FY2020 Project for Ministry of the Environment Japan

City to City Collaboration for Zero-carbon Society in FY2020 Project to Promote the Formation of an Autonomous Decarbonized Society through City-to-City Collaboration between Hiroshima Prefecture and Soc Trang Province, Vietnam Report

10 March 2021

E-Square Inc.
Hiroshima Prefecture

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1. Introduction

1.1. Background and purpose of the survey

All countries participated in the 21st Conference of the Parties (COP21) to the United Nations Framework Convention on Climate Change (UNFCCC) held in December 2015 in the suburbs of Paris, France, where the Paris Agreement, a legal framework for fair and effective climate action beyond 2020, was adopted, followed by the adoption of a rulebook at COP24 in Katowice, Poland, in December 2018, which sets out specific obligations for each country starting in 2020.

At COP21, where the Paris Agreement was adopted, it was decided to recognize the actions of non-state actors, including cities, and to welcome the efforts of all non-governmental actors (cities and other local governments, etc.) and invite them to scale up their efforts. Cities are places of activity that support socio-economic development and are inhabited by large numbers of people. About half of the world's population lives in urban areas, which account for 2% of the world's total land area, and this proportion is expected to increase to 70% by 2050. As of 2006, more than 70% of the world's CO2 emissions were estimated to come from urban areas. Urban areas play a significant role in mitigating climate change, and the steady implementation of climate change countermeasures in urban areas and the reduction of greenhouse gas emissions are important for achieving the goals of the Paris Agreement. In this project, Japanese research institutes, private companies, universities, and other organizations, together with Japanese cities that have experience and know-how in the formation of a low-carbon society, will conduct research projects necessary to effectively and efficiently support efforts to form a low-carbon society in overseas cities.

This survey was conducted in Soc Trang Province, Socialist Republic of Vietnam, with the aim of reducing greenhouse gas emissions in the field of renewable energy, forming JCM projects that will contribute to such reduction, and strengthening cooperation among cities.

1.2. Survey overview

We conducted basic research on the geopolitics, economic situation, and agriculture, especially rice cultivation, of the target country, Vietnam, and Soc Trang Province. In addition, a workshop (online) was held to discuss inter-city cooperation between Hiroshima Prefecture and Soc Trang Province. In addition, the possibility of reducing CO2 emissions through the use of rice husk solid fuel, solar power generation systems, and BEMS was examined.

(1) Basic Survey of Soc Trang Province
(2) Collaboration between Hiroshima Prefecture and Soc Trang Province
(3) Survey on fuel replacement project of coal boiler using rice husk solid fuel
(4) Survey on energy creation and energy saving projects by introducing solar power generation

systems and BEMS

1.3. Survey items

The details of the survey and its implementation in this study are as follows.

(1) Basic Survey on Soc Trang Province

Based on JETRO Vietnam's reports, local interviews, and other research, the content was prepared by gathering the latest local information.

1. Overview of Vietnam
2. Overview of Soc Trang Province
3. Economic Situation in Vietnam
4. Economic Situation in Soc Trang Province
5. Electricity Situation in Vietnam
6. Electricity Situation in Soc Trang Province
7. Overview of Rice Cultivation in Vietnam
8. Overview of Rice Cultivation in Soc Trang Province
9. Environmental and Energy Law in Vietnam

(2) Collaboration between Hiroshima Prefecture and Soc Trang Province

Hiroshima Prefecture organized its know-how and knowledge and conveyed them to Soc Trang Province to discuss the possibility of collaboration.

1. Past collaboration between Hiroshima Prefecture and
2. Creating a mechanism for continuous identification and formation of new projects through collaboration between Hiroshima Prefecture and Soc Trang Province
3. Hiroshima Prefecture's support for know-how on community-based renewable energy installation projects
4. Online workshop between Hiroshima Prefecture and Soc Trang Province
5. Prospects for further collaboration

(3) Survey on fuel replacement project of coal boiler using rice husk solid fuel

On the assumption that the rice husk solid fuel production equipment (curl chip production machine) of Tromso Co., Ltd., a company in Hiroshima Prefecture, would be introduced to the site, we conducted a field survey on the following items and examined their feasibility.

1. Technologies / products proposed
2. Survey of rice milling businesses
3. Survey on coal use in Vietnam
4. Survey on coal boiler users
5. Potential of adopting the project
6. Future prospect
7. Risk and benefit of introduction

(4) Survey on energy creation and energy saving projects by introducing solar power generation systems and BEMS

The following field survey was conducted to investigate the feasibility of introducing a solar power generation system and BEMS (Building Energy Management System) of Hirokawa Enath Co., Ltd. a company in Hiroshima Prefecture.

1. Technologies / products proposed
2. Survey on energy intensive businesses in Soc Trang Province
3. Potential of adopting the project
4. Future prospect

1.4. Survey structure

The structure of this survey is shown below.

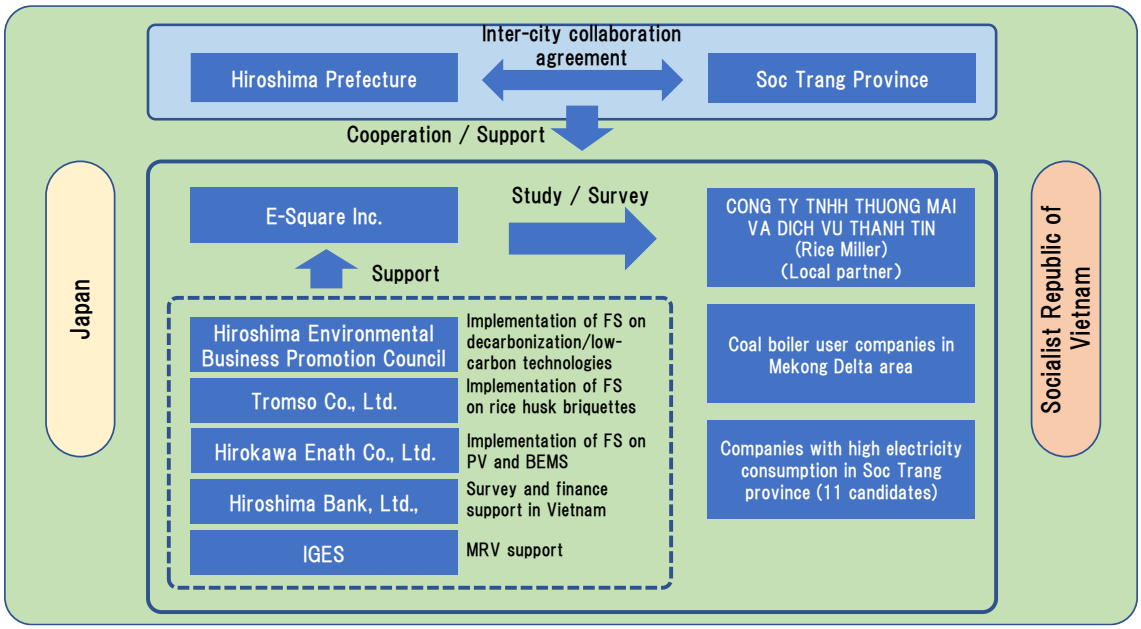


Figure 1 Survey structure

E-Square Inc. as the implementer, Hiroshima Prefecture as the Japanese local government, Hiroshima Environmental Business Promotion Council, Tromso Corporation, Hirokawa Enas Corporation, Hiroshima Bank, Ltd. and Institute for Global Environmental Strategies (IGES) as the co-implementers.

1.5. Survey schedule

This study started in December 2020 and was completed in March 2021.

Item	Dec 2020	Jan 2021	Feb	Mar
Basic survey	→	→		
Collaboration between Hiroshima and Soc Trang	→	→	→	
Survey on rice husk sold fuel	→	→	→	
Survey on PV and BEMS	→	→	→	
Online work shop		★		
C to C seminar by MOEJ			★	
Briefing to MOEJ				★
Report	→	→	→	submission

Figure 2 Survey schedule

2. Basic Survey on Soc Trang Province

2.1. Overview of Vietnam

Vietnam is officially known as the "Socialist Democratic Republic of Vietnam" (hereinafter referred to as Vietnam). It is located on the east side of the Indochina Peninsula at latitudes 8.35-23.4 degrees north/longitudes 102.8-109.4 degrees east, bordered by Laos and Cambodia to the west, and the South China Sea to the east. The distance from Tokyo to Ho Chi Minh City is 4,336 km, and it takes about 6 hours by air.

Figure 3 Location of Vietnam and Japan

Figure 4 National flag of Vietnam

The political system is a socialist republic led by the Communist Party of Vietnam. The current system has been in place since the declaration of independence by Ho Chi Minh in 1945 (independence of the Democratic Republic of Vietnam), the Vietnam War, and the reunification of North and South Vietnam in 1976.

Vietnam has an area of 329,241 ㎢ (about 90% of the area of Japan), three quarters of which is mountainous. The country can be roughly divided into the northern, central, and southern regions. In the north, the capital Hanoi is the political and cultural center. In the central region, tourism is becoming a major industry with Da Nang, the third largest industrial city after Hanoi and Ho Chi Minh. In the south, the former capital of South Vietnam, Saigon, has been replaced by Ho Chi Minh City as the commercial center of the country. The Mekong Delta region in the south is also the center of rice cultivation in Vietnam, where rice production is flourishing nationwide.

The population is approximately 94.67 million (2018 estimate). The Kinh people account for about 85% of the population, and the rest is made up of 53 ethnic minorities. 35.7% of the population live in urban areas such as Hanoi, Ho Chi Minh City and Can Tho City, while 64.3% live in rural areas. As can be seen from the population pyramid （Figure 5）, the population is predominantly young, with a large number of working-age and reserve population under 60 years old.

The number of Japanese residents in Vietnam was 22,125 as of October 1, 2018 (according to the Ministry of Foreign Affairs of Japan).

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）
Religion	Urban area: Overall ratio 35.7% / Rural area: 64.3%
Language	Buddhism(80％), Christianity (9％)、others(Islam, Cao Dai etc.)
Administrative division	Official terminology：Vietnamese
unemployment rate	58 provinces、5 direct-controlled municipalities （Hanoi, Ho chi minh, Haiphong, Danang and Can Tho City）

Source：General Information of Vietnam April, 2019 by JETRO

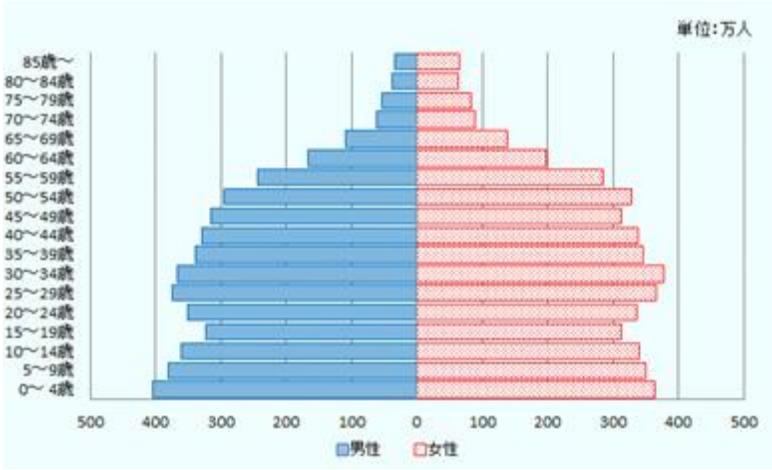


Figure 5 Population pyramid in Vietnam (2016)

Source：Region analysis report by JETRO

Figure 6 Economic development is remarkable in Ho Chi Minh City

2.2. Overview of Soc Trang Province

Soc Trang Province, with which Hiroshima Prefecture has concluded an inter-city partnership agreement, is a municipality in the Mekong Delta region of southern Vietnam, facing the South China Sea. It has a population of about 2 million people, and is an area where agricultural production, mainly rice cultivation, and shrimp farming are flourishing, and where many food processing factories are located.

Figure 7 Location of Soc Trang Province

(1) Land use

The total area of Soc Trang Province is 331,176 ha. The land in Soc Trang Province is fertile and suitable for the cultivation of paddy rice, sugarcane, soybeans, corn, onions, garlic and other vegetables, grapefruit, mangoes, durian and other fruit trees. Agricultural land accounts for 205,748 ha (62.13%), forest land 11,356 ha (3.43%), aquaculture land 54,373 ha (16.42%), and salt production and other agricultural land 0.97%. Land for rice cultivation occupied 144,156 ha, land for other annual crops 21,401 ha, and land for perennial crops and fruit trees 40,191 ha. In particular, non-agricultural land is 53,963 ha and unused land is 2,536 ha (Statistics of Soc Trang Province, 2008).

(2) Climate

Soc Trang Province has a mild climate throughout the year, with an average weather temperature of 26.7℃, a maximum temperature of 28.2℃ (April), and a minimum temperature of 25.2℃ (January). Located in the Mekong Delta and facing the South China Sea, the average humidity is as high as 86%. Floods and typhoons are rare.

Soc Trang Province has a tropical monsoon climate, with a dry season from November to April and a rainy season from May to October, with an average annual rainfall of 1,779.5 mm. The average annual sunny hours is 2,372 hours, and the average annual solar radiation is 140-150 kcal/cm2.[1]。

[1] Portal site of the Ministry of Planning and Investment, Vietnam

2.3. Economic situation in Vietnam

Vietnam's economy showed solid growth in 2019. On December 27, the General Department of Statistics of Vietnam announced the real GDP growth rate (estimated) for 2019 at 7.0% year-on-year. This exceeded the government's target of 6.6-6.8%, and maintained high growth in the 7% range following the previous year (7.1%).

The quarterly growth rates were 6.8% in the first quarter, 6.7% in the second quarter, 7.5% in the third quarter, and 7.0% in the fourth quarter (estimated). By industry, agriculture, forestry, and fisheries accounted for 2.0% (down 1.8 percentage points from the previous year), mining and construction 8.9% (unchanged from the previous year), and services 7.3% (up 0.3 percentage points). The agriculture, forestry, and fisheries industry was affected by losses due to drought, abnormal weather, and the spread of ASF (African swine cholera). Within mining and construction, manufacturing led the growth at 11.3%, but the growth rate slowed down compared to 2017 (14.5%) and 2018 (13.0%) (JETRO Business Brief).

Meanwhile, in 2020, Vietnam's economy was greatly affected by the outbreak of the novel coronavirus. On March 31, the Vietnamese government introduced measures to severely restrict economic and social activities called "Total Social Isolation Measures" throughout the country. Under the total social quarantine, going out of the house was limited to cases of genuine necessity, public transportation was suspended, and business was suspended except for commercial facilities that provide goods and services necessary for daily life. As a result, there were no new cases of infection in the city after April 17, and from mid-April, the restrictive measures were gradually eased according to the risk in the area, allowing the resumption of almost all economic and social activities after May 8.

However, on July 25, a citywide outbreak was discovered in the central city of Da Nang. Quarantine measures were again imposed in the city, and certain restrictions were also imposed in Hanoi and Ho Chi Minh City. Thanks to the government's quick response, no new infections were detected after September 3, and all restrictive measures in Da Nang were lifted on September 25.

While Vietnam has been relatively successful in containing the new coronavirus, the impact of the restrictions on economic activities has been significant. The real GDP growth rate for the second quarter (April-June) was 0.36%, on the verge of negative growth. In particular, the service sector, many of which were forced to suspend operations, fell to -1.76%. Although the third quarter (July-September) saw an overall rebound to 2.62%, this is still far short of the growth rate of over 7% before the pandemic of the novel coronavirus (JETRO Regional and Analytical Report).

2.4. Economic situation in Soc Trang Province

(1) Major industries

Soc Trang Province is a province with a thriving agricultural production and agro-fishery processing industry. The average annual production of rice is over 2 million tons, of which high-grade rice accounts for over 52% of the province's total rice production. The total annual volume of milled rice exceeds about 1 million tons/year, and the export value of rice reaches US$160 million (2020).

The total production of aquaculture in 2020 was 317,182 tons, with about 94,000 tons of processed frozen shrimp and 15,000 tons of frozen squid and fish; the export value of fishery products in 2020 was US$820 million.

(2) Economic growth rate

In Soc Trang Province, stable economic growth has continued (Table 2), with high positive growth in 2020 despite the impact of the novel coronavirus outbreak.

Table 2 Economic growth rate of Soc Trang Province

Year	Growth rate
2016	5.22%
2017	7.01%
2018	7.20%
2019	7.30%
2020	6.75%

(3) Work force

Soc Trang Province has a population of about 2 million, with a population density of 362 persons/km2 , and a working population of about 658,000 persons aged 15 and over, of which 31.62% is urban and 68.38% is rural. The male to female ratio of the working population is 58.51% for males and 41.49% for females.

2.5. Electricity Situation in Vietnam

Vietnam's electricity demand has continued to grow in recent years, and total electricity generation has continued to increase substantially over the years: total electricity generation in 2017 increased by 8.4% year-on-year, nearly 14 times more than in 1995. The village electrification rate (penetration rate) reached 98.8% in 2015.

As of 2017, hydropower was the most common type of power generation in terms of both installed

capacity and output, but since 2014 there has been a notable increase in coal-fired power generation. Since 2015, coal-fired power generation has surpassed hydropower generation as the largest amount of power generation, but in 2017, hydropower generation surpassed coal-fired power generation due to high precipitation and sufficient storage capacity in dams.

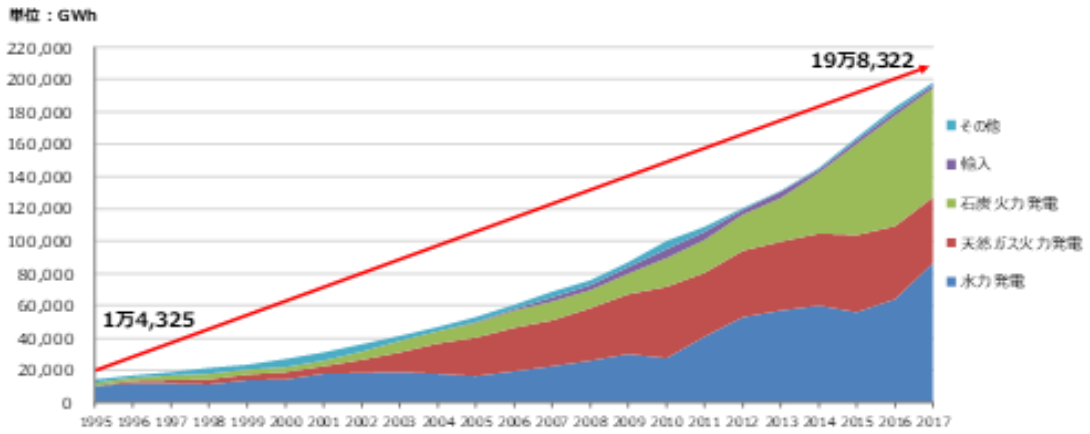


Figure 8 Changes of total power generation

Source: JETRO Hanoi Office

The electricity policy is being implemented in accordance with the revised Seventh National Electricity Master Plan (enacted on March 18, 2016) and the Revised Seventh National Electricity Master Plan (2011-2020 Electricity Development Plan with an eye on 2030).In FY2017, the total power generation capacity was 198,322 GWh and In FY2017, the total power generation was 198,322 GWh, and the power generation capacity was 45,410 MW, but the goal is to increase the total power generation to 572,000 GWh and the installed power generation capacity to 129,500 MW by 2030.

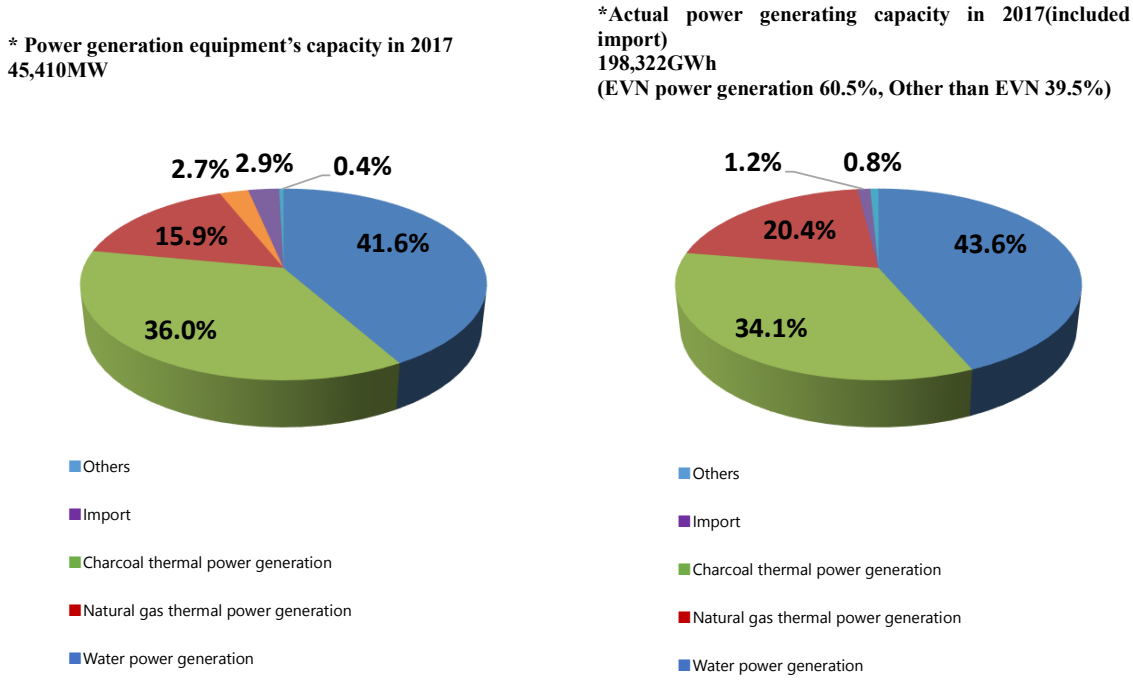


Figure 9 Total installed capacity and total power generation in Vietnam in 2017
Source: JETRO Hanoi Office

In the electricity system, the state-owned Electricity Generating Board of Vietnam (EVN), established in 1994, is responsible for the generation, transmission, supply, and trading of electricity. EVN has a monopoly on transmission and distribution of electricity.

The Vietnamese government is promoting the expansion of power generation from renewable energies, and has set a numerical target of 27,195 MW of installed capacity and 61,000 GWh of power generation by 2030. The target for biomass power generation by 2030 is 3,281 MW of installed capacity and 12,000 GWh of power generation.

