1. Fundamental subjects of the project

1.1 Background, overview and survey objectives of the project

This survey project is aimed at studying on the business feasibility of the CDM project for the reduction of CO_2 emissions from fossil fuels by reducing methane gases evolved from a tapioca starch processing plant in Tay Ninh province in Vietnam and consuming collected methane gases in the plant as an energy resource, by installing a plant to collect methane gases from an open lagoon (processing pond) that constitutes the wastewater treatment equipment of the existing plant.

1.2 Overview of Vietnam and the site

1.2.1 Overview of Vietnam[1-1]

(1) Climate

The Socialist Republic of Vietnam (metropolis Hanoi) is located at the eastside of the Indochinese Peninsula, with a national land area of about 330,000 km^2; 73% of the area are mountains with narrow plains along the coastline including the Red River delta in the north and the Mekong delta in the south.

In the northern Red River delta district (metropolis Hanoi) belongs to the subtropical zone with considerable temperature differences between summer and winter. However, in the Mekong delta in the south, the annual average temperature is 27°C~29°C with differences of about 3°C only between summer and winter, so the climatic attribute is a tropical zone.

(2) Population and races

The Vietnamese population is about 82,030,000; the ratio of Vietnamese (Kinh tribes) is 86% together with 53 minority races according to the government.

(3) National economy

The Vietnamese economy, since the Doi Moi policy in 1986, has been based on socialism, while market economies have rapidly grown and have achieved a growth rate as high as about 7% from 2000 because of increased exports, inflow of funds from overseas Vietnamese, ODA increase, etc. Vietnam has also joined unions of local economies such as ASEAN (joined July 1995), AFTA (January 1996) and APEC (November 1998), and played a role of hosting APEC leaders meeting held November 2006, and also joined WTO in January 2007.

Table 1-1 Economic conditions of Vietnam in 2005[1-2]

Main industry	Agriculture forestry, fisheries and mining
Per capita GDP	US$640
Rate of economic growth	8.5%
Price rise index	8.4%
International trade amounts	(1) Export US$32.23 billion (2) Import US$36.88 billion
Major international trade articles	(1) Export Crude oil, clothing, footwear, marine products (2) Import Machinery, equipment parts, oil, iron, textile goods
Trading partners	(1) Export U.S.A., Japan, China (2) Import China, Singapore, Taiwan
Shares of foreign-owned corporations in international trade	(2) Export 57.5% (2) Import 37.1%

1.2.2 Supply and demand of energy in Vietnam[1-3]

(1) Overview

In Vietnam, stabilized supply of electric energy is ranked as one of the most important tasks to sustainably support the growth of social economy. Although the per capita consumption of electric power in Vietnam is attributed to a low level in Southeast Asia, it is increasing because of fast growth of commerce, moving of people between large cities and the rise of life levels. In terms of the amount of generated electric power, an average annual growth rate of more than 10% has been recorded between 2002 and 2004. According to a long-term plan up to 2015, various plants of water power, natural gas, thermal power, etc. are planned to be installed additionally.

(2) Energy supply

Regarding energy resources, the north and the south depend largely on coal and natural gas, respectively. Electricity is supplied by Electricity of Vietnam (EVN), including retailing enterprises. The electric power systems include 500 kV transmission lines extended to north and south, aiming at stabilized supply. Six Distribution Companies controlled by EVN operate transmission and distribution systems and contracts with energy users. The Tay Ninh Province in charge of this project is controlled by Power Company No. 2 (PC2).

1-1 Cited from "ARC Report 2005 Vietnam" by World Economic Information Service.

1-2 Cited from "Vietnam Overview, February 2006" by JETRO Hanoi Center.

(3) Resources of electricity supply

Fig. 1-1 shows electricity supply resources. Hydropower and gas turbines are used mainly for electricity supply, occupying about 70% of total electric power generated. The balance resources of about 30% include coal-fired thermal power, oil-fired thermal power and diesel systems, along with power generation systems by independent power producers.

