Johkasou introduction project for domestic wastewater treatment improvement in Malaysia

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0. Outline of the Ministry of the Environment's (MOE) Program

Title

- Water Environment Improvement Project in Asia

Purpose

- To support the improvement of the water environment in Asian countries by disseminating Japanese water treatment technology
- To support the dissemination of efficient water treatment technologies made by Japanese private companies to foreign countries

Method

- MOE seeks publicly for appropriate technologies from Japanese private companies. The selected companies are supported financially by MOE.
- These companies shall conduct a feasibility study (F/S) in the first year and develop a pilot project after the second year as well as a business model through the demonstration and promotion of the applied technology.
- Projects can disseminate the applied technology to other areas and contribute to the water environment improvement in the country.

Others

- Each adopted project will be supported for 3 years by MOE with a maximum allowable fund of JPY 40 million.
- The targeted fields are domestic wastewater treatment, industrial wastewater treatment, phosphorous resource recovery systems, control of non-point source pollution.

1. Summary of the project

① Target Area : Petaling Jaya, Selangor, Malaysia

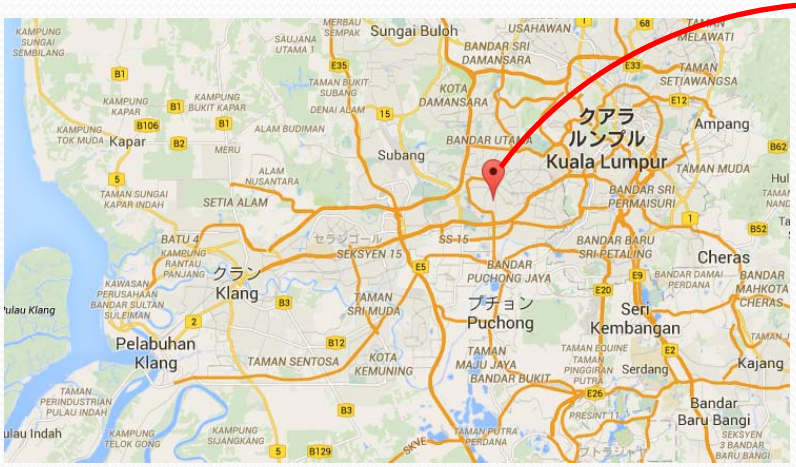
② Aim of the project : In Malaysia, 4,400 communal septic tanks are in operation, but most of these facilities show low treatment performance due to inappropriate maintenance and aging conditions. The aim of the project is to improve the existing problematic CSTs by introducing the Japanese johkasou and contribute to the improvement of public health and the water environment in Malaysia.

③ Content of implementation : Shift from CST to Japanese johkasou

④ Technology : Japanese johkasou technology

⑤ Expected benefits : Solve the problems associated with CSTs and contribute to the improvement of public health and the water environment

⑥ Outline of business model : Start johkasou business in Malaysia through collaboration with local companies for the replacement of CSTs and the upgrade of CSTs. In addition, introduction of johkasou in commercial facilities and specific areas.



Location of Petaling Jaya district source : Google Map

Air photo of Petaling Jaya distrct source : Google Map

2. Conditions and Issues for Project Implementation (1)

1) Current conditions and issues of domestic wastewater treatment in Malaysia

① In Malaysia 8,524 sewage treatment facilities have been constructed, covering about 23,000,000 PE. The number of people connected to on-site wastewater treatment facilities – Septic Tanks (STs), Small Sewage Treatment System (SSTSs) and Cesspits – is about 12,000,000 PE. In addition there are also night soil and sludge treatment facilities.

② Septic Tanks and Cesspits, which form the majority of on-site wastewater treatment facilities, are limited in performance. Moreover, a limited number of Septic Tanks receive regular desludging, thus turning these facilities into pollution sources. In addition to pollution increase, this situation poses a public health threat.