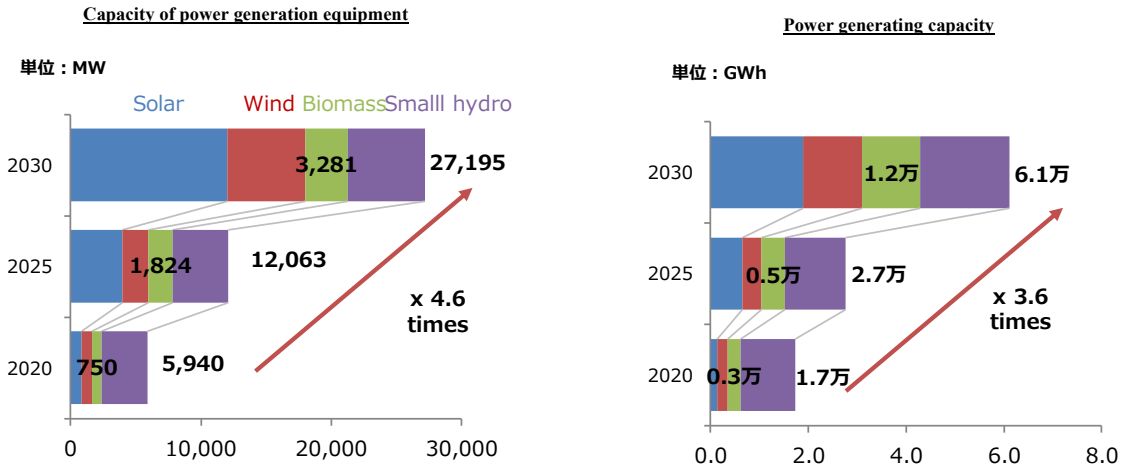


Figure 10 Renewable energy expansion targets in Vietnam

Source: JETRO Hanoi Office

In 2017, the ratio of thermal power generation using fossil fuels was nearly 60%, and the ratio of coal-fired thermal power generation was around 35%, so greenhouse gas emissions from power generation have remained high and need to be improved. The emission factor for electricity is 0.7 kg-CO2/kWh, which is higher than Japan's current factor of 0.55 kg-CO2/kWh, and an energy transition is required. The price of electricity has been increasing year by year (Figure 11). The reason for the increase in electricity prices is the improvement in the EVN deficit and the increase in coal prices. By industry, electricity prices are higher for commercial, consumer, and industrial sectors, in that order.

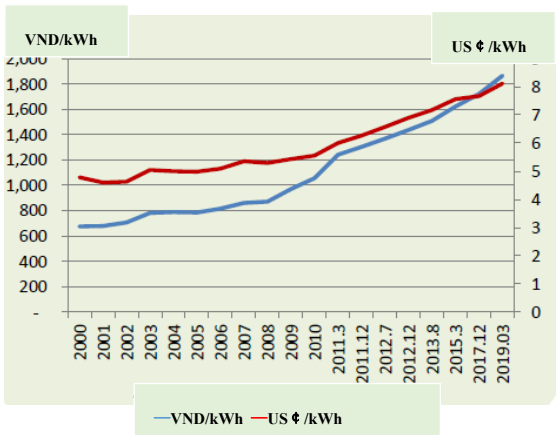


Figure 11 Changes in electricity charges （overall average）

Source：Survey on electricity in Vietnam by JETRO

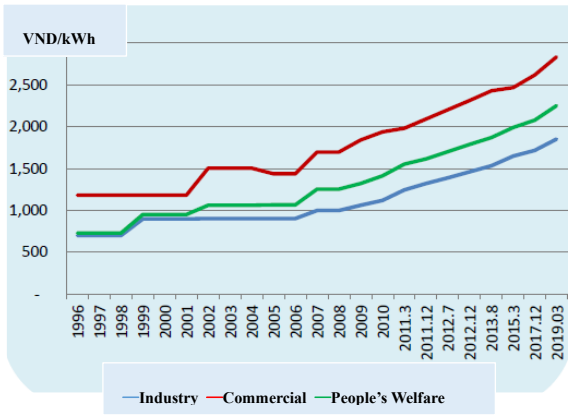


Figure 12 Changes in electricity charges （average of industries）

Source：Survey on electricity in Vietnam by JETRO

Vietnam does not have basic electricity tariffs like Japan, and industrial electricity tariffs consist of metered rates with three levels of unit prices by time of day.

On March 20, 2019, the Ministry of Industry and Trade of Vietnam promulgated Decision No. 648/QD-BCT of the Ministry of Industry and Trade on the increase of electricity tariffs, which will be increased by 8.36% on average. The average electricity tariff, excluding value-added tax, is now VND1,864.44 per kilowatt-hour (kWh), up from VND1,720.65 per kWh (about ¥8.1; 1 VND = about ¥0.0047). The price hike is the first since December 2017 and took effect on March 20, the day of the promulgation. Electricity tariffs were priced differently depending on usage and time of day, with prices in the industrial sector ranging from VND970 to VND3,076 per kWh.

Mr. Dinh Quang Chi, Vice President of the Electricity Generating Authority of Vietnam (EVN),

pointed out that the main reason for the price hike was the rise in coal prices and the gap between the power trading prices. Vietnam has been increasingly relying on coal-fired power generation in recent years, but coal prices have been rising, increasing the cost of power generation. In addition, EVN purchases electricity from power producers, and the difference between the purchase price and the selling price is becoming substantial. In addition, payments for water resource development rights and rising natural gas prices have also contributed to the growing deficit in the power business. With this price hike, EVN will be able to pay its suppliers and deal with the increased cost of power generation, but further price hikes were necessary to improve power generation facilities and make new investments.

The electricity price hike will raise production costs in the manufacturing sector, and this has resulted in some companies having to consider whether to pass on the price hike to product prices or bear the cost themselves for the time being. The price hike was expected to raise the consumer price index (CPI) by 0.29 percent and push down GDP by 0.22 percent, according to estimates by the Ministry of Commerce and the General Administration of Statistics. The price hike was originally scheduled to take place in 2018, but was postponed to 2019 after Prime Minister Nguyen Xuan Phuc indicated that he would not approve the price hike in order to achieve the CPI and GDP targets[2].

Table 3 The list of electricity charge in Vietnam(Revised on 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

[2] JETRO Business Report

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

・ Normal time (Monday to Saturday: 4:00am to 9:30am, 11:30am to 5pm and 8pm to 10pm Sunday: 4am to 10pm)

・Off-peak time (10pm to 4am)
・Peak time (Monday to Saturday: 9:30am to 11:30am, 5:00pm to 8pmSunday: None)
Source: JETRO

Vietnam's Ministry of Industry and Trade announced in April 2020 that it will reduce and exempt electricity tariffs from April to June 2020 as an economic measure in response to the impact of the spread of the new coronavirus. Electricity rates for industry and commerce will be reduced by 10 percent for all time periods, and tourism and accommodation facilities that have been hit hard will be subject to cheaper industrial electricity rates instead of the usual commercial rates.
Electricity tariffs for daily use for general households were reduced by 10% for households using less than 300 kilowatt-hours (kWh) per month, but households using more than 300 kWh were considered high-income households less affected by the new coronavirus and were excluded from the reduction.

In December 2020, the Ministry of Industry and Trade of Vietnam decided to reduce or exempt electricity tariffs for October to December following April to June as a measure against the new coronavirus.
Electricity tariffs for daily use for general households were reduced by 10% for households using less than 300 kilowatt-hours (kWh) per month, while travel accommodations and warehouses with distribution stock were subject to cheaper industrial electricity tariffs instead of the usual commercial tariffs. In addition, facilities for the prevention and control of new coronaviruses were exempted from electricity charges, except for facilities that charge for centralized isolation. Specifically, facilities for the centralized isolation and examination of persons infected or suspected to be infected with the new coronavirus were exempted from all electricity charges. In addition, medical facilities where infected or suspected infected persons are diagnosed, examined, and treated have had their electricity rates reduced by 20%. (Note that the electricity rates for industry and commerce, except for the above, which were exempted in the first round, are not exempted in the second round.

2.6. Electricity situation in Soc Trang Province

In Soc Trang Province, the cumulative electricity output in 2020 reached 1,620.79 million kWh, an increase of 89.74 million kWh (5.86%) compared to 2019 (1,503.06 million kWh). Of this, commercial electricity consumption reached 1,512.26 million kWh, an increase of 94.12 million kWh (6.59%) compared to the same period in 2019 (1,427.14 million kWh).
As of December 2020, there were 386,437 electricity subscribers, with 352,717 residential customers (accounting for 91.27% of the total). The number of business customers is 33,720 (accounting for 8.73%).
Electricity projects (thermal, wind, etc.) in Soc Trang Province are under construction and have not

yet been put into operation (generated electricity); the amount of solar power generated in 2020 is 9.4 million kWh.

In accordance with the decision of the Ministry of Industry and Trade (No. 2630/QĐ-BCT) on approving the power development plan for Soc Trang Province from 2016 to 2025, during the period 2021-2025, the power utility plans to invest in the power grid to ensure safe and continuous power supply for the development of the provincial economy.

2.7. Rice production in Vietnam

Vietnam is long and narrow from north to south, with three quarters of its land area consisting of mountains, hills, and plateaus, and its varied topography and climate produce a wide range of agricultural products.

Rice produced in the two fertile deltas of the Mekong (in the south) and the Red River (in the north) is the main agricultural crop, and is an important export. The country also produces sugarcane and cassava, and is the second largest coffee producer in the world after Brazil (2017).

Seafood, such as shrimp and tuna, is also a valuable export, and is often exported to Japan.

Table 4 Status of agriculture, forestry and fisheries in Vietnam and Japan in 2017

Unit: USD 100 million

	Vietnam		Japan	
	Nominal value	% of GDP	Nominal value	% 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	

Source: Ministry of Agriculture, Forestry and Fisheries of Japan

Table 5 Production of major crops

Unit: 10,000 tons

	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	-

Source: Ministry of Agriculture, Forestry and Fisheries of Japan

2.8. Rice production in Soc Trang Province

The area of paddy fields in Soc Trang Province is about 149,162 ha, and the area cultivated for rice in recent years has been between about 351,000 ha and 356,000 ha. The annual production of rice (unhulled) is about 2 million tons.

The annual amount of rice husk discharged accounts for about 400,000 tons (about 20% of unhulled rice). Currently, rice husks are used as fuel for rice dryers and industrial boilers, and as agricultural materials (subsoil, fertilizer, etc.) (interview with Soc Trang Province).

2.9. Environment and energy law of Vietnam

Laws related to renewable energy in Vietnam include the National Energy Development Strategy, the Electricity Law, and the Environmental Protection Law. The strategies and laws of Vietnam are set out in the following order: National Strategy, Laws, Decisions and Protocols, and Directives.

The basic plan is the Revised Seventh National Power Master Plan (Revised PDP7: REVISIONS TO THE NATIONAL POWER DEVELOPMENT PLAN FROM 2011 TO 2020 WITH VISIONS EXTENDED TO 2030). The 7th National Power Master Plan was revised on March 18, 2016. The revised PDP7 announces the plan for the period 2016-2030 and aims to achieve a total power generation capacity of 572,000 GWh and installed capacity of 129,500 MW by 2030. The plan also includes ensuring energy security, introducing energy-saving technologies, and protecting the environment.

(1) Environmental laws

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

Table 6 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) Electricity law

Regarding renewable energy, the Law on Electricity (Luật Điện Lực, Electricity Law 28/2004/QH11) explicitly provides incentives for new energy and renewable energy source development project plans in relation to investment, taxes and electricity tariffs in accordance with the Ministry of Finance (MOF) policy (the basis for FIT) and encourages organizations and individuals to use renewable energy, especially for electrification of rural and remote areas.

(3) FIT

The Feed-in-Tariff (FIT) program was launched in 2011 and covers solar, wind, biomass, and waste energy, with a 20-year purchase period.

The FIT was launched in 2011, but the amount of electricity generated by renewable energy sources in 2019 is only 0.8% of the total.

Table 7 FIT (Feed-in Tariff) system in Vietnam

	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 based on Vietnam Electricity Survey in 2018 by JETRO Hanoi Office

Major directives and decisions related to FIT include Decision 24/2014/QD-TTg (Decision on support mechanisms for the development of biomass The main directives and decisions related to biomass power projects in Vietnam are Decision 24/2014/QD-TTg (Decision on support mechanisms for the development of biomass power projects in Vietnam) and Decision 31/2014/QD-TTg (Decision on support mechanisms for the development of power generation projects using solid waste(s) in Vietnam). generation projects using solid waste(s) in Vietnam), Decision 31/2014/QD-TTg on support mechanisms for the development of power generation projects using solid waste in Vietnam (Decision on support mechanisms for the development of power generation projects using solid waste(s) in

Vietnam) and Decision 37/2011/QD-TTg on support mechanisms for the development of (Decision on support mechanism for the development of wind power project).
In addition, the term "biomass for power generation" is defined in the current regulations of Vietnam. However, the definition does not mention any specific goods, such as which types are included in the definition. As for "biomass energy for power generation", Decision (24/2014/QĐ-TTg) on the support mechanism for the development of biomass power generation projects in Vietnam states that "by-products and wastes generated in agricultural production and processing and other cultivation in agriculture and forestry that can be used for power production". Waste".
In addition, Vietnam has a draft National Master Plan for Biomass Power Development by 2025 for the year 2035. This was drafted by the Energy Research Institute at the request of the Ministry of Industry and Trade, and although it was published in 2017, it has not yet been approved by law. However, this draft may be operationalized as a document for policy consideration for biomass power generation. The draft focuses on two types of biomass (wood residues and agricultural crop residues) and mentions specific objects for each.

＜Wood residues>
Wood residues include woody fuels from forest trees, perennial industrial crops, and fruit trees (obtained from felling and pruning), as well as their wastes (from felling and pruning):

- Logs: from natural forests, populated forests, and scattered trees
- Shrubs: from forested areas
- Bamboo (Neohouzeaua, Bambusa nutans): from forested areas
- Periodically harvested logs and branches: from perennial industrial crops
- Prunings: of fruit tree origin
- Branches, stumps and bark: from harvested logs
- Wood residues (e.g. sawdust, wood chips, etc.): originating from wood processing
- Other (wood from construction work, house/furniture repair/renovation, where database is available or estimable)

＜Crop residues
Biomass derived from agricultural crops (by-products after harvest) and waste (generated during processing).

- Rice straw, rice husks
- Sugarcane bagasse, leaves and tips
- Stems, pods, and cobs
- Groundnut stalks and husks
- Soybean stalks and husks

- Cassava
- Coconut leaves, husks
- Shells: cashew nuts, coffee
- Other trees (if database is available or estimable)

It can be seen that rice husk, which is one of the targets of this project, is also recognized as biomass.

3. Collaboration between Hiroshima Prefecture and Soc Trang Province

3.1. Past collaboration between Hiroshima Prefecture and Soc Trang Province

(1) Period of building a foundation for B-to-B business exchange between the two municipalities (2013-2016)

In Hiroshima Prefecture, there are many leading companies that are active in the global market and have distinctive products by using the technology and know-how cultivated in environment-related equipment and pollution prevention measures. As part of its industrial policy for the 2020 Challenge Vision, Hiroshima Prefecture is supporting the overseas expansion of environment-related industries in the prefecture, with the aim of promoting the concentration of environment-related industries in the prefecture, economic growth, and the resolution of environmental pollution and contamination overseas.

In order to smoothly promote industrial exchange with Vietnam and link it to concrete business results, Hiroshima Prefecture is aiming to organize and realize an environment-related project in southern Vietnam by concentrating the technologies of Hiroshima Prefecture's companies. In 2013, we used the overseas basic research project of JETRO's Regional Industry Tie-Up Project (RIT Project) to conduct research on organizations and companies that could cooperate with the project, as well as business fields and regions with potential needs.

During the survey, we received a very positive indication from Soc Trang Province that they would like to promote business exchange. We also interviewed the People's Committee and the Department of Natural Resources and Environment about the environmental issues in the province, and found that the needs for the following items ① to ③ are extremely high, and that there are technologies in the province that can help solve these issues.

①Access to Clean Water in Rural Areas

②Effective use of rice husks in Soc Trang Province, one of Vietnam's leading rice-producing regions

③Improving water pollution around shrimp farms, one of the most productive shrimp farms in the world

Therefore, for three years from 2014 to 2016, JETRO's Regional Industry Tie-Up Project (RIT Project) was utilized to start a business exchange with Soc Trang Province in order to solve the environmental issues faced by Soc Trang Province, mainly the three needs mentioned above, in a business sustainable manner. The counterpart was the Department of Natural Resources and Environment (DONRE), a department that understands the environmental issues faced by each company in Soc Trang Province and the environmental needs of Soc Trang Province itself.

In the RIT project, DONRE compiled a list of local companies from Soc Trang Province that were

facing environmental issues each year, and the prefecture's staff met with these companies to delve into their needs, and for projects with a high probability of business development, business matching was conducted by meeting with companies in Hiroshima Prefecture that had the corresponding technology. When discussing business with Soc Trang Province companies in Hiroshima, the prefecture's own budget was used to invite the vice chairman of Soc Trang Province's Personnel Committee and the director of DONRE, along with Soc Trang Province companies, to gain better understanding of Hiroshima Prefecture's environmental technologies and to hold a seminar in Hiroshima Prefecture to provide an opportunity to discuss environmental issues and needs in Vietnam. In addition, a seminar was held in Hiroshima Prefecture to create an opportunity for matching about environmental issues and needs in Vietnam.

In addition, in order to demonstrate the projects created by these matching opportunities and to lead to orders, we have been conducting demonstration experiments in the field while providing companies with the "Subsidy for Promotion of Environmental Business Cluster" of Hiroshima Prefecture. As a result, the results shown in Table 8 have been produced so far.

Table 8 Results of exchange between Hiroshima Prefecture and Soc Trang Province

Product/Service	Entities in Soc Trang Province that gave order	Year
Water Purifier	Soc Trang Province Water Purification Center	2015～
Water purification agent for shrimp cultivation	Shrimp cultivators	2019～
Water purification membrane for shrimp aquaculture	Shrimp aquaculture operators	2019～
Waste-derived organic fertilizer	Fertilizer wholesaler	2018～
Rice husk fermented liquid	Vegetable farmers	2016
Agricultural materials	fertilizer manufacturer	2016
Recycled plastic materials	Plastic molding companies	2016～

(2) BtoB business + project projects (2017-2020)

After the completion exchange program by JETRO RIT project in 2016,we continued to discuss the scope of future collaboration by using Invitation Program for Promising Asian Leaders of CFIEC

(Center for International Economic Collaboration, formerly known as Institute for International Studies and Training: IIST) and a Memorandum of Understanding(MOU) in the field of environmental remediation industry was signed with Soc Trang Province at the Mekong Delta Business Matching Seminar jointly held by Hiroshima Prefecture and Soc Trang Province in September 2017. In the MOU, in addition to the BtoB business matching that has been actively promoted, the two regions have agreed to cooperate in organizing cooperative projects and holding regular meetings.

With the signing of this MOU, in addition to the introduction of individual companies from Soc Trang Province, a cooperative system has been established to address and solve the environmental issues faced by Soc Trang Province as a project. At present, the two sides are cooperating on the following projects in order to solve the problems and create new values.

In addition, in order to build on this cooperative relationship and turn the project into a business, a Vietnam Support Desk was established in 2018 in cooperation with Hiroshima Bank to provide support for companies entering the Vietnamese market. Some of the projects currently underway with Soc Trang Province are listed in Table 9.

Table 9 Project by Hiroshima Prefecture and Soc Trang Province

Project Name	Duration	Summary
Project for purification of shrimp farm environment and branding of shrimp with low environmental impact	2018～	This is a project to use water purification products owned by companies in Hiroshima Prefecture to cultivate shrimp with reduced environmental impact that will not pollute the surrounding environment, and to brand and sell the shrimp in Japan and Vietnam. TROMSO Co., Ltd. has developed a water purification agent using rice husks, and it is hoped that this product can be applied to shrimp farms in the future.
Efficient collection and transportation of general waste and waste treatment projects	2019～	The project will utilize know-how on efficient collection and transportation of general waste, waste collection services, and data collected during collection and transportation to construct optimal waste treatment facilities.
Water purification service business to reduce plastic waste	2020～	By installing water purifiers in each household's water supply, the project aims to reduce the large amount of plastic waste generated by the plastic bottled water service that is widely used in the region.

3.2. Creating a mechanism for continuous identification and formation of new projects through collaboration between Hiroshima Prefecture and Soc Trang Provincee

In order to continuously identify projects, a "Hiroshima- Soc Trang Intercity Cooperation Council" (tentative name) will be established as a mechanism to match the needs of Soc Trang Province with the seeds of Hiroshima Prefecture, and promising projects will be identified and narrowed down, leading to the implementation of FS in the intercity cooperation project and subsequent subsidy schemes. This will lead to the implementation of FS and subsequent subsidy schemes in inter-city collaborative projects（Figure 13）.

