



# DECENTRALIZED WASTEWATER MANAGEMENT (DWWM) IN VIETNAM

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- **DWWM models**
- **Design – Build – Operation (D-B-O) challenges**
- **Fecal sludge management**
- **Performance test**
- **Recommendations: solutions for improvement**



# Recent situation of wastewater treatment in Vietnam

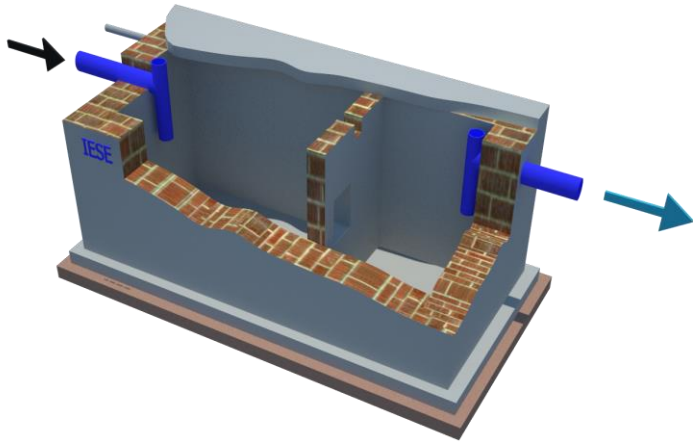
	Centralized Wastewater Treatment system (Ex: Sewer system)	Middle scale or cluster type wastewater treatment system	Decentralized wastewater treatment system (Ex: Septic tank, johkasou, pit latrine)	Without any wastewater treatment
Definition of each treatment system in your country	<ul style="list-style-type: none"> <li>- HHs + Collection + WWTP for city scale serving basin or sub-basin catchment area</li> <li>- <u>Septic tanks</u> at HHs as preliminary treatment are in most cases</li> </ul>	<ul style="list-style-type: none"> <li>- Serving towns, townlets, development areas with sewers</li> </ul>	<ul style="list-style-type: none"> <li>- Non-sewered areas, or short distance sewer lines (resorts, individual apartments, shops, restaurants, hospitals, factories, etc)</li> </ul>	<ul style="list-style-type: none"> <li>- Sewered + direct discharge</li> <li>- Non-sewered areas</li> </ul>
Installed plant number	<ul style="list-style-type: none"> <li>- <u>70 WWTPs</u> in &gt;40 cities, with design capacity 1.4 mio. m<sup>3</sup>/day</li> <li>- <u>80 WWTPs</u> are under design or construction, with design capacity 1.6 mio. m<sup>3</sup>/day</li> </ul>	<ul style="list-style-type: none"> <li>- 10% of 4,000 urban development areas = <u>400 WWT stations (WWTS)</u> in paper, 50% of them are functioning in realty = <u>200 WWTS</u>: Phu My Hung, Ecopark, Royal city, Times city, Ocean park, Dang Xa, etc</li> </ul>	<ul style="list-style-type: none"> <li>- Country: 90% of 13,600 medical points (hospitals, clinics, etc) = 12,250 WWTS, among which 35% are in good operation condition.</li> <li>- 1,000 WWTS in factories</li> <li>- 200 WWTS in restaurants, shops, resorts</li> <li>- 1,000 WWTS in hotels</li> <li>- <u>Total: 14,500 WWTS</u></li> </ul>	
Number of Population using each wastewater treatment systems	<ul style="list-style-type: none"> <li>- 17% of urban population = <u>6 million</u> persons</li> </ul>	<ul style="list-style-type: none"> <li>- 200 WWTS x 50% of design capacity x 500 m<sup>3</sup>/d or 3,000 persons = <u>30,000 persons</u></li> <li>- Handcraft villages: just a few</li> </ul>	<ul style="list-style-type: none"> <li>- <u>Besides: 25,000 systems</u> with Septic tanks only</li> <li>- Livestock farms: 400,000 m<sup>3</sup>/d x 30% with biogas digester</li> <li>- Hospitals: <u>1,012,500</u> persons are served</li> <li>- Hotels, resorts: <u>1,260,000</u> p. served</li> <li>- Factories: <u>300,000</u> p.</li> </ul>	

