FY2019 Project for Ministry of the Environment Japan

# FY2019
# City to City Collaboration Programme for Low-Carbon Society
# Biomass Power Generation Project Using Rice Husk Briquettes Discharged from Rice Mills
# Report

2 March, 2020

Tromso Co., Ltd.
Hiroshima Prefecture

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# 1. Introduction

## 1.1 Background and purpose of the survey

All countries attended the 21st Conference of the Parties（COP21）to the UNFCCC (United Nations Framework Convention on Climate Change) at Suburbs of Paris, France in December 2015 and the Paris Agreement which is the legal framework of fair and effective climate policy measure after 2020 was adopted. Subsequently, the rule book that defines specific duties of each country was adopted at COP24 at Katowice, Poland.

It was determined to recognize the actions of non-state actors including cities and welcome efforts of all non-governmental entities (cities and other local governments etc.) and promote its scaleup, on COP21 at which the Paris Agreement was adopted. ″City ″ is a place for activities that support social and economic development, and a lot of residents live. Approximately half of the world's population live in Urban areas that account for 2% of the total land area of the world and its ratio is assumed to increase to 70% until 2050. It also assumed that urban areas emit more than 70% of global CO2 emissions as of 2006. the role of urban areas in mitigating climate change is important to accomplish the goals of the Paris Agreement by the steady conduction of climate policy measure in urban areas and reduction of greenhouse gas emissions.

In this project, Japanese research institutes, private companies, and universities implement the feasibility survey in order to support effectively and efficiently initiatives to create a low-carbon society in overseas cities, collaborating with Japanese cities with experience and know-how related to low carbon society formation.

The survey was conducted to reduce greenhouse gas emissions and form of the JCM projects that contribute to reduction of the gas on the aspect of highly demanding renewable energy in Can Tho City, Vietnam.

## 1.2 Project outline

The Basic survey was conducted on Geopolitics, economic situation, agriculture especially rice cultivation in Vietnam, the target country. The following surveys was carried out in order to clarify availability of rice husks that are the target of this rice husk power generation, environmental / economic / business rationality of the generated power, availability of it to actual rice mill factory and possibility of expansion in Vietnam and overseas.

(1) Basic survey in Vietnam
(2) Survey of Availability as Biomass Power
(3) Outline of targeted rice mill factory and energy use
(4) Potential introduction of this project as an alternative to power purchase at the target plant
(5) JCM Methodology (Draft)
(6) Others

## 1.3 Detail of this project

Details of the survey contents and implementation contents of the survey are as follows.

(1) Basic survey in Vietnam

Collecting the Latest information based on General situation in Vietnam by JETRO and hearing surveys in Vietnam, and reviewing the contents.

1)Geopolitics in Vietnam and Can Tho City
2)Economic situation in Vietnam
3)Power situation in Vietnam
4)Outline of agriculture/ rice cultivation
5)The law on environment and power

(2) Survey of as biomass power

Collecting the Latest information based on agricultural data such as rice production announced by The Food and Agriculture Organization (FAO) and hearing surveys in Can Tho City and local rice mill factory, and reviewing the contents.

1) Rice planting area in Vietnam
2)Usage situation of rice husks
3)Rice husk waste

(3) Outline of targeted rice mill factory and energy use

Collecting the basic information based on hearing surveys to TRUNG THANH HI-TECH FARMING JSC, a local rice milling company.

1)Factory outline (Address, Area, the number of workers, production item etc.)
2)Process of rice milling
3)Major equipment
4)Energy use (electricity etc.)
5)Cost for energy use (unit price of power etc.)
6)Rice production and rice husk waste
7)Usage situation of rice husks (storage, disposal, utilization etc. )

(4) Potential introduction of this project as an alternative to power purchase at the target plant

Appropriate biomass power generation method was considered on the basis of the above (1), (2) and (3). Subsequently, A preliminary design of the generation method was conducted. The preliminary design is conducted to create a layout and appropriate process flow making use of past construction achievements of biomass power plants. In addition, the estimation of construction and operating costs and profitability assessment was conducted. Furthermore, this project draft is that the generation by rice husk discharged from rice mill factory at first. Afterwards, the reduction of greenhouse gas emissions is accomplished due to inhouse-use of the all amount of electricity at a rice mill factory and replacement the electricity supplied from a power supply company to the bio electricity derived from rice husk, biomass resource. External consultant experienced in methodology drafting created the JCM methodology draft.

1)Installation equipment specifications based on power consumption
2)Selection of optimum equipment (Proposed installation equipment specifications)
3)Reduction of greenhouse gases
4)Potential for heat utilization
5)Availability of charcoal as a byproduct
6)Other way to use rice husk in the case that the amount of rice husk is more than the amount of power generation

7)Calculation of profitability (payback period and IRR) *In the case that JCM facilities are subsidized and not subsidized.
8)Introduction risk and benefit
9)Regulation under the domestic laws of Vietnam, and the existence of subsidies in Vietnam

(5) JCM methodology (draft)

JCM methodology (draft) assuming adaptation to this project was created referring to similar projects.

(6) Others

1)Field visiting and training of Can Tho City officers in Hiroshima
2)Workshop in Can Tho City
3)Local workshop
4)Others

## 1.4. Implementation system at the time of JCM project transformation

The structure of this survey is indicated as follows.

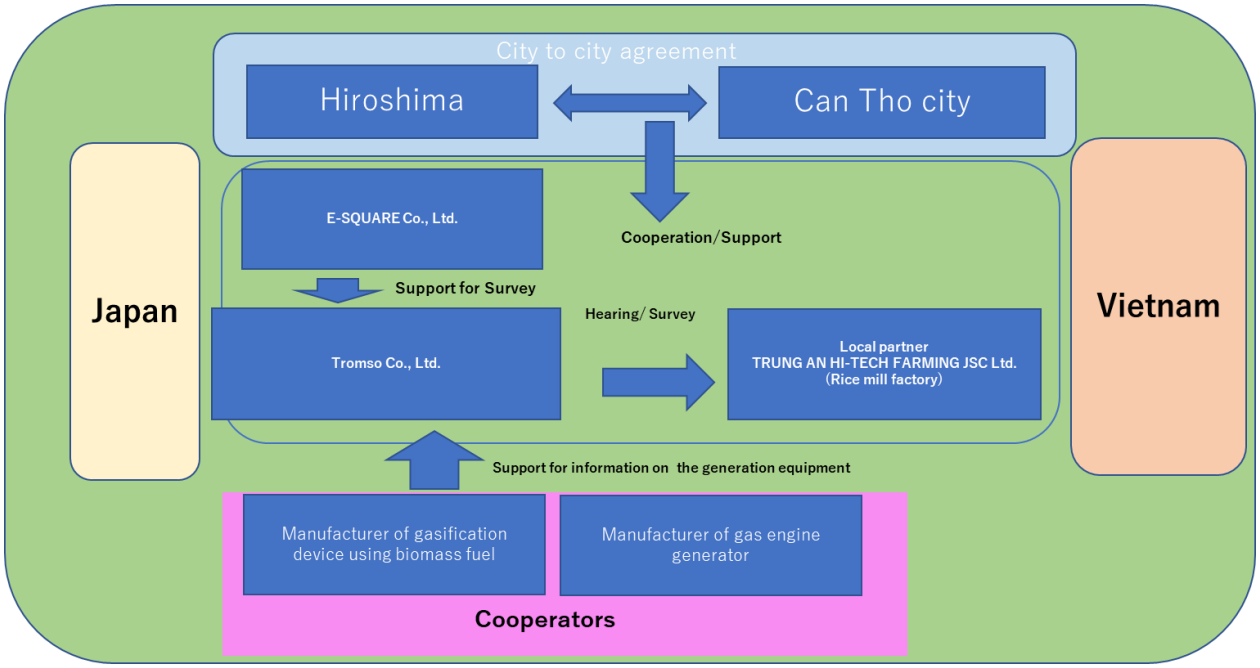



Figure 1 The structure of this survey

Tromso Co., Ltd. is the project implementer and Hiroshima prefecture, Japanese local government is co-implementer based on city-to-city collaboration. Tromso CO., Ltd. as implementer and E-Square Co., Ltd. as outsourcer conducted understanding the state of affairs in Vietnam and a legal system survey etc.

## 1.5. Schedule of this survey

The implementation schedule of this survey is indicated as follows.

| No. | Item/month | Sep-19 | Oct | Nov | Dec | Jan-20 | Feb | Mar | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Field visiting | | | | | | | | |
| | 【Survey】 | | | | | | | | |
| 2 | Basic information of Vietnam | | | | | | | | |
| 3 | Availability of rice husks | | | | | | | | |
| 4 | Usage of the power in the targeted rice mill factory | | | | | | | | |
| 5 | Feasibility the project in the targeted rice mill factory | | | | | | | | |
| 6 | Possibility to expand the project in Can tho city or Vietnam | | | | | | | | |
| 7 | relevant matters | | | | | | | | |
| | 【Event】 | | | | | | | | |
| 8 | Field visiting regarding the aspect of technology | | | | | | | | |
| 9 | Workshop in Vietnam | | | | | | | | |
| | 【Report】 | | | | | | | | |
| 10 | Creating a report | | | | | | Submission | | |
| | 【MOE(Ministry of Environment)】 | | | | | | | | |
| 11 | Monthly report | ○ | ○ | ○ | ○ | ○ | ○ | | |
| 12 | Meetings | | | ○ | | | ○ | | |
| 13 | Expense settlement | | | | | | | ○ | |
| Remarks | | | | | | | | | |

Figure 2　The implementation schedule

# 2. Basic survey of Vietnam

## 2.1 Geopolitics in Vietnam and Can Tho City

Formal name of Vietnam is 「Socialist Republic of Vietnam」(referred to as Vietnam) Vietnam is located on east side of Indochina Peninsula at 8.35 to 23.4 degrees north latitude / 102.8 to 109.4 degrees east longitude and bordered Laos and Cambodia to the west and South China Sea to the east. Ho Chi Minh city, Vietnam is 4,336km away from Japan and It takes for approximately 6 hours by airplane.

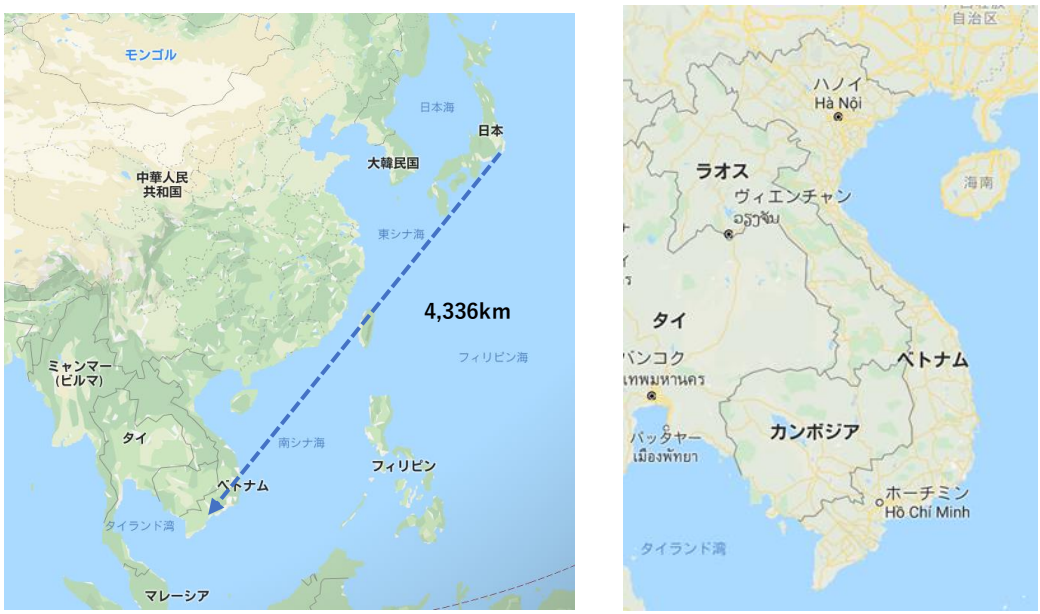



Figure 3 Location of Vietnam and Japan

Figure 4 Vietnam flag

Political system is the socialist republic which Vietnam communist party leads. The current system has continued since the North-South Reunification in 1976 after Ho Chi Minh Declaration of Independence in 1945 (Independent of the Socialist Republic of Vietnam) and Vietnam war.

The area is 329,241 ㎢(approx.90% of Japan's area), three quarters of which are mountainous. The region is divided into North / Central / South. Capital city, Hanoi located in the north is the central of political culture. Tourism becomes one of the major industries in Da Nang located in the middle part, the third industrial city following Ho Chi Minh city. In the South, Economic development is remarkable commercially in Ho Chi Minh city, which is changed from Former South Vietnam's capital, Saigon. Additionally, Mekong Delta is located in the

south, which is the center of rice production in Vietnam where it is extensive nationwide.

Population in Vietnam is 95,56 million which is composed of approx.85% of Kin tribe and the remaining 53 ethnic minorities. 35.7% of total population is concentrated in urban areas which is Hanoi, Ho Chi Minh city and Can Tho City which has a relationship of the city to city collaboration with Hiroshima, Japan. On the other hand, 64.3% of the rest lives in rural areas. According to Table (1)-2-Population pyramid, it is mainly consisted young people, people who is the working age under 60 years old and pre-working age. Future migration from rural to urban areas will be likely to happen. Overall, future economic growth can be expected, focusing on the aspect of population. (Japanese living in Vietnam is approx. 16,000 in 2016)

Table 1 Major indicators

| Item | content |
|---|---|
| Country name | Socialist Republic of Vietnam |
| Capital city | Hanoi |
| Area | 329,241 ㎢(Equivalent to the area of Japan excluding Kyushu region) |
| Population | Approx.95.56 million （Estimation in 2018）<br>Urban area: Overall ratio 35.7% / Rural area: 64.3% |
| Religion | Buddhism(80%), Christianity (9%)、others(Islam, Cao Dai etc.) |
| Language | Official terminology：Vietnamese |
| Administrative division | 58 provinces、5 direct-controlled municipalities （Hanoi, Ho chi minh, Haiphong, Danang and Can Tho City） |
| unemployment rate | 2.0% overall, 2.95% in urban area and 1.55% in rural area（＊Working population over 15 years old is 55.4 million） |

Source：JETRO「General situation in Vietnam」April, 2019

Unit: Million

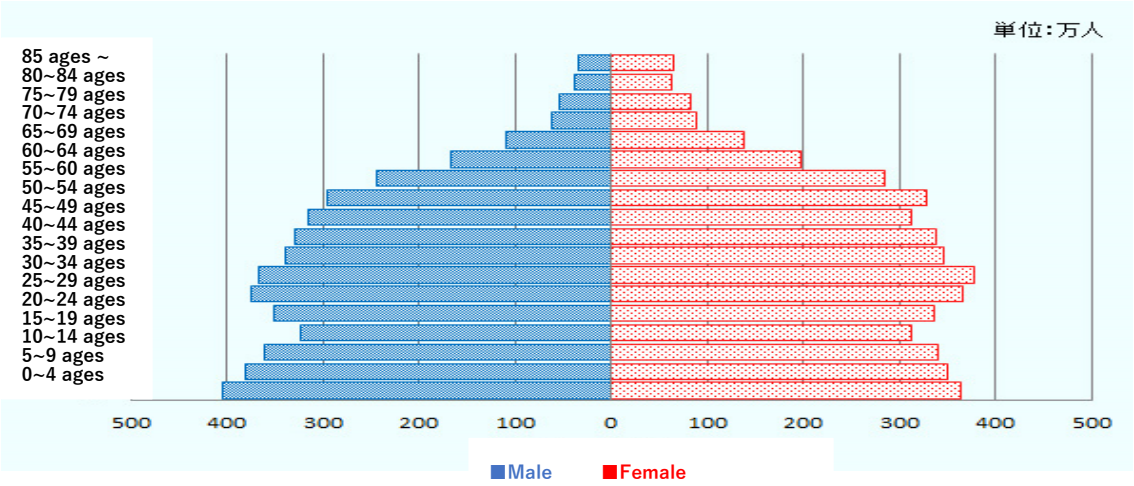



Figure 5 Population pyramid in Vietnam (2016)
Source：Region analysis report by JETRO

Figure 6 Economic development is remarkable in Ho Chi Minh City

Can Tho City is concluded the city to city collaboration agreement with Hiroshima, Japan and, in which TRUNG THANH HI-TECH FARMING JOINT STOCK COMPANY (the cooperator of this field survey) located. It is ranked the 5th of city in Vietnam and the central of south Mekong Delta region. The population is 1,235,171 people who is consisted 860,557 people in urban areas and 374,614 people in rural areas. It is 170km southwest away from Ho Chi Minh city and it takes for approximately 3.5 hours by vehicle.

Figure 7 The location of Cao tho city

Table 2 Population in Can Tho City (2019)

| Population | Urban area | Rural area | Male | Female |
|---|---|---|---|---|
| 1,235,171 | 860,557 | 374,614 | 612,543 | 622,628 |

Source：Statistics Bureau in Can Tho City

A major industry in Can Tho City is agriculture, especially rice cultivation because Mekong Delta region in Can Tho City is famous on rice cultivation. There are 232,000 hectares of farmland in city, which paddy fields is accounted for 80% of the lands. Approx. 1,000,000 ton of rice are produced yearly.

◇Hearing survey in Can Tho City

◇Paddy fields in Can Tho City

◇Rice shipped from rice mill factory(For export)

Figure 8 Current state in Can Tho City

## 2.2 Economic situation in Vietnam

Economy in Vietnam (2018) indicated steady growth.

The actual GDP growth included steadily to 7.1% from 2016, Unemployment rate steadied in the first half of 3% as well and consumer price inflation also remains stable at 3.5%, continuing from 2017. The trade balances have risen significantly since 2017, which was a surplus of $ 68.28 billion.

The GDP growth rate by industry indicates dramatical growth on the field of milling, construction and Service. The growth of agriculture was lower than the others. However, it was improved since 2017.

Above all, Vietnam current economic is promising.

Table 3 Major economic indicators in Vietnam

| | 2016 | 2017 | 2018 |
|---|---|---|---|
| **Actual GDP growth rate(%)** | **6.2** | **6.8** | **7.1** |
| **Rate of increase in consumer price index(%)** | **2.7** | **3.5** | **3.5** |
| **Unemployment rate(%)** | **3.2** | **3.2** | **3.0** |
| **Trade balance(1 million US dollers)** | **2,521** | **2,915** | **6,828** |
| **Current account balance(1 million US dollers)** | **8,235** | **6,124** | **n.a** |
| **Gross foreign currency reserves(1 million US dollers)** | **36,527** | **49,076** | **n.a** |
| **Gross external debt balance(1 million US dollers)** | **85,642** | **104,079** | **n.a** |
| **Exchange rate(Average amount of VND / 1 USD during the period)** | **21,935** | **22,370** | **22,602** |

Source：JETRO「General situation in Vietnam」April, 2019

Table 4 Actual GDP growth rate by industry in Vietnam

(Unit : %)

| | 2017 | 2018 | | | | | 2019 |
|---|---|---|---|---|---|---|---|
| | | | Q1 | Q2 | Q3 | Q4 | Q1 |
| Actual GDP growth rate | 6.8 | 7.1 | 7.4 | 6.8 | 6.9 | 7.3 | 6.8 |
| Agriculture, Forestry and Fisheries | 2.9 | 3.8 | 4.1 | n.a. | 3.5 | 3.9 | 2.7 |
| Mining and Construction | 8.0 | 8.9 | 9.7 | n.a. | 8.6 | 8.7 | 8.6 |
| Service | 7.4 | 7.0 | 6.7 | n.a. | 6.9 | 7.6 | 6.5 |
| Indirect tax(excluded subsidies) | 6.3 | 6.1 | 6.2 | n.a. | 6.0 | 6.3 | 6.1 |

(Attention) Estimated value, Quarterly growth compared to the corresponding period last year
(Source)Vietnam Statistical Office

Source：JETRO_ World Trade and Investment Report in 2019

Regarding exports and imports, exports account for 20.2% of electronic components of 50% of Industrial products and imports have similar tendency. Industrialization of Vietnam has been made progress for one of the

alternatives of a production base instead of china because of Soaring labor costs in China.

Main trading partners are USA and China on exports. On the other hand, China and South Korea account for 40% of the total imports. Japan is ranked the 3rd on exports and imports with Vietnam as the trade partner but has huge gaps from top 2 countries.

Table 5 Major items by import and export in Vietnam＜Based on The Customs＞

(Unit : 1million USD, %)

| | Export(FOB) | | | | | Inport(CIF) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2017 | 2018 | | | | 2017 | 2018 | | |
| | Amount | Amount | Composition ratio | growth ratio | | Amount | Amount | Composition ratio | growth ratio |
| Telephone, Parts | 45,271 | 49,219 | 20.2 | 8.7 | Computer electronic products, Parts | 37,774 | 43,135 | 18.2 | 14.2 |
| Sewing products | 26,120 | 30,477 | 12.5 | 16.7 | Machinery, Parts | 33,882 | 32,878 | 13.9 | △3.0 |
| Computer electronic products, Parts | 25,978 | 29,562 | 12.1 | 13.8 | Telephone, Parts | 16,435 | 15,920 | 6.7 | △3.1 |
| Machinery, Parts | 12,913 | 16,359 | 6.7 | 26.7 | Woven, Fabric | 11,381 | 12,772 | 5.4 | 12.2 |
| Footwear | 14,678 | 16,236 | 6.7 | 10.6 | Steel | 9,077 | 9,900 | 4.2 | 9.1 |
| Timber, Wood products | 7,702 | 8,907 | 3.7 | 15.6 | Plastic raw material | 7,582 | 9,083 | 3.8 | 19.8 |
| Marine products | 8,309 | 8,787 | 3.6 | 5.8 | Petroleum products | 7,065 | 7,636 | 3.2 | 8.1 |
| Transport equipment, Parts | 7,017 | 8,018 | 3.3 | 14.3 | Metal | 5,860 | 7,257 | 3.1 | 23.8 |
| Camera etc. | 3,801 | 5,239 | 2.1 | 37.8 | Plastic products | 5,465 | 5,924 | 2.5 | 8.4 |
| Steel | 3,147 | 4,547 | 1.9 | 44.5 | Fiber, leather raw material | 5,429 | 5,711 | 2.4 | 5.2 |
| Total(included others) | 215,119 | 243,697 | 100.0 | 13.3 | Total(included others) | 213,007 | 236,869 | 100.0 | 11.2 |
| Domestic enterprises | 62,570 | 71,930 | 29.5 | 15.0 | Domestic enterprises | 85,171 | 94,930 | 40.1 | 11.5 |
| Overseas enterprises | 152,549 | 171,767 | 70.5 | 12.6 | Overseas enterprises | 127,836 | 141,939 | 59.9 | 11.0 |

(Source)Vietnam General Administration of Customs

Source : JETRO「General situation in Vietnam」 April, 2019

Table 6 Major countries or areas by import and export in Vietnam ＜Based on The Customs＞

(Unit : 1million USD, %)

| | Export(FOB) | | | | | Inport(CIF) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2017 | 2018 | | | | 2017 | 2018 | | |
| | Amount | Amount | Composition ratio | growth ratio | | Amount | Amount | Composition ratio | growth ratio |
| USA | 41,592 | 47,530 | 19.5 | 14.3 | China | 58,592 | 65,516 | 27.7 | 11.8 |
| China | 35,404 | 41,366 | 17.0 | 16.8 | Korea | 46,961 | 47,582 | 20.1 | 1.3 |
| Japan | 16,859 | 18,834 | 7.7 | 11.7 | Japan | 16,977 | 19,041 | 8 | 12.2 |
| Korea | 14,819 | 18,241 | 7.5 | 23.1 | Hong Kong | 12,727 | 13,231 | 5.6 | 4 |
| Hong Kong | 7,582 | 7,958 | 3.3 | 4.9 | USA | 9,349 | 12,747 | 5.4 | 36.4 |
| Netherland | 7,105 | 7,085 | 2.9 | △0.3 | Thailand | 10,643 | 12,043 | 5.1 | 13.2 |
| Germany | 6,363 | 6,873 | 2.8 | 8.0 | Malaysia | 5,949 | 7,450 | 3.1 | 25.2 |
| India | 3,758 | 6,544 | 2.7 | 74.1 | Indonesia | 3,660 | 4,937 | 2.1 | 34.9 |
| UK | 5,422 | 5,779 | 2.4 | 6.6 | Singapore | 5,316 | 4,527 | 1.9 | △14.9 |
| Thailand | 4,808 | 5,487 | 2.3 | 14.1 | India | 3,940 | 4,147 | 1.8 | 5.3 |
| Total(included others) | 215,119 | 243,697 | 100.0 | 13.3 | Total(included others) | 213,007 | 236,869 | 100.0 | 11.2 |

(Source)Vietnam General Administration of Customs

Source : JETRO「General situation in Vietnam」 April, 2019

Secondly, a huge difference exists between the 1st group of ASEAN (Thailand/Malaysia/Indonesia), the 2nd group and Vietnam in comparison on the economy with surrounding areas. However, the Vietnam economy develops more than another group (Cambodia/Laos/Myanmar) and as much as Philippine currently.

The growth as much as the 1st group in near future will be likely not to be difficult, taking into account for demographic dividend and the alternative of production base instead of China.

Table 7 Comparison with ASEAN countries and surrounding areas

| Item | | Vietnam | Cambodia | Myanmar | Laos | Philippine | Indonesia | Thailand | Malaysia | Brunei | Singapore | China | Korea | Japan |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Area | A million ㎢ | 33 | 18 | 68 | 24 | 30 | 189 | 51 | 33 | 0.6 | 0.1 | 960 | 10 | 38 |
| Population | A million persons | 94.6 | 16.3 | 52.8 | 6.8 | 107.0 | 265.3 | 69.2 | 32.4 | 0.4 | 5.7 | 1,397.0 | 51.7 | 126.4 |
| political system | | Socialist republic | Constitutional monarchy | Presidential system/ Republic | People's democratic republic | Constitutional monarchy | Presidential system/ Republic | Constitutional monarchy | Constitutional monarchy | Constitutional monarchy | Constitutional monarchy | Pepple's democratic republic | democratic republic | Parliamentary cabinet system |
| Actual GDP growth ratio | % | 6.6 | 7.0 | 6.4 | 6.8 | 6.5 | 5.1 | 4.6 | 4.7 | 2.3 | 2.9 | 6.6 | 2.8 | 1.1 |
| Nominal GDP | A billion USD | 241.4 | 24.1 | 71.5 | 18.2 | 331.7 | 1,005.3 | 490.1 | 347.3 | 14.7 | 346.6 | 13,457.3 | 1,655.6 | 5,070.6 |
| GDP/person | USD | 2,553 | 1,485 | 1,354 | 2,690 | 3,099 | 3,789 | 7,084 | 10,704 | 33,824 | 61,230 | 9,633 | 32,046 | 40,106 |
| Infrastructure rate | % | 3.8 | 3.3 | 6.0 | 0.9 | 4.9 | 3.4 | 0.9 | 1.0 | 0.4 | 1.0 | 2.2 | 1.5 | 1.2 |
| Current account Balance | A billion USD | 5.2 | ▲2.6 | ▲3.8 | ▲2.5 | ▲5.0 | ▲23.9 | 44.8 | 10.1 | 1.1 | 64.1 | 97.5 | 82.3 | 183.7 |

Source: Excerpt from Estimated value 2018 by IMF / Japanese Ministry of Foreign Affairs website regarding area and political system

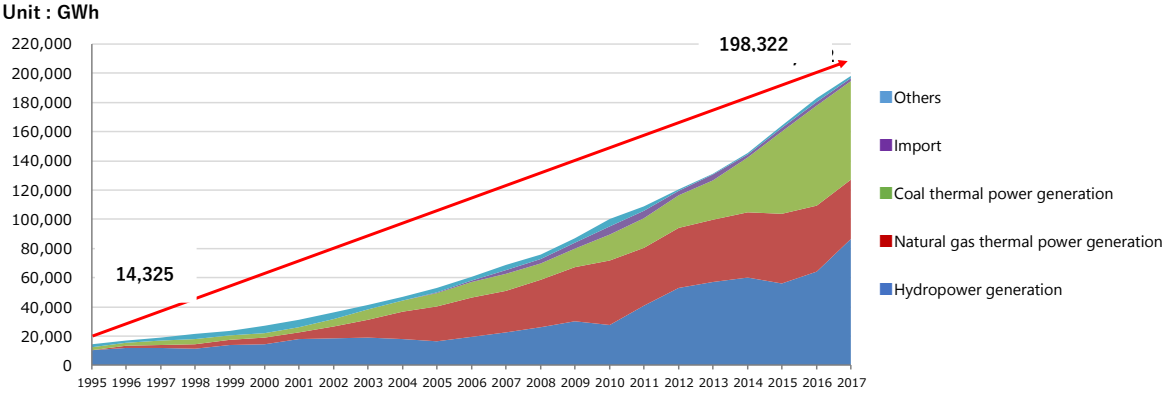
Source : JETRO Hanoi「General situation in Vietnam」 April, 2019

## 2.3. Power situation in Vietnam

Currently, the power demand in Vietnam has been increased and the total power generation has had significant growth yearly. The total power generation in 2017 increased by 8.4% year-on-year and increased nearly 14 times compared to 1995. The GDP per capita in 2017 has increased nearly 8 times compared to 1995 but the graph indicates the power demand has grown faster than economic expansion. Village electrification rate (electrification penetration rate in villages) has achieved 98.8%.

As of 2017, hydropower generation is the largest in both of power generation equipment's capacity and Actual power generation. However, A sharp increase in coal thermal power generation is noticeable after 2014. Coal thermal power generation has the highest output over hydropower generation

on the Electric-generating capacity, but Hydropower generation outpaced coal thermal power generation at 2017 because the water storage capacity of dams was sufficient.




Source: JETRO Hanoi office

Figure 9 Changes in all power generation

The electrical power policy is enforced on the basis of National Power Development Plan VII rev (effective from 18th March 2016) which is a stronger emphasis on Renewable Energy development and on power market liberalization for the period of 2016 – 2030 with the vision to 2030. The power generation at 2017 is 198,322GWh and the generation capacity is 45,410MW. The former aims 572,000GWh and the latter do 129,500MW by 2030.

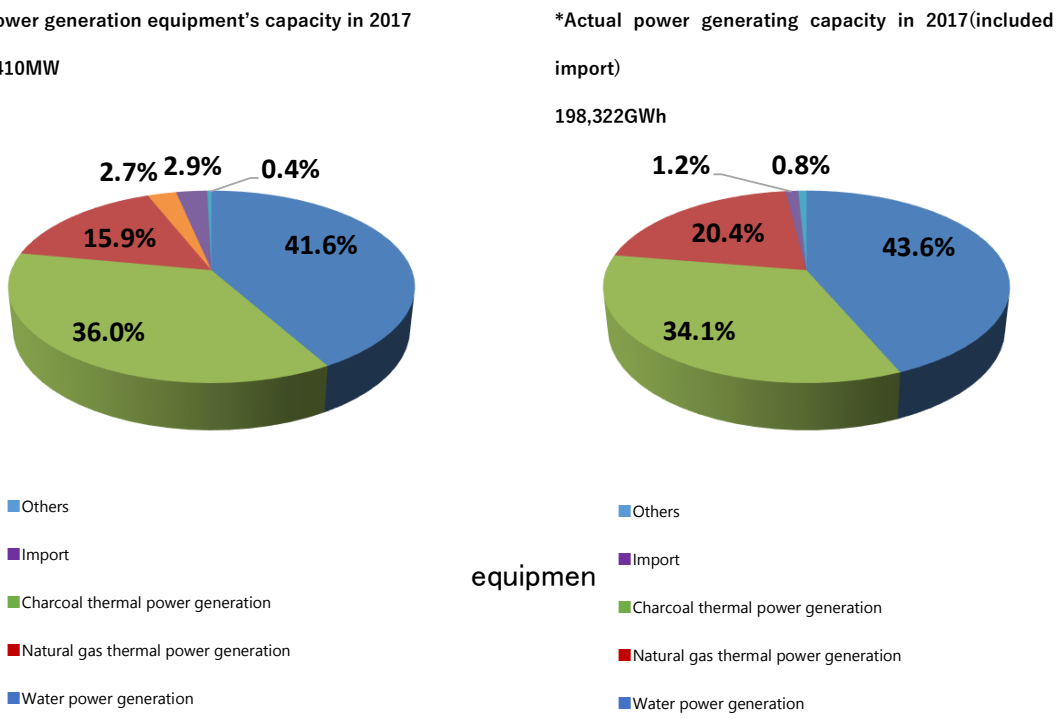



Figure 10 equipmen
capacity
Source :

The Electricity system was established EVN, VIETNAM ELECTRICITY (referred to as EVN) which is the government-owned company dealing the business of power generation, transmission, supply and trade at 1994. This company monopolizes on the power Transmission and distribution.

