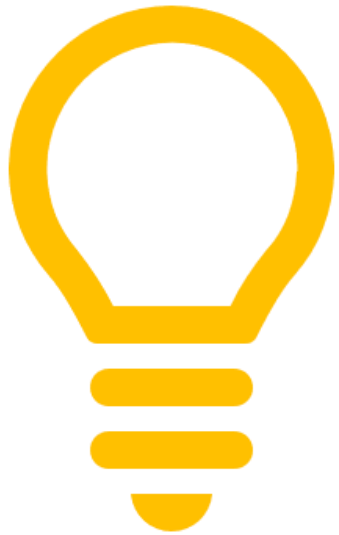


# AIT TESTING CENTRE









- Assures that house owners purchase quality wastewater treatment products,
- Jointly develop a standard procedure to test performance efficiency of a wastewater treatment product,
- Certify and promote certified products only in the region.

# AIT TESTING CENTRE





# Testing Protocols

- Material test
  - EN 12566-1 (European Standard)
  - TIS: Packaged Wastewater Treatment Tanks For Residential Building
- Performance test
  - EN 12566-3 (European Standard)
  - NSF/ANSI 40 (US. Standard)
  - TIS: Packaged Wastewater Treatment Tanks For Residential Building
- Development of AIT-BORDA testing protocol for Prefabricated or Site-assembled Domestic Wastewater Treatment Plants



# Performance Test

- EN 12566-3 (European Standard)
- NSF/ANSI 40 (US. Standard)
- AIT-BORDA protocol for Prefabricated or Site-assembled Domestic Wastewater Treatment Plants
- Testing Center





# Comparison of Current Standards and AIT-BORDA Protocol

Item	EN 12566-3 (2005)	NSF/ANSI 40 (2013)	AIT-BORDA
Scope	For packaged and/or site assembled domestic wastewater treatment plants used for <u>populations up to 50 inhabitants</u>	For residential wastewater treatment systems having capacities <u>1,514 – 5,678 L/day (400 - 1,500 gal/day)</u>	Up to <u>6,000 L/day (6 m<sup>3</sup>/day)</u>
Materials	Concrete, steel, PVC-U, Polyethylene (PE), Polypropylene (PP) and Glass Reinforced Polyester (GRP-UP)	Materials shall be durable and capable of withstanding stresses and wear during shipping, assembly, installation, and operation.	Concrete, steel, PVC-U, Polyethylene (PE), Polypropylene (PP) and Glass Reinforced Polyester (GRP-UP)
Monitoring parameters	BOD, TSS, Temperature, Power consumption, daily hydraulic flow	- pH, SS, BOD, CBOD (regular monitor) - color, odor, oily film and foam (3 samples over testing period)	- pH, BOD, TSS, Power consumption, daily hydraulic flow (Compulsory) - TDS, TKN, TP (Optional)
Influent characteristics	- BOD = 150-500 mg/L (or COD = 300-1000 mg/L) - TSS = 200-700 mg/L - TKN = 25-100 mg/L (or NH <sub>3</sub> -N = 22-80 mg/L) - TP = 5-20 mg/L	- BOD = 100-300 mg/L - TSS = 100-350 mg/L - Alkalinity > 175 mg/L as CaCO <sub>3</sub> <i>Note: Values are averaged for 30 days</i>	- BOD = 150-500 mg/L - TSS = 200-700 mg/L

50 inhabitants x (0.8 x 200 L/capita-day) = 8,000 L/day (8 m<sup>3</sup>); (Source: ONEP, 2007)