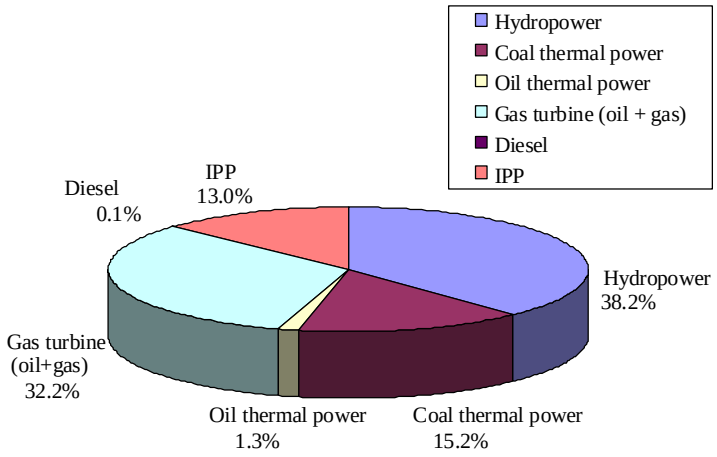

Fig. 1.1 Electricity supply resources in Vietnam

(4) Applications of primary energy

Regarding coal, high-quality anthracite is produced in the northern part of Vietnam. About 40% of coal is exported, while the balance 60% is used for electricity generation and domestic consumption; more than 70% of domestic consumption is used in industrial sector.

Most oil is imported; 96% is consumed domestically, while using 4% for power generation. For domestic consumption, transportation and industrial sectors share 85%, and the balance is consumed in commercial and public utility businesses, agriculture and fisheries, and public consumers.

Natural gas is produced domestically, and more than 99% is utilized for power generation and the balance is consumed domestically. All domestic consumers belong to the industrial sector.

1-3 Cited from "EVN Annual Report 2003," "EVN Report 2004-2005" and "International Energy Agency (http://www.iea.org//)."

1.2.3 Present status of CDM in Vietnam

The Vietnamese government ratified the United Nations Framework Convention on Climate Change (UNFCCC) and The Kyoto Protocol (KP) on December 16, 1994 and September 25, 2002, respectively. In March 2003, the Ministry of Natural Resources and Environment has been designated as DNA, that is, CDM National Authority. The CDM operating organization of the Vietnamese government is composed as shown below; the CDM National Executive and Consultative Board is held 4 times a year (January, April, August and whenever necessary), where a CDM project is approved.

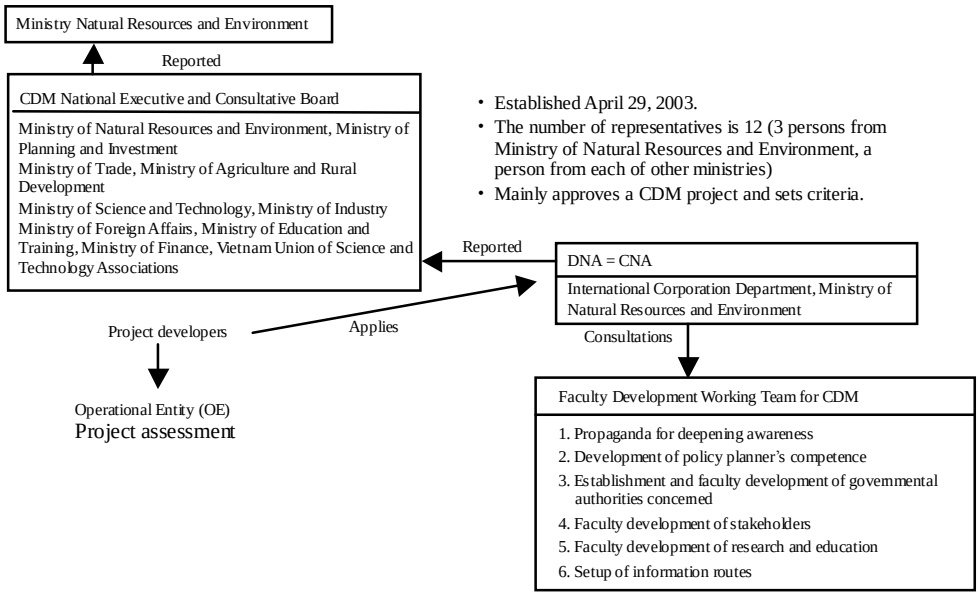

Fig. 1-2 Operating organization of CDM projects

Approval and registration procedures of the Vietnamese government for a CDM project are shown below.