The government of Vietnam promotes the expansion of power generation by renewable energy and announces the target value that is the aim of equipment's capacity 27,195MW, power generation 61,000GWh by 2030. The target value of biomass power generation is the equipment's capacity 3,281MW and the power generation 12,000Gwh as well.

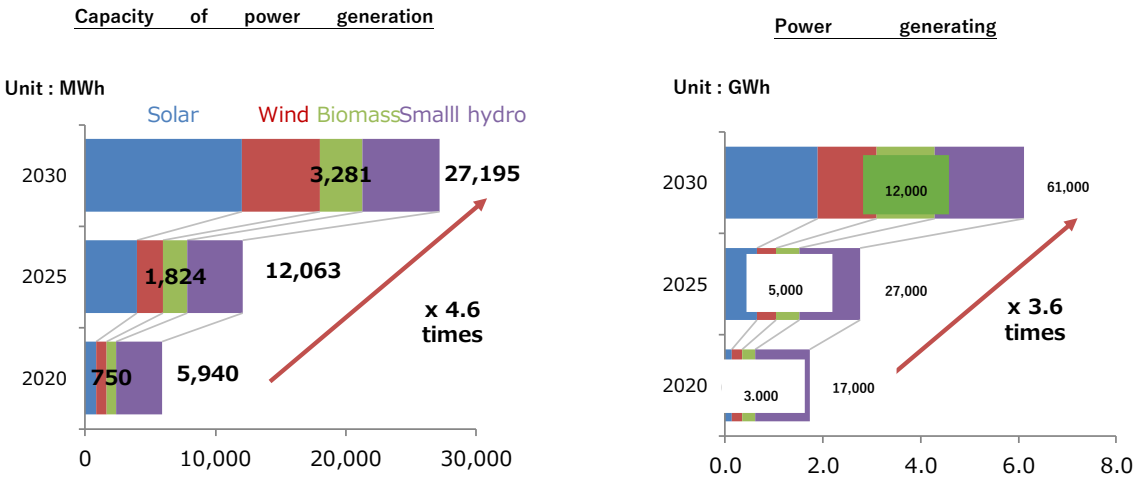



Figure 11 The goal of expansion of renewable energy in Vietnam
Source: JETRO Hanoi office

The ratio of thermal power generation in 2017 using fossil fuels was nearly 60%. It was approx. 35% in the case of coal. Namely, greenhouse gas emissions from power generation have been high and necessary to be improved. Compared to 0.55 kg-CO2/kWh of the CO2 emission factor in Japan regarding electric matters, it in Vietnam is 0.7 kg-CO2/kWh. Above all, actions to "Energy Transition" are needed because the factor is higher than it in Japan. Electricity prices in this region are increasing year by year. It has been raised 1,864.44VND/kWh by Ave 8.36% on 20th March 2019. According to Image 10, it can be confirmed 5.9% increase at 8.1 US cents / kWh (USD basis). The growth rate on USD basis is slowing compared at VND basis since VND value continues to weaken. A measurement to improve the deficit of EVN and rising coal prices results in Electricity charges increase. Electricity charges are higher commercial, people's welfare and industrial in order.

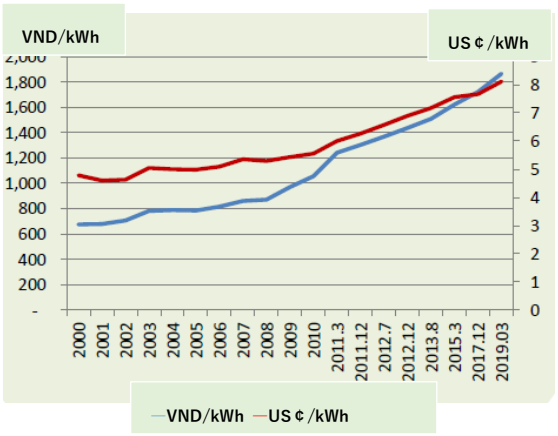



Figure 12 Changes in electricity charges （overall average）

Source：Survey on electricity in Vietnam_JETRO_201903

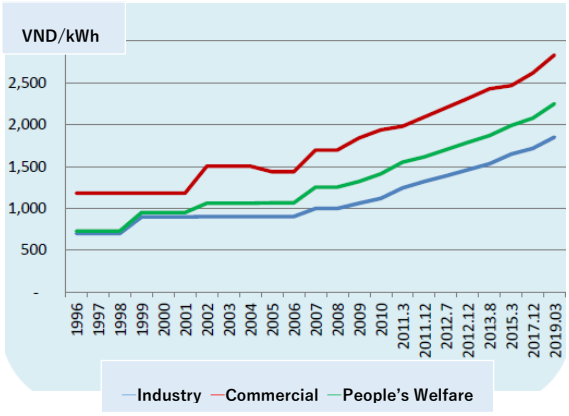



Figure 13 Changes in electricity charges （average by industry）

Source：Survey on electricity in Vietnam_JETRO_201903

The basis charge system has been accepted in Japan but there is no the system in Vietnam. Instead of the system, the pay-as-you-go rates which consisted of Three levels of unit price by time zone per day is adopted.

Decision 648/QD-BCT on 20th March 2019 on electricity price increase by the Ministry of Commerce and Industry in Vietnam was announced that it increased average 8.36%. The average electricity charge excluding value-added tax is from 1,720.65VND (approx.8.1JPY, 1VND=approx.0.0047JPY) to 1,864.44VND. The price increase was applied on 20th March 2019 as the effective date, since December 2017. The price varies depending on the application and time zone and is set between 970VND and 3,076VND per 1kWh in industrial use.

Din Kuan Chi vice president, EVN said that the major factors of price increase is rising coal prices and deviation in electricity purchase prices. Currently, dependence on coal–fired power generation has been increased but the price of coal and generation costs has been risen as well. In addition, EVN has purchased electricity from Power generation companies and the difference between the purchase price and the sale price tend to have been growing. Moreover, the payment of Water resources development rights and the price of natural gas have been increased, the deficit of EVN electricity business has been growing as the background of price increase. This price increase caused for EVN to correspond payments to customers and increase of electricity generation cost, but additional price increase is necessary to improve the electricity generation equipment and make a new investment.

Electricity charge increase forced companies to respond adding price increases to product prices or enduring for a while because it raised the production cost to manufacture. According to the estimation by the ministry of Commerce and Industry and Bureau of Statistics, it is predicted that this price increases grows consumer price index (CPI) by 0.29% and pushes down GDP by 0.22%.

The price increase should have been carried out during 2018 as Initial plan but it was postponed to2019 since Nguyen Xuan Phuc Prime Minister rejected it to achieve the goal of CPI and GDP.[1]

[1] JETRO business short letter

Table 8 The list of electricity charge in Vietnam(Revised at 20th March)

Unit: VND/kWh

| Item by fields | | Electricity charge | |
|---|---|---|---|
| | | Pre-revision | Post-revision |
| 1 | Electricity charge in manufacturing industry | | |
| 1.1 | Voltage: More than 110kV | | |
| ・General time a day | | 1,434 | 1,536 |
| ・Off-peak time a day | | 884 | 970 |
| ・Peak time a day | | 2,570 | 2,759 |
| 1.2 | Voltage: 22kV to less than110kV | | |
| ・General time a day | | 1,452 | 1,555 |
| ・Off-peak time a day | | 918 | 1,007 |
| ・Peak time a day | | 2,673 | 2,871 |
| 1.3 | Voltage: 6kV to less than 22kV | | |
| ・General time a day | | 1,503 | 1,611 |
| ・Off-peak time a day | | 953 | 1,044 |
| ・Peak time a day | | 2,759 | 2,964 |
| 1.4 | Voltage: Less than 6kV | | |
| ・General time a day | | 1,572 | 1,685 |
| ・Off-peak time a day | | 1,004 | 1,100 |
| ・Peak time a day | | 2,862 | 3,076 |
| 2 | Electricity charge in government and specialty | | |
| 2.1 | Hospital, Nursery school, kindergarten and school | | |
| 2.1.1 | Voltage: More than 6kV | 1,531 | 1,659 |
| 2.1.2 | Voltage: Less than 6kV | 1,635 | 1,771 |
| 2.2 | Public lighting, administrative business | | |
| 2.2.1 | Voltage: More than 6kV | 1,686 | 1,827 |
| 2.2.2 | Voltage: Less than 6kV | 1,755 | 1,902 |
| 3 | Electricity charge in commerce | | |
| 3.1 | Voltage: More than 22kV | | |
| ・General time a day | | 2,254 | 2,442 |

| | | | |
|---|---|---|---|
| ・Off-peak time a day | | 1,256 | 1,361 |
| ・Peak time a day | | 3,923 | 4,251 |
| 3.2 | Voltage: 6kV to less than 22kV | | |
| ・General time a day | | 2,426 | 2,629 |
| ・Off-peak time a day | | 1,428 | 1,547 |
| ・Peak time a day | | 4,061 | 4,400 |
| 3.3 | Voltage: Less than 6kV | | |
| ・General time a day | | 2,461 | 2,666 |
| ・Off-peak time a day | | 1,497 | 1,622 |
| ・Peak time a day | | 4,233 | 4,587 |
| 4 | Electricity charge in People's welfare | | |
| 4.1 | Electricity charge in household | | |
| 0 to 50kWh | | 1,549 | 1,678 |
| 51 to 100kWh | | 1,600 | 1,734 |
| 101 to 200kWh | | 1,858 | 2,014 |
| 201 to 300kWh | | 2,340 | 2,536 |
| 301 to 400kWh | | 2,615 | 2,834 |
| More than 401kWh | | 2,701 | 2,927 |

- General time a day (Monday to Saturday: 4:00am to 9:30am, 11:30am to 5pm and 8pm to 10pmSunday: 4am to 10pm)
- Off-peak time a day (10pm to 4am)
- Peak time a day (Monday to Saturday: 9:30am to 11:30am, 5:00pm to 8pmSunday: None)

Source: JETRO Business short letter

A Rate structure applicable to the rice mill factory targeted for this estimation is indicated as follows.

Table 9 The system of industrial electricity rates in Vietnam (Voltage: 22kV to less than 110kV)

| Stage | General | Peek time | Off peek time |
|---|---|---|---|
| | BT | CD | DT |
| VND/kWh | 1,452 | 2,673 | 918 |

Unit: VND/kWh

Source: EVN

The electricity charge for rice mill factory (TTC) targeted for this survey is indicated as follows.

EVNSPC
TỔNG CÔNG TY ĐIỆN LỰC MIỀN NAM

**HÓA ĐƠN GTGT (TIỀN ĐIỆN)**
(Bản thể hiện của hóa đơn điện tử)
Kỳ:3 Từ ngày: 16/01/2020 Đến ngày: 25/01/2020

Mẫu số: 01GTKT0/004
Ký hiệu: **AL/20E**
Số: **0034944**
ID HĐ: 795697207

**Công Ty Điện Lực TP Cần Thơ - Điện Lực Cờ Đỏ**
Địa chỉ: số 6, khu hành chính huyện Cờ Đỏ, TPCT
Điện thoại: 19009000 MST: 0300942001-022 ĐT sửa chữa: 19001006

**Tên khách hàng: Công Ty Cổ Phần Nông Nghiệp Công Nghệ Cao Trung Thạnh**
Địa chỉ: khu vực Thạnh Phước 1, P. Thạnh Hòa, Thốt Nốt, Cần Thơ
Điện thoại: 02923857218 MST: 1800650168 Số công tơ: 17090151 Số hộ : 0
Mã KH: PB11090039824 Mã T.toán: PB11090039824 Mã NN: 2201 Mã tổ: TNVT
Mã trạm: 1109C3341 Cấp ĐA: 5 Số GCS: K3030D001 P GCS: 25
Mã giá: BT: 100%*1555-SXBT-A; CD: 100%*2871-SXBT-A; TD: 100%*1007-SXBT-A

| Bộ CS | CHỈ SỐ MỚI | CHỈ SỐ CŨ | HS NHÂN | ĐN TIÊU THỤ | ĐƠN GIÁ | THÀNH TIỀN |
|---|---|---|---|---|---|---|
| BT | 2.189 | 2.183 | 100 | 600 | | |
| | | | | 600 | 1.555 | 933.000 |
| CD | 199 | 197 | 100 | 200 | | |
| | | | | 200 | 2.871 | 574.200 |
| TD | 557 | 555 | 100 | 200 | | |
| | | | | 200 | 1.007 | 201.400 |
| Cộng: | | | | **1.000** | | **1.708.600** |
| Thuế suất GTGT: 10% | | | | Thuế GTGT: | | **170.860** |
| Tổng cộng tiền thanh toán: | | | | | | **1.879.460** |
| *Số tiền viết bằng chữ: Một triệu tám trăm bảy mươi chín nghìn bốn trăm sáu mươi đồng.* | | | | | | |

**Ngày ký: 26/01/2020**
**Người ký : CÔNG TY ĐIỆN LỰC THÀNH PHỐ CẦN THƠ - ĐIỆN LỰC CỜ ĐỎ**

Figure 14 Electricity charge (the invoice of TTC)

## 2.4. Overview of Agriculture/ Rice cultivation

Vietnam is elongated from north to south, in which Three quarters of the country is made up of mountains, hills and plateaus. A wide range of agricultural crops are produced due to variety of terrain and climate. Rice produced in two fertile deltas which is the Mekong (south) and the Red River (north) is main export crops on the agriculture in Vietnam. In addition, Sugar cane, cassava, etc. are often produced. Coffee production is the world's second largest after Brazil (2017). Shrimp, tuna and other marine products are also valuable exports. A lot of such marine products have been exported to Japan as well.

| | Vietnam | | Japan | |
|---|---|---|---|---|
| | Nominal value | Proportion of GDP | Nominal value | Proportion of GDP |
| Gross Domestic Product (GDP) | 2,238 | | 48,724 | |
| Agriculture, forestry and fisheries GDP | 343 | 15 | 542 | 1.1 |
| GDP per capita(USD) | 2,342 | | 38,220 | |

Figure 15 Status of agriculture, forestry and fisheries in Vietnam and Japan
Source: Ministry of Agriculture, Forestry and Fisheries_ general situation of Agriculture, forestry and fisheries in Vietnam

| | Vietnam | | | | | Japan |
|---|---|---|---|---|---|---|
| | 2013 | 2014 | 2015 | 2016 | 2017 | 2017 |
| Rice(Paddy) | 4,404 | 4,497 | 4,509 | 4,311 | 4,276 | 978 |
| Sugar cane | 2,013 | 1,982 | 1,834 | 1,631 | 1,836 | 150 |
| Other fresh vegetables | 1,219 | 1,301 | 1,325 | 1,382 | 1,424 | 265 |
| Cassava | 976 | 1,021 | 1,074 | 1,091 | 1,027 | – |
| Maize | 519 | 520 | 529 | 524 | 511 | 0.02 |
| Other fresh fruits | 280 | 285 | 292 | 294 | 297 | – |
| Banana | 189 | 186 | 194 | 194 | 205 | 0.003 |
| Caffee(raw beans) | 133 | 141 | 145 | 146 | 154 | – |

Figure 16 Production situation Major agricultural crops
Source: Ministry of Agriculture, Forestry and Fisheries_ general situation of Agriculture, forestry and fisheries in Vietnam

Agricultural policies in Can Tho City have been conducted as below;
To rebuild the agriculture and form small scale of featural agricultural areas in order to development a potentiality and advantages of Can Tho City efficiently, aiming to steady and high effective agriculture.

- Regions characterized by high quality rice production.
- Regions characterized by concentration of rice for sales
- operation areas for advanced technologies around the city
- Specialty of fruit combined with ecotourism.
- Concentrated Aquaculture areas

To develop Agriculture and rural areas for Modernization towards sustainable situation comprehensively and promptly.

To expand Major Agricultural products (rice, fruit, marine product and livestock) and a production scale of rural industrial product, to concentrate on raw material supply for a processing industry or exports.

To develop institutes which focus on the variety development of high quality of crops, animal and aquatic species, combined with Leading researches and penetration on urban agricultural model and high-tech agricultural advanced model.2

## 2.5. Environmental administration in Vietnam

The Ministry of Natural Resources and Environment: MONRE takes a responsibility on environmental management administration based on the collaboration principle, cooperating with related ministries in regards with the law on Environmental Protection. The organizational reform in MONRE was conducted in September 2008 and the Vietnam Environment Administration (VEA) was established. This organization has the environmental management related functions such as policy or strategy planning, environmental impact assessment, and administrative execution such as inspections. VEA also provides some guidance to local departments and agencies.

VEA has established branch offices for VEA in the Department of Natural Resources and Environment (DONRE) in local provinces, responding to the organizational reform of MONRE. DONRE is positioned under the provincial People's Committee as the administrative organization of Vietnam and the local administration's command. The local governance in Vietnam is handled by the People's Committee of each provinces or centrally managed cities and is played an important role of Environmental pollution measures by the Provincial People's Committee.3

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2 Based on Hearing survey of Can Tho City

3 Ministry of Economy, Trade and Industry "Business FS for oversea expansion of high quality of energy infrastructure in 2017"

## 2.6. The law on environment and energy in Vietnam

Renewable energy laws in Vietnam is for example, National Energy Development Strategy, Electricity Law and Environmental Protection Law etc. The strategy and law in Vietnam are determined National strategies, laws, decisions / agreement and directives in turn. The strategy and law in Vietnam are defined National strategies, laws, decisions / agreement and directives in order. PDP7(REVISIONS TO THE NATIONAL POWER DEVELOPMENT PLAN FROM 2011 TO 2020 WITH VISIONS EXTENDED TO 2030) is defined as a basic plan. It is the electrical development plan from 2011 to 2020, which is revised in 18 March 2016 in order to accomplish until 2030. Revised PDP7 is announced the scenario from 2016 to 2030 which aims total power generation 572,000 GWh and power generation capacity 129,500 MW until 2030. This plan is included the energy security securement, energy-saving technologies introduction and the environment protection.

① Environmental laws and regulations

Environmental laws and regulations in Vietnam are shown by the below table.

Table 10 The list of Environmental laws and regulations in Vietnam

| Item | Law |
|---|---|
| General environmental management | Law on Environmental Protection enforced in 2015(No.55/2014/QH13) |
| | Decree detailing the Implementation of a Number of Articles of the Law on Environmental Protection (Decree No.19/2015/ND-CP) |
| | Decree on the Sanction of Administrative Violations in the Domain of Environmental Protection (Decree No.179/2013/ND-CP) |
| | Decree on February 14, 2015 on Environmental Protection Planning, Strategic Environmental Assessment, Environmental Impact Assessment and Environmental Protection Plans (Decree No. 18/2015/ND-CP) |
| | Decree providing for Incentives and Supports for Environmental Protection Activities (Decree No.04/2009/ND-CP) |
| | Circular on December 31, 2015 on the Guidelines for the corporate income tax policies for environmental protection activities |

| | |
|---|---|
| | regulated at the government's decree No. 19/2015/ND-CP (Circular 212/2015/TT-BTC) |
| | Decision approving the Strategy for Protecting the National Environment by 2020, and the Orientation towards 2030 (Decision 1216/2012/QD-TTg) |
| | Decree on January 6, 2015 on Environmental Damage Assessment (Decree No. 03/2015/ND-CP) |
| | Decree on December 31, 2014 regulating the Requirements Applicable to Environmental Monitoring Service Activities (Decree No. 127/2014/ND-CP) |
| | Circular on December 8, 2015 on the Evaluation, Inspection, and Final Check and Acceptance of Projects on Application of Natural Resources and Environment Information Technology (Circular No. 58/2015/TT-BTNMT) |
| Air quality | National Technical Regulation on Ambient Air Quality (QCVN 05/2013/BTNMT) |
| | National Technical Regulation on Hazardous Substances in Ambient Air (QCVN 06/2009/BTNMT) |
| | National Technical Regulation on Industrial Emission of Inorganic Substances and Dusts (QCVN 19/2009/BTNMT) |
| | National Technical Regulation on Industrial Emission of Organic Substances (QCVN 20/2009/BTNMT) |
| | National Technical Regulation on Emission of Thermal Power Industry (QCVN 22/2009/BTNMT) |
| | National Technical Regulation on Road Vehicles – Maximum permitted limits of exhaust gases (TCVN 6438:2005) |
| | Circular on August 17, 2015 on the Technical Procedure on Monitoring Exhaust Gas (Circular No. 40/2015/TT-BTNMT) |
| Water quality | National Technical Regulation on Surface Water Quality (QCVN 08-MT:2015/BTNMT) |
| | National Technical Regulation on Domestic Water Quality (QCVN 02/2009/BTNMT) |
| | National Technical Regulation on Underground Water Quality (QCVN 09-MT:2015/BTNMT) |
| | National Technical Regulation on Coastal Water Quality (QCVN 10-MT:2015/BTNMT) |
| | National Technical Regulation on Domestic Wastewater (QCVN 14/2008/BTNMT) |
| | National Technical Regulation on Industrial Wastewater (QCVN 40/2011/BTNMT) |

| | |
|---|---|
| Waste | National Technical Regulation on Hazardous Waste Thresholds (QCVN 07/2009/BTNMT) |
| | Decree on April 24, 2015 on Management Of Waste And Discarded Materials （ Decree No.38/2015/ND-CP） |
| | Circular on June 30, 2015 on Management of Hazardous Wastes （Circular No.36/2015/TT-BTNMT） |
| | Decision on March 22, 2015 on the recovery and disposal of waste （Decision No.16/2015/QD-TTg） |
| Noise | National Technical Regulation on Noise (QCVN 26/2010/BTNMT) |
| Vibration | National technical Regulation on Vibration (QCVN 27/2010/BTNMT) |
| Soil | National Technical Regulation on the Allowable Limits of Heavy Metals in the Soils (QCVN 03/2008/TNMT) |
| Forest resources | Law on Forest Protection and Development （No.29/2004/QH11） |
| | Decree on the Implementation of the Law on Forest Protection and Development (Decree No.23/2006/ND-CP) |
| Biodiversity | Law on Biodiversity (No.20/2008/QH12) |
| Environmental assessment | Decree on February 14, 2015 on Environmental Protection Planning, Strategic Environmental Assessment, Environmental Impact Assessment and Environmental Protection Plans （Decree No. 18/2015/ND-CP） |
| | Circular on March 29, 2015 on Strategic Environmental Assessment, Environmental Impact Assessment and Environmental Protection Plans （ Circular No. 27/2015/TT-BTNMT） |
| Land use and residents | Law on Land (No. 45/2013/QH13) |
| | Housing Law (No. 65/2014/QH13) |
| | Detail regulation on the Law on land (Decree No. 43/2014/ND-CP) |
| | Regulation on land price (Decree No. 44/2014/NĐ-CP) |
| | Law on Land lease, water lease (Decree No. 46/2014/NĐ-CP) |
| | Enforcement order on Housing Law (Decree No.90/2006/ND-CP) |
| | Law on Relocation, compensation, and support for land acquisition by the government (Decree No. 47/2014/NĐ-CP) |
| | Vocational training to Local residents until 2020 (Decision No.1956/2009/QD-TTg) |

| | |
|---|---|
| | Vocational training to farmer involved in farmland expropriation. (Decision No.52/2012/QD-TTg) |
| | The regulation of DONRE on Relocation, compensation, and support for land acquisition by the government (Circular No.37/2014/TT-BTNMT) |
| | The Ministry of Finance regulations on Establishment of fund and Accumulation on Relocation, compensation, and support for land acquisition by the government (Circular No.57/2010/TT-BTC) |

Source: Ministry of Economy, Trade and Industry "Business FS for oversea expansion of high quality of energy infrastructure in 2017"

② The law on electricity

The law on electricity (Luật Điện Lực, Electricity Law 28/2004/QH11) on renewable energy not only provides incentives (basis of FIT) related to investment, taxes and electricity bills to new energy and renewable energy source development business plan in accordance with MOF policy but makes sure to promote the use of renewable energy in organizations and individuals in rural and remote areas engaged in electrifying.

③ FIT (Feed-in Tariff)

FIT has been commenced since 2011. The target of FIT is solar, wind, biomass and waste. Purchase period is for 20 years.

FIT has been commenced since 2011. However, the power generation in 2019 remained only 0.8% of the total, and still depended on fossil fuel.

Table 11 FIT (Feed-in Tariff)

| | Biomass | | Wind power | Waste | Solar power |
|---|---|---|---|---|---|
| | Biomass power generation project on grid with power supply companies | | | | |
| | Cogeneration | Non-cogeneration (for only power generation) | | | |
| basis laws | Decree 24/2014/QD-TTg | Decision 942/QD-BCT** (Effective from 1st Jan, 2016) | Decree 37/2011/QD-TTg | Decree 31/2014/QD-TTg | Decree 11/2017/QD-TTg |

| | | | | | | |
|---|---|---|---|---|---|---|
| Electricity charge/kWh Without taxes | 1,120VND (5.8US¢) | Northern part | 1,644VND (7.36US¢) *** | 1,614VND (7.8US¢) | Direct burning 2,114 VND (10.05US¢) Combustible gas (Collection from large scales of dumps) 1,532 VND (7.28US¢) | 2,086VND (9.35US¢) |
| | | Middle part | 1,642VND (7.35US¢) | | | |
| | | Southern part | 1,673VND (7.48US¢) | | | |
| Subsidy/kWh | | | | 207VND to the side of power purchase (1cent) *From The Environmental Protection Fund | | |

Source：Created on the basis of the Vietnam electric power survey in 2018 by JETRO Hanoi office

Major directive and decisions related to FIT is the decision on support mechanisms for the development of biomass power projects in Vietnam (24/2014/QD-TTg), Decision on support mechanisms for the development of power generation projects using solid waste(s) in Vietnam(31/2014/QD-TTg)and Decision on support mechanism for the development of wind power project(37/2011/QD-TTg).

The current legislation in Vietnam is defined the term of ″Biomass for power generation ″. However, the specific reference of items is lacked because its definition does not be included which kinds of resource etc. ″Biomass energy for power generation ″ is indicated on the decision on support mechanisms for the development of biomass power projects in Vietnam (24/2014/QD-TTg) that Byproduct or waste available to generate power and It discharged through the process of agricultural production, processing in agriculture and forestry and other cultivation.

In addition, the draft of the national biomass power generation development plan in Vietnam for 2035 until 2025 exists as well. This draft was created by Energy Research Institute requested by The Ministry of Commerce and Industry and has been announced in 2017. It has not been approved as the law presently. However, it is likely to be operated as the material for seeking appropriate policy on biomass power generation.
It focuses on two types of biomass (wood residue and agricultural residue) and mentions specific each object.

<Wood residue>
It is included (by logging and pruning) forest trees, perennial commercial crops, woody fuel for fruit trees and wood waste from logging and pruning as follows.

- ✓ Log: Material derived from Natural forest, artificial forest and scattered trees
- ✓ Shrub: Material derived from Forestry area
- ✓ Bamboo (Neohouzeaua, Bambusa nutans): Material derived from Forestry area
- ✓ Log and branch cut down periodically: Material derived perennial commercial crops
- ✓ Pruned material: Material derived from fruit trees
- ✓ Branch, stump and bark: Material derived from harvested logs
- ✓ Wood residue (example: sawdust and woody chip etc.): Material derived from timber processing
- ✓ Other (wood derived from construction operation, Repair or renovation of houses and furniture in the case that database is available and can be estimated.)

<Agricultural residue>
Biomass derived from agricultural crops as byproduct (post-harvested) and waste (derived from the processing process) as follows.

- ✓ Rice straw and rice husk
- ✓ Sugarcane bagasse, leaf and tip parts
- ✓ Stem, pod and cob
- ✓ Stem and shell of peanut

- ✓ Stem and shell of soybean
- ✓ Cassava
- ✓ Leaf and shell of coconut
- ✓ Shell: Cashew nut and coffee
- ✓ Other trees (in the case that database is available and can be estimated)

It can be recognized that rice husk targeted in this project is regarded as biomass

## 3. Survey of availability as biomass power

### 3.1. Rice production

Vietnam is the 5th largest producer of rice in the world after China, India, Indonesia and Bangladesh (2017). Rice production in Vietnam in 2017 is 42,760,000 ton (rice paddy). Rice production in Japan is less than a quarter of Vietnam at 97,800 ton per year, the 13th of rice production worldwide.

Table 12 Top countries of rice(rice husk) production (2017)

Unit：Ton

| Rank | Country name | Production |
|---|---|---|
| 1 | China | 212,676,000 |
| 2 | India | 168,500,000 |
| 3 | Indonesia | 81,382,000 |
| 4 | Bangladesh | 48,980,000 |
| 5 | Vietnam | 42,763,682 |
| 6 | Thailand | 33,383,382 |
| 7 | Myanmar | 25,624,866 |
| 8 | Philippine | 19,276,347 |
| 9 | Brazil | 12,469,516 |
| 10 | Pakistan | 11,174,700 |
| 11 | Cambodia | 10,350,000 |
| 12 | Nigeria | 9,864,277 |
| 13 | Japan | 9,780,000 |

source：FAOSTAT

## 3.2. Usage of rice husks

Rice husks are regarded as valuables in Vietnam. Rice millers generally use rice husks as their own fuel for drying rice, and sell surpluses to outsiders. A Sales price of rice husks is 500～1,000VND/kg depending of the supply and the demand of the season.

Table 13 Sales price of rice husk and briquette

| Company | Sales price of rice husk | Sales price of briquette | Purchase price of briquette |
|---|---|---|---|
| TTC | 500～1,000VND/kg | 1,800VND/kg | In-house production |
| AGRICAM | 500～700VND/kg | 1,500～1,700VND/kg | In-house production |
| GENTRACO | Normal season：600～800VND/kg<br>Low season：1,200VND/kg | None | 2,000VND/kg |

Source: Tromso created the above table based on hearing surveys of each company

Currently, rice mill factories in Can Tho are generally keen to improve the quality of processed rice. It is difficult to control the moisture content of rice with rice husk combustion dryer and smell of smoke often stick to rice, which lead to lower grade rice. There is a tendency that electric dryers and heating systems using steam, which have no smell and are easy to control, are preferred and the use of rice husk by rice mills may decrease in the future. among the three rice mills visited during the survey, one rice mill had already adopted an electric dryer, and another rice mill was planning to introduce a steam heating method.

## 3.3. Available rice husks

There is no the official statistic on the waste amount of rice husks, but it is said that approx. 20% of paddy rice are rice husks. It can assume that approx. 8.55 million tons of rice husks are discharged yearly in Vietnam. Approx. 260 thousand tons of rice husks are discharged yearly since 80% (232,000 ha) of

the agricultural land in Can Tho City is for rice cultivation and approx. 1.3 million tons of rice paddy is produced per year.

