

Fiscal Year 2015 Commissioned Project for MOE

**Fiscal Year 2015**  
**Commissioned Business of JCM Project**  
**Formation Possibility Study for**  
**Realization of Low-Carbon Society Asia**  
**Waste-to-Energy of Mixed Combustion of**  
**Sewage Sludge Solid Fuel and Municipal**  
**Solid Waste in Hai Phong City**  
**(Kitakyushu City - Hai Phong City**  
**Cooperative Project)**

**Report**

**March, 2016**

**Kitakyushu Asian Center for Low Carbon Society**  
**Nippon Steel & Sumikin Engineering**  
**NTT Data Institute of Management Consulting**

# Contents

## Summary

|           |  |       |
|-----------|--|-------|
| Chapter 1 | Background and Purpose of Project, Etc.....  | 1-1   |
| 1.1       | Overview of Hai Phong City .....   | 1-1   |
| 1.1.1     | Condition of Nature .....  | 1-1   |
| 1.1.2     | Social and Economic Conditions .....   | 1-2   |
| 1.1.3     | Social Infrastructure.....   | 1-2   |
| 1.2       | Green House Gas Emissions Reduction Policy of the Vietnamese Government .....                  | 1-3   |
| 1.3       | Efforts and Challenges towards Reduction of Green House Gas Emissions for Hai Phong City ..... | 1-3   |
| 1.4       | Cooperative Relationship of Hai Phong City and Kitakyushu City .....                           | 1-5   |
| 1.5       | Background and Purpose of Project, Etc. ....   | 1-5   |
| Chapter 2 | Waste-to-Energy of Mixed Combustion of Sewage Sludge Solid Fuel and Municipal Solid Waste..... | 2-6   |
| 2.1       | Project Overview and Implementation System, Etc.....   | 2-6   |
| 2.1.1     | Project Overview .....   | 2-6   |
| 2.1.2     | Application Technologies .....   | 2-7   |
| 2.1.3     | Study Implementation System.....   | 2-8   |
| 2.1.4     | Study Method and Schedule.....   | 2-10  |
| 2.2       | Study Results.....   | 2-14  |
| 2.2.1     | Processing Situation of Sewage Sludge and Municipal Solid Waste, Etc. in Vietnam .....         | 2-14  |
| 2.2.2     | Processing Situation of Sewage Sludge and Municipal Solid Waste, Etc. in Hai Phong City.....   | 2-17  |
| 2.2.3     | Waste Quality Analysis.....  | 2-23  |
| 2.2.4     | Legal System in Relation to Project, Etc.....  | 2-245 |
| 2.2.5     | Scale of Facilities and Project Costs .....  | 2-334 |
| 2.2.6     | Greenhouse Gas (Particularly Energy Originated Carbon Dioxide) Emission Reduction .....        | 2-478 |
| 2.2.7     | MRV Methodology and Monitoring system .....  | 2-489 |
| 2.2.8     | Cost Effectiveness and Secondary (Co-beneficial) Effects .....                                 | 2-556 |
| 2.3       | Examination towards Project Realization.....   | 2-56  |
| 2.3.1     | Project Realization Plan .....   | 2-567 |

|       |   |      |
|-------|---|------|
| 2.3.2 | Challenges for Project Realization..... | 2-61 |
| 2.3.3 | Future Plans.....                       | 2-62 |

Attachment

Chapter 1 Background and Purpose of Project, Etc.

1.1 Overview of Hai Phong City

1.1.1 Condition of Nature

The successive trends for temperature and volume of rainfall are shown in Figure 1-1-1 as the condition of nature of Hai Phong City.

In recent years, the temperature has been on the rise. Additionally, in the future a rise in temperature of about 1°C is predicted compared to 1980 and 1990. The tendency for the volume of rainfall has been to decrease in recent years; however it is predicted to slightly increase in the future.

In any case, there is a need to pay attention to the various effects associated with climate change based on global warming and it is essential to consider dealing with flood control, securing water sources, agriculture, forestry, fisheries, etc.

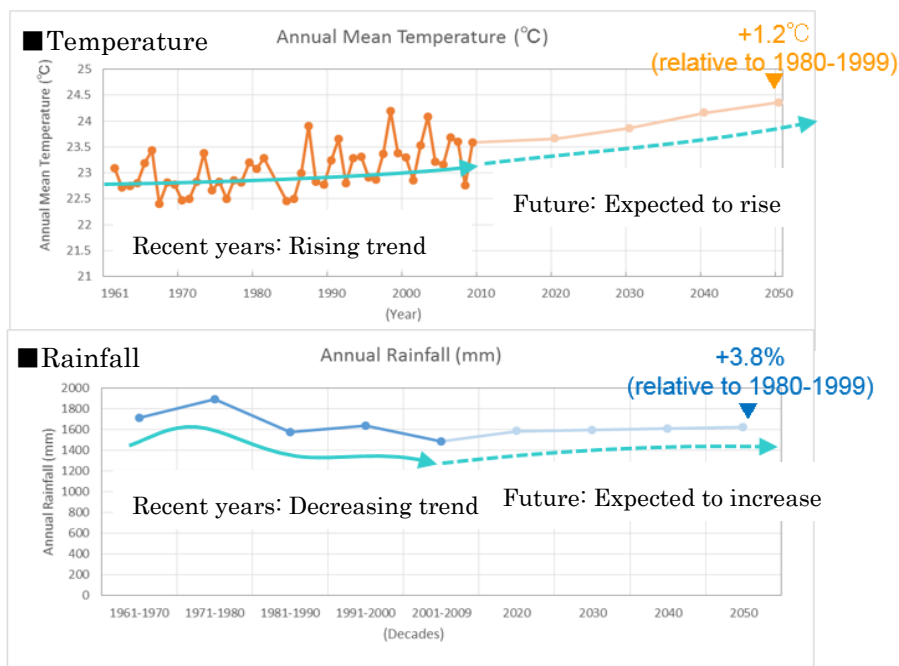


Figure 1.1-1 Annual average temperature and average rainfall volume for Hai Phong City

Source: Agriculture and Rural Development Bureau documents, Climate change, sea level rise scenarios for Viet Nam

### 1.1.2 Social and Economic Conditions

The trend and prediction for the population and GDP of Hai Phong City is shown in Figure 1-1-2 to summarize its social and economic conditions.

According to the Master Plan of Hai Phong City, the population of approximately 1.86 million in 2011 will increase 1.4x by 2020 to 2.62 million and by 2025, is predicted to increase approximately 1.6x to 3 million people. In addition, the GDP of 57,284 billion VND in 2010 will increase by 4.3x in 2020 to 246,360 billion VND and a great economic action is predicted to be active.

There are 11 industrial parts within the city and 50 or more Japanese companies made inroads here and because of the importance of steady economic growth and as a logistics base, further expansion is expected.

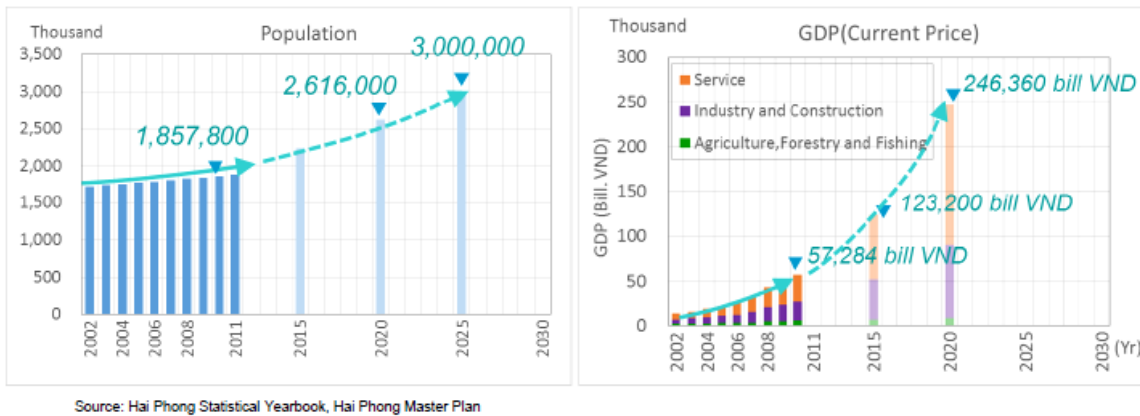


Figure 1.1-2 Prediction of Future Population and GDP of Hai Phong City

### 1.1.3 Social Infrastructure

The current situation and plans for the main infrastructure of Hai Phong city are shown in Figure 1-1-3. Although connected to the Capital of Hanoi by National Highway Number 5, a new high-speed road with a total length of 105.5 km connecting Hanoi City to Dinbu Harbor of Hai Phong City was opened in 2015. The largest container port of Northern Vietnam, Hai Phong Port, can accept up to 40,000DWT (Dead Weight Tonnage) and Lack Huyen, and the deep water port being constructed offshore will have an area of 1,200ha and be able to berth 2 100,000 DWT class large-scale ships at the same time. Hai Phong City as the largest port logistics base in Northern Vietnam, aims to become an environmentally considerate Green Port City.

Hai Phong has developed into the largest port city and logistics base of northern

Vietnam and is predicted to continue growing in the future. Additionally, because it is located close to Hanoi, foreign companies are making inroads in the area and the development of industries and services is remarkable.

In the future, in addition to the high-speed road and the deep water port Lach Huyen, the Cat Bi International Airport will be prepared and accordingly its function as a logistics base will be further reinforced and further growth in population and economic activity is expected.

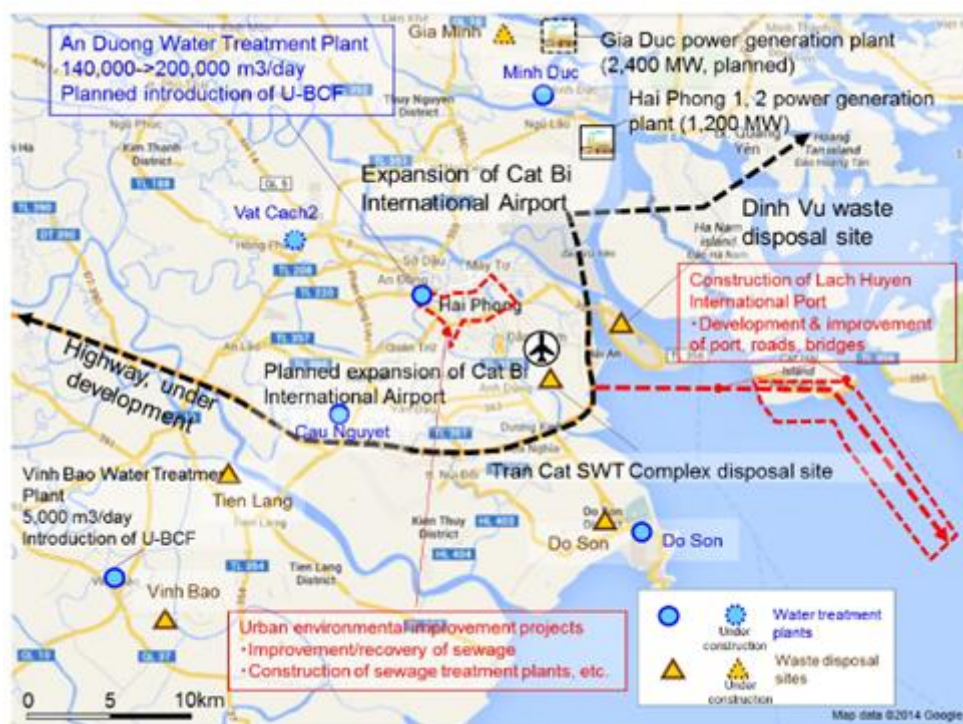


Figure 1.1-3 Infrastructure of Society Current Situation and Plans for Preparations

### 1.2 Green House Gas Emissions Reduction Policy of the Vietnamese Government

The National Climate Change Strategy (2139/QD-TTg) was enacted in Vietnam in 2011 and the of development of renewable energy, energy saving in the industrial production, construction and transport sectors, efficiency of the agricultural sector, and processing of waste materials and use of energy were listed as four priority objectives and coincides with the direction of this proposal.

### 1.3 Efforts and Challenges towards Reduction of Green House Gas Emissions for Hai Phong City

Hai Phong City, based on the Green Growth Strategy (1393 / QD-TTg) determined by the Prime Minister in September 2012 (hereon referred to as GGS) and the Green

Growth Action Plan (403 / QD-TTg) determined by the Prime Minister in March 2014 (hereon referred to as GGAP) and the consolidation and development of Hai Phong City (Green Port City) (72-KL/TW) at the time of industrialization and modernization of the nation by the communist party, decided on the Hai Phong City GGS Action Plan (1463/QD-UBND) (hereon referred to as HPGGSAP) in July 2014. This Action Plan, as shown in Figure 1-3-1, has taken into account the contents of the master plan of each related field and other main plans of Hai Phong City.

It is stated that in Section 8 of this Action Plan (1463/QD-UBND), as for "Under the cooperation of the Bureau of Foreign Affairs and Department of Planning and Investment, propose a cooperative program with Japan's Ministry of the Environment and Kitakyushu City and prepare a concrete project to embody the Green Growth Strategy." that "The Department of Natural Resources and Environment will supervise and implement the following in cooperation with regional posts and agencies" and the "Hai Phong Green Growth Strategy Action Plan" has been assigned legal status.

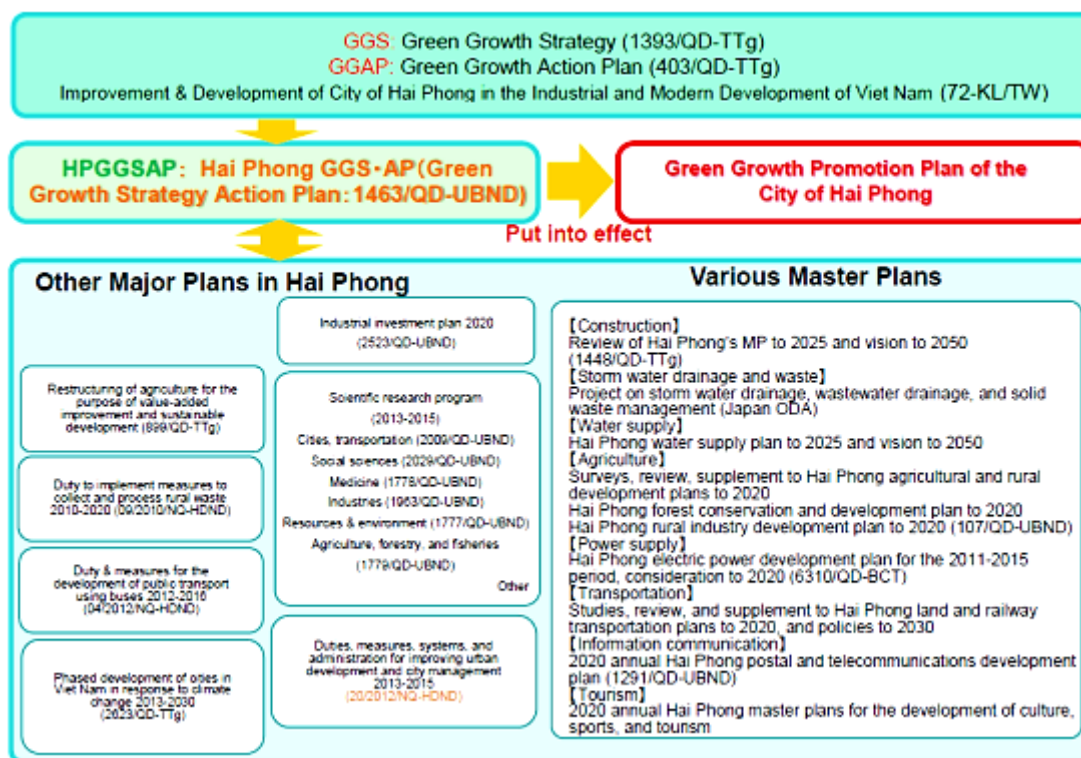


Figure 1-3-1 HPGGSAP Legal Position and Relationship to Green Growth Promotion Plan

#### 1.4 Cooperative Relationship of Hai Phong City and Kitakyushu City

Kitakyushu City and Hai Phong City since signing a friendship and cooperation agreement in 2009, have participated in such events as the local introduction of "advanced water treatment technology" in the field of water supply, the participation of the Wakamatsu Goheita Bayashi Enthusiasts "Hibiki" in the largest event of Hai Phong City, the "Hong River Festival" and exchanges in various fields and cooperative projects. Since the 2009 agreement had reached the end of its 5 year period, based on the achievements of exchanges up until now, and as a result of consultations with Hai Phong City, a sister city agreement was entered with Hai Phong City in 2014 and the "Hai Phong Green Growth Strategy Action Plan" previously described was developed through the cooperation of both cities last year.

#### 1.5 Background and Purpose of Project, Etc.

In order to ease the effects of global warming, Japan restated the goal of "50% reduction in the entire world by 2050, 80% reduction of all industrialized nations" at the COP20 high level segment (Ministry Level Meeting) held in December 2014 and declared that "We will contribute to the reduction of emissions of the entire world with our environmental technology and environmental science and the bilateral credit system (JCM) is the pillar of contribution to environmental technology."

In order to halve the Green House Gas (GHG) emissions in the world by 2050, multiple GHG emission reduction projects must be found and formed for the various Asian Pacific countries having significant economic growth and action towards a sustainable low-carbon society construction in Asia is necessary and our country at the above mentioned high level segment has expressed that it will submit a draft promise sufficiently prior to the 2015 COP21 as soon as possible and in the promise draft, the contribution of JCM in reduction of emissions overseas is greatly anticipated.

In this project towards the goal of acquiring JCM credits, Kitakyushu City with its know-how of low-carbon society formation in cooperation with Vietnam's Hai Phong City, will construct a mechanism that includes local system operation for "Waste-to-Energy with biomass fuel and Municipal Solid Waste Mixed Combustion for power generation " that has high potential in reducing emissions of energy originated CO<sub>2</sub>, and implement activities to attempt surface development of our countries technology.



## Chapter 2 Waste-to-Energy of Mixed Combustion of Sewage Sludge Solid Fuel and Municipal Solid Waste

### 2.1 Project Overview and Implementation System, Etc.

#### 2.1.1 Project Overview

In this project, rather than the minimum limit of incineration, assumes project implementation by URENCO that has a high interest in this same project for Waste-to-Energy using municipal solid waste with the possibility of improving the profitability of the project and undertake examination of the specific introduction system, evaluation of the project's profitability including the initial investment and running costs related to the introduction system, carry out detailed and specific examination of the effectiveness of CO<sub>2</sub> emission reduction in addition to other collateral environmental benefits, with the goal of early realization of the project in regards to introduction of Waste-to-Energy from mixed combustion of sewage sludge solid fuel and municipal solid waste.

It should be noted that the assumed facility installation location, Trang Cat complex facility, has established composting facilities and waste sorting (hand sorting line/vibration sorting, etc.). The compost produced by the compost facility is "inadequately sorted" and from "lack of knowledge regarding fermentation", does not meet the quality standards for compost and is used as cover soil for landfills (substantial landfill disposal). In order to resolve such problems, by promoting sorting at the discharge and intermediate processing stages, it would be possible to control the quality and the quantity of the materials for combustion to a degree. Because the promotion of sorting improves "production of good quality compost", "avoidance of incineration of valuable materials" and additionally the awareness of 3R by residents, this project also will consider a comprehensive package system that includes in addition to intermediate processing (Waste-to-Energy), sorting collection, intermediate processing, and final processing.

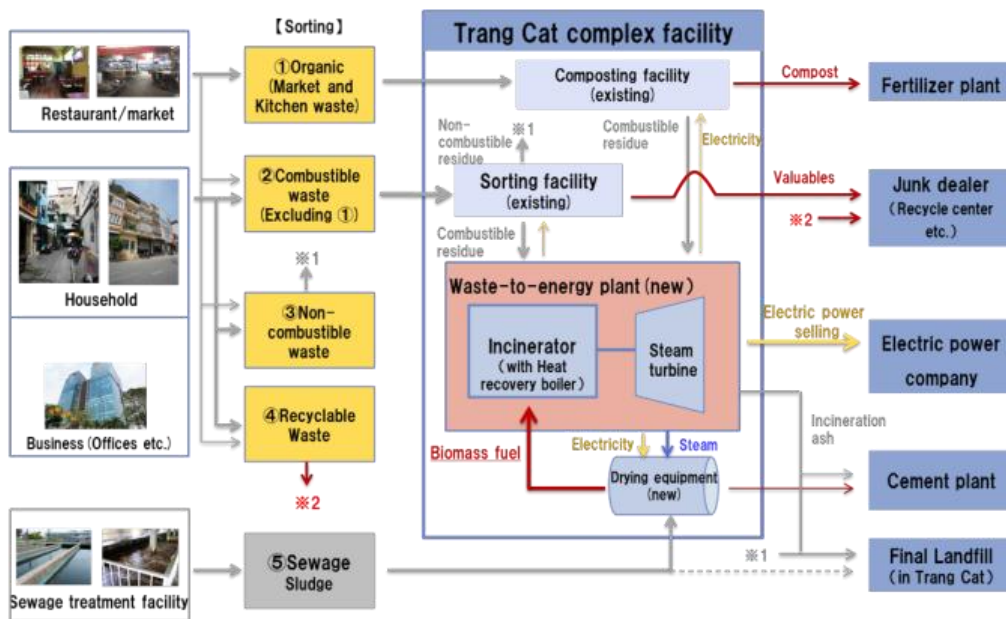


Figure 2.1-1 Waste-to-Energy of Mixed Combustion of Sewage Sludge Solid Fuel and Municipal Solid Waste Project Overview

### 2.1.1 Application Technologies

Combustion power generation is introduced in this project through the Stoker Incinerator. The number of Japan's Waste-to-Energy facilities for general waste is the number one in the world and Japan's level of technology for all processes from the collection of general waste to Waste-to-Energy, power generation results and processing of resulting incineration ashes, are the world's leading edge level. This projects aims to promote this world's leading edge technology in Vietnam. The following points of the technological features are included in this Waste-to-Energy facility that our company is proposing. Additionally, the overall flowchart (reference) is shown in Figure 2-1-2.

- 1) Accommodates a wide range of waste quality
  - Low calorific value, stable combustion possible up to 1,200 ~ 5,000 kcal / kg
- 2) Scale up properties
  - Processing possible up to a maximum of 1,200 t/d per line
- 3) Highly efficient power generation
  - Possible to reach a maximum of 30% power generation efficiency
- 4) Advanced gas processing
  - Possible to provide various technologies according to needs (dry, semi-dry, moist processing)

5) Stable operation

- Achieves annual operation time of over 8,000 hours

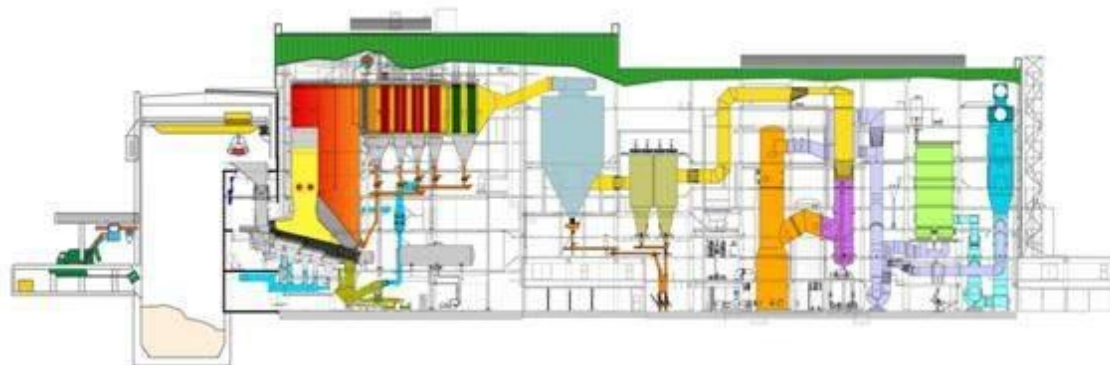


Figure 2-1-2 Waste-to-Energy Facility Overall Flowchart (reference)

Our incinerators have been installed at over 500 sites all over the world, including those by our overseas subsidiaries. Additionally, the track record of the equipment that has been installed shows continuous operation of 300 to 330 days annually is possible. For the same number of operational days, it is recognized that for a typical combustion incinerator the operational days would be more or less 80% of this and while this is a relatively high ratio of operational days, the power generation rate accompanying the increase in operational days is also expected to improve.

In addition, our company through attaining high temperature high pressure for boilers, changing materials for super heaters, reduction of (combustion) air ratio, reduction of exhaust gas temperature and reduction of turbine exhaust, has realized improvement of facility power generation rate by 25 to 28%. The fewer days a waste incinerator facility can operate, the larger the scale of the facility to be built will become. When the incinerator is not in operation, the need to study proper processing for waste materials during that period also arises and so the longer operational days per year for the same incinerator can be said to also meet the local needs of struggling to secure landfill sites.

Furthermore, because high efficiency of power generation directly connects to profitability, it can easily be presumed that high efficiency generation with the combination of a high performance steam turbine will be welcomed by local governments that have problems related to waste material processing.

### 2.1.2 Study Implementation System

The study implementation system is shown in Figure 2-1-3. Under the cooperative structure of Kitakyushu City and Hai Phong City entered through a sister city

agreement, NTT Data Institute of Management Consulting will mainly be in charge of studying the related legal system and CO2 emissions reduction quantification activities and for study of sorting and composting at the Trang Cat complex facility, Nishihara corporation will be in charge.

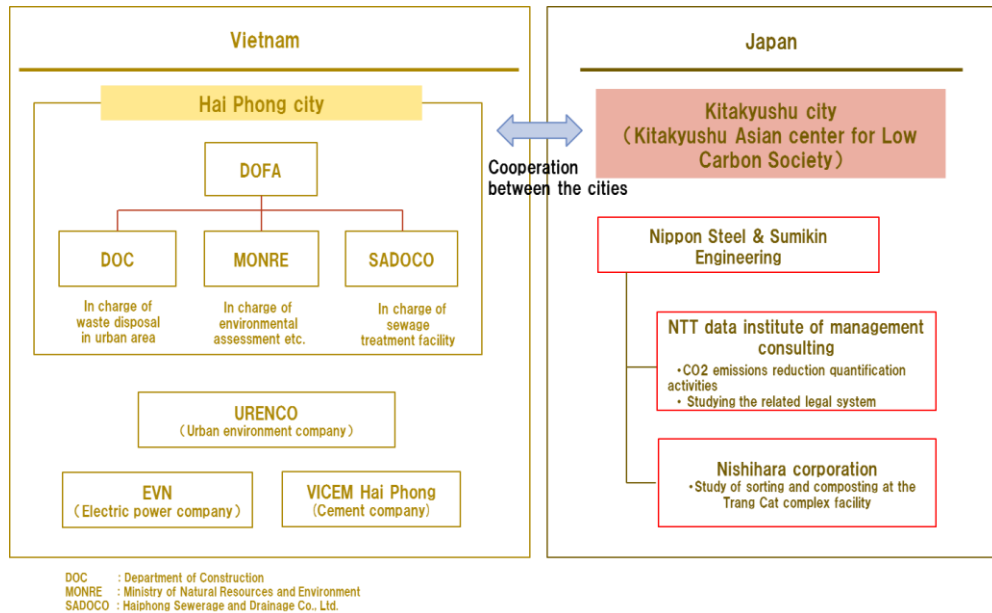


Figure 2.1-3 Project Implementation System

### 2.1.3 Study Method and Schedule

#### (1) Study Items

##### 1) Detailed study of waste generating situation and confirmation of the related legal system

To confirm the feasibility as a project, confirm the discharged situation of general waste, properties of the waste being discharged, estimate the of volume of sewage sludge discharged and the intentions of the local government and business discharging waste relating to Waste-to-Energy, then use this as materials to evaluate the feasibility of the project.

In addition, understand the latest trends including existing results from past studies, regulations relating to waste and even regulations relating to Waste-to-Energy.

##### 2) Considerations relating to Waste-to-Energy facilities

Based on the results of 1), including further examination of a sorting system at the discharge stage and intermediate processing stage, carry out investigation on scale of the Waste-to-Energy facility, specifications, installation location, etc.

In this project model, the volume and properties (moisture ratio, viscosity, etc.) of sewage sludge to process with the drying equipment will have a significant impact on the volume of steam from the Waste-to-Energy facilities, and since the influence also spreads to the amount of power generation (steam turbine scale, etc.) therefore consideration must be done with particular care regarding steam balance.

##### 3) Considerations Regarding Economics

Based on the examination results of 2), evaluation of the economics will be done. Along with examination of costs regarding the initial investment and operational costs for the Waste-to-Energy facility, the expected profit, etc., after application of guidelines regarding Chipping fees issued from the Vietnam Ministry of Construction and energy sale price (Waste-to-Energy price) according to Vietnam FIT, will be evaluated.

Additionally, since the drying and molding equipment may be applicable to the JCM facility funded project, the economics in the case where the equipment is funded will also be examined.

##### 4) Considerations regarding Quantification Method for Reduction of CO2 Emission

Based on the examination results of 2) and 3), an examination regarding CO2

emission reduction will be done. In the examination, application of JCM will be entered in the field and the reference scenario and project scenario will be examined and the quantification method for CO2 reduction in each scenario will be considered. Additionally, from having the field including JCM applied, examination of monitoring items will also be done.