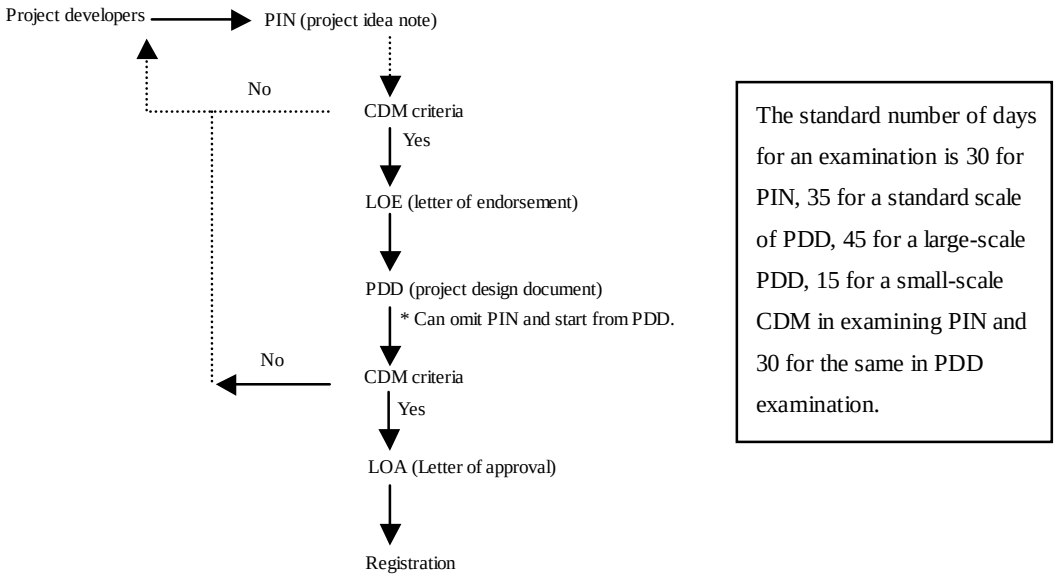

Fig. 1-3 CDM project approval procedures

Criteria of CDM in Vietnam, when a CDM project is examined, consist of absolute criteria to be applied first and preferential criteria applied in a meeting with a relevant authority and stakeholders, so the following themes are to be expected when developing and achieving the CDM project.

① Renewable energy
② Energy efficiency, conversion, energy preservation
③ Fuel change
④ Recollection and use of methane at reclaimed lands, coal mines and wastewater treatment plants
⑤ Recollection and use of associated gas from oil fields
⑥ Afforestation and reforestation

The following 6 CDM projects have been approved by the Vietnamese DNA, as a trend thus far.

① Recollection and use project of associated gas from Rang Dong oil field
② Song Muc hydropower project
③ Renovation model project at a beer Brewery in Thanh Hoa province, to increase energy utilization efficiency
④ Song Con 2 hydropower project
⑤ Ngoi Duong hydropower project
⑥ Anaerobic wastewater treatment and energy recovery project at Xa Bang rubber factory

1.2.4 Present status of agriculture and cassava root production in Vietnam[1-4]

(1) Present status of agriculture in Vietnam

Although Vietnamese industries have been recently modernized, agriculture still takes one of the most important positions because 60% of working population are engaged. Agriculture is considered to be most important for the future growth of national economy. The share of agriculture in the general domestic production in 1997 is 26% which is higher than the shares of other ASEAN countries.

(2) Information on the production of cassava root in Vietnam

The cassava is a tropical shrub of the manihoteae tribe, euphorbiaceae family, and malpighiales order. The amount of world production in 2002 is 180 million tons. Top three production countries are Nigeria (18.7%), Brazil (12.5%) and Thailand (9.1%).

The total production amount in Vietnam has been steadily increasing up to now from 2000; the production in 2004 was 5,572 thousand tons. In the Asian countries, Vietnamese production is ranked third following Indonesia (19,424 thousand tons) and Thailand (19,236 thousand tons). The production amount of Tay Ninh province is 790.1 thousand tons, sharing about 14.2% of the Vietnamese domestic production, which is top ranked among other provinces.

1.3 Survey operating organization

(1) Corporation responsible for the survey Toshiba Corporation

(2) Locale counterpart VIETMA Co., Ltd. (VIETMA)

The project operating site is a tapioca starch processing plant. In this survey project, the corporation and the counterpart administrate meetings with governmental authorities and other organizations, site surveys, facility planning work, and surveys operated by participating parties.