4. Overview of targeted rice mill factory and energy use

4.1. Factory outlet (Address, Area, the number of workers, production item)

| | |
|---|---|
| Company name | TRUNG THANH HI-TECH FARMING JSC |
| Address | Ap Thanh Hung 1 xa Trung Humg Huyen Co Do,Tp. Can Tho |
| Area of factory | the 2nd rice mill factory : 7,000 ㎡<br>The 3rd rice mill factory : 14,500 ㎡ |
| The number of workers | 63 labors (Electricity management: 10 labors<br>Qualification holder: 5 labors |
| Business content | rice cleaning and rice sales |
| Production item | cleaning rice |

4.2. Process of rice mill

Purchasing rice with hulls (vessel transportation) → Drying → Hulling → Rice cleaning → Removing bran → Color sorting → Packing → Shipping ( Vessel transportation)

4.3. Major equipment

Table 14 Major devices or major equipment at the second rice mill factory

| No. | Product name | Output | Unit | Q'ty | Model No. |
|---|---|---|---|---|---|
| A | No.1 transformer | 1,100 | kVA | 1 | |
| 1 | Conveyor (the shape of trough) | 5.5 | kW | 1 | B500 |
| 2 | Conveyor for rice husks | 7.5 | kW | 1 | B500 |
| 3 | Conveyor (the shape of flat) | 5.5 | kW | 1 | B600 |
| 4 | Conveyor (the shape of flat) | 5.5 | kW | 1 | B600 |
| 5 | Bucket-loading | 7.5 | kW | 1 | F400 |
| 6 | Bucket-loading | 5.5 | kW | 1 | F400 |
| 7 | Bucket-loading | 2.2 | kW | 1 | E250 |
| 8 | Conveyor | 7.5 | kW | 1 | EX700 |
| 9 | Conveyor | 1.5 | kW | 1 | Ep100 |
| 10 | Scales and packing machines | 0.5 | kW | 1 | |
| 11 | Hulling machine | 250 | kW | 3 | DRTA |

| | | | | | |
|---|---|---|---|---|---|
| 12 | Hulling machine | 250 | kW | 11 | CL-600C |
| 13 | Rice milling machine | 755 | kW | 1 | |
| 14 | Rice milling machine | 755 | kW | 1 | |
| 15 | Automatic rice milling machine | 55 | kW | 2 | |
| 16 | Bran removal machine | 110 | kW | 1 | CBL 10C |
| 17 | Bran removal machine | 132 | kW | 1 | CBL 10C |
| 18 | Color sorter | 4 | kW | 2 | BCC-M320A |
| 19 | Color sorter | 4 | kW | 2 | BCC-M320A |
| 20 | Color sorter | 4 | kW | 1 | BCC-S480CL |
| 21 | Color sorter | 8 | kW | 1 | 12R-6SXM-756 |
| 22 | Compressor | 75 | kW | 1 | VS660 |
| 23 | Air dryer | 37 | kW | | HANKAN 2000L |
| 24 | Sub-equipment for color sorter | 5 | kW | 1 | |
| 25 | Color sorting system | 4 | kW | 4 | |
| 26 | Automatic packing system | 1 | kW | 1 | TC-40 |
| 27 | Transformer | 1250 | kVA | 1 | 3phi22kV/400V |
| 28 | Generator | 75 | kVA | 1 | |

Source; TTC

Table 15 Major equipment at the third rice mill factory

| No. | Product name | Output | Unit | Q'ty | Regards |
|---|---|---|---|---|---|
| B | No.2 transformer load | 1,000 | kVA | 1 | :22,000V/380V |
| 1 | Drying system (Hot air blowing) | 30 | kW | 36 | Total load:630kW |
| 2 | Tanking system | 280 | m3 | 21 | |
| 3 | Conveyor for powder | 40 | t/h | 1 | |
| 4 | Transformer for 3 phases | 1000 | kVA | 1 | |
| 5 | Firefighting equipment | | kW | 2 | |

## 4.4. Energy use (electricity etc.)

The survey on electricity consumption was carried out for 1 year from Jan 2018 to Jan 2019.

Table 16 Power consumption at the second rice mill factory

| Period | | | Power consumption(kWh) | | | | Average power consumption by time zone (kWh) | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | BT(13h) | CD(5h) | TD(6h) | Total | BT | CD | TD |
| 1/11 | ～ | 2/11 | 214,900 | 58,400 | 96,400 | 369,700 | 661 | 467 | 643 |
| 2/11 | ～ | 3/11 | 219,300 | 80,500 | 105,800 | 405,600 | 675 | 644 | 705 |
| 3/11 | ～ | 4/11 | 346,800 | 102,400 | 145,000 | 594,200 | 1,067 | 819 | 967 |
| 4/11 | ～ | 5/11 | 308,500 | 98,500 | 124,500 | 531,500 | 949 | 788 | 830 |
| 5/11 | ～ | 6/11 | 202,600 | 94,800 | 175,600 | 473,000 | 623 | 758 | 1,171 |
| 6/11 | ～ | 7/11 | 265,400 | 87,600 | 115,400 | 468,400 | 817 | 701 | 769 |
| 7/11 | ～ | 8/11 | 264,500 | 80,800 | 162,800 | 508,100 | 814 | 646 | 1,085 |
| 8/11 | ～ | 9/11 | 255,200 | 78,200 | 148,800 | 482,200 | 785 | 626 | 992 |
| 9/11 | ～ | 10/11 | 234,500 | 104,000 | 152,200 | 490,700 | 722 | 832 | 1,015 |
| 10/11 | ～ | 11/11 | 200,400 | 88,400 | 160,500 | 449,300 | 617 | 707 | 1,070 |
| 11/11 | ～ | 12/11 | 244,600 | 68,700 | 104,200 | 417,500 | 753 | 550 | 695 |
| 12/11 | ～ | 1/11 | 186,900 | 86,500 | 124,400 | 397,800 | 575 | 692 | 829 |
| Total | | | 2,943,600 | 1,028,800 | 1,615,600 | 5,588,000 | 755 | 686 | 898 |

Capacity of transformer：1200kVA

Source; TTC

Table 17 Power consumption at the third rice mill factory

| Period | | | Power consumption(kWh) | | | | Average power consumption by time zone (kWh) | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | BT(13h) | CD(5h) | TD(6h) | Total | BT | CD | TD |
| 1/11 | ～ | 2/11 | 59,000 | 12,600 | 25,500 | 97,100 | 182 | 101 | 170 |
| 2/11 | ～ | 3/11 | 56,900 | 21,500 | 36,300 | 114,700 | 175 | 172 | 242 |
| 3/11 | ～ | 4/11 | 42,900 | 18,500 | 30,100 | 91,500 | 132 | 148 | 201 |
| 4/11 | ～ | 5/11 | 48,900 | 17,200 | 29,400 | 95,500 | 150 | 138 | 196 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 5/11 | ～ | 6/11 | 50,100 | 20,400 | 34,600 | 105,100 | 154 | 163 | 231 |
| 6/11 | ～ | 7/11 | 52,200 | 20,100 | 36,200 | 108,500 | 161 | 161 | 241 |
| 7/11 | ～ | 8/11 | 43,400 | 19,800 | 32,000 | 95,200 | 134 | 158 | 213 |
| 8/11 | ～ | 9/11 | 53,400 | 20,200 | 24,100 | 97,700 | 164 | 162 | 161 |
| 9/11 | ～ | 10/11 | 48,100 | 18,600 | 24,600 | 91,300 | 148 | 149 | 164 |
| 10/11 | ～ | 11/11 | 49,800 | 19,800 | 33,500 | 103,100 | 153 | 158 | 223 |
| 11/11 | ～ | 12/11 | 44,200 | 20,200 | 26,200 | 90,600 | 136 | 162 | 175 |
| 12/11 | ～ | 1/11 | 46,200 | 21,600 | 28,200 | 96,000 | 142 | 173 | 188 |
| Total | | | 595,100 | 230,500 | 360,700 | 1,186,300 | 153 | 154 | 200 |

Attention：Capacity of transformer：1,000kVA

Source; TTC

Table 18 Total power consumption at the second and third rice mill factory

| Period | | | Power consumption(kWh) | | | | Average power consumption by time zone（kWh） | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | BT (13h) | CD(5h) | TD(6h) | 合計 | BT | CD | TD |
| 1/11 | ～ | 2/11 | 273,900 | 71,000 | 121,900 | 466,800 | 843 | 568 | 813 |
| 2/11 | ～ | 3/11 | 276,200 | 102,000 | 142,100 | 520,300 | 850 | 816 | 947 |
| 3/11 | ～ | 4/11 | 389,700 | 120,900 | 175,100 | 685,700 | 1,199 | 967 | 1,167 |
| 4/11 | ～ | 5/11 | 357,400 | 115,700 | 153,900 | 627,000 | 1,100 | 926 | 1,026 |
| 5/11 | ～ | 6/11 | 252,700 | 115,200 | 210,200 | 578,100 | 778 | 922 | 1,401 |
| 6/11 | ～ | 7/11 | 317,600 | 107,700 | 151,600 | 576,900 | 977 | 862 | 1,011 |
| 7/11 | ～ | 8/11 | 307,900 | 100,600 | 194,800 | 603,300 | 947 | 805 | 1,299 |
| 8/11 | ～ | 9/11 | 308,600 | 98,400 | 172,900 | 579,900 | 950 | 787 | 1,153 |
| 9/11 | ～ | 10/11 | 282,600 | 122,600 | 176,800 | 582,000 | 870 | 981 | 1,179 |
| 10/11 | ～ | 11/11 | 250,200 | 108,200 | 194,000 | 552,400 | 770 | 866 | 1,293 |
| 11/11 | ～ | 12/11 | 288,800 | 88,900 | 130,400 | 508,100 | 889 | 711 | 869 |
| 12/11 | ～ | 1/11 | 233,100 | 108,100 | 152,600 | 493,800 | 717 | 865 | 1,017 |
| Total | | | 3,538,700 | 1,259,300 | 1,976,300 | 6,774,300 | 907 | 840 | 1,098 |

Source; TTC

Energy resource used at each process (purchasing, hulling, rice cleaning, sorting, quality checking, packing and shipping etc.) excluded the drying process at the targeted rice mill factory for this survey is not fossil fuel but only electricity. The energy resource used at the drying process is rice husks solid fuel which the rice mill factory produced. 100% of Electricity resource used at each process is supplied by EVN currently. Electric consumption is 6.77 million kWh.

## 4.5. Cost for energy use (Unit price of power etc.)

Electricity charge and Electricity consumption of the targeted rice mill factory (TTC) as below;

Table 19 Power consumption and electricity charge of targeted rice mill factory

| | | Normal | At peek | At offpeek | Total |
|---|---|---|---|---|---|
| | | BT | CD | TD | |
| Annual power consumption | kWh | 3,538,700 | 1,259,300 | 1,976,300 | 6,774,300 |
| Unit price | VND/kWh | 1,452 | 2,673 | 918 | |
| Annual electricity charge | VND | 5,138,192,400 | 3,366,108,900 | 1,814,243,400 | 10,318,544,700 |
| Annual electricity charge | JPY | 23,943,977 | 15,686,067 | 8,454,374 | 48,084,418 |

Source; TTC

Annual electricity charge for approx. 6.77 million kWh is approx. 48.08 million JPY. The unit price of electricity charge is 7.1 JPY (before March 2019).

Only the pay-as-you-go rates is adopted, different from the 2 pillars of basic charge by volume(kW) and the pay-as-you-go rates on the electricity charge system in Japan. Unit price of pay-as-you-go rates is separated by time zone which is composed of noon, peek and night. The highest unit price (VDN/kWh) at peek time is 2,673VDN/kWh, the second highest unit price (VDN/kWh) is 1,452VDN/kWh at noon and the lowest unit price (VDN/kWh) is 918VDN/kWh at night.

4.6. The amount of rice production and rice husks

The amount of paddy rice processed in the target rice mill is 300 thousand tons and 60 thousand tons (average 5,000 t/month, the maximum 6,000 t/month and the minimum 3,000t/month) of rice husks are discharged annually.

4.7. Usage situation of rice husks (storage, disposal, utilization)

Storage status

Stored at indoor of factory at all the rice mill factories visited during the survey.

Usage status

Utilizing rice husk briquettes which rice mill factories produce, for drying process of paddy.

Sales of briquettes which cannot be consumed at the drying process: 1800VND/kg

Sales of raw rice husks as well

Sales price of rice husks: 500～1000 VND/kg (Rice husks are traded at high price during low season)

5. Potential introduction of this project as an alternative to power purchase at the target plant

5.1. Power consumption and proposed installation equipment specifications at target plants

① Equipment standard

Power plants are subject to relevant laws and regulations in Viet Nam

For grid-connected facilities, the laws and regulations of Viet Nam and the regulations of the Electricity Authority apply.

② Output and number of generators

The value should have the power supply capacity of the current rice mill plus the power used to manufacture fuel.

It should be noted that the fuel fabrication and production time zone is the general time zone. In addition, the number of generators is set to be a plurality so that power can be supplied by other generators when one generator is broken or repaired.

③ Electric power specification equipment

The power generation facilities installed in rice mills are connected to the power sources of electric power companies, and when surplus power is consumed in rice mills, the power can be sold, and when power generation is insufficient, the power can be purchased.

④ Start/Stop of generator and parallel operation control

The start and stop of the generator can be remotely controlled from the machine side and the switchboard, and the parallel operation is provided with an automatic parallel operation and disconnection device by a manual push button on the switchboard.

⑤ Electric power consumption by applicable factory hours

The electric power consumption by applicable factory hours is indicated as follows.

Table 20 Electric power consumption of surveyed rice milling plants

| Time zone | Unit | Normal | Peak | Off Peak | Total |
|---|---|---|---|---|---|
| | | BT | CD | DT | |
| | | 4:00～9:30 | 9:30～11:30 | 0:00～4:00 | |
| | | 11:30～17:00 | 17:00～20:00 | 22:00～0:00 | |
| | | 20:00～22:00 | — | — | |
| Total time | h | 13 | 5 | 6 | 24 |
| Annual operating days | days | 300 | 300 | 300 | 300 |
| Annual operating hours | h | 3,900 | 1,500 | 1,800 | 7,200 |
| Annual power consumption | kWh | 3,538,700 | 1,259,300 | 1,976,300 | |

| | | | | | |
|---|---|---|---|---|---|
| Average power consumption | kW | 907 | 840 | 1,098 | |

⑥ Gasification furnace fuel ratio of gasification power plant

Fuel consumption coefficient for power generation by gasification furnace manufacturers was investigated in order to confirm power required for fuel production based on confirmation of power generation fuel ratio of gasification furnace using briquettes of rice husks as fuel.

Table 21 Fuel ratio to the generated power of Company A and B

| | Unit | A Co. | B Co. |
|---|---|---|---|
| Gasification furnace fuel ratio | Kg/kWh | 1.417 | 1.0 |
| self-consumed power | kW | 100 | 100 |

⑦ Outline of fuel manufacturing equipment

The outline of the equipment for manufacturing fuel is as follows. It is assumed that rice husks are solidified by the equipment and are broken into small pieces by a crusher before gasification. The brand name of the solid fuel (briquette) production equipment is Grind Mill and will be hereinafter referred accordingly.

Table 22 Briquette manufacturing apparatus and Briquette Crusher

| | Unit | Grind Mil | Briquette Crusher |
|---|---|---|---|
| Manufacturing capability | Kg/h | 120 | 500 |
| Power | | AC-380V3φ50HZ | AC-380V3φ50HZ |
| Motor | | 4P-15kW | 4P-7.5kW |
| Electric heater | | 3—1.5kW | — |
| Power consumption | kW | 17 | 14.8 |

⑧ Estimation of fuel and power consumption required for fuel processing for both A and B to cover the power consumption of rice mills

fuel production time zone conditions Fuel is manufactured by 13 hour operation during normal hours (BT).

Table 23 Fuel required by Company A and B and power consumption required for fuel processing

| Items | Unit | A Co. | B Co. |
|---|---|---|---|
| Electricity consumed by rice mills | kW | 907 | 907 |
| Gasification furnace fuel ratio | Kg/kWh | 1.417 | 1.0 |
| Required fuel per hour for gasifier | Kg/h | 1,285 | 907 |
| Required number of grinding mills for the same purpose | unit | 10.71 | 7.56 |
| No. of pulverizers required for the above | unit | 2.57 | 1.81 |
| Briquette production power | kW | 182 | 128 |
| Power for manufacturing crushed products | kW | 38 | 27 |
| Power consumption of gasifier | kW | 100 | 100 |
| Total power consumption | kW | 1,227 | 1,162 |

The generator output of the gasification power plant is assumed to be 1500 kW in consideration of this estimated value and the fuel manufacturing equipment.

⑨ -1, Setting of generator output, power consumption after plant installation, and trading power profit

Condition-1, The generator is operated at full power (1,500 kW) for 24 hours and 300 days.

Condition-2, Fuel production is conducted 13 hours a day, 300 days a year, during normal hours.

Table 24 Example of gasification furnace of Company A

| Operating hours | Unit | Normal | Peak | Off Peak | Total |
|---|---|---|---|---|---|
| Operating time | h | 13 | 5 | 6 | 24 |
| Generator output | kW | 1,500 | 1,500 | 1,500 | |
| Gasification furnace fuel ratio | Kg/kWh | 1.417 | 1.417 | 1.417 | |
| Necessary fuel | kg/h | 2,126 | 2,126 | 2,126 | 6,377 |
| Annual operating days | days | 300 | 300 | 300 | 300 |
| Annual operating hours | h | 3900 | 1500 | 1800 | |

| | | | | | |
|---|---|---|---|---|---|
| Annual fuel requirement | kg | 8,289,450 | 3,188,250 | 3,825,900 | 15,303,600 |
| Briquette production capacity | kg/h | – | – | – | 120 |
| Annual production of briquettes | kg/unit | – | – | – | 468,000 |
| Required number of grinding mills | unit | 32.7 | – | – | 32.7 |
| Grind mill power consumption | kW/unit | – | – | – | 17 |
| Power consumption during processing | kW | 555.9 | – | – | 555.9 |
| Crusher capacity | kg/h | – | – | – | 500 |
| Annual pulverized product production | kg/unit | – | – | – | 1,950,000 |
| Number of grinding machines required | unit | 7.85 | – | – | 7.85 |
| Power consumption of pulverizer | kW | – | – | – | 14.8 |
| Power consumption during processing | kW | 116.2 | – | – | 116.2 |
| Plant's own power consumption | kW | 100 | 100 | 100 | |
| Power consumption of rice milling facilities | kW | 907 | 840 | 1,098 | |
| Total generator load power | kW | 1,679 | 940 | 1,198 | |
| generator load factor | % | 112% | 63% | 80% | |
| Electric power purchased by FIT | kW | 179 | – | – | |
| Electric power purchased annually in the above table | kWh | 698,297 | – | – | |

| | | | | | |
|---|---|---|---|---|---|
| Unit price of electricity purchased | VND/kWh | 1,450.0 | – | – | |
| Electricity sales by FIT | kW | – | 660 | 402 | |
| Electric power sold in the above | kWh | – | 990,000 | 723,600 | |
| Unit price of electricity sold | VND/kWh | – | 1,673 | 1,673 | |
| Annual profit | VND | -1,012,530K | 1,656,270K | 1,210,583K | 1,854,322K |

⑨-2, Setting of generator output, power consumption after plant installation, and trading power profit

Condition-1, The generator is operated at full power (1,500 kW) for 24 hours and 300 days.

Condition -2、Fuel production is conducted 13 hours a day, 300 days a year, during normal hours.

Table 25 Example of adoption by Company B

| Operating hours | unit | normal | Peak | Off Peak | Total |
|---|---|---|---|---|---|
| Operating time | h | 13 | 5 | 6 | 24 |
| Generator output | kW | 1,500 | 1,500 | 1,500 | |
| Gasification furnace fuel efficiency | Kg/kWh | 1.0 | 1.0 | 1.0 | |
| Necessary fuel | kg/h | 1,500 | 1,500 | 1,500 | 4,500 |
| Annual operating days | days | 300 | 300 | 300 | 300 |
| Annual operating hours | h | 3,900 | 1,500 | 1,800 | 7,200 |
| Annual fuel requirement | kg | 5,850,000 | 2,250,000 | 2,700,000 | 10,800,000 |
| Briquette production capacity | kg/h | – | – | – | 120 |
| Annual production of briquettes | kg/unit | – | – | – | 468,000 |

| | | | | | |
|---|---|---|---|---|---|
| Required number of grinding mills | unit | 23.1 | – | – | 23.1 |
| Grind mill power consumption | kW/unit | – | – | – | 17 |
| Power consumption during processing | kW | 392.3 | – | – | 392.3 |
| Crusher capacity | kg/h | – | – | – | 500 |
| Annual pulverized product production | kg/unit | – | – | – | 1,950,000 |
| Number of grinding machines required | unit | 5.5 | – | – | 5.5 |
| Power consumption of pulverizer | kW | – | – | – | 14.8 |
| Power consumption during processing | kW | 80.2 | – | – | 80.2 |
| Plant's own power consumption | kW | 100 | 100 | 100 | |
| Power consumption of rice milling facilities | kW | 907 | 840 | 1,098 | |
| Total generator load power | kW | 1,481 | 940 | 1,198 | 3,619 |
| Generator load factor | % | 99% | 63% | 80% | |
| Electric power purchased by FIT | kW | – | – | – | |
| Electric power purchased annually in the above table | kWh | – | – | – | |
| Unit price of electricity purchased | VND/kWh | 1,450 | 1,450 | 1,450 | |
| Electricity sales by FIT | kW | 18.7 | 560 | 302 | 881 |
| Yearly sales of electric power | kWh | 73,020 | 840,000 | 543,600 | 1,456,620 |
| Unit price of electricity sold | VND/kWh | 1,673 | 1,673 | 1,673 | |

| | | | | | |
|---|---|---|---|---|---|
| Annual profit | VND | 122,162K | 1,405,320K | 909,443K | 2,436,925K |

## 5. 2. Selection of optimum equipment (Proposed installation equipment specifications)

(1) Grind Mill (Rice husk briquette machine)

In addition to gasification device explained below, it is Tromso's Grind Mill (rice husk briquette machine) that is assumed to be introduced as a part of power generation equipment.


Figure 17 Grind Mill

Grind Mill is the device that can solidify rice husks through the process of grinding, compression molding and heating. The device can manufacture 120kg of rice husk briquettes per hour. (rice husk 120kg≒rice husk briquette 120 kg). The solid fuel is derived from 100% rice husks and does not require any addition of adhesive or binding materials when solidifying.

Rice husk has a hydrophobic cuticle layer (wax component) of the epidermis. The structure of rice husk is very hard due to the accumulation of silica in this layer. Processing rice husks wears metal parts quickly because of its hard structure.

However, the core parts of Grind Mill have a special surface treatment and are improved dramatically Abrasion resistance.
Moreover, the volume of solid fuel is approximately one tenth due to compression molding process. The calories of the solid fuel are approx. 4,000 kcal / kg and the solid fuel burns with a flame for approx. 30 minutes, in addition remains on fire for approx. 1 hour. Highly compressed solid fuel is difficult to collapse and tend to be able to be produced high quality of charcoal. It has high demands as raw material of activated carbon and heat preservation material for metal manufacturer.

The parts of Grind Mill on the process of grinding, compression molding and heating are indicated following image below.

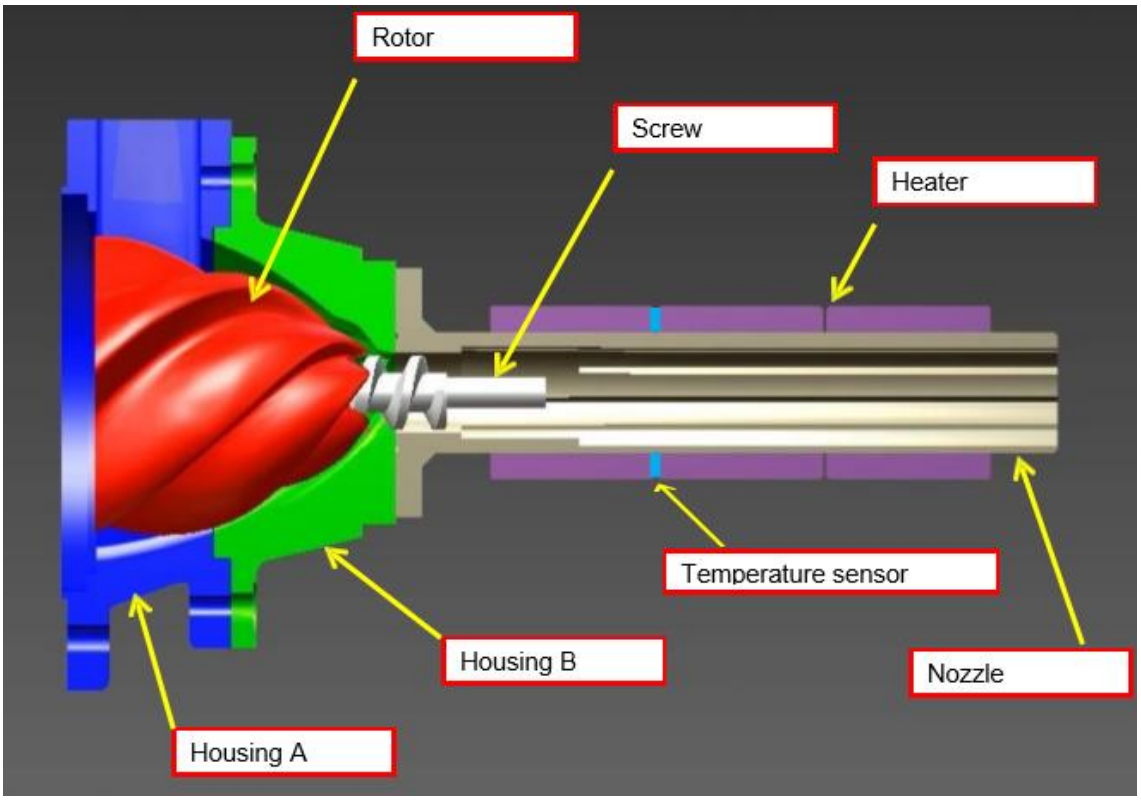



Figure 18 The core parts of Grind Mill

The process of grinding is performed by the rotation of the rotor and the housings A and B when rice husk is put into the raw material hopper. Treated rice husk proceeds to the direction of the nozzle due to the rotation of the rotor and screw. It is pushed out to the nozzle outlet side while heating by the heaters mounted on the nozzle. it is adhered and solidified by an effect of Lignin contained in rice

husk making use of the heating process. it is pushed out of the nozzle and discharged as rod-shaped solid fuel. Approx. 37 cm of solid fuel is equivalent to approx. 1 kg.

Refer to Appendix at the end of this report on the analysis results on rice husk solid fuel.

(2) Gasification power generation plant

Gasification power generation plant is the plant which can be generated by generators through the process of gasification by heating rice husk solid fuel and removal of impurities.

A Gasification power generation plant by Tohne Manufacturing,Inc. in Mukojima next to Innoshima where Tromso located was considered to introduce at the application stage of City-to-city Collaboration Programme. Its features are a water-free cooling system on the gas cooling process and Loofah filter that can be used repeatedly as an inexpensive gas filter.

The generation system which has the generation capacity of 1,500kw is estimated to introduce through this survey of the project but the maximum output of gasification power generation plant by Tohne Manufacturing, Inc. is no more than 20kw. Therefore, 75 units is required to introduce in order to meet the assumed generation capacity. In that case, it is predicted that the operation is complicated because the secure of large scale of area for the plant installation is necessary. Overall, we were supposed to consider the generation system by two other Japanese companies which can be communicated smoothly.

Image: the gasification power generation plant by Tohne Manufacturing, Inc.

As for biogas power plants, a company that can arrange a gasification furnace, an internal combustion engine, a generator, a switchboard, etc., in Vietnam, considering maintenance after installation, etc., was selected as a condition for selection.

Other selection conditions for bio gasification power plants

- ✓ Biofuel
  a briquette made by processing rice husk

- ✓ Generating engine
  Bio-Generated gas burning engine using rice husk briquette as fuel

- ✓ Generating capacity
  Electricity consumption of existing facilities at rice milling plants and electricity used to manufacture briquettes for fuel

- ✓ Power system cooperation
  The electric power of the power plant is made to be the power supply of Vietnam Electric Power Co., Ltd. and reverse tide flow interconnection.

- ✓ Gasification furnace
  To provide a gasification furnace having a function of utilizing burned residue as charcoal.

(1) Company A

① Composition and main specifications of the gasification power plant

- ✓ gasification furnace
  3 sets (2 250 kW 40-foot containers)
  Installation of gasification furnace with low tar generation rate and gas purification equipment (ESP)
  Fuel consumption of gasification furnace 500 kW 17 tons in 24-hour operation (Varies by material)
- ✓ Engines
  3 x 500 kW 40 ft container
- ✓ air compressor

For starting 1 7.5 kW engine

- ✓ Generator

  3 – 500 kW AC –400 V 3 $\phi$ 50 HZ Class-F insulating brushless

- ✓ cubicle

  1set　Partial modification of existing products

- ✓ Power Distribution Board (MSB)

  1set 2)-1 ③Refer to the switchboard system.

- ✓ Fuel manufacturing apparatus

  33 grind mills 8 briquette crushers

- ✓ Others

  Briquette transfer conveyor

- ✓ ancillary equipment

  Briquette silo, charcoal recovery silo, security system, and remote-control system

- ✓ heat recovery

  Optional: Approximately twice as much heat as the generator output

  Note: Heat recovery of about 10.8 million kW is expected when a 1500 kW generator is operated at full power for 24 hours and 300 days.

- ✓ durability

  Gasification furnace: Approximately 30 years (Maintenance Required)

② Gasification system flow

Controller ➡ Briquette Feeder ➡ Gasifier ➡ Cyclone ➡ Gas Primary Cooler ➡ Condenser (secondary cooling) ➡ Gas Secondary Purifier ➡ Reheater ➡ Biogas Outlet ➡ Engine ➡ Generator

③ Switchboard system

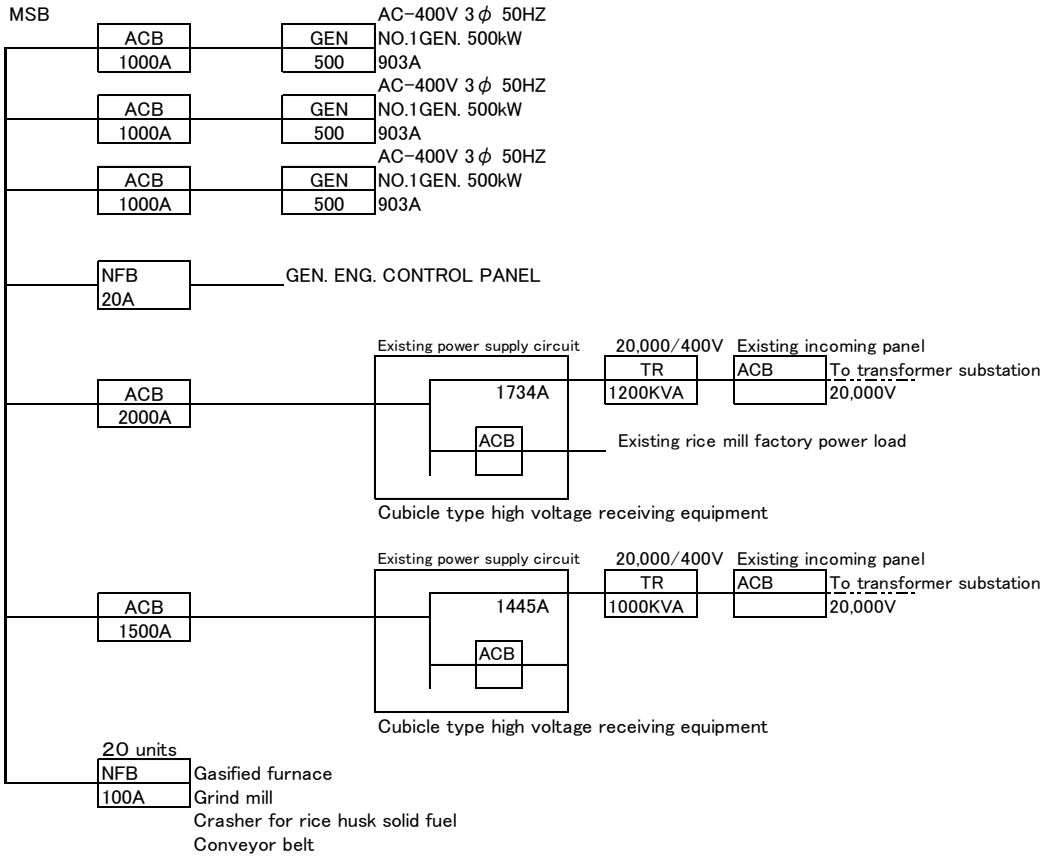


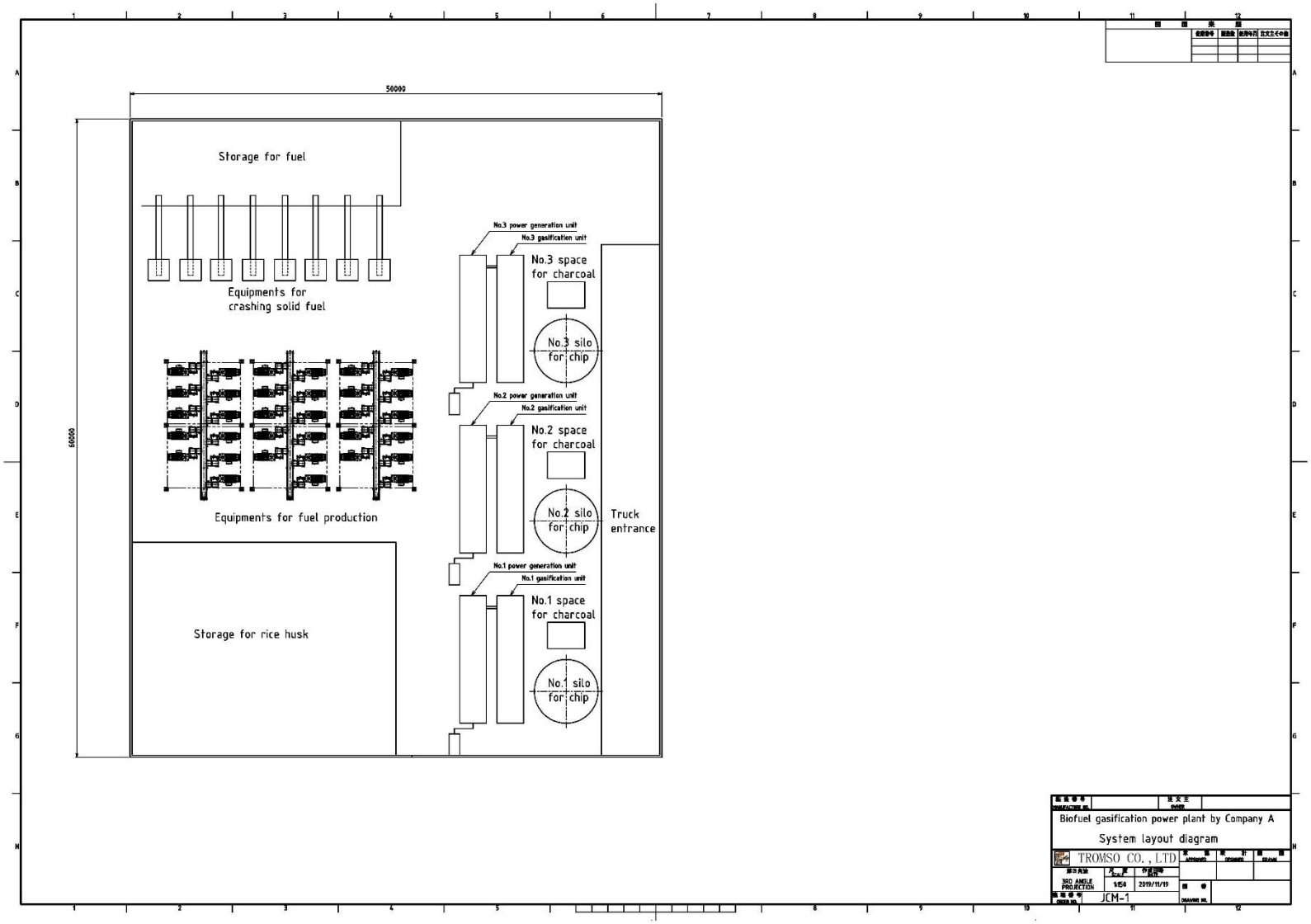

Figure 19 Power distribution unit system diagram (Company A)

④ Meters attached to switchboards

| | |
|---|---|
| wattmeter | 3 |
| voltmeter | 3 |
| ammeter | 3 |
| frequency meter | 3 |
| phase rotation indicator | 1 |
| automatic synchronous input mechanism | 1 |
| AVR | 3 |
| Reverse power protection device | 1 |
| generator start/stop switch | 3set |
| Generator engine control circuit | 3set |
| bifurcation NFB | 20-100A |

Table 26 Meters attached to switchboards

## ⑤ System layout diagram



(2) Company B

①Configuration of gasification power plant

- ✓ gasification furnace
  2sets-750kW　Updraft with semiflow circulating bed function
- ✓ engine
  3x500kW
- ✓ air compressor
  1x7.5kW
- ✓ generator
  3xAC-400V 3$\phi$50HZ Brushless　F-type
- ✓ cubicle
  1set　　Partial modification of existing products
- ✓ Power Distribution Board (MSB)
  2)-2　Refer to ③the switchboard system.
- ✓ Fuel manufacturing apparatus
  24x Briquette manufacturing apparatus　6x Briquette crushers
- ✓ Others
  Briquette transfer conveyor
- ✓ ancillary equipment
  Fuel briquette silo, coal recovery silo, and remote-control device
- ✓ heat recovery
  Optional: Approximately twice as much heat as the generator output
  Note: Heat recovery of about 10.8 million kW is expected when a 1500 kW generator is operated at full power for 24 hours and 300 days.