(1) Study Method

The study method for each study item in (1) above is shown below.

| Study Items  | Method and Means   |
|--|--|
| 1. Detail study of waste generation situation and confirmation of related legal system | <ul style="list-style-type: none"> <li>• Organize existing study results (latest information) regarding situation and properties of general waste generated and expected volume of sludge and properties of sewage sludge, etc.</li> <li>• Implement analysis of waste quality at the discharge stage in order to comprehend detailed information regarding waste quality. Specifically, collect multiple samples to understand the composition, 3 components (combustible content/moisture/ash content), and calorific value.</li> <li>• Comprehend the legal system through study of existing study results and public information, study of interviews with relevant knowledgeable experts and regulatory officials including FIT.</li> </ul> |
| 2. Examination regarding Waste-to-Energy facility                                      | <ul style="list-style-type: none"> <li>• Based on the study results of 1, comprehend the scale, necessary installation area of the desirable facility.</li> <li>• Also examine properties and introduction rate of sewage sludge solid fuel to Waste-to-Energy facility.</li> <li>• Extract the challenges when installed in the assumed facility location of Trang Cat Complex Facility.</li> <li>• Examine and conduct deliberations with companies that possess technology in regards to sewage sludge drying and molding facilities.</li> </ul>  |
| 3. Examination regarding economics   | <ul style="list-style-type: none"> <li>• Confirm electrical power fees for Vietnam by directly asking the Vietnamese Government and Hai Phong City, etc. (local interviews).</li> <li>• Acquire data by requesting estimates from companies having the technology for drying and molding facilities of sewage sludge.</li> <li>• Conduct an examination of a business model as part of the economics. Specifically, examine the business scheme when establishing URENCO and SPC.</li> </ul>   |
| 4. Examination of quantification method for reduction of CO2 emission volume           | <ul style="list-style-type: none"> <li>• Apply JCM in the field of view, conduct a study of a reference scenario and project scenario regarding a Waste-to-Energy business and implement an examination of the basic unit for calculating CO2 emissions and examination of monitoring items, etc.</li> <li>• For the examination, if there are similar projects that are already being examined, also reference the examination results of this project and conduct an examination.</li> <li>• Carry out interviews for MRV methodology with specialized agencies and third party knowledgeable experts as deemed necessary.</li> </ul>  |

Figure 2.1-4 Method of study for each item

(2) Study Schedule

The Study Schedule is shown below.

| Month  | Aug.                                 | Sep.               | Oct.  | Nov.                                       | Dec.   | Jan.                                  | Feb.                    | Mar. |
|--|--------------------------------------|--------------------|---|--|--|---------------------------------------|-------------------------|------|
| 1. Detail study of waste generation situation and confirmation of related legal system | Study of waste generation situation  |                    | Study of related legal system/ Analysis of waste quality        |  |  |                                       |                         |      |
| 2. Examination regarding Waste-to-Energy facility                                      |                                      |                    | Examination regarding detail design of WtE plant                |  | Deliberations with concerned parties/ Review of detail design of WtE plant |                                       |                         |      |
| 3. Examination regarding economics   |                                      |                    | Arrangement of basic information related to economic evaluation |  | Economic evaluation/ Examination of business scheme                        |                                       |                         |      |
| 4. Examination of quantification method for reduction of CO2 emission volume           |                                      |                    | Study of scenario   | Examination of CO2 emission ratio          | Interviews with specialized agencies                                       |                                       |                         |      |
| Drawing up of report   |                                      |                    | Draft submission (10/30)  |  |  | Final draft submission (2/5)          | Report submission (3/4) |      |
| Local survey   | Kick-off meeting/ Local survey (1st) | Local survey (2nd) |   | Interim report meeting/ Local survey (3rd) |  | Local workshop (Final report meeting) |                         |      |
| Progress report meeting  |                                      |                    |   |  |  |                                       |                         |      |

Figure 2.1-5 Study Schedule



## 2.2 Study Results

### 2.1.4 Processing Situation of Sewage Sludge and Municipal Solid Waste, Etc. in Vietnam

#### (1) Municipal Solid Waste

##### 1) Definition of waste

In Vietnam, the Environmental Protection Act (2005 law) defines “waste” as "materials discarded during processes of daily life, service, and other activities" and "taking the form of solids, gases, liquids" (Article 3 Paragraph 10). For "Government protocol regarding the management of solid waste" (NO : 59/2007/ND-CP), waste materials discarded from individuals, households, and public facilities are defined as "Daily-life Solid Waste" and waste materials discarded from industries, handicraft villages, commercial enterprises, service industries, etc. are defined as "Industrial Solid Waste" (Article 1 Paragraph 3).

##### 2) Waste Management System

In regards to the management responsibility of waste discharged according to the Environmental Protection Act (2005 law), it declares that "Organizations or individuals generating waste through activities have the responsibility to strive to reduce, recycle, reuse, or remove such in order to limit waste to the minimum" (Article 66, Paragraph 1) . As for collection transport and storage, according to the 2007 "Government Protocol Regarding Solid Waste", based on the waste management plan of local governments, organizations such as companies shall under contract carry out such activities. (Article 24, Paragraph 2). In actuality, the collection, transport, and final disposal of household waste are done by the Urban Environment One-member Co., Ltd. (URENCO).

Additionally, in district organizations less than communes, waste collection and transport groups became organized and the collection, transport and landfill tasks were done on a rotation basis. As for fees for collection and transport, the people discharging waste paid an amount determined by the local government.

##### 3) Ministries with Jurisdiction for Municipal Solid Waste Management

In regards to management of Municipal Solid Waste, the Ministry of Construction (MOC) has jurisdiction. At the time of facility development, the assessment of environmental impact is by the Department of Natural Resources and Environment however, the Ministry of Industry and Trade (MOIT) has jurisdiction regarding FIT for Waste-to-Energy.

#### 4) Waste Management Policy

"Decision No.2149/QĐ-TTg 17/12/2009" exists at the top of the policies for solid waste. As the national strategy regarding solid waste, the goal is to have all solid waste to be collected, reused, recycled and properly processed through technology with concern for the environment by 2015. No.798/QĐ-ttg 25/05/2011 exists as a supplement to the above Decision No.2149.

As for policies regarding other solid waste processing, there is QCVN 07:2010/BXD. In this policy, the processing technology used for solid waste processing must be safe and also sanitary for landfill disposal, made into compost, made into fuel, used for generating energy and additionally 85% or more of solid waste reused and the ratio for landfill disposal not exceed 15%.

#### 5) Volume of Waste Generated

As a summary of public data for the volume of municipal solid waste generated throughout Vietnam, the 2003 data of World Bank exists however, public data published by public institutions after this have not been released.

Figure 2.2-1 Waste data for Vietnam in 2003

| Item  | Numeric Value   |
|---|---|
| Municipal Solid Waste (ton/year)                              | 12,800,000 (Urban area: 6,400,000, Farming area: 6,400,000)                 |
| Industrial hazardous waste (ton/year)                         | 128,400 (Urban area: 126,000, Farming area: 2,400)                          |
| Non-hazardous industrial waste (ton/year)                     | 2,510,000 (Urban area: 1,740,000, Farming area: 770,000)                    |
| Hazardous medical waste (ton/year)                            | 21,500  |
| Agricultural hazardous waste (ton/year)                       | 8,600   |
| Agricultural reservoir accumulated chemical waste (ton/year)  | 37,000  |
| Agricultural waste (ton/year)                                 | 64,560,000  |
| Municipal solid waste generated basic unit (kg/person/day)    | 0.4 (Urban area: 0.7, Farming area: 0.3)                                    |
| Municipal solid waste collection rate (% per generated waste) | Urban area:71%, Farming area: 20% or less, slums: 10~20%                    |
| Number of waste treatment and disposal facilities             | Open dumping: 74 locations<br>Sanitary landfill disposal area: 17 locations |
| Medical hazardous waste treatment rate (%)                    | 50 (processed ratio in regards to generated volume)                         |

Source: World Bank data (2004)

## (2) Sewage Sludge

### 1) Ministries with jurisdiction for sewage sludge management

Regarding management of sewage sludge, in the same manner as municipal solid waste, the Department of Construction (MOC) is the ministry with jurisdiction. Also note that the environmental impact assessment at the time of construction of facilities, the Department of Natural Resources and Environment (MONRE) has jurisdiction and jurisdiction related to FIT for Waste-to-Energy belongs to the Department of Industry and Trade (MOIT).

| Function                  | Institution   |
|---------------------------|---|
| Policy-setting            | Ministry of Construction (MoC)  |
| Planning and financing    | Ministry of Planning and Investment (MPI) and Ministry of Finance (MoF)   |
| Operation and Maintenance | Provincial Urban Environmental Companies (URENCOs), controlled by the PPCs  |
| Monitoring and Evaluation | Ministry of Health (MoH) regulates the quality of water supply and sanitation and the Ministry of Natural Resources and Environment (MoNRE) the quality of effluents. |

### 2) Legal framework relating to sewage sludge management

The principal legal framework for sewage sludge management is as given below.

1. Law on Environmental Protection promulgated on November 29, 2005, came into force on July 1, 2006;
2. Law on Water Resources 1998;
3. Government Decree 80/2006/ND-CP, August 9, 2006, detailing the implementation of Law on Environmental Protection;
4. Circular 08/2006/TT-BTNMT, September 8, 2006, providing instruction and guidance on strategic environmental assessment (SEA), environmental impact assessment (EIA) and environmental protection engagement;
5. National Strategy on Environmental Protection up to the year 2010 and Vision to 2020, approved by Decision No. 256/2003/QD-TTg, issued on December 2, 2003 by the Prime Minister;
6. Strategic Orientation for Sustainable Development (Viet Nam Agenda 21), approved by Decision No. 153/2004/QD-TTg, issued on August 17, 2004 by the Prime Minister;
7. Government Decree No. 88/2007 on Urban and Industrial wastewater, May 28, 2007;
8. Government Decree No. 59/2007 on Solid waste management, April 9, 2007.

## 2.1.5 Processing Situation of Sewage Sludge and Municipal Solid Waste, Etc. in Hai Phong City

### (1) Sewage Sludge Municipal Solid Waste Processing Master Plan, Midterm Plan, Future Plans, etc.

In the "Hai Phong Green Growth Strategy" that was decided upon in 2014, the below basic policies were established for the waste field, and the water supply, sewage, rainwater and wastewater fields.

#### <Waste Field>

##### Proper Processing of Waste and Construction of a Resource Recycling Oriented Society

- Along with constructing a social system that properly processes waste, reuse it as a resource, create a new recycling business.
- Realize lifestyles and industrial activities with little waste generated and construct a society with little impact on the environment and minimal GHG emissions that originate from waste.

#### <Water Supply, Sewage, Rainwater, Wastewater Fields>

##### Provide Safe and Secure Water Supply and Promote Sewage and Rainwater Measures that Coincide with Regional Characteristics.

- The water supply is a vital part of the city infrastructure that supports its society, economic activities and people's livelihood and in the future for the increase in water demand, strive to provide safe and secure water along with clean water and a water distribution process with energy saving and improved water leakage rate.
- Wastewater treatment facilities for household wastewater and industrial wastewater is indispensable for sustaining society, the economy, and environment. Promote development of regionally distributed processing facilities and large-scale sewage facilities based on the characteristics of urban and agricultural areas

In the energy field that is closely related to Waste-to-Energy, the following basic policies have been established and the principles supporting starting new projects that use recyclable energy such as biomass are clarified.

#### <Energy Sector>

##### Promotion of Efficient Energy Management and Clean Distributed Energy

- In the energy sector where GHG emissions are the greatest, aggressively promote

efficient energy use and energy saving and strive to greatly reduce GHG emissions.

- Implement and apply new technologies in order to realize this, launch new projects regarding utilization of reusable energy such as solar energy, wind power, and biomass and achieve a framework for both the economy and environment.

In Figure 2-2-2 the evaluation index values of the goals and situation of efforts of each sector to be achieved through implementation of the Green Growth Promotion Plan that includes the basic policies that have been set are shown.

The target years comply with the GGS of the Vietnamese Government and are set into the divisions short term: 2011~2020, medium term: 2030 and long term: 2050.

## (2) Sewage Sludge and Municipal Solid Waste Processing Facility Construction Plan

### 1) Municipal Solid Waste Processing Facility

Currently at the northern area of Hai Phong City of Gia Minh, under the assistance of JICA (yen loan application) a new final disposal site is being constructed. It is currently being constructed and in July of 2018, the first phase of construction (approximately 50% overall) will be completed.

The final disposal capacity of Gai Minh will be 2.5 million m<sup>3</sup> and area of 36ha and planned for a 10 year landfill period. The planned landfill volume per day in 2050 is 647 tons and scheduled for waste generated from the inland area of Hai Phong City and is not intended to be a landfill the entire city area of Hai Phong (Reference: In the literature study results, the volume of municipal solid waste generated by Hai Phong in 2025 is said to be 3,000 tons/day) .

### 2) Completion of Sewage Treatment Plant

In the water supply and sewage sector, development of a sewage treatment plant is underway for 4 city center districts (Hong Bang, Ngo Quyen, Le Chan and Hai An) (plan summary below). Completion is scheduled for December 2017 and the sewage sludge from this treatment plant is planned for drying and mixed combustion.

- Scheduled Completion: December 2017
- Processing Method: Activated sludge method
- Processing Scale: Design (max)      54,000t/d  
   Average                      36,000t/d

|                                       |                                   | Target Year   | Years 2011 - 2020   | Year 2030   | Year 2050   |
|---------------------------------------|-----------------------------------|---|---|---|---|
| Item                                  |                                   |   |   |   |   |
| Nation Overall                        | GHG emission reduction volume     |   | 8 - 10% reduction (comparative to 2010)                               | Yearly 1.5 - 2.0% reduction<br>20 ~ 30% reduction (BaU )              | Yearly 1.5 - 2.0% reduction   |
|                                       | Energy Consumption                |   | 1.0 - 1.5% reduction throughout year ( with Unit GDP )                | -   | -   |
| Hai Phong City                        | GHG                               | Emissions   | Approx. 10,950×10 <sup>3</sup> t-CO <sub>2</sub> /year                |   |   |
|                                       |                                   | Reduction   | 10% reduction ( comparative to 2010※)                                 | 25% reduction ( BaU )   | 50% reduction ( BaU )   |
|                                       | Evaluation Index Value (Standard) | Waste to resource rate                                | Municipal solid waste : 85% or more<br>Industrial waste : 85% or more | Municipal solid waste : 90% or more<br>Industrial waste : 90% or more | Municipal solid waste : 95% or more<br>Industrial waste : 95% or more |
|                                       |                                   | Energy consumption per GDP                            | 20% or more reduction ( comparative to 2010 )                         | 50% or more reduction ( comparative to 2010 )                         | 70% or more reduction ( comparative to 2010 )                         |
|                                       |                                   | Public transportation Usage rate                      | 20%   | 30%   | 50%   |
|                                       |                                   | Air quality environmental standards achievement rate  | 50% or more   | 90% or more   | 100%  |
|                                       |                                   | Surface water environmental standard achievement rate | 50% or more   | 70% or more   | 90% or more   |
|                                       |                                   | Sewage processing rate                                | Household : 5% or more<br>Industrial : 10% or more                    | Household : 40% or more<br>Industrial : 70% or more                   | Household : 75% or more<br>Industrial : 100%                          |
|                                       |                                   | Green region area                                     | Approx. 24,200ha  | 10% increase( comparative to 2020 )                                   | 20% increase( comparative to 2020 )                                   |
|                                       |                                   | Forest policy implementation rate                     | 20% or more   | 70% or more   | 100%  |
| Green agriculture implementation rate | 10% or more                       | 40% or more   | 70%   |   |   |

※GHG emissions in 2010: 12,172 × 10<sup>3</sup> t-CO<sub>2</sub>/year (for estimated values, refer to “Concepts of target setting” .)

Figure 2.2-2 Numerical Goal and Evaluation Index Setting (Plan)

### (3) Classification of Hai Phong City Municipal Solid Waste and Volume of Household Waste and Sewage Sludge Generation

According to the report regarding management and recovery potential of solid waste of Hai Phong City, currently the discharge basic unit per person of the city is approximately 0.7 kg/person/day (Nguyen Hoai Duc, 2014). When the discharge basic unit is multiplied by the population (1,925,200 people), the volume generated by the entire city would be approximately 1,347.7 tons/day (waste tons/day). In the future, it is predicted that the discharge basic rate would increase to 1.3 kg/person/day in the municipal area and 1.2 kg/person/day in urban areas and the lifestyle type waste discharged until 2025 could potentially be approximately 3,045 tons/day.

In regards to sewage sludge, currently construction of a sewage treatment plant is in progress and generation is scheduled for after 2017.

(4) Situation of collection, transportation, intermediate processing and final disposal (implementation system, processing unit price, etc.)

In regards to collection, transport, intermediate processing, and final disposal of household waste, the Hai Phong Urban Environment One-member Co., Ltd. (URENCO Hai Phong) is responsible for waste generated in the urban area and approximately 900 tons per day is collected and disposed. Of the 900 tons, 200 tons are processed into compost materials at the Trang Cat compost facility and the remaining 700 tons are disposed of as land fill at the final disposal area.

The discharge ratio and collection fees for general waste (household waste, business waste) are shown in Figure 2-2-3. The chipping fee for final disposal is 4 USD per ton of processed waste.

| Item                   | Household Waste  | Business Waste   |
|------------------------|--|--|
| Discharge Ratio        | 80%  | 20%  |
| Waste collection costs | 20,000~26,000VND/household per month<br>(100~130 yen/month in Japanese currency) | Government office:<br>120,000VND/m <sup>3</sup><br>(600 yen/m <sup>3</sup> in Japanese currency) |
|                        |  | Typical business:<br>180,000VND/m <sup>3</sup><br>(900 yen/ m <sup>3</sup> in Japanese currency) |

Figure 2-2-3 Discharge ratio and collection fees for general waste



(5) Waste Processing Costs

The total budget for Hai Phong City in fiscal years 2015 and 2016, infrastructure related budget and waste processing related budget are shown in the table below.

The total budget for fiscal year 2015 when calculated to Japanese yen was approximately 300 billion yen, for fiscal year 2016; it was approximately 330 billion yen for an increase of 10% compared to the previous year. The waste processing related budget for 2015 was approximately 1.47 billion yen and for fiscal year 2016 it was 1.39 billion for a reduction of 6% compared to the previous year however, when looking at the infrastructure budget, it was 10 billion for a 13% increase compared to the previous year.

|    | Cost Item   | 2015 Jan~Dec<br>(Unit : 1 million VND)  | 2016 Jan~Dec<br>(Unit : 1 million VND)  |
|----|---|---|---|
| 1. | Hai Phong City total budget   | 56,364,832<br>(298,789 millions of yen) | 62,815,700<br>(332,986 millions of yen) |
| 2. | In 1 above, infrastructure development (roads, bridges, water supply and sewerage systems, final disposal sites, ports, airports, parks, etc.) related budget | 1,671,377<br>(8,859 millions of yen)    | 1,888,090<br>(10,008 millions of yen)   |
| 3. | In 1 above, waste disposal (waste collection and transportation, intermediate treatment, final disposal, etc.) related budget                                 | 277,153<br>(1,469 millions of yen)      | 261,359<br>(1,385 millions of yen)      |

Exchange rate 1VND=0.005301 yen

Figure 2-2-4 Hai Phong City Budget

### 2.1.6 Waste Quality Analysis

In regards to the 2 types of waste discharged from households and market waste, with the cooperation of Hai Phong URENCO and the ETM Center, 3 samples of household waste and 1 sample of market waste were analyzed.

The lower calorific value of household waste was approximately 1,300~1,500 cal/kg and was confirmed to be a sample within reach of the 1,500 cal/kg said to be generally possible for power generation. The lower calorific value is on an upward trend compared to the previous year. On the other hand, the market waste was lower than 1,000 cal/kg and the quality was not suitable for Waste-to-Energy.

| Item                | Unit               | Sample 1<br>Market<br>Waste | Sample 2<br>An Duong | Sample 3<br>Hong Bang | Sample 4<br>Hai An |
|---------------------|--------------------|-----------------------------|----------------------|-----------------------|--------------------|
| Moisture            | %                  | 62.5                        | 64.1                 | 64.5                  | 62.3               |
| Non-combustibles    | %                  | 15.2                        | 8.7                  | 9.2                   | 9.1                |
| Combustibles        | %                  | 22.4                        | 27.2                 | 26.3                  | 28.6               |
| Organic             | %                  | 12.1                        | 11.8                 | 9.6                   | 11.0               |
| Plastics            | %                  | 5.5                         | 8.1                  | 8.5                   | 8.2                |
| Fibers              | %                  | 0.7                         | 1.8                  | 3.5                   | 1.9                |
| Paper               | %                  | 1.1                         | 2.1                  | 2.4                   | 2.1                |
| Other               | %                  | 3.0                         | 3.4                  | 2.3                   | 5.4                |
| Low calorific value | kcal/kg            | 979                         | 1,262                | 1,312                 | 1,520              |
| Bulk density        | ton/m <sup>3</sup> | 0.32                        | 0.27                 | 0.31                  | 0.27               |

Figure 2-2-5 Waste Analysis Results

## 2.1.7 Legal System in Relation to Project, Etc.

### (1) Environmental Standards

#### 1) Emission Standards

The emission standards for waste incinerators of Japan and Vietnam are shown in Figure 2-2-6. In Vietnam, emission standards are established by QCVN 30:2012/BTNMT (National Technical Regulation on Industrial Waste Incinerator). The above standards are intended for industrial waste incinerators however since the small incinerator developed by the Hanoi University of Technology (supplied to Hai Phong and various other regions, processing general waste) is also in compliance with the above standards, currently these standards are required to be applied when constructing a general waste incinerator.

| Item                                 | Vietnam                                   | Japan                     |
|--------------------------------------|---|---------------------------|
| Prerequisites (oxygen concentration) | 6~15%                                     | 12%                       |
| Dust                                 | 100mg/Nm <sup>3</sup>                     | 40mg/Nm <sup>3</sup>      |
| Hydrogen chloride (HCl)              | 50mg/Nm <sup>3</sup>                      | 700mg/Nm <sup>3</sup>     |
| Hydrogen fluoride (HF)               | 5mg/Nm <sup>3</sup>                       | —                         |
| Carbon monoxide (CO)                 | 250mg/Nm <sup>3</sup>                     | —                         |
| Sulfur dioxide (SO <sub>2</sub> )    | 250mg/Nm <sup>3</sup>                     | K value=9                 |
| Nitrogen oxides (NO <sub>x</sub> )   | 500mg/Nm <sup>3</sup> (※NO <sub>2</sub> ) | 250ppm                    |
| Mercury (Hg)                         | 0.2mg/Nm <sup>3</sup>                     | —                         |
| Cadmium (Cd)                         | 0.16mg/Nm <sup>3</sup>                    | —                         |
| Lead (Pb)                            | 1.2mg/Nm <sup>3</sup>                     | —                         |
| Hydrocarbons (HC)                    | 50mg/Nm <sup>3</sup>                      | —                         |
| Other heavy metals total             | 1.2mg/Nm <sup>3</sup>                     | —                         |
| PCDD/PCDF                            | 0.6ng-TEQ/Nm <sup>3</sup>                 | 0.1ng-TEQ/Nm <sup>3</sup> |

Figure 2-2-6 Comparative table of waste incinerator exhaust gas standards

#### 2) Noise and Vibration Standards

The noise and vibration standard values (general area) applicable in Vietnam are shown in Figure 2-2-7. QCVN 26: 2010 / BTNMT (National Technical Regulation on Noise) applies to noise and QCVN 27: 2010 / BTNMT (National Technical Regulation on Vibration) applies to vibration.

| Item                    | Time       |            |
|-------------------------|------------|------------|
|                         | 6:00~21:00 | 21:00~6:00 |
| Noise (common area)     | 70dB       | 55dB       |
| Vibration (common area) | 70dB       | 60dB       |

Figure 2-2-7 Noise and vibration standards value (common area)

### 3) Odor Standards

As regulations to conform odor standards, the environment (QCVN 06: 2009 / BTNMT) for harmful substances in the air environment is shown in Figure 2-2-8.

| Substance        | Permitted Concentration<br>( $\mu\text{g}/\text{m}^3$ ) | Average Time |
|------------------|---|--------------|
| Ammonia          | 200   | 1 hour       |
| Acetaldehyde     | 45  | 1 hour       |
|                  | 30  | 1 year       |
| Propionic Acid   | 300   | 8 hours      |
| Hydrogen Sulfide | 42  | 1 hour       |
| Methyl Mercaptan | 50  | 1 hour       |
|                  | 20  | 24 hours     |
| Styrene          | 260   | 24 hours     |
| Toluene          | 1,000   | 30 minutes   |
|                  | 500   | 1 hour       |
|                  | 190   | 1 year       |
| Xylene           | 1,000   | 1 hour       |

Figure 2-2-8 Environmental Standards for Harmful Substances in Air Environment

#### 4) Wastewater Standards

Industrial wastewater standards are shown in Figure 2-2-9.

| Item                        | Unit  | Standard                            |                                     |
|-----------------------------|-------|-------------------------------------|-------------------------------------|
|                             |       | Daily Use Water<br>Water Usage Area | Non-daily Usage<br>Water Usage Area |
| Temperature                 | °C    | 40                                  | 40                                  |
| Chromaticity                | Pt/Co | 50                                  | 150                                 |
| pH                          | -     | 6-9                                 | 5.5-9                               |
| BOD (20°C)                  | mg/l  | 30                                  | 50                                  |
| COD                         |       | 75                                  | 150                                 |
| Total suspended solids      |       | 50                                  | 100                                 |
| Arsenic                     |       | 0.05                                | 0.1                                 |
| Mercury                     |       | 0.005                               | 0.01                                |
| Lead                        |       | 0.1                                 | 0.5                                 |
| Cadmium                     |       | 0.05                                | 0.1                                 |
| Hexavalent Chromium         |       | 0.05                                | 0.1                                 |
| Trivalent Chromium          |       | 0.2                                 | 1                                   |
| Copper                      |       | 2                                   | 2                                   |
| Zinc                        |       | 3                                   | 3                                   |
| Nickel                      |       | 0.2                                 | 0.5                                 |
| Manganese                   |       | 0.5                                 | 1                                   |
| Iron                        |       | 1                                   | 5                                   |
| Cyanide                     |       | 0.07                                | 0.1                                 |
| Phenol                      |       | 0.1                                 | 0.5                                 |
| Mineral Oil                 |       | 5                                   | 10                                  |
| Sulfur Compound             |       | 0.2                                 | 0.5                                 |
| Fluorine Compound           |       | 5                                   | 10                                  |
| Ammonium Nitrogen           |       | 5                                   | 10                                  |
| Total Nitrogen              |       | 20                                  | 40                                  |
| Total Phosphorus            |       | 4                                   | 6                                   |
| Chloride                    |       | 500                                 | 1,000                               |
| Residual Chloride           |       | 1                                   | 2                                   |
| Organochlorine Insecticide  |       | 0.05                                | 0.1                                 |
| Organic Insecticide         |       | 0.3                                 | 1                                   |
| PCB                         |       | 0.003                               | 0.01                                |
| Coliform Bacteria           |       | MPN/100ml                           | 3,000                               |
| All $\alpha$ -ray Intensity | mg/l  | 0.1                                 | 0.1                                 |
| All $\beta$ -ray Intensity  |       | 1.0                                 | 1.0                                 |

Figure 2-2-9 Industrial Emission Standard

#### 5) Fly Ash Processing Standards

QCVN 07:2009/BTNMT (National Technical Regulation on Hazardous Waste Thresholds) applies to fly ash generated from waste incinerators.

(2) Technology Standards

The basic specification table for waste incinerators in Vietnam defined by QCVN 30:2012/BTNMT is as follows. Compared to the standards of Japan, the combustion chamber temperature might be considered overblown.

| Item   | Vietnam            | Japan   |
|--|--------------------|---|
| Incinerator Capacity                                     | 100 kg/h or higher | —   |
| Primary combustion chamber temperature                   | 650°C or higher    | 850°C or higher<br>(900°C or higher is desirable) |
| Secondary combustion chamber temperature                 |                    |   |
| Non-hazardous waste                                      | 1,000°C or higher  |   |
| Hazardous waste not containing halogen organic compounds | 1,050°C or higher  |   |
| Hazardous waste containing halogen organic compounds     | 1,200°C or higher  |   |
| Gas retention time in combustion chamber                 | 2 sec. or longer   | 2 or longer                                       |
| Residual oxygen concentration                            | 6~15%              | 12% conversion                                    |
| Incinerator outer wall temperature                       | 60°C or lower      | —   |
| Exhaust gas temperature                                  | 180°C or lower     | —   |
| Auxiliary fuel consumption heat                          | 1,000kcal or lower | —   |
| Continuous operational time                              | 72 days or longer  | —   |

Figure 2-2-10 Waste incinerator basic specifications

### (3) Investment Licensing System

The legal system regarding investments in Vietnam (list) and summary are shown in Figure 2-2-11 and 2-2-12.