# Comparison of Current Standards and AIT-BORDA Protocol

Item	EN 12566-3 (2005)	NSF/ANSI 40 (2013)	AIT-BORDA																																				
Hydraulic daily flow	Based on volume of the daily hydraulic capacity of the system	Based on volume of the daily hydraulic capacity of the system	Based on volume of the daily hydraulic capacity of the system																																				
Flow pattern	<table><tr><th>Time of day</th><th>% of daily flow</th></tr><tr><td>6:00 – 9:00</td><td>30</td></tr><tr><td>9:00 – 12:00</td><td>15</td></tr><tr><td>12:00 – 18:00</td><td>0</td></tr><tr><td>18:00 – 20:00</td><td>40</td></tr><tr><td>20:00 – 23:00</td><td>15</td></tr><tr><td>23:00 – 6:00</td><td>0</td></tr></table>	Time of day	% of daily flow	6:00 – 9:00	30	9:00 – 12:00	15	12:00 – 18:00	0	18:00 – 20:00	40	20:00 – 23:00	15	23:00 – 6:00	0	<table><tr><th>Time of day</th><th>% of daily flow</th></tr><tr><td>6:00 – 9:00</td><td>35</td></tr><tr><td>11:00 – 14:00</td><td>25</td></tr><tr><td>17:00 – 20:00</td><td>40</td></tr></table>	Time of day	% of daily flow	6:00 – 9:00	35	11:00 – 14:00	25	17:00 – 20:00	40	<table><tr><th>Time of day</th><th>% of daily flow</th></tr><tr><td>6:00 – 9:00</td><td>30</td></tr><tr><td>9:00 – 12:00</td><td>15</td></tr><tr><td>12:00 – 18:00</td><td>0</td></tr><tr><td>18:00 – 20:00</td><td>40</td></tr><tr><td>20:00 – 23:00</td><td>15</td></tr><tr><td>23:00 – 6:00</td><td>0</td></tr></table>	Time of day	% of daily flow	6:00 – 9:00	30	9:00 – 12:00	15	12:00 – 18:00	0	18:00 – 20:00	40	20:00 – 23:00	15	23:00 – 6:00	0
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Tested period	Consecutive 38 + X * weeks	Consecutive 26 weeks	Consecutive 16 + X * weeks I.e. - Normal load 6 week - Overload 2 weeks - Normal load 2 weeks - Underload 2 weeks - Normal load 2 weeks -No load 2 weeks																																				
Number of sample data	26 data	96 data	32 data (twice a week)																																				
Method of sample collection	24-hr composite sampling	24-hr composite sampling	24-hr composite sampling																																				