③ Among the facilities serving less than 1,000 PE (including SSTSs), many have structural (aging) problems or show low treatment performance due to inappropriate maintenance. Functional improvement and upgrade are needed.

Table 1: SEWERAGE COVERAGE AREA IN MALAYSIA (2013), *reference :SPAN handout*

TYPES OF SERVICES AND APPLICATION	
Type of Services	Units (PE)
Off-site treatment	
Decentralized (Multipoint)	8,445 (17,209,749)
Centralized (Regional)	79 (6,034,593)
On-site Treatment	
Individual Septic Tank	1,275,757 (6,608,56
Commural Septic Tank (CST)	4,380 (528,875)
Small Sewage Treatment System	2,400 (240,000)
Cess Pit (Pour Flush)	894,859 (4,474,293)

Reasons for targeting CSTs (＞150PE):
- no longer allowed for installation
- effluent quality regulated
- functional deterioration
  - aging
  - renewal needed

Figure 10 Effluent Pump

Figure 11 Full view of CST

An aging CST plant

2. Conditions and Issues for Project Implementation (2)

2) Current conditions and water environment issues

① Until 2008, more than 8,000 sewerage treatment plants have been constructed. Although water quality in rivers went through a period of slight improvement, conditions have deteriorated in recent years, during which BOD values have increased. Accordingly, domestic wastewater can be identified as the biggest source of pollution.

② **Principal causes:**

・Although water quality standards for effluent exist, they do not apply to individual septic tanks or cesspits, and although CSTs fall under this effluent standard regulation, they are often not applied to these facilities. As these facilities contribute to pollution increase, immediate measures are needed.

・The treatment function of small scale wastewater treatment facilities (less than 1,000 PE) is insufficient.

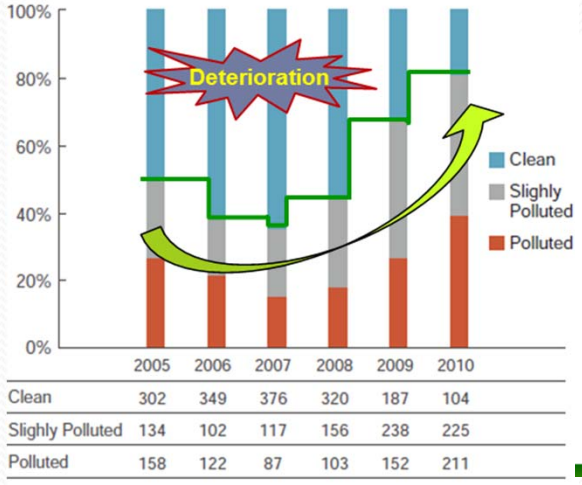
③ **Issues to tackle:** ・Adopt strengthened effluent standards for wastewater treatment facilities

・ Improve the treatment function of small scale wastewater treatment facilities

・ Convert ISTs/CSTs and cesspits to highly efficient wastewater treatment facilities

Table 2 Effluent water quality and effluent standard of on-site treatment facilities, *reference :SPAN handout*

Type of Service／water standard	effluent water quality／effluent standard	
	BOD (mg/L)	SS (mg/L)
aerobic lagoon	100	120
aerobic stabilization pond	120	150
trickling filter tank	175	150
CST	200	180
Standard A（located upstream the of water)	20	50
Standard B（other）	50	100



	2005	2006	2007	2008	2009	2010
Clean	302	349	376	320	187	104
Slighly Polluted	134	102	117	156	238	225
Polluted	158	122	87	103	152	211