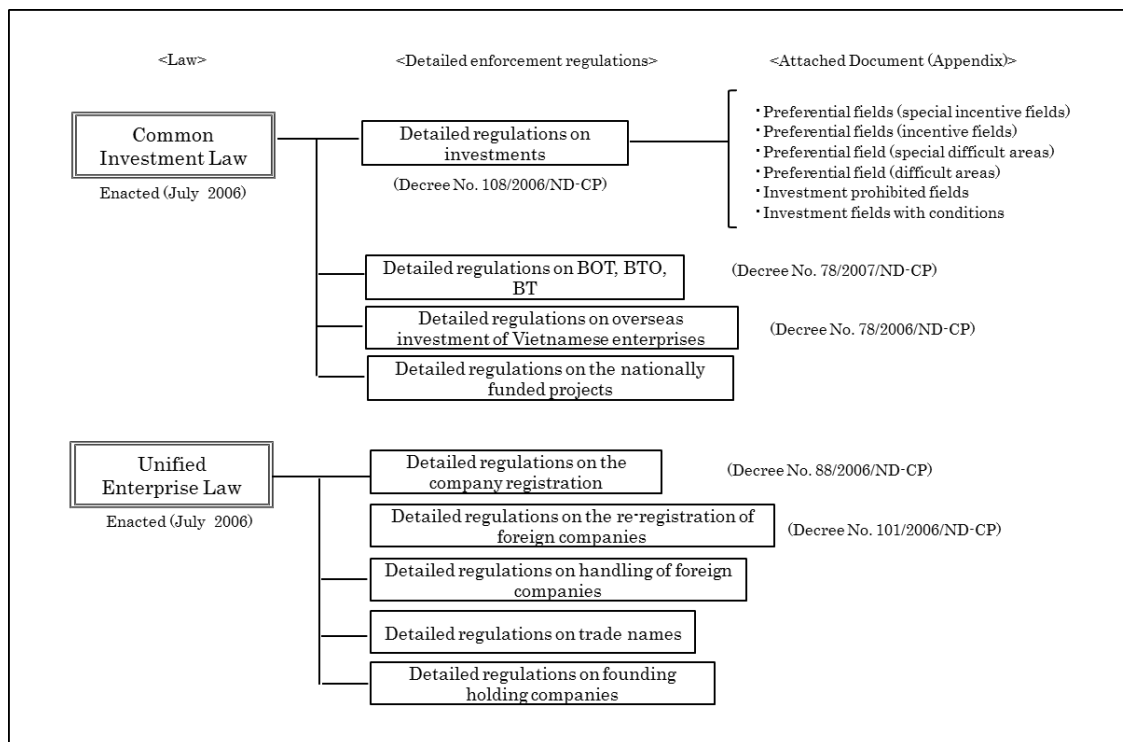


Figure 2-2-11 Legal system regarding investments (Source: Vietnam Investment Environment (Japan Bank for International Cooperation))

| Law                   | Summary   |
|-----------------------|---|
| Common Investment Law | Established to provide a unified legal framework that should be observed when investing within Vietnam and overseas for both Vietnamese and foreign investors. Specifically, it defines the investment fields that are subject to preferential treatment or restrictions, investment forms that investors can carry out, applicable permit requirements, resolution of disputes and general provisions regarding security granted to investors by Vietnam.  |
| United Enterprise Law | Provisions for legal framework for the establishment and operation of all forms of companies form in Vietnam, including the following forms of companies.<br><input type="checkbox"/> Limited liability company with single member)<br><input type="checkbox"/> Limited liability company with two or more members)<br><input type="checkbox"/> Joint stock company)<br><input type="checkbox"/> Partnership company)<br><input type="checkbox"/> Private enterprise)<br><input type="checkbox"/> Parent company and subsidiaries, Economic Conglomerate 1 and including other forms, Corporate Group 2 |

(Source: Vietnam Business Regulations Guidebook for Japanese Companies (JETRO))

Figure 2-2-12 Summary of Laws



Note investment forms in Vietnam are shown in Figure 2-2-13

| Law  | Summary  |
|--|--|
| ① 100% Foreign Enterprise  | <ul style="list-style-type: none"> <li>• Investment form where all funds provided by foreign investor and company is established</li> <li>• Single or multiple foreign enterprises may invest.</li> <li>• 100% ownership (foreign) in many service fields are approved however there are still areas of service fields (transport industry, etc.) where 100% ownership (foreign) is regulated.</li> </ul>  |
| ② Joint Venture  | <ul style="list-style-type: none"> <li>• Investment form where funding is provided by both a Vietnamese enterprise (state-owned, private, and individual) and a foreign investor and the company is formed based on a joint venture contract.</li> </ul>   |
| ③ Business Cooperation Contract (BCC)  | <ul style="list-style-type: none"> <li>• Investment form where a Vietnamese enterprise and foreign investor promote sharing of profits, assets, and liabilities regarding a contract without establishing a company as a legal entity.</li> <li>• Used for investment in a business that will be implemented in a short period or designated businesses such as the communications business that is regulated by the government, drilling for oil or other natural resources, exploration, mining or other joint venture businesses</li> </ul>   |
| ④ BOT (build-operate-transfer) contract, BOT (build, transfer, management) contract, BOT (build and transfer) contract | <ul style="list-style-type: none"> <li>• Formed by a foreign investor and a Vietnamese government agency, when the constructed infrastructure facility is transferred to the Vietnamese government, depending on the management method after the transfer, classified to one of three types BOT, BTO or BT contract.</li> <li>• The foreign investor funds the entire amount or through a joint investment with the Vietnamese government to establish a company.</li> <li>• Used for infrastructure construction projects such as roads, ports, airports, railways, bridges, water supply and electricity.</li> </ul> |
| ⑤ Indirect investment (stock purchase, merger and acquisitions)  | <ul style="list-style-type: none"> <li>• Securities law, in accordance with other related regulations.</li> <li>• The percentage that a foreign investor can invest in a listed company is limited to a maximum of 49%. The possible percentage that can be invested for each field of investment is determined by government regulations.</li> </ul>  |
| ⑥ Establishment of branches and representative offices   | <ul style="list-style-type: none"> <li>• Establishment of law offices, accounting offices, banks, etc.</li> <li>• Representative offices, market research, information collection, business activities where the objective is for management of contract manufacturing are not permitted.</li> <li>• Details are defined in the revised commercial law.</li> </ul>   |

|  |   |
|--|---|
| <p>⑦ Other,<br/>(Contract<br/>manufacturing,<br/>etc.)</p> | <ul style="list-style-type: none"> <li>• For contract manufacturing, there is the method where product are purchased with the manufacturing fee (free contract manufacturing method), method where raw materials are charged for then provided, and method where fees for both raw materials and processing are paid for products (paid contract manufacturing method)</li> <li>• Additionally, construction contracts where construction permits are received for each project and based on a contract with the owner, construction installation business is done, technology transfer contract where consideration is given to supply patents and know-how, business format where Vietnamese shops are used as agencies for sales and sales agency contracts, etc.</li> </ul> |
|--|---|

Figure 2-2-13 Format for investing in Vietnam (Source: Vietnam's investment environment (Japan Bank for International Cooperation))

(4) Feed-in Tariff : FIT

In May 2014, the Prime Minister's decision on (No.: 31/2014 / QD-TTg: On support mechanism for the development of power generation projects using solid waste (s) in Vietnam) was published along with establishment of the purchase price for electric power generated directly from the combustion of solid waste 2,114VND / kWh (10.05US cent / kWh) (Note: 1,532VND / kWh (7.28US cent / kWh) was set for power generated using combustion gas from landfills.)

The above decision by the Prime Minister was put into effect on June 20, 2014 and business entities (investors) that only agreed to Construction Law Article 72 (Conditions for commencement of construction) and the related documents (investment certificate, purchaser of electrical power purchase contract, connection of electrical power to electric distribution and transmission operators, etc.) were given permission to start construction.

In regards to the prospects of increasing the purchase price (10.05 US cent / kWh), it was commented at the Ministry of Commerce and Industry hearings that if in 2 to 3 years, an investor did not come forward, there would be a need to submit an application regarding a review to the Prime Minister. In a similar case, after the decision for FIT (wind power) (2011: No. 37 decision notification), investors did not sufficiently come forward after 4 to 5 years and currently the situation is that an

increase from 7.8 US Cent / kWh to 9.0USCent / kWh has been submitted to the Vietnamese Prime Minister and is waiting for approval. In the background of the price increase for wind power FIT, the goal at the introduction was 10,000MW by 2020 but in the current situation, it has been decided that obtaining this goal would be difficult.

In October 2015, in the notification by the Vietnam Chamber of Commerce and Industry Ministry "Circular No: 32/2015 / TT-BCT" (Notification related to solid waste to energy project development and standard power purchase agreement of the power generation business)" was published and the template for electric power sales and purchasing contracts was presented. In Article 10 of this notice, since it clarifies that basic changes to the sales and purchasing contract would not be approved (additions are permitted), in order to apply FIT, a contract with the power company (Electricity of Vietnam: EVN) must be based on the template (See appendix for details). It should be noted in the hearing with EVN, the risks related to the collateral of the amount of power sold by investors (business entities) (risks, such as insufficient volume of waste and solid waste calorific value, when the assumed power cannot be generated), penalties were not provided and a response that the total amount of power would be purchased even when an excess or deficiency occurs.

## 2.1.8 Scale of Facilities and Project Costs

### (1) Basic Plan

#### 1) Waste Types and Properties

As the results of the quality study show, the lower calorific values were 1,300 to 1,500 kcal/kg. Although it has been increasing compared to last year, the level of the calorific value is generally low. If the goal is to maximize the income from the power generation business, it is desirable to increase the input of heat in order to obtain the highest output possible. Therefore, in addition to the general waste generated from Hai Phong City that was being processed in this facility, sewage sludge, assumed to have a high calorific value, would be added. The steam generated from incineration of waste would be used to dry out the sewage sludge. After drying the moisture content is set to 30% from the adhesion to the device.

The waste quality to input is set as in Figure 2-2-14 from the results of the waste analysis.

| Item                  | Unit    | Planned Waste Quality |
|-----------------------|---------|-----------------------|
| Lower calorific value | kcal/kg | 1,630                 |
| Moisture              | %       | 60.3                  |
| Ash content           | %       | 11.61                 |
| Combustible content   | %       | 28.1                  |
| C                     | %       | 13.69                 |
| H                     | %       | 2.19                  |
| O                     | %       | 10.45                 |
| N                     | %       | 0.42                  |
| S                     | %       | 0.08                  |
| Other                 | %       | 1.31                  |

Figure 2-2-14 Assumed waste quality

#### 2) Facilities Plan

The scale of this facility is based on the assumption for mixed combustion of 450 tons/day of general waste and 50 tons/day of sewage sludge generated by Hai Phong City and the scale for processing 500 tons/day of the Waste-to-Energy facility was setup.

Note that on the assumption that the input would not change, especially for the

delivery of general waste, the condition is that a stable volume would always be delivered. When operations stop at the scheduled maintenance time, delivery of general waste and sewage sludge would be halted and it is assumed that final disposal would be in a landfill.

Additionally, the number of days annually operational is 330 days.

### 3) Basic Flow of Waste Processing

The figure below shows the basic flow of waste processing. The waste and sewage sludge discharged from Hai Phong City is stored in the same waste pit and input into the incinerator as mixed waste. The exhaust from incineration, after heat is recovered in the boiler, goes through the exhaust gas treatment facility and is finally dissipated into the atmosphere. Steam generated in the boiler is sent to steam turbines and is effectively used to generate power. The main ash discharged from the incinerator is used as soil covering for landfills and the fly ash removed at the exhaust gas processing facility is finally disposed at a landfill. The detailed flow is shown in Figure 2-2-15.

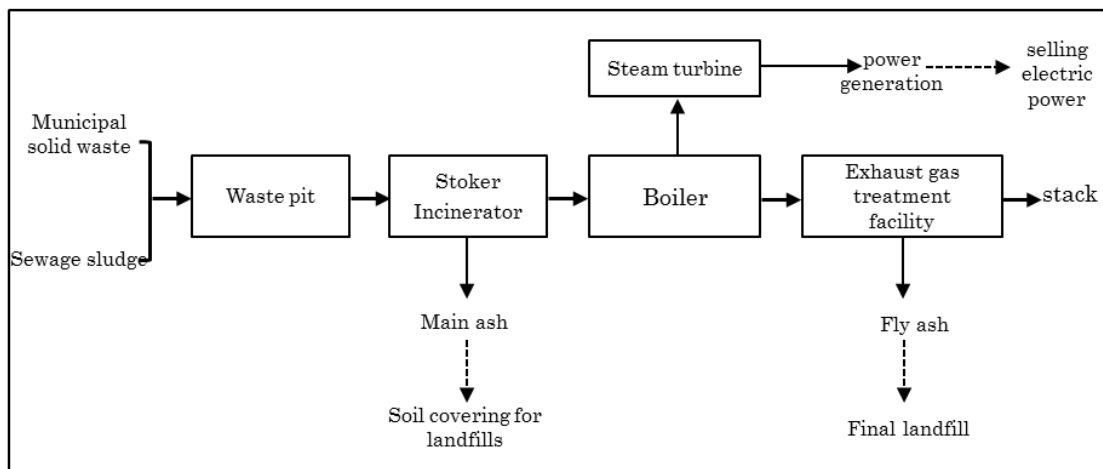


Figure 2-2-15 Waste Processing Basic Flow

### 4) Material Flow

The outline of material balance is as shown in Figure 2-2-16. This method assumes the sale of approximately 9MW of electricity.

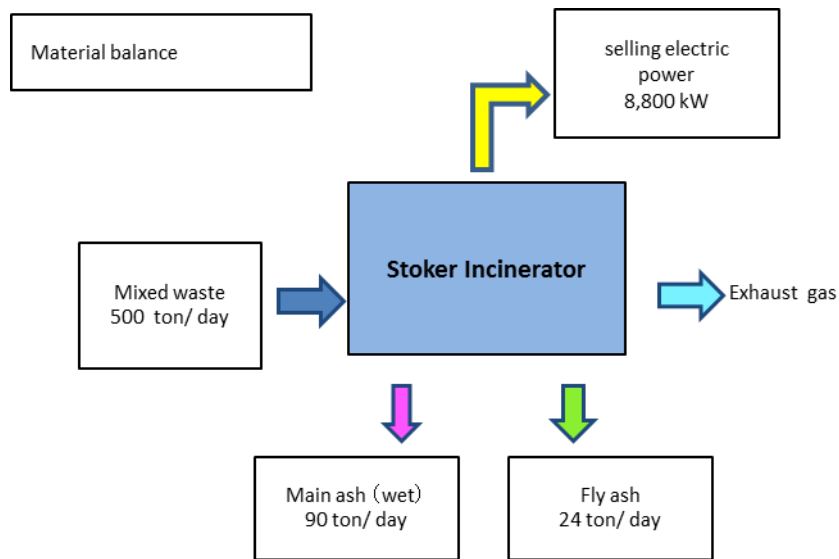


Figure 2-2-16 Outline of Material Flow

#### 5) Stoker Incinerator main facilities

This facility is composed of a single series from an input hopper to the stack.

Main facilities are as shown below.

- |                                 |  |
|---------------------------------|--|
| (1) Feeder supply               | Pit & crane system   |
| (2) Combustion facility         | Stoker type incinerator  |
| (3) Combustion gas cooler       | Steam boiler system  |
| (4) Exhaust gas treatment       |  |
| • Dust collector                | Filtration type dust collector (bag filter)                      |
| • HCl · SO <sub>x</sub> remover | Dry system (slaked lime blowing method)                          |
| • NO <sub>x</sub> remover       | Combustion control<br>+ Selective Non-Catalytic Reduction system |
| • Dioxins remover               | Combustion control<br>+ activated carbon blowing system          |
| (5) Generator                   | Steam turbine (10 MW)  |
| (6) Ventilation                 | Balanced ventilation system                                      |
| (7) Ash removal system          | Slag yard & shovel loader transport                              |
| (8) Sludge drying facility      | Steam dryer  |

#### 6) Waste to Energy

The equipment layout and side view for the Waste-to-Energy facility are shown in Figure 2-2-17 and Figure 2-2-18.

Additionally, the installation location of the facility is presumed as the Trang Cat

Complex Facility operated by Hai Phong URENCO. In this location compose facilities, sorting equipment for combustion, medical waste processing facilities, weighing building, etc., are established. Also, in 2018 there are construction plans to build a vehicle base (70 units) for waste collection vehicles. For this reason, the prerequisite was that use of the administrative building of the Waste-to-Energy facility, parking area, weighing building, etc., would be diversified and the area of the facilities was set to approximately 1 ha.

The Cat B Airport is located on the outskirts of the Trang Cat Complex Facilities and the height limit of building is a concern. It is 3 kilometers in a straight line from the Cat B airport to the Trang Cat Complex Facilities and currently expansion of the airport with new airport construction is going on.

According to the regulations of Decree No.20/2009/ND-CP for height management around the airport, building heights within the premises can be 45m or lower. However, outside the premises confirmation with the airport administrative office or the Department of Defense is required.

Height for the stack height must be secured in consideration for the diffusion of exhaust gas and in this plan, 60m, which is the same as in Japan is assumed and it will be necessary to confirm the above in the future.

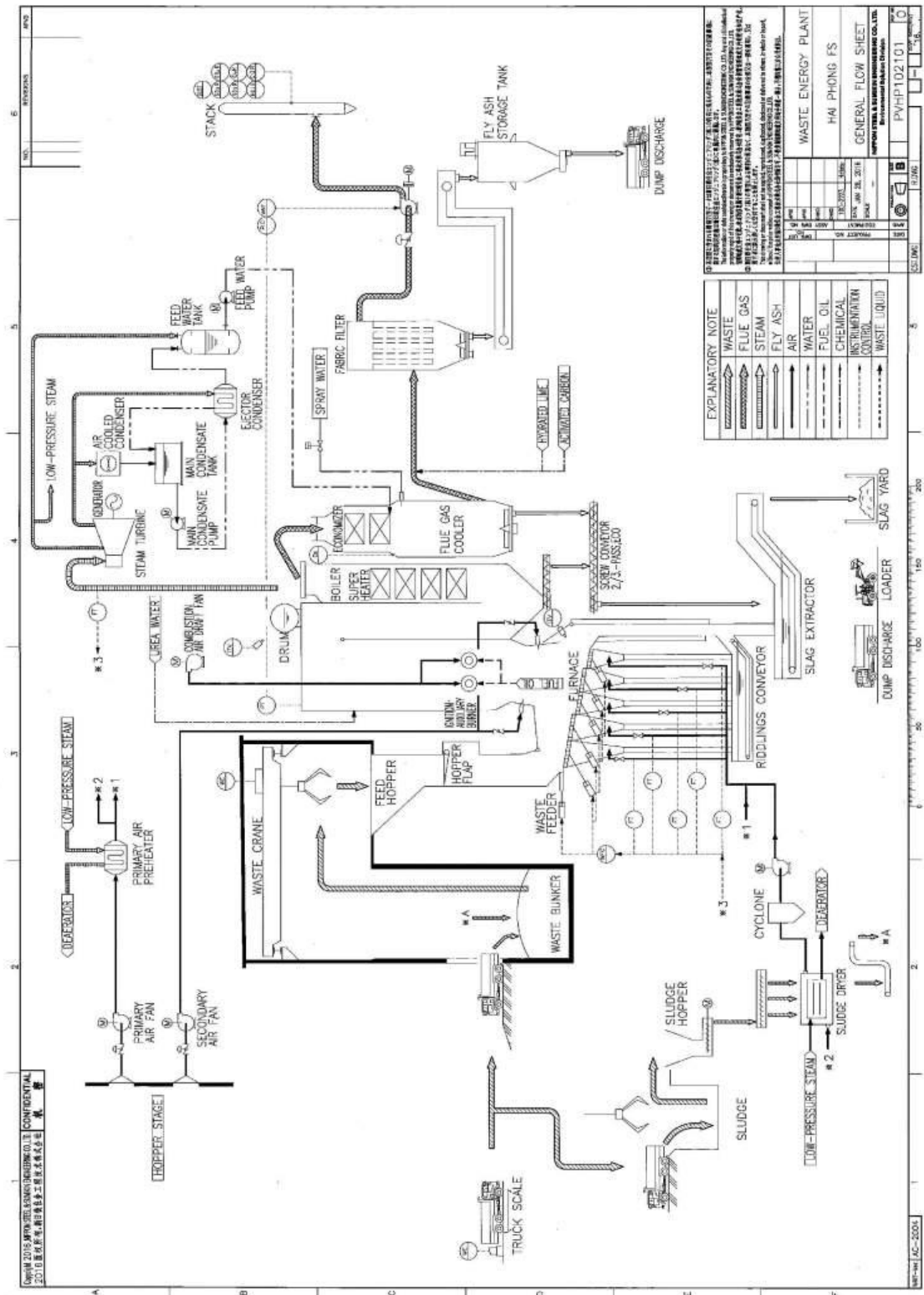


Figure 2-2-17 Facility Flow Sheet



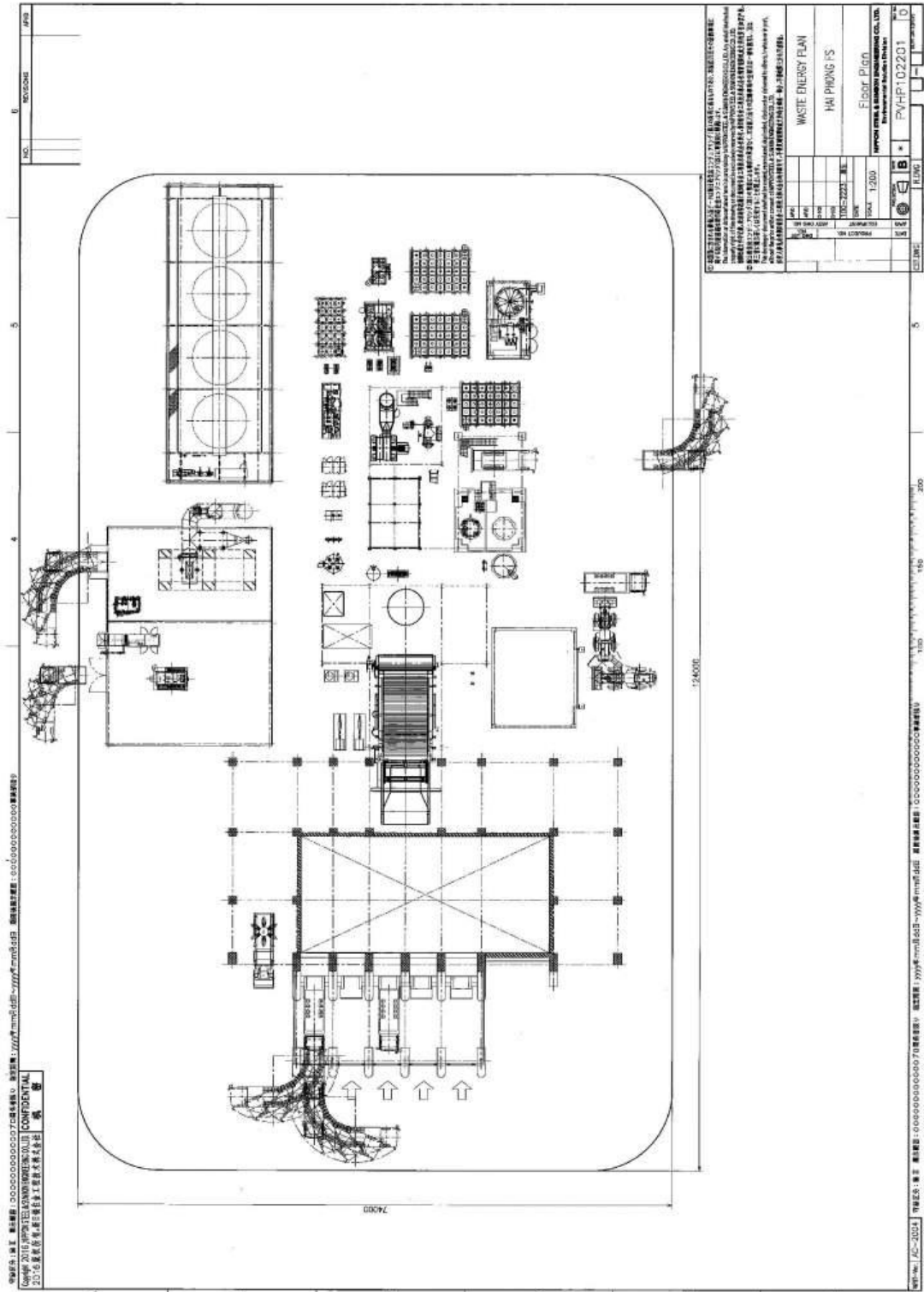


Figure 2-2-18 Equipment layout

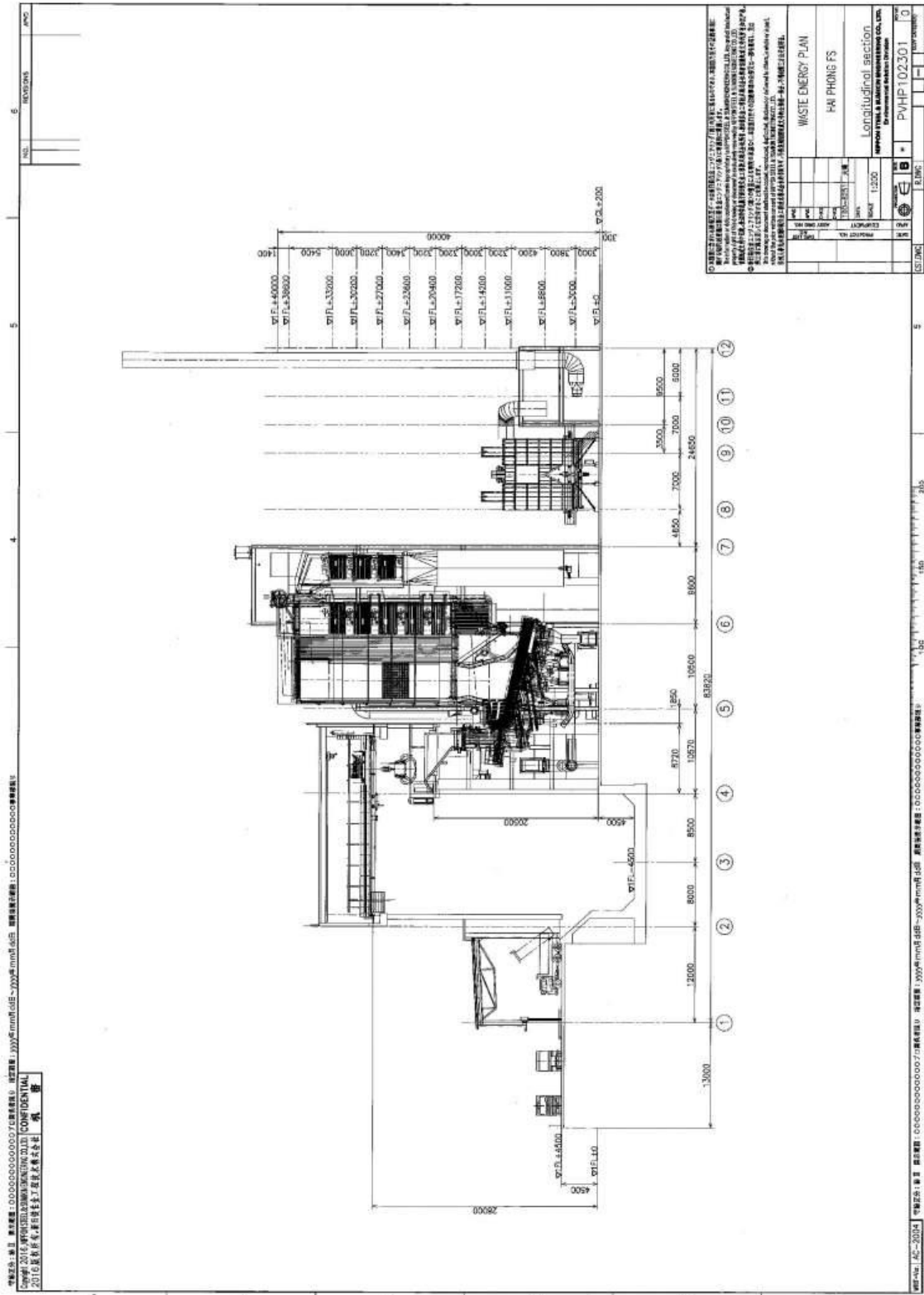


Figure 2-2-19 Equipment layout (side)

(2) Project Cost Estimate Conditions

The preconditions for calculating the project costs for the presumed Waste-to-Energy facilities are shown in Figure 2-2-20.

| Item                                | Precondition   | Remarks   |
|-------------------------------------|--|---|
| Project period                      | 20 years   |   |
| Processing capacity                 | 500 tons/day   | Single series                                       |
| Annual operation time               | 7,920 hours/year (330 days/year)   |   |
| Turbine steam condition             | 400°C、4 MPa  |   |
| Possible power sales amount         | 6,8700 kW  | Power generation amount-on site power               |
| Power sales unit price              | 12.06 yen/kWh  | 10.05 US Cent/kWh<br>Exchange rate 1 dollar 120 yen |
| Building site                       | Presumed to be URENCO Trang Cat Complex Facilities   | New construction, etc. unnecessary                  |
| Processing transport costs          | By utilizing the existing local resources of URENCO (personnel, equipment, etc.,) collection and transport costs are not expected. |   |
| Incineration residue disposal costs | Ash and processed fly ash can be delivered to the existing landfill and so no processing costs are expected.                       |   |

Figure 2-2-20 Waste-to-Energy facilities preconditions

Since at this facility, it is assumed that facilities have been built in the Trang Cat Complex Facility operated by URENCO (compost facilities, medical waste processing facilities), costs for land for construction and construction are not expected. Also since SPC should enforce acquiring licenses and the environmental impact assessment, costs other than the planning support costs were not included.

### (3) Construction Costs and Maintenance Costs

#### 1) Construction Costs

The calculation results for construction are shown in Figure 2-2-21.