② Flow diagram of gasification system

Fuel (briquette) storage ➡Bucket conveyor➡gasification furnace ➡cyclone filter➡4pipe filter➡ electric dust collector ➡ dehumidifier ➡gas analyzer➡Gas control device ➡ internal combustion engine

③　Switchboard system

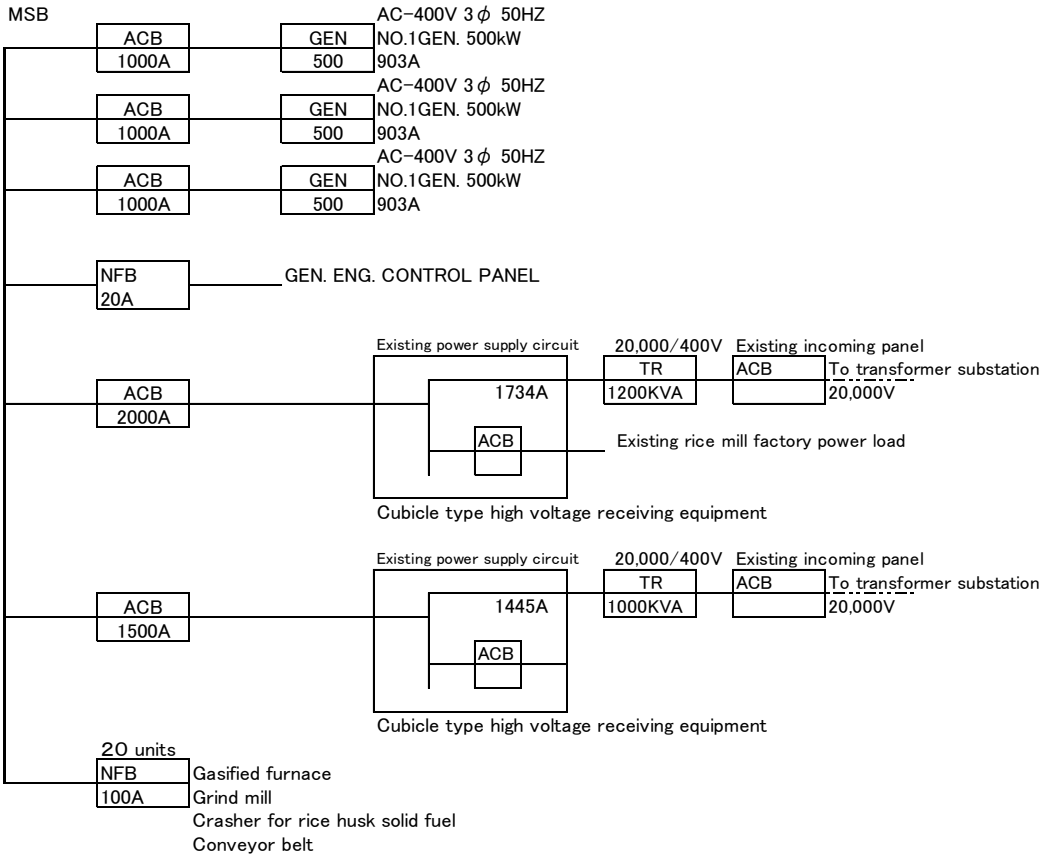
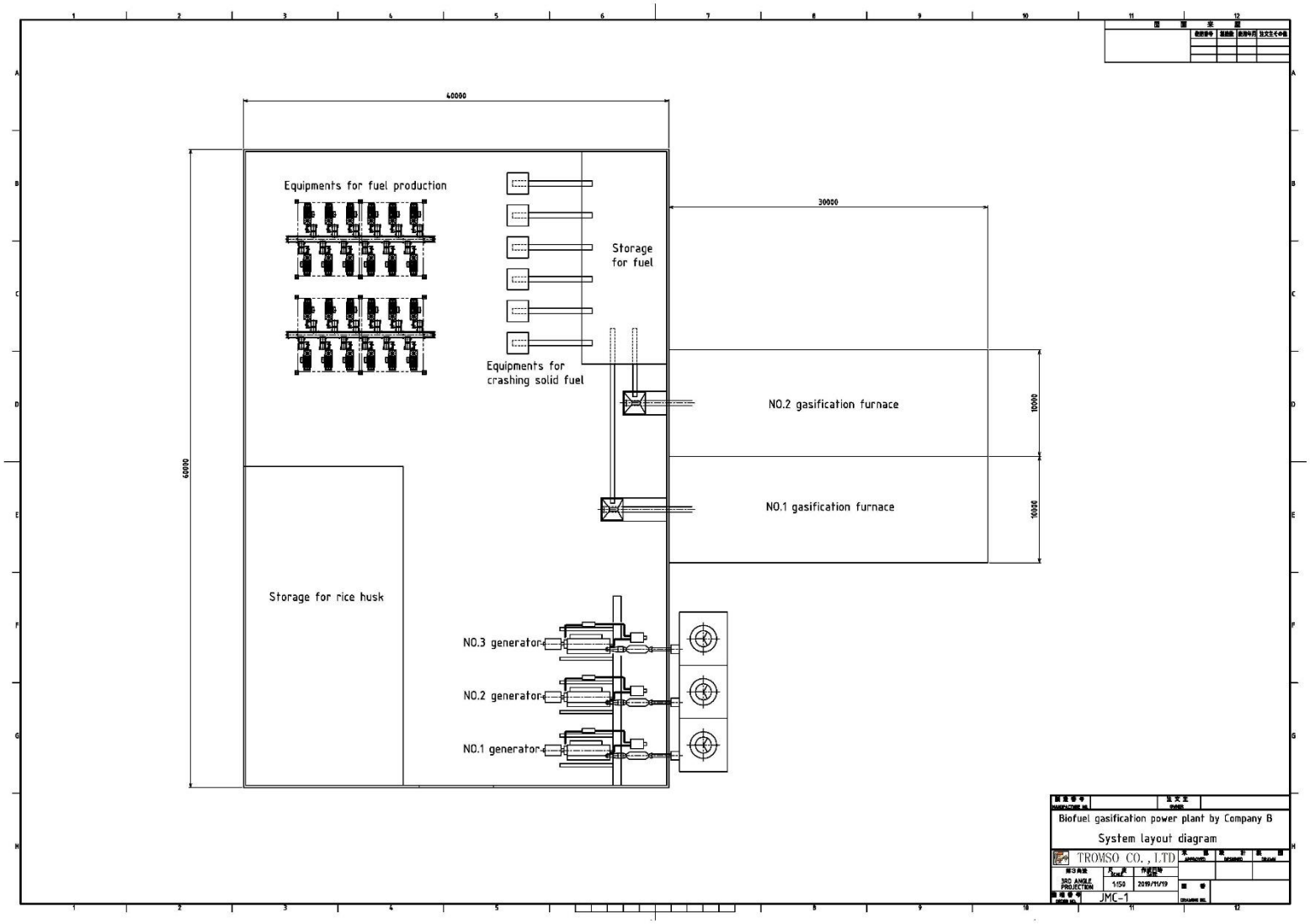



Figure 20 Power distribution unit system diagram (Company B)

④ Meters attached to switchboards

| | |
|---|---|
| wattmeter | 3 |
| voltmeter | 3 |
| ammeter | 3 |
| frequency meter | 3 |
| phase rotation indicator | 1 |
| automatic synchronous input mechanism | 1 |
| AVR | 3 |
| Reverse power protection device | 1 |
| generator start/stop switch | 3set |
| Generator engine control circuit | 2set |
| bifurcation NFB | 20-100A |

⑤ System layout diagram



⑥ Characteristics of the gasification furnace

The gasification furnace is a gasification system (FPT Corporation of India) by semi-flow circulation (improved type) updraft method, and the 1st feature is high cold gasification efficiency (~90%) and gasification system independent of raw material size. Since the FPT method is derived from the updraft method, tar is once produced as a by-product in the furnace, but in the next gas purification process, the tar fraction and particulates are removed by a cyclone and a gas cooling device (tar liquefaction), and in addition, a trace amount of residue is almost completely removed by an electrostatic treatment device (ESP), and clean synthesis gas can be supplied to the engine in the next process.

The second feature is that it corresponds to various raw materials. In addition to clean chips and wood waste, rice husks (Use of briquettes required) and bamboo (Raw material analysis confirmation required), amorphous municipal waste, coal (waste) and waste can be gasified as they are the feed material size can be used up to 20 cm without any problem. In addition, the moisture content of the fuel can be used up to 30 ~ 35%, although the thermal efficiency is slightly reduced by the moisture evaporation heat content.

## 5. 3. Reduction of greenhouse gases

By installing this bio gasification power plant and using grid interconnection to supply electricity to the rice mill, it is expected that CO2 emissions from the power plant will be reduced through sales of electricity in addition to the reduction of CO2 emissions from the power plant from the conventional grid interconnection.

(1) Current annual power consumption (System power consumption) of rice mills and CO2 emissions from power consumption

Table 27 Electricity consumption at the surveyed rice mill (Actual data for 2018)

| Category | unit | Normal | Peak | Off peak | Total |
|---|---|---|---|---|---|
| Total time | H | 13 | 5 | 6 | 24 |
| Annual operating days | days | 300 | 300 | 300 | 300 |
| Annual operating hours | h | 3,900 | 1,500 | 1,800 | 7,200 |
| Annual power consumption | kWh | 3,538,700 | 1,259,300 | 1,976,300 | 6,774,300 |

CO2 emissions from annual electricity consumption at current rice milling plants = grid electricity consumption x emission factor
= 6,774,300kWh x 0.000777t-CO2 /kWh = 5,264t-CO2

(2) CO2 reduction by installing Company A's plant

The net electricity generation from the plant is 8,204,904kWh/year and the amount of CO2 reduction is 6,375t-CO2 assuming 330 days operation.

(3) CO2 reduction by installing Company B's plant

The net electricity generation from the plant is 9,460,282kWh/year and the amount of CO2 reduction is 7,351t-CO2 assuming 330 days operation.

5.4. Potential for heat utilization

Co-generation (combined heating and electricity supply) is available on biogas gasification power plant. A feature of cogeneration is extracting heat energy while generating electricity. Effective use of more than 80% of the energy of rice husks is also possible in the case of using all electric and heat energy. The largest heat demand in rice mill factory is the drying process for paddy rice. The business profitability is likely to be improved, making use of heat energy in this process effectively.

TTC, the target for this equipment introduction was supposed to change from the direct burning rice drying process using conventional rice husk solid fuel to the indirect heating drying process in which high-temperature steam is generated in a boiler, and heated, dried by the steam. Specific considerations for incorporating the Waste heat utilization by rice husk power generation could not ne proceeded since new drying system to be introduced at TTC has not been determined the specification yet.

5.5. Availability of charcoal as a byproduct

Rice husk solidified by our grind mill (rice husk solid fuel) is gasified, and the gas is used to generate electricity with a gas engine in this project. some amount of charcoal remains after gasification of rice husk briquettes. It is assumed that selling the charcoal to Japan will progress the profitability of the business. (①raw material for rice husk activated carbon (export to Japan), ②heat preservation material targeted to steel manufacturers (export to Japan) and ③agricultural material (for domestic Vietnam). Our grind mill takes play a critical role of this project because it is important that the solid fuel has a high degree of compression before carbonization in regards with ① and ② and rice husk solid fuel distributed in domestic Vietnam does not have enough

compression rate. On the other hand, it does not depend on the degree of compression of the rice husk solid fuel in regards with ③.

① Used as a raw material for rice husk activated carbon

It has been found that activated carbon with special properties can be produced by etching treatment (removing process) of Silica ingredient and performing activation treatment (high-temperature treatment with steam) after rice husks are solidified by our grind mill and carbonized. A major company has already commercialized it.

The rice husk activated carbon has a porous structure with countless minute holes. The principle of adsorbing odor substances and impurities in the pores is the same as activated carbon, but the size of the pores is different in comparison with other activated carbon. In addition to the micropores (2 nm or less) found in conventional activated carbon, the rice husk activated carbon has mesopores (2 to 50 nm) and macropores (about 1 μm) larger than the micropores. In other word, small, medium, and large size of numerous of pores exist in combination. In addition to characteristics that can easily adsorb large molecular substances which is organic molecules such as humic substances and blue-green worms that cause water pollution, allergens and small proteins such as enzymes and viruses were difficult to adsorb with conventional technology, high-speed adsorption of low molecular compounds such as organic chlorides and pesticides is possible.

② Heat preservation material targeted to steel manufacturers

Rice husk charcoal is used as a heat preservation material for blast furnaces by steel manufacturers. Rice husk charcoal is mainly composed of fixed carbon and SiO2 (silicon dioxide). It is said to have the following advantages in comparison with Competing materials such as paper sludge.

- Coverability the entire surface of the molten metal in small quantities because of low bulk specific gravity.
- High thermal preservation effect due to the fixed carbon burning and generating heat gradually.
- SiO2 forms a layer after combustion of fixed carbon and blocks molten metal and outside air.
- low content of ″sulfur″ and ″phosphorus″ which are harmful elements for steel products

Tromso has already sold some amount of rice husk charcoal to a major steel manufacturer and can also sell charcoal produced as a by-product of this project.

③ Agricultural material (for local market in Vietnam)

Rice husk charcoals have already used in local market in Vietnam as a raw material for raising seedlings and a soil conditioner for fields. Rice husk charcoals contains SiO2 (silicon dioxide). It has the effect of making the plant strong and hard to fall down when mixed with soil, making it easy to absorb moisture and nutrients from the roots and suppressing continuous cropping failure. Pulverized charcoal which is difficult to sell can be sold as agricultural materials in domestic Vietnam, after satisfying the needs for ① and ② written above.

## 5.6. Other way to use rice husk in the case that the amount of rice husk is more than the amount of power generation

Rice husks is regarded as a reusable item and dealt as what is worth in Vietnam. Hearing survey with city staffs and 3 of rice mill factories result in rice mill factories reuse usually rice husks as their fuel for drying process of rice and sell the surplus to outside.

The annual paddy rice processing volume of TTC, the target rice mill is 300,000ton. On the other hand, the amount of discharged rice husk is 60,000ton (Average 5,000t/month, Maximum 6,000t/month and Minimum 3,000t/month). Approx.50,000t will be left intact after 9,504t are being used for 1,500kW gasification power plant. TTC will use the remaining amount in the drying process for rice husk in TTC rice mill factory and the unused portion will be sold as fuel, bedding material livestock and soil improvement materials.

## 5.7. Calculation of profitability (payback period and IRR)

### (1) Prerequisites

In this project, the electric power generated in the milled rice plant other than the electric power used by the biomass gasification plant to be introduced was estimated as the business income, and the preconditions of this project were set as follows.

| Prerequisites | Contents |
|---|---|
| Project Duration | 20 years |
| Depreciation period and legal durable years | 15 years |
| Equipment supplier | Company B |
| Exchange rate | 1VND＝0.00473JPY |

| | |
|---|---|
| Income tax | 4 years exemption for agribusiness |
| Initial investment | 1,300,000,000JPY |
| Amount applicable to subsidy | 1,200,000,000JPY |
| Amount of subsidy | 600,000,000JPY (subsidy rate 50%) |
| Net initial investment | 700,000,000JPY |
| Surplus power generation (consumed in-house) | 9,460,282 kWh |
| Days of operation | 330 days/year |
| Unit price of electricity | 8.0JPY/kWh |
| Power Savings (business revenue) | 76,775,666JPY/year |
| CO2 reduction within legal durable years | 110,260t-CO2 |
| Cost benefit performance (amount of subsidy/total CO2 reduction during legal durable years) | 5,442JPY/t-CO2 |

(2) Financial analysis

① Initial investment amount and funding plan

The initial investment for this project is estimated at 1,300,000,000 yen. The necessary funds for this project are assumed to be procured from TTC's own funds and equipment subsidies from the Ministry of the Environment of Japan.

② Income statement

In this project, the profit and loss are examined in 2 patterns: a case in which only surplus electricity is considered as business revenue (Case 1), and a case in which surplus electricity and sales revenue from charcoal generated from the power generation process are considered as business revenue (Case 2). The profit and loss calculations for this project are as follows.

(case1：A case in which only surplus electricity is considered as business revenue)

| Item | JPY |
|---|---|
| Revenue (Amount of reduction in electricity costs) | 76,775,666 |
| Rice husk cost * 1 | -26,972,352 |

| | |
|---|---|
| Labor cost* 2 | −3,000,000 |
| Maintenance and consumables costs | −40,000,000 |
| Depreciation cost | −46,666,667 |
| Total | −39,863,353 |

（case 2：A case in which surplus power and charcoal sales are regarded as business revenue）

| Item | JPY |
|---|---|
| Revenue (Amount of reduction in electricity costs) | 76,775,666 |
| Revenue (charcoal sales) * 3 | 72,159,000 |
| Rice husk cost | −26,972,352 |
| Labor cost | −3,000,000 |
| Maintenance and consumables costs | −40,000,000 |
| Depreciation cost | −46,666,667 |
| Total | 32,295,647 |

＊１：600VND/kg x9,504,000kg

＊２：Rice husk briquette production : 3 persons, Machine maintenance : 1 person Total 4 persons

＊３：2,851t = 1,500 t sold for 40 yen/kg and 1,351t sold for 9 yen/k

③ Cash flow statement

The following is the projected cash flow statement for this business. the cash flow calculation is analyzed separately with and without the facility subsidy.

- 3-1 Cash flow calculation with the facility subsidy

  1.3 billion JPY total capital investment, (600 million yen for equipment subsidies and 700 million yen for initial investment.)

Currency: JPY

| | 0 (year) | 1(year) | 2(years) | 3(years) | 4(years) | 5(years) | 6(years) | 7(years) | 8(years) | 9(years) | 10(years) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Net power generation( k Wh ) | 0 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 |
| Electricity savings | 0 | 76,775,666 | 76,775,666 | 76,775,666 | 76,775,666 | 76,775,666 | 76,775,666 | 76,775,666 | 76,775,666 | 76,775,666 | 76,775,666 |
| CO2 reduction (t-CO2) | | 7,351 | 7,351 | 7,351 | 7,351 | 7,351 | 7,351 | 7,351 | 7,351 | 7,351 | 7,351 |
| Net intial investment | 700,000,000 | | | | | | | | | | |
| Rice husk cost | | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 |
| Labor cost | | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 |
| Maintenance and consumables | | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 |
| Depreciation | | 46,666,667 | 46,666,667 | 46,666,667 | 46,666,667 | 46,666,667 | 46,666,667 | 46,666,667 | 46,666,667 | 46,666,667 | 46,666,667 |
| Profit before tax | | -39,863,353 | -39,863,353 | -39,863,353 | -39,863,353 | -39,863,353 | -39,863,353 | -39,863,353 | -39,863,353 | -39,863,353 | -39,863,353 |
| Corporate tax | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Profit after tax | | -39,863,353 | -39,863,353 | -39,863,353 | -39,863,353 | -39,863,353 | -39,863,353 | -39,863,353 | -39,863,353 | -39,863,353 | -39,863,353 |
| **Cash flow (case 1)** | -700,000,000 | 6,803,314 | 6,803,314 | 6,803,314 | 6,803,314 | 6,803,314 | 6,803,314 | 6,803,314 | 6,803,314 | 6,803,314 | 6,803,314 |
| **Accumulated cash flow (case 1)** | -700,000,000 | -693,196,686 | -686,393,372 | -679,590,058 | -672,786,743 | -665,983,429 | -659,180,115 | -652,376,801 | -645,573,487 | -638,770,173 | -631,966,859 |
| Charcoal sales | | 72,159,000 | 72,159,000 | 72,159,000 | 72,159,000 | 72,159,000 | 72,159,000 | 72,159,000 | 72,159,000 | 72,159,000 | 72,159,000 |
| Profit before tax | | 32,295,647 | 32,295,647 | 32,295,647 | 32,295,647 | 32,295,647 | 32,295,647 | 32,295,647 | 32,295,647 | 32,295,647 | 32,295,647 |
| Corporate tax | | 0 | 0 | 0 | 0 | 1,614,782 | 1,614,782 | 1,614,782 | 1,614,782 | 1,614,782 | 1,614,782 |
| Profit after tax | | 32,295,647 | 32,295,647 | 32,295,647 | 32,295,647 | 30,680,865 | 30,680,865 | 30,680,865 | 30,680,865 | 30,680,865 | 30,680,865 |
| **Cash flow (case 2)** | -700,000,000 | 78,962,314 | 78,962,314 | 78,962,314 | 78,962,314 | 77,347,532 | 77,347,532 | 77,347,532 | 77,347,532 | 77,347,532 | 77,347,532 |
| **Accumulated cash flow (case 2)** | -700,000,000 | -621,037,686 | -542,075,372 | -463,113,058 | -384,150,743 | -306,803,212 | -229,455,680 | -152,108,148 | -74,760,616 | 2,586,915 | 79,934,447 |

| | 11(years) | 12(years) | 13(years) | 14(years) | 15(years) | 16(years) | 17(years) | 18(years) | 19(years) | 20(years) | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Net power generation( k Wh ) | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 189,205,632 |
| Electricity savings | 76,775,666 | 76,775,666 | 76,775,666 | 76,775,666 | 76,775,666 | 76,775,666 | 76,775,666 | 76,775,666 | 76,775,666 | 76,775,666 | 1,535,513,323 |
| CO2 reduction (t-CO2) | 7,351 | 7,351 | 7,351 | 7,351 | 7,351 | 7,351 | 7,351 | 7,351 | 7,351 | 7,351 | 147,013 |
| Net intial investment | | | | | | | | | | | 700,000,000 |
| Rice husk cost | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 539,447,040 |
| Labor cost | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 60,000,000 |
| Maintenance and consumables | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 800,000,000 |
| Depreciation | 46,666,667 | 46,666,667 | 46,666,667 | 46,666,667 | 46,666,667 | 0 | 0 | 0 | 0 | 0 | 700,000,000 |
| Profit before tax | -39,863,353 | -39,863,353 | -39,863,353 | -39,863,353 | -39,863,353 | 6,803,314 | 6,803,314 | 6,803,314 | 6,803,314 | 6,803,314 | -563,933,717 |
| Corporate tax | 0 | 0 | 0 | 0 | 0 | 1,360,663 | 1,360,663 | 1,360,663 | 1,360,663 | 1,360,663 | 6,803,314 |
| Profit after tax | -39,863,353 | -39,863,353 | -39,863,353 | -39,863,353 | -39,863,353 | 5,442,651 | 5,442,651 | 5,442,651 | 5,442,651 | 5,442,651 | -570,737,032 |
| **Cash flow (case 1)** | 6,803,314 | 6,803,314 | 6,803,314 | 6,803,314 | 6,803,314 | 5,442,651 | 5,442,651 | 5,442,651 | 5,442,651 | 5,442,651 | -570,737,032 |
| **Accumulated cash flow (case 1)** | -625,163,545 | -618,360,230 | -611,556,916 | -604,753,602 | -597,950,288 | -592,507,637 | -587,064,985 | -581,622,334 | -576,179,683 | -570,737,032 | |
| Charcoal sales | 72,159,000 | 72,159,000 | 72,159,000 | 72,159,000 | 72,159,000 | 72,159,000 | 72,159,000 | 72,159,000 | 72,159,000 | 72,159,000 | 1,443,180,000 |
| Profit before tax | 32,295,647 | 32,295,647 | 32,295,647 | 32,295,647 | 32,295,647 | 78,962,314 | 78,962,314 | 78,962,314 | 78,962,314 | 78,962,314 | 879,246,283 |
| Corporate tax | 1,614,782 | 1,614,782 | 1,614,782 | 3,229,565 | 3,229,565 | 15,792,463 | 15,792,463 | 15,792,463 | 15,792,463 | 15,792,463 | 99,954,485 |
| Profit after tax | 30,680,865 | 30,680,865 | 30,680,865 | 29,066,083 | 29,066,083 | 63,169,851 | 63,169,851 | 63,169,851 | 63,169,851 | 63,169,851 | 779,291,798 |
| **Cash flow (case 2)** | 77,347,532 | 77,347,532 | 77,347,532 | 75,732,749 | 75,732,749 | 63,169,851 | 63,169,851 | 63,169,851 | 63,169,851 | 63,169,851 | 779,291,798 |
| **Accumulated cash flow (case 2)** | 157,281,979 | 234,629,511 | 311,977,042 | 387,709,792 | 463,442,541 | 526,612,392 | 589,782,244 | 652,952,095 | 716,121,946 | 779,291,798 | |

- 3-2 the cash flow calculation without the facility subsidy

  Zero equipment subsidy with initial investment of 1.3 billion JPY

Currency: JPY

| | 0 (year) | 1(year) | 2(years) | 3(years) | 4(years) | 5(years) | 6(years) | 7(years) | 8(years) | 9(years) | 10(years) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Net power generation( k Wh ) | 0 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 |
| Electricity savings | 0 | 76,775,666 | 76,775,666 | 76,775,666 | 76,775,666 | 76,775,666 | 76,775,666 | 76,775,666 | 76,775,666 | 76,775,666 | 76,775,666 |
| CO2 reduction (t-CO2) | | 7,351 | 7,351 | 7,351 | 7,351 | 7,351 | 7,351 | 7,351 | 7,351 | 7,351 | 7,351 |
| Net intial investment | 1,300,000,000 | | | | | | | | | | |
| Rice husk cost | | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 |
| Labor cost | | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 |
| Maintenance and consumables | | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 |
| Depreciation | | 86,666,667 | 86,666,667 | 86,666,667 | 86,666,667 | 86,666,667 | 86,666,667 | 86,666,667 | 86,666,667 | 86,666,667 | 86,666,667 |
| Profit before tax | | -79,863,353 | -79,863,353 | -79,863,353 | -79,863,353 | -79,863,353 | -79,863,353 | -79,863,353 | -79,863,353 | -79,863,353 | -79,863,353 |
| Corporate tax | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Profit after tax | | -79,863,353 | -79,863,353 | -79,863,353 | -79,863,353 | -79,863,353 | -79,863,353 | -79,863,353 | -79,863,353 | -79,863,353 | -79,863,353 |
| **Cash flow (case 1)** | -1,300,000,000 | 6,803,314 | 6,803,314 | 6,803,314 | 6,803,314 | 6,803,314 | 6,803,314 | 6,803,314 | 6,803,314 | 6,803,314 | 6,803,314 |
| **Accumulated cash flow (case 1)** | -1,300,000,000 | -1,293,196,686 | -1,286,393,372 | -1,279,590,058 | -1,272,786,743 | -1,265,983,429 | -1,259,180,115 | -1,252,376,801 | -1,245,573,487 | -1,238,770,173 | -1,231,966,859 |
| Charcoal sales | | 72,159,000 | 72,159,000 | 72,159,000 | 72,159,000 | 72,159,000 | 72,159,000 | 72,159,000 | 72,159,000 | 72,159,000 | 72,159,000 |
| Profit before tax | | -7,704,353 | -7,704,353 | -7,704,353 | -7,704,353 | -7,704,353 | -7,704,353 | -7,704,353 | -7,704,353 | -7,704,353 | -7,704,353 |
| Corporate tax | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Profit after tax | | -7,704,353 | -7,704,353 | -7,704,353 | -7,704,353 | -7,704,353 | -7,704,353 | -7,704,353 | -7,704,353 | -7,704,353 | -7,704,353 |
| **Cash flow (case 2)** | -1,300,000,000 | 78,962,314 | 78,962,314 | 78,962,314 | 78,962,314 | 78,962,314 | 78,962,314 | 78,962,314 | 78,962,314 | 78,962,314 | 78,962,314 |
| **Accumulated cash flow (case 2)** | -1,300,000,000 | -1,221,037,686 | -1,142,075,372 | -1,063,113,058 | -984,150,743 | -905,188,429 | -826,226,115 | -747,263,801 | -668,301,487 | -589,339,173 | -510,376,859 |

| | 11(years) | 12(years) | 13(years) | 14(years) | 15(years) | 16(years) | 17(years) | 18(years) | 19(years) | 20(years) | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Net power generation( k Wh ) | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 189,205,632 |
| Electricity savings | 76,775,666 | 76,775,666 | 76,775,666 | 76,775,666 | 76,775,666 | 76,775,666 | 76,775,666 | 76,775,666 | 76,775,666 | 76,775,666 | 1,535,513,323 |
| CO2 reduction (t-CO2) | 7,351 | 7,351 | 7,351 | 7,351 | 7,351 | 7,351 | 7,351 | 7,351 | 7,351 | 7,351 | 147,013 |
| Net intial investment | | | | | | | | | | | 1,300,000,000 |
| Rice husk cost | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 539,447,040 |
| Labor cost | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 60,000,000 |
| Maintenance and consumables | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 800,000,000 |
| Depreciation | 86,666,667 | 86,666,667 | 86,666,667 | 86,666,667 | 86,666,667 | 0 | 0 | 0 | 0 | 0 | 1,300,000,000 |
| Profit before tax | -79,863,353 | -79,863,353 | -79,863,353 | -79,863,353 | -79,863,353 | 6,803,314 | 6,803,314 | 6,803,314 | 6,803,314 | 6,803,314 | -1,163,933,717 |
| Corporate tax | 0 | 0 | 0 | 0 | 0 | 1,360,663 | 1,360,663 | 1,360,663 | 1,360,663 | 1,360,663 | 6,803,314 |
| Profit after tax | -79,863,353 | -79,863,353 | -79,863,353 | -79,863,353 | -79,863,353 | 5,442,651 | 5,442,651 | 5,442,651 | 5,442,651 | 5,442,651 | -1,170,737,032 |
| **Cash flow (case 1)** | 6,803,314 | 6,803,314 | 6,803,314 | 6,803,314 | 6,803,314 | 5,442,651 | 5,442,651 | 5,442,651 | 5,442,651 | 5,442,651 | -1,170,737,032 |
| **Accumulated cash flow (case 1)** | -1,225,163,545 | -1,218,360,230 | -1,211,556,916 | -1,204,753,602 | -1,197,950,288 | -1,192,507,637 | -1,187,064,985 | -1,181,622,334 | -1,176,179,683 | -1,170,737,032 | |
| Charcoal sales | 72,159,000 | 72,159,000 | 72,159,000 | 72,159,000 | 72,159,000 | 72,159,000 | 72,159,000 | 72,159,000 | 72,159,000 | 72,159,000 | |
| Profit before tax | -7,704,353 | -7,704,353 | -7,704,353 | -7,704,353 | -7,704,353 | 78,962,314 | 78,962,314 | 78,962,314 | 78,962,314 | 78,962,314 | 279,246,283 |
| Corporate tax | 0 | 0 | 0 | 0 | 0 | 15,792,463 | 15,792,463 | 15,792,463 | 15,792,463 | 15,792,463 | 78,962,314 |
| Profit after tax | -7,704,353 | -7,704,353 | -7,704,353 | -7,704,353 | -7,704,353 | 63,169,851 | 63,169,851 | 63,169,851 | 63,169,851 | 63,169,851 | 200,283,968 |
| **Cash flow (case 2)** | 78,962,314 | 78,962,314 | 78,962,314 | 78,962,314 | 78,962,314 | 63,169,851 | 63,169,851 | 63,169,851 | 63,169,851 | 63,169,851 | 200,283,968 |
| **Accumulated cash flow (case 2)** | -431,414,545 | -352,452,230 | -273,489,916 | -194,527,602 | -115,565,288 | -52,395,437 | 10,774,415 | 73,944,266 | 137,114,117 | 200,283,968 | |

④ Internal rate of return (IRR) and payback period

The internal rate of return and payback period of this project are as follows.