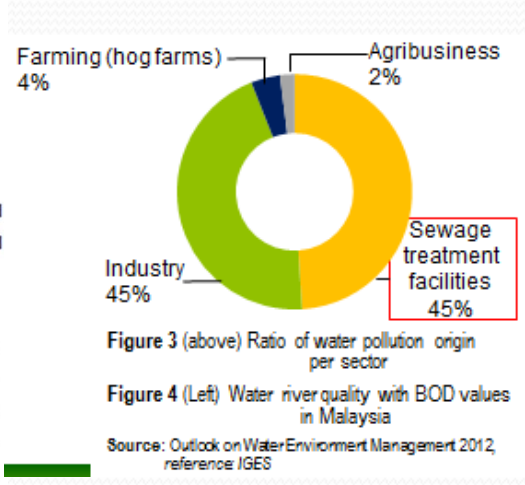


Figure 3 (above) Ratio of water pollution origin per sector

Figure 4 (Left) Water river quality with BOD values in Malaysia

Source: Outlook on Water Environment Management 2012, *reference IGES*

3. Project Implementation Structure

Ministry of the Environment, Japan

Study & Verification of business costs

Consortium

Verification Test
Localization of Johkasou technology
Formulation of business model
Daiki Axis Co., Ltd

Feasibility Study
Formulation of business plan
Instruction course in Japan
Japan Education Center of Environmental Sanitation

Workshop convener
Support for education and public awareness activities
Kyokuto Giko Consultant Co., Ltd.

Collaboration

Cooperation

FS/Guidance for demonstration project
National Water Service Commission

Ministry of Energy, Green Technology and Water (KeTTHA)

Cooperation/inputs/ support
FS/demonstration project
Indah Water Konsortium (IWK)

Ministry of Natural Resources & Environment (NRE)

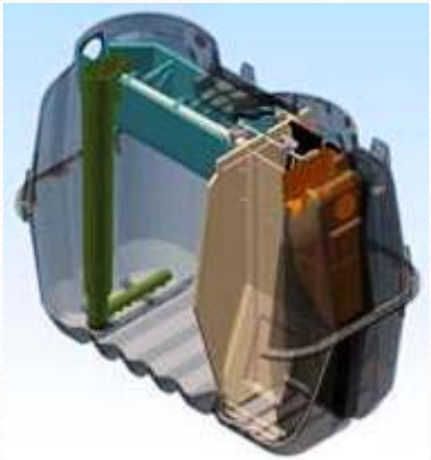
Dep. Of Env. (DoE)

FS/Collaboration for demonstration project
Registered Companies

4. Japanese Johkasou Technology

①Small-scale johkasou (5～10PE)

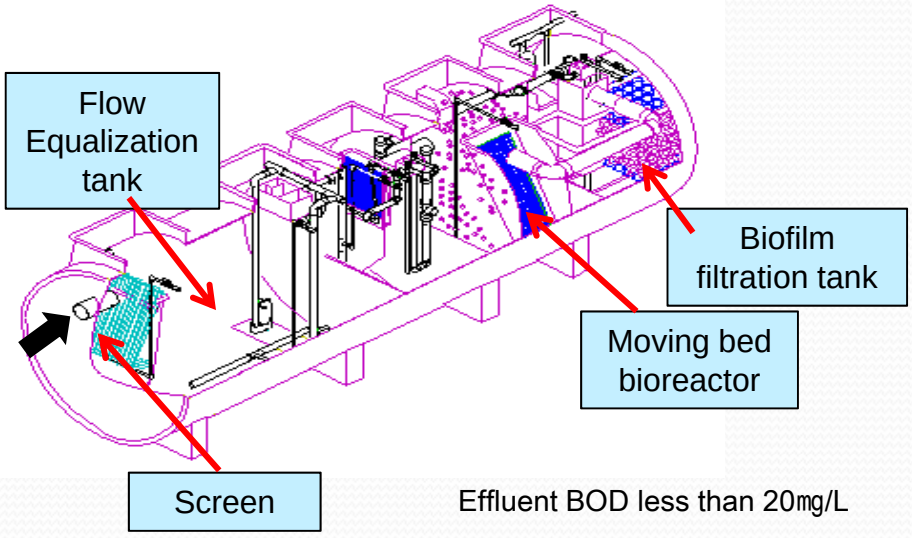
Daiki Axis　XE type （Moving Bed Bioreactor）