1-4 Cited from "ARC Report 2005 Vietnam" by World Economic Information Services and "Vietnam Statistics Year Book The Japan-Vietnam Trade Association, 2004 Version" published by Vista PS.

2 Details of project

2.1 Project overview

This project is aimed at reducing CO_2 emissions out of fossil fuels and is performed at a tapioca starch processing plant in the Tay Ninh province; the existing wastewater treatment equipment consisting of open lagoons is improved, and methane gas is recovered preliminarily, thereby reducing the gas emitted from the lagoon while utilizing collected methane gas as a resource of energy consumed in the plant.

2.2 Operating site

Outline of operating site

Name of operating site:
VIETMA company
Address: Tay Ninh province, Socialist Republic of Vietnam
Established: January 2005
Production article: Tapioca starch
Production capacity: 120 t/day
Production amount:
(Mean) 3,000 t/month
Power consumption:
527,338 kWh/month
Used fuel: Coal (80 kg/t-starch)

Fig. 2-1 Outlook of VIETMA company

2.2.1 Existing wastewater treatment facilities

The existing wastewater treatment facilities consist of a total of 5 open lagoons, and to cope with the revision of the emission standard, open lagoons are planned to be installed additionally at 2 locations.

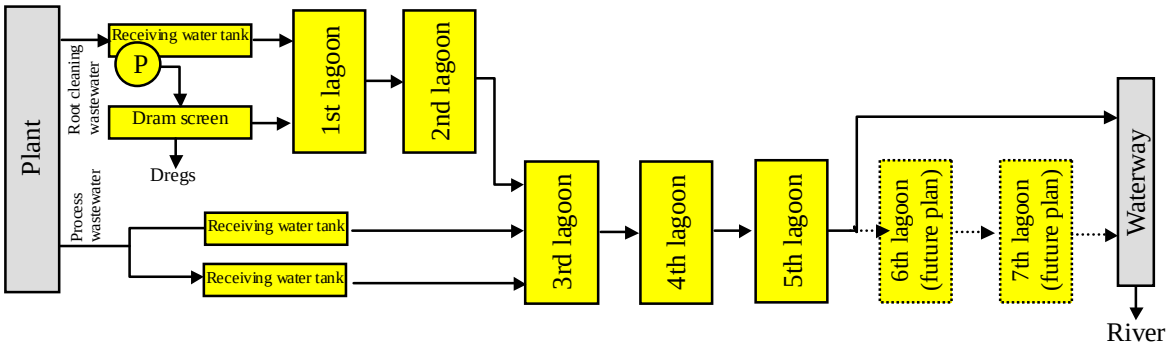

Fig. 2-2 Processes at existing wastewater treatment facilities

The lagoons directly receive wastewater in a very high pollution concentration, discharged from production processes, therefore, the interior of a lagoon is considered to be in an anaerobic environment; on the surface of a lagoon, a large amount of bubbles is observed, that may be created by methane gas.

Fig. 2-3 Lagoon of VIETMA company

2.2.2 Types of produced wastewater

Two types of wastewater are produced from the plant; root cleaning wastewater and process drainage. The amount and quality of wastewater is shown below.

Table 2-1 Amount and quality of wastewater (mean values)

Wastewater type		Root cleaning wastewater	Process drainage
Amount		456 m^3/day	2079 m^3/day
Water quality	Temperature	33 ℃	33 ℃
	COD	7,520 mg/L	16,682 mg/L
	BOD	4.865 mg/L	9,988 mg/L
	SS	3,005 mg/L	3,000 mg/L

2.3 Equipment for project

For the present project, methane fermentation equipment is installed at the front stage of existing lagoons, and organic matters contained in wastewater are decomposed beforehand, and methane gas is collected. As a result, organic matters entering lagoons are reduced, so the amount of methane gas evolved from lagoons is reduced.

Methane gas, collected in the methane fermentation equipment, is purified by removing impurities such as hydrogen sulfide by the gas purifying equipment to be installed in this project, and is used as a fuel for the drying equipment used in the drying process of the plant. At present, coal is used as the fuel of the drying equipment. However, by replacing the fuel with methane gas recovered from the wastewater treatment step, coal consumed is drastically reduced.