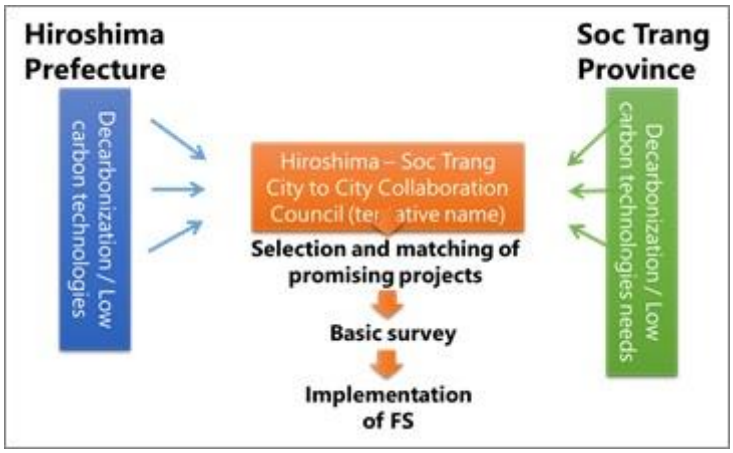


Figure 13 Mechanism for continuous identification and formation of new projects through collaboration between Hiroshima Prefecture and Soc Trang Province

3.3. Hiroshima Prefecture's support for know-how on community-based renewable energy installation projects

Hiroshima Prefecture operates a mega solar power plant jointly with a local electric power company, and has the know-how to create and operate a system that returns part of the profits to the local community in the form of subsidies for the installation of renewable energy and energy-saving equipment (Figure 14）.In addition to transferring this know-how to Soc Trang Province, the project also aims to introduce equipment and services from companies in the prefecture to the local market. The goal is to establish a self-sustaining and developmental mechanism to support small-scale renewable energy and energy-saving projects in the region by utilizing large-scale renewable energy projects such as the JCM equipment subsidy project as seeds

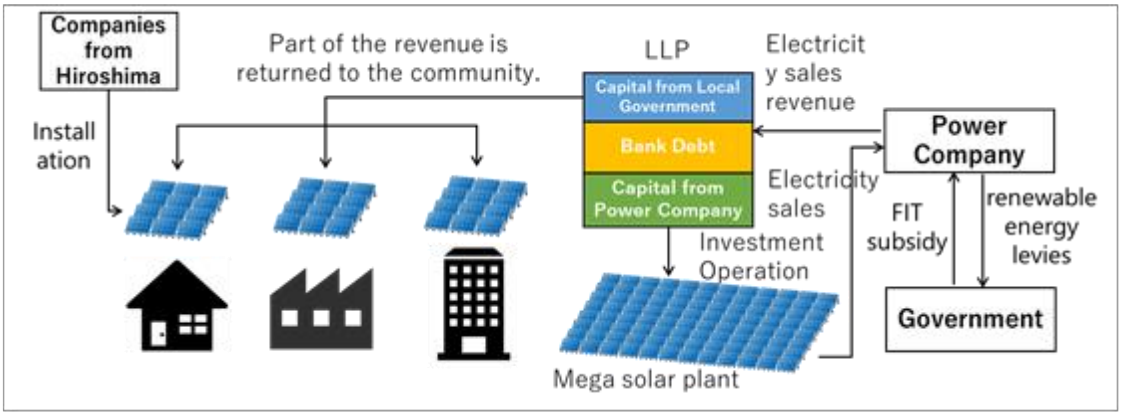


Figure 14 Hiroshima Prefecture's community-based renewable energy project

3.4. Online workshop between Hiroshima Prefecture and Soc Trang Province

Due to the new coronavirus epidemic, it was extremely difficult to travel between Japan and Vietnam this year, therefore, the Soc Trang Province agreed that the workshop (meeting), which is usually held locally, would be conducted online.

The Hiroshima Prefecture-Soc Trang Province online workshop was originally scheduled to be held in November 2020, but due to a personnel change in the Vice Chairman of the People's Committee of Soc Trang Province, who is responsible for this project, the workshop was postponed to January 2021. Ahead of the online workshop, materials on Hiroshima Prefecture's renewable energy initiatives were sent to the Soc Trang Province side via email (see Appendix 4 and 5).

The outline of the on-wine workshop is as follows.

Date/Time	January 21, 2021 (Thu) 10:00 ~ 11:00
Style	Online
Participants	＜Japan＞ Hiroshima Prefecture: Mr. Kazuki Matsubara （Manager, Foreign Business Division, Commerce, Industry and Labor Bureau, Hiroshima Prefectural Government） E-Square Inc.: Mr. Hiroyuki Yanagida, (Senior Manager)
	＜Vietnam＞ Bureau of Commerce and Industry：Mr. Vo Van Chieu (Chairman） DONRE (Department of Natural Resources and Environment）：Mr. Nguyen Thi Thuy Nhi (Vice Chairman） Department of Agriculture and Rural Development(DARD) Water Purification Center：Mr. Nguyen Thanh Duoc（Vice President） Department of Planning and Investment：Mr. Vuong Thanh Nam （Vice

	Chairman） Khuong Le (Coordinator） Thanh Mai（Coordinator）
Program	✓ Introduction and Opening Remarks (Hiroshima Prefecture, Mr. Matsubara) ✓ Introduction of Hiroshima Prefecture's community-based renewable energy introduction project (Hiroshima Prefecture, Mr. Matsubara) ✓ Proposal of the creation of a mechanism for the continuous identification and formation of new projects through cooperation between Hiroshima Prefecture and Soc Trang Province (Hiroshima Prefecture, Mr. Matsubara) ✓ Introduction of Soc Trang Province's renewable energy initiatives (Vo Van Chieu, Chairman, Bureau of Commerce and Industry) ✓ Exchange of Opinions（Participants） ✓ Future Cooperation（Hiroshima Prefecture, Mr. Matsubara）

First, Mr. Matsubara of Hiroshima Prefecture introduced Hiroshima Prefecture's community-based renewable energy introduction project and proposed the creation of a mechanism for the continuous identification and formation of new projects through cooperation between Hiroshima Prefecture and Soc Trang Province, followed by an introduction of Soc Trang Province's renewable energy initiatives and an exchange of opinions on future cooperation.

Mr. Matsubara, Hiroshima Prefecture made following remarks.

- ✓ In Hiroshima Prefecture, an investment steering committee is formed with the electric power company to conduct the power generation business, and the revenue generated from the sale of electricity. Hiroshima Prefecture is responsible for project planning, operation, public relations, and land provision, while the power company is responsible for material procurement, construction, and maintenance. This activity currently manages six power plants in Hiroshima Prefecture, with a total capacity of 10 MW.
- ✓ After deducting expenses, about 300 million yen in revenue remains. The revenue is being used to increase renewable energy in Hiroshima Prefecture by installing solar panels and energy-saving type air conditioners at facilities in the prefecture, as well as for public relations activities to promote energy conservation and renewable energy. Perhaps because of this, more and more people in Hiroshima Prefecture are installing solar panels on their homes.
- ✓ Apart from the mega solar power generation, the prefecture is also working to increase solar power generation using buildings owned by Hiroshima Prefecture. In cooperation with a solar power system leasing company, we are installing panels procured from the leasing company to generate electricity and returning the income after deducting the lease fee to the citizens of the

prefecture.

- ✓ In this year's inter-city collaboration project, if the new coronavirus had not affected us, we were planning to invite people to come and see the solar power plants in Hiroshima Prefecture and the solar panels installed using the profits from the solar power business.
- ✓ In Hiroshima Prefecture, the government is taking the lead in promoting renewable energy, and if we can share our knowledge and expertise with Soc Trang Province, we would be very happy to do so.
- ✓ Hiroshima Prefecture and Soc Trang Province have had an opportunity to talk face to face about once every three months since 2016, and we would like to continue to promote exchanges under Corona. We would like to resume our visits once the Corona disaster has stabilized. For the time being, we would like to hold meetings using the Internet about once every three months in the form of this online workshop. (Mr. Vo Van Chieu expressed his agreement.)
- ✓ In the online meeting, we would like to have Soc Trang Province introduce to us what kind of technology they are looking for or what kind of problems they are facing. We hope to resume this process in April this year. (→ Mr. Vo Van Chieu said that he would like to proceed as proposed in order to enrich the contents of the online meeting.

Mr. Vo Van Chieu, Director General of Soc Trang Province Department of Commerce and Industry, made the following remarks.

- ✓ In Soc Trang Province, the private sector has also installed solar power generation systems on 950 houses and buildings, with a total generation capacity of 50 MW.
- ✓ In addition, there are new plans to produce 800MW of electricity: the first is 500MW on 620ha of land, the second is 300MW on 320ha of land. Soc Trang Province has land available and is ready to provide land if there are investors. We are currently looking for investors. Investors will be selected through a bidding process. Soc Trang Province will provide the land, but will not be directly involved in the project (no investment).
- ✓ If there is any kind of subsidy from the Japanese government, please let me know. (→Mr. Matsubara replied that it may be eligible for JCM's equipment subsidy)
- ✓ The installation of solar power systems in four buildings owned by Soc Trang Province has also begun on a trial basis. The total capacity of the system is 50 kW, and although the system was installed to save on electricity bills, we have not yet considered how to use the profits. We also haven't decided how to calculate the profit from the solar power generation business, so we would really like to know the example of Hiroshima Prefecture. (Mr. Matsubara replied that he would provide the example of Hiroshima Prefecture later)

- ✓ Soc Trang Province has installed its own solar power generation systems in four locations, and if

it proves effective over a certain period of time, we will consider installing more.

- ✓ There are three coal-fired power generation projects in Soc Trang Province, with a total capacity of 430 MW, but none of them are yet in operation. We know that coal-fired power generation emits a lot of CO2, but we believe that it is essential for the supply of electricity in the Mekong Delta region. We are trying to minimize the impact on the environment by using the latest technology. (Mr. Matsubara introduced a case of Osakikamijima of Hiroshima prefecture where various cross-sectional research and development of carbon recycling technologies are taking place, aiming at the early practical application of carbon recycling technology that effectively uses CO2 as a resource.)
- ✓ There are 22 wind farms with a total capacity of 1,430 MW, of which 20 are in operation and 2 are not yet operational. Additional 30 are planned to be applied for between 2021 and 2030, bringing the total capacity to 8,000 MW.
- ✓ For solar power, there are 12 projects, 10 of which are small, but 2 are, as mentioned earlier, large, the 500 MW and 300 MW.
- ✓ We understand each building in Hiroshima Prefecture has installed solar power generation, but how many locations and how much power are they generating? We would like to know the price of electricity sold. The selling price in Soc Trang Province is 1,930 VND/kWh. (Mr. Matsubara explained that there are two leased solar power plants and seven mega solar power plants owned by the province, totaling 10.4 MW at nine locations, and that the unit selling price is 40 yen/kWh level though the price varies among power plants.)
- ✓ For biomass power plants, a proposal of 20 MW project is submitted and waiting for the result.
- ✓ A proposal of 10 MW project of waste power generation is submitted and waiting for the result.
- ✓ Regarding the cooperation with Hiroshima Prefecture, the vice chairman of the People's Committee used to be the point of contact for Soc Trang Province, but from now on, depending on the topic, we would like to assign DONRE to deal with the environment and the Commerce and Industry Bureau to deal with energy. In the future, however, we would like to consult with the People's Committee assign an appropriate point of contact depending on the topic.

After this online workshop, it was arranged to hold another working-level online meeting in February 2021, but due to circumstances on the part of Soc Trang Province, it was postponed until March or later.

3.5. Prospects for further collaboration

This year's survey revealed that Soc Trang Province has installed solar panels on its own in four buildings in the province to generate 50 kW of electricity and save money on electricity bills, and if the effectiveness of this demonstration experiment is confirmed, they intend to expand the scale of the

experiment and roll it out horizontally.

In addition, since they would like to refer to Hiroshima Prefecture's project on the mechanism and calculation method when profits are generated from solar power generation projects, they will exchange information on the efforts being made by Hiroshima Prefecture's solar power generation project in the next fiscal year.

As for the theme of this year's project, "Creating a mechanism for continuous identification and formation of new projects through collaboration between Hiroshima Prefecture and Soc Trang Province," following the online workshop, Soc Trang Province immediately requested a solution for the purification of exhaust gas from charcoal manufacturers. We are in the process of confirming the details with Soc Trang Province. As soon as detailed information is shared, we plan to introduce the technologies of companies in the province. In addition, Soc Trang Province has been consulting with us on general waste treatment and wastewater treatment, and we are now considering how to respond to these issues together with companies in Hiroshima Prefecture that have relevant technologies. We will continue to cooperate with Soc Trang Province so that such projects can continue to emerge.

4. Survey on fuel replacement project of coal boiler using rice husk solid fuel

We conducted a field survey and examined the feasibility of introducing the rice husk solid fuel production equipment (curl chip production machine) of Tromso Co., Ltd., a company in Hiroshima Prefecture, to the site.

4.1. Technologies / products proposed

(1) Grind Mill (rice husk briquette machine: TRM-200CR)

Tromso's Grind Mill (rice husk briquette machine) is the machine to be proposed.

In the grind mill (TRM-120F/120JPF) of Tromso Corporation, the rice husk extruded by the rotor screw passes through a nozzle heated to 310°C by an electric heater, where it is compressed and molded, and the surface is baked to form a bar-shaped briquette (solid fuel) Figure 15.

Figure 15 Grind Mill

The grind mill is a device that grinds rice husks and solidifies them through compression molding and heating processes and can convert 120 kg of rice husks into solid fuel per hour (120 kg of rice husks ≒ 120 kg of rice husk solid fuel). The solid fuel produced is 100% derived from rice husks, and no adhesives need to be added when solidifying the fuel.

The rice husk has a water-repellent cuticular layer (waxy) on its surface, and silica is accumulated in this layer, making it very solid. Therefore, the processing of rice husks causes metal parts to wear quickly, but the main parts of the grind mill have a special surface treatment that greatly improves wear resistance.

In addition, the volume of the solid fuel is reduced to about 1/10 (rice husk ratio) because it is manufactured through a compression molding process. The calorie content of rice husk solid fuel is about 4,000 kcal/kg, and when ignited, it burns with a flame for about 30 minutes and then continues to burn for about one hour.

The main parts of the grind mill for the rice husk grinding compression molding and heating processes are shown in the Figure below.

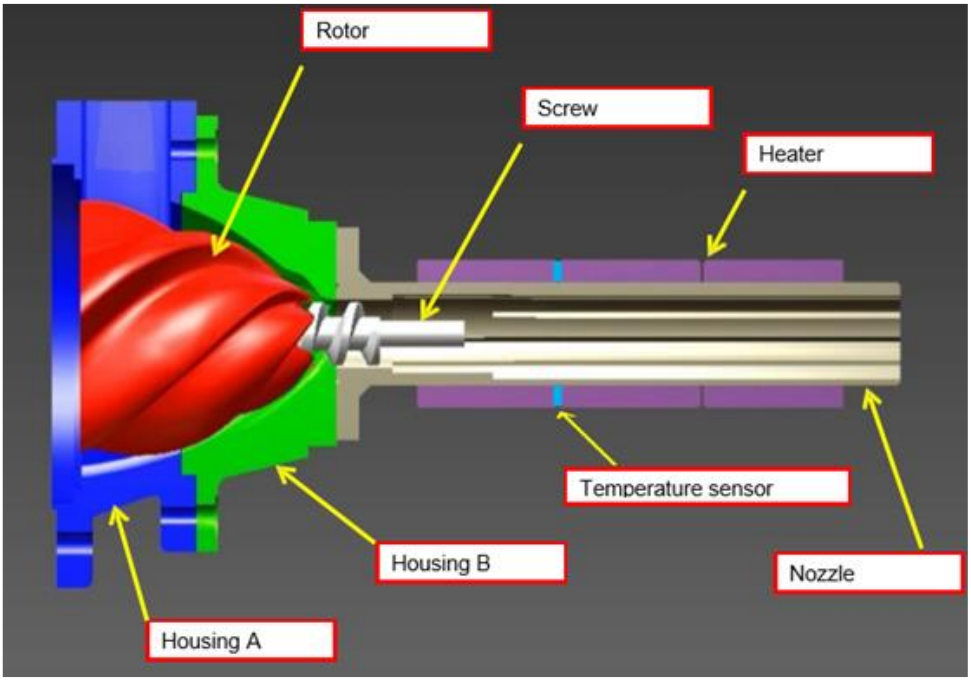


Figure 16 The core parts of Grind Mill

When rice husks are fed into the material hopper, they are ground by the rotation of the rotor and the engagement of housings A and B. The ground rice husks are pushed out toward the nozzle by the rotation of the rotor and screw. The ground rice husks are heated by the heater attached to the outer circumference of the nozzle and are pushed out toward the nozzle exit. The heating causes the husks to adhere to each other and solidify due to the action of lignin contained in the husks. When the rice husks are pushed out of the nozzle, they are discharged as solid fuel in the form of sticks. About 37 cm of solid fuel is equivalent to about 1 kg.

For the results of component analysis of rice husk solid fuel and rice husk, refer to the appendix " Compositional analysis data on rice husk solid fuel and rice husk" at the end of this report.

On the other hand, the proposed grind mill (a special machine for curl chips) can produce curl chips made of coiled rice husks without an electric heater. The lignin in the rice husk is softened by frictional heat and pushed into the curl chip nozzle by a screw. The pressed husk is formed into a coiled solid fuel that follows the shape of the screw. The curl Chip has a slightly lower heat value of about 3,700 kcal compared to the briquette (about 4,000 kcal). When ignited, it burns with a flame for about 15 minutes and then continues to burn for about an hour. In addition, because of the compression molding process, the volume of the curl chips is reduced to about 1/8 to 1/9 (relative to rice husk).

Figure 17 Grind Mill for curl chip Production (TRM-200CR)

The curl chip machine, when operated with the nozzle removed, can produce ground rice husks with a size of 1 to 3 mm. Since the ground rice husks are produced by applying pressure to the husks and rubbing them together, frictional heat of about 90°C is applied inside the machine. As a result, the ground rice husk is sterilized to some extent and has excellent water absorption and retention properties. The ground rice husk can be used as gardening soil or livestock bedding.

The characteristics of briquettes, curl chips, and ground rice husks that can be made by the grind mill are shown in the following table.

Table 10 Comparison of briquette, curl chip, and ground rice husk

Item	Briquette	Curl Chip	Ground Rice Husk
Machine Type	Briquette	Curl Chip	
Size	Diameter 55mm, hole diameter 15mm, length 350mm	Width 20 mm, thickness 17 mm	1～3 ㎜
Shape	Hollow Bar	Coil Shaped	Powder
Heater	Yes	No	No
Main Application	Fuel	Fuel	Gardening medium, bedding material, fertilizer material
Heat Generation	3,970kcal/kg	3,700kcal/kg	―
Image			

The table below shows a comparison of grind mills (machines dedicated to briquetting and curling chips).

Table 11 Comparison of Grind Mills (machines dedicated to briquetting and curling chips)

Item	Briquettes	Curl Chip
Capacity	Approx.120kg/h	Approx.240kg/h
Dimensions	Approx. width 2,500 x depth 990 x height 1,500 (mm)	Approx. width 2,250 x depth 1,100 x height 1,550 (mm)
Weight	Approx.850kg	Approx.985kg
Drive power	AC200-400V 3 ϕ 50/60Hz 4P Reduction ratio 1/15	AC200-400V 3 ϕ 50/60Hz 4P Reduction ratio 1/7.12
Power Consumption	20kW	30kW
Price (JPN)	500 million Yen(+tax)	400 million Yen(+tax)

(2) Sales and introduction record of the machine and similar models

Domestic and overseas sales and introduction results for ① above (year of sales launch, sales volume, sales amount, market share, etc.)

Sales started June 2008

Domestic sales approx. 120 units (as of January 2021)

Overseas sales　30 units (see Table 12）

Most recent sales　94million Yen (domestic/overseas sales of grind mills)

Table 12 Overseas deliveries of grind mills (dedicated to briquetting and curling chips)

year	country	Number of units	Model name	Remarks
2014	China	1	TRM-120F	
2014	Tanzania	4	TRM-120F	Introduced through JICA dissemination and demonstration project
2015	Tanzania	4	TRM-120JPF	Introduced through JICA dissemination and demonstration project
2015	Tanzania	1	TRM-120TA	
2015	Nigeria	1	TRM-120TA	
2015	Vietnam	1	TRM-120TA	
2016	Vietnam	3	TRM-120JP	
2018	Madagascar	3	TRM-120JPF	
2019	Nigeria	7	TRM-120JPF	Grant Aid, Ministry of Foreign Affairs
2019	Tanzania	3	TRM-120JPF	Assembled by local partner
2020	Senegal	2	TRM-200CR	

The company has already sold Grind Mills (specialized for curl chip machines) to the Republic of Senegal in 2020, and plans to introduce them as part of a project by JICA to improve the organizational capacity of vocational training centers in Senegal. One grind mill will be installed in the training building of the Center for Japanese Vocational Training (CFPT) in Dakar, Senegal, and one in the premises of a private company in Saint-Louis, which is linked to the CFPT. One grind mill will be installed in the premises of a private company in the state of Saint-Louis, with the aim of procuring equipment and conducting training that will strengthen CFPT's human resource development function to demonstrate and prove the feasibility of promoting grind mills in the region through the sale of solid fuel operation and maintenance of the equipment. At the same time, a grind mill will be installed at the CFPT and maintenance skills will be taught to the CFPT instructors. The trained instructors will then teach the same skills to trainees and graduates, enabling CFPT graduates to take up jobs in grind mill maintenance and manufacturing. It is expected to contribute to various fields such as human resource development, job creation, and effective utilization of waste, not only for commercial use but

also to promote environmental protection by replacing the fuel for daily cooking in households, and to create employment opportunities for local workers engaged in machine manufacturing. The project is expected to contribute to various fields such as human resource development, job creation, and effective utilization of waste.

(3) Dimensions

The Figure 18 shows dimensions of the Grind Mill (for curl chips).