In case 1 with the facility subsidy, the IRR is −13% and the payback period is 108.3 years, resulting in no payback within the project period. Case 2 with the facility subsidy, on the other hand, has an IRR of 9% and a payback period of 9.5 years, enabling payback within the project period.

On the other hand, in case 1 without the facility subsidy, the IRR is −17% and the payback period is 201.1 years, resulting in no payback within the project period. In case 2 with the facility subsidy, has an IRR of 1% and a payback period of 17.3 years, resulting in no payback within the project period as well.

- ④−1 With the facility subsidy

＜Case1：Power generation only＞

| | |
|---|---|
| **IRR（Internal Revenue Rate)** | -13% |
| **Payback period** | 108.3years |

**＜Case2：Power generation and charcoal sales＞**

| | |
|---|---|
| **IRR（Internal Revenue Rate)** | 9% |
| **Payback period** | 9.5years |

- ④-2 Without the facility subsidy

＜Case1：Power generation only＞

| | |
|---|---|
| **IRR（Internal Revenue Rate)** | -17% |
| **Payback period** | 201.1years |

**＜Case2：Power generation and charcoal sales＞**

| | |
|---|---|
| **IRR（Internal Revenue Rate)** | 1% |
| **Payback period** | 17.3years |

5.8. Introduction risk and benefit

① Introduction risk

①-1 Risk of rising raw material prices

In Vietnam, the price and quantity of rice husks tend to be unstable. At present, the price is assumed to be 600 VND/kg. However, there is a possibility that the price of rice husks will rise in the future due not only to domestic consumption, but also to rising demand for exports to overseas countries, so the risk of an increase in business operation costs is assumed.

①-2 Risk of obtaining investment licenses

Acquiring investment licenses for renewable power generation is likely to be more demanding and time-consuming than licenses for other businesses. Therefore, it is assumed that "About 1 year" investment capacity is required, which increases investment uncertainty and investment risk. In addition, the importance of local partners is also high, since it is expected to be necessary to proceed with the acquisition of licenses jointly, and in selecting partners, it is desirable to select partners who are well versed in the acquisition of investment licenses and renewable energy investment.

② Introduction benefit

②-1Contributing to the government's renewable energy policy

The Vietnamese government is promoting renewable power generation and has set a numerical target of "27,195 MW installed capacity, 61000 GWh

generated″ by 2030. Biomass targets will be ″3,281 MW installed capacity, 12000 GWh generated″ by 2030. This project is expected to contribute to the Vietnamese government's biomass power generation target.

②–2 Contributing to Increasing Electricity Demand

The total amount of power generation in Vietnam has been increasing year by year, and the demand for electricity has been increasing. Total power generation in 2017 increased by 8.4% over the previous year and by nearly 14 times over 1995, and GDP per capita increased by about 8 times over 1995. By promoting this project, a new power supply system will be installed, which is expected to supplement the increasing power demand.

②–3 Effective use of crop residues

In this project, approximately 9,500 tons/year of rice husks will be used to generate electricity, which is expected to contribute to the effective use and reduction of agricultural residues from rice mills.

5.9. Regulations under the domestic laws of Vietnam, and the existence of subsidies in Vietnam

Viet Nam has a feed–in tariff (FIT) system and electric power companies are required to purchase electricity for 20 years (Refer to Table 11). In order to promote the use of renewable energy, a FIT system has been introduced since 2011 for each power source, but the fixed price of electricity derived from biomass is set lower than that of other renewable energy sources.

Table 28 FIT Purchase Price Comparison by Country

| | Vietnam | Japan | Germany | Malaysia | Thailand | Philippine |
|---|---|---|---|---|---|---|
| Wind power | 7.8 | 18.7～46.8 | 6.7～11.5 | | 16.8 | 17.1 |
| Biomass | 5.8～7.48 | 11.1～34.0 | 14.3 | 6.0～6.9 | 11.8～14.8 | 13.3 |
| Waste | 7.3～10.1 | | | | 14.1～17.6 | 17.4 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Solar | 9.35 | 20.4～28.1 | 8.6 | 15.2～25.3 | 15.7～19.0 | 11.8 |
| Small scale waterpower | 2.7～2.8 | 11.9～28.9 | | 5.1～5.3 | 13.6 | |
| Geothermal power | | 22.1～34.0 | | | | |

(Note1) The exchange rates of the U.S. dollar and local currencies are as of December 28, 2016 of the IMF

(Note2) Vietnam small hydro is the peak off-peak night rate in northern Vietnam in 2016

(Note3) The exchange rate for the price of small hydro in Viet Nam is 22,156 VND/USD at the central rate of the State Bank on December 28, 2016.

Refer to 1.6 for related laws and regulations.

## 6. JCM Methodology (Draft)

This methodology is applied to a model in which rice husks generated from a rice mill are used to generate electricity, and all the generated electricity is used for the electricity used in the rice mill.

### 6.1. Methodology name

Power generation using rice husks

### 6.2. Definition of terms

None

### 6.3. Summary

| Item | contents |
|---|---|
| GHG reduction methods | Reduce greenhouse gas emissions by replacing electricity supplied by GRID with electricity generated from rice husks, a biomass resource.<br>Reduction through heat utilization is not covered here. |
| baseline emissions | GHG emissions from grid electricity use. |
| Project Emissions | The GHG emissions of electricity generated from rice husks are zero.<br>GHG emissions from transportation, energy use in ancillary facilities, and auxiliary fuel use in this facility are considered. Transportation is not considered when rice husks are generated at the same site as the power plant. There is a chaff solidification facility as an ancillary facility, but the GHG emission becomes zero, because the electric power of this power plant is used except for the initial operation.<br>Therefore, auxiliary fuel/transportation is targeted. |
| Monitoring | Amount of electricity generated by the project/amount of fossil fuel used as auxiliary fuel/distance traveled to the rice husk power plant/emission factor of electricity from GRID / |

6.4. Eligibility requirements

| Condition | Requirements |
|---|---|
| Power generation using rice husks from the rice milling process at a rice milling plant | To use only rice husks generated in a rice milling factory of a rice milling factory and to prevent plundering from other places.<br>Methane generation due to decay during long-term storage shall not occur even if rice husks exceeding the amount used for power generation are generated. Since there is a demand for rice husks in Vietnam, there is a good possibility of sales. |

6.5. Sources and types of GHGs

| Emission source | Types of GHGs |
|---|---|
| 【baseline emission】 | |
| Power provided by the GRID | CO2 |
| 【project emission】 | |
| Fossil fuels used in rice husk power plants | CO2 |
| Transportation of rice husks to power generation facilities | CO2 |

6.6. Estimation of baseline emissions

The target rice-milling plant uses all electricity from GRID before implementation of the project.

$REp = REelec,p$

$REelec,p = ESgrid,p \times EFgrid$

$REp$ : Baseline emissions for period (p)[tCO2/p]

REelec,p : Standard emissions from power generation during period (p) [tCO2/p]

$ESgrid,p$ : Amount of power supplied from the grid during period (p)[MWh/p]

$EFgrid$ : GRID power emission factor [tCO2/MWh]

6.7. Estimation of project emissions

Emissions here are attributed to the transport of auxiliary fuel and rice husks in the project facilities.

$PEp = PEFF,p + PETR,p$

$PEp$ : Project emissions during period (P)[tCO2/p]

$PEFF,p$ : Fossil fuel emissions during period (P)[tCO2/p]

$PETR,p$ : Transport emissions during period (P)[tCO2/p]

$PEFF,p = \Sigma FCi,p \times NCVi \times EFi$

$PEFF,p$ : Fossil fuel emissions during period (P)[tCO2/p]

$FCi,p$ : Fossil fuels consumed in period (p)[mass or volume]

$NCVi$ : Net calorific value [GJ/mass or volume] of fossil fuel i

$EFi$ : CO2 emission factor for fossil fuel i[tCO2/GJ]

i: Types of fossil fuels

$PETR,p = \Sigma RHj,pj \times Dj \times EFCO2,f$

$PETR,p$ : Transport emissions during period (P)[tCO2/p]

$RHj,pj$ : Amount of rice husks transported from rice mill J[ ton/p] ]

$Dj$ : Distance from rice mill J to power plant[km]

If the amount of each rice husk cannot be specified at several mills, the farthest mills are used.

$EFCO2,f$ : CO2 emission coefficient for transportation[245*10-6t-CO2/t-km]※1

j : rice mill

※ Methodological Tool□"Project and leakage emissions from road transportation of freight

6.8. Estimation of emission reductions

$ERp = REp - PEp$

$ERp$ : Reduction in emissions during the period (P)[tCO2/p]

$REp$ : Baseline emissions for period (p) [tCO2/p]

$PEp$：Project emissions during period (P)[tCO2/p]

6.9. Preset parameters and data

| Parameter | Contents | Value or method of determination |
|---|---|---|
| EFgrid | GRID power emission factor [tCO2/MWh] | Contact the power company. If none, use national factor |
| NCVi | Net calorific value of fossil fuel i [GJ/ Mass or volume] | IPCC 2006GL vol2.1 ch1 lower of table 1.2. See ※2 |
| $EFi$ | CO2 emission factor for fossil fuel i [tCO2/GJ] | IPCC 2006GL vol2.1 ch1 lower of Table 1.4 See ※2 |
| $EFCO2,f$ | CO2 emission coefficient for transportation | 245*10-6t-CO2/t-km※1 |

※2 "Climate Change Support Tool (JICA Climate-FIT) Version 3.0 September 2019"

6.10. Parameters to be monitored

| Parameters | Contents | Monitoring method |
|---|---|---|
| $ESgrid,p$ | Amount of power supplied from the grid during period (p) [MWh/p] | Measurement of electric power generated by rice husk power generation/electric power meter |
| $FCi,p$ | Fossil fuels [Mass or volume] consumed in period (p) | Metering/Measuring instrument at the time of loading |
| $RHj,pj$ | Amount of rice husks transported from rice mill J [ton/p] | Measurement/Measuring instruments at the time of shipment or receipt Certificates/invoices or invoices for transactions |
| $Dj$ | Distance from rice mill J to power plant [km] | Measurement on maps, etc. Actual measurement during transportation/vehicle meter |

6.11. Others

None

7. Others

7.1. Field survey report

(1) The first field survey report

① Visitors

Mr. Masaaki Uesugi, Mr. Tsuyoshi Makihata, Mr. Kenichiro Horikiri

Mr. Yasuhiro Takemura (E-Square Inc.: Subcontractors)

② Schedule

| | |
|---|---|
| September 21 | Departure from Ho Chi Minh City |
| September 22 | Moved to Canto City |
| September 23 | AM)TRUNG THANH HI-TECH FARMING JOINT STOCK COMPANY※ Visit headquarters<br>※Company operating a rice mill covered by PJ<br>PM) Can Tho Department of Natural Resources and Environment |
| September 24 | AM) PJ Kickoff Meeting<br>PM) Visit to other companies' rice milling plants: VINACAM CO DO AGRIFOOD COMPANY LIMITED |
| September 25 | Target rice mill tour |
| September 26 | AM) Move to Ho Chi Minh City<br>PM) Visit to JETRO's Ho Chi Minh Office |
| September 27 | Departure from Ho Chi Minh City |
| September 28 | homecoming |

③ Survey/ Meeting

1. TRUNG THANH HI-TECH FARMING JOINT STOCK COMPANY
   Head office and rice mill plant
   Number of plants: One of the plants is for rice polishing only, and the target plant is a plant with processes from rice husks to rice polishing.

   Summary of target plants:
   TRUNG THANH HI-TECH FARMING JOINT STOCK COMPANY" for the outline of facilities.

- 150,000 tons/year of polished rice shipped; 60,000 tons of rice husks shipped

- Total planting area of 50 contracted farms 100 h (0.2 h x 50 cases)
- Sales destinations: Vietnam, Philippines, and African countries
- Electricity consumption/electricity charges: Obtaining data for calculation (bill)

- Process

  Storage ⇒ Measurement ⇒ Drying ⇒ Measurement ⇒ Threshing ⇒Milling ⇒ Stock ⇒ Inspection ⇒ Bagging ⇒ Shipping

  Others: Manufacturing process of drying fuel from rice husks

  Storage: Transport from basic farms by ship using waterways

  Drying: 30 tons of unhulled rice at 120 ° C for 20 h

  30 dryers

  Compressed rice husks are used as fuel

  Temperature control is automatically controlled by measurement.

  Threshing: 16 units

  Milling: 4 machines

  Inspection: Color after cleaning. If the size is less than a certain value, it is judged as NG.

  NG rice is sold not for disposal but for low-grade rice and livestock.

  Inspection standards for domestic and export products are different.

  Strict and high quality for export.

  Shipping: Truck transportation for domestic use /For overseas use, we ship down the river from the same yard as the warehouse and ship it via the port.
- factory hours

  Normal period: 8 h (7 AM to 11 AM, 1 PM to 17 PM)

  Busy period: about 2 months from October 24 h
- Construction of a low-temperature warehouse is planned.

  Total construction cost 900 million VDN

  Maintain at 18 ~ 20 ° C for 24 hours

  Request specifications for air conditioning equipment.
- Vietnamese subsidies can also be used for biomass power generation.

  The balance with the JCM subsidy was confirmed with the Ministry of the Environment.

2. VINACAM CO DO AGRIFOOD COMPANY LIMITED

- Factory Overview: 30 full-time employees, 100 workers
- Profit: 50 million yen/year
- Amount of polished rice shipped: 72,000 tons/year
- Amount of rice husks: 12,900 tons/year
- Process: Storage ⇒ Measurement ⇒ Drying ⇒ Measurement ⇒ Threshing ⇒ Milling ⇒ Stock ⇒ Inspection ⇒ Bagging ⇒ Shipping

  Others: Manufacturing process of drying fuel from rice husks

  Storage: Basically transport from farmers by ship using waterways

  Shipping: Ship down the river from the same yard as the warehouse and transport it by sea via the port.
- Energy consumption: electricity and compressed rice husk briquettes

  Electric power contract 2,800 kW(Dried 1,250 kW, polished rice 1250 kW, threshed 350 kW)

  The amount of electricity used was 50 million yen/year (Approximately ¥4 million/month), although no answer was given.

- Operating conditions: 24 hours x 355 days * Only briquettes are manufactured at 8 hours/day x 355 days.

  Holiday 10 days (6 New Year, 4 national holidays)

  High season: March to April and October

  (Processing of imports from Cambodia)
- Clients, etc.: Trading companies (Australia, India and Singapore)

  ※The end is not recognized even at the factory.

  Rice that fails inspections: Sake and sold to the poor (8,000 VND/kg)

  Rice husks (900 VND) – for drying fish, etc.

  Sales of ash from briquettes used for drying (7 tons/year)
- Freight: 350 VND/t from farmhouse to factory
- Other information: There are 100 similar plants within 100 km of the site.

✓ Can Tho City

・Details of hearings from each department

◆Bureau of Statistics

Population (Until April 1, 2019):

| All | Cities | Rural | Men | Women |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| 1,235,171 | 860,557 | 374,614 | 612,543 | 622,628 |

◆Electric power in Can Tho City

– Power:

+ Electricity penetration rate: As of the end of August 2019, 331.192/331.301 households had access to electricity, which is 99 and 97%.

+ The target blackout rate for fiscal 2019 is 295 minutes for annual blackout hours (SAIDI), and the cumulative total until August is 135 minutes.

+ Power supply source: The main power is drawn from the national grid through 220 kV ohmon wires and supplied to 10 substations (Cassin themed, Thânt Nâdt, Thi thun, Bnh thhh, Khu Cng Nghip, Phat Sóng Nam, Hâng Hua, Long Hua Thnai, Thi thai) at 110 kV.

Other plants in Can Tho include the Canto Thermal Power Plant (TRA NOC) and the OMON Thermal Power Plant. The Canto Thermal Power Station (TRA NOC) has 4 generator groups supplying 168.5 MW of power and the OMON Thermal Power Station has 2 generator groups supplying 660 MW of power.

+ The average electricity price in August 2019 was 1.829, 07 VND/kWh.

– The power consumption of all the rice mills in Can Tho City is 1, 950 million kWh/month.

◆Industrial and Commercial Bureau

– Number of rice mills in Can Tho City: 107

◆Resource and Environment Bureau

– Use of rice husks：

By 2018, 46 rice-milling projects in Can Tho City had submitted environmental impact assessment reports and received DONRE approval. In addition to rice polishing, the company also invested in a machine to make briquettes from rice husks, using rice husks from the rice polishing process. Briquettes are manufactured, used as fuel in the hull-drying process, or sold. Some farmers use rice husks to make organic fertilizer for their fields.

Since there is no industrial waste disposal site in Can Tho City, many companies are contracted by waste collection and disposal companies or by places where there is a need for waste recycling.

– Policies related to greenhouse gas reduction:
Vietnam is implementing various measures to reduce greenhouse gas emissions. Among them, renewable energy and environmentally friendly energy (Photovoltaic power generation, etc.) are preferentially used. Especially, Hanoi and Ho Chi Minh, which have a lot of greenhouse gases. Develop and implement low greenhouse gas emissions projects in areas such as tourism, agriculture, civil engineering, waste management, industry, transport, energy, and urban planning. The government decree (2053/QD– TT) issued on October 28, 2016, focuses on greenhouse gas reductions and climate change adaptation, and outlines the implementation plan for the Paris Agreement on Climate Change.
On November 21, 2017, the Can Tho Municipal People's Committee issued the Action Plan for the 170/KH–UBND Paris Agreement on climate change. The plan calls for greening of agriculture, rural development, transport, civil engineering and industry, as well as submission and implementation of greenhouse gas reduction proposals.
Projects such as the ″low–waste industry″ and the ″low energy″ are being developed, and companies that use a lot of energy are being guided about their obligations to save energy based on the ″Energy Saving, Efficient Usage″. We will carry out activities that can contribute to the reduction of greenhouse gas emissions in Vietnam.
environmental protection policy：
The government's environmental protection policy is stipulated in the Environmental Protection Law issued in 2014. Specifically, the following：

i. Create an environment where individuals, families and organizations can participate in environmental protection activities, and confirm and supervise environmental protection activities as required by law.
ii. Dissemination and education in combination with administrative, economic and other means of building environmental discipline and culture.

iii. Reduce waste by conserving biodiversity, using and using natural resources rationally and economically, developing clean and renewable energy, and promoting recycling and reuse.

iv. Prioritize addressing pressing environmental issues, serious environmental pollution, and water pollution; focus on environmental protection in residential areas; and develop a technical infrastructure to protect the environment.

v. Diversify investment funding sources for environmental protection. Allocate specific environmental protection expenditures to the budget in increasing proportion to general growth. The source of funding for environmental protection shall be uniformly controlled and used for prioritized key areas of environmental protection.

vi. Provide land and financial support for environmentally friendly companies and environmental protection activities.

vii. Conduct human resource education related to environmental protection.

viii. Develop environmental science and technology, prioritize research and operation of advanced and environmentally friendly technologies, and apply environmental standards that can better meet environmental protection needs.

ix. Integrate environmental safety, climate change, resource conservation and environmental protection activities.

x. States recognize and praise the institutions, organizations, households and individuals that have actively contributed to environmental protection activities.

xi. Expand and strengthen international cooperation on environmental protection and fulfill international commitments on environmental protection.

◆Department of Agriculture and Rural Development

－statistics office data

The total product value of agriculture, forestry and fisheries (GRDP) (Calculated based on 2010 values) in FY 2018 was 53.992 billion VND, up 2,077% from the 2017 GRDP.

The production value of agriculture, forest and fisheries is 134.741 billion 7 billion VND, (129.435 billion dong) 4, 1% over the plan.

– future agricultural plan:
Local key product lists and policies:
+ Rebuild agriculture to efficiently develop the potential and benefits of the city for stable, high-growth agriculture and rural development; To create distinctive agricultural subregions: high-quality hulled rice regions, hulled rice concentration areas for sale, advanced technology operation areas around cities, local fruit production areas combined with ecotourism, concentrated aquaculture areas, etc.
+ Rapidly and comprehensively develop agriculture and rural areas for modernization, greening, cleanliness, diversity and sustainability. Increase the scale of production of key agricultural (Rice, fruits, marine products, and livestock) and rural industrial products, with a focus on raw material supply and export for processing industries. In combination with leading the research and application of urban and high-tech agricultural application models, the development of institutions will focus on the development of high-quality plants, animals and aquatic varieties.

– Population in Agriculture: About 163,814 people work in agriculture, forestry and fisheries in the city.
– mainstream agricultural products:
It will develop agriculture in the direction of urban and high-tech agriculture in the city of Canto, emphasizing the development of biotechnology, breeding and other agricultural technology services. Currently, the city's main agricultural production value chains are rice, marine products, fruit trees, vegetables and mushrooms.

– Location and Production Volume of the U.S. Industry:
The city of Can Tho is one of the five major cities beneath the central government of Viet Nam and is the capital of the Mekong Delta.
80% (232,000 ha) of the agricultural land in the city of Can Tho is rice production. The land use factor is about 2.7. There is a production volume of about 1.3 million tones/year.
The general types of rice are as follows:

+ Aromatic rice (soft rice): Popular varieties include jasmine and VD 20.

＋ High Quality Rice (soft and variously scented rice): The most popular varieties are OM 4218 and OM 5451.

＋ Common rice (rice suitable for making cakes and noodles): the popular variety is IR 50404.

– Status of rice husk use and problems：

The annual production of unhulled rice is 1.3 million tons, and 260.000 tons of chaff is generated.

Rice husks are used as fuel, as a raw material for making briquettes from rice husks, and as fertilizer.

◆Other

- Can Tho City is promoting rice husk power generation and plans to build 1 unit in 10 2020 MWh and 2 more by 2025. They will send you the data of the power plant.
- The biomass power plant, which was built in 2020 and 2010, is said to be bankrupt as a base company.
- promise to cooperate with me in the future.

④ PJ kickoff meeting

Attendees: Canto City, Can Tho University, TRUNG THANH HI-TECH FARMING JOINT STOCK COMPANY

- The rice company wants to sell the electricity. He explained that he would propose a balance with investment based on the survey results.
- The city of Can Tho promises to send us the necessary information regarding the laws on power plant construction.
- PJ is exempt from customs duties and fixed asset taxes.
- The Bureau of Industry is in charge of power generation.
- Canto City will support this project, so please feel free to contact us if you have any requests.

⑤ JETRO Ho Chi Minh office

Person in charge: Mr. Tahara, Mr. Sugiyama

- I get an explanation of the research materials.

- The Vietnamese government is also promoting biomass energy, but the number of rice husk power generation operations is zero not counting generators for self-consumption.

This is because the FIT price is low, and the rice husk price is not stable, and the attractiveness of investment is low.

- On the other hand, since this PJ is mainly made by a rice mill, the rice husk procurement is stable, and the current electric power price is the point to recover the investment because it is self-used. In addition, by gasification, rice husks become secondarily usable as charcoal, and the investment recovery becomes shorter. In addition to the above, heat utilization by waste heat is also added, and PJ is planned to be more attractive investment.
- We were briefed on restrictions on foreign investment, but this time we did not intend to receive investment from Japan, so we asked for some information as a reference.
- A power license is not required for private use but is required for partial sales.
- We will be able to meet the requirements for obtaining a business license in the future.
- It is advisable to contact the government and ministries to obtain appropriate advice.
- Ask Mr. Sugiyama to check the latest power emission factor.

⑥ Issues for 2nd investigation

The following items that could not be heard/investigated this time will be surely completed in the second hearing/investigation. I will clear up the tasks to be done until next time.

◆Matters to be investigated at the second survey

－Power Generation Related

i. Confirming the load contents of two transformers – For studying the power distribution method
ii. Check the power specifications of the newly installed cooling equipment and the transformer to which it is connected.
iii. Quantity of fuel manufacturing facilities (grind mill and pulverizer) and electric power estimation

iv. Confirmation of power consumption review documents for the thermal utilization (hulled rice drying) system of the COGENE system

We will investigate and prepare a power survey table and estimate the output and number of generators.

Based on the above survey, we plan to determine the required electric power for rice mills, the electric power required for fuel production, and the related additional electric power, calculate the generator output and the number of units, and estimate the gasification power plant for the above two companies.

◆Other

－TRUNG THANH HI-TECH FARMING JOINT STOCK COMPANY

1) About the new warehouse

- Building drawings for a new low-temperature warehouse
- air conditioning specifications
- Estimated amount of electricity used for air conditioning (kWh)
- Control Temperature (We heard it was 18 ~ 20 degrees, but just wanted to check.)

2) Reconfirmation of production volume at target plants

- Amount of unhulled rice purchased from farmers/year
- Amount of polished rice shipped/year
- Rice husks per year

3) Energy consumption

- Amount of rice husks (compressed matter) used in the drying process per year

－Canto City

- Act on Construction of Private Power Generation Facilities and Qualified Persons, etc.
- Power plant materials under construction

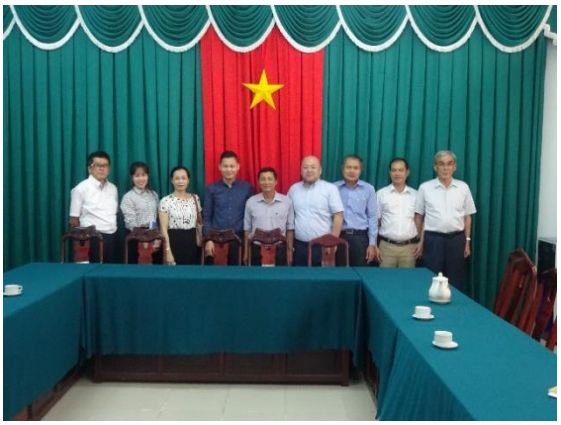
－Rice husk power producers

- equipment specification
- Power generation (kWh)/year
- Power Use (Sales of electricity and in-house use, etc.)
- Amount of rice husks/year as fuel
- Rice husks procurement (Chargeable/free, suppliers, etc.)

- Concept of the investment payback period
- Regulatory content for construction and operation

Scene of the field survey

◆Kickoff meeting at TTC



◆Rice mill factory of TTC

◆Meeting with each department in Can Tho City

(2) The second field survey report

① Visitors

5 people

Mr. Masaaki Uesugi, Mr. Tsuyoshi Makihata,

Mr. Naoki Kono (Estelle Inc. : Subcontractors)

Mr. Yasuhiro Takemura, Mr. Hiroyuki Yanagida (E-Square Inc.: Subcontractors)

② Schedule

| | |
|---|---|
| October 20 | Departure from Ho Chi Minh City⇒Moved to Can Tho City |
| October 21 | AM) TRUNG THANH HI-TECH FARMING JOINT STOCK COMPANY Visit headquarter |
| | PM) Meeting at Hotel |
| October 22 | AM) Visit to Rice milling companies |
| | PM) Visit to Rice milling plants |
| October 23 | TRUNG THANH HI-TECH FARMING JOINT STOCK COMPANY Visit to Rice milling plants |
| October 24 | Moved to Ho Chi Minh City Departure from Ho Chi Minh City (Makihata, Takemura, Yanagida) |
| October 25 | Meeting with local consultant (Request for additional information collection, etc.) |
| October 26 | homecoming (Uesugi, Kono) |

③ Survey/meeting

(1) TRUNG THANH HI-TECH FARMING JOINT STOCK COMPANY (TTC) Head Office

Respondents: TTC President, 2 employees and 2 investors

Project Overview Description

Gasification power generation plan using rice husks and rice milling power supply system

1. Transportation of equipment to rice mills

Power plant size and transport LxWxH = 8 x 2 x 3.5 m Weight 16.5 t is necessary to confirm the conditions of road transportation/canal transportation, etc. by the above size and weight when the project is carried out.

2. Sales price of rice husks
   Prices fluctuate monthly and increase at the end of the year.
   Rice husks 1000 VND/kg
   Rice husk briquettes 1800 VND/kg
3. About Briquette Machines
   It is imported from Germany. Made in Vietnam is fragile.
   Problems such as rust and abrasion
4. investor
   Consideration of the use of chaff briquettes as an environmental measure, and the use of such briquettes is as fuel for power generation
   Weakness: Low heat
5. December Workshop
   Scheduled to be held on December 10
   A little less than 50 people to be attended.
   Announcement of the current plan
   Asked President VAN to give a lecture. The theme was contacted by Mr. Tan from Uesugi after returning home.
   President: OK.
   Confirming Attendance
   Hiroshima Prefectural Office
   Can Tho Municipal People's Committee
   rice milling company
   ※If the president of VAN is in trouble about the support, we will mediate the relation with Can Tho City.
6. operating hours of rice milling plants
   8-12 o'clock, 13-17 o'clock
7. Rice husks generated in 13 provinces in southern Vietnam
   6 million tons/year
8. Is there any problem with the heat quantity of rice husk briquettes as fuel for power generation?
   No problem.
9. Plans call for the introduction of a boiler to dry rice.
   It will be completed in 3 months. It will probably be completed in 2019.
   - Boiler capacity: 10 t
   - Rice husk drying performance: 1200 Boiler fuel rice husk 1 kg for 20 kg of rice husk dried for 24 hours per day

10. Regarding the question about the planned constant temperature warehouse, the president will send it to you by email later.

◇TRUNG THANH HI-TECH FARMING JOINT STOCK COMPANY Head Office

(2) VINACAM AGRIFOOD JOINT STOCK COMPANY

Respondents: Tra Van Hieu Vice President

Tan Long Group Pham Letu and 1 other person

- ISO-9001 certified plant
- Overview of the project
- Workshop (Can Tho city) Schedule Explanation
- The heat source for drying chaff in our factory is chaff + chaff briquette.

Rice husks are sold and consumed on their own.

Ash used for private consumption is used as fertilizer.

- Boilers installed in rice hull drying system, fueled by rice husks
- The maximum amount of rice to be milled in April is 6 ~ 7000 tons per month, with a minimum of 90 tons per day.

※Our company considers rice husks to be 15% of the amount milled.

If the amount of polished rice is 300,000 tons, the amount of rice husks is 45,000 tons.

- All electricity is purchased from EVN.