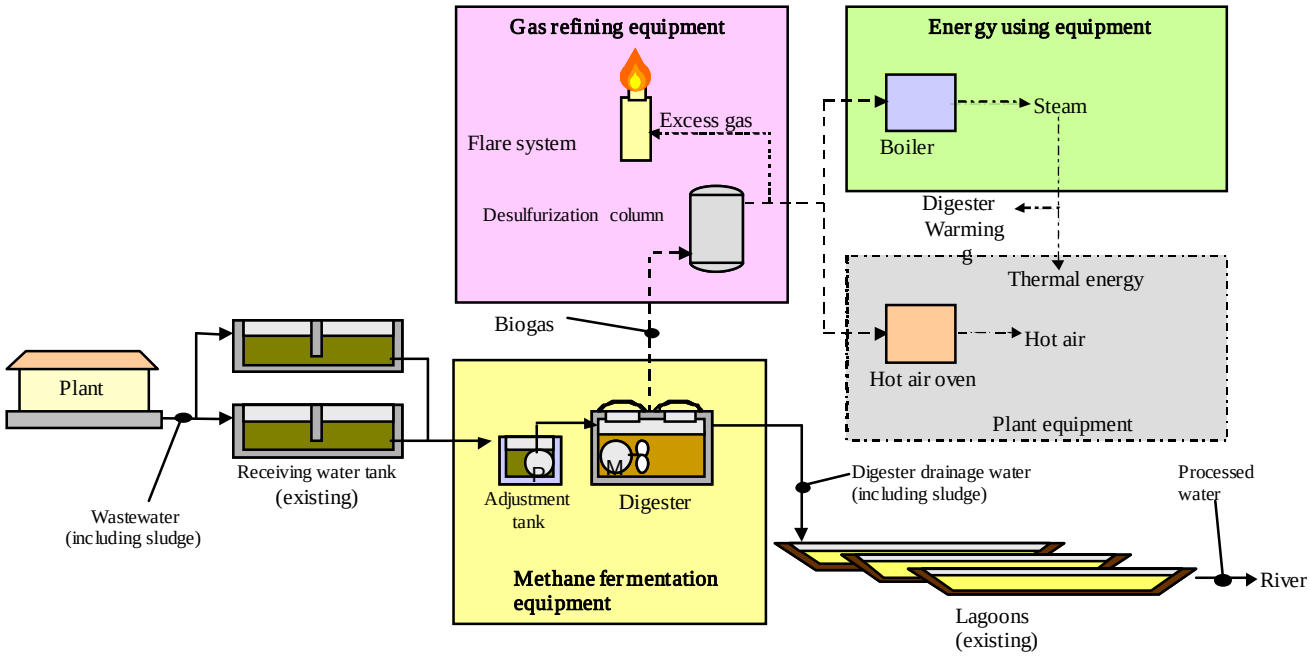

Fig. 2-4 Processes of project equipment

2.4 Setting of baseline

2.4.1 Application methodology

The following approval methodology is applied to this project.
AM0013Ver04: Avoided methane emissions from organic waste-water treatment

Another approval methodology AM0022Ver04 (Avoided Wastewater and On-site Energy Use Emissions in the Industrial Sector) may also be applicable to this project. However, this regulation limits subject organic compounds only at monosaccharide group, so if the regulation is applied to the present project, rightfulness must be proved in advance, then a new methane emission coefficient must be predicted. Therefore, AM0013Ver04 is adopted with a view to increasing the feasibility of the project as a business.

2.4.2 Identification of baseline

A baseline scenario is ascertained based on option A of AM0013Ver04.

- Is the present processing equipment an anaerobic open lagoon? → Yes
- Can the present processing equipment satisfy laws and regulations? → Yes
- Will the laws and regulations be made severer in the future? → Yes/Maybe
- Can a pond be added? → Yes

The baseline becomes an anaerobic open lagoon.

2.5 GHG emissions

Referring to AM0013Ver04, GHG emissions are calculated trially before the project.

Table 2-2 Trial calculation of GHG emissions

Baseline	Emissions from lagoon	29,424 tCO_2/yr
	Emissions associated with electricity and fuels	10,143 tCO_2/yr
	Baseline emissions	39,567 tCO_2/yr
Project	Emissions from lagoon	5,890 tCO_2/yr
	Physical leakage	263 tCO_2/yr
	Emissions associated with thermal energy and electricity consumption	384 tCO_2/yr
	Project emissions	6,537 tCO_2/yr
GHG emission reduction amount		33,030 tCO_2/yr

2.6 Monitoring plan

Monitoring is planned as follows based on AM0013.