Equipment costs are based on purchases in Southeast Asia and prices will be set based on interviews with local suppliers for civil engineering construction work, machinery and electrical construction.

| Item                       | Total (billions of yen) | Total (USD x 10 <sup>6</sup> ) |
|----------------------------|-------------------------|--------------------------------|
| Plant category             | 5.8                     | 48.7                           |
| Civil engineering category | 1.6                     | 13.4                           |
| Total                      | 7.4                     | 62.1                           |

Exchange rate 1 dollar = 120 yen

Figure 2-2-21 Construction costs calculation results

#### 2) Operation and Maintenance Costs

A local SPC will be established for operation and maintenance costs and when the plant is operated under the management of SPC, it will be setup so that local acquisition of local labor unit prices and operating materials will be considered.

| Item                          | Total (millions of yen/year) | Total (USD×10 <sup>6</sup> ) |
|-------------------------------|------------------------------|------------------------------|
| Personnel costs               | 48                           | 0.4                          |
| Inspection repair costs       | 180                          | 1.5                          |
| Utility and maintenance costs | 228                          | 1.9                          |
| Total                         | 456                          | 3.8                          |

Exchange rate 1 dollar = 120 yen

Figure 2-2-22 Calculation Results of Operation and Maintenance Costs

3) Construction Process

The following construction period is assumed.

The design period would take 1 year and the civil engineering construction and the plant construction would take about 2 and half years. The trial operations would be implemented start for a half year after this.

| Year                               | 1 |    |     |    | 2 |    |     |    | 3 |    |     |    |
|------------------------------------|---|----|-----|----|---|----|-----|----|---|----|-----|----|
| Quarter                            | I | II | III | IV | I | II | III | IV | I | II | III | IV |
| Basic design                       | ■ |    |     |    |   |    |     |    |   |    |     |    |
| Detailed design                    |   | ■  |     |    |   |    |     |    |   |    |     |    |
| Civil engineering and construction |   |    | ■   |    |   |    |     |    |   |    |     |    |
| Plant construction                 |   |    |     |    | ■ |    |     |    |   |    |     |    |
| Trial operation                    |   |    |     |    |   |    |     |    |   |    | ■   |    |

Figure 2-2-23 Waste-to-Energy facility construction process chart

(4) Other (Effective use of the Trang Cat Complex Facilities)

At the planned facilities construction site of the Trang Cat Complex Facilities as described above, composting facilities and waste sorting facilities (manual sorting lines / vibrating sieves, etc.) will be established. Here, the promotion of sorting during the intermediate processing stage by placing consideration on controlling quality and quantity, etc., of incineration materials for effective use of sorting facilities for incineration materials was organized.

### 1) Current Situation

Multiple visits were carried out from the start of the study in 2015, however in the Trang Cat complex facilities, operations of sorting facilities (manual sorting / vibration sieve, etc.) for waste materials had stopped (refer to photos below).



Photo ① Input area



Photo ② Initial sorting line



Photo ③ Secondary sorting line  
(Materials with heavy specific gravity)



Photo ④ Secondary sorting Line  
(Materials with light specific gravity)

The URENCO side explained that the reason was maintenance was being done however, when considering the status of the waste pit; it appeared that sorting processes were not being done for extended periods. It could be considered that production was discontinued because of the previous issue of the quality of compost not improving.

Pictures of the sorting facilities in operation in 2014 have been attached on the next page.

Reference: Sorting facilities operational status (2014)



Sorting line input waste



Hand sorting



Sorted waste collected in bottom of sorting spaces



Trommel



Magnetic sorter

## 2) Effective Use of the Sorting Facilities

It is necessary to take full advantage of the processing capabilities of the trommel and magnetic sorter including effectively and efficiently utilize manual sorting lines. In order to effectively utilize the manual sorting lines to the fullest, after striving to "clarify of what must be removed during manual sorting" and "clarify of the objective of sorting" it is necessary to take measures to structure the initial sorting lines and the secondary sorting lines.

### ① Initial Sorting Line

The initial sorting line is designed to have 8 persons perform sorting tasks. In the first process, the 4 persons at the head of the line should mainly specialize in tearing open bags and taking out its contents, 4 persons at the end of the line should thoroughly sort and remove "metal objects", "glass and ceramics", "diapers, etc. and other wastes", to improve the work efficiency of the equipment in the latter stages (trommel, magnetic sorter) so that further thorough sorting can be attained for the secondary sorting lines.

### ② Secondary Sorting Line (Materials with heavy specific gravity)

The design of the sorting line where waste with heavy specific gravity (organic waste, etc.) passes through the trammel, is made to accommodate 10 workers for sorting. Waste containing foreign objects difficult to remove passes through the trommel, mainly waste containing water. The sorters assigned to the head of the line spread out the waste on the conveyor as much as possible to make foreign objects easier to find. Sorters assigned to the middle crush and break down solid objects and separate foreign objects and at the end of the line, remove small objects. Since this line greatly affects the quality of the compost, there is a need to train skilled workers. On the hardware side, the conveyor is too wide and areas are out of reach. The height is also too high for women and in consideration of safety concerns, an elevation stage or steps are necessary.

### ③ Secondary Sorting Line (Materials with light specific gravity)

The design of the sorting line where waste with light specific gravity (plastics, paper) passes through the trammel, is made to accommodate 10 workers. In this line, the focus is mainly on sorting valuable materials such as plastics and paper. It is necessary for the sorters assigned to the head of the line to thoroughly separate specific trash (unsuitable items). Because small parts of compact household appliances and



packaging of drugs were discovered in the piles of compost, comprehensive training of workers in sorting materials to thoroughly separate materials that lead to deterioration of compost should be done.

Additionally, improving the sorting conveyor can also be considered to be necessary. The distance from the sorting line to the floor surface is 835mm and the width of the conveyor is 1,600mm, however this is "too high" and "too wide" for the local workers. Since even for a large male reaching beyond the middle is only barely possible, raising the floor of the work space for the problem of height and width will enable reaching beyond the middle of the conveyor and make it possible to improve the efficiency of work.

### 2.1.9 Greenhouse Gas (Particularly Energy Originated Carbon Dioxide) Emission Reduction

When Waste-to-Energy is not implemented, energy is supplied by using fossil fuels or heat energy is supplied. In this project, when Waste-to-Energy is not implemented and a power source in place of this project is connected to the power grid and supplying the power, the Green House Gas volume generated is used as reference emissions and the project emissions volume was set as follows.

- 1) CO<sub>2</sub> emissions from amount of power and fuel consumed for recovering energy from incineration.
- 2) CO<sub>2</sub> emissions from incineration of waste including carbon derived from fossil resources
- 3) It may be considered that wastewater from the incineration process may produce methane emissions when done under anaerobic conditions, however in this methodology; such a case would be eliminated by the qualification requirements.
- 4) GHG emissions from transport relating to project activity can be thought of to be almost the same as transport that is taking place in the reference and are not considered in this methodology. For example, transport to the MSW incineration facilities for project activities and transport of ash discharged from project activities to SWDS is equivalent to transport of MSW to the incineration facilities, etc.

### 2.1.10 MRV Methodology and Monitoring system

#### (1) GHG emission reduction technology to be applied.

This methodology produces energy and electrical power by incineration of Municipal Solid Waste (MSW) and the objective is to replace technology using fossil fuel with renewable energy technology. Definitions of terms are shown on the following page.

| Terminology                      | Definition  |
|----------------------------------|---|
| Fresh waste                      | Solid waste collected at the waste disposal site but has not yet been discarded. Municipal waste is included but disposed waste and hazardous waste removed.  |
| Incineration                     | Incineration of managed organic matter with both fossil resources and biological matter as the source. Ideally, all of the organic matter would be converted to CO <sub>2</sub> and H <sub>2</sub> O. However in actuality, incomplete incineration, inorganic matter, and other foreign matter would be mixed in and is discharged from the incinerator.         |
| Municipal Solid Waste (MSW)      | Mixture of different types of waste and usually collected from government bodies and other local public institutions. Includes waste from households, gardens, parks, commercial and public facilities.   |
| Solid Waste Disposal Site (SWDS) | Area specified as final disposal site for solid waste. The location where waste is piled up would be recognized as a waste disposal site if it satisfies the following conditions.<br>(a) Ratio of surface area to volume is 1.5 or greater and additionally (b) that the waste is placed in anaerobic conditions (low porosity, high humidity) can be confirmed. |

#### (2) Reference Emissions Volume

When Waste-to-Energy is not implemented, energy is supplied by using fossil fuels or heat energy is supplied. Here, when Waste-to-Energy is not implemented and a power source in place of this project is connected to the power grid and supplying the power, the Green House Gas volume generated is used as reference emissions.

### (3) Volume of Project Emissions

The project emission volume is as follows.

1. CO<sub>2</sub> emissions from consumption of power and fuel for incineration and energy recovery
2. CO<sub>2</sub> emissions from incineration of waste containing carbon from fossil resources
3. Methane emission may be considered when wastewater from incineration is treated under anaerobic conditions however, in this methodology, such a case would be eliminated by the qualification requirements.
4. GHG emissions from transport relating to project activity can be thought of to be almost the same as transport that is taking place in the reference and are not considered in this methodology. For example, transport to the MSW incineration facilities for project activities and transport of ash discharged from project activities to SWDS is equivalent to transport of MSW to the incineration facilities, etc.

### (4) Monitoring Parameters

The monitoring parameters are the following 3.

- ① Ratio of total volume and type of waste input to incineration
- ② Consumption amount of power and fuel for incineration and to recover energy
- ③ Amount of power and heat energy that can be produced by the energy recovery equipment

### (5) Qualification Requirements

The qualification requirements are set as in the table below.

|                |   |
|----------------|---|
| Requirement 1  | The project activities that apply this methodology are used to incinerate Municipal Solid Waste that has not been processed (Fresh MSW) and the heat energy and power obtained from this is used.   |
| Requirement 2  | If this project is not implemented, the organic waste included the Municipal Solid Waste (MSW) for incineration in this project, is disposed at a landfill in the Solid Waste Disposal Site (SWDS) and generates methane gas under anaerobic conditions at the Solid Waste Disposal Site. |
| Requirement 3  | The waste incineration technology corresponds to one of the following rotary kiln, fluidized bed or stoker types.   |
| Requirement 4  | If incineration of Municipal Solid Waste (MSW) is mandatory by law, the weight of the MSW to be incinerated to comply with the law does not exceed 50% of the nation's entire MSW (weight basis).   |
| Requirement 5  | Composition (waste type) and ratio of each type of the MSW to be incinerated with project activities can be determined.   |
| Requirement 6  | Power consumed by project activities is supplied by the energy produced by project activities or its system power grid.   |
| Requirement 7  | If fossil fuel is consumed for incineration and recovery of energy, the ratio of the heat energy produced by the fossil fuel does not exceed 50% (heat volume basis) of the overall heat energy.  |
| Requirement 8  | Facilities and equipment introduced and used with the project are new and are not facilities and equipment that have been used for other activities and are not transferred or renovated from currently used existing facilities.   |
| Requirement 9  | MSW collected is not stored under anaerobic conditions with this project.   |
| Requirement 10 | If wastewater is generated during project activities, the wastewater will not be anaerobically treated.   |
| Requirement 11 | The volume of MSW that would have been recycled if there were no project activities are not reduced because of implementation of project activities.  |

## (6) GHG Emission Source and GHG Types

GHG emission source and GHG types for reference emission and project emission volumes are summarized in the table below.

| Emission Classification   | Activity Classification                            | GHG Type        | Evaluation and postscript   |
|---------------------------|--|-----------------|---|
| Reference Emission volume | Incineration                                       | CO <sub>2</sub> | Green House Gas generated when the power source connected and supplying power to the power grid, generates the amount of power in place of the project, when Waste-to-Energy is not implemented |
| Project Emission Volume   | Use of fossil fuel by power generation facility    | CO <sub>2</sub> | Volume of Green House Gas generated with facility operational fuel and auxiliary fuel use within the power generation facility  |
|                           | Consumption of energy by power generation facility | CO <sub>2</sub> | Volume of Green House Gas generator with use of power of the power generation facility  |

## (7) Reference Emission Volume

The reference emission volume is the Green House Gas volume generated when the power source connected and supplying power to the power grid, generates the amount of power in place of the project, when Waste-to-Energy is not implemented and quantified by the following formula ①. Additionally, each parameter value used in the calculation formula ① is presumed in the content of the table descriptions below.

$$RE_p = EG_p \times EF_{grid} \quad \text{Calculation formula ①}$$

$RE_p$  = Reference emission volume (t CO<sub>2</sub>) for Period p

$EG_p$  = Amount of power generated (MWh) with combined type waste incineration power generation facility for Period p

$EF_{grid}$  = Grid emission factor (t CO<sub>2</sub> / MWh)

## (8) Project Emission Volume

The project emission volume is presumed by quantification in the formula below.

$$PE_p = PE_{elec,plant,p} + PE_{FF,plant,p}$$

Calculation

formula ②

$PE_p$  = Project emission volume (t CO<sub>2</sub>) for Period p

$PE_{elec,plant,p}$  = Green House Gas emission volume(t CO<sub>2</sub>) generated from power consumption within power generation facility for Period p

$PE_{FF,plant,p}$  = Green House Gas Emission Volume (t CO<sub>2</sub>) generated from consumption of fossil fuel within power generation facility for Period p

## (9) Emission Reduction Volume

The emission reduction volume is the amount reduced from the reference emission volume by the project emission volume.

$$ER_p = RE_p - PE_p$$

Here

$ER_p$  = Reduction volume of Green House Gas (t CO<sub>2</sub>) for Period p

(10) Calculation of Emission Reduction Volume

Refer to 2-5. (2) Project cost trial calculation conditions for estimate conditions for calculations.

④ Reference Emission Volume

The reference emission volume, namely the probable Green House Gas Emission Volume from power generation to supply the power grid in the case that the project was not implemented, is quantified by the following calculation formula ①. Additionally, the parameter values used in calculation formula ① is presumed in is presumed in the content of the table descriptions below.

$$REp = EG_p \times EF_{grid} \qquad \text{Calculation Formula ①}$$

| Parameter   | Unit     |               | Remarks  |
|-------------|----------|---------------|--|
| $EG_p$      | MWh      | Monitoring    |  |
| $EF_{grid}$ | tCO2/MWh | Default Value | Host Country DNA<br>Published Value 0.5638<br>(tCO2/MWh) |

② Project Emission Volume

Since the project that is the subject of this study is a power generation facility that is an addition to the Municipal Solid Waste incineration that have been under examination, the Green House Gas activity generated from Municipal Solid Waste incineration, would have been generated even without the implementation of this project. Accordingly, the project emission volume from implementing the project will be the Green House Gas Volume generated from power consumption within the power generation facility and Green House Gas generated by the power generation facility by consuming fossil fuel. The Green House Gas Emission Volume from project activities is calculated with the following calculation formula. Additionally, individual project emission volumes that constitute the calculation formula can be obtained by calculation formula below.



Calculation

$$PE_p = PE_{elec,plant,p} + PE_{FF,plant,p}$$

Formula ②

$PE_p$  = Project emission volume (t CO<sub>2</sub>) for Period p

$PE_{elec,plant,p}$  = Green House Gas Emission Volume(t CO<sub>2</sub>) generated from power consumption within the power generation facility for Period p

$PE_{FF,plant,p}$  = Green House Gas Emission Volume(t CO<sub>2</sub>) generated from consumption of fossil fuel within the power generation facility for Period p

- Green House Gas Emission Volume associated with consumption of power within the facility

$$PE_{elec,plant,p} = EC_{plant,p} \times EF_{grid}$$

Here

$EC_{plant,p}$  = Amount of energy consumed (MWh) by power generation facility for Period p

$EF_{grid}$  = Grid emission factor (t CO<sub>2</sub>/MWh)

- Green House Gas Emission Volume from consumption of fossil fuel by the power generation facility

$$PE_{FF,plant,p} = \sum FF_{aux,i,p} \times NCV_{FFi} \times EF_{FF,i}$$

Here

$FF_{aux,i,p}$  = Amount of fossil fuel is consumed for Period p

$NCV_{FFi}$  = Lower calorific value of fossil fuel i (GJ / t)

$EF_{FFi}$  = CO<sub>2</sub> emission factor of fossil fuel i

Details of Parameters used in the calculation formula above are as shown below

| Parameter        | Unit     | Value         | Remarks  |
|------------------|----------|---------------|--|
| $EC_{plant,p}$   | MWh      | Monitoring    |  |
| $EC_{pre-t,p}$   | MWh      | Monitoring    |  |
| $EF_{grid}$      | tCO2/MWh | Default value | Host country Published value 0.5638              |
| $FF_{aux,i,p}$   | 1        | Monitoring    |  |
| $FF_{pre-t,i,p}$ | 1        | Monitoring    |  |
| $NCV_{FFi}$      | GJ/t     | Default value | i=light oil (43.3)<br>IPPC default value         |
| $EF_{FFi}$       | tCO2/GJ  | Default value | i=light oil (0.0748)<br>IPPC default upper limit |

When the above is include in calculations, the reference emissions volume is  
 $69,696\text{MWh/year} \times 0.5638 = 39,294$  tons

Project emissions: 16,535 tons

Accordingly, reduction volume of Green House Gas will be  
 $39,294 - 16,535 = 22,759$  tons.

#### 2.1.11 Cost Effectiveness and Secondary (Co-beneficial) Effects

If the facilities scale is assumed at 500 tons/year, the estimated facility maintenance costs would be 7.45 billion yen. Within this, the applicable power generation facilities would be 40% overall and when 50% is assumed for equipment auxiliary, it will be 3.754 billion. The assumed statutory useful life is 17 years

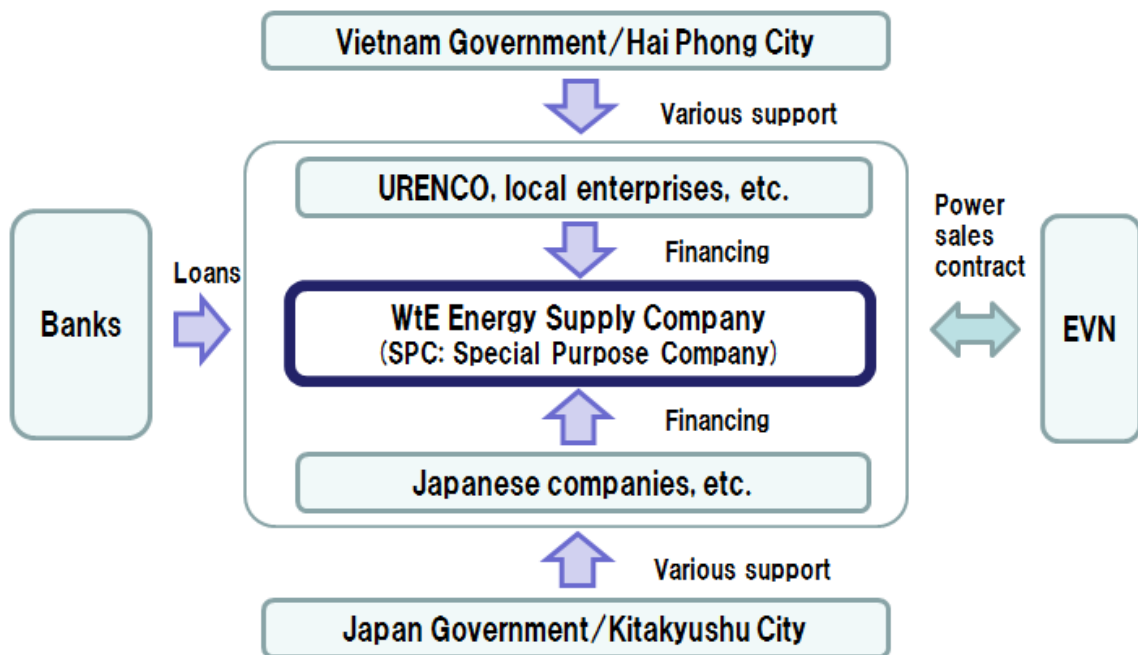
CO2 emission reductions cost effectiveness results

Assumed to be  $1.490 \text{ billion yen} \div (29,210 \text{ tons} \times 17 \text{ years}) \doteq 30,000 \text{ yen/ton}$ .

## 2.2 Examination towards Project Realization

### 2.2.1 Project Realization Plan

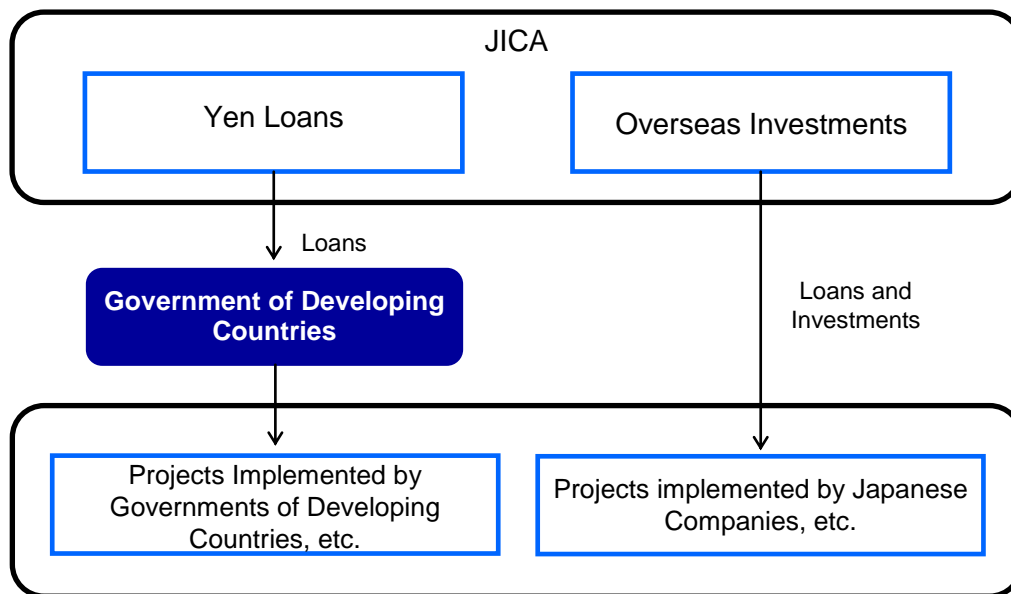
The business scheme (assumptions, examples) is shown below. In the figure below, as a PPP (Public Private Partnership) project, an SPC (Special Purpose Company) is established by URENCO and local companies (Vietnam side) and Japanese companies (Japan side) for a scheme to finalize a contract to sell electricity to EVN, an electric power company.



In regards to acquisition of funds, business schemes other than PPP are put into view and preparations were made for JICA overseas investments/yen loans and JBIC investment financing and export financing.

#### (1) JICA Overseas Investments and Yen Loans

An overview of JICA yen loans and overseas investments are shown in the figure below. The conditions etc., for loans were organized based on published information and interviews with JICA.



① Overseas Investments

Conditions for investments are given below.

●Loan Ratio:

In principle, within 70% of the total project cost

●Repayment Period:

In principle, within 20 years. Grace period is within 5 years (\*It is unlikely that the grace period would become 5 years. The image for the construction period is about 2 years. The premise is that repayment is due as soon as profits are generated.)

●Currency:

Yen/Dollar base \*Local currency (Vietnam dong) cannot be accepted.

●Interest Rate :

• Yen base: Fixed interest rate (Japanese government bond interest rate + risk premium)

• Dollar base: Variable interest rate (USD LIBOR 6M + risk premium)

1) Risk premium added to the interest rate is decided on by taking into account credit risk.

2) Calculation of risk premium does not take into account country risk (Only business risk, JICA does the risk taking for country risk).

●Other:

• Secure guarantee or physical collateral that JICA recognizes as qualified

(Government guarantee necessary. In the current situation for the PPP Decree, it appears that government guarantee will come, however the need to study this is understood).

- At the least, a decision on the degree of credit risk based on the following detailed study is necessary.
  - (a) Level of Hai Phong City financial situation, and disclosure of data on credit as the premise to a decision.
  - (b) Offtaker, EVN financial situation, credit standing level
  - (c) Absence or presence of Tipping Fee linked inflation
- Burden of fluctuation in quality and volume of waste (guarantee for composition of waste and volume necessary)
- Investment currency (conversion of Vietnam dong is not possible)
- Limited Recourse is fundamental for project finance.
- ADB, IFC, etc., is premise for co-financing.

Note that, since the central government is promoting the implementation of the project as PPP, in the case of a publicly managed public facility, because central government needs to compress external debts, the arrangement would not be a grant to the local government but rather financing through a loan that would be repaid as a premise. Additionally, on the basis that the waste PPP projects in southern Vietnam are not in line with the Tipping Fee, etc., it was brought up at the JICA interview that it was recognized that it was necessary to have the priority of waste disposal clarified within the Vietnam government.

### ③ Yen Loans

Financing conditions are as follows.

- Loan Ratio:

Financing up to 100% of the total cost of project

- Repayment Period:

Priority conditions, for fixed interest rate (standard): In principle 40 years. Grace period is within 10 years

1) Grace period is seen basically as 10 years.

2) For example, even if the project is completed in 30 years, repayment ahead of schedule will not be requested.

●Interest Rates: For priority conditions and standards

- Fixed interest rate: (0.30%)
- Variable interest rate: (yen LIBOR – 100bp)

1) For Japanese procurement ratio (STEP), although the place of origin rule for originating in Japan applies for yen financed loans for 30% or more of the total amount of the main contract, the interest rate would lower that amount.

●Other:

- Raising project priorities in the long list is important.
- Loans to the government would be sublet to Hai Phong City (Will not be a Grant to Hai Phong City)
- The scale of the business must be at least around 10 billion yen for a yen loan business (Waste-to-Energy along would be severely difficult. Need to combine with other components)
- Repayment ability and strong intention to implement project of Hai Phong City necessary
- Since the central government is encouraging the implementation of the project with PPP, a strong reason for a public project and not PPP for yen loans is necessary
- During investigation of project feasibility by the Japanese side, order for Japanese companies and profits for Japanese companies in the locality must be inquired

(2) JBIC Investment Financing and Export Financing

① Investment Financing

Standard loan conditions are as follows.

●Loan Ratio:

Limited to 60% of the total project cost

●Interest Rate:

- Yen Currency: 0.475%

1) Interest rate for yen loan investment financing is set in accordance to the loan, grace period, and repayment form (However, the interest lower limit is currently 0.20%). "10 years (after 3 year deferment, 7 years even half-year cycles) " for the loan rate for the above is shown.

- Foreign Currency: LIBOR + 0.375%

2) Foreign currency interest rate set based on USD LIBOR (6 months).

- 3) Apply special interest rate depending on the significance of policies in contributing to the maintaining and improving the international competitiveness of Japan's industries.
- 4) For both yen and foreign currencies, a corresponding premium is added after consideration of creditworthiness of the business entities, collateral, guarantees, and financing scheme.

●Other:

- For investment finance, Two Step Loans (TSL) are possible for the purpose of aggressively supporting overseas business development of Japanese companies including small and medium-sized companies and support for M&A by domestic companies.
- Must be able to explain why "JBIC funding is necessary (need for public funds highly necessary)". The degree of participation by Japanese companies to be inquired.
- If the funding ratio was 51% by URENCO and 49% by Japanese companies, business prime would appear to be on the Vietnam side. In this case the premise would be to make it a consolidated subsidiary or equity method affiliate company (will be a deciding factor for financing).
- However, even if the financing ratio of Japanese companies is 49% or less, if the actual control of business is on the Japanese company side, the decision on financing will differ.
- If the financing by Japanese companies is even more subdivided, although it would be compared to the financing ratio of the Japanese company within the subdivided, for example how much grip can be taken by the company with financing ratio of 20% if the Japanese side was taking the prime would be material for the financial decision.
- There are no cases of transactions with local governments in Vietnam. Risk assessments of local governments are difficult.

② Export Financing

Standard loan conditions are given below.

●Loan Ratio:

Limited to 60% of the total project cost

●Interest Rate:

- Fixed interest rate at financing agreement (yen CIRR) →1.08% (Repayment period longer than 8.5 years)
- Fixed interest rate prior to export contract restrictions →0.2% added to the above interest rate
  - 5) Composite of JBIC and co-financing financial institution interest rates
  - 6) OECD premium added on based on OECD official export credit arrangement

●Other:

- Financing with the objective of exporting of Japanese company machinery, facilities, technologies, etc. and granted to foreign importer or foreign financial institutions, etc.
- In the past, the ratio of Japanese company made products was at the minimum 30%, however currently the ratio of Japanese company made products is at the minimum of 10%, and product ratio of overseas subsidiaries, etc., of Japanese companies is at the minimum 20%.

## 2.2.2 Challenges for Project Realization

The main issues for establishing a business are listed below, including the challenges in financing as described in 2.3.1.

### (1) Validity of Chipping Fees

In the case of the current situation where open dumping at the low cost of 4USD/ton is done at landfills to change to where Waste-to-Energy is implemented, there would be a huge increase in the chipping fee. When the budget of Hai Phong City is considered, it should have the ability to pay the chipping fee when Waste-to-Energy is implemented, however it would be no small matter for Hai Phong City to cope with the burden of this sudden increase. Accordingly, in order to have Hai Phong City fully understand and approve of why the increase in the chipping fee is necessary, etc., cost reductions (initial and running costs) on the business entities side must be done to the fullest extent first, then present the chipping fee and it would be necessary to continue discussions with the People's Committee and relevant organizations. By securing the economics with the appropriate chipping fee, stable business operations become



possible.

#### (2) Appropriate Risk Sharing with Hai Phong City

When implementing projects, appropriate division of risks with Hai Phong City is essential. Especially in regards to the volume and quality of waste that greatly influence income and expenditures of businesses, if the business entities must shoulder the risk in its entirety, it would be difficult for Japanese companies to participate and also would affect financing by financial institutions and therefore ample discussions with Hai Phong City are necessary.

#### (3) Possibility of Successful Bidding by Japanese Companies

On the basis of the current PPP Decree (Public-Private Partnership investments according to Decree No. 15 (Decree No.15 / 2015 / ND-CP)) the incentives for project proponents would be limited to a portion of the projects. Because in principle, competitive bidding is inevitable for this scale of business, it is desirable to structure the bid so that it is advantageous to Japanese companies (Examples: include high power efficiency, track record for extended periods of continuous operation, etc.).