Remark: \* X is a period of system start up

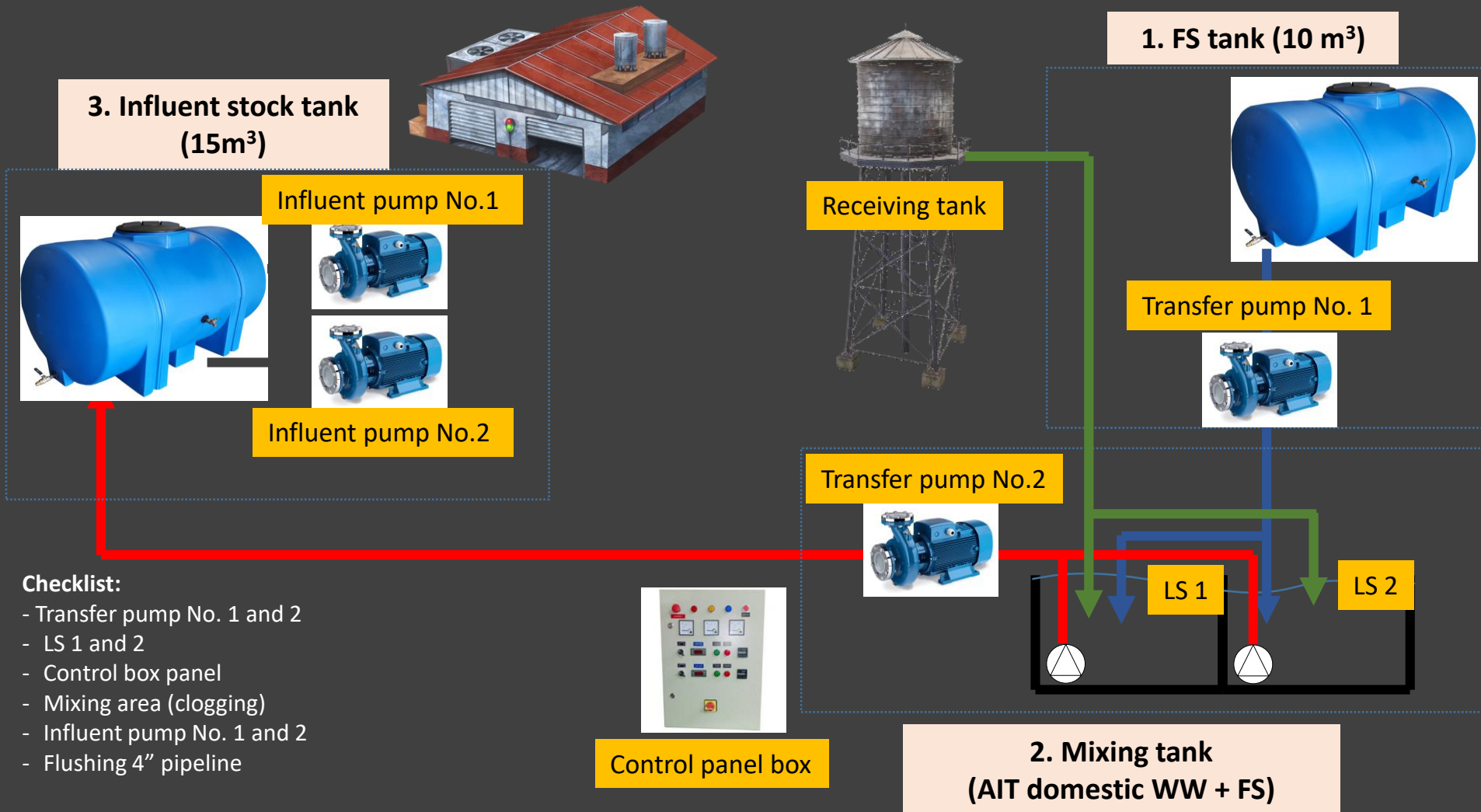




# TESTING CENTRE









Influent stock tank (15m<sup>3</sup>)

Flow meter



Flange 4"