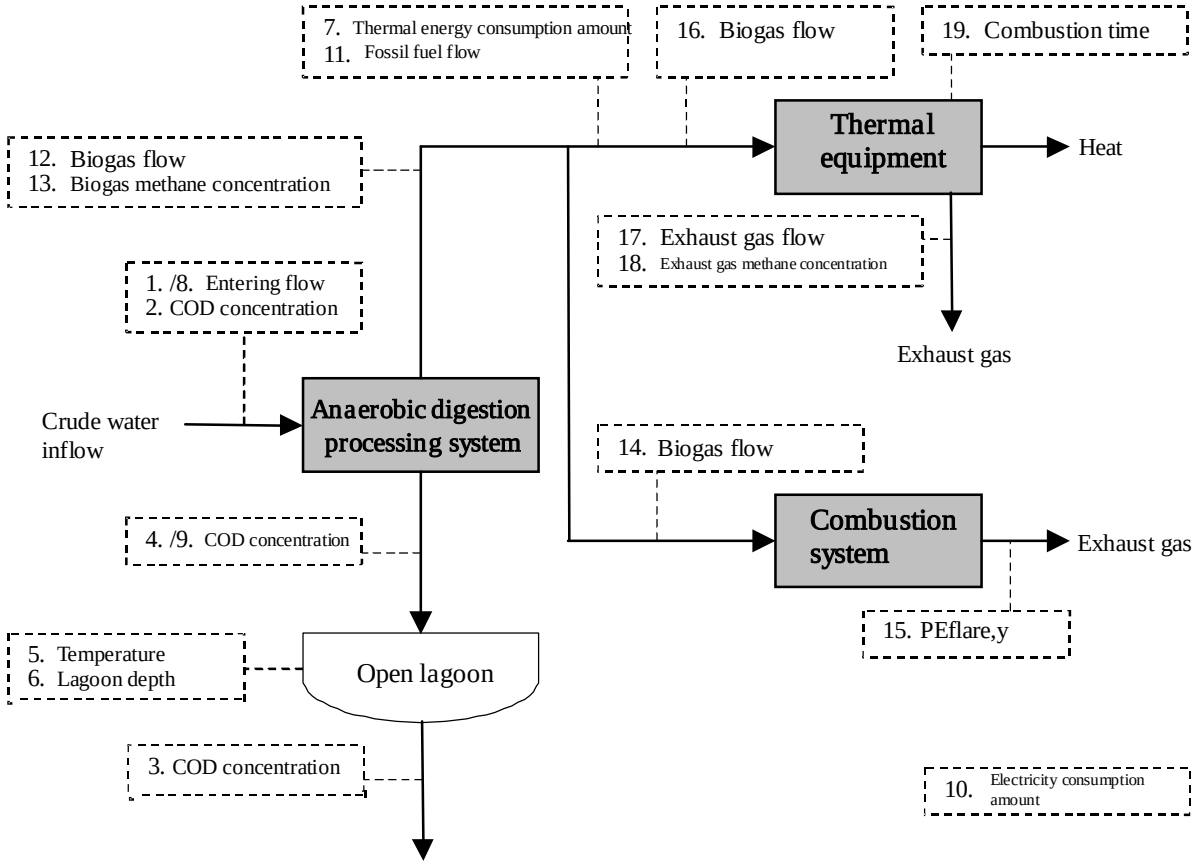

Fig. 2-5 Monitoring plan

2.7 Environmental effects and other indirect effects

2.7.1 Environmental effects

Obnoxious odors evolved from open lagoons are reduced because wastewater from the plant is preliminarily purified by removing pollutants from wastewater, at the closed methane fermentation tank installed in this project, and the water is discharged to open lagoons. In addition, another expected effect is that groundwater pollution due to permeation of liquids stored in open lagoons is reduced.

Furthermore, work environment at the project site is improved as a result of reduced obnoxious odor, and the improvement of groundwater quality contributes to the betterment of surroundings.

2.7.2 Other indirect effects

The quality of groundwater used as agricultural and life waters is ameliorated, so sanitary conditions for nearby inhabitants are expected to improve.