- Drying temperature of the fir: 39 degrees C to 40 degrees C
- Exports to Papua New Guinea, etc.
- Email us if you have any additional questions

◇VINACAM AGRIFOOD JOINT STOCK COMPANY

✓ GENTRACO CORPORATION

Respondents: Mrs.VU THI DUNG (Marketing Manager)

- Project Overview Description
- Workshop (Can Tho city) Schedule Explanation

Presenter: Can Tho City People's Committee, Hiroshima Prefecture,

Canto City Rice Milling Company, Tromso, E-Square.

- Rice mills: 5 plants

2 plants have 600 t/day of rice polishing and 1800 ha of rice fields.
The remaining 3 plants are 3 ~ 5000 tons of polished rice.
No. 1 Plant 1250 kVA electric drying * For Europe, odor and quality improvement
No. 2 Plant 560 kVA electric drying * For Europe, odor and quality improvement
No. 3-5 Plant 1000 kVA Briquette Burning and Drying
※Due to the drying of the unhulled rice, the two plants adopted the electric heating and drying method. ⇒ Improve quality

- Treatment of rice husks: 1200 VND/kg when rice husks sales are high Normal period 600 ~ 800 VND/kg
- Briquette purchase 2,000 VND/kg
- Expect other energy efficient briquette machines
  ※The company has no briquette machines and does not use briquettes.
- 600 t/day of rice milling
  Annual processing volume: 18,000 t/year

* From the number of days of rice polishing operation

- Rice milling workday 300 days (No. 1, No. 2), other 280 to 300 days
- Question from their side: Can we use rice straw as fuel?
  It is difficult to use only 100% rice straw, but it is possible to use mixed firing. The person in charge will explain it to you later.
- Answers questions about specifications, production capacity, etc., of Tromso briquette machines.
- If you ask us about the contract amount of electricity and the amount
  of electricity used, we will answer your questions.

◇GENTRACO CORPORATION


GENTRACO
Gạo thơm
Miss CAN THO
5kg
MISS
CAN THO

✓ TRUNG THANH HI-TECH FARMING JOINT STOCK COMPANY

Respondents: Person in charge of facilities, person in charge of general affairs

- Does the 900-kW power contract cover the load of 2 transformers?
  Load containing two units.
- 2 of the maximum load of each transformer is
  NO1:1000kw　　約 600kW
  NO.21200kW　　約 800kW
- Power received up to 900 kW
- How much briquette does it take to dry the rice in a year?
  Answer by email later
- 1 year 12-months power consumption
  Answer by email later
- Current use of direct heat rice huller
  Used together with boiler drying
  When the capacity of the boiler drying is unknown, it is necessary to examine the measures for the direct heat dryer based on the boiler utilization record, and then decide whether to reduce the direct heat dryer after confirmation. (person in charge)
- Other answers to the questionnaire.
  Responses are received in writing.

◇TRUNG THANH HI-TECH FARMING JOINT STOCK COMPANY rice mill


(3) The Third field survey report

① Visitors

3 people

Mr.Masaaki Uesugi, Mr.Yuichi Yanaka (Tromso CO.,LTD)

Mr.Kenichi Tamura (E-Square Inc.: Subcontractors)

② Schedule

| | |
|---|---|
| December 7 | Departure from Ho Chi Minh City |
| December 8 | work at hotel (Ho Chi Minh City) |
| December 9 | AM) Visit DINH HAI COEGN JOINT STOCK COMPANY<br>PM) Moved to Can Tho City Meeting with Hiroshima Prefecture staff |
| December 10 | AM) Workshop held at TTC Hotel<br>PM) Visit TRUNG THANH HI-TECH FARMING JOINT STOCK COMPANY |
| December 11 | Project Meeting |
| December 12 | Visit TRUNG THANH HI-TECH FARMING JOINT STOCK COMPANY |
| December 13 | Moved to Ho Chi Ming City (Uesugi, Yanaka),<br>Departure from Ho Chi Ming City (Tamura) |
| December 14 | Meeting with Mr.Thanh (Subcontractors) |
| December 15 | Departure from Ho Chi Ming City (Uesugi, Yanaka) |

December 16　　Arrived Japan (Uesugi, Yanaka)

③ Survey/meeting

(1) DINH HAI COEGN JOINT STOCK COMPANY (DINH) Head Office

＜Meeting outline＞

Date: December 9 10: 00 ~

Attendees: DINH President Hai, Tromso President Uesugi, Mr. Yanaka, and E-Square Tamura

- ✓ Explanation of Tromso's business, JCM business, future schedule, etc.
- ✓ DINH imports and sells equipment from Siemens and other European and North American machinery manufacturers.
- ✓ DINH is planning a rice husk power generation project in the city of Canto, but the project has not progressed much as there is no prospect for the procurement of rice husks, the installation of facilities, and the acquisition of licenses.
- ✓ DINH plans to introduce a cogeneration system using a biomass boiler generator, and to secure profitability by using electricity and selling steam.
- ✓ The initial investment amount is expected to be approximately 10 million USD (2 million USD per 1 MW) and the scale of 5 MW. The initial estimate is that the payback period will be 5 years and the profit margin will be about 22% (Details unknown).
- ✓ The capacity of the boiler is 20 t/h, and the steam generated can be sold at 600 VND/kg.
- ✓ DINH has steam pipes and plans to sell steam mainly to fruit processing plants.
- ✓ The procurement price of rice husks is 1500 VND/1 kg. Since chaff dealers sell chaff without issuing an invoice, it is difficult to handle taxes such as VAT (DINH will actually pay the VAT to the government.).
- ✓ Tromso held a workshop in the city of Canto on December 10 and agreed to share the contents of the workshop at a later date.

(2) TRUNG THANH HAI COEGN JOINT STOCK COMPANY (DINH) Head Office

＜Meeting Outline＞

Date: December 10 18:00-, December 12 13:00-

Interviewees: TTC President Pham; Tromso President Uesugi; Yanaka; E-Square Tamura (10th); Thanh (10th)

December 10

- ✓ Explain WS announcement again
- ✓ Thank for participating in the WS and participating in the dinner

December 12

- ✓ Discussed future cooperation and confirmed that they would continue to consider it.
- ✓ In addition, a meeting was held regarding a workshop scheduled to be invited in January next year, and the contents of the announcement were confirmed.
- ✓ Decided to have the presentation materials submitted by next year's event.

④ Workshop

Refer to 7.3.

7.2 Visit of Can Tho City officers to Hiroshima Prefecture

The prefecture invited Vice chairman of the People's Committee in Can Tho City and Deputy Director-General, Resource and Environment Bureau, People's Committee in Can Tho City to Hiroshima and introduced the initiatives to reduce carbon dioxide in Hiroshima, Hiroshima company with waste treatment technology.

(1) Introduction the initiatives to reduce carbon dioxide in Hiroshima

Date: 2019 October 29 (Tue) 9:40 ~

Place: Overseas Business Division, Hiroshima Prefectural Office

Participants

| | | |
|---|---|---|
| Can Tho City | Vice Chairman of the People's Committee | DAO ANH DUNG |
| | Deputy Director-General, Resource and Environment Bureau, People's Committee | NGUYEN CHI KIEN |
| Hiroshima Prefecture | Low Carbon Society Promotion Group, Environmental Policy Division, Environmental Citizens Bureau | Hiroyuki Fukutomi |

| | | |
|---|---|---|
| | Director, Overseas Business Division, Commerce and Labor Bureau | Kenji Naraki |
| | Director, Overseas Business Division, Commerce and Labor Bureau | Kazuki Matsubara |
| VJ Connection | Coordinator (Hiroshima Prefecture) | TRAN THI LE KHUONG |
| interpreter | | Haruki Aikawa |

Presentation on the following two points

- Japan's energy policy
- Hiroshima Prefecture's Efforts to Reduce Carbon Dioxide

(2) Exchange of opinions with Deputy Governor of Mr. Yamada, Hiroshima

Date: 2019 October 29 (Tue)11:40 ~

Place: Lieutenant Governor's Office, Hiroshima Prefecture

Participants

| | | |
|---|---|---|
| Can Tho City | Vice Chairman of the People's Committee | DAO ANH DUNG |
| | Deputy Director-General, Resource and Environment Bureau, People's Committee | NGUYEN CHI KIEN |
| Hiroshima Prefecture | lieutenant governor | Hitoshi Yamada |
| | Director, Overseas Business and Investment Promotion Department, Commerce, Industry and Labor Bureau | Kazunari Kawaguchi |
| | Director, Overseas Business Division, Commerce and Labor Bureau | Kenji Naraki |
| | Director, Overseas Business Division, Commerce and Labor Bureau | Kazuki Matsubara |
| VJ Connection | Coordinator (Hiroshima Prefecture) | TRAN THI LE KHUONG |
| interpreter | | Haruki Aikawa |

< DAO ANH DUNG >

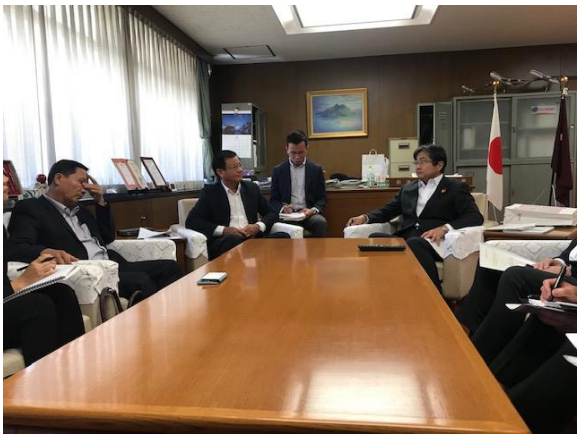
Thank you for your invitation and welcome.
I would also like to congratulate Vice-Governor Yamada on his appointment.
The exchange between Hiroshima Prefect. and Can Tho City started from 2013, and the matching between what has the technology and what requires the technology, which is also the content of MoU, is being promoted in both ministries.
Can Tho City uses the technology of rice polishing of Satake in Hiroshima Prefecture.
In addition, the technology introduction advances in water treatment technology of Hiroshima Prefecture, wastewater treatment of shrimp culture, fractionation of domestic refuse, treatment field, and volume reduction of sewage sludge, and the business exchange spreads in the biomass related field after the MoU conclusion.
Our common goal is to reduce carbon dioxide emissions, and we would like to promote the use of biomass as a means of achieving this goal. The Government of Vietnam has also signed the Paris Agreement, and we share the same issues.
And, it is hoped that the environmental technology which Hiroshima Prefect. has is utilized, and that the support is also future on the waste treatment problem which Can Tho City holds.
Under the MoU that we have concluded, we need the support of Vice-Governor Yamada in order to proceed in the future.
As the role of Can Tho City, what I can promise here is to do my best to promise the support of the enterprises in Hiroshima Prefecture in Vietnam. Especially in the seminar in December, we will support you so that you can have a big event.

< Mr.Yamada>
I was in a section of the Ministry of Economy, Trade and Industry dealing with environmental technologies.
The G 20 was in Karuizawa in June of this year, and the problems were global warming and marine plastics.
As the vice governor of Hiroshima Prefecture, he would like to promote environmental activities.
I hope you will enjoy Hiroshima Prefecture as sightseeing is reasonable. Please let me know if you have any requests to do more.

< DAO ANH DUNG >

●I think the good thing about Hiroshima Prefecture is its friendliness.

I have also just assumed the chairmanship of the People's Committee of the City of Can Tho and is a former Vice Minister of Investment Planning of Viet Nam. (Former Chairman of the People's Committee of the City of Can Tho Becomes Vice Minister of Investment Planning of Viet Nam)



(3) Visiting Solar power plant

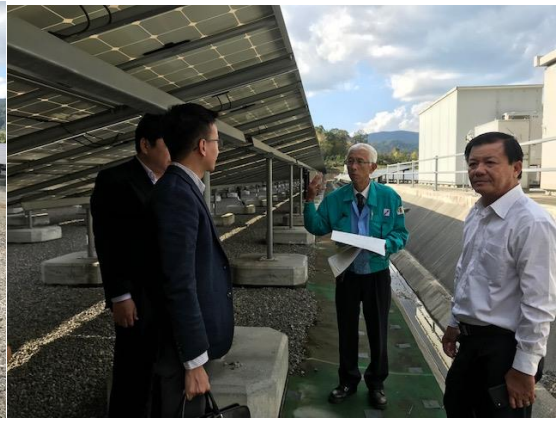
Date: 2019 October 29 (Tue)11:40 ～

Place: Fukutomi Power Station No.1 and No.2 in Hiroshima Prefecture

Participants

| | | |
|---|---|---|
| Can Tho City | Vice Chairman of the People's Committee | DAO ANH DUNG |
| | Deputy Director-General, Resource and Environment Bureau, People's Committee | NGUYEN CHI KIEN |
| Hiroshima Prefecture | Low Carbon Society Promotion Group, Environmental Policy Division, Environmental Citizens Bureau | Hiroyuki Fukutomi |
| | Director, Overseas Business Division, Commerce and Labor Bureau | Kenji Naraki |
| | Director, Overseas Business Division, Commerce and Labor Bureau | Kazuki Matsubara |
| VJ Connection | Coordinator (Hiroshima Prefecture) | TRAN THI LE KHUONG |
| interpreter | | Haruki Aikawa |

Visits to the solar power generation business in Hiroshima Prefecture and the project to return profits from sales of electricity.



(4) Visiting a company making uses of rice husk

Date: 2019 October 30 (Wed)11:40 ~

Place: Tromso Co., Ltd Head office

Participants

| | | |
|---|---|---|
| Can Tho City | Vice Chairman of the People's Committee | DAO ANH DUNG |
| | Deputy Director-General, Resource and Environment Bureau, People's Committee | NGUYEN CHI KIEN |
| Tromso Co., Ltd. | Representative Director | Masaaki Uesugi |
| | Technical Advisor | Tsuyoshi Makihata |
| Hiroshima Prefecture | Director, Overseas Business Division, Commerce and Labor Bureau | Kenji Naraki |
| | Director, Overseas Business Division, Commerce and Labor Bureau | Kazuki Matsubara |
| VJ Connection | Coordinator (Hiroshima Prefecture) | TRAN THI LE KHUONG |
| interpreter | | Haruki Aikawa |

From Uesugi Representative Director

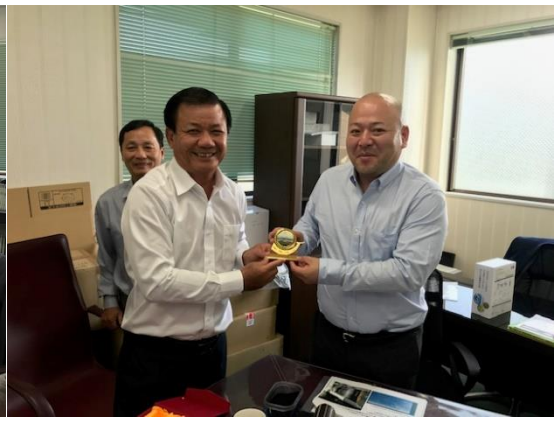
- Introduction of biomass power generation project using compressed solid fuel of rice husks generated from rice mills
- Description of the JCM scheme
- Outlook after the JCM Project

Comment by Vice-Chairman Dung

- Though the common goal is the reduction of carbon dioxide, it is difficult to popularize it unless the proposal is profitable for the rice mill. At present, in Mekong Delta, the supply is not in time for the electric power needs of rice mills. And, this project meets not only carbon dioxide reduction but also needs of the region economically, because the price of electric power is rising. If the technology transfer advances in this project, it can also contribute to the electric power shortage in the region.
- At the workshop on December 10, Canto City will do its best to back up the project. Please provide us with information on the number of companies that Japan would like to participate in. Gather in Can Tho City.

Comments and questions from Dung, Vice-Chairman of the Committee, on gasification equipment at Tohne Works

- In Vietnam, gourds are suitable for localization because they are cheap and available.
- Have you ever used chaff as fuel?
  →Currently under verification. It has a good record in bamboo. Bamboo belongs to the grass family.
- This machine is a gasifier, can it generate electricity?
  →The demonstration is being carried out in Niigata at present.

(5) Visiting a Hiroshima company with waste treatment technology

Date: 2019 October 31 (Thu)9:20 ~

Place: Ogawa Economics Motoyama Plant, Ukai Plant

Participants

| | | |
|---|---|---|
| Can Tho City | Vice Chairman of the People's Committee | DAO ANH DUNG |
| | Deputy Director-General, Resource and Environment Bureau, People's Committee | NGUYEN CHI KIEN |
| Ogawa Econos | Chairman of the Board | Isao Ogawa |
| | Managing Director | Ogawa |
| | General Manager, Corporate Planning Dept. | Hiroshi Oka |
| | General Manager, Human Resources & General Affairs Dept. | Tomohiro Tsukamoto |
| | General Manager, Head Office Sales Division | Yūta Senoo |
| Hiroshima Prefecture | Director, Overseas Business Division, Commerce and Labor Bureau | Kenji Naraki |
| | Director, Overseas Business Division, Commerce and Labor Bureau | Kazuki Matsubara |
| VJ Connection | Coordinator (Hiroshima Prefecture) | TRAN THI LE KHUONG |

| | | |
|---|---|---|
| interpreter | | Haruki Aikawa |

- Presentation on the RPF business conducted by Ogawa Econos, Inc., which manufactures RPF from general waste and industrial waste
- Taking a lecture of waste treatment facilities (General, industrial, and hazardous waste)

Comment by Vice-Chairman Dung
It's a great effort.
The technology which effectively utilizes all wastes and converts them into valuable ones is excellent.
RPF should also be required by the boiler - using enterprises in the city of Can Tho.
If it satisfies the standard in Vietnam, I would like to introduce it to various factories in Can Tho City.


(6) Visiting a Coal-fired power generation demonstration project
Date: 2019 October 31 (Thu)14:00 ~
Place: Osaki Coolgen Co., Ltd.

Participants

| | | |
|---|---|---|
| Can Tho City | Vice Chairman of the People's Committee | DAO ANH DUNG |

| | | |
|---|---|---|
| | Deputy Director-General, Resource and Environment Bureau, People's Committee | NGUYEN CHI KIEN |
| Osaki Coolgen | Director | Haruhito Kubota |
| | Head of General Affairs Group | Yasuharu Onaka |
| Hiroshima Prefecture | Director, Overseas Business Division, Commerce and Labor Bureau | Kenji Naraki |
| | Director, Overseas Business Division, Commerce and Labor Bureau | Kazuki Matsubara |
| VJ Connection | Coordinator (Hiroshima Prefecture) | TRAN THI LE KHUONG |
| interpreter | | Haruki Aikawa |

Presentation on the contents of the demonstration experiment at Osaki Coolgen
(Photography is prohibited on the premises, so there are no photographs.)

7.3. Workshop

① Workshop outline

Date: 2019 October 10 8:00 ~12:00

Place: TTC Premium Hotel Can Tho/Orchid room

② Workshop Agenda

| Time | Program | PIC |
|---|---|---|
| 07:30 | Opening | Matsubara, Matsumoto (Hiroshima Prefecture) |
| 08:00 | Greetings from the Environment Bureau, Ministry of Natural Resources, Can Tho City | Kiem Deputy director |
| 08:10 | Greeting from Tromso Co.,LTD | Uesugi Representative Director |
| 08:20 | Outline of Tromso and JCM Project | Mr.Yanaka |
| 09:00 | Installation of JCM facilities and business plans | Mr.Tamura (E-Square) |

| | | |
|---|---|---|
| 09:30 | Greetings from the Overseas Business Division, Hiroshima Prefecture | Mr.Matsubara |
| 10:00 | Closing | |
| 10:00–12:00 | personal interview | |

③ Photos

workshop presentation 1

workshop presentation 2

workshop presentation 3

workshop presentation 4

Scene of the workshop　　personal interview

④ List of participants in the workshop

| No. | Name of Organization |
|---|---|
| 1 | Omon Thermal Power Olant（GENCO2） |
| 2 | Environmental Service Technology Co., Ltd. (TAN DYEN) |
| 3 | Omon District Resources and Environment |
| 4 | Bintan County Department of Resources and Environment |
| 5 | Can Tho City Security Committee |
| 6 | BSA Centre |
| 7 | BSA Centre |
| 8 | Can Tho City Electric Power Company |
| 9 | Faculty of Environment and Natural Resources, Can Tho University |
| 10 | Can Tho City Investment Planning Bureau |
| 11 | Can Tho City Commerce and Industry Bureau |
| 12 | Can Tho City Ministry of Construction |
| 13 | Can Tho City Science and Technology Bureau |
| 14 | Can Tho City Science and Technology Association |
| 15 | Can Tho Information and Communications Bureau |
| 16 | Can Tho Economic and Social Research Institute |
| 17 | Can Tho City Natural Resources and Environment Bureau Resource Environment Measurement Center |
| 18 | Can Tho City Environmental Police |
| 19 | Can Tho City Vietnam Homeland Front |
| 20 | Can Tho City Women's Association |
| 21 | Natural Resources and Environment Bureau, Can Tho City |
| 22 | Can Tho City Natural Resources and Environment Bureau Water and Climate Change Division |
| 23 | Can Tho City Adaptation Office |
| 24 | Can Tho City Natural Resources and Environment Bureau |
| 25 | Can Tho City Natural Resources and Environment Bureau |
| 26 | Van Loi Food Processing Co., Ltd. |

＊Participant names omitted

## 7.4. Other resources

様式 F5

**Analysis test report**

| Requester | Tromso Co., Ltd. |
|---|---|
| Item | Analysis of rice husk briquette combustion gas |

報告日 : 2008/3/7
整理番号 : F0701771

| Sample code | Analysis item | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CO | CO2 | NOx | SOx | | | | | | | | | | |
| Units | mL／10g・g | mL／10g・g | mL／10g・g | mL／10g・g | | | | | | | | | | |
| Rice husk briquette | 88 | 1198 | Undetected | | | | | | | | | | | |

【 備 考 】

[分析方法]
・CO, CO2 JIS K7217 プラスチック類燃焼ガス分析準拠 （ガスクロマトグラフィー測定）
・NOx、SOx （イオンクロマトグラフィー測定）
・単位： mL／10g・gとは、1gの粉砕を750℃で燃焼させ10L容器に捕集した時の含有濃度

JFEテクノリサーチ株式会社（JFE－TEC）
分析・評価事業部 福山事業所
広島県福山市鋼管町1番地 （JFE スチール構内） 〒721－0931
TEL 084(945)4137 FAX 084(945)3989
所 長 山 下 正 明

様式 F5

**Analysis test report**

| Requester | Harison Co., Ltd. |
|---|---|
| Item | Analysis of rice husk briquette combustion gas |

報告日 : 2008/5/26
整理番号 : F0800261

| Sample code | Analysis item | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | H2 | O2 | N2 | CO | CH4 | CO2 | C2H4 | | (水分) | | | | | |
| Units | % | % | % | % | % | % | % | | % | | | | | |
| Rice husk briquette | 0.70 | 43.8 | 11.1 | 4.6 | 0.7 | 39.1 | 0.3 | | 5.3 | | | | | |

【 備 考 】

[分析方法]
別紙試験方法

JFEテクノリサーチ株式会社（JFE－TEC）
分析・評価事業部 福山事業所
広島県福山市鋼管町1番地 （JFE スチール構内） 〒721－0931
TEL 084(945)4137 FAX 084(945)3989
所 長 山 下 正 明

様式 F5

## Analysis test report

| | |
|---|---|
| Requester | Tromso Co., Ltd. |
| Item | Analysis of rice husk briquette ash composition |

報告日 : 2007/ 12/20
整理番号 : F0701332

| Sample code | Analysis item | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Fe2O3 | CaO | SiO2 | Al2O3 | MgO | MnO | P | TiO2 | | | | | |
| Units | % | % | % | % | % | % | % | % | | | | | |
| Horizonal stripes | 0.24 | 1.04 | 95.42 | 0.38 | 0.12 | 0.22 | 0.23 | Tr | | | | | |

【 備 考 】

[分析方法]
・試料を粉砕破砕後、電気炉で灰化したものを分析に供した。
・定量：蛍光X線分析装置

JFEテクノリサーチ株式会社(JFE－TEC)
分析・評価事業部　福山事業所
広島県福山市鋼管町1番地 (JFE スチール構内)　〒721－0931
TEL 084(945)4137　FAX 084(945)3989
所長 山下 正明

## Analysis test report

| | |
|---|---|
| Requester | Tromso Co., Ltd. |
| Item | Analysis of calorific value rice husk briquette |

報告日：２００７年１２月１２日
整理番号：

| Sample code | Analysis item | |
|---|---|---|
| Units | KJ／Kg | |
| NO.1 Yellow stripes | 16570 | Rice husk briquette |
| NO.2 Ruled line | 15480 | Crashed Rice husk briquette |
| NO3. Black | 19340 | Rice husk briquette ash |

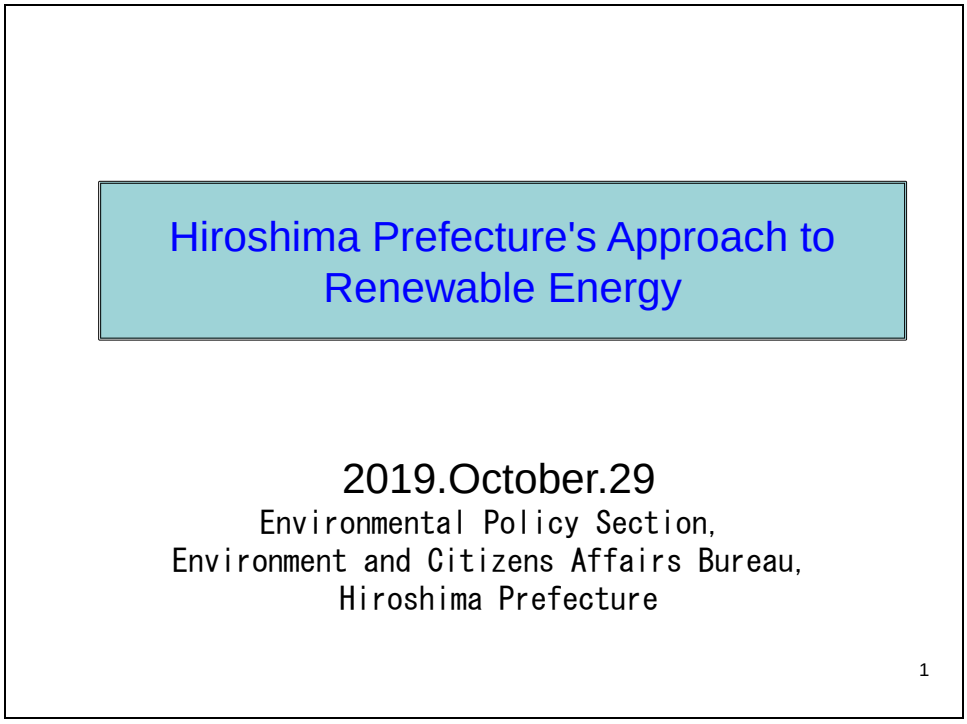
【備考】

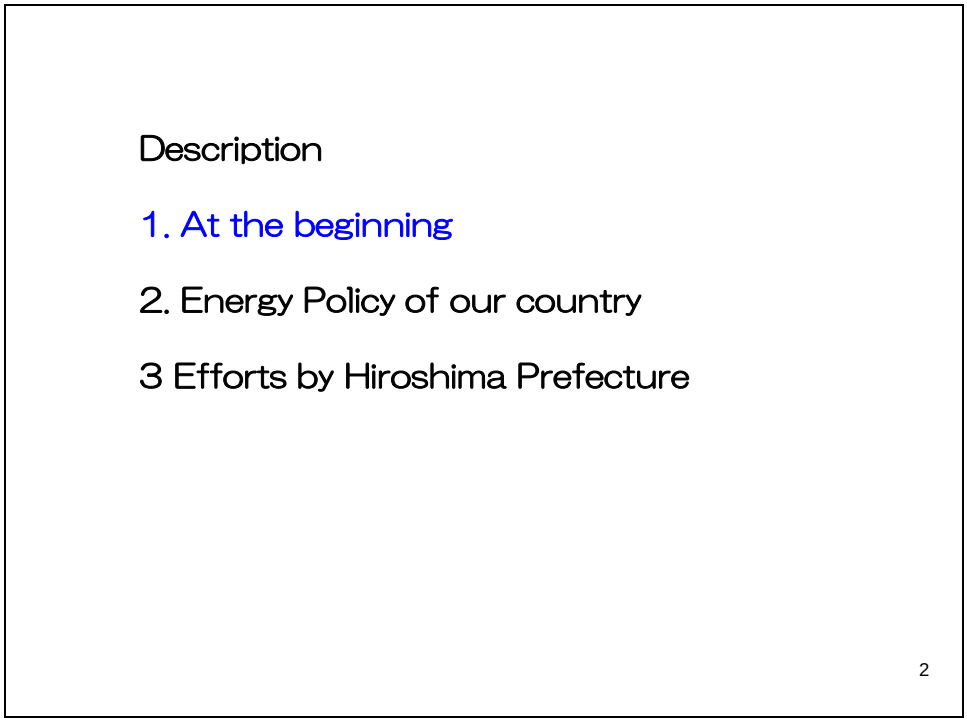
【分析方法】
JIS M8814 石炭及びｺｰｸｽ類 ボンブ燃料計による総発熱量の定量法に準じる

ＪＦＥテクノリサーチ株式会社（ＪＦＥ－ＴＥＣ）
分析・評価事業部　福山事業所
721-0931
広島県福山市鋼管町１番地（JFE ｽﾁｰﾙ構内）
ＴＥＬ084(945)4137　ＦＡＸ084(945)3989
所長 山下 正明

8. Attachment

(1) Visit of the City of Can Tho officers to Hiroshima Prefecture(the initiatives to reduce carbon dioxide in Hiroshima)



## 1 Current Status of Global Warming Issues

■ The temperature of the ground surface rises due to an increase in atmospheric carbon dioxide, etc.

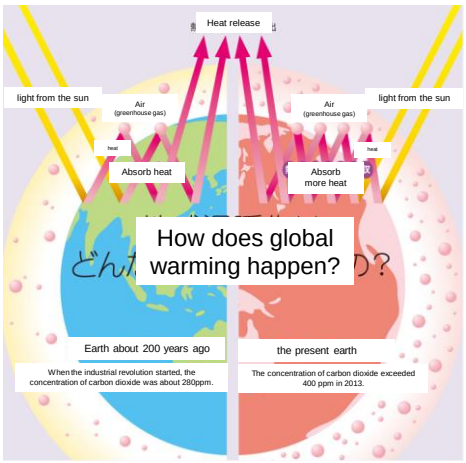
### Mechanism of the greenhouse effect

with energy from the sun
the heat from the surface of the Earth
Greenhouse gases are absorbed and re-emitted to warm the atmosphere.

If atmospheric concentrations of carbon dioxide and other greenhouse gases increase ・・・

The greenhouse effect becomes stronger than before, and the temperature of the ground surface rises.

This is global warming.

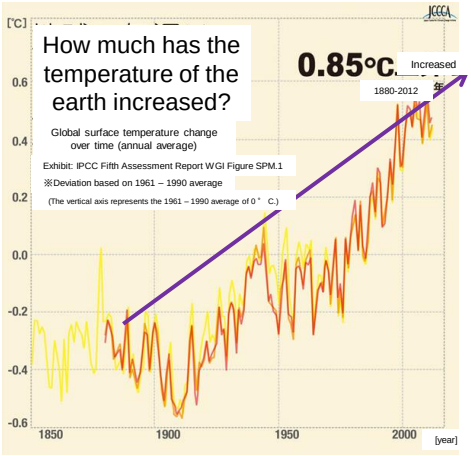



3

## 1 Current Status of Global Warming Issues - Progress of Global Warming -

■ There is no doubt that the climate system is warming.

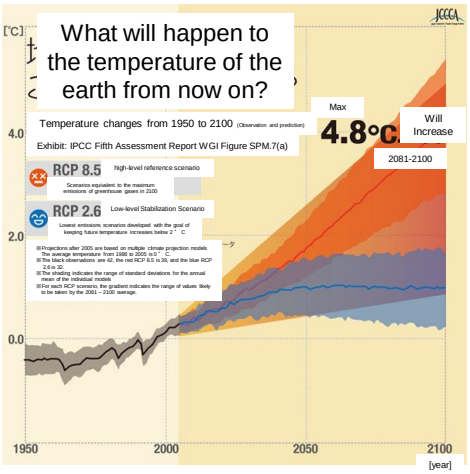
■The main cause of global warming is the massive consumption of fossil fuels since the Industrial Revolution.




4

## 1 Current Status of the Global Warming Problem
### - Prospects for Further Progress -

■Unless stringent measures are taken, temperatures are expected to rise by up to 4.8 ° C by the end of this century.