Effluent BOD&T-N less than 20㎎/L

③Large-scale Johkasou (51PE～)

Daiki Axis　RBF type (Moving bed/biofilm filtration bioreactor)

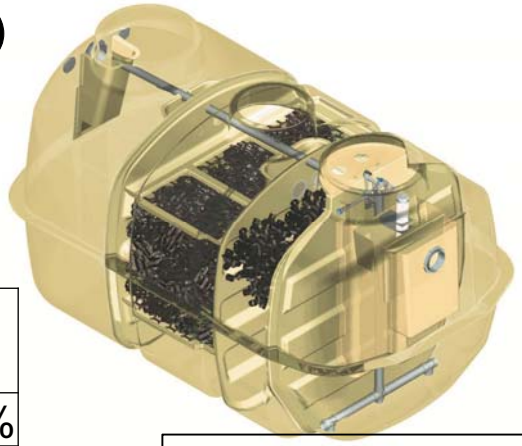


Effluent BOD less than 20㎎/L

②Middle-scale Johkasou (11～50PE)

Daiki Axis　DCX type （Moving Bed Bioreactor）

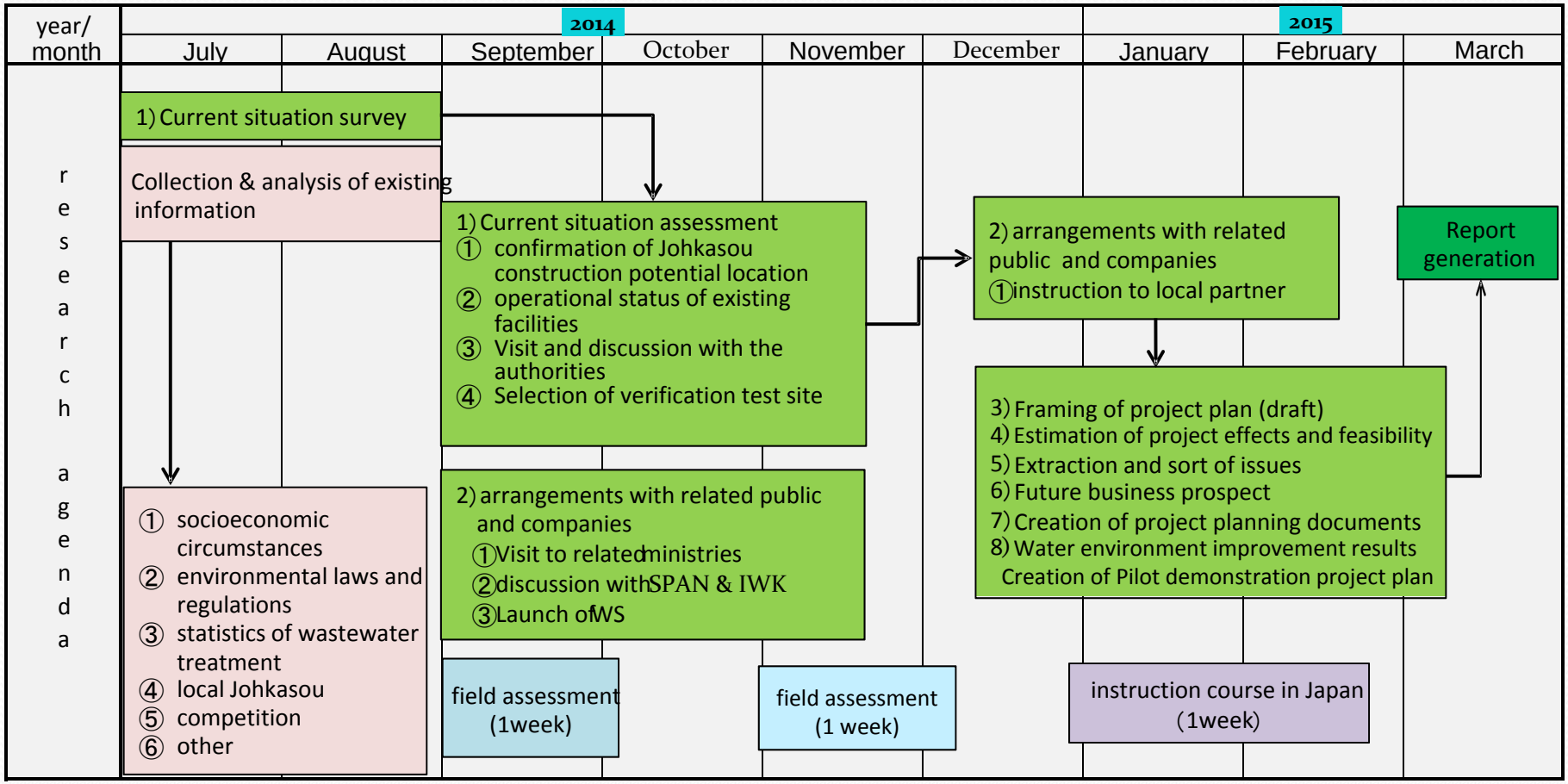
	Inf.	Eff.	Removal rate
B O D	200㎎/L	20㎎/L	90%
T - N	45㎎/L	20㎎/L	55.6%