Moreover, once the project is completed, tapioca starch processing plants in Vietnam can be operated with a small amount of energy, so that the operation efficiency of tapioca starch plants is improved, resulting possibly in the economical growth of Vietnamese agricultural areas and correcting economical handicap to urban districts.

2.8 Stakeholders' comments

The following organizations were interviewed to acquire stakeholders' comments.

- The Ministry of Natural Resources and Environment, Tay Ninh province
- People's Committee, Tay Ninh province
- Ministry of Agriculture and Rural Development (MARD)

3. Establishing an enterprise

3.1 Project operating systems and organization

A SPC (Special Purpose Company) is established by the investment of Toshiba Corporation to launch the business, and the SPC operates the CDM business. The structure diagram of the business is shown below.

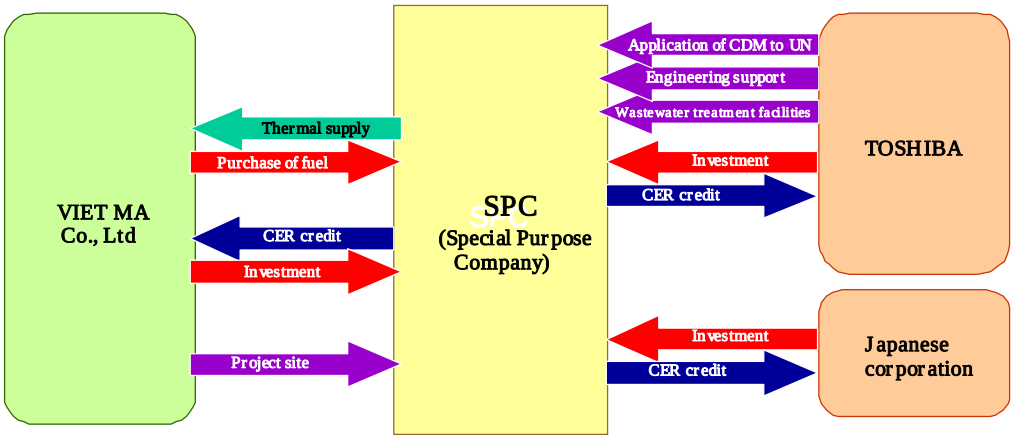

Fig. 3-1 CDM business operating system diagram

3.2 Funds raising program for project operation

The SPC is established by the investment of Japanese corporations, and the business is launched.

■ A total of 310 million yen for initial investment (approximate value)

Breakdown: Detailed study and design of equipment	:	20 million yen
Procurement and manufacture of equipment	:	80 million yen
Local work	:	200 million yen
Launching cost	:	10 million yen

3.3 Analysis of economic performance and tasks toward business success

3.3.1 Major equipment and conditions of trial calculation

(1) Methane fermentation tank
(2) Gas purifying equipment
(3) Hot air drying machine

Table 3-1 Conditions of trial calculation of IRR

Item	Price
Initial investment (Including costs of equipment engineering, procurement and construction)	2,677,500 US$
Operation and maintenance costs (Including running costs for labor, administration, utilities, etc.)	70,400 US$/year
Revenue by selling biogas	331,350 US$/year
CER selling price	0, 5,10,15 US$/t$CO_2$

3.3.2 Results of IRR trial calculation

Table 3-2 Results of IRR trial calculation

Credit price	IRR (%)			
	7 years	10 years	14 years	15 years
No credit	-9.1	-1.6	3.0	3.0
5US$/t-$CO_2$	-1.3	5.5	9.3	9.5
10US$/t-$CO_2$	5.0	11.1	14.3	14.6
15US$/t-$CO_2$	10.3	15.9	18.6	18.9

3.3.3 Tasks toward business success

Considering Table 3-2, IRR with no CER credit recovery is as low as –9.1% after 7 years and 3.0% after 14 years, so starting business will not be possible. To the contrary, with CER credit (10US$/t-CO2), profits are IRR 5.0% after 7 years and 14.3% after 14 years, so the business can be evaluated as a successful business. Therefore, it is revealed that business success depends on CER credit prices, as a problem.

At present, trial calculations are based on an initial investment amount of 310,000 thousand yen. However, the amount is approximate and should be scrutinized in the future for the goal of success.