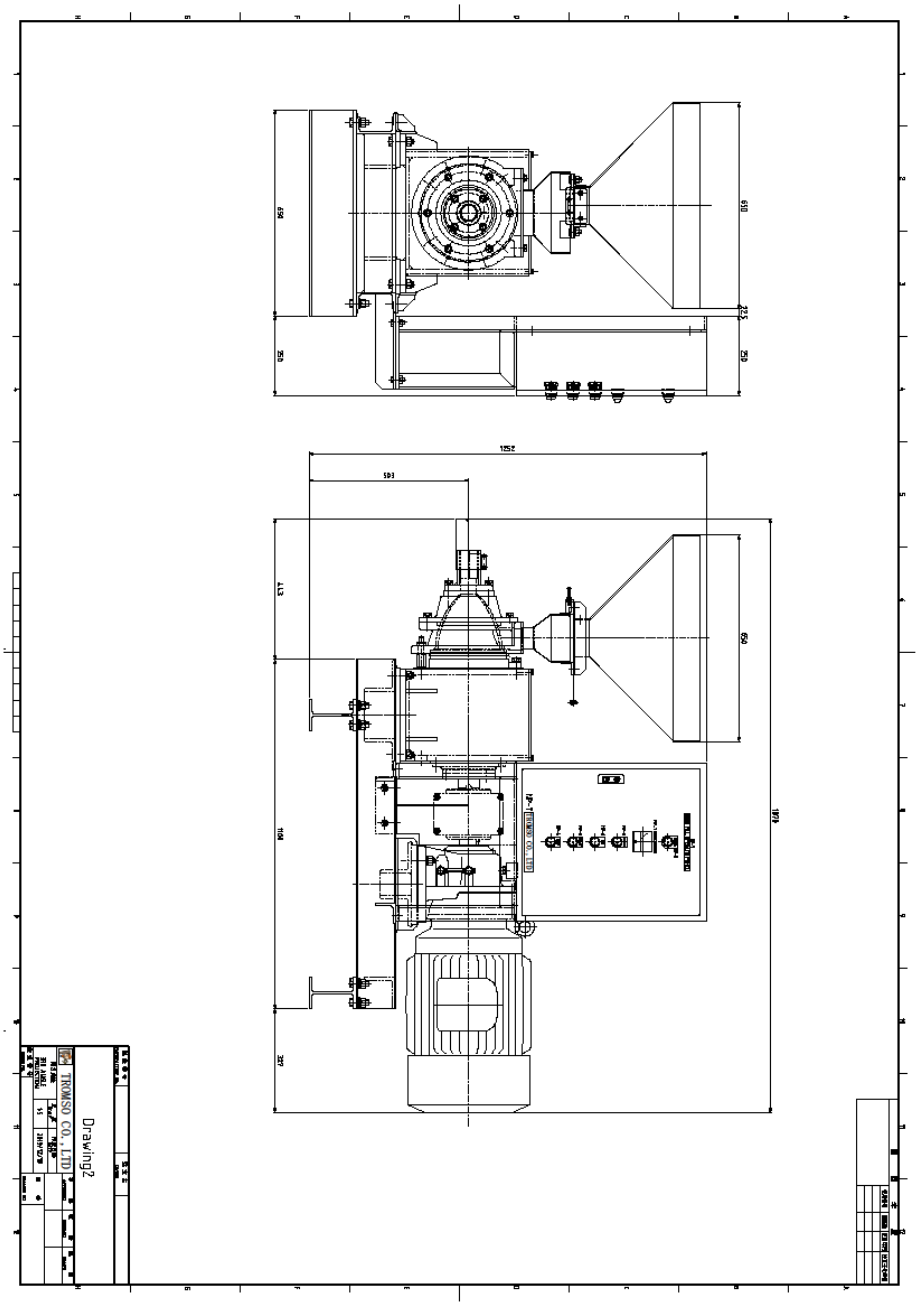


Figure 18 Grind Mill (TRM-200CR) dimension

4.2. Survey on rice milling businesses

Both rice mills are located along the riverside and the unhulled rice is brought to the mills by boat, Chau Hung is a small-scale rice mill, while ThanTin is a large-scale rice mill that also exports milled rice and plans to increase its production in the future. Both rice mills are not equipped with coal boilers and do not consume rice on their own; instead, their customers (e.g., feed companies) purchase the coal as fuel for their boilers.

Table 13 Results of hearings with Rice Millers

Company name	Chau Hung	Thanh Tin
Location (Province)	Soc Trang	Soc Trang
Factory type	rice mill	rice mill
Number of Employees	20 people	208 people
Site Area	5,000 square meters	70,000 m2
Production Output	Rice milling volume: 2,400 t/year	Rice concentrate volume: 220,000t/year Mainly exports, targeting 500,000 tons in 5 years
	Rice husk production: 480t/year	Rice husk production: 44,000t/year
Rice Sales	Rice husk: 1.4 yen/kg	Rice husk: 5.4 yen/kg
	After solidification: 5.9 yen/kg	After solidification: 8.2~9.1 yen/kg
Boiler	None	None
Curl Chip Availability	Possible Currently, rice husks are consumed in house.	Possible Currently owns 15 briquetting machines Production of rice husk briquettes 40t/day
Transportability (curl Chip)	The river is narrow and requires transportation by small boat. Large ship 20km away	river transport The factory is on riverside
Curl Chip storage space	No site or building available, acquisition required	
Business Development (interest in utilizing rice husks)	No plan to increase production volume Yes, if the price of the product is increased.	Would be interested the selling price goes up. Yes, as long as selling curl chip is profitable.
Transportation Cost and Volume	Currently, unhulled rice is transported by river, however, it is as far as not to interrupt the voyage of large ships	Currently, unhulled rice is transported by river or sea. Curl chips can be transported.

(Exchange rate: 1000VND=4.53yen)

(1) Chau Hung Rice Milling Plant

Shown in from Figure 16 to 18 is the Chau Hung's rice mill equipped with a briquetting machine that solidifies rice husks that can be used as fuel for the boiler.

The briquette manufacturing equipment is shown in the Figure 19and the equipment for processing rice husks into briquettes is shaped as shown in the Figure 20. The supplied rice husks are fed into a funnel-shaped receptacle from the top of the machine, and then transported to the rotor in the lower processing section, where they are processed into a cylindrical shape by the rotation of the rotor, and briquettes are manufactured as solid fuel (cylindrical) as shown in the Figure 21. The briquettes are piled up and stored in the factory. Currently, there are four of these machines installed in the plant.

On average, about 200 tons of unhulled rice is delivered to rice mills per month, and 40 tons of rice husks are generated per month. 1/2 of these husks are processed into briquettes, which are sold and used as fuel for boilers.

Figure 19 Briquette manufacturing equipment

Figure 20 Briquette processing equipment (husk input from the top)

Figure 21 Fabricated tubular briquettes

The plant is built beside on the riverside, and the unhulled rice is transported by waterway. Since it is a small river, it is difficult for large ships to pass through, so the ships dock at places where large ships can dock, and when transporting the unhulled rice, small ships of about 10 tons are used to transport the rice over a distance of about 20 km to and from the places where large ships are docked.

The company wishes to expand its facilities in the future, giving priority to business expansion of existing businesses. In addition, at present, unprocessed rice husks are transported to the facility for sale, but a business plan is being formulated so that sales can be started around the rice field where the rice husks are generated. With regard to the introduction of the grind mill, the price is a concern.

(2) Thanh Tin Rice Milling Plant

The Thanh Tin rice mill is equipped with a number of state-of-the-art, large-scale, Vietnamese-made briquetting equipment (Figure 22-Figure 25).

The unhulled rice delivered to the rice mills is milled by the large automatic production equipment shown in the Figure 22and the resulting chaff is discharged by the automatic production equipment as solid fuel in the form of cylindrical briquettes, as shown in the Figure 22. The amount of milled rice produced by the rice mills is 220,000 tons/year in 2019, and the estimated amount of rice husks generated is 44,000 tons/year in the same year. Of these rice husks, about 70% are processed into briquettes and sold to companies that produce livestock feed.

Figure 23 Fabricated tubular briquettes

Figure 24 A boat for transporting rice paddy

Figure 25 Rice paddy

This rice mill is located beside a river, and rice and unhulled rice are transported by waterway. The largest vessel that can operate on the river can transport 3,000 tons of unhulled rice. The maximum length of the vessel is 50 meters.

They are planning to expand their business by expanding the facilities and scale of their existing business and developing products using by-products such as rice husk oil. In the project to introduce a grind mill (a specialized machine for curling chips), they will consider introducing it if it can further increase the sales volume along with the processed rice husk products that they are currently selling. At present, 15 briquetting machines made in Vietnam are installed, and they can produce 40 tons of briquettes per day. Also, they are less expensive than grind mills, so it is necessary to clarify the

difference between them and the briquetting equipment made in Vietnam.

4.3. Survey on coal use in Vietnam

(1) Characteristics of coal in Vietnam

The quality of coal in Vietnam was surveyed in order to provide basic data for the feasibility study on fuel conversion of coal boilers in this study. Vietnam is one of the leading coal-producing countries in the ASEAN region, producing more than 40 million tons per year domestically. However, the supply of domestic coal cannot keep up with the demand for electricity that supports the country's economic growth, and imports have been increasing rapidly in recent years.

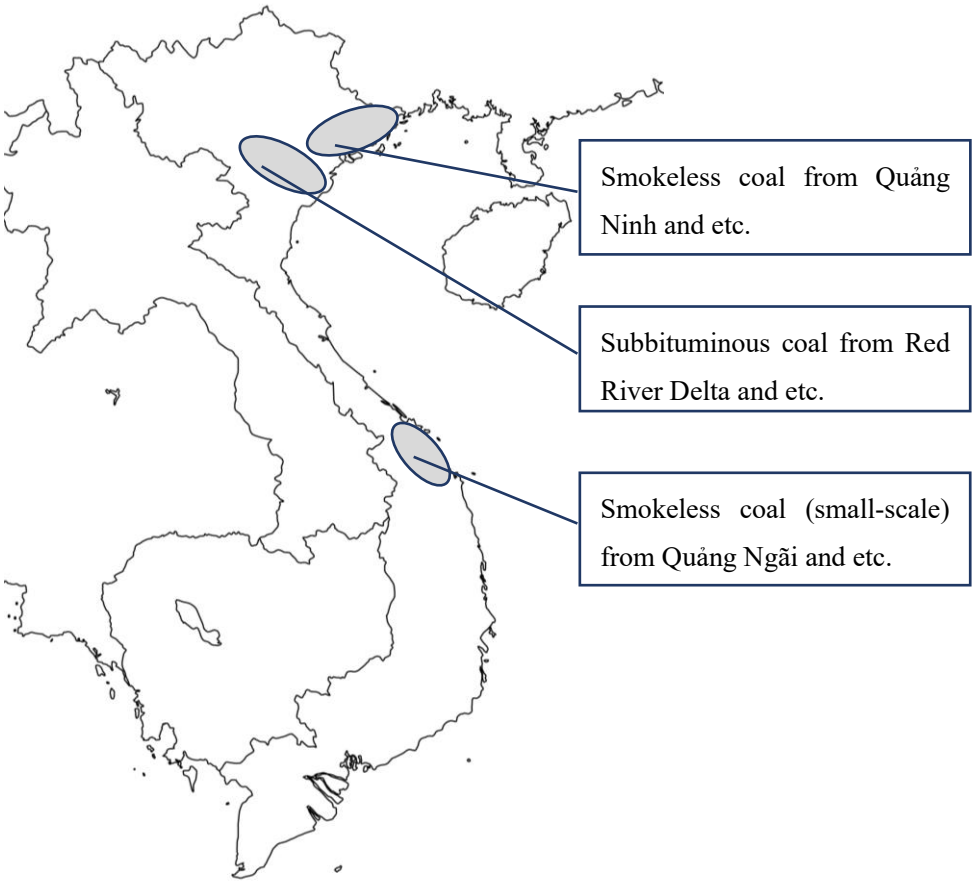


Figure 26 Major coal mines in Vietnam

Source: Compiled by JCOAL

The major coal fields are shown in the Figure 26. The age of coal formation in Vietnam is Paleozoic to Cenozoic, and it is mainly found in the northeast of the country. It is also distributed in the central and southern parts of the country, but except for a small amount of anthracite coal around Quang Ngai in the central part, it is peat, lignite, or sub-bituminous coal. In the north, anthracite coal from the

Quang Ninh coalfield and sub-bituminous coal from the Red River Delta coalfield in southern Hanoi are representative.

Since the coal-producing areas are mainly located in the northern part of the country, the central and southern parts of the country are transported by rail and coastal vessels. As a result, southern coal users must pay a premium for transportation. Some major power companies also import coal from Indonesia for their own power plants.

Table 14 and Table 15 show the specifications and quality of Vietnamese domestic charcoal. Vietnamese charcoal produces a lot of anthracite coal, which is enriched with carbonaceous matter (Figure 24 and Table 14), and high-quality anthracite coal is exported to such countries as Japan and China for steal processing as a source of foreign currency. In recent years, the government has adopted a policy of prioritizing the domestic market, and exports have frequently been unilaterally suspended. In recent years, the government has adopted a policy of prioritizing domestic production, and exports have frequently been stopped unilaterally. On the other hand, grades with high ash content and relatively low calorific value are distributed to coal-fired power plants and small domestic users.

Table 14: Standards for domestic charcoal in Vietnam

	Grade		Size	Ash content (%)	
	Domestic	World	(mm)	Average	Scope
Lump	2a	02A	35-100	8.00	6.00-10.00
(Lump coal)	2a	02B	25-100	12.50	10.01-15.00
	3	03A	25-50	4.50	3.00-6.00
	4a	04A	15-35	5.50	4.00-7.00
	4a	04B	15-35	9.50	7.01-12.00
	4a	04C	15-35	14.00	12.01-16.00
	5a	05A	6-18	6.50	5.00-8.00
	5b	05B	6-18	10.00	8.01-12.00
Fine	1	06	<15	6.50	5.00-8.00
(Powdered coal)	2a	07	<15	9.00	8.01-10.00
	3a	08A	<15	11.50	10.01-13.00
	3a	08B	<15	14.50	13.01-16.00
	3a	08C	<15	17.50	16.01-19.00
	4a	09A	<15	21.00	19.01-23.00
	4a	09B	<15	25.00	23.01-27.00
	5a	10A	<15	29.00	27.01-31.00

	5b	10B	<15	33.00	31.01-35.00
	6a	11A	<15	37.50	35.01-40.00
	6b	11B	<15	42.50	40.01-45.00
Sludge	1a	12A	<0.5	29.00	27.01-31.00
(Sludge)	1b	12B	<0.5	33.00	31.01-35.00

Source: Compiled by JCOAL from VINAVCON data

Table 15 Quality of Domestic Coal in Vietnam

	Grade	mineral content (%)	moisture (%)	Volatile Component (%)	Sulfur Content (%)	Calorific value (kcal/kg)
		average	average	average		
Lump	2a	8.00	4.00	6.00	0.65	7,600
(Lump coal)	2a	12.50	4.00	6.00	0.65	7,100
	3	4.50	4.00	6.00	0.65	7,950
	4a	5.50	4.50	6.00	0.65	7,900
	4a	9.50	4.50	6.00	0.65	7,400
	4a	14.00	4.50	6.00	0.65	7,050
	5a	6.50	4.50	6.00	0.65	7,850
	5b	10.00	4.50	6.00	0.65	7,400
Fine	1	6.50	8.00	6.50	0.65	7,800
(Powdered coal)	2a	9.00	8.00	6.50	0.65	7,600
	3a	11.50	8.00	6.50	0.65	7,300
	3a	14.50	8.00	6.50	0.65	7,000
	3a	17.50	8.00	6.50	0.65	6,750
	4a	21.00	8.00	6.50	0.65	6,400
	4a	25.00	8.00	6.50	0.65	5,950
	5a	29.00	8.00	6.50	0.65	5,600
	5b	33.00	8.00	6.50	0.65	5,250
	6a	37.50	8.00	6.50	0.65	4,800
	6b	42.50	8.00	6.50	0.65	4,350
Sludge	1a	29.00	20.00	7.00	0.65	5500
(Sludge)	1b	33.00	20.00	7.00	0.65	5200

Source: Compiled by JCOAL from VINAVCON data

As can be seen from the Table 15 the moisture, volatile matter, and sulfur content of Vietnamese coals are the same regardless of the grade, indicating typical anthracite properties. The difference in calorific value is inversely proportional to the amount of ash contained, and since the price is set based on calorific value, the higher the grade, the higher the price. The higher the grade, the higher the price. However, depending on the volume of trade and transportation costs, selected coal[3] may be used.
The Table 17 shows the projected demand for coal in Vietnam. Most of the demand is for coal-fired power generation to meet the increasing demand for electricity, while the demand from other industries is increasing slightly.

Figure 24

①Wood
②Cellulose
③Lignin
④Peat
⑤Lignite
⑥Low Level Bituminous Charcoal
⑦Bituminous Charcoal
⑧Highly Bituminous Charcoal
⑨Semi-anhydrous Coal
⑩Anthracite Coal

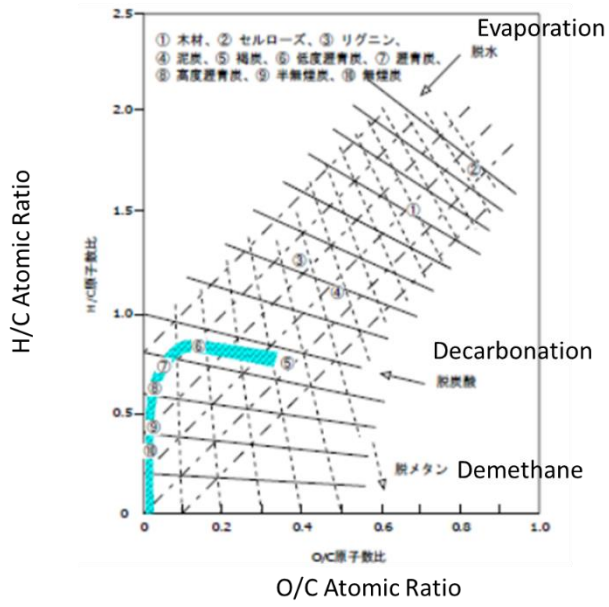


Figure 27 Coal type, coal band
Source: JCOAL Call Note 2011, original source Van Krevelen, "Coal.

[3] It is also called coal washing. A method of continuous sedimentation and separation of rocks and coal under a stream of water, using the difference in specific gravity between the two.

Table 16 Types and characteristics of coal

Types of coal	Features
lignite	It is the youngest coal in terms of coalification reaction and contains a large amount of volatile matter and moisture. Therefore, it is not suitable for long-distance transportation because of its tendency to spontaneously combust during long-term storage and is often used in coal-producing areas. Figure 275.
bituminous coal	It has properties intermediate between those of lignite and bituminous coal. It is less expensive than bituminous coal on the international market, and its use as a fuel for power generation in blends with bituminous coal has been increasing in Japan in recent years. Figure 27⑥
bituminous coal	Coal commonly used in Japan for power generation. Coal with high calorie content and low moisture, ash, and sulfur content is expensive, but Japan procures it under long-term contracts. Some of it is also used for steel production. Figure 27⑦、⑧
smokeless coal	It is a bituminous coal that has undergone further coalification reactions. It is high in calories, but takes a long time to burn. Good quality anthracite is used as a raw material for steel coke. Figure 27⑨, ⑩

Table 17 Projected Coal Demand in Vietnam

(Unit: million tons)

No.	Coal demand	2016	2020	2025	2030
1	Thermal Power Generation	33.2	64.1	96.5	131.1
2	Fertilizers and Chemicals	2.4	5.0	5.0	5.0
3	Cement	4.7	6.2	6.7	6.9
4	Metallurgy	2.0	5.3	7.2	7.2
5	Others	5.2	5.8	6.1	6.4
Total		47.5	86.4	121.5	156.6

Source: Compiled by JCOAL from CDP, Ministry of Industry and Trade, Vietnam

(2) The position of coal power in Vietnam

Vietnam's power operations were governed by Power Development Plan 7 (PDP7), the country's most recent power generation capacity plan, which was amended in March 2016 and revised to significantly increase the share of renewable energy for 2030, as shown in Figure 28.

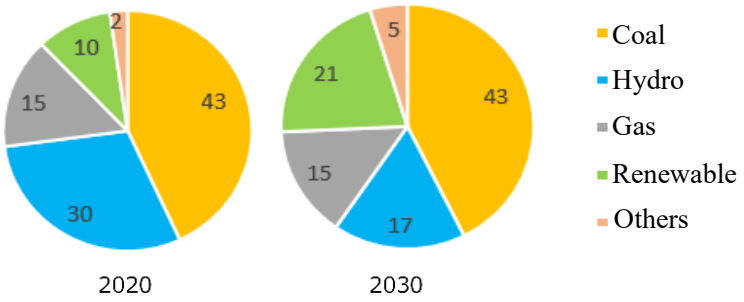


Figure 28 Share of installed capacity and share of electricity generation by power generation plan in Vietnam

Source: Compiled by JCOAL from the revised PDP7 of the Vietnamese Ministry of Industry and Trade

As a result, the share of renewable energy is expected to increase substantially, not only in electricity, but also in projected demand for primary energy from agriculture, forestry, and fisheries, industry and construction, and consumer-related industries. Among the renewable energies, the use of biomass for power generation and heat supply is expected to increase substantially. As coal-fired power generation is expected to continue, the increased use of biomass in renewable energies is expected; therefore, the use of biomass in coal boiler is desirable.

4.4. Survey on coal boiler users

(1) List of coal boiler user survey results

Table 18 and Table 19 show the survey results of coal boiler users and others in the Mekong Delta region.

Table 18 Results of Interview Survey of Coal Boiler Users, etc.

	FICO	MTV	MTI	Pulppy
Location (Province)	Tay Ninh	Dong Nai	Bin Duong	Binh Duong
Factory type	Cement plant	Drying of agricultural products (unhulled rice, sorghum)	Children's clothing/ Protective clothing manufacturing	Tissue manufacturing
# of employees	250	5	60 110 at HQs.	500
site	460,000 ㎡	1,000 ㎡	3000 ㎡	20,000 ㎡

production output	Cement production volume: 1,500,000 t/year		Products: 290,000 pieces HQs: 400,000 pieces	
boiler	○ （coal/electricity)	○	○	○
fuel	Coal 150,000t/year	Coal 350 to 400 t/year	Diesel (DO)	Coal 18,000t/year
coal properties	5,800 kcal/kg	N/A	-	6,500 kcal/kg
	raw coal price 7.2 yen/kg.	Purchase Price 23 yen/kg	-	
	Operation Price 10.7 yen/kg	Operation Price same as above	-	Price 16-18 yen/kg
	(Inclusive: purchase - grinding - burning)	Purchased from a vender and transported by a truck	transport cost 1 yen/kg	Transport cost 1 yen/kg
Boiler	Boiler (Sinomax, China)	Dry furnaces (2 furnaces: 4x8m)	DO-fry boiler (Martech)	Boiler (Dong Hung Khai, Taiwan)
	Mill (Pfeifer, Germany)	Made by local dry oven manufacturer		2 units (shift operation)
Crusher	Pulverized coal mill (90 μm in particle size)	None (purchased in chunks, grounded to 20 cm by hammer)	None	None (purchased in powder form)
coal conveying equipment	Conveyor	None	None	Transported by bulldozer
Coal storage.	Capacity 60,000t (2-3ha)	None (15 ㎡ of storage space next to the furnace)	None	Stored in a 100 ㎡ warehouse (delivered by truck daily)
ash disposal	Mixed in cement material	Backfilling the pond	None	Processing by contractor at 540 yen/ton

Dust removal equipment	Cloth filter only (5 micron) (No countermeasures required due to surrounding rubber plantation)	None	None	Waste gas filtered with water before discharged.