#### (4) Convertibility of Foreign Currency

In the same manner as (3) above, guarantee for the full amount for convertibility of foreign currency is not clarified in the current PPP Decree. In order to secure stable operations of businesses, this can be considered to be necessary and so dealing with the above is desirable.

#### (5) Subsidy Repayment Risk

Additionally, if a project was started as a subsidized project and the project was abruptly stopped without any sign of resuming, for the Ministry of Environment JCM facilities subsidies, if the waste incineration facility does not operate for the number of years equal to or more than the statutory usable life, a requirement to repay the amount of subsidies equivalent to the number of years remaining after subtracting the number of years of actual operation from the number of years of statutory usable life will arise.

### 2.2.3 Future Plans

After multiple discussions with Hai Phong City, a degree of understanding for the need for Waste-to-Energy facilities and issues, etc. was obtained from the Hai Phong City side. Hai Phong City had experienced failure with the Trang Cat Complex

Facilities (compost facilities) and was cautious of the new construction for the intermediate processing facility. However, in assuming the amount of waste in the future, the landfill capacity could possibly become full before the projected landfill period (10 years) for the current new final disposal site under construction (Gai Minh) and reduction of the volume of waste has been recognized as an important issue.

The Hai Phong City People's Committee Vice Chairman commented that they would continue to study the construction of the WtE facilities based on the materials provided so far and would give a summary of opinions from Hai Phong City by around mid-April 2016. Accordingly, promotions of discussions will continue at an early stage from next fiscal year. The schedule is to continue to study the goal of starting operations as initially expected in 2020.

## Appendix

1. Local final report meeting presentation materials
2. Reference Material 1 Waste-to-Energy FIT Prime Minister Decision  
No31/2014/QĐ-TTg) ( English, Vietnamese)
3. Reference Material 2 Waste-to-Energy contract Ministry of Commerce and  
Industry (No32 / 2015 / TT-BCT) ( English, Vietnamese)
4. Reference Material 3 Renewable energy introduction strategy (No2068 / QĐ-TTg)  
( English, Vietnamese)

To: PPC of Hai Phong city

**WE MAKE THE WORLD A CLEANER PLACE**

**Year 2015 JCM Project Proposal Feasibility Study Project Consignment for the realization of a Low-Carbon Society in Asian**

**Sewage Sludge Solid Fuel and Municipal Solid Waste Mixed Combustion Waste-to-Energy Project (Kitakyushu City – Hai Phong City Cooperative Project) Report material**

- January 12, 2016
- Nippon Steel & Sumikin Engineering Co., Ltd.
- Kitakyushu City
- NTT Data Institute of Management Consulting , Inc.



- **01 Project Positioning and Study Background** ..... **P. 3**
- **02 Project Overview** ..... **P. 4**
- **03 Major Results of Project Implementation** ..... **P. 5**
- **04 Future Image of Municipal Waste Processing of Vietnam** ..... **P. 6**
- **05 Future Image of Municipal Waste Processing of Hai Phong City** ..... **P. 6**
- **06 Study Results** ..... **P. 8**
- **Reference Materials** ..... **P. 10**

## ① Increase in generation of waste volume

- The current volume of waste generated by Hai Phong city is 1,350 tons/day. However, 10 years later in 2015, this is expected to increase to about 3,000 tons/day (2.2 fold)



The strain of the landfill capacity for final disposal site in Hai Phong is a concern.

## ② Government support of Waste-to-Energy

- In May 2014, the decision of the Prime Minister regarding the application of the Waste-to-Energy energy purchasing system (FIT: Feed-In Tariff) was published and the purchase price for electrical power was set at 2,114VND/kWh (10.05 US cent/kWh).



Strong backing of government for construction of Waste-to-Energy facility  
Can contribute greatly to the CO2 emissions numerical target value (25% reduction) set in the "Hai Phong Green Growth Promotion Plan".

## ③ Compost production facilities

- The quality of the compost produced at the Trang Cat compost production facility (construct by Korea ODA) does not meet the quality standards for use in farmlands. Additionally, the operation ratio is low and the facility is not being used effectively.



-Improving the quality of the compost may be possible by reviewing the compost production process.

-Effective use as a pre-processing facility for the Waste-to-Energy facility may be possible.

# 02 Project Overview

- This project will install a Waste-to-Energy facility and sludge drying facility within the area of the Trang Cat complex facility.
- Combustible waste and sewage sludge generated from the sewer processing plant (schedule for construction) will be processed and the electricity generated will be sold to the power company.

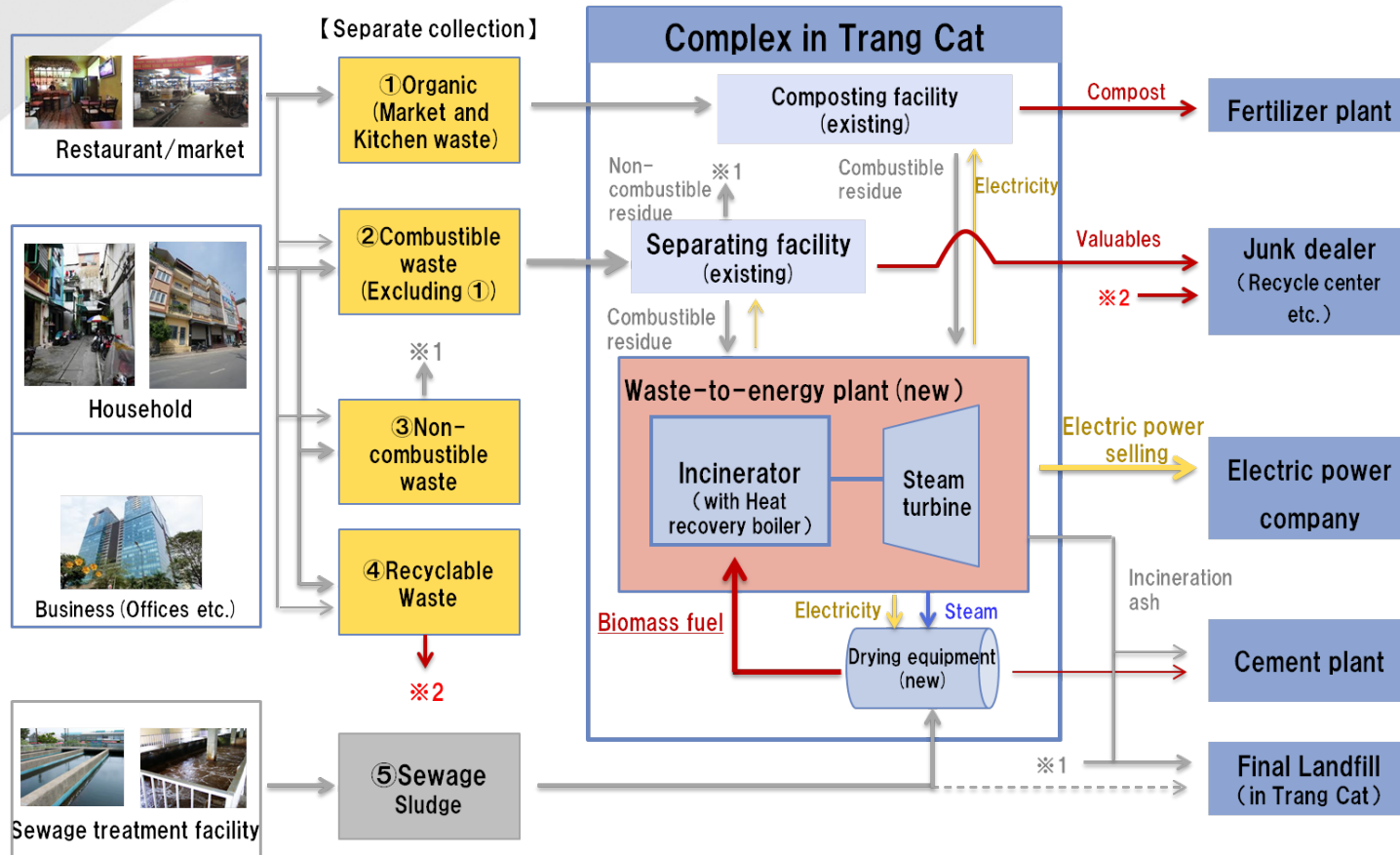


Figure 2 Overall Summary of Trang Cat Complex Facility Waste-to-Energy Project.

## ① Economic Effects of Waste Processing Project Construction and Operation

- Secure local employment (construction period (approx. 2 years): Max 600 people, operational period (approx. 20 years): constant: approx. 40 people)
- Stable tax revenue from continuous operational profit

## ② Extend Life of Existing Final Disposal Site and Improvement of Surrounding Environment

- Reduce current Trang Cat final disposal site land fill disposal volume by about 10%  
(\*If incineration ash is used for raw material in cement plants, the land fill volume will be further reduced)
- Improvement of contaminated water leakage and obnoxious odors in surrounding environment

## ③ Green House Gas Reduction Effect

Large reduction in CO<sub>2</sub>\*<sub>1</sub> and greatly contribute to “Hai Phong Green Growth Promotion Plan” CO<sub>2</sub> emission numeric value target value (Year 2030: 25% reduction from 2010).

※1 According to the Japan-Vietnam JCM system agreement, subsidies of up to a maximum of 50% may possibly be provided for costs in construction of Waste-to-Energy facilities.

Enables providing Hai Phong City with the world's highest class Waste-to-Energy technology with little burden.

## ④ Effective use of Existing Facilities

Manufacture good quality compost at Trang Cat compost facility. Consider use as pre-processing facility for Waste-to-Energy facility and promote further effective use existing facilities.



## ( 1 ) Strategy for use of renewable energy of Vietnam by 2030 and approval by 2050 regarding judgement [Prime Minister decision]

( Decision 2068/QĐ-TTg November 25, 2015 declaration)

- In each sub-sector development policy, there is a "development policies regarding biomass energy) and one of them refers to the use of general waste.
- For use of general waste as energy, from the current situation of almost not being used at all, the intended goals of 20% by 2020, 70% by 2030, and almost all by 2050 to use general waste for energy were clarified.



- When the goals are judged to be difficult to attain, taking action similar to an addition to the fixed purchase price of wind power generation as described in the next page may be considered.

## (2) FIT Preparation Status (Major results of discussions with Vietnamese Ministry of Industry and Trade)

### ① Prospect of purchase Price Increase (10.05US cent/kWh)

→If investors do not come forward after 2~3 years, it would be necessary to send an application regarding a review to the Prime Minister.

In a similar case, for the FIT (wind power generation) decision (2011: decision notice 37), after 4~5 of being put into effect, the price was increased from 7.8 US Cent/kWh to 9.0 US Cent/kWh because investors did not come forward.

Currently the situation is pending and waiting for approval by the Vietnamese Prime Minister.

→In the background of the price increase for wind power FIT, the goal at the introduction was 10,000MW by 2020 but in the current situation, it has been decided that obtaining this goal would be difficult.

⇒ Price increase can be considered depending on the situation.

### ② Risks related to the collateral of the amount of power sold by investors (business entities)

→When there is insufficient volume of waste and waste calorific value and the power predicted cannot be generated, it is recognized that generation of electricity by renewable energy is unstable and nothing can be done. Other than natural disasters and other force majeure, if there is a satisfactory explanation, there will be no penalties. It is possible to clarify conditions for responsibility in additional individual contracts. (October 8 Notice: Business developments applicable to solid waste power generation businesses and regulations related to power purchase agreement (notification) Article 10, paragraph 2)

⇒ For risks related to the collateral of the amount of power sold by investors (business entities) (such as insufficient volume of waste and waste calorific value and the assumed power cannot be generated, etc.), penalties were not especially provided and a response that the total amount of power would be purchased even when an excess or deficiency occurs.

## 【STEP1】

- Introduction of WtE facility at Trang Cat Waste Complex Facility (500t / d × 1 base)
  - The Trang Cat disposal site is located within Hai Phong city and there are already a compost facility (200t/d), a medical waste incineration facility, etc. and is a waste complex facility.

Through introduction of Kitakyushu-type compost for good quality waste compost and recovery of energy through Waste-to-Energy introduction, it can evolve to realize a proper processing and recycling system.

### (Note 1) Gia Minh (Zanmin) Final Disposal Site Construction

Hai Phong City is utilizing a JICA yen loan to construct of a final disposal site in the northern area of Hai Phong in the Tuiguen district. According to the data provided by the Hai Phong City People's Committee, 647 tons/day of landfill volume is predicted in 2015. On the other hand, according to literature study results, the municipal waste generated in 2025 by Hai Phong City would be approximately 3,000 tons/day and it would not be possible to absorb the waste generated by the entire city of Hai Phong in the above single landfill site. ⇒ Through skillfully combining WtE, landfill disposal and composting, etc., appropriate, efficient and effective processing implementation can be expected.

### (Note 2) Regarding RPF Facilities

The RPF facility processes is paper, wood, plastics, etc., and does not process organic waste that composes 60% of Hai Phong City's household waste. Since the situation for organic waste is landfill disposal in the same manner, the proper processing and recycling system targeted cannot be realized.

## 【STEP2】

### ● Expansion of WtE Facilities to Hai Phong City

→Based on Decision 2068 / QD-TTg of policies, etc., consider the expansion of WtE facilities at the timing to get the WtE facility in operation on track for STEP1.

The installation location at Gai Minh (Zanmin) final disposal site can be considered as one suggestion for the installation location however, since it is located quite a distance away from urban district (situated far north), whether to make the installation near the urban district and transport the incinerator ash to Gia Minh, etc., on the premise of not building a new final disposal site, a study including the location is planned.

Additionally, collect organic waste at the Trang Cat compost facility where there is processing surplus and plan to utilize the facility to its fullest capability.

→Access to the Trang Cat facility by highway is good and has the advantage of being able to collect waste from a wide area and so Trang Cat as a candidate for the expansion of the WtE facility can also be considered.

This way, opposition by citizens against construction of a new facility can be circumvented and the quick implementation of the facility can be expected.

## 【STEP3】

### ● Construction of a recycling oriented society and proper processing of waste of Hai Phong City

→ Establishment of sorting waste and improving the recycling rate, energy recovery of all non-recyclable combustible waste and through reduction of waste, strive for proper and sanitary waste processing and resource recycling society of Hai Phong.

## ( 1 ) Hai Phong City Budget

The total city budget for fiscal year 2015 was approximately 300 billion yen, in fiscal year 2016 it was 330 billion yen, a 10% increase from the previous year. The budget related to waste processing was approximately 1.47 billion yen in fiscal year 2015 and in fiscal year 2016, it was approximately 1.39 billion yen, a 6% decrease from the previous year. However, looking at the infrastructure development budget, in fiscal year 2016 it was approximately 10 billion yen, for about a 13% increase from the previous year.

|    | Cost Item   | 2015 Jan~Dec<br>(Unit : 1 million VND)                                     | 2016 Jan~Dec<br>(Unit : 1 million VND)                                     |
|----|---|--|--|
| 1. | Hai Phong City total budget   | 56,364,832<br>(298,789 millions of yen)<br>Exchange rate 1VND=0.005301 yen | 62,815,700<br>(298,789 millions of yen)<br>Exchange rate 1VND=0.005301 yen |
| 2. | In 1 above, infrastructure development (roads, bridges, water supply and sewerage systems, final disposal sites, ports, airports, parks, etc.) related budget | 1,671,377<br>(8,859 millions of yen)                                       | 1,888,090<br>(10,008 millions of yen)                                      |
| 3. | In 1 above, waste disposal (waste collection and transportation, intermediate treatment, final disposal, etc.) related budget                                 | 277,153<br>(1,469 millions of yen)   | 261,359<br>(1,385 millions of yen)   |

## (2) Waste Quality Analysis Results

The lower calorific value of household waste was approximately 1,300~1,500cal/kg and samples that reached 1,500cal/kg, generally considered to be suitable for power generation, was confirmed. (\*the lower calorific value is on an upward trend compared to last year)

| Item                | Unit               | Sample 1<br>Market Waste | Sample 2<br>An Duong | Sample 3<br>Hong Bang | Sample 4<br>Hai An |
|---------------------|--------------------|--------------------------|----------------------|-----------------------|--------------------|
| Moisture            | %                  | 62.5                     | 64.1                 | 64.5                  | 62.3               |
| Non-combustibles    | %                  | 15.2                     | 8.7                  | 9.2                   | 9.1                |
| Combustibles        | %                  | 22.4                     | 27.2                 | 26.3                  | 28.6               |
| Organic             | %                  | 12.1                     | 11.8                 | 9.6                   | 11.0               |
| Plastics            | %                  | 5.5                      | 8.1                  | 8.5                   | 8.2                |
| Fibers              | %                  | 0.7                      | 1.8                  | 3.5                   | 1.9                |
| Paper               | %                  | 1.1                      | 2.1                  | 2.4                   | 2.1                |
| Other               | %                  | 3.0                      | 3.4                  | 2.3                   | 5.4                |
| Low calorific value | kcal/kg            | 979                      | 1,262                | 1,312                 | 1,520              |
| Specific gravity    | ton/m <sup>3</sup> | 0.32                     | 0.27                 | 0.31                  | 0.27               |

## (3) Chipping Fees

For Waste-to-Energy, if investors do not come forward in the same manner as wind power generation, consideration of increasing the power purchase price (10.05UScent/kWh) is assumed. Here, the case for the purchase price increase of wind power generation (approximately 1.2 fold) and a case where even a greater increase (1.5 fold) chipping fee was estimated.

\*An application for increasing the purchase price of wind power generation power purchase price from 7.8UScent/kWh to 9UScent/kWh (approximately 1.2 fold) has been submitted and in the future if no investors come forward, the Waste-to-Energy power purchase price will very likely follow the 2 price increases as in the table below.

| Item           | Unit       | Case 1 | Case 2<br>(1.2x) | Case 3<br>(1.5x) |
|----------------|------------|--------|------------------|------------------|
| Purchase Price | UScent/kWh | 10.05  | 12.06            | 15.08            |
| Chipping Fee   | USD/ton    | 48     | 41               | 33               |

### ◆ Chipping Fee Estimate Premise

Waste disposal volume 500t/d X 1 base In the equipment costs, JCM system assistance is included

\*Reduction of the Chipping Fee possible by mix combustion, etc., of industrial and medical waste

# 06 Study Results

## (4) Funding: Upon completion (example)

Amount Unit: M USD

| Operation                     |             | Procurement              |                    | Planned Procurement Source                          |
|-------------------------------|-------------|--------------------------|--------------------|---|
| Equipment Costs               | 58.3        | Loan                     | 40.3 (60%)         | Private Loans                                       |
|                               |             | Equipment subsidies      | 12.5 (19%)         | JCM   |
| Overhead Costs * <sub>1</sub> | 8.3         | Net Worth * <sub>2</sub> | 13.8 (21%)         | -URENCO<br>-Private Enterprises<br>(Japan, Vietnam) |
| <b>Total</b>                  | <b>66.6</b> | <b>Total</b>             | <b>66.6 (100%)</b> |   |

\* 1 Interest rates during construction period, opening costs, etc.

\* 2 Amount of capital at the time of SPC establishment.

| Loan Terms (assumed) |                  |          |               |
|----------------------|------------------|----------|---------------|
| Currency             | Repayment Period | Interest | Payment Terms |
| US dollars           | 5~7 years        | 6~8%     | Annuity       |



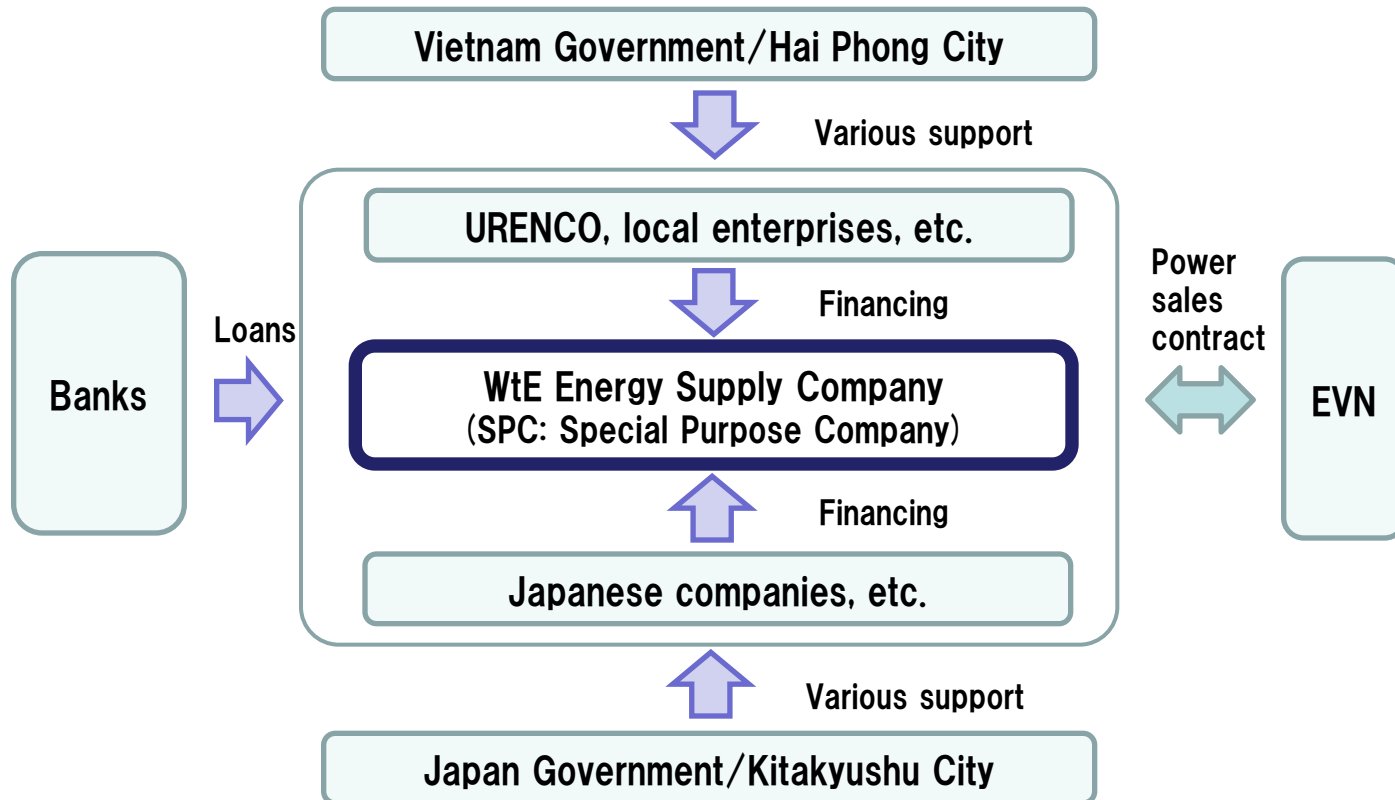
## (5) CO2 reduction and cost effectiveness

- The reference emission volume is the Green House Gas volume generated when Waste-to-Energy is not implemented and a power source in place of this project is connected to the power grid and supplying the power. The thinking on project emissions volume is that since it is intended to be built as an additional power generation facility to the municipal waste incinerator that was being studied, the Green House Gas activities associated with the incineration of municipal waste would be considered the same as if the project was not implemented.
- For the project emissions volume associated with the implementation of the project, the greenhouse gas emissions that occur associated with power consumption for power generation within the facility and the green house gas generated associated with the consumption of fossil fuel for the operation of the facility will be set as the project emissions volume.
- When calculated based on the above concept, reference emissions would be 39,294t/year, project emissions 5,200t/year, and CO2 reduction amount would be  $39,294 - 5,200 = 34,094$  tons/year (※under study).
- For cost effectiveness, facility maintenance costs are estimated at 7.45 billion yen, within this 40% would be for the overall power generation equipment and an estimated 50%, approximately 1.49 billion yen, would be for auxiliary equipment. Cost effectiveness expected is  $1.49 \text{ billion yen} \div 34,094 \text{ tons} \approx 43,700$  yen/ton (※under study)

# Reference Materials 1 Project Implementation System (Example and Image)

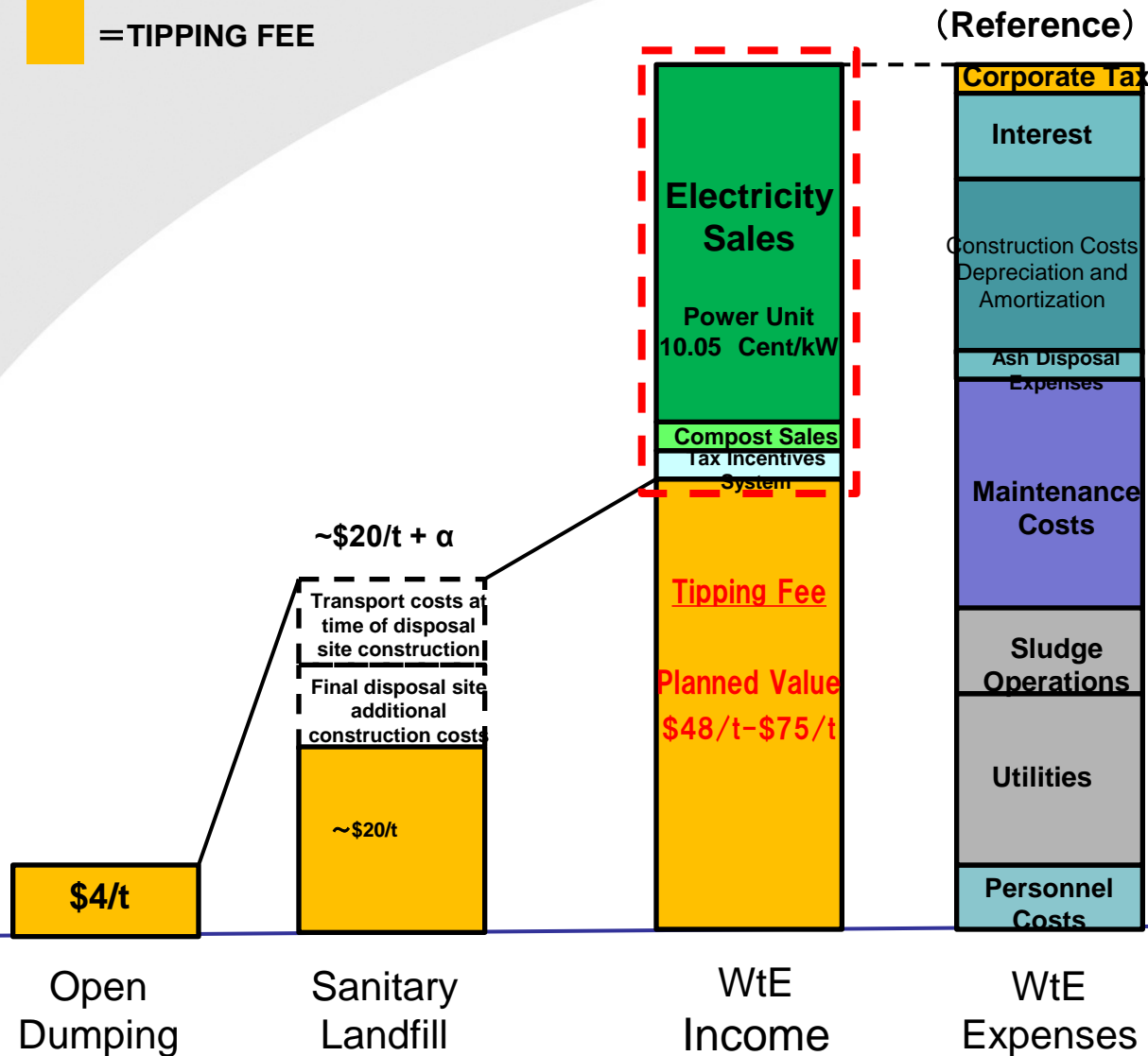
- The project implementation system (example and image) is shown in figure 3. As a PPP (Public Private Partnership) project, a SPC (Special Purpose Company) will be established by URENCO, local businesses, etc. (Vietnam side) and Japanese companies, etc., (Japanese side) and a power sales contract will be made with EVN, a power company. \*This fiscal year, a highly realizable project implementation system is planned to be studied.

Chart Project Implementation System (example image)



# Reference Materials 2 Setting of Appropriate Tipping Fee (Mid-term report material)

= TIPPING FEE



# Thank You Very Much



**DISCLAIMER** : This document is intended for the purpose to only provide information and not for the solicitation of specific transactions or force brokerage, etc. Please understand that the information contained in this document is not guaranteed to be accurate or reliable. Copyright of this document belongs to our company and no part or whole of this document may be ① reproduced or photocopied, etc., and ② distribution is strictly prohibited without our written consent.

**DECISION**

**on support mechanism for the development of power generation projects using solid waste(s) in Vietnam**

*Pursuant to the Law on Government Organization dated 25 December 2001;*

*Pursuant to the Law on Electricity dated 3 December 2004; the Law on the Amendment of and Supplement to several articles of the Law on Electricity, dated 20 November 2012;*

*Pursuant to the Law on Environmental Protection dated 29 November 2005;*

*Pursuant to the Law on Investment dated 29 November 2005;*

*Pursuant to the Law on Construction dated 26 November 2003; the Law No. 38/2009/QH12 dated 19 June 2009 on the Amendment of and Supplement to several articles of the laws related to civil works investment;*

*In response to the request made by the Minister of Industry and Trade;*

*The Prime Minister promulgates the Decision on the support mechanism for the development of power generation projects using solid waste(s) in Vietnam,*

**Chapter I**

**GENERAL PROVISIONS**

**Article 1. Scope of Regulation and Subjects of Application**

1. This Decision regulates the support mechanism for the development of power generation projects using solid waste(s) in Vietnam.