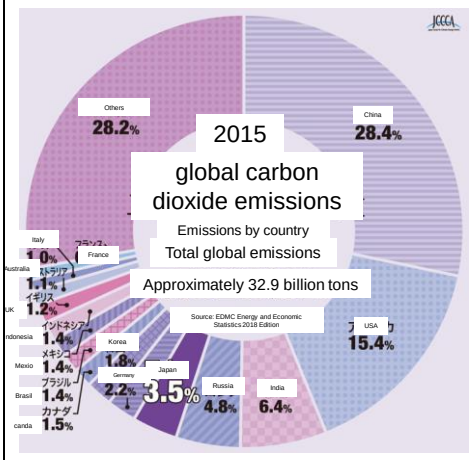


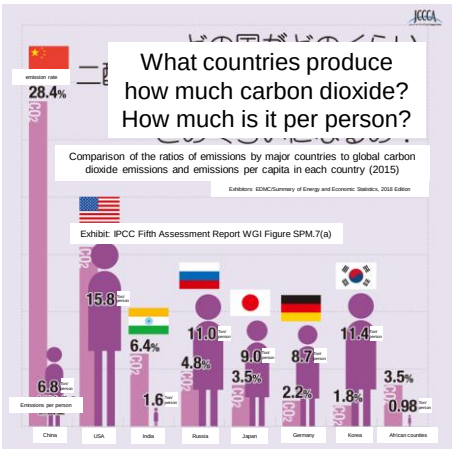

5

## 1 Current Situation of Global Warming
### -Ratio of Carbon Dioxide Emissions by Country

■China is the largest emitter of greenhouse gases, followed by the United States. Japan ranked 5th with 5.3%

■The United States has the largest per capita emissions.




（Source：JCCCA）

## 1 Current Status of Global Warming Issues
### - Recent Trends -

■ Greta Thunberg Speaks Out at U.N. Climate Summit (September 2019)

■77 countries at the summit announced a target of virtually 0 emissions of greenhouse gases by 2050.

### Miss Greta's argument

・The idea of halving greenhouse gas emissions in 10 years has only a 50% chance of keeping temperature increases below 1.5 ° C.

・The current level of emissions will reach the remaining CO2 emissions in less than eight and a half years.

・World leaders must act now on climate change, not economic growth.

7


## Description

1. At the beginning

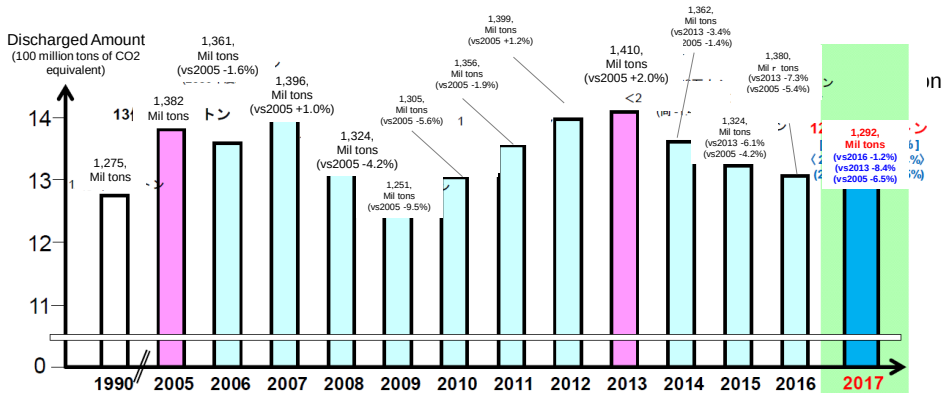
2. Energy Policy of our country

3 Efforts by Hiroshima Prefecture

8

## 2 Our country's Energy Policy: Trends in Greenhouse Gas Emissions

■Although it has increased since 9, it has been on a decreasing trend in recent years.

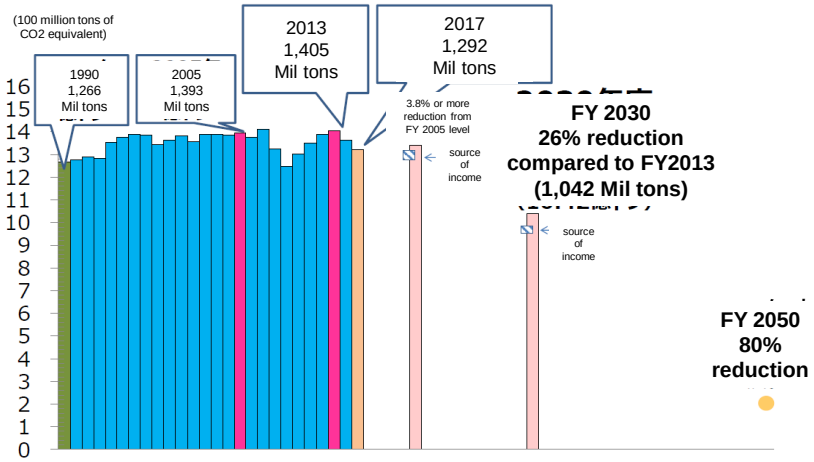



9

## 2 Energy policy in our country -Greenhouse Gas Emissions Targets under the National Global Warming Prevention Plan (2016.5)-

■ Aim to reduce emissions by 26% from FY 13 levels by FY 2030 and by 80% by FY 2050 over the long term

■ For this purpose, the introduction of renewable energy is essential.




10

## 2 Energy policy in our country

■ 5th Basic Energy Plan (September 2018)

- The aim is to contribute to the further development of our country's economy and society, the improvement of the lives of its citizens, and the sustainable development of the world through a long-term, stable, sustainable and autonomous energy supply.
- Positioning of Renewable Energy

  2030

  To lay the groundwork for mainstay power supply,
  to reduce costs, to overcome system constraints,
  and to secure thermal power adjustment capability

  2050

  Aiming to become an economically independent, decarbonized mainstay power source

  Started development of hydrogen, storage and digital technologies

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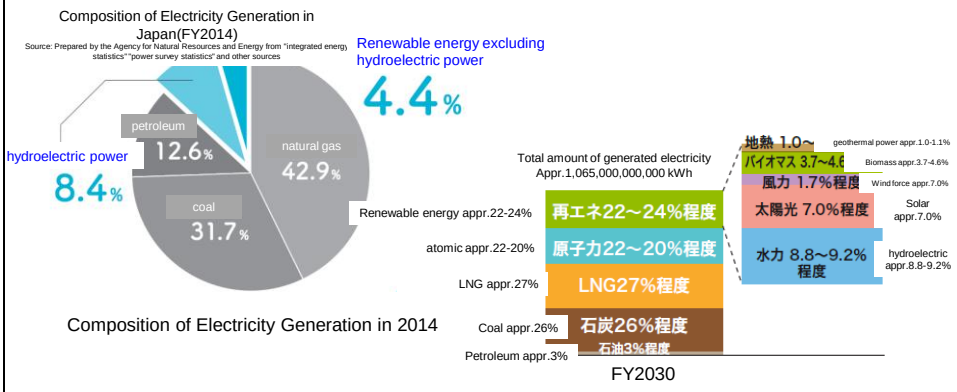
## 2 Energy policy in our country
### - Amount of renewable energy introduced under the Fifth Basic Energy Plan -

■ Renewable energy will account for 22 to 24% of total electric power generation by 2030.




12

## 2 Energy policy in our country
### - Amount of renewable energy introduced under the Fifth Basic Energy Plan -

Hydropower, geothermal, and biomass
Power supply capable of stable operation regardless of natural conditions

▼

Reduce dependence on nuclear power by introducing as much as possible while taking into account environmental regulations and coordination with local residents

solar and wind power
a power supply whose output varies greatly under natural conditions

▼

Maximize deployment to reduce power costs

| | 2013 Amount of generated electric power | | 2030 Amount of generated electric power |
|---|---|---|---|
| geothermal power | 2.6 billion kWh | about four times | 102-103billion kWh (1.0-1.1%) |
| biomass power generation | 176billion kWh | about four times | 394-490billion kWh (3.7-4.6%) |
| hydraulic power | 849billion kWh | about four times | 939-981billion kWh (8.8-9.2%) |

| | 2013 Amount of generated electric power | | 2030 Amount of generated electric power |
|---|---|---|---|
| solar | 114billion kWh | about seven times | 749billion kWh (7.0%) |
| wind power | 52billion kWh | about four times | 182billion kWh (1.7%) |

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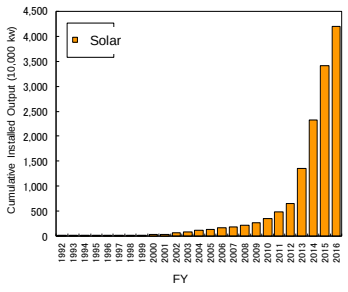
## 2 Energy Policy in our country
### - Introduction of Photovoltaic and Wind Power Generation Systems -

■Cumulative introduction of both photovoltaic power generation and wind power generation increased.

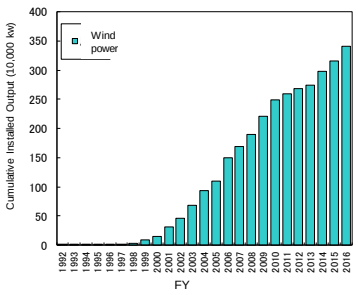
■Photovoltaic power generation, in particular, has rapidly increased in recent years due to the feed-in tariff system.

Cumulative installed solar power generation by FY 2016




<Source> National Survey Report of PV Power Applications in JAPAN 2016 (International Energy Agency)

Cumulative installed wind power generation by FY 2016




<Source> Japan New Energy and Industrial Technology Development Organization (NEDO))

14

## 2 Our country's Energy Policy
## - Various Photovoltaic Power Generation Systems -

roof of a private house

Roof of prefectural facilities (Seibu Kodomo Katei Center)

Mega Solar
(Shobara Photovoltaic Power Plant)

Water photovoltaic power plant
(Source: Ministry of the Environment)

Rural photovoltaic power generation
(Source: Ministry of Agriculture, Forestry and Fisheries)

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Description

1. At the beginning

2. Energy Policy of our country

3 Efforts by Hiroshima Prefecture

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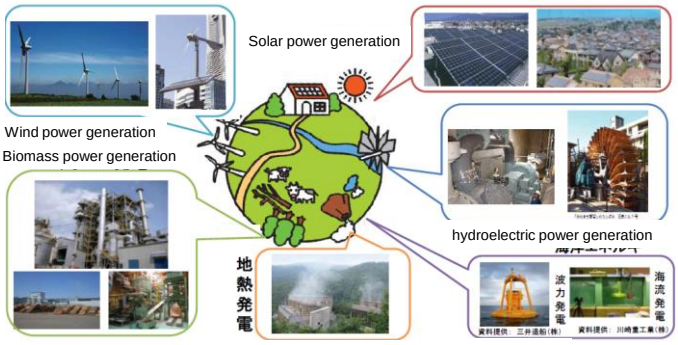
## 3 Efforts by Hiroshima Prefecture

- Renewable energy is a clean and sustainable source of energy
- The Great East Japan Earthquake and the accident of the Fukushima nuclear power plant have triggered the review of the national energy policy, and the importance of renewable energy is increasing.
- Hiroshima Prefecture has advantages because of abundant solar radiation and woody biomass.
- Utilizing the national feed-in tariff system, work on "photovoltaic generation" "Woody biomass power generation" and "small hydroelectric power generation"

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(Source: Ministry of Economy, Trade and Industry)

## 3 Efforts by Hiroshima Prefecture
## Hiroshima Prefecture's Priority Areas
## -Photovoltaic Power Generation-

- Promoting the installation of solar power generation systems by taking advantage of the nation's third-largest amount of abundant solar radiation
- Since it is easy to use as an energy source, it is possible to make various efforts such as housing, business facilities, mega solar power, etc.

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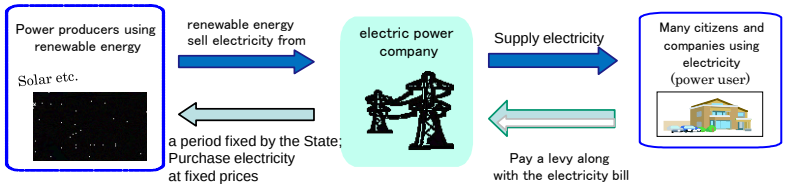
## 3 Efforts by Hiroshima Prefecture
### - Projects to Introduce Renewable Energy Based on Local Reductions-

■ Prefectural Government takes the initiative in mega solar power generation and widely returns profits to prefectural residents




● The feed-in tariff system is an effective method for expanding the use of renewable energy. On the other hand, it is inherently unfair that the profits of power producers are supported by a large number of citizens and enterprises (power user) through levies.

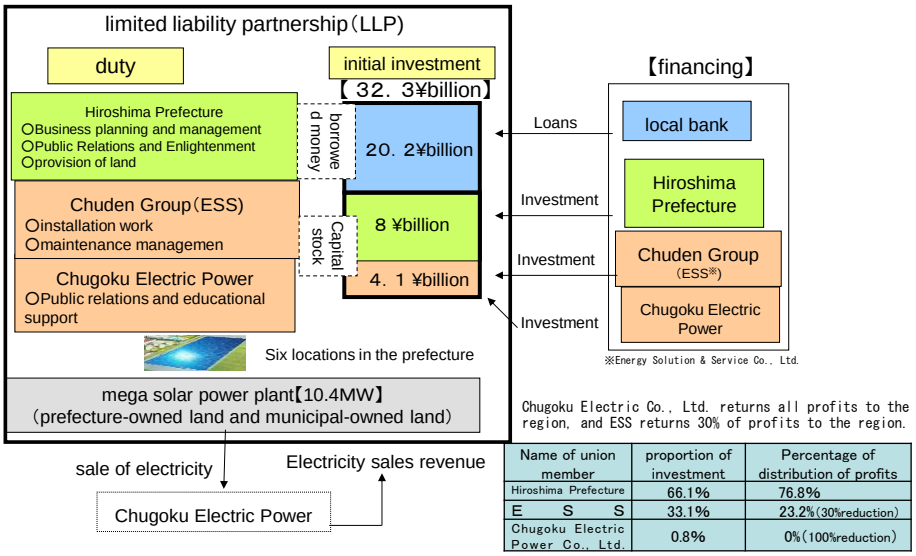
● The prefecture takes the initiative in mega solar power generation using the electric power purchase system, and returns the profit obtained from the power generation business to the region to mitigate the unfairness.

● The prefecture and the Chugoku Electric Power Group jointly launched a mega solar power generation project (First time in Japan)

19

## 3 Initiatives by Hiroshima Prefecture
### Project to Introduce Community-Based Renewable Energy (Business Frame)

■ Joint project between the prefecture and the Chugoku Electric Power Group (Establishment of business associations)

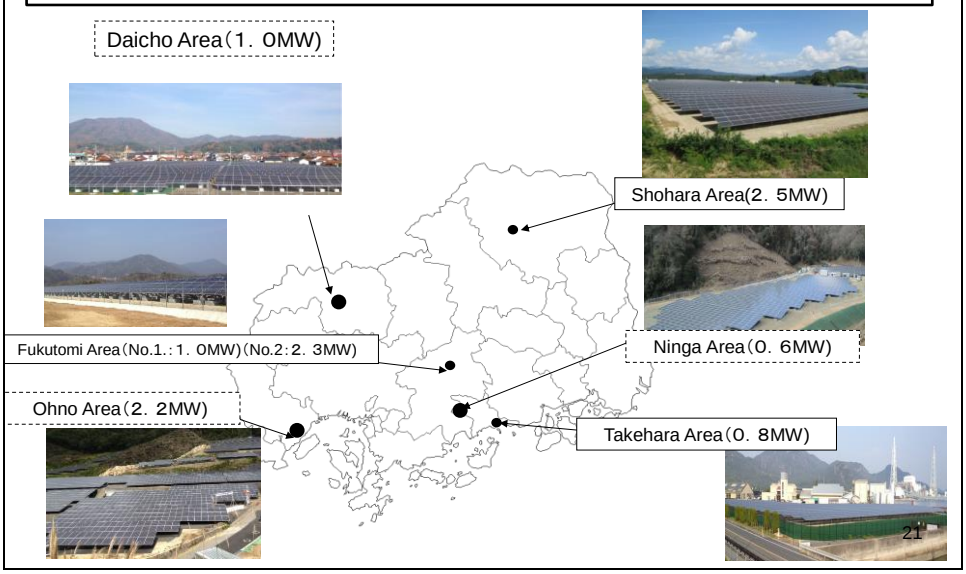



Chugoku Electric Co., Ltd. returns all profits to the region, and ESS returns 30% of profits to the region.

| Name of union member | proportion of investment | Percentage of distribution of profits |
|---|---|---|
| Hiroshima Prefecture | 66.1% | 76.8% |
| E S S | 33.1% | 23.2%(30%reduction) |
| Chugoku Electric Power Co., Ltd. | 0.8% | 0%(100%reduction) |

## 3　Efforts by Hiroshima Prefecture
### Mega Solar Power Generation with Local Feedback

■ A mega solar power plant was established as a joint project between the prefecture and the Chugoku Electric Power Group. Utilizing Earnings to Return to Local Communities

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## 3　Efforts by Hiroshima Prefecture
### Subsidizing the installation of energy-saving equipment (local return)

■Supporting the installation of energy-saving air conditioners and solar power generation systems in kindergartens and nursery schools

22

## 3 Activities of Hiroshima Prefecture

- Assistance for Promotion of Energy Conservation Activities (local return) -

■Supporting energy conservation activities by local organizations

Development of energy saving meisters

Energy saving workshop

green curtain

delivery lecture

Energy saving event

Eco-cooking

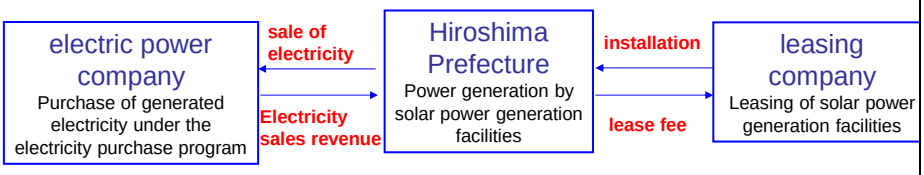
23

## 3 Initiatives by Hiroshima Prefecture

Introduction of prefecture-owned solar power generation facilities

In order to promote the use of renewable energy, photovoltaic power generation facilities are installed on the roofs of prefectural facilities (2. Facilities) under lease.

【business scheme】

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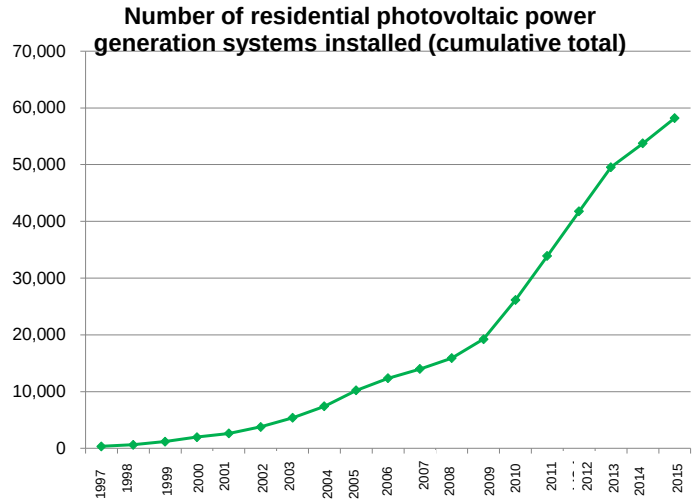
## 3 Efforts in Hiroshima Prefecture

Introduction of residential photovoltaic power generation in Hiroshima Prefecture

■ Approx. 60,000 residential photovoltaic power generation systems have been installed (The number of households in the prefecture is approximately 1.24 million, and the number of detached houses is approximately 6.7 billion.)

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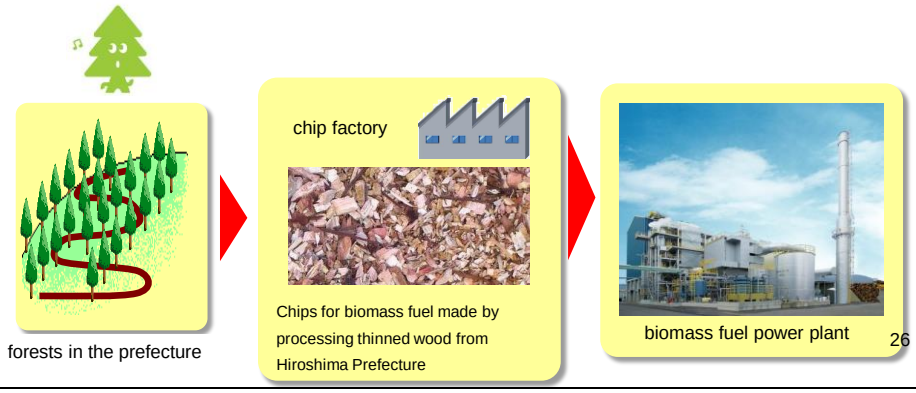
## 3 Efforts by Hiroshima Prefecture - Woody Biomass Power Generation -

■ Woody biomass is attracting attention as an environmentally friendly fuel because it does not increase carbon dioxide, which causes global warming, even when burned.

■ Fuel used for woody biomass power generation is manufactured by processing thinned wood, etc.

■ Promoting efforts to collect wood and support the development of facilities necessary for processing in order to secure fuel in a stable manner

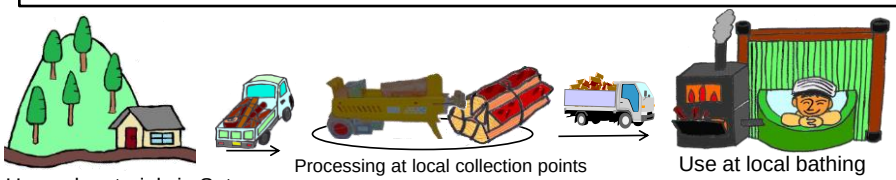



26

## 3 Efforts by Hiroshima Prefecture

**- Satoyama Biomass Utilization Promotion Project -**

■ Promotion of efforts to use unused materials from Satoyama as a heat source for local communities in cooperation with local communities

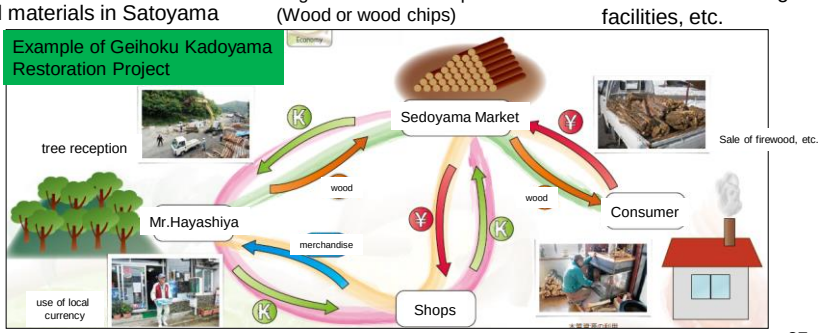


Unused materials in Satoyama

Processing at local collection points (Wood or wood chips)

Use at local bathing facilities, etc.

Example of Geihoku Kadoyama Restoration Project




*Satoyama: mountain forests adjacent to villages and human settlements. There are ecosystems affected by humans.*

27

## 3 Efforts by Hiroshima Prefecture
## - Satoyama Biomass Utilization Promotion Project -

■ Promoting activities throughout the prefecture.

①creation of momentum → ②Excavation of candidate for challenge → ③Establishment of preparatory organization → ④activity content determination → ⑤Establishment of an executive organization

lecture

Establishment of preparatory organization

carry-out training

round-table discussion

Health examination in the forest

inspection of advanced areas

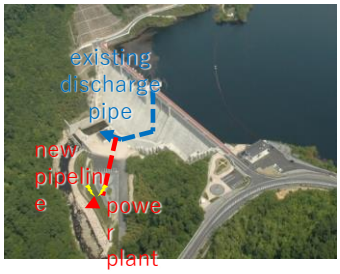
28

## 3 Efforts by Hiroshima Prefecture
## Small Hydroelectric Power Generation

■ In the prefecture, small hydroelectric power generation has been developed for a long time.

■ Although there is little room for new development, the development of small hydroelectric power generation using discharged water from prefectural dams is promoted.

■ The generated electricity is used for the maintenance of dams and the efficiency of dam management is promoted.




Fukutomi Dam
（Output: 370 kw, generated electricity: approximately 2.6 GWh/year）

29

## (References) Power Stations around Hiroshima City


Legend：●Thermal power, ●Thermal power (Mixed combustion with biomass) , ●Solar, ●hydraulic power

Electric Japan Website (National Institute of Informatics)
http://agora.ex.nii.ac.jp/earthquake/201103-eastjapan/energy/electrical-japan/

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(2) Visit of Can Tho City officers to Hiroshima Prefecture (Introduction of Fukutomi Power station No.1 and No.2)


| Name of power plant | | Fukutomi Solar Power Station 1 | Fukutomi Solar Power Station 2 |
|---|---|---|---|
| location | | 2376 -1 Okurita, Hisayoshi, Fukutomi-cho, Higashihiroshima-shi | 2375 -1 Okurita, Hisayoshi, Fukutomi-cho, Higashihiroshima-shi |
| panel footprint | | 約12,000㎡ | 約26,000㎡ |
| Solar Power Station | panel capacity | 950kW | 2,280kW |
| | Number of panels | 3,640 | 8,736 |
| | Power generation output (PCS) | 700kW | 1,960kW |
| | Estimated power generation (year) | 960,000 kWh/year (Equivalent to the annual electricity consumption of 270 households) ※Calculated by approx. 300 kWh/month per household | 2,410,000 kWh/year (Equivalent to the annual electricity consumption of 700 households) ※Calculated by approx. 300 kWh/month per household |

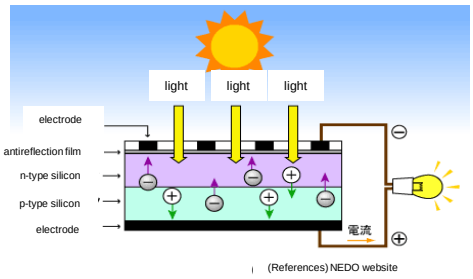
## What is solar power?

The system uses panels (solar cell) that generate electricity when exposed to sunlight. You can convert sunlight directly into electricity.

Although the amount of electricity that can be generated depends on the weather, it can be said to be an earth-friendly power generation system because there is no fear that it will disappear and carbon dioxide is not emitted.

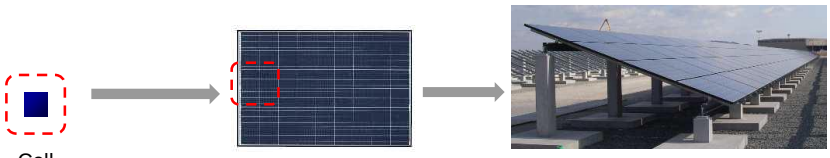
### Principle of a solar cell

When a solar cell is exposed to light, positive and negative particles are produced, and negative electricity collects toward n-type silicon and positive electricity toward p-type silicon. As a result, electric current flows when a light bulb is connected to the electrode. This is the principle of solar cells.



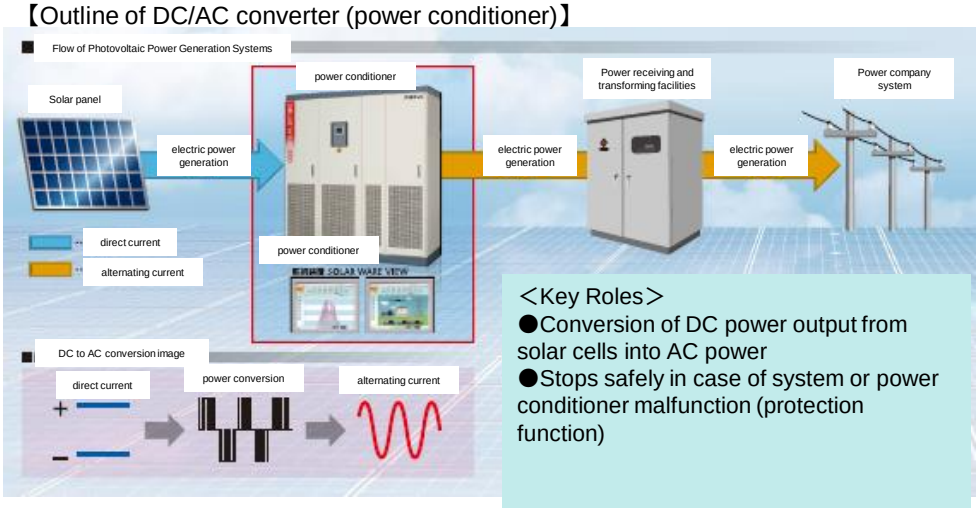

(References) NEDO website

### 【References】Names according to solar cell configuration



Cell　　Module　　Array

【Outline of DC/AC converter (power conditioner)】




＜Key Roles＞

●Conversion of DC power output from solar cells into AC power

●Stops safely in case of system or power conditioner malfunction (protection function)

(3) Visit of Can Tho City officers to Hiroshima Prefecture (Introduction of Tromso Co., Ltd. Biomass power generation project using milled rice husks for compressed solid fuel)

# “Biomass power generation project using milled rice husks for compressed solid fuel”

30th Oct, 2019

Tromso Co., Ltd.

# Company Outline

An Innovative Technology Developed in the Heartland of Shipbuilding Industry

| | |
|---|---|
| Company name | TROMSO Co.,Ltd. |
| Contact | 5265 Shigei-cho, Innoshima,Onomichi-shi,Hiroshima<br>TEL 0845-24-3344　FAX 0845-24-3181<br>http://www.tromso.co.jp/<br>info@tromso.co.jp<br>●Youtube<br>https://www.youtube.com/channel/UCAp6il7D-HwlKnVdg9fvPtA |
| Main business | Production and sales of rice husk briquette machines |
| Date founded | March 15, 2007 |
| Capital | 3 million JPY |
| CEO | Masahiro Nakasaka |
| Main bank | Hiroshima Bank |

Issued in October, 2018

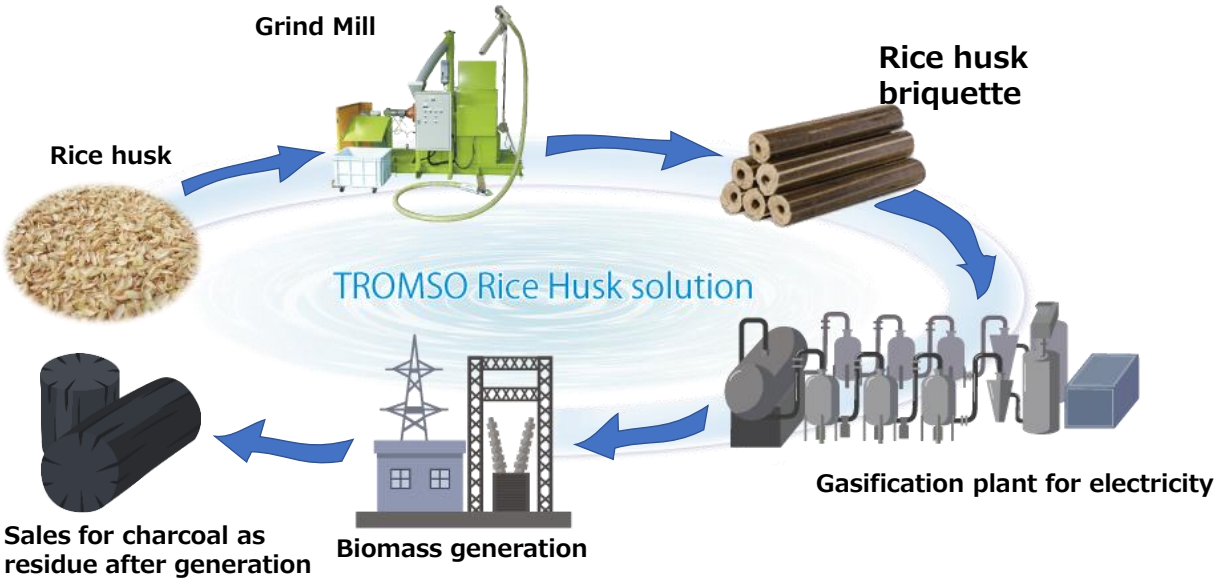
## モミガライト製造機 [Grind Mill]

| | |
|---|---|
| Processing capacity | Approx.120kg/h |
| Dimension | 2500(W)×990(D)×1500(H) |
| Weight | Approx. 850kg |
| Power | AC200V 3φ 50/60Hz |
| Motor | 15KW　4P reduction ratio 1/15 |
| Heater | 1.5KW×3個 |

## モミガライト [Rice husk briquettes]

- ✓ Solid fuel made from 100% of rice husk
- ✓ No binders to solidify
- ✓ Calorific value　Rice husk briquette 3970kcal/kg　Firewood 4000kcal/kg
- ✓ It is possible to mix with other material(sow dusts, peanut shell etc.)