\*Reference: figures are calculated by author based on various sources

# Classification of DWWM models

- **Group 1:** On-site sanitation systems
  - **1a.** Low-cost on-site sanitation systems
  - **1b.** Mechanized on-site sanitation systems
- **Group 2:** Cluster DWWM systems (with wastewater collection network)
  - **2a.** Low-cost cluster wastewater treatment systems
  - **2b.** Mechanized cluster wastewater treatment systems
- Different ownership, sources of funding, modes of management, etc.

# Group 1a, Low-cost on-site sanitation systems



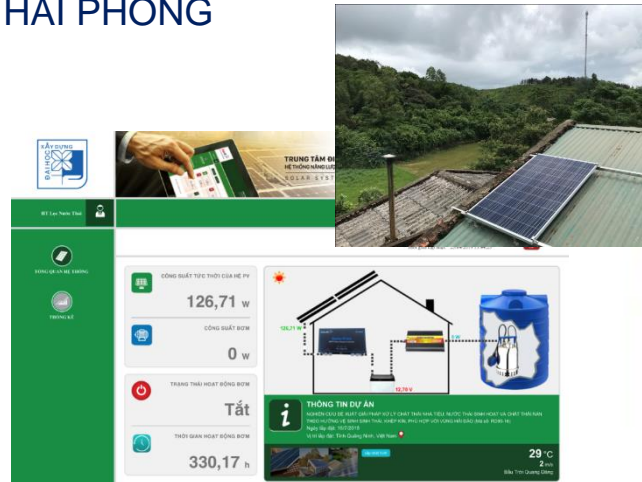


# Group 1b, Mechanized on-site sanitation systems



BASTAFAT-F FOR 12 HIGH-CLASS VILLAS AT NCC MY DINH, HANOI

BASTAFAT-F FOR CAT BA ISLAND, HAI PHONG



UV MODULE FOR DISINFECTION

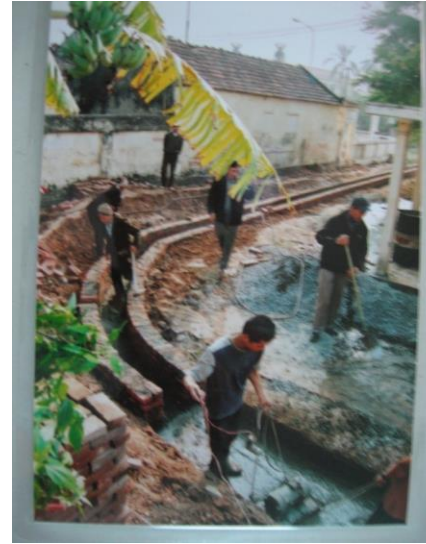
SOLAR PANEL AND REMOTE (ON-LINE) CONTROL

JAPANESE JOHKASOU

# Group 2, Cluster systems for group of households

## Drainage and sewerage network:

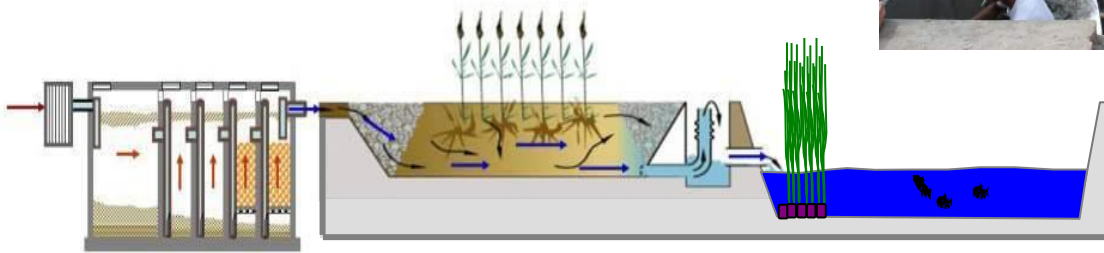
- Household connection
- Combined sewerage system
- Separate sewerage system
- Stormwater overflows