Table 19 Results of interviews with coal boiler users and others (continued)

	FICO	MTV	MTI	Pulppy
Use of curl chips	NG (modification needed)	OK	NG	OK
	Rice husks are usable	Not enough storage	Boiler not suitable	
	The price of rice husk high	Cost addition	Only diesel oil	
Transportation of curl chip	Transported from the rice mill in Soc Trang	Transported from the rice mill in Soc Trang	Transported from the rice mill in Soc Trang	Transported from the rice mill in Soc Trang
	200km (waterway)	300km (truck) 6hr(JPY1/kg)	250km (truck) 5hr(JPY1/kg)	250km (truck) 5hr(JPY1/kg)
Transportation of coal	70km from the port by truck	5km by truck	-	Delivered by a distributor by truck
Storage space	Storage for coal	Storage for coal(15 ㎡)		Storage for coal
Interest in the project	The cost is too high to use rice husks	If the drying capacity is unchanged	No	If the calorific values is unchanged
	Profitability is necessary	If the project is profitable		Easy maintenance is a must
	If the running cost is the same as coal			Need a trial

(2) FICO Cement Plant

It is the largest among the companies surveyed this time. The cement plant does not own a coal boiler,

but feeds coal pulverized in a mill into a cement kiln (see Figure 29 Cement production process).
In Japanese cement factories, cement raw materials are calcined in rotary kilns for firing and in a pre-heater process, and in addition to conventional coal, fuel wastes, municipal waste, waste tires, biomass, etc. are used as fuels for heating and firing. These wastes and byproducts are recycled as raw materials for cement, which reduces coal consumption and also helps to protect the natural environment.
Among biomass, Vietnam generates a large amount of rice husks after milling rice, which is a staple food in the country (rice husks account for about 20% of rice production (unhulled rice)), and effective use of these husks in kilns is expected in the future. In addition, as the production of coal (anthracite), which is used as fuel, is decreasing in Vietnam, it is expected that biomass, especially rice husks, will be used as an alternative fuel in order to save coal.

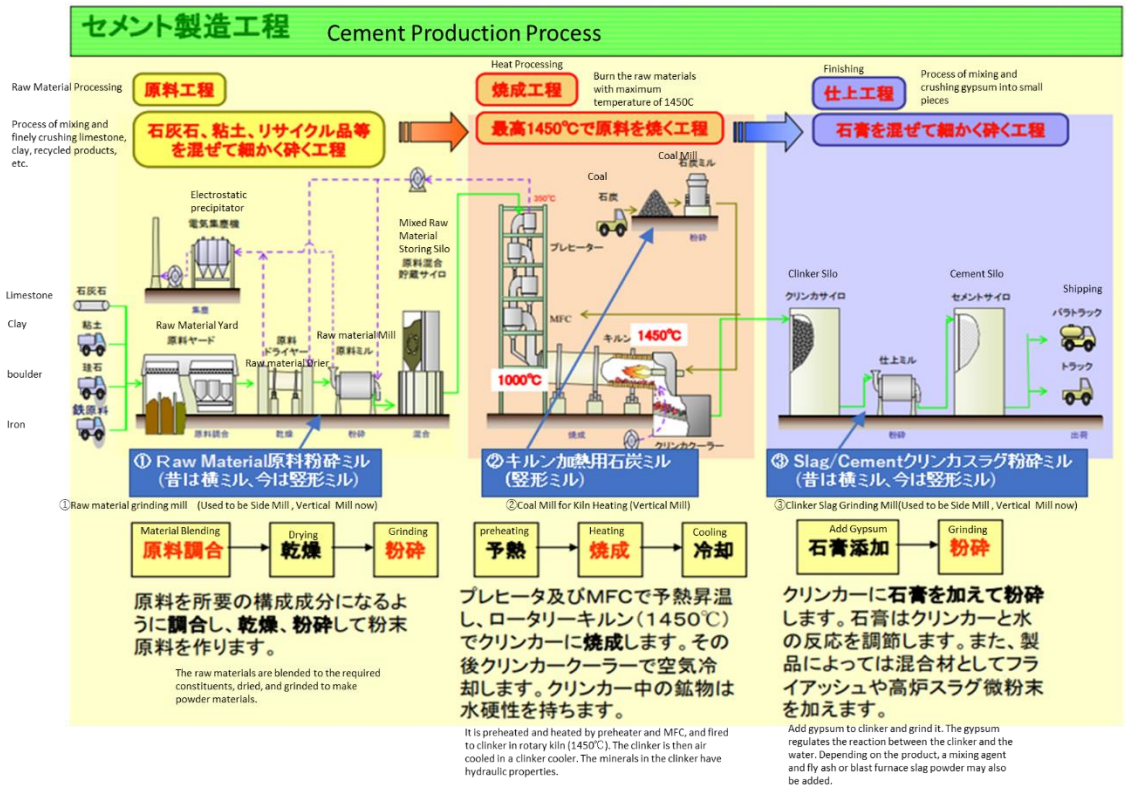


Figure 29 Cement manufacturing process

Source: JCOAL appended to data from Ryoko Lime Industry Co.

The mill at the FICO cement plant is a vertical mill manufactured by PFEIFER (MPS 3070) in Germany, as shown in the photo in the Figure 30, and its grinding performance is 90μm in size after grinding. The role of coal in this process is to secure the calorific value, but it is also necessary to check the compatibility with the ash properties because the remaining ash is directly used as a raw material for cement.

Figure 30 Coal mill used at FICO

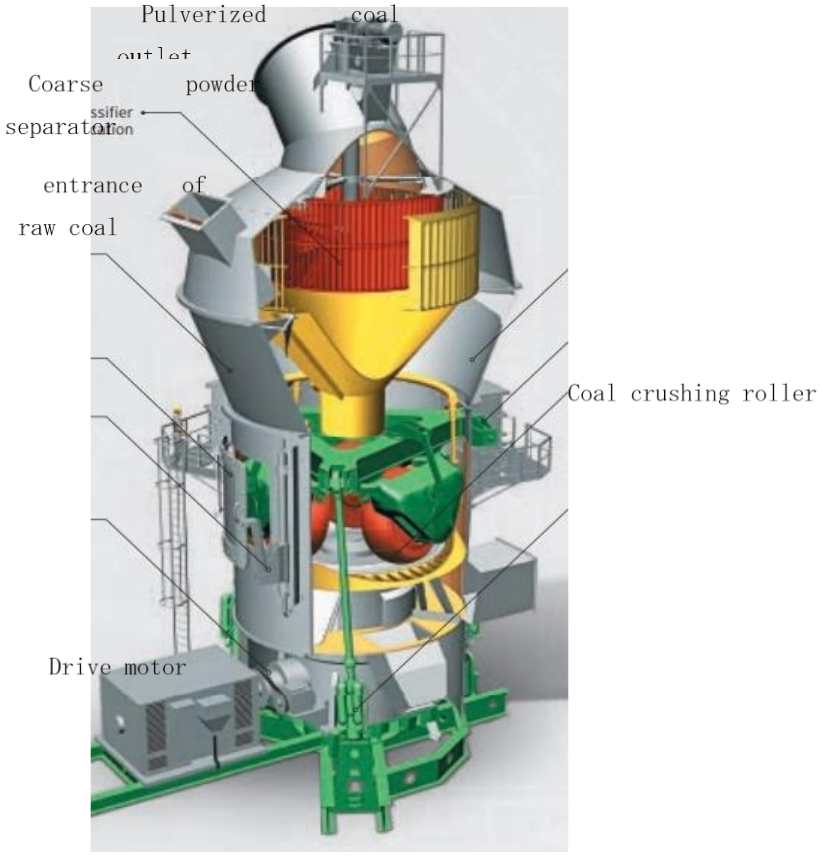


Figure 31 Structure of the coal mill used at FICO (vertical mill MPS 3070 manufactured by PFEIFFER)

Source: PFEIFFER data with JCOAL addition.

The price of coal is fluctuating, so it is not constant, but it is about 1,600 VND/kg. The reason for the low price compared to the average market price is that the company is a state-owned enterprise, and its suppliers are also state-owned enterprises, which allows state-owned enterprises to cooperate with each other in the implementation of the project. The price includes the costs incurred in the entire process from purchasing coal to transporting and pulverizing it for use in the coal boiler, which is approximately 4 USD per gigajoule. Therefore, 239,006 kcal per gigajoule, 239,006 kcal ÷ 5,800 kcal (heat value per kg of coal used) = about 41.2 kg of coal required per gigajoule.

The annual consumption is about 150,000 tons with a calorific value of 5,800 kcal (the composition list of the coal used is confidential and not shared). The company purchases pulverized coal (powdered coal), 97% of which is less than 50mm in diameter, to ensure uniform quality. The pulverized coal is further pulverized to 90 microns to meet the specifications of the coal boiler using our own equipment. The pulverized coal is spewed into the furnace and burned.

The products are transported from the supplier to the port of HIEPPHUOC by ship, and then transported to the factory by truck. The distance from the port to the factory is about 70 km.

Regarding the substitution of coal for rice husk solid fuel, if the price is equivalent to the price of coal currently used, there is potential for use. Therefore, approximately 4 USD per gigajoule will be considered as the standard. In the case of substituting curl chips, 239,006 kcal / 3,700 kcal (heat value per kg of curl chips used) = about 64.5 kg (amount of curl chips required per 1 GJ). Therefore, if the total cost, including the cost of purchasing 64.5 kg of curl chips and using them in the boiler, is within about 4 USD, it is considered to be profitable.

(3) MTV Produce Drying Plant

It seems that the coal is pulverized to the extent that it can be fed into an agricultural product drying plant, and since there is no specific pulverizing equipment and the volume handled is small, the plant is purchasing coal at a high price. There is no particular pulverizing equipment, and the volume handled is small, so the company seems to be purchasing expensive coal. It seems that the coal can be replaced with curl chips, but the demand is expected to be small.

Agricultural products are placed on the grid floor at the top of the drying chamber, and coal is fed into the combustion furnace through the coal feed port from the drying chamber.

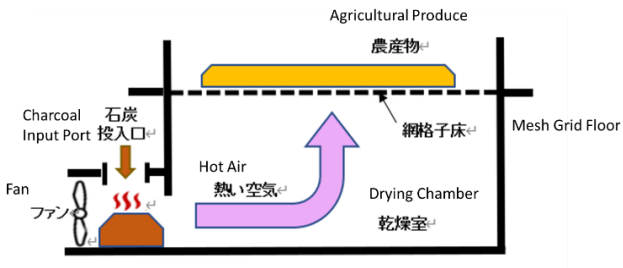


Figure 32 Structure of the agricultural product drying plant


Figure 33 Coal feed port to the combustion furnace (left), coal placed in the coal combustion furnace (right)

Figure 34 Coal inlet to the combustion furnace
(Combustion gases enter the lower part of the drying chamber.

Figure 35 Agricultural product dryer (upper part of the drying chamber)
(Produce is placed on a lattice floor to dry)

The price of coal is 5,000 VND/kg and the annual consumption is 350-400 tons. The company purchases solid coal and uses coal with a diameter of 40 cm as the largest size. When the coal is fed into the coal boiler dryer, it is crushed by hand using a hammer and shaped to a diameter of 20 cm before use. Ashes and soot discharged after coal combustion are reused for pond reclamation. The coal is purchased from a coal sales site located about 5 km away from the plant and is procured by the company using its own trucks.

Regarding the substitution of coal for rice husk solid fuel, the fact that the existing coal boiler drying equipment can be used is an advantage, but new employment and a place to store the rice husk solid fuel will be required. If a certain amount of profit can be expected for these initial investments, the company would like to consider introducing the system. The transportation time is expected to be about 300 km by land and 6 hours by truck, and the transportation cost will be about 250 dong/kg.

(4) MTI Child Clothing/Protective Clothing Manufacturing Factory

It is a clothing factory, but the boiler of the factory is a diesel oil-fired boiler, so replacing the boiler with rice husk solid fuel will require updating the furnace itself, which will involve a large initial investment. The boiler is manufactured by MARTECH in Vietnam (designed by an Australian company) and has a compact shape as shown in the Figure 36

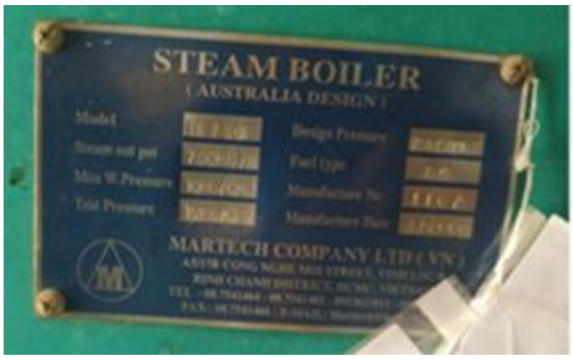


Figure 36 Diesel oil-fired boiler used at MTI

The solar water heater (for the boiler) is used to heat the water that reenters the boiler. The steam after each process is discharged directly through the chimney.

MTI transports diesel oil by tanker truck from a supplier in BINHDUONG Province.

A transport pipe is installed in the facility and diesel oil flows into the boiler through the pipe, so it is impossible to use rice husk solid fuel together due to its structure. In the case of using rice husk solid fuel for purposes other than boiler use, transportation is expected to take about 250 km by land, or 5 hours by truck one way, and the transportation cost will be 200-250 dong/kg.

(5) Pulppy tissue manufacturing plant

The coal boiler installed in the tissue manufacturing plant has the following specifications.

- ✓ Boiler type: Stoker type
- ✓ Boiler specifications: evaporation rate 10 t/h
  Steam pressure: 7 to 10 kg/cm2
  Temperature: 200°C

The stoker used in the plant is a "Grate," in which the fuel is placed on a grate to be burned by fire, and the air for combustion is supplied from below the grate to burn the fuel as it rises through the gaps in the grate. The stoker used in Pulppy is a "traveling stoker type" with a moving grate, and as shown in the Figure 37, the fuel supplied from the hopper at the front of the boiler furnace onto the stoker is burned on the grate, moves gently backward like a conveyor, and the ash after combustion is discharged from the end of the conveyor to the outside of the furnace.

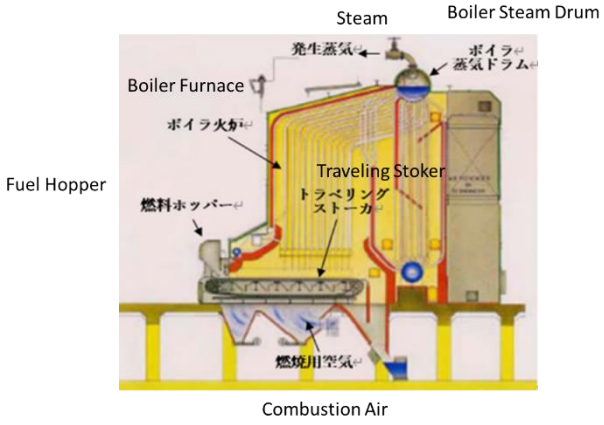


Figure 37 Traveling stoker type boiler

Source: Product Information｜Source: Yoshimine Corporation Product Information

http://www.yoshimine.co.jp/products/product_h.html

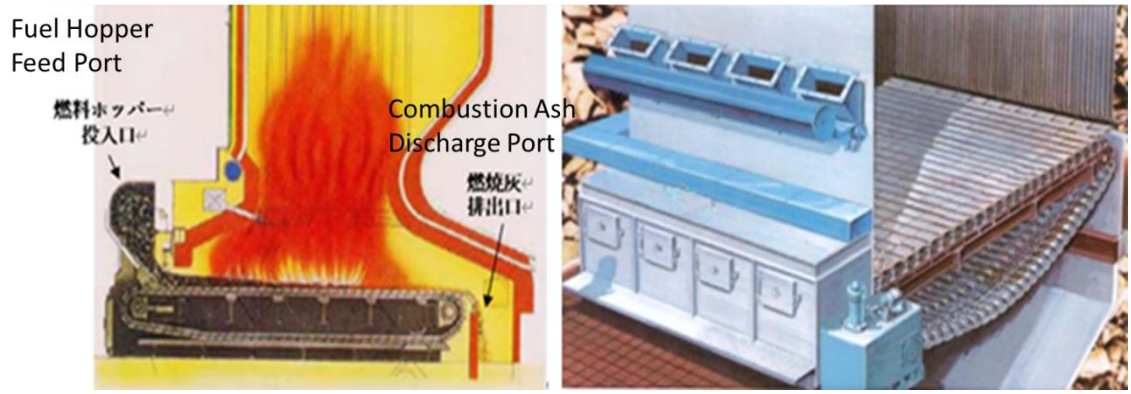


Figure 38 Geometry of a traveling stoker-type combustion furnace

Source: Same as Figure 34, right Figure is from Keystone Energy

Figure 39 Appearance of coal boiler (left) and fuel receiving hopper (right)

Figure 40 Stoker grate (left) (with fuel moved to the right) and stoker combustion ash outlet (right)

Pulppy's coal consumption is 18,000 tons, an order of magnitude less than that of FICO, and the boiler is a stoker type, which uses coal without pulverizing it, so it can be used as it is even if it is replaced by curl chips. However, since the calorific value of the existing coal is high, assuming the same level of heat supply, 27,000 tons of curl chips will be required, a 50% increase. It is necessary to confirm the quality of the coal to be used, but the amount of curl chips will vary because the ash content is higher than that of curl chips. This is the most likely scenario among the companies interviewed this time.

(6) Coal usage by other companies

Of the results of the survey of coal boiler users by each company, the results of the survey on coal usage are summarized (Table 20).

Table 20 Summary of coal usage by each company

	FICO Cement Plant	MTV Produce Drying Plant	MTI Children's Clothing Protective Clothing Factory	Pulppy tissue manufacturing plant
Coal consumption t/year	150,000	400	0	18,000
Coal calorific value Kcal/kg	5,800	6200	0	6,500
coal price Yen/kg	7	23	0	17
coal price VND/kg	1,600	5,000	0	3,750
Coal calorific value equivalent per kg rice husk solid fuel requirement (kg)	1.57	1.68	0	1.76
Amount of rice husk solid fuel required. t/year	235,135	670	0	31,622

1JPY=222.1VND (as of February 3, 2021)

Curl chip calorific value = 3,700kcal/kg

4.5. Potential of adopting the project

(1) Production cost of rice husk solid fuel

In this project, we assume that the grind mill (TRM-200CR) will be installed in Thanh Tin Rice Mill, considering the amount of rice husk discharged and the possibility of installation. This is based on the assumption that one TRM-200CR will be installed and operated 20 days a month for 8 hours a day to produce 460 tons of curl chips in 12 months.

i Scenario in which rice husk cost is not considered

1. Prerequisites.

Item		Quantity	Unit	Remarks
1)	Purchase of TRM-200CR grind mill	270	10,000 yen	CR model 2.5 million yen + 200,000 yen transportation fee included
2)	Building electrical equipment installation cost	0	10,000 yen	Assumed to be installed in an existing building.

	Total equipment cost (2.5 million yen + 200,000 yen)	270	10,000 yen	
3)	Depreciation and amortization (2.7 million yen / 7)	39	10,000 yen	Equal amortization over 7 years.
4)	Months of curl chip production	12	(# of) months	
5)	Consumable parts (per 1920 hours)	68.4	10,000 yen / 1920h	8h x 20 days x 12 months = 1920h
6)	Labor cost for production (12-month operation)	30.0	10,000 yen / 12 months	25,000/month refer to Thanh Tin Rice Mill labor cost (general)
7)	Amount of electricity used (for 12 months)	57,600	kwh/12 months	30kw×1920h=57,600kwh
8)	Electricity Bill (for 12 months)	40.9	10,000 yen / 12 months	7.1 yen/kWh Excerpted from in-house_2019 rice mill electricity usage rate survey
9)	Curl chip production rate (1 hour operation)	240	kg/h	Assume 240 kg/h.
10)	Curl chip production (12 months 1920 hours operation)	460.8	t/1920h	12-month production volume

2. Production cost estimate

Item	Cost	Unit	Remarks
Rice husk procurement cost	0.0	10,000 yen	Assume rice husks are procured at 0 yen/kg/use own emissions
Depreciation of grind mill equipment	39	10,000 yen	2.7 million ÷ 7
Labor cost (for 12 months)	30	10,000 yen	25,000 yen per month x 12 months
Electricity charges (for 12 months)	40.9	10,000 yen	7.1 yen/kWh Excerpted from in-house_2019 rice mill electricity usage rate survey
Cost of consumables	68.4	10,000 yen	Parts unit price x 1920h
Total	177.9	10,000	

		yen	

3. Production cost per ton of briquette

Item	Quantity	Unit
Curl chip production volume	460.8	t
Production cost of 460.8 tons of curl chips	177.9	10,000 yen
Production cost of 1 ton of curl chips	0.39	10,000 yen/ton
Production cost of 1 kg of curl chips	3.9	Yen/kg

1 dong = 0.0045 yen as of January 28, 2021

ii Scenario in which rice husk cost is considered

1. Prerequisites

Item		Quantity	Unit	Remarks
1)	Purchase of TRM-200CR grind mill	270	10,000 yen	CR model 2.5 million yen + 200,000 yen transportation fee included
2)	Building electrical equipment installation cost	0	10,000 yen	Assumed to be installed in an existing building.
	Total equipment cost (2.5 million yen + 200,000 yen)	270	10,000 yen	
3)	Depreciation and amortization (2.7 million yen / 7)	39	10,000 yen	Equal amortization over 7 years.
4)	Months of curl chip production	12	(number of) months	
5)	Consumable parts (per 1920 hours)	68.4	10,000 yen / 1920h	8h x 20 days x 12 months = 1920h
6)	Labor cost for production (12-month operation)	30.0	10,000 yen / 12 months	25,000/month refer to Thanh Tin Rice Mill labor cost (general)
7)	Amount of electricity used (for 12 months)	57,600	kwh/12 months	30kw×1920h=57,600kwh
8)	Electricity Bill (for 12 months)	40.9	10,000 yen / 12 months	7.1 yen/kWh Excerpted from in-house_2019 rice mill electricity usage rate survey

9)	Curl chip production rate (1 hour operation)	240	kg/h	Assume 240 kg/h.
10)	Curl chip production (12 months 1920 hours operation)	460.8	t/1920h	12-month production volume

2. Production cost estimate

Item	Cost	Unit	Remarks
Rice husk procurement cost	125.8	10,000 yen	Assume rice husk is procured at 2.73 yen/kg (600 dong/kg)
Depreciation of grind mill equipment	39	10,000 yen	2.7 million ÷ 7
Labor cost (for 12 months)	30	10,000 yen	25,000 yen per month x 12 months
Electricity charges (for 12 months)	40.9	10,000 yen	7.1 yen/kWh Excerpted from in-house_2019 rice mill electricity usage rate survey
Cost of consumables	68.4	10,000 yen	Parts unit price x 1920h
Total	177.9	10,000 yen	

3. Production cost per ton of briquette

Item	Quantity	Unit
Curl chip production volume	460.8	t
Production cost of 460.8 tons of curl chips	177.9	10,000 yen
Production cost of 1 ton of curl chips	0.39	10,000 yen/ton
Production cost of 1 kg of curl chips	6.6	Yen/kg

1 dong = 0.0045 yen as of January 28, 2021

If one unit of TRM-200CR is installed in Thanh Tin rice mill, the production cost will be 3.9 yen (1,066VND)/kg if the price of rice husk is not set, and 6.6 yen (1,177VND)/kg if the price of rice husk is set.