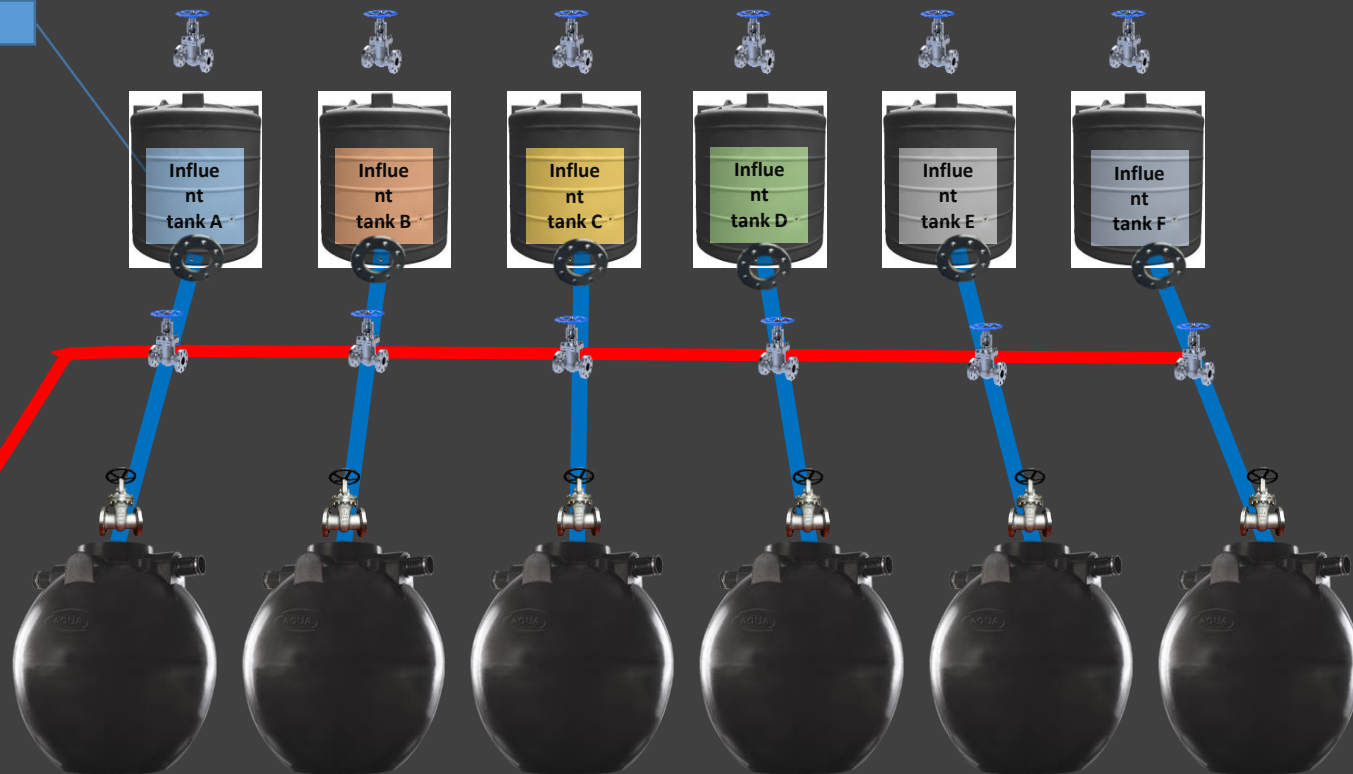
Influent pump No.1

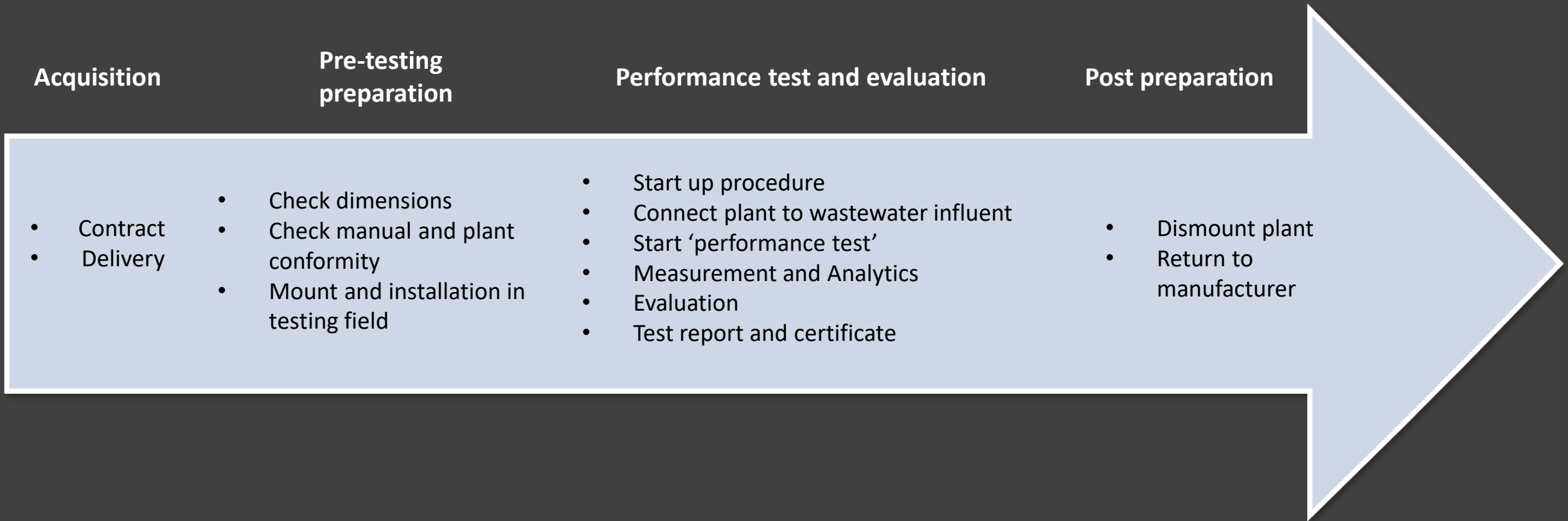


Influent pump No.2



Air Comp.