2. The subjects of application in this Decision shall be the organizations/individuals participating in electric power activities related to the development of power generation projects using solid waste(s) in Vietnam.

**Article 2. Interpretation of Terms**

In this Decision, the following terms shall be construed as follows:

1. Purchaser means the Electricity of Vietnam or its authorized subsidiary.
2. Seller means an organization/individual that is granted with the license on electric power operations in the area of generating the electricity from power plants using solid waste(s).
3. Investor in power generation projects using solid waste(s) means an organization/individual that carries out the investment in power generation projects using solid waste(s) in accordance with the provisions of Vietnamese laws.
4. Solid waste to be used for power generation means the waste of solid form, which is discharged from production, business, service and domestic processes or other activities and does not contain hazardous waste elements.
5. Power generation project using solid waste(s) is a power generation plant project that uses its main source of energy from solid waste(s), which are directly incinerated or combusted the gas collected from solid waste landfills for purposes of electricity production and partial or wholly supply of electric power produced to the national electricity grid.
6. Connection point is where the Seller's electric line is connected to the Purchaser's electric system.
7. Electricity delivery point is where the electric measurement/counting equipment is installed as stipulated in the Power Purchase Agreement in order to determine the Seller's power output sold.
8. Standardized Power Purchase Agreement for power generation projects using solid waste(s) means the MoIT-promulgated Power Purchase Agreement, forming the basis for the transactions between the Seller and Purchaser with regard to selling and purchasing of electricity produced by power generation projects using solid waste(s) ,

## **Chapter II**

### **PLANNING AND DEVELOPMENT OF POWER SOURCES USING SOLID WASTE(S)**

#### **Article 3. Planning for the Development of Power Sources using Solid Waste(s)**

1. The Master Plan for the Development of Power Sources using Solid Waste(s) is an electricity sector's plan, which is prepared at national level, forms the basis for investment activities in the development of power sources using solid waste(s), and shall be appropriately adapted to assessments/studies on the solid waste potentials in each relevant period.

2. The Master Plan for the Development of Power Sources using Solid Waste(s) shall be required to be consistent with the country's socio-economic development strategies, regional master plans, solid waste management master plans approved by competent levels, land use master plans and other relevant plans.

3. The Master Plan for the Development of Power Sources using Solid Waste(s) shall be prepared once for the period up to 2020 and vision to 2030, and adjusted and supplemented when required. For the next planning periods, the Master Plan for the Development of Power Sources using Solid Waste(s) shall be integrated into provincial/national electric power development plans and adjusted/supplemented in accordance with studies/assessments on solid waste potentials for electricity production.

**Article 4. Preparation, Appraisal, Approval, Promulgation and Adjustment of the Master Plan for the Development of Power Sources using Solid Waste(s)**

1. The MoIT shall arrange for the preparation, appraisal and submission of the Master Plan for the Development of Power Sources using Solid Waste(s) for the Prime Minister's approval; and for the promulgation, guidance, monitoring and inspection of the approved Master Plan for the Development of Power Sources using Solid Waste(s).

2. The promulgation and adjustment of the Master Plan shall be performed in accordance with current regulations.

**Article 5. Expenditures for the Preparation, Appraisal, Approval and Promulgation of the Master Plan for the Development of Power Sources using Solid Waste(s)**

1. Central budget shall guarantee the expenditures for the preparation, appraisal, promulgation and adjustment of the Master Plan for the Development of Power Sources using Solid Waste(s).

2. Other legitimate financial sources for the preparation of the Master Plan for the Development of Power Sources using Solid Waste(s) shall be encouraged.

**Article 6. Investment in the Development of Power Generation Projects using Solid Waste(s)**

1. The investment in the development of power generation projects using solid waste(s) shall be in compliance with the Master Plan for the Development of Power Sources using Solid Waste(s) and the master plan(s) for electric power development as approved by competent levels.

2. For power generation projects using solid waste(s) which are not included in the approved Master Plan for the Development of Power Sources

using Solid Waste(s) and National Electric Power Development Master Plan, the project investor shall be responsible for preparing the written request for the project inclusion into the Master Plan and sending to the MoIT for appraisal and submission for the Prime Minister's consideration and decision.

3. As the Master Plan for the Development of Power Sources using Solid Waste(s) has not been approved, the investment in power generation projects using solid wastes shall be subject to the Prime Minister's approval.

4. The investment in power generation projects using solid waste(s) shall be in accordance with legal provisions on construction, fire prevention/fighting and environmental protection, and other relevant regulations.

### **Article 7. Connection of Power Generation Projects using Solid Waste(s) to Electricity System, and Load Dispatch and Operations of Solid Waste-to-Electricity Plants**

1. The connection of power generation projects using solid waste(s) to the national electricity grid must be in accordance with the approved electric power development master plan(s). The connection point shall be agreed upon by the Seller and Purchaser on the principle that the Seller shall be responsible for investing in electric transmission lines up to the nearest connection point where the national electricity grid is available in accordance with the provincial electric power development master plan. If the point connected to the national electricity grid is not prescribed in the electric power development master plan, the investor shall be required to reach a connection point agreement with the electricity distribution or transmission entity, forming the basis for a supplemented provincial electric power development master plan under the provisions of existing regulations. In case it fails to come to a connection point agreement, the Seller shall be required to submit for the MoIT's consideration and decision.

2. The investor of a power generation project using solid waste(s) shall be responsible for investing in, operating and maintaining the transmission line and transformer station (if any) from the Seller's power plant to the connection point as agreed with the Purchaser.

3. Depending on the connected voltage levels, the Electricity Distribution or Transmission Entity shall be responsible for investing in the transmission line from the point connected to the national electricity grid as prescribed in the approved electric power development master plan and signing connection agreement(s) with investors of power generation projects using solid waste(s).

4. Upon the completion of investment and hand-over for commercial operations, the Load Dispatch/Electricity Market Operations Entity shall be responsible for mobilizing the power generation plant using solid waste(s) on the principle that priority shall be given to exploiting its full capacity and



electric power generated in accordance with the supply conditions of solid waste fuels within the plant area.

**Article 8. Conditions for Launching the Construction of Power Generation Projects using Solid Waste(s)**

1. The investor shall only be permitted to launch the construction of his/her power generation plant using solid waste(s) if he/she has obtained, in addition to conditions as prescribed in Article 72, Construction Law and relevant legal normative documents, the following: Investment Certificate, Purchaser's written agreement on electricity purchase; connection agreement with the Electricity Distribution or Transmission Entity; comments on the design from competent state agency(ies) in accordance with legal regulations on the management of and investment in works construction.

**Article 9. Termination of Project Implementation**

If the investor fails, within 12 months from the issuance date of the Investment Certificate, to launch the construction of the project's main categories or if he/she fails, within maximum 24 months from the committed date of operations as prescribed in the Investment Certificate, to put the power generation project using solid waste(s) into operation. The Provincial People's Committee shall be responsible for taking the revoking of the Investment Certificate into consideration, and reporting and making recommendations to competent state agency(ies) on giving the project to another investor. If valid justifications are provided and accepted by the competent level(s), the suspension or rescheduling of the project implementation shall be allowed.

**Article 10. Reporting on Project Implementation**

1. The investor shall be responsible for, no later than 5 working days from the issuance date of the Investment Certificate, sending a certified copy of the Investment Certificate to the MoIT for monitoring and management purposes.

2. During the construction of the power generation project using solid waste(s), the investor shall be required, no later than the 15<sup>th</sup> day of the first month of each quarter, to report on the project implementation in the previous quarter and implementation plan for the following quarter. The investor shall be required, no later than 15 January each year, to report to the relevant Provincial People's Committee and MoIT for management, consolidation and monitoring purposes and notify the Purchaser for coordination, on the project implementation in the previous year and implementation plan for the following year.

**Chapter III**  
**SUPPORT MECHANISM FOR DEVELOPMENT OF POWER**  
**GENERATION PROJECTS USING SOLID WASTE(S)**

**Article 11. Responsibility for Power Purchase from Power Generation Projects Using Solid Waste(s)**

1. The Purchaser shall be responsible for purchasing all electric power produced by the power generation plant using solid waste(s) under its jurisdiction.

2. The power purchase and selling shall be performed via the power purchase agreement, which is prepared in accordance with the MoIT-promulgated Standardized Power Purchase Agreement applicable to power generation projects using solid waste(s).

3. The Purchaser shall be required, no later than 6 months from the issuance of the written request for electricity sale by the investor in power generation projects using solid waste(s), to sign the power purchase agreement with the Seller in accordance with regulations

3. The duration of the power purchase agreement applicable to power generation projects using solid waste(s) is 20 years from the date of commercial operations. After 20 years, the two sides may choose to extend the existing agreement or sign a new agreement in accordance with existing legal regulations

**Article 12. Preferences for Investment Capital and Taxes**

1. Mobilization of investment capital

a) Investors shall be permitted to mobilize capital from domestic and foreign organizations/individuals for the purpose of investing in the implementation of power generation projects using solid waste(s) under the provisions of existing laws on investment.

b) Power generation projects using solid waste(s) shall be entitled to preferential treatment on investment credits as prescribed in current regulations on State investment and export credits.

2. Import duties: Power generation projects using solid wastes shall be exempt from import duties for goods imported to establish project fixed assets; goods imported as raw materials, materials and semi-finished products that are not domestically produced and imported for project's production purposes under the provisions of the existing laws on import and export taxes.

3. Corporate income tax: The exemption and reduction of corporate income tax applicable to power generation projects using solid waste(s) shall be

similar to that of projects included in preferential treatment categories as prescribed in the current legal regulations on taxes.

### **Article 13. Preferences for Land**

1. Power generation projects using solid waste(s), and transmission line and transformer station projects for connection to the national electricity grid shall be entitled to the exemption/reduction of land use/rental costs as prescribed in the existing laws applicable to projects included in preferential treatment categories.

2. On the basis of the plan approved by the competent authority, the Provincial People's Committee shall be responsible for allocating adequate land for the investor's implementation of power generation project(s) using solid waste(s). The compensation and support to premise clearance shall comply with the provisions of existing laws on land.

### **Article 14. Electricity Price Support to Power Generation Projects using Solid Waste(s)**

1. The Purchaser shall be responsible for purchasing all electric power produced by the power generation plant using solid waste(s) with the electricity purchase price (VAT exclusive) at the delivery point as follows:

- For power generation projects using solid waste(s) that are directly incinerated, the price shall be VND 2,114/kWh (equivalent to 10.05 US cents/kWh).

- For power generation projects using combusted gas collected from solid waste landfills, the price shall be VND 1,532/kWh (equivalent to 7.28 US cents/kWh).

2. Power generation projects using solid waste(s) that apply the electricity purchase price as prescribed in Paragraph 1 of this Article shall not be entitled to any price subsidies for project power outputs as prescribed in other existing regulations; the electricity purchase price shall be subject to VND/USD exchange rate fluctuations.

3. The costs of electricity purchased from power generation projects using solid waste(s) shall be calculated and fully reflected in the input parameters of the EVN's annual electricity selling price scenario as approved by competent level(s).

4. The MoIT shall monitor and propose the calibration of the electricity purchase price as stipulated in Paragraph 1 of this Article, and report for the Prime Minister's consideration and decision.

## **Chapter IV**

### **IMPLEMENTATION ARRANGEMENTS**

#### **Article 15. Responsibilities of Ministries and Localities for the Development of Power Generation Projects using Solid Waste(s)**

1. The MoIT shall be responsible for:

a) Providing guidance on the contents, sequence and procedures of the preparation, appraisal, approval, adjustment and promulgation of the Master Plan for the Development of Power Sources using Solid Waste(s).

b) Making arrangements for, and facilitating and coordinating with the Provincial People's Committees in supervising and monitoring the implementation of this Decision.

c) Promulgating the Standardized Power Purchase Agreement applicable to power generation projects using solid waste(s).

d) Establishing, promulgating or submitting for the competent level's promulgation of national technical standards for power generation technologies using solid waste(s).

2. The Provincial People's Committees shall be responsible for:

1. Coordinating and providing investors with support to compensation, site clearance, infrastructure and human resources for investment in, implementation and development of locally-based power generation projects using solid waste(s).

2. Taking lead and coordinating with relevant agencies in prescribing the unit costs, which shall be paid to investors of power generation projects using solid waste(s), for the collection, transportation and disposal of solid wastes produced in the province.

3. Exercising the function of local state management of power generation projects using solid waste(s) in accordance with provisions of existing laws.

#### **Article 16. Effectiveness**

1. This Decision shall take effect from 20 June 2014.

2. Ministers, Heads of Ministerial-level agencies, Heads of Government-dependent agencies, Chairpersons of Provincial People's Committees; Heads of agencies, entities and organizations that involve in the development of power generation projects using solid waste(s) in Vietnam shall be responsible for executing this Decision./.

***Recipients:***

- Central Communist Party Secretariat;
- Prime Minister, Deputy Prime Ministers;
- Ministries, Ministerial-level agencies, Government-dependent agencies;
  
- People's Councils and Committees of provinces and centrally-run cities;
- Central Office and Committees of the Communist Party;
- General Secretary Office;
- State President Office;
- Ethnic Minority Council and National Assembly Committees;
- National Assembly Office;
- People's Supreme Court;
- People's Supreme Procuracy;
- State Audit;
- National Financial Monitoring Committee;
- Social Policy Bank;
- Vietnam Development Bank;
- Central Committee of Vietnam Fatherland Front;
- Central Agencies of Mass Organizations;
- Government Office: Minister-Chairperson, Vice Chairpersons, Prime Minister's Secretary, Chairperson of E-Portal, dependent Departments, Official Gazette;
- For filing: Clerical section, KTN (3 copies).

**PRIME MINISTER**

**Nguyễn Tấn Dũng**

No.: 32/2015/TT-BCT

*Hanoi, 8 October 2015*

**CIRCULAR**

**on**

**project development and Standardized Power Purchase Agreement for  
power generation projects using solid wastes**

*Pursuant to the Electricity Law No. 28/2004/QH11 dated 03 December 2004 and the Law on Amendment of and Supplement to some Articles of Electricity Law dated 20 November 2012;*

*Pursuant to the Government's Decree No. 95/2012/NĐ-CP dated 12 November 2012 prescribing the functions, tasks, powers and organizational structure of the Ministry of Industry and Trade (MoIT);*

*Pursuant to the Prime Minister's Decision No. 31/2014/QĐ-TTg dated 5 May 2014 on the support mechanism for development of power generation projects using solid wastes in Vietnam;*

*In response to the request made by the General Director of the General Directorate of Energy (GDE)*

*The Minister of Industry and Trade hereby promulgates the Circular on project development and Standardized Power Purchase Agreement for power generation projects using solid wastes in Vietnam.*

**CHAPTER 1  
GENERAL PROVISIONS**

**Article 1. Scope of Regulation**

This Circular stipulates the development of grid-connected power generation projects using solid wastes and promulgation of Standardized Power Purchase Agreement for grid-connected power generation projects using solid wastes in Vietnam (hereinafter referred to as the SPPA).

## **Article 2. Subjects of Application**

This Circular shall be applicable to the following subjects:

1. Investors of grid-connected power generation projects using solid wastes;
2. Units that manage and operate grid-connected power generation facilities using solid wastes
3. Power purchaser;
4. Organizations that develop power generation projects using solid wastes for the purpose of power purchase/sale;
5. Other relevant organizations and individuals.

## **Chapter II DEVELOPMENT OF POWER GENERATION PROJECTS USING SOLID WASTES**

### **Article 3. Incorporation of power generation projects using solid wastes into the national development plan for power sources using solid wastes**

1. The solid waste power project investor shall, in accordance with legal regulations on works construction investment, prepare the project proposal and send it to the People's Committee of the province or centrally-run city (hereinafter referred to as PPC) where the project is located. On the basis of the project proposal, the PPC shall prepare the dossier requesting for project incorporation into the national development plan for power sources using solid wastes (hereinafter referred to as the dossier requesting for project incorporation into the national plan) in accordance with provisions as prescribed in Article 4 of this Circular and then send to MoIT.

2. Within 05 (five) working days from the receipt of the dossier, the MoIT (GDE) shall be required to issue the written request for additional information if the dossier requesting for project incorporation into the national plan is not complete and/or valid.

3. The GDE shall be responsible for appraising the dossier requesting for project incorporation into the national plan within 30 (thirty) working days from the receipt of the complete set of valid documentation. If required, the GDE shall be allowed to engage appraisal/review consultant(s) for appraisal purposes. On the basis of the appraisal results, the GDE shall report to the Minister of Industry and Trade for consideration/approval or for submission for the Prime Minister's approval.

#### **Article 4. Dossier requesting for project incorporation into the national development plan for power sources using solid wastes**

1. Submission letter by the PPC Chairperson requesting for project incorporation into the national development plan for power sources using solid wastes.

2. Basic information on the investor: legal status documentation, business registration, key personnel, project implementation experience and financial/technical capabilities, including a list of completed (industrial and power) projects if any;

3. Information on the proposed power generation project using solid waste:

a) Type of solid waste(s) to be used and potential supply;

b) Necessity of project investment, advantages and constraints, and option(s) for solid waste exploitation and utilization (if any);

c) Project description: location, scale and project construction area, and project's works categories; items of industry-based, landfill and local construction planning;

d) Preliminary implementation solutions, including: technical plans, technology and capacity; technical infrastructure connection option(s); equipment installation option(s); implementation progress and project management method; general option(s) for resettlement compensation and technical infrastructure support plan, if any; cost plan(s) and option(s);

dd) Environmental impact assessment;

e) Fire prevention and firefighting solutions, and requirements for security and national defense;

g) Total project investment volume; potential capital mobilization, capital sources and progress-based financing capacity; analysis and assessment of the project's financial-economic and social efficiencies.

4. Opinions of the regional Electric Power Corporation or power transmission unit (if connected to the power transmission system) on the dossier requesting for project incorporation into the national plan.

#### **Article 5. Power generation investment projects using solid wastes**

1. The investor shall only be allowed to prepare a solid waste power generation investment project which is incorporated in the approved national development plan for power sources using solid wastes. Contents of this solid waste power investment project shall be in accordance with the current regulations on the management of construction works investment and provisions



as prescribed in Clause 3 of this Article.

2. For a solid waste power generation project that is divided into different investment phases with different total capacity and date of operation for each phase, the investor shall be required to prepare a separate investment project for each phase. If the difference between the expected date of project operation and the date prescribed in the national development plan for power sources using solid wastes is longer than 6 (six) months, the investor shall be responsible for reporting to the PPC and GDE-MoIT.

3. Contents of a solid waste power investment project shall be in accordance with the legal regulations on the management of construction works investment, with the following additional items:

a) Impact assessment of option(s) for the connection of a power generation project using solid wastes to the regional power system;

b) Cost/technical plan(s) and option(s) for dismantlement and management of solid waste power plant equipment upon the project completion.

#### **Article 6. Requirements for works safety and environmental protection**

The investment and development activities of a power generation project using solid waste must comply with the current regulations and standards for works safety and environmental protection.

### **Chapter III**

#### **ELECTRICITY PRICE APPLICABLE TO POWER GENERATION PROJECTS USING SOLID WASTES**

##### **Article 7. Calculation of electricity purchase price**

No later than 30 October each year, the GDE shall calculate, on the basis of the system's electricity cost and price, the capacity of power sources using solid wastes and send to ERAV for ERAV's calculation of the following year's electricity price applicable to power generation projects using solid wastes and submission to the Minister of Industry and Trade for subsequent reporting for the Prime Minister's consideration and final decision.

##### **Article 8. Electricity purchase and selling price applicable to grid-connected power generation projects using solid wastes**

1. The Purchaser shall be responsible for purchasing all electric power produced by grid-connected power generation projects using solid wastes with the electricity purchase price (VAT exclusive) at the delivery point as follows:

a) For power generation projects using solid wastes that are directly incinerated, it shall be VND 2,114/kWh (10.05 US cents/kWh equivalent).

b) For power generation projects using combusted gas collected from solid waste landfills, it shall be VND 1,532/kWh (7.28 US cents/kWh equivalent).

2. Power generation projects using solid wastes, which apply the electricity purchase price as prescribed in Clause 1 of this Article, shall not be allowed for any price support mechanisms for project power output as stipulated in other current regulations; the electricity purchase price shall be subject to VND/USD exchange rate fluctuations.

3. The electricity purchase cost for power generation projects using solid wastes shall be calculated and fully incorporated into input parameters in the EVN's scenario of annual electricity selling price, which shall be approved by competent state agency(ies).

## **Chapter IV**

### **STANDARDIZED POWER PURCHASE AGREEMENT FOR GRID-CONNECTED POWER GENERATION PROJECTS USING SOLID WASTES**

#### **Article 9. Application of Standardized Power Purchase Agreement (SPPA) to power generation projects using solid wastes**

1. The use of SPPA for power generation projects using solid wastes shall be mandatory in the power purchase/sale between the grid-connected power generation projects using solid wastes and the Purchaser.

2. Power generation projects using solid wastes shall have all electric power produced from solid waste sources.

#### **Article 10. Contents of SPPA applicable to power generation projects using solid wastes**

1. The contents of SPPA applicable to power generation projects using solid wastes are prescribed in the Appendix to this Circular.

2. The Seller and the Purchaser may include additional items into the SPPA in order to clarify responsibilities and powers of the parties, but no changes to the fundamental content of the SPPA shall be allowed.

## **Chapter V IMPLEMENTATION ARRANGEMENTS**

### **Article 11. Responsibilities of state management agencies**

1. GDE shall be responsible for:
  - a) Calculating, on yearly basis, the capacity of power sources using solid wastes and send to ERAV.
  - b) Providing the Purchaser and Seller with support to address possible SPPA-related problems that may arise;
  - c) Disseminating, guiding and inspecting the implementation of this Circular.
2. ERAV shall be responsible for calculating the following year's electricity price on the basis of the GDE-estimated capacity of power sources using solid and submitting to the Minister of Industry and Trade for subsequent reporting for the Prime Minister's consideration and final decision.
3. The PPC shall be responsible for monitoring, supervising and inspecting the development of local power generation projects using solid wastes in accordance with the approved national development plan for power sources using solid wastes and provisions as prescribed in this Circular.

### **Article 12. Responsibilities of related organizations/individuals**

1. EVN shall be responsible for fully calculating electricity purchase cost for power generation projects using solid wastes and incorporating input parameters into the EVN's scenario of annual electricity selling price, which shall be approved by competent state agenci(es).
2. The Seller shall be responsible for:
  - a) Negotiating and signing PPA with the Purchaser in accordance with the SPPA and electricity purchase/selling price applicable to power generation projects using solid wastes as prescribed in Article 8 of this Circular;
  - b) Installing the 3-rate power meter in compliance with current regulations in order to measure the power quantity used for payment purpose;
  - c) Sending 01 (one) copy of the signed PPA to GDE no later than 30 days from the signature date.
  - d) Complying with MoIT-promulgated regulations on power system operation, power transmission and power distribution.
3. The Purchaser shall be responsible for:
  - a) Negotiating and signing PPA with the Seller in accordance with the SPPA and electricity purchase/selling price applicable to power generation projects using solid wastes as prescribed in Article 8 of this Circular;
  - b) Complying with MoIT-promulgated regulations on power system operation, power transmission and power distribution.

### **Article 13. Provision for transition**

For PPAs that have been signed before the effective date of this Circular,

both parties shall be responsible for reaching agreement and signing on the amendment Appendix in accordance with provisions as stipulated in this Circular.

#### **Article 14. Enforcement**

1. This Circular shall take effect from 7 December 2015.

2. Any difficulties/constraints that may arise during the implementation process shall be reported by the GDE, in coordination with relevant agencies/units, to the MoIT for its consideration, possible amendment and addition of this Circular./.

#### **Recipients:**

- Prime Minister, Deputy Prime Ministers;
- Office of Party's General Secretary;
- Ministries, Ministerial-level agencies and Government-dependent agencies;
- People's Committees of provinces and centrally- run cities;
- Official Gazette;
- Government's website;
- MoIT's website; GDE's website;
- Ministry of Justice (Department for Checking Legal Normative Document);
- DoITs;
- EVN;
- Electric Power Corporations;
- For filing: Clerical section, GDE, Legal section.

**ON BEHALF OF  
MINISTER  
VICE-MINISTER**



**Hoàng Quốc Vượng**

**APPENDIX**  
**STANDARDIZED POWER PURCHASE AGREEMENT FOR GRID-  
CONNECTED POWER GENERATION PLANTS USING SOLID  
WASTES**

*(Issued together with Circular No 32/2015/TT-BCT dated 8 October 2015 by the  
Minister of Industry and Trade)*

**TABLE OF CONTENT**

Article 1. Interpretation of terms

Article 2. Delivery and electricity power purchase and sale

Article 3. Connection, metering and operation of the power plant

Article 4. Billing and payment

Article 5. Coordination in case of force majeure

Article 6. Duration of Agreement

Article 7. Breaches, damage compensations and suspension of Agreement performance

Article 8. Settlement of disputes

Article 9. Entrustment, transfer and restructuring

Article 10. Other agreements

Article 11. Implementation commitment

Appendix A: System connection agreement

Appendix B: Technical specifications of the power plant

Appendix C: Requirements prior to the date of commercial operation

Appendix D: Other agreements

**STANDARDIZED POWER PURCHASE AGREEMENT  
FOR GRID- CONNECTED POWER GENERATION PLANTS USING  
SOLID WASTES**

**BETWEEN**

**SELLER**  
*(Name)*

**AND**

**PURCHASER**  
*(Name)*

*(Issued together with Circular No.32/2015/TT-BCT dated 8 October 2015 by the  
Minister of Industry and Trade)*

## TABLE OF CONTENT

|  |    |
|--|----|
| Article 1. Interpretation of terms .....   | 5  |
| Article 2. Delivery, power purchase/sale and operation .....                           | 7  |
| Article 3. Connection, metering and operation of the power plant.....                  | 10 |
| Article 4. Billing and payment .....   | 13 |
| Article 5. Force majeure.....  | 15 |
| Article 6. Duration of agreement .....   | 16 |
| Article 7. Breaches, damage compensations and suspension of Agreement performance..... | 16 |
| Article 8. Settlement of disputes .....  | 18 |
| Article 9. Entrustment, transfer and restructuring.....                                | 19 |
| Article 10. Other agreements .....   | 19 |
| Article 11. Implementation commitment .....  | 21 |
| Appendix A: System connection agreement  |    |
| Appendix B: Technical specifications of the power plant                                |    |
| Appendix C: Requirements prior to the date of commercial operation                     |    |
| Appendix D: Other agreements   |    |

**SOCIALIST REPUBLIC OF VIETNAM**  
**Independence- Freedom- Happiness**

---

**POWER PURCHASE AGREEMENT**

Pursuant to the Electricity Law No. 28/2004/QH11 dated 03 December 2004 and the Law on Amendment of and Supplement to some Articles of Electricity Law dated 20 November 2012;

Pursuant to Commerce Law dated 14 June 2005;

Pursuant to the Prime Minister's Decision No. 31/2014/QĐ-TTg dated 5 May 2014 on the support mechanism for development of power generation projects using solid wastes in Vietnam;

Pursuant to Circular No.32/2015/TT-BCT dated 8 October 2015 by the MoIT on the project development and Standardized Power Purchase Agreement for power generation projects using solid wastes;

Based on the demand for power purchase/sale of the two parties,

Today, DD.....MM.....YY, at.....

***We are:***

**Seller:** \_\_\_\_\_

Address: \_\_\_\_\_

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_

Tax Code: \_\_\_\_\_

Account No.: \_\_\_\_\_ at Bank \_\_\_\_\_

Represented by: \_\_\_\_\_

Title: \_\_\_\_\_ (To be authorized by \_\_\_\_\_

\_\_\_\_\_ in accordance with

Authorization document No. \_\_\_\_\_, DD \_\_\_\_\_ MM \_\_\_\_\_ YY  
\_\_\_\_\_)



**Purchaser:** \_\_\_\_\_

Address: \_\_\_\_\_

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_

Tax Code: \_\_\_\_\_

Account No.: \_\_\_\_\_ at Bank \_\_\_\_\_

\_\_\_\_\_

Represented by: \_\_\_\_\_

Title: \_\_\_\_\_ (To be authorized by \_\_\_\_\_

\_\_\_\_\_ in accordance with

Authorization document No. \_\_\_\_\_, DD \_\_\_\_\_ MM \_\_\_\_\_ YY  
\_\_\_\_\_)

The parties hereto agree to sign the Power Purchase Agreement for the power purchase and sale as follows:

### **Article 1. Interpretation of terms**

In this Agreement, the following terms shall be construed as follows:

**1. Lender** means an organization/individual that grants the Seller or Purchaser loan(s) to effectuate this Agreement. The list of Lender(s) shall be notified to each other by parties in compliance with Article 6 of this Agreement.

**2. Party or parties** means the Seller, Purchaser or both or unit(s) that shall take on rights and obligations of a party or the parties of this Agreement.

**3. Connection point** is where the electric line of the Seller is connected to the electric system of the Purchaser as agreed in Appendix A of this Agreement.

**4. Electricity delivery point** is where the metering equipment is installed in order to determine the Seller's power output sold.

**5. Electric power purchased/sold** is the amount of electric power calculated in kWh and generated by the power plant at its highest capacity,

subtracted by the electric power self-consumed and lost by the power plant, and accepted to be sold and delivered to the Purchaser by the Seller as prescribed in Appendix B of this Agreement.

**6. *The Agreement*** includes this text and Appendices herewith.

**7. *Inter-bank average interest rate*** is the inter-bank average interest rate within 01 (one)-month term as announced by the State Bank of Vietnam at the time of payment.