# Group 2a, Low-cost systems

BASTAF for 160 households



BASTAF for 400 HHs, Xuan Mai townlet,  
Chuong My, HN



BASTAF + CW for 2,600 HHs,  
Cho Moi townlet, Bac Kan





BASTAF for handcraft villages  
(food processing, livestock  
breeding, ...)



BASTAF for 100 HHs in Lim  
townlet, Bac Ninh prov.

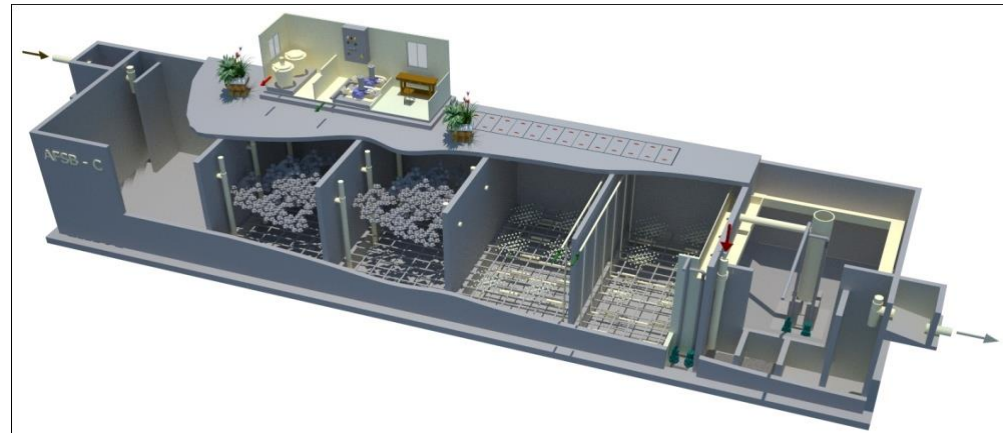
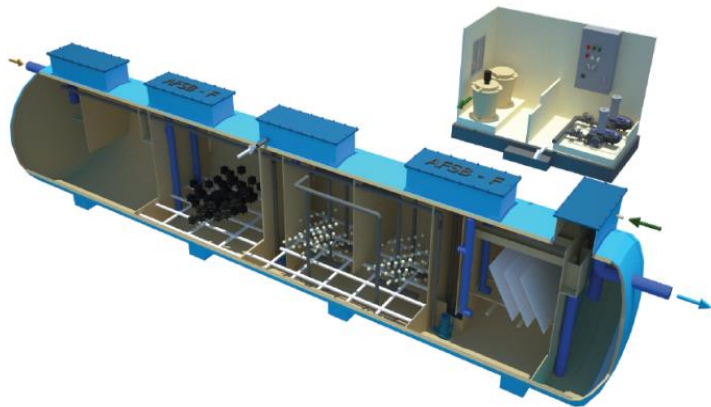


BASTAF + CW + Pond,  $Q = 100 \text{ m}^3/\text{day}$ ,  
Vietnam Friendship Village, Hanoi



# Group 2b, Mechanized systems

PACKAGED WWTS AFSB-C



PACKAGED WWTS AFSB-F



AFSB-F at Vicostone Co.