(2) Transportation cost of rice husk solid fuel

In the case of using rice husk solid fuel (curl chips) as a substitute for coal by the coal boiler users, the transportation cost from Thanh Tin rice mill to the users should be included. Based on the results of the field interview survey, the cost of transportation to the coal boiler users is as follows

Table 21 Cost of transporting curl chips to each coal boiler user company

	FICO Cement Plant	MTV Produce Drying Plant	MTI Child Clothing / Protective Clothing Factory	Pulppy tissue manufacturing plant
transportation expenses VND(JPY)/kg	310(1.4)	250(1.13)	200(0.9)	220(0.99)
means of Transport Land Transportation or canal	Canal + Land Transportation	land transportation	land transportation	land transportation
Transit time h(one way)	8	5	6	5 to 6
Transport distance km	200 (canal) 70 (land transportation)	250	300	250
Charcoal instead of possible maximum amount (t/year)	150,000	350-400	0	18,000

(3) Cost calculation when rice husk solid fuel is used instead of coal

The following table shows the simulations when each company replaces coal with rice husk solid fuel (curl chips), including the transportation cost in the following Table.

Table 22 Simulation of substitution of coal for curl chips

Item	Unit	Pulppy	MTV	MTI	FICO
Curl Chip Purchase Price (case of free rice husk)	VND/kg	1,088	1,111	1,066	1,177
Curl Chip	VND/k	1,688	1,710	1,666	1,777

Purchase Price (Case of rice husk is paid for)	g				
Curl Chip purchase price (Case of free rice husk)	Yen/kg	4.9	5.0	4.8	5.3
Curl Chip purchase price (case of rice husk is paid for)	Yen/kg	7.6	7.7	7.5	8.0
Amount of rice husk solid fuel required	t/year	31,622	670	0	235,135
Annual curl Chip purchase fee (case of free rice husk)	VND/year	34,404,736,000	744,035,000	0	276,784,462,550
	JPY/year	154,906,511	3,350,000	0	1,246,215,500
Annual curl Chip purchase cost (Case of rice husk is paid for)	VND/year	53,377,936,000	1,145,813,900	0	417,787,868,000
	JPY/year	240,332,895	5,159,000	0	1,881,080,000

1JPY=222.1VND (as of February 3, 2021)

When coal/user replaces the coal currently used with curl chips, the cost is 4.8 yen (1,066VND) to 5.3 yen (1,177VND)/kg if the rice husk as raw material is free, and 7.5 yen (1,644VND) to 8.0 yen (1,754VND)/kg if the rice husk is paid. If rice husks are paid for, the price is 7.5 yen (1,644VND) to 8.0 yen (1,754VND)/kg.

(4) Calories of coal used by coal boiler users

According to the survey results obtained this time, the calories (calorific value) of the coal used are

5,800 kcal/kg for FICO and 6,500 kcal/kg for Pulpy, respectively, so it can be inferred from the Table 23 that powdered coal 5a and 6a are used, respectively.

Table 23 Coal quality used (estimated from standards)

Business	Grade	Ash content (%)	Moisture (%)	Volatile matter (%)	Sulfur content (%)	calorific value (kcal/kg)
FICO	5a	29.00	8.00	6.50	0.65	5,600
Pulppy	4a	21.00	8.00	6.50	0.65	6,400

In the case of the Pulppy tissue manufacturing plant, coal is stored in a warehouse, so the frequency of receiving curled chips, which are about 1.7 times larger in terms of calorific value, needs to be increased in order to receive them on a regular basis. In addition, combustion ash is processed at a cost of 540 yen per ton, but curled chips have less than half the ash content of coal, which is expected to reduce the processing cost.

(5) Application of rice husk solid fuel to coal boilers

At the FICO cement plant, pulverized coal is sent directly from the mill to the kiln, and can be used by inserting it directly into the kiln. The boiler at the MTI children's clothing/protective clothing manufacturing plant is a diesel oil-fired boiler, so replacing it would require updating the furnace itself, which is not practical.

However, rice hulls contain a large amount of silicic acid, which is essential for the healthy growth of rice, so when they are burned in a boiler, a mass of crystalline silica called clinker is formed in the combustion furnace of the boiler. In the case of a stoker type boiler, it is necessary to take care of the high temperature inside the furnace due to excessive combustion, to protect the walls of the combustion furnace with refractory materials or linings, and to prevent blowing through the grate or, conversely, blockage.

In the FICO cement plant, pulverized coal is sent directly from the mill to the kiln, and it seems that direct insertion into the kiln is a good way to use it.

Stoker boiler combustion at the Pulpy tissue plant is also not expected to cause any problems.

As for the items to be considered, pre-treatment facilities (delivery → storage → transfer → input to kiln/boiler) seem to be important for both.

(6) Possibility of fuel replacement by rice husk solid fuel

Based on the results of the coal use survey, MTI's child clothing/protective clothing factory uses diesel oil, so it is excluded from the assumed alternative destination for curl chips. In addition, the potential

annual use of rice husk solid fuel by FICO's cement plant is large, and the impact of substituting curl chips would be significant, but the maximum annual production capacity of curl chips at Thanh Tin Rice Mill is equal to the amount of rice husk generated (44,000 tons), and therefore Thanh Tin Rice Mill alone cannot supply enough curl chips. In addition, if the curl chips are to be used in the existing boiler facilities, it is necessary to grind the curl chips to the same shape and granularity, which will require new investments such as a new mill for grinding. Therefore, FICO's cement plant was also excluded from the assumed alternative destination for the curl chips, and a potential grind mill site that discharges a large amount of rice husks from Thanh Tin rice mill will be selected for the next survey to make a trial calculation.

On the other hand, the Pulppy Tissue Plant and the MTV Produce Drying Plant can use existing facilities as they are and can use curl chips, so there is no new capital investment and few obstacles to coal substitution. Therefore, we will estimate the costs incurred by the Pulppy Tissue Plant and the MTV Produce Drying Plant when using coal and the costs incurred when using curl chips.

Table 24: Cost calculation of using curl chips to Pulppy and MTV

			Pulppy tissue factory	MTV Produce Drying Plant	Remarks
coal	Coal consumption	t/year	18,000	400	
	Coal calorific value	kcal/kg	6,500	6,200	
	coal price	VND/kg	3,750	5,000	
		JPY/kg	17	23	
	Annual coal purchase cost	VND/year	67,500,000,000	2,000,000,000	
		JPY/year	303,917,154	9,004,953	
	Boiler maintenance costs	VND/year	280,800,000	0	
		JPY/year	1,264,295	0	
	Annual running costs when using coal	VND/year	67,780,800,000	2,000,000,000	
		JPY/year	305,181,450	9,004,953	
curl chip	Amount of curl chip used	t/year	31,622	670	
	Curl chip heat value	kcal/kg	3,700	3,700	
	Curl chip unit price	VND/kg	1,088	1,111	free of charge
		JPY/kg	4.9	5.0	
		VND/kg	1,688	1,710	rice husk paid
		JPY/kg	7.6	7.7	
	Annual curl chip purchase fee	VND/year	34,404,736,000	744,370,000	free of charge
		JPY/year	154,906,511	3,351,508	

		VND/year	53,377,936,000	1,145,700,000	rice husk paid
		JPY/year	240,332,895	5,158,487	
	Boiler maintenance costs	VND/year	140,400,000	0	
		JPY/year	632,148	0	Estimated 50% of coal boiler maintenance cost due to half the ash content.
	Annual running costs when using curl chip	VND/year	34,545,136,000	744,370,000	free of charge
		JPY/year	155,538,658	3,351,508	
		VND/year	53,518,336,000	1,145,700,000	rice husk paid
		JPY/year	240,965,043	5,158,487	

In addition, the following table shows the cost savings if the companies were to replace all coal use with curl chips.

Table 25: Fuel cost savings when curl chip is used by Pulppy and MTV

			Pulppy tissue factory	MTV Produce Drying Plant	Remarks
Comparison	Cost savings achieved by switching from coal to curl chips as boiler fuel.	VND/year	33,235,664,000	1,255,630,000	free of charge
		JPY/year	149,642,792	5,653,444	
		VND/year	14,262,464,000	854,300,000	rice husk paid
		JPY/year	64,216,407	3,846,466	
	Percentage reduction in annual cost incurred for curl chip specification compared to annual cost incurred for coal use.	percentage	51.0	37.2	free of charge
		percentage	79.0	57.3	rice husk paid

Therefore, although the cost savings will vary depending on whether rice husks are used free of charge or for a fee, the Pulpy Tissue Factory can expect to save 61,602,352 yen (13,681,882,400 VND) to 147,028,737 yen (32,655,082,400 VND) per year compared to using coal. In addition, the MTV Agricultural Products Drying Plant is expected to save 51.0% to 79.0% of the coal consumption. The MTV agricultural product drying plant is expected to save 3,846,466 yen (13,681,882,400 VND) to

5,653,444 yen (32,655,082,400 VND), which is 37.2% to 57.3% of the coal consumption.

(7) CO2 reduction and cost effectiveness (solar power generation system)

i Overview

The GHG emission reductions associated with fuel switching at existing manufacturers (non-energy applications) were evaluated. The project focused on the fuel switching from coal to rice husk-derived curl chips. As a result of the study on the "potential of curl chips as an alternative fuel" in Soc Trang Province, it was suggested that producing curl chips at Thain Tin Rice Mill and utilizing the curl chips as an alternative fuel for boiler at two corporations, namely, Pulppy and MTV was suggested to be feasible. In this section, GHG emission reduction potentials and cost-effectiveness were evaluated for the following two cases:

1) All coal used at Pulppy is switched to curl chips supplied by Thain Tin Rice Mill
2) All coal used at MTV is switched to curl chips supplied by Thain Tin Rice Mill

ii MRV methodology

The CDM methodology “AMS-III.AS.: Switch from fossil fuel to biomass in existing manufacturing facilities for non-energy applications (Version 2.0)” was referred to as an MRV methodology. The methodology is applicable to complete or partial fuel switching projects (Figure 41).

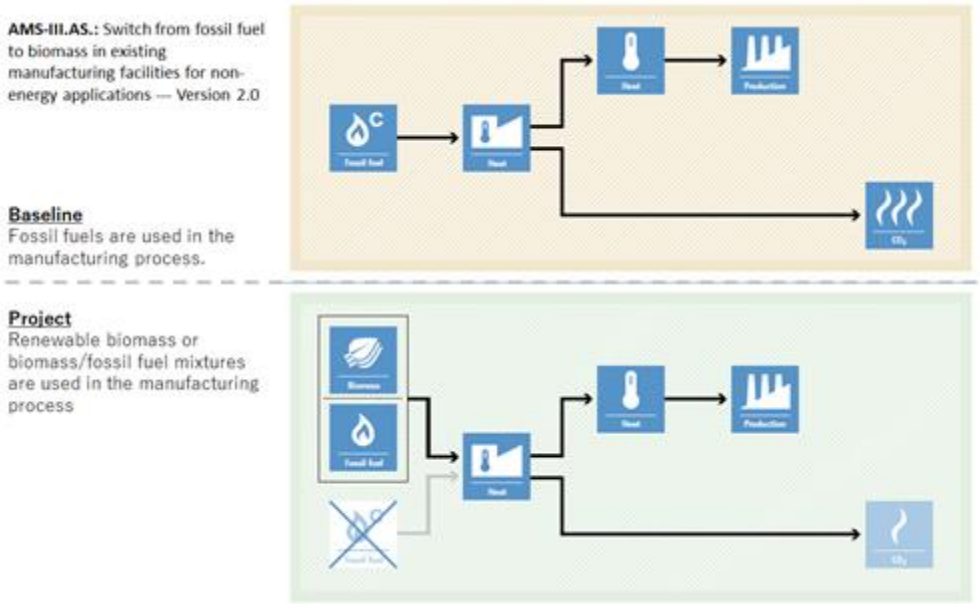


Figure 41 Image of a fuel switching project subject to CDM methodology AMS-III.AS.
Source: UNFCCC “CDM Methodology Booklet - Eleventh edition”, Nov. 2019.

The eligibility requirements (applicability) of the project is as follows. The project under consideration was assumed to meet all the requirements.

<Applicability>

(a) The baseline fossil fuel and the project biomass are consumed in thermal energy conversion equipment (e.g. furnaces, kilns, dryers) that are used in the manufacture of products (e.g. steel, ceramics, aluminium, lime, clinker). This is referred to as an element process in this methodology;

(b) It shall be demonstrated, with historical data, that at least for the immediate prior three years to the start date of project, only fossil fuels (no renewable biomass) were used in the production systems, which are being modified, retrofitted or replaced. In cases where small quantities of biomass were used for experimental purposes then this can be excluded;

(c) Regulations do not restrict the use of the baseline fossil fuel or require the use of project biomass and low carbon energy sources unless widespread noncompliance (less than 50 per cent of manufacturing production activities comply in the country) of the local regulation is evidenced;

(d) The production process where the fuel switch takes place shall have a distinct energy input (i.e. specific fuels) and distinct output (i.e. intermediate or finished product). The output of each element process shall be an output for which an appropriate international/national standard or industrial norm exists;

(e) This methodology is not applicable to project activities where primary output of the processes is energy (e.g. heat, electricity) that can be directly measured;

(f) The product(s) (e.g. ceramic insulators, tiles, steel ingots, lime, aluminium cookware) produced in the industrial facility throughout the crediting period shall be equivalent to the product(s) produced in the baseline. For the purposes of this methodology, equivalent products are defined as products having the same use, the same general physical properties, and which function in a similar manner. In addition, products produced in the industrial facility throughout the crediting period shall provide the same level of service, or better, and be of the same level of quality, or better than the product(s) produced in the baseline. When national or international product standards apply to the product(s), product quality shall be as defined in such standards, otherwise the relevant industrial norms are to be followed;

(g) The type of input materials used in the project shall be homogeneous and similar to the input material that was used in the baseline and any deviation during the crediting period of input material type, composition, or amount used per unit of product output shall be within the range of ±15 per cent of the baseline characteristics and values;

(h) The facilities involving modification, retrofit and/or replacement shall not influence the production capacity beyond ±15 per cent of the baseline capacity.

iii Project boundary

The project boundary is generally assumed to be a physical, geographical site where the switching of energy sources takes place. It includes all installations, processes or equipment affected by the fuel switching.

In the project under consideration, CO2 emissions from electricity consumption for curl chip production from rice husks and fuel consumption for transporting curl chips in a project scenario were the subject of estimation; while, in the reference scenario, CO2 emissions from electricity consumption for briquette production from rice husks and fuel consumption for transporting briquettes were not accounted for in order to ensure conservativeness.

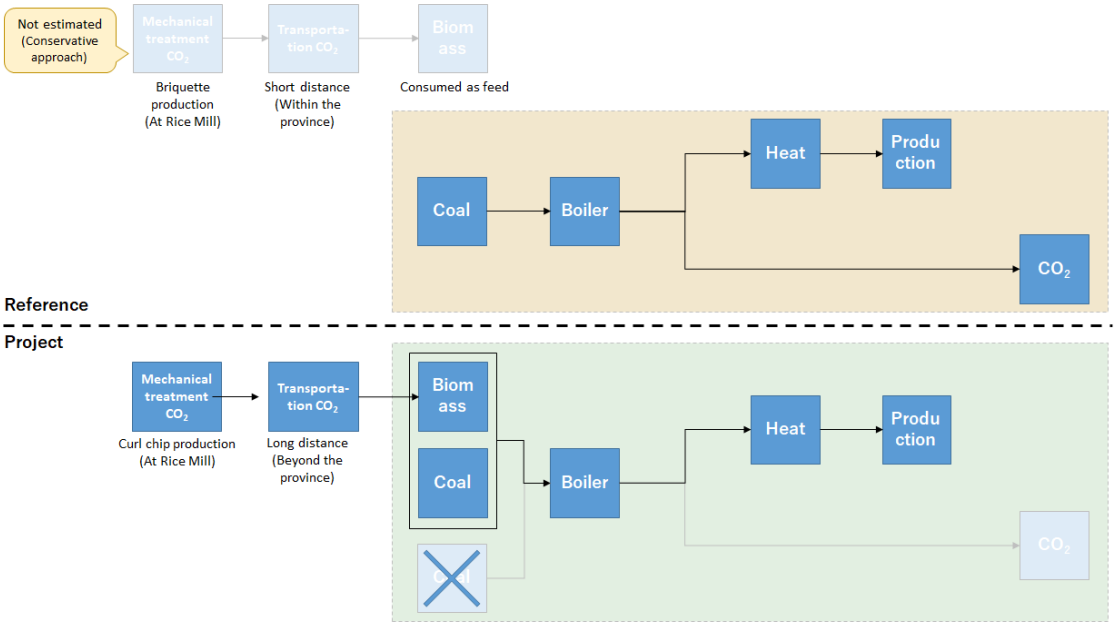


Figure 42 Boundary of the project

Table 26 GHGs and emission sources subject to estimation

	Emission source	GHG	Subject of estimation	Note
Reference	Coal consumption at boiler	CO_2	Yes	Emission source
		CH_4,N_2O	No	Negligible. Excluded for the sake of conservativeness.
	Electricity consumption for boiler	CO_2	No	Excluded for the sake of conservativeness, assuming that it is consumed only by limited equipment.
	Electricity consumption for biomass production	CO_2	No	Excluded for the sake of conservativeness
	Fuel consumption for biomass transportation	CO_2,CH_4,N_2O	No	Excluded for the sake of conservativeness
	Decomposition by biomass dumping	CO_2,CH_4,N_2O	No	Consumed as animal feed. Not applicable.

Project	Coal consumption at boiler	CO_2	Yes	Emission source
		CH_4,N_2O	No	Negligible. Excluded for the sake of simplicity.
	Biomass consumption at boiler	CO_2	No	Carbon neutral
		CH_4, N_2O	No	Negligible. Excluded for the sake of simplicity.
	Electricity consumption for boiler	CO_2	No	Excluded for the sake of simplicity, assuming that it is consumed only by limited equipment.
	Electricity consumption for biomass production	CO_2	Yes	Emission source
	Fuel consumption for biomass transportation	CO_2	Yes	Emission source
		CH_4,N_2O	No	Negligible. Excluded for the sake of simplicity.
	Biomass storage	CO_2	No	Carbon neutral
		CH_4,N_2O	No	Excluded for the sake of simplicity, assuming that it is not stored for more than one year and that the amount generated is small.

iv Formula for estimating GHG emission reduction amount and the results

GHG emission reductions at Pulppy and MTV were calculated using the following formula.

Assuming that both companies switched all of their coal with curl chips, Pulppy and MTV were expected to reduce their CO_2 emissions by about 43,000 tonnes and 950 tonnes per year, respectively.

$ER = E_{Reference} - E_{Project}$

ER:	GHG emission reduction amount (t CO_2 eq./y)
$E_{Reference}$:	GHG emissions for the reference scenario (t CO_2 eq./y)
$E_{Project}$:	GHG emissions for the project scenario (t CO_2 eq./y)

GHG emissions for the reference scenario

$E_{Reference} = M_{Coal} * NCV_{Coal} * EF_{Coal}$

$E_{Reference}$:	GHG emissions for the reference scenario (t CO_2 eq./y)	
M_{Coal}:	Consumption amount of coal (t/y)	Measured value
NCV_{Coal}:	Calorific value for coal (GJ/t)	Measured value
EF_{Coal}:	Emission factor for coal (t CO_2/GJ)	IPCC default value for coal: 94.6 kgCO_2/GJ

GHG emissions for the project scenario

$E_{Project} = (M_{Coal} * NCV_{Coal} * EF_{Coal}) + (M_{Electricity} * EF_{Electricity}) + (M_{Transport} * EF_{Transport})$

$E_{Project}$:	GHG emissions for the project scenario (t CO_2 eq./y)	
M_{Coal}:	Consumption amount of coal (t/y)	Subject of monitoring Note: Zero if fully substituted.
NCV_{Coal}:	Calorific value for coal (GJ/t)	Same as for the reference scenario
EF_{Coal}:	Emission factor for coal (t CO_2/GJ)	Same as for the reference scenario
$M_{Electricity}$:	Electricity consumption for curl chip production (kWh/y)	Subject of monitoring
$EF_{Electricity}$:	Emission factor for electricity ($kgCO_2$/kWh)	Data for Viet Nam: 0.9130 $kgCO_2$/kWh
$M_{Transport}$:	Fuel consumption for biomass transportation (L/y)	Subject of monitoring (It can be estimated based on transportation distance, maximum loading capacity of trucks, and fuel consumption. In this case, the transportation distance is the subject of monitoring.)
ρ	Fuel density (kg/L)	Diesel: 0.85 kg/L (source: Science Direct)
$EF_{Transport}$:	Emission factor for fuel ($kgCO_2$/GJ)	IPCC default value for diesel: 74.1 $kgCO_2$/GJ

v Cost-effectiveness

The estimation results of cost-effectiveness for the case where the entire amount of coal used at Pulppy and MTV were replaced by curl chips are shown in Table 2. According to the guidelines for submitting proposals of JCM Model Project, it states that the Cost-effectiveness of financial support necessary to reduce 1 tonne of GHG emissions should be 4,000 JPY/tCO2eq or lower. It was confirmed that if the minimum subsidy rate (30%) was applied, the Cost-effectiveness would be 190-250 yen/tCO2, which is far less than 4,000 yen/tCO2.