# HYDRAULIC EFFICIENCY TEST





# PERFORMANCE EFFICIENCY TEST





# AIT TESTING CENTRE





VISIONS

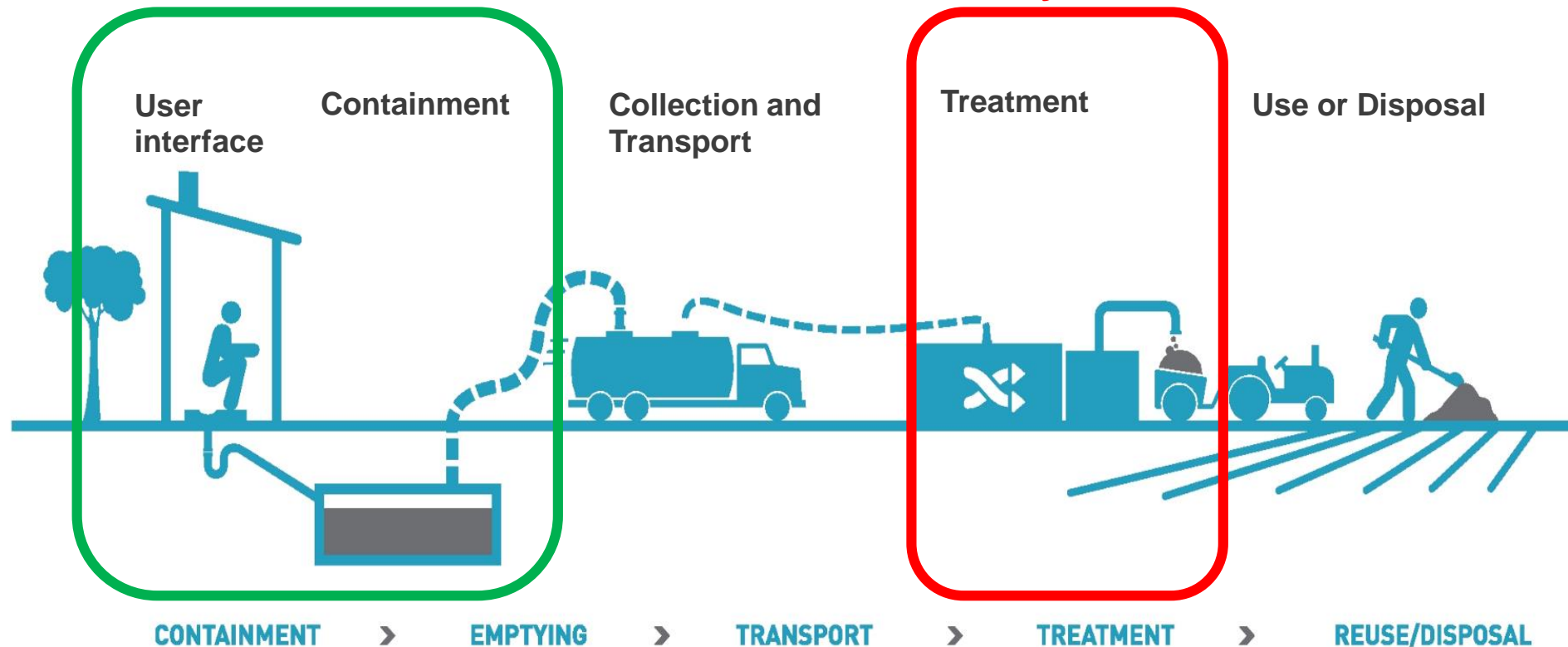
# VISIONS

- To be a recognized testing centre for decentralized wastewater treatment products in Asia
- Establish AIT as a knowledge hub for development of standards for decentralized wastewater treatment products,
- Establish AIT as a network hub for manufacturers, policy makers, users, and academicians.

# PC 305 and 318 – Forward Looking Standard

**PC 305: Sustainable non-sewered sanitation systems (disbanded)**

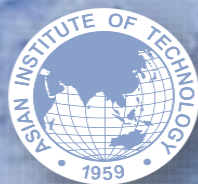
**PC 318: Community scale resource oriented sanitation treatment systems**



*Note: PC is Project Committee, disbanded after standard developed*

*Credits: Bill & Melinda Gates Foundation*





*Thank You*



Bridging Sanitation Innovations to Practice