- Johkasou greater than 50PE of this type will be manufactured in Indonesia from 2015.

Johkasou to be introduced in this project

5. FS Assessment Process



6. FS Assessment Contents (1)

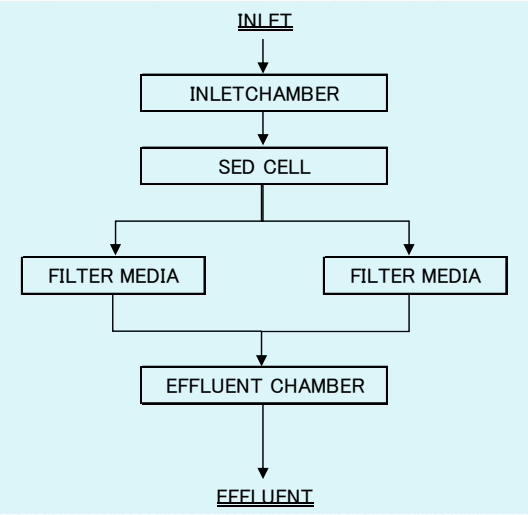
No.	Implementation Contents	Goals
1	– Current assessment situation – • Collection & analysis of existing information : ①socioeconomic circumstances; ②environmental laws and regulations; ③statistics of wastewater treatment; ④local johkasou; ⑤competition; etc. • Research of current conditions of target region : ①confirmation of johkasou construction potential location; ②operational status of existing facilities; ③visit and discussion with concerned authorities • Research on target CST : ①water usage in households ②influent wastewater quality and quantity; ③effluent water quality; ④drainage connection conditions, etc.	- Understanding of current conditions - Verification & selection of demonstration site - Data collection for demonstration project plan (water quality analysis item : BOD, COD, SS, n-Hex, NH_4-N, T-P, coliform)
2	– Framing of demonstration test plan – Planning contents : ①current conditions of target region (population, number of households, water quantity and quality) ; ②PE and spec ; ③manufacturing and carrying plan ; ④construction projects ; ⑤test running· maintenance learning plan ; ⑥treatment performance research plan ; ⑦verification method of water environment improvement effects	- Preparation for demonstration project implementation

6. FS Assessment Contents (2)

No.	Implementation Contents	Goals
3	– Education and public awareness activities / Workshop – • instruction course for technicians • launch of workshop • instruction course in Japan	- Education of johkasou technicians - Diffusion of knowledge about johkasou manufacturers / administration - Visit to johkasou-related organizations in Japan Visit to facilities and observation creation of a workshop with relevant organizations
4	– Expected and business model – • Local FRP plant manufacturer and production • Johkasou needs (public and private markets) • Agenda of johkasou business development	Data collection for creation of johkasou business model