Table 27 Cost effectiveness

Item	Pulppy	MTV	Note
Number of equipment installed	69	2	Curl chip producing equipment
Initial cost (Yen) (1)	186.3 Million	5.4 Million	2.7 Million Yen/Equipment
Product lifetime (y)	7	7	For "Agricultural Equipment" in the Ministerial Ordinance concerning the Useful Life, etc. of Depreciable Assets
GHG emission reduction amount (tCO_2) (2)	300,000	6,400	Performance for the entire period of product lifetime
Cost-effectiveness (Yen/tCO_2)	630	840	(1)/(2) Note: No subsidy is considered.
Cost-effectiveness (Yen/tCO_2)	190	250	Subsidy/(2) Note: Formula for the JCM Model Project is used. Subsidy rate at 30% is assumed.

vi Implementation system for monitoring

The parameters shown in Table 28 needs to be monitored when implementing the project. The monitoring implementers are also indicated in the table. When applying for the JCM Model Project,

MRV reporting is required for the period of legal product lifetime for the installed equipment, so the implementation system for MRV needs to be established. A possible implementation system is shown in Figure 43. Although most of the data can be obtained at the rice mill factory, the data related to fuel consumption for biomass transportation in the project scenario needs to be obtained from the transporters. In order to do so, it is necessary to coordinate with other parties involved in the project, such as by signing cooperation agreements in advance.

In this report, it was assumed that all coal would be replaced by curl chips; however, in the case of partial switching (mixed firing), coal consumption amount should also be a subject to monitoring. In this case, it would be necessary to obtain cooperation from boiler user companies.

Table 28 Monitoring parameters

Parameter	Monitoring implementer
Amount of coal consumed (t/y)	Recorded by the curl chip manufacturer (Thain Tin Rice Mill). Note: Monitoring is not required if the entire amount of coal is replaced.
Amount of curl chip supplied (t/y)	Recorded by the curl chip manufacturer (Thain Tin Rice Mill).
Electricity consumption for curl chip production (kWh/y)	Recorded by the curl chip manufacturer (Thain Tin Rice Mill).
Fuel consumption for transportation (L/y), or transportation distance (km/y)	Recorded by the curl chip manufacturer (Thain Tin Rice Mill). Data needs to be obtained by transporters.

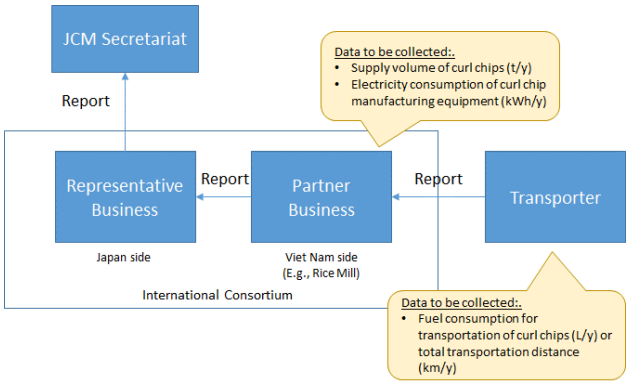


Figure 43 Draft implementation system for monitoring

vii Further considerations

The MRV evaluation needs to be conducted again once the project details are clarified.

4.6. Future prospect

The results of this year's survey revealed that FICO/Pulpy/MTV agro-drying plants have the potential for rice husk solid fuel conversion.

In FICO's cement plant, pulverized coal is fed directly from the mill to the kiln and can be used by direct insertion into the kiln as a utilization method. As an item for consideration, the pre-treatment facility (delivery, storage, transfer, and feeding into the kiln/boiler) seems to be important in both cases.

In the case of Pulppy, a stoker furnace is used, so it can be replaced as it is, but since coal is stored in a warehouse, it is necessary to consider the frequency of receiving coal. On the other hand, as for the disposal of combustion ash, cost reduction can be expected by converting to rice husk solid fuel.

Since the MTV agricultural product drying plant uses less coal, the impact of fuel conversion will be small, but it will be possible to use the existing facilities without new capital investment.

In this year's survey, we were able to show the potential of rice husk solid fuel (curl chips) as a substitute for coal, although there were some restrictions on movement during the field survey and visits to the survey sites due to COVID-19. However, we were able to demonstrate the potential of rice husk solid fuel (curl chips) as a substitute for coal. In the surveys to be conducted in the next and subsequent years, we would like to conduct more detailed studies on existing facilities and equipment installation in cooperation with users based on the results of this survey.

4.7. Risk and benefit of introduction

(1) Risk of introduction

①Risk of rising raw material prices

In Vietnam, the price and quantity of rice husks tend to be unstable. There is a possibility that rice husk prices will rise in the future, not only due to domestic consumption, but also due to higher demand for exports to other countries, and the risk of higher business operation costs is assumed.

②Risk of obtaining an investment license

Obtaining an investment license for renewable energy generation is likely to be more demanding and time-consuming than licenses for other projects. Therefore, it is assumed that an investment capacity of "about one year" will be required, and the uncertainty and investment risk in investment will be high. In addition, the importance of the local partner is high because it is expected that the acquisition of the license will need to be carried out jointly, and it is desirable to select a partner who is familiar with the acquisition of investment licenses and renewable energy investment.

(2) Benefit of introduction

①Contribution to the renewable energy policy promoted by the Vietnamese government

The Vietnamese government is promoting power generation from renewable energies and has set the numerical targets of "installed capacity of 27,195 MW and power generation of 61,000 GWh" by 2030. The targets for biomass are "installed capacity of 3,281 MW and power generation of 12,000 GWh" by 2030. It is assumed that the realization of this project will contribute to the biomass power generation target set by the Vietnamese government.

②Contributing to meeting the increasing demand for electricity

The total power generation in Vietnam has been increasing year by year, and the power demand has been growing continuously; the total power generation in 2017 increased by 8.4% compared to the previous year, and the power generation per capita has increased by almost 14 times compared to 1995, and the GDP per capita has increased by about 8 times compared to 1995. By promoting this project, a new power supply system will be installed, which is expected to supplement the increasing power demand.

③Effective utilization of crop residues

Since rice husks will be used as fuel in this project, it is assumed that the project will contribute to the effective utilization and reduction of agricultural crop residues generated from rice mills.

5. Survey on energy creation and energy saving projects by introducing solar power generation systems and BEMS

We conducted a field survey and examined the feasibility of introducing a solar power generation system and BEMS (Building Management System), both of which are provided by Hirokawa Enath Co., Ltd., a company in Hiroshima Prefecture.

5.1. Technologies / products proposed

(1) Solar power generation systems

Photovoltaic power generation systems are basically used for self-consumption in factories, but surplus power is generated on holidays such as Saturdays and Sundays. The surplus power can be used for refrigeration and freezing facilities, but the output setting of the photovoltaic power generation system is an issue to be considered depending on the handling of the surplus power.

As a company that installs photovoltaic power generation systems, it is possible to install them in factories, hospitals, etc. However, there are restrictions on where the solar panels can be installed depending on the amount of power generated. Possible locations for the installation of photovoltaic systems include vacant lots within the premises, factory roofs, and building rooftops.

This year, due to the outbreak of the new coronavirus, it was extremely difficult for our local collaborators to enter the Soc Trang Province and to obtain cooperation from the survey sites themselves. Therefore, although it was difficult to make the best study and proposal at the stage of lack of field confirmation and information collection, we made a solar panel layout plan with 720kW solar panels installed on the ground and on the roof（Figure 44）.

The materials and equipment to be supplied to the site include solar panels (which can be procured locally), solar panel mounts, power conditioners, and interconnection equipment. For construction, we will use local construction companies and provide technical guidance.

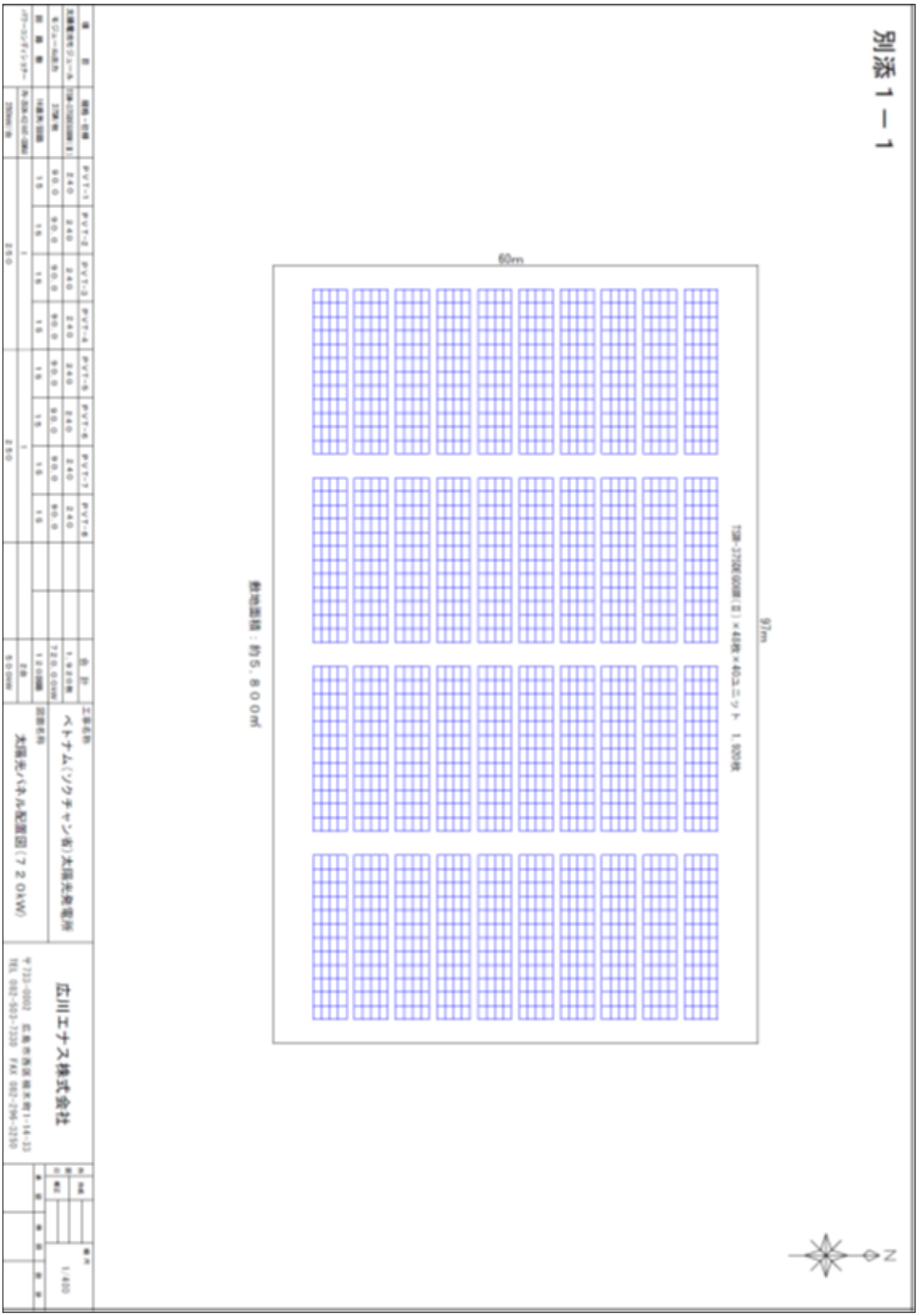


Figure 44 Layout of the solar power generation system (720kW)

(2) BEMS

A system for managing energy is called an EMS (Energy Management System), but for commercial facilities and other buildings it is called a BEMS (Building Energy Management System). BEMS is a system that reduces energy consumption by efficiently managing the operation of equipment and facilities in buildings. BEMS is a system that reduces energy consumption by efficiently managing the operation of equipment and facilities in a building. It uses methods such as demand control, automatic pattern control, and alarm functions to reduce energy consumption.

The BEMS (Building Energy Management System) proposed in this study is an energy-saving system based on the output control of air conditioning that has been installed at Hirokawa Enath Co., Ltd. This is a system in which temperature sensors are installed in each room and the output of the outdoor units is controlled in order to adjust the temperature optimally and reduce the amount of electricity used. Specifically, we are planning to introduce the PN-XERO series from Palcosmo Co., Ltd (Nagano Prefecture).

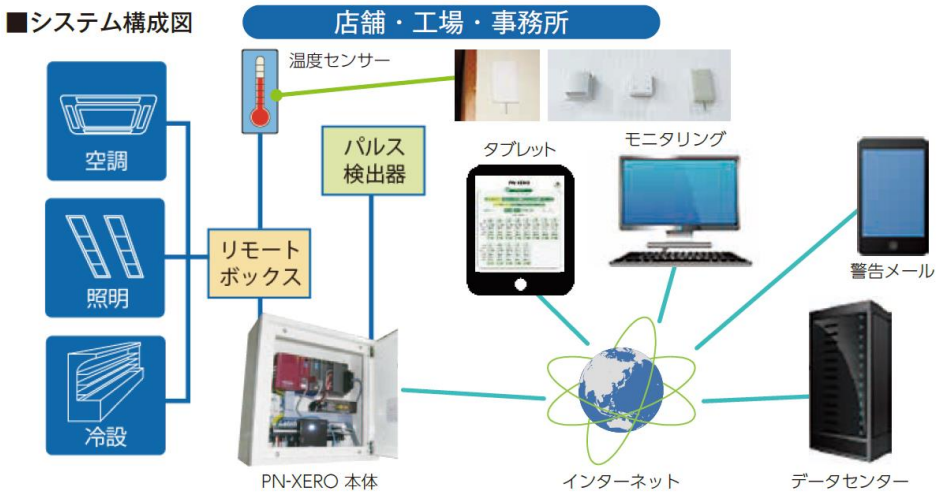


Figure 45 PN-XERO System configuration diagram of the series

Source: Palcosmo Co., Ltd website.

Figure 46 shows an example of a system configuration for air conditioning control.

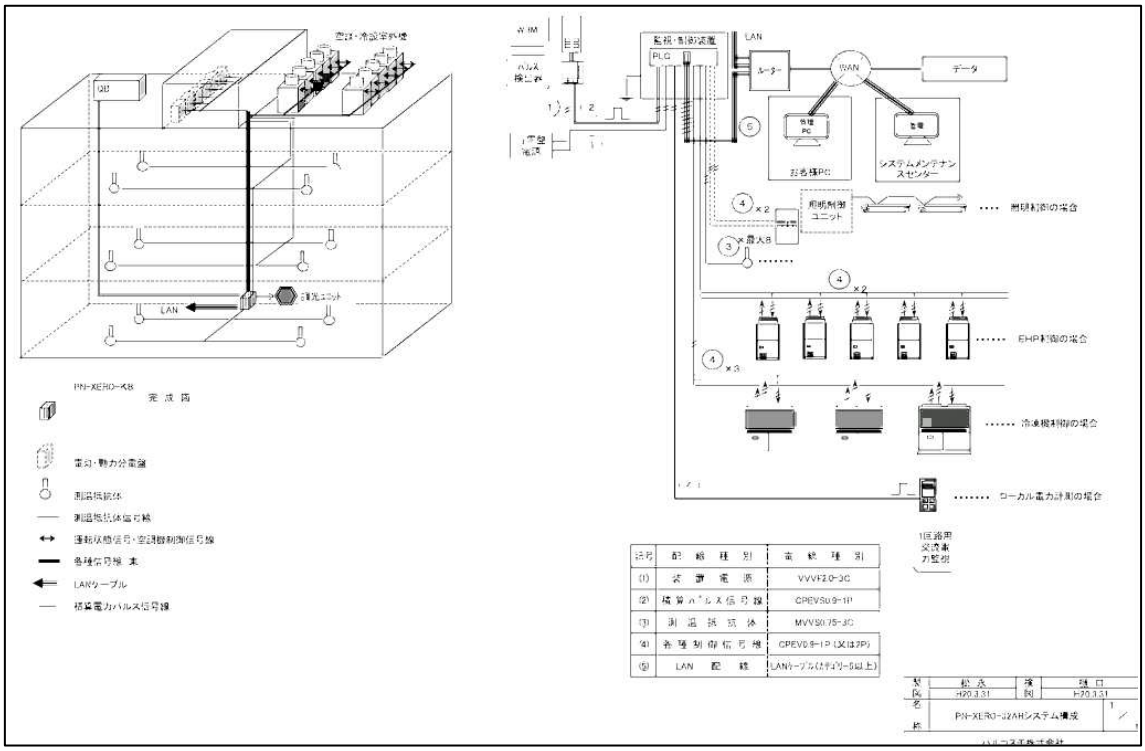


Figure 46 System configuration example for BEMS air conditioning control
Source: Palcosmo Co., Ltd

This system has been used in several thousand cases in Japan and has produced results in energy and cost savings.
Since the output control of the air conditioners is managed and controlled centrally by the equipment manufacturer (Japan), data communication between Vietnam and Japan via the Internet is necessary.
Basically, the models that can be controlled by this system are those manufactured after 2000, but this needs to be confirmed through a detailed field survey.

5.2. Survey on energy intensive businesses in Soc Trang Province

11 energy-intensive businesses in Soc Trang Province were surveyed about their energy creation and energy conservation projects with the cooperation of Soc Trang Province, and responses were received from three locations: one hospital, one fish processing company, and one shrimp farming company.

Table 29 Energy-intensive businesses in Soc Trang Province

No.	Name	Situation
1	Công ty CP thực phẩm Sao Ta（SAOTA FOODS JOINT STOCK）	Answered to the survey

2	Công ty CP thủy sản Sóc Trăng	They refused to conduct the survey because they wanted to consider the survey after receiving detailed information on renewable energy and energy saving systems.
3	Công ty CP chế biến thủy sản Út Xi	Respondents did not want to disclose confidential company information.
4	Công ty CP chế biến thủy sản Tài Kim Anh	Respondents did not want to disclose confidential company information.
5	Công ty TNHH chế biến hải sản xuất khẩu Khánh Hoàng	Respondents indicated that they are not interested in solar power generation.
6	Công ty CP thủy sản sạch Việt Nam（Vietnam Clean Seafood Corporation）	Answered to the survey
7	Công ty TNHH Khánh Sủng	Respondents did not want to disclose confidential company information.
8	Công ty TNHH TM và dịch vụ Thành Tín	They refused to do the survey because past surveys have shown that the factory generates a lot of dust, which affects the solar power generation system.
9	Công ty TNHH chế biến thực phẩm bánh pía-lạp xưởng Tân Huê Viên	The company has already installed a solar power generation system. They refused to do the survey because they did not want to disclose confidential company information.
10	Công ty TNHH MTV QNL	They refused to do the survey because they were not interested in solar power.
11	Bệnh viện đa khoa Sóc Trăng（SÓC TRĂNG HOSPITAL）	Have already responded to the survey (but have no interest in or plans to install a PV system)

Source: Compiled by Hirokawa Enath Co., Ltd. based on field survey results.

Of these, SOC TRANG HOSPITAL (No. 11) was excluded from the consideration of PV systems because it has no interest in PV systems and no plans to install them. The remaining companies, SAOTA FOODS JOINT STOCK COMPANY (a fish processing company) and VIETNAM CLEAN SEAFOOD (a frozen shrimp processing company), have interest in and plans to install PV systems, and further field surveys are needed to finalize the detailed capacity. The final determination of the detailed capacity will require further field surveys but based on the site owned and the load capacity, there is a possibility of installing a 720kW PV system (see Appendix at the end of this report for detailed survey responses).

Table 30 Companies with the potential to introduce solar power generation systems and BEMS

	SAOTA FOODS JOINT STOCK COMPANY	VIETNAM CLEAN SEAFOOD	SOC TRANG HOSPITAL
Business Type	Fishery processing industry	Frozen shrimp processing	Hospital
Service System	7：00～17：00 24 days/month	3 shifts 30 days/month (continuous)	24hr shift Continuous
Business Air Conditioning	GUNTNER 3kW×50	GUNTNER 1000kW×2	TOSHIBA 1.8kW×700
Electric power	23,870MWh／Year	17,582.5MWh／Year	5,384.2MWh／Year
Use of electric generation	203.86 million yen	134.27 million yen	45.06 million yen
	44,452,530,320VND	29,279,957,300VND	9,825,626,580VND
Solar power generation facilities	Interested	Interested	Not Interested
Availability of land, etc.	6,000 ㎡	Facility Expansion Plan Electrical equipment: 500 kW Fish farm: 150 ha	—
Potential systems to be introduced	BEMS	BEMS	BEMS
	Solar power generation system: Approx. 720 kW (Assumed based on site size)	Solar power generation system: Approx. 720 kW (Assumed to be 25% of total compressor capacity)	

Source: Prepared by Hirokawa Enath Co., Ltd. based on field survey results.

5.3. Potential of adopting the project

(1) Profitability (solar power generation system)

In order to improve the accuracy of the upcoming feasibility study, more detailed information such as the installation cost based on the field study is necessary.

In regard with the attachment 3 at the end of this document, "Simulation of Solar Power System Installation," if we assume that the total construction cost is about 87 million yen (720 kW) and the

annual power generation is about 1,220,000 kW, the annual income will be about 10,079,000 yen, assuming that the power is sold to the power company at the unit price of 8.8 yen/kW. This means that the construction cost will be recovered in about 8 years. Considering the maintenance and management costs, interest rates, etc., it would be difficult to make it a stand-alone project, but with JCM's subsidies, it could be a viable business.
In addition, when reducing the cost of electricity used in factories, the business potential may be upside down depending on how much the unit price of electricity is set.

(2) CO2 reduction and cost effectiveness (solar power generation system)
i Overview
The GHG emission reductions associated with the installation of a solar power generation system in Soc Trang Province were evaluated. The results of the survey suggested that solar power generation systems could be installed in a fish processing company and/or a shrimp processing company. GHG emission reduction potentials and cost-effectiveness are evaluated for the following case.

Install a 720 kW solar PV system on the premises or roof of a fish processing company
(Saota Foods) and/or a shrimp processing company (Vietnam Clean Seafood)

ii MRV methodology
The GHG emission reductions associated with the installation of a 720 kW solar PV system to substitute grid electricity and self-generated electricity. A scenario in which all electricity is sold without in-house consumption was assumed. The MRV methodology “VN_AM007: Installation of Solar PV System (Version 1.0)”, which was approved by the JCM Joint Committee between Japan and Viet Nam, was referred to as an MRV methodology.
The eligibility requirements (applicability) of the project are as follows. The project under consideration was assumed as meeting all the requirements.