# Rice husk flow




## Project Outline

Overview

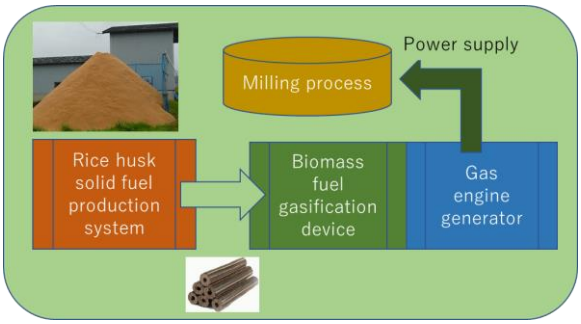
- To utilize the City-to-city programme between Cao tho city and Hiroshima.
- The project is composed of below items;

A) producing briquettes made from rice husks discarded from rice milling process of rice mill factory.

B) Making use of the solid fuel to produce the electric power.

C) The electric power of In-house use is covered by 100% of the power coming from the power generation.

- The rice mill factory has purchased currently the electricity via GRID from national company located in South area which deals with electric power.
- Replacing thermal power generation using charcoal with biomass power generation causes to reduce the greenhouse gas emission dramatically. It takes a benefit that this rice mill factory can emit 0% of greenhouse gas by using the power from biomass power generation and would be green rice mill factory.
- It is expected an employment of power generation business.



## Background

- On the basis of “Cooperative approaches” which are stipulated in Article 6.2 of the Paris Agreement, Japan exchanges contracts related the program of cooperative approaches between each 17 countries included Vietnam.
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The Name of Project：**City-to-city Collaboration Programme Commitment Business regarding a low carbon society development**

環境省 Ministry of the Environment

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- Profitability and Feasibility of Biomass Power Generation Business regarding a reuse of waste rice husks
- Greenhouse gas reduction during the implementation of this project utilizing renewable energy
- Adaptation of the JCM

- This project could be implemented on the basis of below programme after 2020 as long as above conditions will be accomplished.
  - The assistance project for introduction of equipment based on the JCM.

JCM THE JOINT CREDITING MECHANISM

## JCM(The Joint Crediting Mechanism)

JCM THE JOINT CREDITING MECHANISM

- Facilitating diffusion of leading low carbon technologies, products, systems, services and infrastructure as well as implementation of mitigation actions, and contributing to sustainable development of developing countries;
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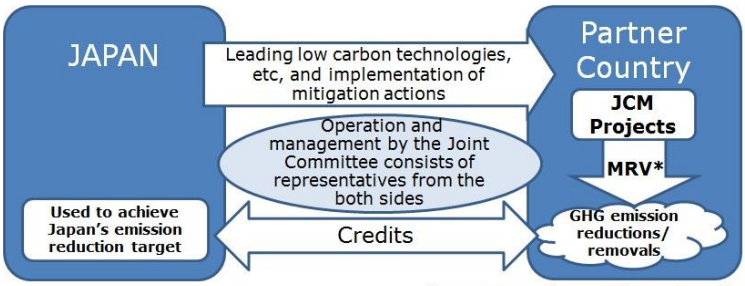


*measurement, reporting and verification

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Mongolia, Bangladesh, Ethiopia, Kenya, Maldives, Vietnam, Laos, Indonesia, Cost Arika, Palau, Cambodia, Mexico, Saudi Arabia, Chile, Myanmar, Thailand, Philippine (June, 2019)

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|---|---|---|
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◎ conduction of City-to-city Feasibility survey business led by Ministry of the Environment
・*A survey of the possibility of introduction of low carbon technologies*.
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A role of this project

◎ Conduction of the JCM

Introduction of the relevant technology be Companies located in Hiroshima

Promotion of the formation of a low carbon society by Can Tho city

# Primary survey items

- Survey items
  - Basic Vietnam Domestic Survey(Population/GDP/Industry/Agriculture/Rice cultivation etc.)
  - Survey of Can Tho city (Population/feature/Agriculture/Rice cultivation etc.)
  - Availability of rice husks as energy
  - Energy usage status at targeted rice mill factory
  - Feasibility to introduce this project as an alternative way of purchase electricity at the targeted rice mill
  - Possibility of diversion to other rice mill factory
  - others
- Rice mill factory as cooperator of this project
  - Trung Thanh Private Enterprise


# Schedule

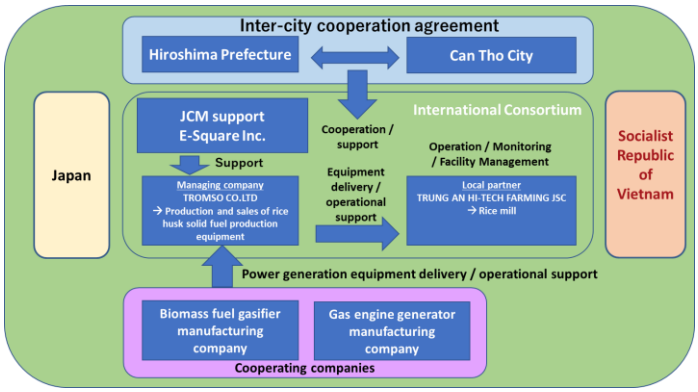
| No. | Item/month | Sep-19 | Oct | Nov | Dec | Jan-20 | Feb | Mar | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Field visiting | ■ | ■ | | ■ | | | | |
| | 【Survey】 | | | | | | | | |
| 2 | Basic information of Vietnam | ■ | ■ | ■ | | | | | |
| 3 | Availability of rice husks | ■ | ■ | ■ | | | | | |
| 4 | Usage of the power in the targeted rice mill factory | ■ | ■ | ■ | | | | | |
| 5 | Feasibility the project in the targeted rice mill factory | ■ | ■ | ■ | | | | | |
| 6 | Possibility to expand the project in Can tho city or Vietnam | | ■ | ■ | ■ | | | | |
| 7 | relevant matters | | ■ | ■ | ■ | ■ | | | |
| | 【Event】 | | | | | | | | |
| 8 | Field visiting regarding the aspect of technology | | ■ | | | | | | |
| 9 | Workshop in Vietnam | | | | ■ | | | | |
| | 【Report】 | | | | | | | | |
| 10 | Creating a report | ■ | ■ | ■ | ■ | ■ | **Submission** | | |
| | 【MOE(Ministry of Environment)】 | | | | | | | | |
| 11 | Monthly report | ○ | ○ | ○ | ○ | ○ | ○ | | |
| 12 | Meetings | | | ○ | | | ○ | | |
| 13 | Expense settlement | | | | | | | ○ | |

Remarks

# After the survey

- Achieving the project making use of the JCM
- Making use of Financing Programme for JCM Model Projects for realization.
  - The subsidy compensates 30~50% of the investment to the equipment which contributes to greenhouse gas reduction.
- Planning to expand this project in domestic Vietnam.

**Implementation system at the time of JCM project transformation**




# Prospect for a future plan

Tromso has an achievement to expand the machine to Tanzania, Nigeria and Madagascar.

There are serious environmental issues on deforestation and climate change etc. all over the Africa

A lot of cases that the issues result in the serious carbon emission.

Establishing and launching **the rice husk gasification power generation system** on the JCM project.

**Can tho City as a future model case for the development for a low carbon society in Africa.**

(4) Visit of Can Tho City officers Hiroshima Prefecture (Toune Mfg. Co., Ltd. Introduction of Biomass power generation)


## MIRAITONE仕様 Specification

Compact & Powerful and environmentally friendly new technologies from Toune

MIRAITONE specification

| Type | Type1 | Type2 | Type3 |
|---|---|---|---|
| rated thermal output | 29kW/h | 58kW/h | 116kW/h |
| heat calorie | 25,000kcal/h | 50,000kcal/h | 100,000kcal/h |
| ignition system | electric heater ignition 400w | electric heater ignition 400w | electric heater ignition 400w |
| main body of the gas generator | exterior ss400 refractory material 1500℃ | exterior ss400 refractory material 1500℃ | exterior ss400 refractory material 1500℃ |
| cyclone dust collector | ss400 Alma processing | ss400 Alma processing | ss400 Alma processing |
| Gas cooling holder | ss400 Alma processing | ss400 Alma processing | ss400 Alma processing |
| gas filter | sus304 | sus304 | sus304 |
| pulverized coal box | ss400 Alma processing | ss400 Alma processing | ss400 Alma processing |
| Compressor | 3Phase 200V 0.75KW | 3Phase 200V 3.7KW | 3Phase 200V 5.5KW |
| Pyroligneous acid tank | sus304 | sus304 | sus304 |
| Double damper for charging | air cylinder opening and closing | air cylinder opening and closing | air cylinder opening and closing |
| Gas tank (1 m2) | sus304 | sus304 | sus304 |
| custom control panel box | ss400 | ss400 | ss400 |
| Fuel consumption (per hour) | 7.5kg/h | 15kg/h | 30kg/h |
| main fuel | Wood pellets, wood chips and bamboo chips | Wood pellets, wood chips and bamboo chips | Wood pellets, wood chips and bamboo chips |
| electrical rated output | 3KVA | 10KVA | 20KVA |

comparison of thermal energy

Fuel costs required to convert 450 liters of water into 15 ° C to 90 ° C hot water

| fuel type | Toune MFG wood chip | Toune MFG wood pellet | A company heavy oil | B company kerosene | C company LPG | D campany wood chip |
|---|---|---|---|---|---|---|
| combustion system | gasification combustion | gasification combustion | boiler combustion | boiler combustion | boiler combustion | direct combustion |
| Lower heating value (kcal/kg) | 3,225 | 3,225 | 10,160 | 10,570 | 12,231 | 3,121 |
| Fuel quantity x unit fuel cost | 10.5 kg x 10 yen | 10.5 kg x 25 yen | 4.02 L x 90 yen | 4.16 L x 98 yen | 3 kg x 290 yen | 13.2 kg x 10 yen |
| Fuel costs (yen) | 105 | 262 | 362 | 408 | 870 | 132 |
| CO2 emissions (kg) | 0 | 0 | 10.9 | 10 | 0 | 0 |

gas composition table

Gas Temperature 740 ~ 800 ° C
(Average of 770 ° C)
Measured by new gasifier

| element name | Percentage of tota | calorific value |
|---|---|---|
| hydrogen | 11.5% | 1.079MJ/m2 |
| carbon monoxide | 20.5% | 2.589MJ/m2 |
| hydrocarbon | — | — |
| methane | 3.0% | 1.073MJ/m2 |
| ethane | 0.10% | 0.063MJ/m2 |
| propane | 0.01% | 0.009MJ/m2 |
| Ethylene | 0.87% | 0.513MJ/m2 |
| Propylene | 0.08% | 0.073MJ/m2 |
| carbon dioxide | 7.90% | — |
| Oxygen | 0.60% | — |
| nitrogen | 55.44% | — |
| Total elements are wood pellets. | 100.00% | 5.399MJ/m2 1296kcal/m2 |

## Biomass fuel Gasification generation device MIRAITONE(ミライトーン)

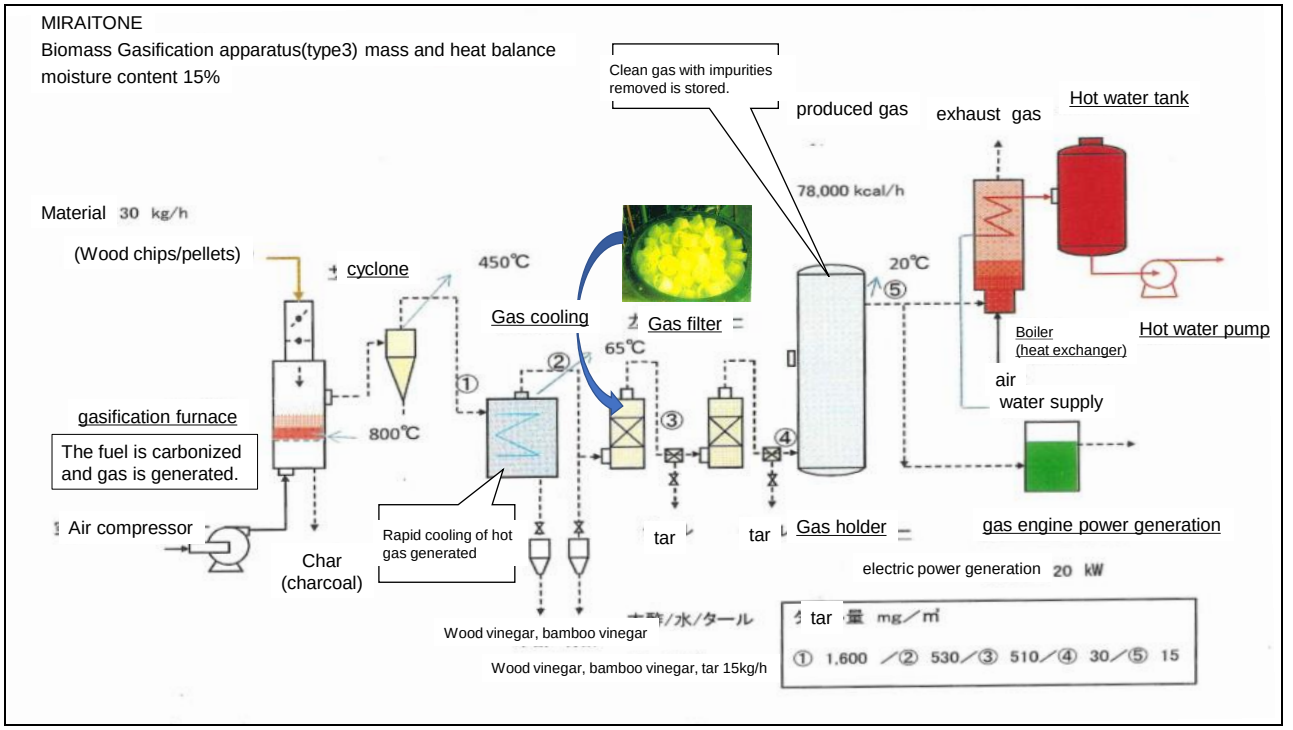
- ✓Combustion gas is generated in a short time.
- ✓Improvement of combustion efficiency by gasification
- ✓Ecology without emitting CO2 into ash
- ✓gas storable
  - →Used for multiple terminals at remote locations by gas piping
- ✓Reuse of wood vinegar and tar

Summary

A gas generator in which wood pellets and chips (biomass) are steam-baked using air to generate gas. After tar and moisture contained in the gas are removed, the wood pellets and chips can be used as fuel for boilers and power generation with a burner.

# MIRAITONE & conventional gasifier

| | MIRAITONE | conventional gasifie |
|---|---|---|
| Fuel | Do not use electricity, diesel oil or fossil fuels. using biomass as fuel, environmentally friendly | Conventional use of electricity, diesel oil and fossil fuels |
| Cooling | A cooling system that does not use water during the gas cooling process. No need to worry about freezing of cooling water in winter. | Cooling water is used. Treat as industrial waste after use. It consumes a lot of water. |
| Filter | **Uses loofah filter** to remove powdered coal, moisture and tar. Inexpensive and reusable | Exchangeable in 2-3 years and very expensive |
| Scale | Compared to conventional gasifiers, this system can be installed at a lower cost and in a paraful manner, despite its small size. | Large and expensive |

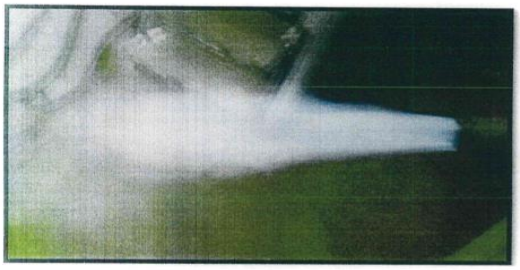


Condition in which generated gas is being combusted externally

Raw materials for gas generators (pellet)

During external combustion

During external combustion



Burning with gas burner

hot water boiler(450L)

Our company's original woody biomass hot water boiler

To increase thermal efficiency, a spiral guide plate attached to the outer circumference of the boiler effectively utilizes combustion exhaust gas to increase thermal efficiency of hot water temperature.

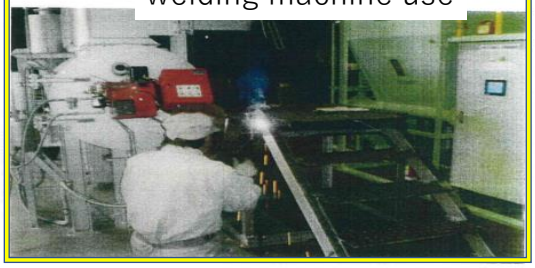
temperature indicator

Boiler combustion chamber temperature about 340 ° C, exhaust gas outlet temperature about 96 ° C

Welding using gas generated from wood pellets in a power generator

engine generator

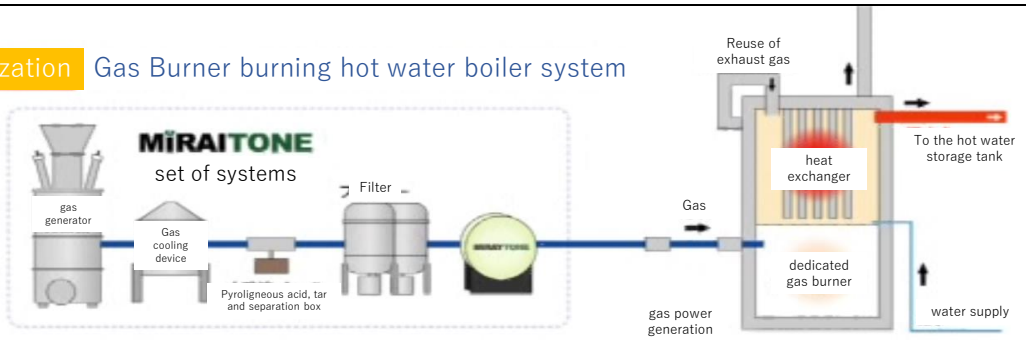

welding machine use



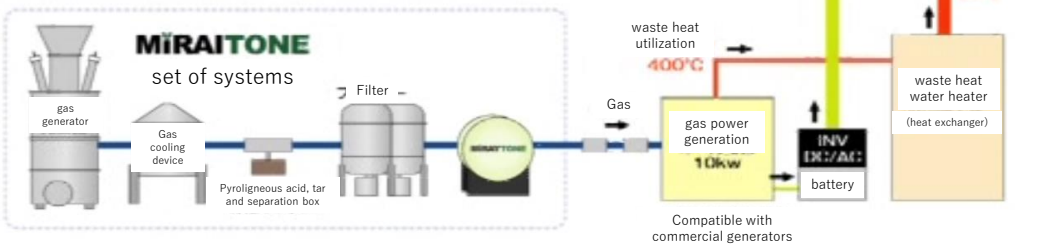
welding machine use

engine generator panel


heat utilization Gas Burner burning hot water boiler system




gas power generation waste heat utilization Gas generator system



# Gas utilization applications

- ✓ For heating vegetables and fruit tree growing houses
- ✓ For heating in flower growing house
- ✓ Heating in livestock raising house
- ✓ For supplying warm water in eel tank
- ✓ For supplying hot water to hospitals, facilities for the elderly, heated pools, etc.
- ✓ Use of hot water for heating and flushing hot spring facilities

(5) Workshop in Can Tho City "Biomass power generation project using milled rice husks for compressed solid fuel"

# "Biomass power generation project using milled rice husks for compressed solid fuel"

10th Dec, 2019

Tromso Co., Ltd.

# Company Outline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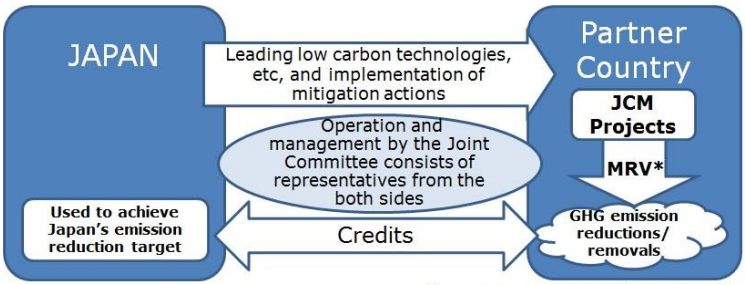


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# Project Outline

Overview

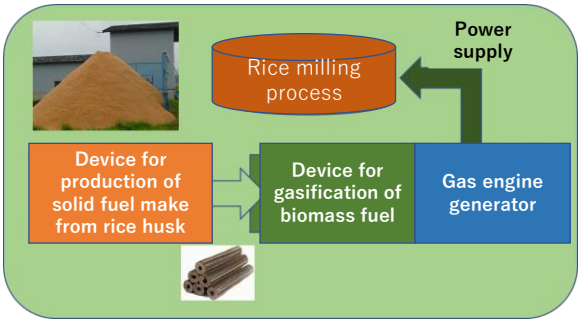
- To utilize the City-to-city programme between Cao tho city and Hiroshima.
- The project is composed of below items;

A) producing briquettes made from rice husks discarded from rice milling process of rice mill factory.

B) Making use of the solid fuel to produce the electric power.

C) The electric power of In-house use is covered by 100% of the power coming from the power generation.

- The rice mill factory has purchased currently the electricity via GRID from national company located in South area which deals with electric power.
- Replacing thermal power generation using charcoal with biomass power generation causes to reduce the greenhouse gas emission dramatically. It takes a benefit that this rice mill factory can emit 0% of greenhouse gas by using the power from biomass power generation and would be green rice mill factory.
- It is expected an employment of power generation business.

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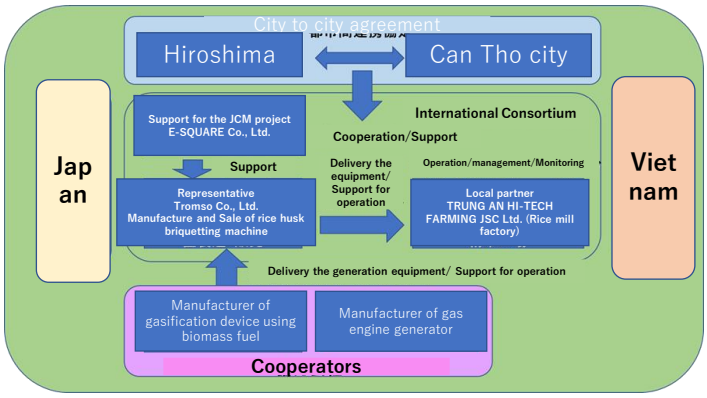
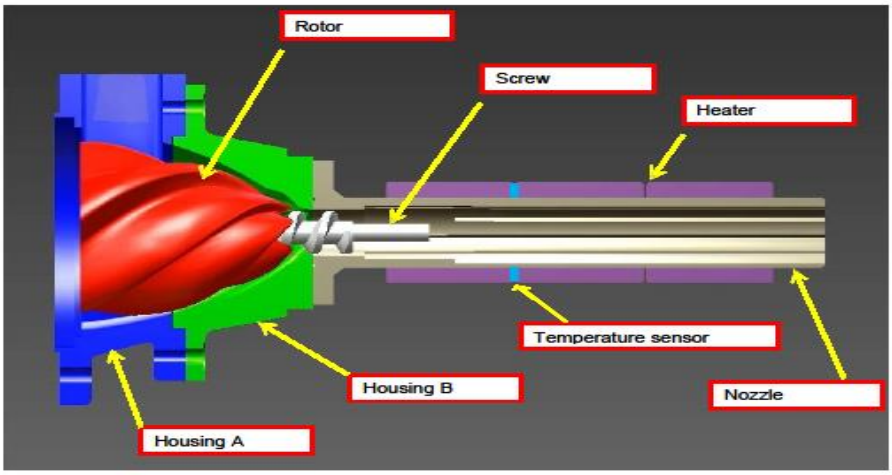
Implementation system diagram of the JCM

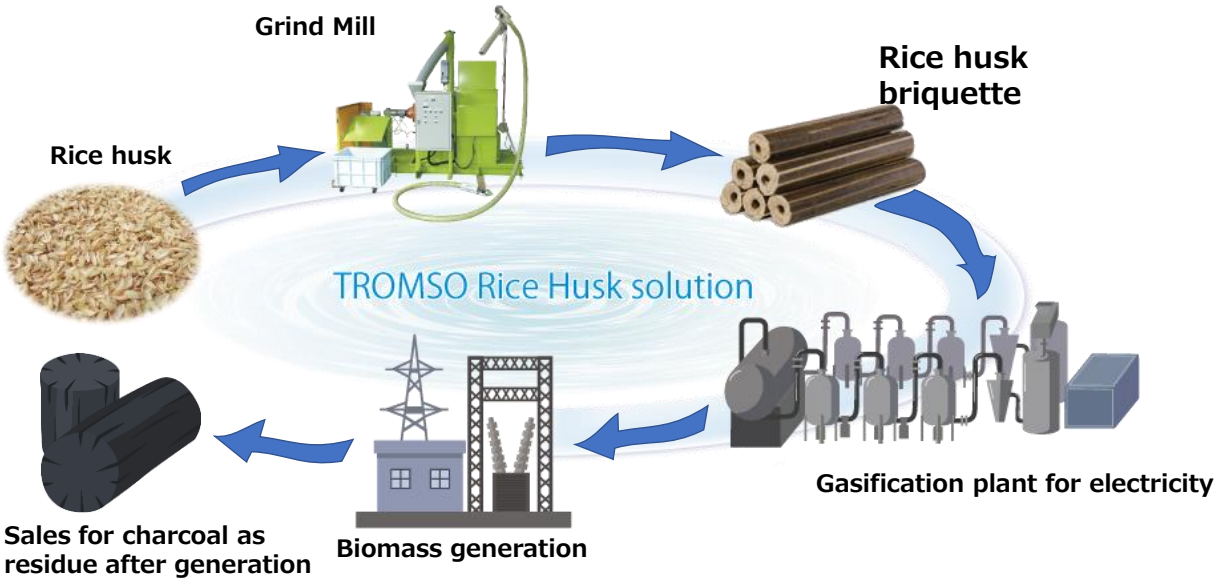


## モミガライト製造機
## [Grind Mill]

## モミガライト
## [Rice husk Briquettes]



# Rice husk flow




## Outline of equipment

| Equipment(Facility) | Specification |
|---|---|
| **Plant for gasification power generation** | 500Kwh ×3 units (Engine generator, chip storage(silo), cubicle type high voltage receiving equipment, Storage and transportation equipment) |
| **Device for Fuel production** | TRM-１２０JP (Hopper for rice husk supply, supplier for rice husk, Crasher, Conveyor etc.) |
| **Storehouse for Equipment etc.** | 150㎡（10m×15m） |

## Cash flow of equipment introduction and Effect of CO2 reduction

| Precondition | Detail |
|---|---|
| **Initial investment** | 1,500,000,000 yen |
| **Equipment subsidy(JCM) 50% of total support** | 750,000,000 yen |
| **Net initial investment** | 750,000,000 yen |
| **Legal durable years** | 15 years |
| **Current unit price** | 7.4 yen/kWh |
| **Working days** | 330 days |
| **Working time** | 24 hours |
| **Surplus power/year** | 9,460,282Kwh |

## Cash flow of equipment introduction and effect of CO2 reduction

| Item | VND | Yen |
|---|---|---|
| Reduction amount of electric utility expense(cost ) | 15,067,834,320 | 71,270,856 |
| Material(cost) | -5,702,400,000 | -26,972,352 |
| Labor(cost) | -634,249,471 | -3,000,000 |
| Maintenance and equipment(cost) | -8,456,659,619 | -40,000,000 |
| Power generation(Balance of payment) | 274,525,229 | 1,298,504 |
| Charcoal sales(revenue) | 14,758,985,201 | 69,810,000 |
| J Credit Sales(revenue) | 2,672,959,565 | 12,643,099 |
| **Total of balance of payment** | **17,706,469,995** | **83,751,603** |

| | | |
|---|---|---|
| Effect of CO2 reduction | **110,026** | **t-CO2** |

# Cash flow of equipment introduction and effect of CO2 reduction

＜Case1：Only equipment introduction＞

| | |
|---|---|
| **IRR（Internal rate of return）** | -21% |
| **Period of return on investment** | 557.6 years |

**＜Case2：Sales of charcoal and J-credit＞**

| | |
|---|---|
| **IRR（Internal rate of return）** | 9 % |
| **Period of return on investment** | 9.0 years |

**＜ Case2：Sales of charcoal and J-credit Detail＞**

| | 0(year) | 1(year) | 2(years) | 3(years) | 4(years) | 5(years) | 6(years) | 7(years) | 8(years) | 9(years) |
|---|---|---|---|---|---|---|---|---|---|---|
| Extra power generation | 0 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 |
| Electricity saving | 0 | 71,270,856 | 71,270,856 | 71,270,856 | 71,270,856 | 71,270,856 | 71,270,856 | 71,270,856 | 71,270,856 | 71,270,856 |
| Net initial investment | 750,000,000 | | | | | | | | | |
| Material cost | | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 |
| Labor cost | | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 |
| Maintenance cost | | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 |
| Depreciation | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Property tax | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cash flow | -750,000,000 | -748,701,496 | -747,402,991 | -746,104,487 | -744,805,983 | -743,507,478 | -742,208,974 | -740,910,470 | -739,611,965 | -738,313,461 |
| Charcoal sales revenue | | 69,810,000 | 69,810,000 | 69,810,000 | 69,810,000 | 69,810,000 | 69,810,000 | 69,810,000 | 69,810,000 | 69,810,000 |
| CO2 reduction | 0 | 7,351 | 7,351 | 7,351 | 7,351 | 7,351 | 7,351 | 7,351 | 7,351 | 7,351 |
| J-Credit revenue | 0 | 12,643,099 | 12,643,099 | 12,643,099 | 12,643,099 | 12,643,099 | 12,643,099 | 12,643,099 | 12,643,099 | 12,643,099 |
| Total of revenue | | 82,453,099 | 82,453,099 | 82,453,099 | 82,453,099 | 82,453,099 | 82,453,099 | 82,453,099 | 82,453,099 | 82,453,099 |
| Charcoal sales revenue/ Cash flow considering CO2 reduction | -750,000,000 | -666,248,397 | -582,496,794 | -498,745,191 | -414,993,588 | -331,241,985 | -247,490,382 | -163,738,778 | -79,987,175 | 3,764,428 |

| | 11(years) | 12(years) | 13(years) | 14(years) | 15(years) | 16(years) | 17(years) | 18(years) | 19(years) | 20(years) |
|---|---|---|---|---|---|---|---|---|---|---|
| Extra power generation | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 | 9,460,282 |
| Electricity saving | 71,270,856 | 71,270,856 | 71,270,856 | 71,270,856 | 71,270,856 | 71,270,856 | 71,270,856 | 71,270,856 | 71,270,856 | 71,270,856 |
| Net initial investment | | | | | | | | | | |
| Material cost | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 | 26,972,352 |
| Labor cost | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 |
| Maintenance cost | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 | 40,000,000 |
| Depreciation | 0 | 0 | 0 | 0 | 0 | | | | | |
| Property tax | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cash flow | -735,716,452 | -734,417,948 | -733,119,444 | -731,820,939 | -730,522,435 | -729,223,931 | -727,925,426 | -726,626,922 | -725,328,418 | -724,029,913 |
| Charcoal sales revenue | 69,810,000 | 69,810,000 | 69,810,000 | 69,810,000 | 69,810,000 | 69,810,000 | 69,810,000 | 69,810,000 | 69,810,000 | 69,810,000 |
| CO2 reduction | 7,351 | 7,351 | 7,351 | 7,351 | 7,351 | 7,351 | 7,351 | 7,351 | 7,351 | 7,351 |
| J-Credit revenue | 12,643,099 | 12,643,099 | 12,643,099 | 12,643,099 | 12,643,099 | 12,643,099 | 12,643,099 | 12,643,099 | 12,643,099 | 12,643,099 |
| Total of revenue | 82,453,099 | 82,453,099 | 82,453,099 | 82,453,099 | 82,453,099 | 82,453,099 | 82,453,099 | 82,453,099 | 82,453,099 | 82,453,099 |
| Charcoal sales revenue / Cash flow considering CO2 reduction | 173,129,904 | 255,583,003 | 338,036,102 | 420,489,200 | 502,942,299 | 585,395,398 | 667,848,497 | 750,301,595 | 832,754,694 | 915,207,793 |