**8. *Agreement year*** is a calendar year of 12 (twelve) months counting from the first day of January to the last day of December of that year, except for the first agreement year which shall start on the date of commercial operation and end on the last day of December of that first agreement year. The last agreement year shall end on the last day of the agreement duration.

**9. *Due date*** refers to a 15 (fifteen)-day term from the date on which the Purchaser receives electricity-payment bill as issued by the Seller.

**10. *Date of commercial operation*** is the date on which the Seller informs the Purchaser of possible power delivery in accordance with all provisions of this Agreement or the date on which the Seller starts to deliver the electric power to the Purchaser in accordance with all provisions of this Agreement, and the Purchaser must pay for the electric power delivered according to the Appendix C of this Agreement.

**11. *A power plant*** consists of the Seller's power generation equipment, protective equipment, connection equipment and related auxiliary equipment; and land to be used for electricity and auxiliary facilities for the purpose of electricity production under this Agreement.

**12. *Standards and technical regulations of the electricity industry*** are regulations, standards and practices applied in the electricity industry and issued by competent organizations of Vietnam, or regulations/standards of international organizations or of nations in the regions in accordance with legal stipulations and recommendations of equipment manufacturers, taking into account resources, materials, fuel and technical conditions acceptable to the Vietnamese electricity industry at a given point of time.

**13. *Regulations on the operation of national electricity system*** mean Circulars/Processes prescribing the standards for operation of the electricity system, conditions and procedures for grid connection, load dispatch of the

electricity system, and metering in the electricity transmission and distribution system.

**14. *Emergency situations*** are situations that may disrupt electric power supply services to the Buyer's customers, including cases that may cause substantial damages to the national electricity system, threatening the human lives and properties or affecting the technical capacity of the power plant.

## **Article 2. Delivery, power purchase/sale and operation**

### **1. *Power delivery***

a) From the date of commercial operation, the Seller agrees to deliver and sell electric power to the Purchaser and the Purchaser accepts to buy electric power from the Seller in compliance with the provisions of this Agreement.

b) The Purchaser shall be responsible for purchasing all electric power generated to the grid by the Seller at the electricity purchase price as stipulated in Clause 2 of this Article.

c) The Seller shall be entitled to the environment-related benefits in compliance with legal stipulations and international treaties.

### **2. *Electricity purchase/selling price***

The electricity purchase/selling price in this Agreement shall apply the provisions as stipulated in Article 14 of the Prime Minister's Decision No. 31/2014/QĐ-TTg dated 5 May 2014 on the support mechanism for development of power generation projects using solid wastes in Vietnam and Circular No.32/2015/TT-BCT dated 8 October 2015 by the MoIT on the project development and Standardized Power Purchase Agreement for power generation projects using solid wastes as follows:

a) For power generation projects using solid wastes that are directly incinerated, it shall be VND 2,114/kWh (10.05 US cents/kWh equivalent).

b) For power generation projects using combusted gas collected from solid waste landfills, it shall be VND 1,532/kWh (7.28 US cents/kWh equivalent).

### **3. *Electricity purchase/sale***

The Seller shall agree to operate the power plant within the available capacity of equipment and in accordance with standards and technical regulations of the electricity industry. The Seller shall not be liable for direct damages to the Purchaser as caused by Seller's provision of insufficient electric power, which is not the Seller's fault. If no Purchaser's written consent is

reached when the Seller reduces the electric power sold for the purpose of electricity sale to the third parti(es) or for other purposes, the Seller shall not be exempt from his/her liability.

#### ***4. Operation plan***

a) Prior to or on the effective date of this Agreement, the Seller shall provide the Purchaser with the chart(s) on annual average electric power generation at the power plant's bus bar on a monthly basis in compliance with the basic design of the power plant and the chart(s) on electric power generation using solid waste data of the previous years;

b) The Seller shall provide the Purchaser with annual electricity production plan(s), comprising of:

- Monthly operation plan(s) of the year (electricity output and available capacity);
- Generator maintenance/repair plan(s) for different months of the year (if any).

c) The Seller must provide information on maintenance/repair and generator mobilization plan(s) for the load dispatch entity (which has control authority) in compliance with legal stipulations on the operation of the national electricity system.

#### ***5. Outage***

The Seller shall inform the Purchaser of the scheduled outage and expected duration for planned and unplanned repairs in consistent with regulations on the operation of the national electricity system.

#### ***6. Electricity grid operation***

a) The Seller shall be responsible for the management, operation and maintenance of electricity grid equipment within the scope of properties management as prescribed in the Connection Agreement(s) with power grid management entities, ensuring the compliance with stipulations on the operation of the national electricity system; standards and technical regulations of the electricity industry; and the power purchase/sale as prescribed in the PPA.

b) The Seller shall be required to discuss and reach its consensus with the national operation entity (which has control authority) on power source mobilization plan and solutions to mitigate the impacts on regional electricity grid transmission as caused by constraints related to regional load and electricity grids.

### ***7. Interruptions during the receipt and purchase of electricity***

The Purchaser shall not be liable for obligations of purchasing or receiving electricity when:

a) The Seller's power plant does not guarantee its operation and maintenance in compliance with the regulations on the operation of the national electricity system and standards and technical regulations of the electricity industry;

b) The Purchaser installs equipment, and repairs, replaces, inspects or checks the electricity grid, and all of these activities are directly related to the connection to the Seller's power plant;

c) The transmission and distribution grid, which is connected to the Purchaser's grid, or the Purchaser's electricity grid equipment, which is directly connected to transmission and distribution grid, encounters incidents;

d) The Purchaser's grid requires post-incident recovery solutions in accordance with provisions on the operation of the national electricity system and standards and technical regulations of the electricity industry.

### ***8. Interruptions during the electricity delivery and sale***

The Seller may terminate or curtail the amount of electricity sold and delivered to the Purchaser in the event of equipment installation, repairs, replacement, inspection, testing or repairs of the power plant, which directly affects the delivery of electric power to the Purchaser.

Before terminating or curtailing the amount of electricity delivered to the Purchaser, the Seller must notify the Purchaser thereof for at least 10 (ten) days in advance, clearly stating the reasons for interruptions, expected starting date and duration.

### ***9. Coordination***

The Purchaser shall be responsible for minimizing the curtailment or outage duration in circumstances as described Clause 7 of this Article. Except for emergency cases, the Purchaser shall be required to inform the Seller for at least 10 (ten) days in advance, clearly stating the reasons for curtailment or outage, expected starting date and duration. When necessary, the Purchaser must transfer load dispatch commands related to the operation of the power plant as received from the load dispatch entity and the Seller must comply with those commands, except for the cases in which those commands would change the plant's mobilization characteristics.

## ***10. Power factor***

The Seller agrees to operate the power plant in synchronized manner with the Purchaser's grid for the purpose of electricity delivery at the delivery point and voltage level/power factor from 0.85 (corresponding to outgoing reactive power) to 0.90 (corresponding to incoming reactive power) as prescribed in Appendix A. Except when the Purchaser otherwise requests, the Seller's power plant must serve the Purchaser at the power factor as determined in accordance with the Regulations on distribution grid at the delivery point.

## ***11. Synchronized operation***

The Seller shall be responsible for providing the Purchaser with written notification at least 30 (thirty) days before the first-time synchronization of power generators at the Seller's power plant into the Purchaser's electricity grid. The Seller must coordinate with the Purchaser during the first-time and subsequent synchronizations.

## ***12. Standards***

The Seller and the Purchaser must comply with regulations relating to the delivery and receipt of electricity in accordance with the Regulations on distribution grid, Regulations on metering and legal normative documents related to the electricity industry.

## ***13. Change of commercial operation date***

Within 06 (six) to 12 (twelve) months prior to the commercial operation date as stipulated in Appendix A, the Seller must give official confirmation on the change of commercial operation date. The parties shall be liable for cooperation; the Purchaser shall not be allowed to decline without valid justifications.

## **Article 3. Connection, metering and operation of the power plant**

### ***1. Responsibilities at electricity delivery point***

The Seller shall be responsible for the investment in/installation of equipment for the electricity transmission and delivery to the Buyer at the electricity delivery point. The Purchaser shall be responsible for cooperation with the Seller in performing this installation.

### ***2. Connection***

a) The Seller shall be responsible for the investment, construction, operation and maintenance of connection equipment, which is for connecting the power plant to the electricity transmission/distribution grid in accordance with Regulations on transmission/distribution grid and other related regulations. The Seller shall bear the costs for upgrading the metering system at the transformer station in order to measure/count 02 (two)-way active and reactive power in the distribution line linking with the power plant in accordance with the provisions as stipulated in Appendix A of this Agreement.

b) The Purchaser shall reserve the right to review the technical design and adequacy of protective devices. The Purchaser must provide the Seller, within 30 (thirty) days from the receipt of a complete set of design-related technical documentation, with the written notification on appraisal results. The Purchaser must notify in writing all design errors that are detected. The Seller must perform additional modifications as recommended by the Purchaser in accordance with legal regulations on national electricity system operation and standards/technical regulations of electric power industry.

### ***3. Connection standards***

The Seller's and Purchaser's equipment must be installed, operated and connected in compliance with Regulations on distribution grid.

### ***4. Inspecting the implementation of connection standards***

Upon the receipt of in-advance notification as regulated, one party shall reserve the right to inspect the other party's connection equipment to ensure the compliance with legal regulations on the operation of the national electricity system. The inspection should not affect the operation of the inspected party. If the inspected party's equipment fails to meet the conditions for operation and maintenance, the inspecting party must notify the inspected party all required calibrations. The inspected party shall be responsible for applying necessary remedies upon the receipt of justified request for calibrations from the inspecting party.

### ***5. Excited generator***

If the Seller's power plant has excited generator(s), the Seller must install a separate capacitor for each generator for the purpose of calibrating the power factor. Those capacitors must be connected or disconnected concurrently with each excited generator. The KVAR of capacitors must ensure the highest standard value, but not exceed KVAR no-load thresholds of generators. The Seller must pay the Purchaser for electricity consumption for operating excited generator(s) at electricity retail price of the corresponding voltage level if the

consumed electricity is taken from the Purchaser's electricity grid. This payment shall be made in accordance with the provisions as prescribed in Article 4 of this Agreement.

## ***6. Metering***

a) The Seller's responsibilities:

- Install and maintain the main and backup metering equipment for the purpose of power metering and billing;
- Make available the space for installing the metering equipment if the connection point is within the power plant.

b) Requirements of metering equipment:

- Comply with metering and other related regulations;
- Be capable of storing and recording bi-dimensional active and reactive power;
- Be capable of transferring data to locations as requested by the Purchaser;
- Be leaded/sealed and capable of recording/storing large quantity of data.

## ***7. Meter readings***

Every month (or otherwise agreed by the two parties), the Purchaser and the Seller shall together perform the meter readings.

After giving notification as prescribed, the Purchaser shall be allowed to enter the power plant or metering equipment place for meter readings and other activities related to the performance of this Agreement. The Purchaser's activities at the power plant must not affect the Seller's normal operations. The Purchaser-appointed employees or inspectors must obey safety regulations and the power plant's rules.

## ***8. Inspection of metering equipment***

a) The checks/inspection of metering equipment and confirmation of metering equipment accuracy must comply with power-metering regulations and be performed by competent or authorized organization(s). Inspection(s) should be done before the first-time operation of metering equipment. All metering equipment must be sealed, leaded and locked after being inspected, and the Purchaser shall reserve the right to witness this process.

b) All the power plant's metering equipment must be inspected on a yearly basis in accordance with power-metering regulations, and the inspection cost shall be paid by the Seller. If required, a party may propose to inspect the accuracy of any metering equipment, and the inspection cost shall be borne by the proposing party. The inspection results must be notified to the other party upon request. If the metering equipment shows errors, which are greater than the acceptable level as prescribed in metering regulations, the Seller shall be



responsible for calibrating or replacing and returning the Purchaser the relevant paid amount plus the interest rate of relevant paid amount (based on the prescribed basic interest rate) and inspection expense(s). Each party shall be notified in advance and reserve the right to appoint person(s) to participate in sealing-off, checking, inspecting and leading/sealing the power meter. If one party finds that the power meter is broken or not working, such party must promptly notify the other party for subsequent checks and repairs by the one who owns the equipment.

### ***9. Transfer of electricity ownership***

At the electricity delivery point, the electricity ownership shall be transferred from the Seller to the Purchaser. At this point, the Purchaser shall have the right for ownership/control and take responsibility for the electric power received. The electric power shall be transmitted by three (3)-phase AC, fifty hertz frequency (50Hz) with the voltage as specified in Appendix A of this Agreement.

### ***10. Operation of the power plant***

The Seller must operate the power plant in accordance with Regulations on electricity distribution grid; Standards of the electricity industry and other relevant legal provisions.

## **Article 4. Billing and payment**

### ***1. Billing***

Every month (or otherwise agreed by the two parties), the Purchaser and the Seller shall together performing the meter readings on the agreed date to determine the amount of electricity delivered in the given month. The Seller shall record, using the template format, the meter readings that shall be confirmed the Purchaser representative(s), and send meter-reading results together with printed invoice (or by fax with an official letter later or by mail) to the Purchaser no later than 10 (ten) working days from the completion of meter readings.

### ***2. Payment***

a) The Purchaser shall pay the Seller for the entire electric power delivered no later than the due date of payment as prescribed in Clause 9 Article 1 and electricity purchase price as specified in Clause 2 Article 2 of this Agreement.

b) If the Purchaser fails to pay within the period as specified above, the Purchaser shall be liable to pay the interest for the late payment. The late payment interest shall be equal to the inter-bank average interest rate applicable to one (01)-month term, counting from the date after the due date.

c) If the Purchaser does not participate in the meter readings as prescribed in Clause 1 of this Article, the Purchaser shall be required to pay the Seller the amount of electric power delivered.

d) The Seller shall be required to pay the Purchaser according to the electricity distribution price as prescribed in the Agreement (if any).

### ***3. Estimation of electricity sold***

If there is insufficient data necessary to determine the amount of electricity or payment that the Purchaser owes the Seller (except for cases as specified in Clause 4 of this Article), the Seller shall be required to estimate those figures and make adjustment to the payment amount to reflect the actual situation for the purpose of subsequent payments.

### ***4. Sequence of applying and replacing meter figures***

In order to determine the electricity amount received and accepted by the Purchaser within a given payment period, the meter readings, billing and payment must be based on data estimates of the following sequence:

a) Power plant's main meter figures for the given payment period, which show a degree of accuracy in accordance with the provisions of Clause 8, Article 3 of this Agreement;

b) Power plant's backup meter figures (if the backup meter is used to meter the electricity delivered), which show a degree of accuracy in accordance with the provisions of Clause 8, Article 3 of this Agreement;

c) When all meters fail to accurately record the electricity amount delivered, the estimation of electricity delivered must be done on the basis of the power plant's monthly average data (if any) for the same payment period of the preceding year of the agreement year, and must be reasonably adjusted for the given billing period based on the corresponding available data that affect the power plant's electricity generation, e.g. biomass parameters, generator efficiency, number of operating hours, operation duration of generator(s) and self-consumed electricity (generally referred to as "operation parameters") while the meters are not working.

In the absence of reliable data, the estimation of electricity delivered must be done on the basis of the power plant's monthly average electricity data collected for 06 (six) payment periods (or less if the power plant has been operating for less than six months) just preceding the date when meters stop working and must be adjusted according to the outage duration or operation parameters.

### ***5. Bill disputes***

a) If one party does not agree with all or part(s) of the bill in terms of electricity output delivered or payment amount, such party shall reserve the right, prior to the due date of payment, to send a written notification to the other party. If the parties fail to reach agreement, the duration for dispute settlement for one party or all parties shall be 01 (one) year from the date when the Purchaser receives the valid invoice.

b) If the Seller wins in dispute settlement as stipulated in Clauses 1 and 2, Article 8 of this Agreement, the Purchaser must pay the Seller all the disputed amount plus the interest calculated on the basis of inter-bank average interest rate and the monthly interest to be covered from the due date to the payment date of disputed amount. If the Purchaser wins, the Seller shall be required to refund the disputed amount that the Seller already received, plus the interest calculated on the basis of inter-bank average interest rate and the monthly interest to be covered from the date of payment receipt to the payment date of disputed amount. All payments referred herein must be done within 15 (fifteen) days from the issuance date of final decision on dispute settlement in accordance with Article 8 of this Agreement.

## **Article 5. Force majeure**

### ***1. Force majeure***

Force majeure events mean unforeseeable events that are irreparable despite all available remedies and resources. Force majeure events include:

a) Decision(s) by competent authorities, affecting a Party's fulfillment of obligations;

b) Natural disasters, fires, explosions, floods, tsunamis, epidemics or earthquakes;

c) Violence, riots, war, resistance, sabotage, embargo, besiegement, blockade, or any act of war or hostilities against the community whether the war is declared or not;

d) Nationalization, expropriation or confiscated properties of the Seller under decision(s) by competent State agencies;

e) Other causes, which are beyond the control and not the faults of the party citing for force majeure events.

## ***2. Settlement of a force majeure event***

In case of force majeure, the party citing for force majeure event(s) shall:

- a) Promptly send a written notice on force majeure event(s) to the other party, clearly stating reasons, sufficient supporting evidence for such force majeure event, anticipated time/duration and possible impacts on its fulfillment of obligations;
- b) Make all efforts within its capacity to perform its obligations as stipulated in the Agreement;
- c) Promptly take necessary actions and provide evidence for its reasonable efforts to address such force majeure event;
- d) Take necessary measures to mitigate damages to the parties of the Agreement;
- d) Promptly inform the parties of the termination of such force majeure event.

## ***3. Consequences of a force majeure event***

As long as all remedies/actions as prescribed in Clause 2 of this Article are taken, the violating party shall be exempt from liabilities related to the failure to perform obligations under the Agreement as caused by such force majeure event.

## ***4. Duration of a force majeure event***

If a force majeure event prevents a party from fulfilling this Agreement's obligations for a period of 01 (one) year, the other party shall reserve the rights to unilaterally terminate the Agreement after 60 (sixty) days from the date of written notification, unless such obligations are to be performed within 60 (sixty) days.

## **Article 6. Duration of agreement**

This Agreement shall take effect from DD...MM...YY and terminate after 20 (twenty) years from the date of commercial operation. Upon the completion of the Agreement, the contents of this Agreement shall continue to take effect for a certain period of time necessary for the concerned parties to prepare the final invoice(s), adjust invoice(s), make payments and perform all rights/obligations in this Agreement.

## **Article 7. Breaches, damage compensations and suspension of Agreement performance**

### ***1. The Seller's breaches***

- a) The Seller fails, within 03 (three) months, to meet the commercial operation date as prescribed in Appendix A, except for force majeure event(s);

b) The Seller fails, within 60 (sixty) days from the receipt of the Purchaser's written notice, to perform or comply with the contents of the Agreement.

If the Seller or the Seller's lending party has tried to address the breaches within the said 60 (sixty) days but its remedial actions could not be completed within such period, the Seller or the Seller's lending party shall be allowed to continue its remedial actions for a maximum of 01 (one) year from the receipt date of written notice on the Seller's breaches. The Seller shall be required to continue its remedial actions in a shortest duration of time, except for cases as prescribed in Article 5 of this Agreement;

c) The Seller denies the validity of a part or the whole of this Agreement;

d) It violates the Seller's commitments as stipulated in Article 10 of this Agreement.

### ***3. The Purchaser's breaches***

a) The Purchaser fails, within 60 (sixty) days from the receipt of the Seller's written notice, to perform or comply with the contents of the Agreement

If the Purchaser or the Purchaser's lending party has tried to address the breaches within the said 60 (sixty) days but its remedial actions could not be completed within such period, the Purchaser or the Purchaser's lending party shall be allowed to continue its remedial actions for a maximum of 01 (one) year from the receipt date of written notice on the Purchaser's breaches. The Purchaser shall be required to continue its remedial actions in a shortest duration of time, except for cases as prescribed in Article 5 of this Agreement;

b) The Purchaser fails to pay the non-dispute amount on the due date under this Agreement, this failure continues for more than 90 (ninety) days without valid justifications;

c) The Purchaser denies the validity of a part or the whole of this Agreement;

d) It violates the Purchaser's commitments as stipulated in Article 10 of this Agreement.

### ***4. Remedial procedures and settlement of agreement breaches***

a) If a breach of the Agreement is found, the affected party must send written notice to the violating party. The violating party must be cooperative to address such breach.

b) The lending party of the violating party shall reserve the right to, as a remedy, appoint a third party or replace the violating party provided that a written notice must be sent to the violating party. In this case, such replacement should not increase the financial burden on the affected party. The affected party must accept such replacement or ask the third party as appointed by the lending party to remedy the agreement breaches. The lending party of the violating party shall provide the affected party with a written notice on anticipated remedies on the violating party's behalf, and reach a consensus with the affected party on a

reasonable period from the receipt date of written notice on the fulfillment of Agreement's obligations on the violating party's behalf.

### ***5. Compensation for damages***

a) The violating party shall be obliged to pay compensation for damages caused by its breaches to the affected party. The compensation shall cover the values of actual/direct damages to the affected party as caused by the violating party as well as potential direct benefits for the affected party in case of no breaches.

b) The affected party must provide proven evidence on damages/level of damages caused by such breaches and potential direct benefits for the affected party in case of no breaches.

### ***6. Suspension of Agreement performance***

If the breaches of the Agreement are not settled in accordance with Clause 4 of this Article, the affected party may continue to ask the violating party to take remedial actions or to suspend the Agreement performance by providing written notice to the violating party. If the affected party chooses to suspend the Agreement performance under the provisions of this Agreement, the Agreement parties shall not be required to perform contractual obligations, except for cases as prescribed in Clause 1 of this Article, and the affected party shall reserve the right to request for damage compensation from the violating party.

If the Seller is the affected party that chooses to suspend the Agreement performance, the compensation shall be calculated as the value of the Seller's actual electricity generated in the preceding year as of the suspension date of Agreement performance.

## **Article 8. Settlement of disputes**

### ***1. Settlement of disputes via negotiations***

In case of disputes between parties of this Agreement, the requesting party must provide the other party with a written notice on the disputes and subsequent requirements within a certain valid period. The parties shall negotiate the possible settlement of disputes within 60 (sixty) days from the receipt date of written notice from the requesting party. The settlement of disputes, which are related to electricity payment, shall be done within 15 (fifteen) days from the receipt date of written notice from the requesting party.

If the consensus cannot be reached as prescribed above, the parties may submit a written request to the General Directorate of Energy for assistance.

This mechanism for dispute settlement shall not apply to disputes, which are not directly arisen from this Agreement between one party of the Agreement and the third party.

### ***3. Settlement of disputes in the electricity market in compliance with legal regulations***

If the settlement of disputes via negotiations as described in Clause 1 of this Article is not possible or one of the parties does not comply with the negotiation results, a party or parties may request for dispute settlement in accordance with the provisions of the MoIT's Circular No.40/2010/TT-BCT dated 13 December 2010 prescribing the sequence and procedures for settling disputes on the electricity markets, or choose a body, as agreed by the two parties, in order to settle disputes in accordance with the provisions of relevant laws.

## **Article 9. Entrustment, transfer and restructuring**

### ***1. Entrustment and transfer***

If this Agreement is entrusted or transferred for performance purpose, the provisions on rights and obligations as prescribed in the Agreement shall continue to take effect to the parties' legal/authorized representatives.

If the Seller entrusts or transfers the performance of this Agreement, the Purchaser's written consensus shall be required, except for cases that the Seller partly or wholly authorizes its lending party in order to borrow and purchase equipment or construct the power plant. If the Seller's entrusted amount is close to the value of good-performing equipment, it is regarded as a valid entrustment under this Agreement.

The party that entrusts or transfers shall be required to send a written notice on entrustment or transfer to the other party.

### ***2. Restructuring***

If the restructuring of the electricity industry affects the Seller's or Purchaser's rights or obligations under this Agreement, the performance of the Agreement shall be transferred to take-over unit(s). The Purchaser must be responsible for written confirmation and guarantee that take-over units shall fulfill their obligations to purchase or distribute electricity and other rights/obligations under this Agreement.

### ***3. Choosing to participate in the electricity market***

The Seller may choose to participate in electricity market in accordance with the regulations on competitive electricity market. In this case, the Seller must send the Purchaser and ERAV a written notification for 120 (one hundred and twenty) days in advance, and shall reserve the right to unilaterally terminate this Agreement upon fulfillment of notified obligations in accordance with legal regulations.

## **Article 10. Other agreements**

### ***1. Amendment of the Agreement***

The amendment of and supplement to this Agreement shall be done in accordance with stipulations of Circular No. 32/2015/TT-BCT dated 8 October 2015 by the Minister of Industry and Trade on project development and Standardized Power Purchase Agreement for power generation projects using solid wastes, and shall be performed in writing on the basis of both parties' consensus.

## ***2. Obligations for cooperation***

The Seller shall be obliged to perform legal procedures related to the power plant. The Purchaser shall be responsible for cooperating with the Seller to obtain its license and necessary approval/permission from competent State agencies related to the plant location, fuel, resources management, investment, transmission and sale of electric power, ownership and operation of the power plant, including the provision of supplementary or archived documents and carrying out other necessary and reasonable activities for the purpose of agreement performance by the parties.

## ***3. Applicable law***

The interpretation and performance of this Agreement shall be done in consistent with provisions of Vietnamese laws.

## ***4. Non-fulfillment of rights***

The non-fulfillment of rights at any time under this Agreement shall not affect the enforcement of rights under the subsequent Agreements. The parties agree that a party's statement on non-fulfillment of rights to any commitments or conditions under the Agreement, or any breaches of the Agreement shall not be considered as an abandonment of such party's similar rights in the future.

## ***5. Independence of Agreement contents***

In case any part of this Agreement is considered as inconsistent with the legal regulations or invalid under the court's ruling, other parts of the Agreement shall still take effect if these parts can be comprehensively interpreted without necessary reference to the invalid text.

## ***6. Notification***

Any notifications, invoices or other necessary communications during the performance of this Agreement must clearly state the date and reference to the Agreement. Notifications, invoices or communications must be made in writing and delivered by mail or fax. If being sent by fax, the original must be sent later by mail with prepaid postage. Notifications, invoices or communications must be sent to the following addresses



a) The Seller: Director General, \_\_\_\_\_, \_\_\_\_\_  
\_\_\_\_\_, \_\_\_\_\_, Việt Nam

b) The Purchaser: \_\_\_\_\_, \_\_\_\_\_,  
\_\_\_\_\_, \_\_\_\_\_, Việt Nam

c) The parties should specify, in their notifications including those related to the lending party, the another sender's or recipient's address in a format as prescribed in this Clause.

d) For the said methods of delivery, each notification, invoice or communication sent by mail shall be considered as being delivered and received by the time it reaches the recipient's address or by the time it is refused by the recipient at such address.

### ***7. Confidentiality***

The Purchaser agrees to keep confidential the power plant's information as stipulated in the Agreement's Appendices, except for the information previously announced by the Seller or the General Directorate of Energy.

### **Article 11. Implementation commitment**

The two parties shall be committed to perform this Agreement as follows:

1. Each party is legally established to engage in business operations in Vietnam;
2. Each party's signature and performance of this Agreement is in accordance with the conditions and contents of the Power Operations License as issued by the competent authority and relevant legal provisions;
3. A party shall have no legal or administrative acts preventing or affecting the other party from performing this Agreement;
4. A party's signature and performance of this Agreement shall not violate any provisions of other Agreements or not be part of another Agreement in which such party is a beneficiary.

The Agreement is made in 10 (ten) copies of equal validity with 4 Appendices, which are integral to this Agreement. Each party keeps 04 (four) copies, and the Seller shall be deemed to send 01 (one) copy of PPA to the General Directorate of Energy and 01 (one) copy to the ERAV.

**SELLER'S REPRESENTATIVE**

*(Title)*

*(Sealed and Signed)*

*(Full Name)*

**PURCHASER'S  
REPRESENTATIVE**

*(Title)*

*(Sealed and Signed)*

*(Full Name)*

## **APPENDIX A**

### **SYSTEM CONNECTION AGREEMENT**

(To be separately applied to individual projects according to technical specifications of the projects, including one-line diagram of connection devices, list of metering system characteristics, voltage and requirements for connection)

## APPENDIX B

### TECHNICAL SPECIFICATIONS OF THE POWER PLANT

#### Part A. General specifications

1. Name of the power plant: .....
2. Location of the power plant: .....
3. Rated power: .....
4. Power sold to the Purchaser: minimum .....kW; maximum .....
5. The power plant's self-consumption: minimum.....kW; maximum.....
6. Expected annual electric output: .....kW
7. Completion date of plant construction: .....
8. Expected date of the plant's commercial operation: .....
9. Voltage generated to distribution grid: .....V
10. Connection point to distribution grid: .....
11. Location of metering equipment: .....

#### Part B. Operational parameters of specific technology

1. Type of fuel: .....
2. Generation technology: .....
3. Characteristics of designed operation: .....
4. Fuel quantity/month: .....
5. Volume of fuel tank: .....
6. No-fuel duration: .....

## **APPENDIX C**

### **REQUIREMENTS PRIOR TO THE DATE OF COMMERCIAL OPERATION**

(Commitment to commercial operation date, agreements on testing procedures, acceptance and putting the plant into commercial operation....)