AFSB-F for Residential – Office Complex  
12 Thuy Khue, Hanoi





# Group 2b, Mechanized systems



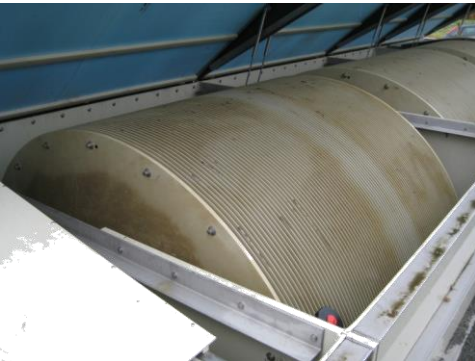
Pacific building, Hanoi  
35 FRP tanks



Sofitel Plaza, Hanoi



VCB bldg, Hanoi



PVN bldg, Hanoi



Tam Chuc Temple, Ha Nam  
(Fudeso Co.)



# Challenges at Group 1, Low-cost on-site sanitation systems

## Design:

- No official Design Standard (MOH: Manual only)
- Volume if not enough?
- No water proof?
- Some use house foundation to make tank wall
- “Not allowed” Infiltration chamber (soak pit)

## Build:

- No water proof
- No access for check and desludging
- No ventilation
- Misconnection (inlet, outlet, inside the tank)

## Operation:

- Septic tank is a property of household
- No desludging unless clogging
- Sludge management is not controlled
- Miss-use: hazardous waste



# Challenges at Group 1b, Mechanized on-site sanitation systems

## Design:

- No official Design Standard
- No specific requirement on technology and product certification, so that everybody does in different ways with out control on materials, equipment, technology
- Problem in effluent standard
- Manufacturers are trying to reduce costs by minimizing dimensions, simplifying equipment, materials

## Build:

- Floating
- No requirements on loading, floating resistance, sand back fill, anchoring, ...
- No requirements on transportation, installation, testing, comisisoning, evaluation...

## Operation:

- Treatment tank is a property of household
- No desludging unless clogging
- Sludge management is not controlled
- Miss-use: hazardous waste

# Challenges at Group 2, Cluster DWWS.

## - Wastewater collection network

### Design:

- Connection is not a concern of many wastewater projects
- Wrong selection of collection network type
- Lack of low-cost sewerage solutions
- Lack of integration with drainage system

### Build:

- Quality of construction works
- Misconnection (rainwater and wastewater, household connection, manhole, reverse flow, etc)

### Operation:

- Solids clogging
- No fund for O&M
- No clear solution for dredged sludge treatment/ disposal
- Poor public involvement

# Challenges at Group 2a, Cluster DWWS.

## - Low-cost wastewater treatment systems

### Design:

- Lack of Design Standard
- Vietnamese standard QCVN 14:2008/BTNMT, N, Coliforms: not achievable.
- Lack of adequate HH connection and wastewater collection components

### Build:

- Quality of construction works
- Planning and phasing
- Start up difficulties

### Operation:

- Solids clogging
- Hydraulic loads
- No fund for O&M
- No clear solution for dredged sludge treatment and disposal
- Limited capacity of operators

# Challenges at Group 2b, Mechanized wastewater treatment systems

## Design:

- Lack of Design Standard
- QCVN 14:2008, N, Coliforms: not achievable.
- Lack of adequate wastewater collection component
- Double investment in urban areas
- Too shallow: limited aeration and settling efficiency
- Limited access, especially for underground tanks

## Build:

- “Small” thinking, not adequate attention for QA
- Quality of construction works: leaking, sinking, etc.
- FRP tanks: very different quality, not certified
- Start up
- Media wash-out

## Operation:

- Solids clogging
- No fund for O&M
- Smell control
- C/N ratio is too low
- No professional O&M team



# QCVN 14:2008/BTNMT

No	Parameters	Column A <sup>(a)</sup>	Column B <sup>(b)</sup>
1	pH	5 - 9	5 – 9
2	BOD <sub>5</sub> (20°C), mg/l	30	50
3	TSS, mg/l	50	100
4	NH <sub>4</sub> -N, mg/l	5	10
5	NO <sub>3</sub> <sup>-</sup> , mg/l [NO <sub>3</sub> -N ???] *	30	50
6	PO <sub>4</sub> <sup>3-</sup> , mg/l [PO <sub>4</sub> -P ???] **	6	10
7	Total Coliforms, MPN/100 ml	3,000	5,000

(a) - Maximum allowable values for wastewater discharged to water bodies serving domestic water supply purpose.