7. Field Assessment

No.	ID of Facility	PE for Design	Start for Service	Treatment Process
6	PJA010	265	1970s	trickling filter process

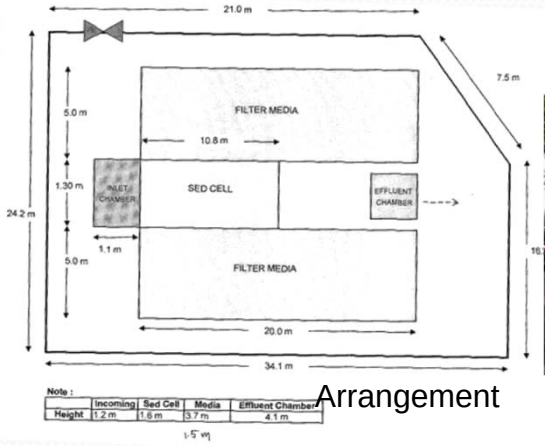


Flow chart

View of the demonstration site

Result of field assessment

No.	Inflow of gray water	Installa-tion space	Pumping	Access
1	△	△	×	○
2	△	×	×	○
3	△	△	×	○
4	△	○	○	○
5	○	○	△	△
6	○	○	○	○



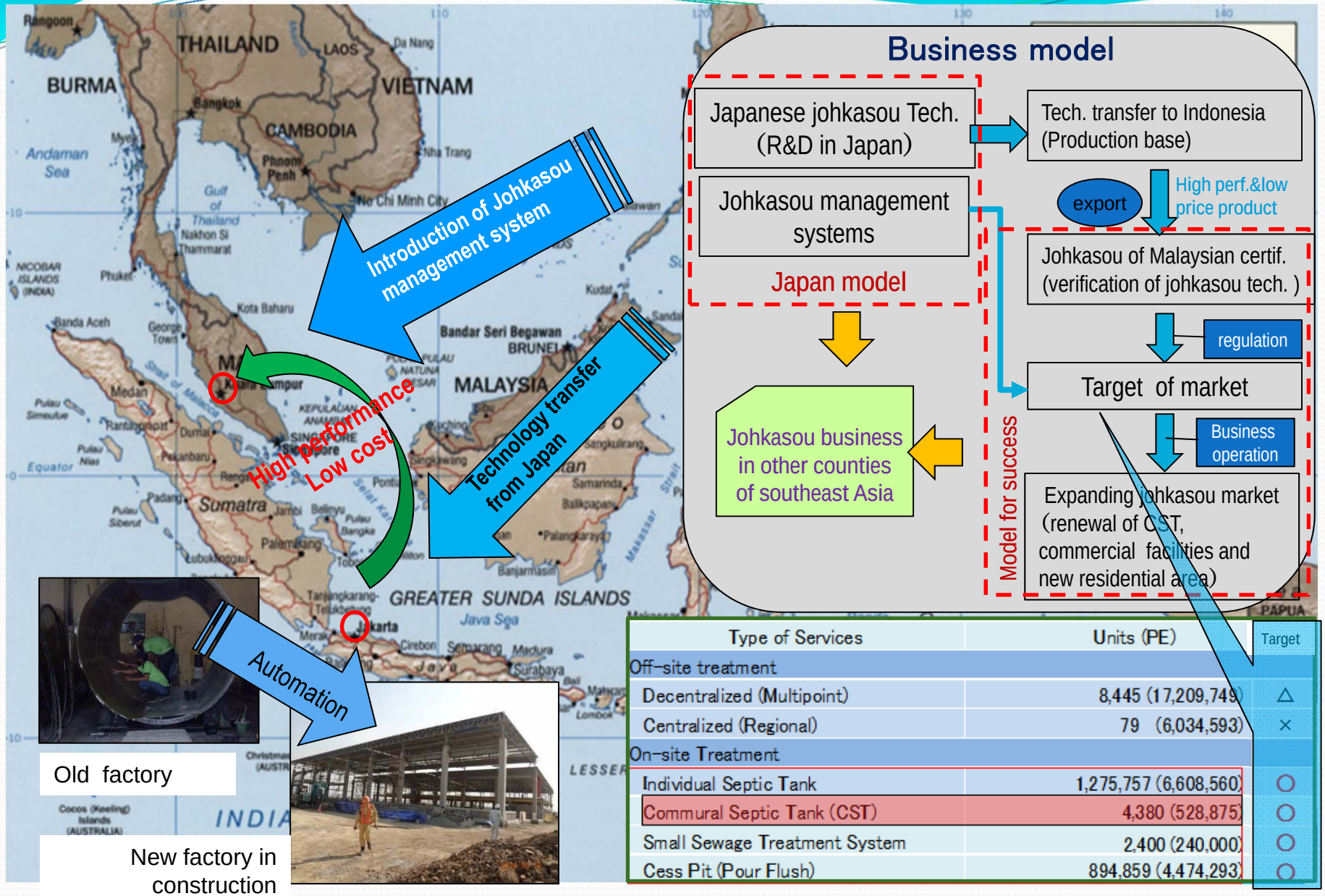
Arrangement

Access to the plant

Outflow

Trickling filter

8. Business Model



Type of Services	Units (PE)	Target
Off-site treatment		
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Centralized (Regional)	79 (6,034,593)	×
On-site Treatment		
Individual Septic Tank	1,275,757 (6,608,560)	○
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Small Sewage Treatment System	2,400 (240,000)	○
Cess Pit (Pour Flush)	894,859 (4,474,293)	○

9. Expected Benefits

1. Raising of on-site waste water treatment technology

By introducing Japan's johkasou technology, decentralized wastewater treatment facilities using anaerobic process, which are currently the mainly utilized facilities, can be shifted with a technology achieving high treatment performances using aerobic process. With this technology can be implemented O&M techniques and a management system which can lead to the improvement of all decentralized wastewater treatment systems in Malaysia.

2. Activation of local economy

Progress of overseas markets for Japanese johkasou businesses can be achieved ; jobs can be created in Malaysia in relation to the johkasou business which can also stimulates the local economy .

3. Raising of environmental awareness