**APPENDIX D**  
**OTHER AGREEMENTS**

**THE PRIME MINISTER**

**SOCIALIST REPUBLIC OF VIETNAM**

**Independence - Freedom - Happiness**

No.: 2068/QĐ-TTg

*Hà Nội, 25 November 2015*

**DECISION**

**Approving the Viet Nam's Renewable Energy Development Strategy up to 2030 with an outlook to 2050**

**THE PRIME MINISTER**

*Pursuant to the Law on Government Organization dated 25 December 2001;*

*Pursuant to the Law on Electricity dated 14 December 2004; the Law on the Amendment of and Supplement to the Law on Electricity dated 20 November 2012;*

*In response to the request made by the Minister of Industry and Trade,*

**DECIDES:**

**Article 1. To approve the Viet Nam's Renewable Energy Development Strategy up to 2020 with an outlook to 2050 with following main contents:**

**I. VIEWPOINTS ON DEVELOPMENT**

1. Development of renewable energies (RE) shall be in synergy with the realization of economic, social and environment goals: The RE promotion shall not only focus on expanded scale and higher RE share in total primary energy supplies thus contributing to energy security, but also deal with the energy supply for rural areas, giving a reason for better production and establishment of a society that utilizes resources in economical, efficient and environmentally-friendly manners. The RE development shall be built upon resources and socio-economic development needs, and tied in with national and local resources and energy needs.

2. RE development and use shall be concerted with an expansion of RE industry: Priorities shall be given to rapid expansion of such RE areas of enormous resources and good commercial prospects as wind, solar and biomass power. Necessary measures shall be taken to magnify market demands and strengthen international cooperation for the purpose of technology transfer for stronger development of the equipment manufacturing industry. The pick-up and approaching mastery of available technologies as well as better equipment manufacturing capability and stronger competitiveness in the RE market shall be guaranteed in order to meet market demands in sustainable and stable manners, hence creating favorable conditions for the development of a large-scale RE industry.

3. The use of short-term technologies shall go hand in hand with the promotion of long-term technologies: Focus shall be given to proven technologies in the RE field (including hydropower, wind power, solar power, biomass energy and biogas) with a view to generating various RE sources for efficient power supply to the national electricity system and thermal energy for heating needs in production and residential activities. At the same time, emphasis shall also be placed on such new, modern and highly-prospective technologies as the one applied in liquid biofuel production, which is based on the 2<sup>nd</sup> and 3<sup>rd</sup> advanced technology.

4. Incentives/support policies shall be matched with the market mechanism: Various economic and financial incentives/support policies shall be exercised to promote the RE development and use, aiming at addressing primary energy shortages and energy supply to rural areas. Market mechanisms and measures shall be established/taken with a view to bringing together capital sources from all economic sectors into the RE growth, contributing to improved technical level of RE technologies, enhancing the development of RE equipment manufacturing industry, continuously improving the competitiveness and moving towards a RE industry, which is expected, via state support policies, to quickly reach its large-scale position.

5. Restructuring and state management capacity building shall come together in the RE field: State management capacity shall be strengthened at central and local levels in terms of the management of development activities and RE utilization. Barriers shall be gradually removed and mechanisms/incentives shall be promulgated to encourage the appropriate RE development for rapid generation of RE sources.

## **II. DEVELOPMENT STRATEGY AND OBJECTIVES**

### **1. Development strategy:**

Encourage/mobilize all resources from the society and people for RE development and better access to modern, sustainable, reliable and affordable energy sources by all citizens; accelerate the expansion and use of RE sources, increase the domestic energy supply, gradually increase the RE share in the national energy production and consumption in order to ensure less dependence on fossil sources, and contribute to better energy security, mitigating climate change, environmental protection and sustainable socio-economic development.

### **2. Strategic objectives**

- Gradually increase the rate of access to clean energy and electricity sources by local people in rural, mountainous, remote and border areas as well as islands: Most of households shall have electricity in 2020 and access to modern, sustainable and reliable energy services with reasonable electricity selling/energy prices in 2030.

- Develop and utilize RE sources in such a way that contributes to fulfilling the objectives of sustainable environment and development of green economy:

+ Reduce greenhouse gas emissions in various energy activities as compared with BAU scenario: by approx. 5% in 2020; approx. 25% in 2030 and around 45% in 2050.

+ Contribute to reduced fuel imports for energy purposes: Reduce by approx. 40 million tons of coal and 3.7 million tons of oil products in 2030; approx. 150 million tons of coal and 10.5 million tons of oil products in 2050.



- Increase the total production and use of RE sources from approx. 25 million TOE (tons of oil equivalent) in 2015 to 37 million TOE in 2020; approx. 62 million TOE in 2030 and 138 million TOE in 2050; the RE share in total primary energy consumption in 2015 shall be approx. 31.8%; 31% in 2020; 32.3% in 2030 and 44% in 2050.

- Increase the total electricity production from RE sources from approx. 58 billion kWh in 2015 to 101 billion kWh in 2020, approx. 186 billion kWh in 2030 and 452 billion kWh in 2050. The share of RE-based electricity in the total national production shall rise from 35% in 2015 to 38% in 2020; 32% in 2030 and 43% in 2050.

- Increase the absorption area of solar water-heating units from approx. 3 million m<sup>2</sup> in 2015 to about 8 million m<sup>2</sup>, i.e. a supply of 1.1 million TOE in 2020; approx. 22 million m<sup>2</sup>, i.e. 3.1 million TOE in 2030 and approx. 41 million m<sup>2</sup>, i.e. 6 million TOE in 2050. Increase the proportion of households with solar water-heating devices (solar water-heating panels, residential cooking hobs, air heating and cooling units, water distillation, etc.) from approx. 4.3% in 2015 to 12% in 2020, 26% in 2030 and 50% in 2050.

- Scale up the application of biogas technologies with a construction volume of from approx. 4 million m<sup>3</sup> in 2015 to 8 million m<sup>3</sup> in 2020; approx. 60 million m<sup>3</sup> in 2030 and 100 million m<sup>3</sup> in 2050.

- Replace biomass-based conventional stoves and low-performing devices with advanced/high-performing items while utilizing traditional biomass for residential and industrial cooking purposes. Increase the percentage of households using advanced/high-performing stoves from negligible level at present to approx. 30% in 2020; about 60% in 2025; and from 2030, high-performing/sanitary stoves shall be used by most of rural households.

- Increase the production of biofuels from approx. 150 thousand TOE in 2015 to about 800 thousand TOE, i.e. 5% of transport sector's fuel demand in 2020; 3.7 million TOE, i.e. 13% of transport sector's fuel demand in 2030; 10.5 million TOE, i.e. 25% of transport sector's fuel demand in 2050.

- Promote the development of RE technologies and industries, establish RE industrial systems and increase the proportion of domestically-manufactured equipment value in the RE field up to approx. 30% in 2020 and 60% in 2030; and in 2050, domestic needs for these equipment items shall be essentially met, and a portion of domestically-manufactured equipment items shall be exported to other countries in the region and around the world

### **III. DEVELOPMENT ORIENTATIONS BY PERIOD**

#### **1. Present to 2030**

- Development and utilization of independent RE sources for achieving rural electrification goal(s): Establish various development programs for independent RE-based and household-scale power systems, serving for disadvantaged/extremely disadvantaged, remote, isolated and mountainous areas as well as islands for the purpose of poverty reduction and socio-economic development so that most of rural households will be provided with electricity and clean/sanitary energy by 2020 and 2030 respectively.

- Investment in the development of RE-based grid-connected power plants:

- + Encourage the investment in building economically-feasible RE-based grid-connected power plants. Provide support on a competitive basis, ensuring that affordable power sources will be mobilized into the system and RE technologies will be developed for long-term purposes.

- + Support the development, on a pilot and selective basis, of several RE technologies that are currently not economically feasible for the purposes of exploitability assessment, technology improvement, market formulation and human resource development.

- + Put resources into R&D and RE-related technology transfer, and investment in the establishment of a RE database for long-term purposes.

- Development and utilization of RE sources for heat supply:

- + Strengthen support to investment, R&D and application of RE sources for heating purposes, thus leading to reduced fossil-fuel use and environmental protection.

- + Provide the Government's partial support at the early stage to put forward the installation and development of RE technologies for efficient and sustainable heat production/use, making sure that quality and standard regulations will be respected in order to meet the set objectives.

- Development and utilization of biofuel sources:

- + Build up resources for R&D; conduct surveys and planning for biofuel development areas and implementation of piloted biofuel projects, aiming at partially using biofuels as a type of substitute gasoline&oil nationwide.

- + Support the investment in piloted generation-2 and -3 biofuel production projects, in which non-food materials will be used.

## 2. Orientations towards 2050

- Bring resources together, and exploit and maximize RE potentials in the country by applying advanced technologies, which are suitable for actual conditions of each region, thus bringing high economic, social and environmental efficiencies.

- Strongly develop RE technology market, machinery/equipment manufacturing industry and supply of domestic RE services.

- Strengthen potentials for research, development, transfer and application of new renewable energies.

## **IV. DEVELOPMENT ORIENTATIONS BY SUB-SECTOR**

### 1. Development orientations towards hydropower:

- The development of conventional hydropower sources shall contribute to local socio-economic development; on-site power supply and improved safety for electricity supply.

- Such development must be consistent with local small and medium hydropower development plans, and built upon comprehensive environmental impact assessments.

- Grid-connected small hydropower projects shall apply the avoided cost tariff.

- The total hydropower production shall be increased from 56 billion kWh in 2015 to nearly 90 billion kWh in 2020; and approx. 96 billion kWh in 2030.

- The pumped storage power plants shall be developed for storage and demand regulation purposes in the power system, thus contributing to improved flexibility and efficiency of power system operations. The capacity of pumped storage power plants shall reach 2,400 MW and 8,000 MW in 2030 and 2050 respectively.

## 2. Development orientations towards biomass energy sources:

- Prioritize the use of biomass energy for the production of power, biogas, pellets/briquettes and liquid biofuels. Increase the utilization rate of wastes generated from industrial/agricultural plants for energy purposes from 45% in 2015 to 50% in 2020, approx. 60% in 2030 and 70% in 2050.

- Increase the disposal rate of animal wastes for energy purpose (biogas) from about 5% in 2015 to 10% in 2020, approx. 50% in 2030, and most of animal wastes shall be disposed in 2050,.

- Increase the disposal rate of municipal wastes for energy purpose from a current negligible level to 30% in 2020, approx. 70% in 2030, and most of municipal wastes shall be used for energy purpose in 2050.

- Total biomass energy volume to be used shall rise from 14.4 million TOE in 2015 to 16.2 million TOE in 2020; approx. 32.2 million TOE in 2030 and 62.5 million TOE in 2050. Of which:

+ Total biomass energy for electricity generation shall go up from 0.3 million TOE in 2015 to 1.8 million TOE in 2020; approx. 9 million TOE in 2030 and 20 million TOE in 2050. Accordingly, the electricity generated shall increase from 0.6 billion kWh in 2015 to 7.8 billion kWh in 2020; approx. 37 billion kWh in 2030 and 85 billion kWh in 2050. The share of biomass power in total electricity production shall increase from 1.0% in 2015 to 3.0% in 2020; approx. 6.3% in 2030 and 8.1% in 2050.

+ Total biomass energy for heat generation shall increase from 13.7 million TOE in 2015, 13.6 million TOE in 2020 to approx. 16.8 million TOE in 2030 and 23 million TOE in 2050. The share of biomass energy in final energy demand shall account for 25% in 2015, 17% in 2020, 14% in 2030 and approx. 12% in 2050.

+ Total biomass energy for biofuel production shall increase from 0.2 million TOE in 2015 to 0.8 million TOE in 2020; approx. 6.4 million TOE in 2030 and 19.5 million TOE in 2050.

## 3. Development orientations towards wind power:

- Onshore wind power shall be prioritized for the period up to 2030; the R&D activities shall be conducted for offshore wind power from 2030 onwards;

- Total electricity generated from wind sources shall increase from approx. 180 million kWh in 2015 to 2.5 billion kWh in 2020; approx. 16 billion kWh in 2030 and 53 billion kWh in 2050. The share of wind power in total electricity production shall increase from a negligible level at present to about 1% in 2020, 2.7% in 2030 and around 5% in 2050.

## 4. Development orientations towards solar energy:

- Develop solar power for supply to the national electricity system and border areas, islands and remote/isolated communities, which are not accessible to the national power grid.

The total solar power production shall increase from about 10 million kWh in 2015 to 1.4 billion kWh in 2020; approx. 35.4 billion kWh in 2030 and 210 billion kWh in 2050. The share of solar power in total electricity production shall increase from a negligible level at present to around 0.5% in 2020, about 6% in 2030 and 20% in 2050.

- Develop solar energy devices that can provide heat for households, industrial production, agriculture and services. The total solar energy for heating purposes shall increase from 1.1 million TOE in 2020 to about 3.1 million TOE in 2030 and 6 million TOE in 2050.

## **V. MECHANISMS/POLICIES**

### **1. Formulation of a RE market:**

- Priorities shall be given to the RE investment and utilization during the expansion of energy sector, forming the basis for the formulation and enhanced growth of a RE market.

- Organizations/individuals of various ownership forms shall be encouraged to play their parts in RE development and utilization. The State shall protect the legitimate rights and interests of those organizations/individuals that develop and utilize RE sources.

### **2. Policies for electricity tariff and guaranteed investment**

- The Ministry of Industry and Trade (MoIT) shall prepare and submit for the Prime Minister's approval of the electricity price applicable to grid-connected power generation projects using renewable energies. The electricity tariff shall be consistent with conditions of different regions and characteristics of various RE-based power generation technologies, and follow the principle that helps promote the RE development and utilization as well as guarantees investors' cost recovery and reasonable profits; the electricity tariff shall be promptly adjusted according to the new development of RE-based technologies.

- Power entities shall be responsible for purchasing all electricity produced from grid-connected RE-based power projects within their jurisdiction. The power purchase shall be performed on the basis of the MoIT-regulated standard power purchase agreement.

- The electricity purchase cost for power generation projects using RE sources shall be accounted into the power entity's electricity tariff, calculated and fully incorporated into electricity retail tariff structure, and recovered from electricity sale revenues.

- The power generation projects using RE sources shall be given with prioritized connection to the national power system. The connection cost and other associated costs as reasonably incurred in the RE-based electricity purchase by a power grid entity (i.e. a transmission/distribution unit) shall be incorporated in such power grid entity's transmission/distribution cost.

- For an independent power system using an independent RE-based power source, the project investor shall prepare the electricity price proposal, determine the total state budget-supported amount and submit for the MOIT's appraisal and report for the Prime Minister's approval. The total state budget-supported amount shall be covered by the Sustainable Energy Promotion Fund.

3. Organizations/individuals operating in the electricity sector shall be responsible for making their contributions to the country's RE development. Power generation/distribution entities shall be required to meet Renewable Portfolio Standard (RPS).

- For power generation entities that have their installed capacity of larger than 1,000 MW (excluding BOT-invested sources), the proportion of electricity generated from RE sources (excluding hydropower sources of greater-than-30 MW capacity) shall not be less than 3%, 10% and 20% in 2020, 2030 and 2050 respectively.

- For power distribution entities that generate/purchase electricity from RE sources and end-use customers who self-generate electricity from RE sources (excluding hydropower sources of greater-than-30 MW capacity), the proportion shall not be less than 5%, 10% and 20% in 2020, 2030 and 2050 respectively.

- The MoIT shall determine, on annual basis, the minimum proportion of electricity generated from RE sources by power generation/distribution entities.

#### 4. Net-metering mechanism:

- End-use customers who are purchasing electricity from the national power system and at the same time able to generate electricity from RE sources for self-assumption purpose shall be entitled to net-metering mechanism.

- Power distribution entities shall be responsible for entering into, on the basis of net-metering principle, power purchase agreements with end-use customers who have power installations using RE sources.

- The MoIT shall introduce simplified connection processes/procedures in order to encourage the investment by end-use customers; and prescribe valuation method(s) and other necessary commercial agreements to guarantee the balanced benefits for both end-use customers and power distribution/trading entities.

- The total production of electricity generated from RE sources by end-use customers shall be incorporated into the power distribution/trading entity's RPS.

#### 5. Preferential and support policies for the RE development and utilization

- RE development and utilization projects shall be entitled to incentives on investment credits as prescribed in current legal regulations on State investment and export credits.

- Tax incentives:

+ Import duties: RE development and utilization projects shall be exempt from import duties for goods imported to establish project fixed assets; goods imported as raw materials, materials and semi-finished products that are not domestically produced and imported for project's production purposes under the provisions of the existing laws on export and import taxes.

+ Corporate income tax (CIT): the CIT exemption and reduction applicable to RE development and utilization projects shall be the same as to projects in the fields of investment priorities as stipulated in the existing laws on taxes.

- Preferential treatment for land: RE development and utilization projects shall be entitled to the exemption/reduction of land use/rental costs as prescribed in the existing laws applicable to projects in the fields of investment priorities

- Priorities shall be given to research studies on RE development and utilization in the field of science & technology and hi-tech industry development; and fund allocation for scientific and technological research studies within pilot and industrialization projects for the purposes of RE development and utilization, promotion of technological improvements related to RE development and utilization, reduced production costs of RE products and higher product quality.

6. Policies for environment protection: Organizations/individuals that use fossil fuels for energy purposes shall be required to pay environmental fees for the fuel volume used. A portion of environmental fees collected shall be used for the promotion of RE development and utilization via Sustainable Energy Promotion Fund.

## **VI. SOLUTIONS TO STRATEGY IMPLEMENTATION**

### **1. Strengthened state management in RE development and utilization**

- The MoIT shall exercise its unified management function of the RE development and utilization across the country. Relevant ministries shall, according to their functions and duties, perform the management of RE development and utilization in relevant field(s).

- Agencies that perform the State management of energy in provinces and centrally-run cities (collectively referred to as provinces) shall be responsible for the management of RE development and utilization within their jurisdiction.

### **2. Inventory of RE sources**

- The MoIT shall take lead and collaborate with relevant ministries and agencies in organizing the surveys/assessments of RE potentials across the country; and provide guidelines/instructions on the contents of surveys/assessments.

- The relevant ministries shall, according to their functions and duties and under the MoIT's guidelines/instructions, be responsible for the assessments of RE potentials within their jurisdiction, and send assessment findings to the MoIT for consolidation purpose.

### **3. Preparation of RE development plan(s)**

- The MoIT shall:

+ On the basis of projected energy demands and RE availability across the country, prepare the national RE development plan, submit for the Prime Minister's approval, and promulgate and work on implementation arrangements after the plan is approved by the Prime Minister.

+ On the basis of national RE development and utilization plan, develop and promulgate the RE industry development plan and list of key projects that should be prioritized.

- The PPC of a province where there is a potential for RE development shall organize the preparation of provincial RE development plan and submit to the Minister of Industry and Trade for approval.

- Relevant ministries shall be responsible for preparing related plans facilitating the implementation of the Prime Minister-approved national objectives for RE development and utilization.

- The national and provincial RE development and utilization plans should indicate development goals, major tasks, key project locations, implementation progress, related electricity network construction, service system, safety measures, etc.

#### 4. Development of national standards and norms

- The MoIT shall develop or promulgate national technical standards applicable to grid synchronization with RE-based power sources and construction of RE-related works and equipment items that require national technical standards for consistent application nationwide.

- For any elements that are not guaranteed by national standards, relevant ministries/agencies shall develop or promulgate for the application of basic related standards.

#### 5. Solutions to improved rate of RE development and utilization:

- Solutions to solar energy development and utilization:

+ Encourage organizations/individuals to develop and utilize solar energy systems for water heating, heating/cooling and power generation systems.

+ Real estate development enterprises shall be responsible for fulfilling all requirements for solar energy use in the design and construction of their building structures in accordance with technical standards as prescribed by competent State management agencies.

+ For a building structure that has been completed, the user(s) may choose to install the solar energy system which satisfies relevant technical standards and product standards, provided that such installation shall not affect the structure quality and safety.

- Solutions to strengthened development and utilization of biomass energy:

+ Coal-fired power plants shall be required to combine coal and biomass energy during their production process. The MOIT shall prescribe specific minimum proportion of biomass energy applicable to each power plant within each geographical location and period.

+ Old and low-performing coal-fired power plant owners should consider and convert into biomass fuel use.

- Incentives for clean/hi-efficient biofuel development and utilization, and growth of energy crops: The State shall encourage the production and use of liquid biofuels. Within their local trading system, gasoline/oil enterprises must also sell liquid biofuels which satisfy national standards; on annual basis, the MoIT shall prescribe specific minimum proportion of liquid biofuels that gasoline/oil enterprises must sell in localities.

- Promotion of RE development and utilization in rural areas: On the basis of the rationale for local socio-economic development, environment protection and comprehensive control of sanitation conditions, the Provincial People's Committee (PPC) shall take lead and coordinate with other relevant authorities in preparing the RE development plan in rural areas

in accordance with local conditions and advocating the use of biogas and other conversion forms of biomass, solar, wind and small-scale hydropower energy.

#### 6. Financial support for the RE development and utilization

- The Sustainable Energy Promotion Fund shall be established and financed by the state budget, revenue from environmental fee levied on fossil fuels, various sources of funds and contributions from domestic and foreign organizations/individuals as well as other legitimate funding sources for the purpose of financial support to the promotion of RE development on the national scale. The Sustainable Energy Promotion Fund shall be used to:

+ Compensate the costs incurred by power entities on the:

. Investment in independent power systems using independent RE-based power sources.

. Construction of a power grid to be connected to RE-based power source(s) while the cost recovery is not possible from the electricity transmission price.

+ Provide support to:

. Scientific and technological research studies on the formulation of standards and demonstration projects for the RE development and utilization;

. Projects using renewable energies in rural areas;

. Construction of independent RE-based power generation systems in remote/isolated areas and islands;

. Surveys and assessments of RE sources, and development of relevant information systems;

. Promotion of local contents during the equipment production for the RE development and utilization.

- Priorities shall be given to research studies on RE development and utilization in the field of science & technology and hi-tech industry development; and fund allocation for scientific and technological research studies within pilot and industrialization projects for the purposes of RE development and utilization, promotion of technological improvements related to RE development and utilization, reduced production costs of RE products and higher product quality.

#### 7. Solutions to human resource development:

- Enhance the management capacity for RE development at all levels;

- Encourage and support universities/vocational training institutions to develop their training curricula and deliver new RE-related courses.

- Promote and support RE-related R&D activities among scientific and technical research organizations, especially the in-depth research on those RE technologies which are suitable for Viet Nam's typical conditions.

- Develop short- and long-term cooperation plans with international organizations in terms of RE-related human resource development, education and training.

- Encourage and support the expansion of services and consulting entities in RE field.



#### 8. Solutions to market formulation and RE technologies:

- Develop a national RE program which aims at promoting RE utilization in power generation and application of solar energy and bio-gas for households; carry out R&D programs for RE technologies; and disseminate information and involve community advocacy in the field of RE development.

- Establish and develop RE industry, and encourage the research, transfer, reception and effective application of technical advances as well as new technologies in RE production and utilization.

- Formulate and expand RE technology market, create equality on the basis of fair competition among enterprises of all economic sectors, and support the promotion of RE production, trading and service projects.

#### 9. Strengthened communication/information activities and better public awareness on RE development and utilization:

- Enhance the communication and knowledge dissemination on the important roles and enormous socio-economic and environmental protection benefits to be brought by RE production and utilization in the process of sustainable development, thus leading to practical actions that contribute to the RE development and utilization.

- Encourage and provide local people/communities with technical support to the implementation and scale expansion of RE development and utilization models among households/enterprises.

- Encourage and provide communities with support to develop RE development and utilization models; pilot and move towards replicating various models of green houses, buildings, urban areas and rural areas (i.e. villages/communes) where the majority of energy needs shall be met by RE sources, and wastes from industrial/agricultural production, forestry and husband shall be adequately disposed and utilized for energy purposes.

#### 10. Stronger international cooperation in RE field:

- Strengthen international cooperation so as to attract more capital sources and promote technology transfer in RE field.

- Effectively receive, accept and transfer the world's technical advances, technologies and new scientific achievements in RE development and utilization for stronger, rapid and sustainable growth of RE sector in Vietnam;

- As an experience-gaining exercise in RE development, enhance bilateral and multilateral cooperation with countries that have well-established RE industry and with foreign organizations/individuals that have strong potentials to learn experience;

- Develop and implement international cooperation programs/projects so as to take full advantage of all assistance available in forms of experience, intelligence, capital and equipment, and to attract investments for RE production and utilization.

## **VII. IMPLEMENTATION ARRANGEMENTS**

### **1. MoIT:**

The MoIT shall be the lead agency, which is responsible for RE development and utilization with the following main tasks:

- Perform the assigned tasks as stipulated in this Decision;
- Develop a roadmap for the implementation of this Decision and submit for the Prime Minister's consideration and approval;
- Conduct studies and pilot projects on RE technologies;
- Determine urban towns/communes of typical conditions in various ecological areas in order to develop pilot projects on green urban/rural zones; on that basis, propose solutions to nationwide replication.
- Establish transparent market mechanisms so as to promote investments in RE development and utilization;
- Enhance the human resource development for the expansion of RE sources;
- Coordinate with concerned Ministries/agencies in the inclusion of RE projects into Rural Electricity Supply Program, National Target Program for establishment of new rural areas and other related programs in rural/mountainous areas and islands.
- Strengthen advocacy activities to raise public awareness on the benefits of RE development and utilization;
- Enhance international cooperation, in RE field, with countries in the region and in the world;
- Promulgate regulations and guidelines for related entities to ensure the fair access to power grid by RE-based power generation projects;
- Propose new mechanisms/policies/regulations, which encourage investments in RE development and utilization and are suitable for each period, and submit for the Prime Minister's approval.

2. The Ministry of Construction: shall collaborate with the MoIT and related Ministries in the development of technical standards for solar energy integration into energy systems in condominiums and high-rise buildings.

### **3. Ministry of Science and Technology (MoST):**

- At the request of concerned ministries/agencies, appraise and promulgate national regulations and standards related to RE production and utilization;
- Given priority to research studies on RE development and utilization in the process of scientific/technological and hi-tech industry development.
- Coordinate with the MoIT in carrying out research programs and promoting RE-related scientific/technological activities in such a way that encourages the absorption and application of the world's advanced technologies.

4. Ministry of Agriculture and Rural Development (MARD):

- Take lead and coordinate with the Ministry of Natural Resources and Environment (MoNRE) and PPCs in determining and developing policies related to the most efficient use of land areas for growing energy crops;

- Coordinate with the MoIT in applying the improved stove model for better efficiency of biomass-based stoves and development of advanced biogas systems in rural areas, thus moving towards universal use of clean energy in rural areas;

- Promulgate sustainability criteria and assessment methods for the development of sustainable biomass energy in the forestry sector, which are drawn upon the combined program for both forestry development and biomass fuels;

- Take lead and coordinate with the MoIT in developing raw material-growing scheme for biofuel production.

- Take lead and coordinate with the Ministry of Planning and Investment (MPI) and Ministry of Finance (MoF) in developing and carrying out preferential/support policies for biomass material growing for biofuel production.

5. Ministry of Transport (MoT): shall coordinate with the MoIT in implementing scientific and technological research studies and policies in order to promote biofuel use by personal vehicles, and public, goods and air transportation systems.

6. Ministry of Finance (MoF): shall coordinate with the MoIT and other related ministries/agencies in working out tax policies and reasonable tax levels applicable to RE projects.

7. Ministry of Planning and Investment (MPI): shall formulate policies and incentives to attract investments and facilitate domestic and foreign investors in the field of RE production.

8. Ministry of Education and Training (MoET) shall integrate RE-related knowledge and technology into courses of both general education and vocational training sub-sectors.

9. Power entities:

- The power grid management entities shall sign grid connection agreement(s) with RE-based power generation projects that have been licensed or incorporated in the RE-based power generation project portfolio as approved by competent authorities, and purchase all electricity produced from RE-based power projects that satisfy technical standards for grid connection within the jurisdiction of power entities.

- The expansion of transmission/distribution grids shall be performed in accordance with the national and local power development plans as approved by competent authorities, taking into account the foreseen elaboration of RE sources and linkages among different areas as well as electricity supply security.

- Power entities shall develop and apply smart grid technologies and energy-storage techniques, enhance grid operation and management, increase the reception of RE-based power sources.

- Power entities shall consider and make preparation for a market design and electricity system operations model, which allows integrating a larger proportion of power sources using variable REs (wind and solar).

- Research shall be conducted on improving the projection of hydro, wind and solar power potentials; and on integrating online projection data with control systems of different load dispatch centers.

- Consideration shall be made on different methods of determining the needs for additional measures to enhance the flexibility of the power system; research shall be carried out to explore and assess the costs and benefits of the electricity system if there is a high proportion of RE-based power sources.

10. Relevant Ministries, sectors, localities, enterprises, organizations and individuals shall, according to their functions and tasks, organize and well implement the provisions of this Decision.

#### **Article 2. Enforcement**

1. This Decision shall take effect from the signing date;

2. Ministers, Heads of Ministerial-level agencies, Heads of Government-dependent agencies, Chairpersons of the People's Committees of provinces and centrally-run cities and relevant entities/individuals shall be responsible for executing this Decision./.

**PRIME MINISTER**

**(Signed)**

#### ***Recipients:***

- Central Communist Party Secretariat
- Prime Minister, Deputy Prime Ministers;
- Ministries, Ministerial-level agencies, Government-dependent agencies;
- People's Councils and Committees of provinces and centrally-run cities;
- Central Office and Committees of the Communist Party;
- Party General Secretary Office
- State President Office;
- Ethnic Minority Council and National Assembly Committees;
- National Assembly Office;
- People's Supreme Court;
- People's Supreme Procuracy;
- State Audit;
- National Financial Monitoring Committee;
- Social Policy Bank;
- Vietnam Development Bank;
- Central Committee of Vietnam Fatherland Front;
- Central Agencies of Mass Organizations;
- Government Office: Minister-Chairperson, Vice Chairpersons, Prime Minister Assistant, E-Portal Manager, Departments of KTTH, KGVX and V.III;
- For filing: Clerical section, KTN (3 copies).

**Nguyễn Tấn Dũng**

*GIZ translation for Reference*