(b) - Maximum allowable values for wastewater discharged to water bodies serving another purposes (irrigation, water transport, etc.).

*\*, \*\* - Different values in MONRE publication, hard copy, and web-site ☹  
 - QCVN 40:2011/BTNMT: Column A: TN = 20 mg/L; Column B: TN = 40 mg/L.*

# Study on wastewater characterization 2021 - 2022

JCES and IESE

## Objectives

- To find characterization of domestic wastewater for PE calculation basis
- To update design standard TCVN 7957-2008 (MOC)

## Targets:

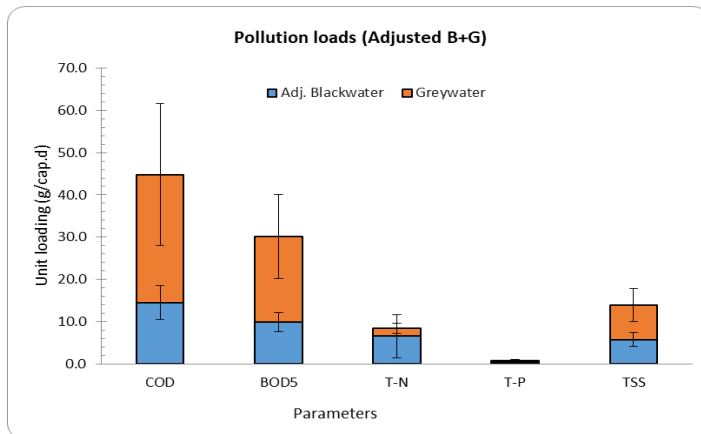
- Individual houses
- Apartment, dormitory
- Public buildings: office, school

## Methods:

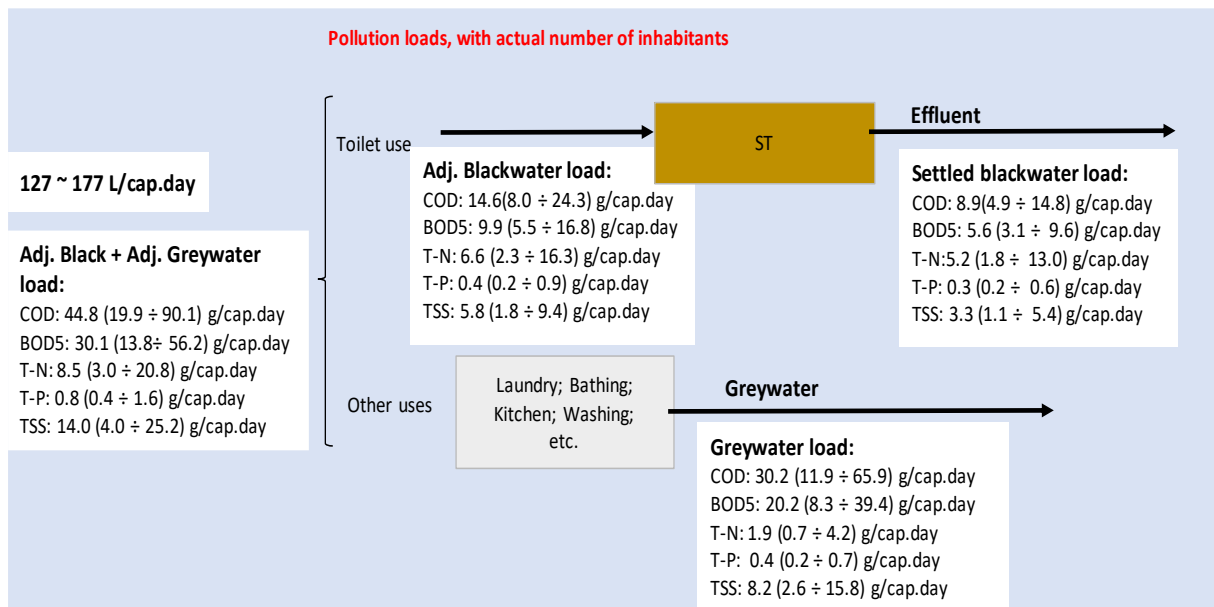
- Composite sampling
- Water consumption, Nutrients regime, Water usage
- Temperature, pH, BOD, COD, TS, TN, TP