With the introduction of johkasou with high treatment performances, visible effects of the improvement of the water environment will be felt. In addition, environmental awareness among citizens will increase and environmental issues will be actively tackled.

4. Contribution to environmental improvement – construction of a recycling society

With pollution load reduction, and the low energy cost of johkasou operations as well as the resource recovery from johkasou sludge, the project can reduce greenhouse gases emission and contribute to the construction of a recycling society

10. Road Map for the Project

Year/ Month	Mission	Content of implementation
2014.11	2nd Field assessment	● Detail survey of johkasou installation site ● Negotiation with local counterparts（IWK, Local consultant, Water analysis lab）
2014.12	Implementation plan of the next FY year	● Planning for design, manufacture and transportation ● Planning for construction and test operation ● Implementation plan of the main experiment
2015.2	Instruction course Japan	● Implementation of the instruction course in Japan
2015.3	Final report generation	● Summary the FS results, write and submit the final report
2015.4	3rd Field assessment	● Explanation the implementation plan and negotiation with related organizations ● Start the procedures of johkasou pilot project related to Malaysian regulations
2015.6	Johkasou installation	● Construction/installation and test operation of johkasou
2015.8～ 2017.3	Start of the main experiment	● Johkasou treatment performance (water quality, sludge generation) ● Johkasou operation/maintenance issues ● Cost/energy consumption analysis ● Environment/social impact analysis ● Development of sustainable business model