# Study on wastewater characterization: Apartments



## JCES and IESE



# Faecal Sludge Management

- One of key components of DWWM
- Poor management practice in most places
- Already mentioned in Decree 80/2014 and some provincial regulations
- QCVN 50-2013: HMs in sludge
- 10TCN 526-2002: Composting fertilizer made from domestic solid waste
- Circular 41/2014/TT-BNNPTN on fertilizer management
- Law of Environment 2020
- Resource recovery from sludge is potential, but sludge reuse Guidance is not yet available.





- (1) Stakeholders involvement: Ben Tre city authority, Public Utility URENCO, Private firms, Women's Union (to work with Households)
- (2) Co-funding (BMGF through EMWF + local budget)
- (3) FS Treatment Station: Settling + Drying Bed; Leachate Treatment
- (4) Legal Framework Setting up: City's FSM Regulation (emptying, transport, treatment, disposal), Cost structure (released 04.2022)



# PERFORMANCE TEST

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## ACTIVITIES:

- Test on tank and tank materials
- Test on effluent quality
- Test on sludge accumulation, characteristics, and treatment

## ISSUES TO BE ADDRESSED:

- Testing site
- Testing time
- Testing conditions
- Certified laboratories
- “Pass” condition
- Certification



# PERFORMANCE TEST

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- **Test on tank and tank materials**
  - Product sample
  - At Quatest Labs (I, II, III)
  - At Quatest-cooperated Labs
  - Materials test: tensile and tear strength, durability against UV and corrosion
  - Tank test: water proof or tightness, hydraulic pressure and top loading



# PERFORMANCE TEST

- **Test on effluent quality**
  - On-site, or at selected wastewater treatment station as wastewater source (to run experiment with product sample)
  - By VLAS and VIMCERT Certified Labs
  - Over 4-6 months including winter time (coldest months)
  - Operation with at least 50% design capacity
- **Parameters in QCVN 14:2008/BTNMT:** pH, BOD, TSS,  $\text{NH}_4$ ,  $\text{NO}_3$ ,  $\text{PO}_4$ , Coliforms
- Other parameters recommended: Temperature, COD, TN, TP.
- “Passed”: sample /week, 90% samples passed (recommended).

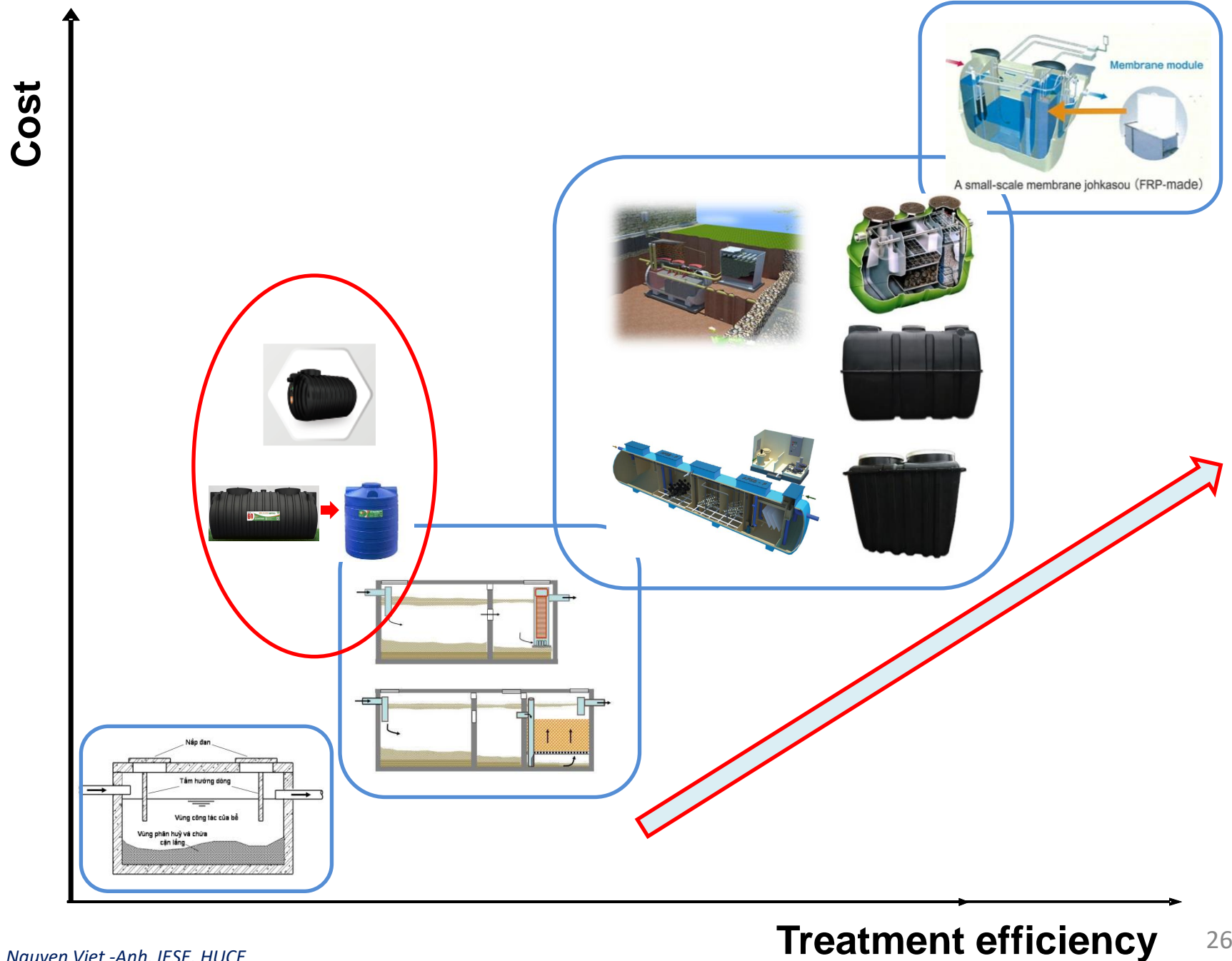




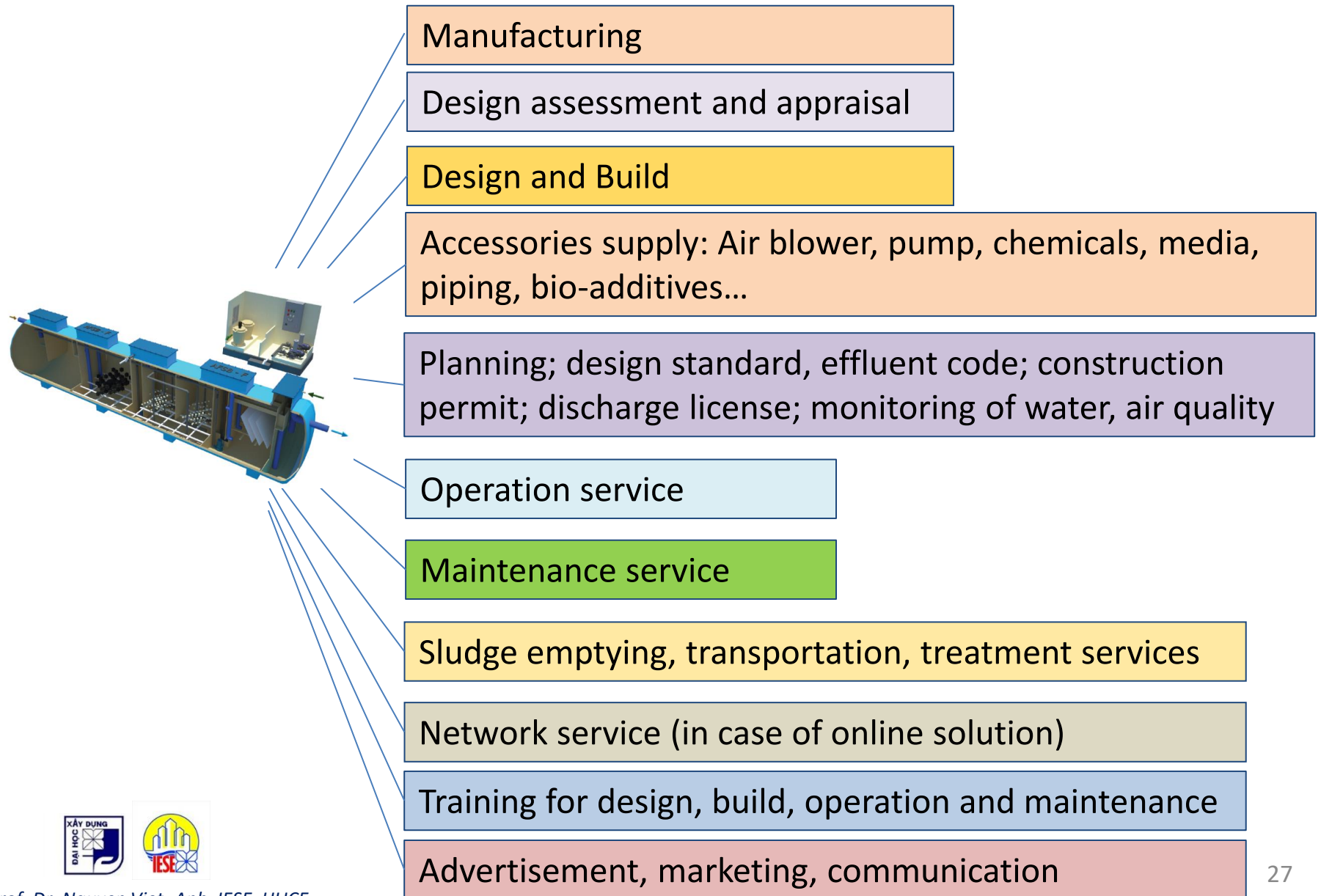
# PERFORMANCE TEST

- **Test on sludge accumulation, characteristics, and treatment**
  - By operators or users
  - Sludge accumulation over the time (L/year)
  - Desludging interval (year)
  - Characteristics (recommended): temperature, pH, COD, BOD, TS, VS, TN, TP, Coliforms, Helminth eggs
  - Collection and transportation method
  - Treatment method
  - Disposal/reuse method
  - Hygienic and social acceptance monitoring at disposal site





# DWWM: related activities



# RECOMMENDATIONS: SOLUTIONS FOR IMPROVEMENT

- Early decision making, integration of DWWM options into *urban planning*
- *Design standards* are to be issued
- *Effluent standards* are to be reviewed, especially on N, and pathogens removal in DWWM systems, and to avoid double investment
- *Testing and Certification* for technology, equipment, operation of w/w systems, sludge management services is needed
- *Household connection* should be compulsory. All components should be considered in a whole chain: HH facilities – collection network – wastewater treatment – disposal or reuse
- Professional *O&M service providers* are needed, on-site or out-sourced. Branch of provincial sewerage and drainage company is one among options
- *Promotion center(s)* with strong networking is needed





# THANK YOU VERY MUCH FOR YOUR ATTENTION !



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