<Applicability>
(a) The project newly installs solar PV system(s).
(b) The PV modules are certified for design qualifications (IEC 61215, IEC 61646 or IEC 62108) and safety qualification (IEC 61730-1 and IEC 61730-2).
(c) The equipment to monitor output power of the solar PV system(s) and irradiance is installed at the project site.

For estimating the amount of electricity generated by the solar PV systems, the "Emission Reduction Calculation File: 01 Photovoltaic Power Generation" available on the website for the FY2020 Open

Call for JCM Model Project was used.

iii Project boundary

The project boundary is generally assumed to be a physical, geographical site where the switching of energy sources takes place. However, such description was not provided in the MRV methodology. Therefore, the estimation was made by simply focusing on the information provided in Table 31.

Table 31 GHGs and emission sources subject to estimation

	Emission source	GHG	Subject of estimation	Note
Reference	Consumption of grid electricity and/or captive electricity	CO_2	Yes	—
Project	Generation of electricity from solar PV system(s)	CO_2	Yes	—

iv Formula for estimating GHG emission reduction amount and the results

GHG emission reductions through the introduction of a 720 kW solar PV system at a fish processing company and/or a shrimp farming company were calculated using the following formula. As a result, about 408 tonnes of reduction amount annually was estimated.

$ER_p = RE_p - PE_p = RE_p$

ER_p:	GHG emission reduction amount in the project period p (tCO_2/p)
RE_p:	GHG emissions in the project period p for the reference scenario (tCO_2/p)
PE_p:	GHG emissions in the project period p for the project scenario (tCO_2/p)

GHG emissions for the reference scenario

$RE_p = \Sigma_i (EC_{j,p} * EF_{RE,i})$

RE_p:	Reference emissions during the period p (tCO_2/p)	
$EC_{j,p}$:	Quantity of electricity consumed or sold to the power company from electricity generated by the project solar PV system i during the period p (MWh/p)	Subject of monitoring
$EF_{RE,i}$:	Reference CO_2 emission factor for the project solar PV system i (tCO_2/MWh)	Emission factor in Viet Nam：0.333 kg CO_2/kWh Source: FY2020 JCM Model Project Application Guidelines, Attachment "List of CO_2 Emission Factors", Emission factors for renewable energy in cases other than "Replacing on-site power generation only".

GHG emissions for the project scenario

$PE_p = 0$

PE_p:	Project emissions during the period p (tCO_2/p)	Project emissions are not assumed in the methodology as electricity consumption by any PV system is negligible.

v Cost-effectiveness

The estimation results for the case where the solar power generation system installed at a fish processing companies, etc. are shown in Table 5. According to the guidelines for submitting proposals of JCM Model Project, it states that the Cost-effectiveness of financial support necessary to reduce 1 tonne of GHG emissions should be 4,000 JPY/tCO2eq or lower. It was confirmed that if the minimum subsidy rate (30%) was applied, the Cost-effectiveness would be 3,800 yen/tCO2, which is less than 4,000 yen/tCO2.

Table 32 Cost-effectiveness

Item	Fish processing companies, etc.	Note
Number of panels installed	1920	
Capacity of solar PV system (kW)	720	Module output: 375W/module
Total annual power generation (kWh/y)	1,225,486	
Initial cost (Yen) (1)	87,000,000	
Product lifetime (y)	17	For "Equipment for the electrical industry, mainly made of metal" in the Ministerial Ordinance concerning the Useful Life, etc. of Depreciable Assets
GHG emission reduction amount (tCO_2) (2)	6,900	Performance for the entire period of product lifetime
Cost-effectiveness (Yen/tCO_2)	12,500	(1)/(2) Note: No subsidy is considered.
Cost-effectiveness (Yen/tCO_2)	3,800	Subsidy/(2) Note: Formula for the JCM Model Project is used. Subsidy rate at 30% is assumed.

vi Implementation system for monitoring

The parameters shown in Table 33 need to be monitored when implementing the project. The monitoring implementers are also indicated in the table. When applying for the JCM Model Project, MRV reporting is required for the period of legal product lifetime of the installed equipment, so the implementation system for MRV needs to be established. A possible implementation system is shown in Figure 47.

Table 33 Monitoring parameters

Parameter	Monitoring implementer
Quantity of electricity consumed or sold to the power	Recorded by the solar PV system installers in Japan

company from electricity generated by the project solar PV system i during the period p (MWh/p)	via the Internet.

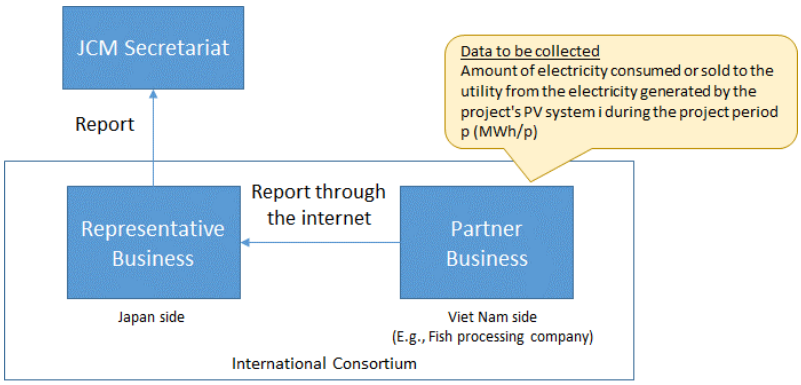


Figure 47 Draft implementation system for monitoring

vii Further considerations

The MRV evaluation needs to be conducted again once the project details are clarified.

(3) Profitability (BEMS)

Using SOC TRANG HOSPITAL as an example, the annual electricity bill for this survey is approximately 45 million yen. If we assume that the electricity used for air conditioning accounts for 50% of this amount, it will amount to 22.5 million yen, and if we assume that BEMS will reduce the electricity bill by 10%, we will be able to save 2.25 million yen per year. Assuming that the cost of the BEMS equipment is 10 million yen, it is expected to be recovered within five years.

Further field surveys will be necessary in the future to determine the details, such as the percentage of electricity used for air conditioning, based on the agreement of the users.

The remaining two companies, SAOTA FOODS JOINT STOCK COMPANY (a seafood processing company) and VIETNAM CLEAN SEAFOOD (a frozen shrimp processing company), have freezing and refrigeration facilities for seafood products. However, because there is a risk of compensation problems if the introduction of BEMS causes some sort of failure in the operation of the facilities, they were excluded from the study.

(4) CO2 reduction and cost effectiveness (BEMS)

i Overview

The GHG emission reductions associated with the installation of a building energy management system (BEMS) in Soc Trang Province were evaluated. The results of the survey suggested that the BEMS could be installed in a hospital. GHG emission reduction potentials and cost-effectiveness are evaluated for the following case.

Install a BEMS at a hospital (SOC TRANG HOSPITAL)

ii MRV methodology

The GHG emission reductions associated with the installation of BEMS to a hospital in Soc Trang Province was evaluated. The MRV methodology "(Draft) Energy-saving by a building energy management system (BEMS) (Ver. 3.0) (Summary in Japanese)" was referred to as an MRV methodology. The methodology is applicable to the project that achieve a reduction in CO2 emissions compared to the reference scenario by improving the efficiency of electricity and fossil fuel use through the installation of BEMS in existing buildings (buildings, etc.).

The eligibility requirements (applicability) of the project are as follows. The project under consideration was assumed as meeting all the requirements.

<Applicability>

(a) BEMS must be installed in existing buildings.
(b) BEMS must be used to manage the operation of equipment, facilities, etc. in accordance with the indoor environment in order to reduce the amount of energy used.
(c) Contracts, etc., must guarantee that the actual results of efficiency improvement will be reported by BEMS providers on a regular basis (at least once every six months) to building owners and other beneficiaries of the energy reduction effects of BEMS after installation.

iii Project boundary

The CO2 emissions from the entire building, including the energy-using facilities that are subject to management by BEMS, as well as the CO2 emissions associated with the electricity used by BEMS itself, were the subject of estimation.

Table 34 GHGs and emission sources subject to estimation

	Emission source	GHG	Subject of estimation	Note
Reference	Electricity consumption without efficiency improvement by BEMS	CO_2	Yes	—
Project	Electricity consumption with efficiency improvement by BEMS	CO_2	Yes	—

iv Formula for estimating GHG emission reduction amount and the results

GHG emission reductions at a hospital in Soc Trang Province were calculated using the following formula. Assuming that energy-saving effect of BEMS is 10%, the hospital is expected to reduce its

CO_2 emissions by about 246 tonnes per year.

$ER_y = RE_y - PE_y (- L_y)$

ER_y:	GHG emission reduction amount (t CO_2 eq./y)
RE_y:	GHG emissions for the reference scenario (t CO_2 eq./y)
PE_y:	GHG emissions for the project scenario (t CO_2 eq./y)
L_y:	Leakage emissions Not: Assumed no leakage.

GHG emissions for the reference scenario

$RE_y = (PEC_y * EF_{e,y} + \Sigma(PFC_{i,y} * NCV_{i,y} * EF_{f,i,y})) / [100\% - \{ EER_j + \Sigma_k(EER_k)\}]$

RE_y:	GHG emissions for the reference scenario (t CO_2 eq./y)	
PEC_y	Electricity consumption of the subject company in the project (MWh/y)	See "GHG emissions for the project scenario" below.
$EF_{e,y}$	Emission factor for electricity (tCO_2/MWh)	
$PFC_{i,y}$	Amount of fossil fuel i used in the subject company in the project (kl, t, 1000Nm3 /y)	
$NCV_{i,y}$	Calorific value of fossil fuel i (GJ/kl, t, 1000Nm3)	
$EF_{f,i,y}$	Emission factor for fossil fuel i (tCO_2/GJ)	
EER_j	Energy use efficiency improvement rate by EMS (%)	Default value is 1% for the methodology.
EER_k	Energy use efficiency improvement rate through the introduction of individual equipment k (%)	Examples of individual equipment in the "Air Conditioning" category include: air conditioner outdoor air intake control, variable air volume air conditioners, power-saving operation control (intermittent operation), temperature set point relaxation, and replacement with high-efficiency PACs. Default values are given in Table 2 of the methodology.

GHG emissions for the project scenario

$PE_y = PEC_y * EF_{e,y} + \Sigma(PFC_{i,y} * NCV_{i,y} * EF_{f,i,y})$

PE_y:	GHG emissions for the project scenario (t CO_2 eq./y)	
PEC_y	Electricity consumption of the subject company in the project (MWh/y)	Subject of monitoring
$EF_{e,y}$	Emission factor for electricity (tCO_2/MWh)	Emission factor of grid electricity in Viet Nam
$PFC_{i,y}$	Amount of fossil fuel i used in the subject company in the project (kl, t, 1000Nm3 /y)	Subject of monitoring
$NCV_{i,y}$	Calorific value of fossil fuel i (GJ/kl, t, 1000Nm3)	Either the default value (●●GJ/ kl, t, 1000Nm3) or the actual measured value held by the project proponent can be used.
$EF_{f,i,y}$	Emission factor for fossil fuel i (tCO_2/GJ)	IPCC default value

<About the performance of BEMS>

In this project, the CO_2 emission reduction rate associated with the introduction of BEMS was assumed to be 10%, based on actual results in Japan. The performance results by introduction of BEMS at a hospital is shown below, which showed an effect of approximately 13% reduction. There are many other examples of BEMS installations, and the same level of reduction has been confirmed for them as well.

Performance summary for a Hospital in Japan

- Amount used the year before the BEMS introduction: 1,173,324 kWh
- Unit price for basic charge: 2008 Yen
- Unit price for summer: 13.8 Yen
- Unit price for other than summer: 12.8 Yen

■Actual results

	4月	5月	6月	7月	8月	9月	小計	10月	11月	12月	1月	2月	3月	計
Expected effect	1,637kWh	616kWh	2,325kWh	9,519kWh	11,160kWh	3,819kWh	29,076kWh	882kWh	5,449kWh	12,732kWh	15,723kWh	11,008kWh	6,475kWh	81,345kWh
	20,954円	7,885円	29,760円	131,362円	154,008円	52,702円	396,671円	11,290円	69,747円	162,970円	201,254円	140,902円	82,880円	1,065,714円
Actual effect	2,761kWh	1,987kWh	5,854kWh	11,652kWh	12,762kWh	7,947kWh	42,963kWh	2,487kWh	13,747kWh	27,635kWh	25,030kWh	22,412kWh	16,041kWh	150,314kWh
	35,341円	25,434円	74,931円	160,800円	176,111円	109,669円	582,286円	31,834円	175,962円	353,723円	320,383円	286,872円	205,318円	1,956,378円

Figure 48 Performance of introducing BEMS at a hospital in Japan

v Cost-effectiveness

The estimation results for the case where the BEMS installed at a hospital in Soc Trang Province are shown in Table 8. According to the guidelines for submitting proposals of JCM Model Project, it states that the Cost-effectiveness of financial support necessary to reduce 1 tonne of GHG emissions should be 4,000 JPY/tCO2eq or lower. It was confirmed that if the minimum subsidy rate (30%) was applied, the Cost-effectiveness would be 810 yen/tCO2, which is far less than 4,000 yen/tCO2.

Table 35 Cost-effectiveness

Item	Hospital	Note
Initial cost (Yen) (1)	10,000,000	
Electricity consumption at a hospital (MWh/y)	5,400,000	50% of this is assumed to be from air conditioners
Energy saving effect through BEMS	10%	
Product lifetime (y)	15	For “Other items” pf “Electrical equipment attached to buildings” in the Ministerial Ordinance concerning the Useful Life, etc. of Depreciable Assets
GHG emission reduction amount (tCO_2) (2)	3,700	Performance for the entire period of product lifetime
Cost-effectiveness (Yen/tCO_2)	2,700	(1)/(2) Note: No subsidy is considered.
Cost-effectiveness (Yen/tCO_2)	810	Subsidy/(2) Note: Formula for the JCM Model Project is used. Subsidy rate at 30% is assumed.

vi Implementation system for monitoring

The parameters shown in Table 36 need to be monitored when implementing the project. The monitoring implementers are also indicated. When applying for the JCM Model Project, MRV reporting is required for the entire period of legal product lifetime, so the implementation system for MRV needs to be established. A possible implementation system is shown in Figure 49.

Table 36 Monitoring parameters

Parameter	Monitoring implementer
Electricity consumption at a building (MWh/y)	Recorded by the building owner
Fuel consumption at a building (kl, t, 1000Nm3 /y)	Recorded by the building owner

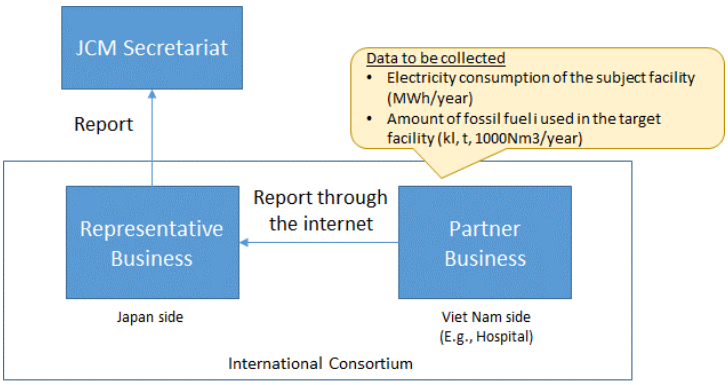


Figure 49 Draft implementation system for monitoring

vii Further considerations

In the MRV methodology for BEMS, reference emissions are estimated based on the amount of electricity consumed at a building where the BEMS is installed, the rate of improvement in energy use efficiency through the EMS, and the rate of improvement in energy use efficiency through the installation of individual equipment. However, those equipment were not specified in the estimation. The MRV evaluation should therefore be conducted again once the details of the project are clarified.

5.4. Future prospect

As a result of this year's survey, we found that SAOTA FOODS JOINT STOCK COMPANY (a fish processing company) and VIETNAM CLEAN SEAFOOD (a frozen shrimp processing company) have the potential to install solar power generation systems, and SOC TRANG HOSPITAL has the potential to install a BEMS. In addition, SOC TRANG HOSPITAL has the possibility of installing BEMS.

Although we were unable to travel to the site this year due to the new coronavirus epidemic, we hope to conduct a more detailed survey of existing facilities and equipment installation in cooperation with users based on the results of this year's survey in the next and subsequent years.

6. Others

A seminar organized by the Ministry of the Environment on the City-to-City Collaboration Project for the Realization of a Decarbonizing Society was held in an online format on February 1, 2021.
The program is as follows.

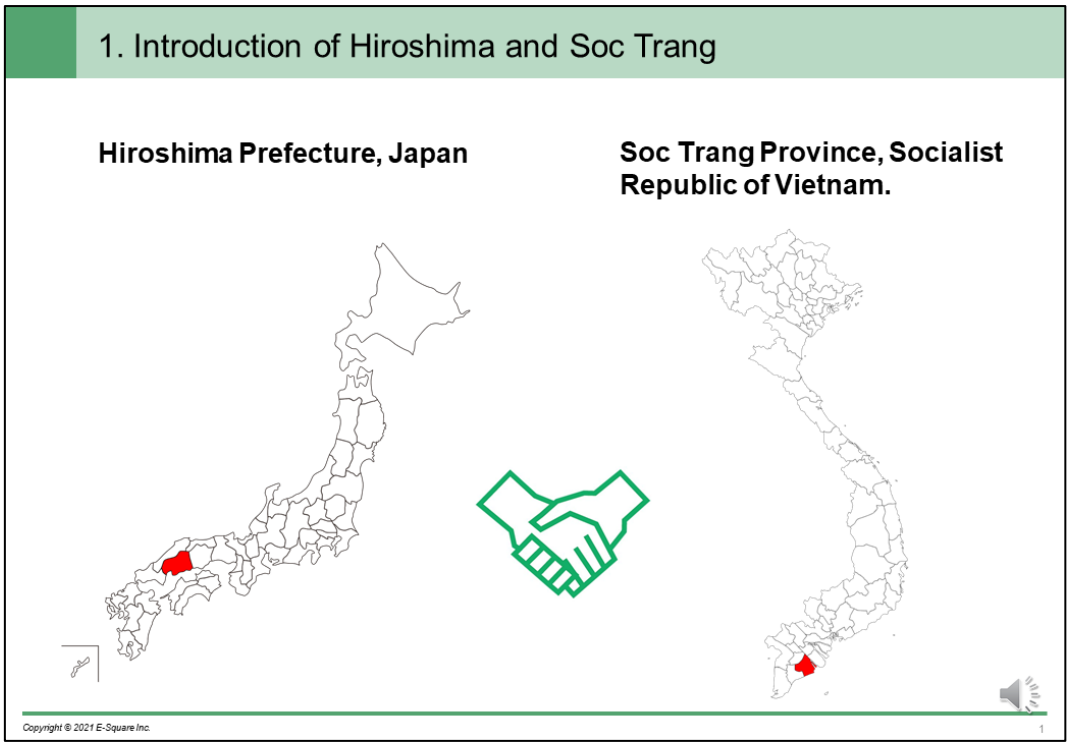
Seminar on City-to-City Collaboration for Creating a Zero-carbon Society
Program for the section closed seminar

Date & Time: February 1st (Mon.) 14:00-16:00 (Japan Standard Time *see below for your time zone)
Place: Zoom (https://zoom.us/meeting/register/tJ0qd-6pqD0qHN1QY8oczW1X1pSVvEDYKjYk)
Language: Japanese & English (Simultaneous translation available)
Participants: Project members involved in the FY2020 C2C Collaboration Programme

Time	Contents
14:00	**Opening remarks** Ryuzo Sugimoto Director, International Cooperation and Sustainable Infrastructure office, Global Environmental Bureau, Ministry of the Environment, Japan (MOEJ)
14:05	**Outline of the support menu for building a decarbonized society** ・ Japan's Measures to Build a Zero-carbon Society Ryuzo Sugimoto Director, International Cooperation and Sustainable Infrastructure office, MOEJ ・ Trends related to JCM and the adoption of JCM Model Projects Kazuhisa Koakutsu Director of International Negotiations, Market Mechanisms Office, Climate Change Policy Division, MOEJ ・ Introduction of Japan Fund for the Joint Crediting Mechanism (JFJCM) Shintaro Fujii Environment and Climate Change Specialist, Climate Change and Disaster Risk Management Division, Sustainable Development and Climate Change Department, Asian Development Bank (ADB) Q & A
14:55	**[Panel discussion] How can we proceed projects in the corona era?** Panelists: - Ryuzo Sugimoto Director, International Cooperation and Sustainable Infrastructure office, MOEJ - Yuichi Arita Director, Kitakyushu Asian Center for Low Carbon Society, Environment Bureau, City of Kitakyushu - Masaru Ishikawa Acting General Manager, International Environment Dept., Nippon Koei Co., Ltd. - Masanori Fujii Project Manager, International Projects Division, Oriental Consultants Co., Ltd. - Yuka Shinohara Manager, Corporate Sales Division, Business Development Support Team, H.I.S. Co., Ltd. - Kensuke Ezoe Corporate Sales Division, Business Development Support Team, H.I.S. Co., Ltd. Facilitator: - Shiko Hayashi Programme Director, Kitakyushu Urban Centre, IGES Q & A End of the program (16:00)

In preparation for this seminar, we prepared a PowerPoint presentation with audio to introduce the "Project to Promote the Formation of an Autonomous Decarbonized Society through City-to-City Collaboration between Hiroshima Prefecture and Soc Trang Province, Vietnam" and introduced the project to the people concerned (see the next section).


February 2021
E-SQUARE
Project to Promote the Formation of an Autonomous Decarbonized Society through City-to-City Collaboration between Hiroshima Prefecture and Soc Trang Province, Vietnam
Hiroyuki Yanagida
E-Square Inc.


1. Introduction of Hiroshima and Soc Trang
Hiroshima Prefecture, Japan
Soc Trang Province, Socialist Republic of Vietnam.
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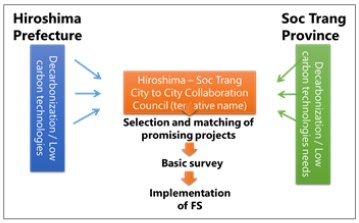
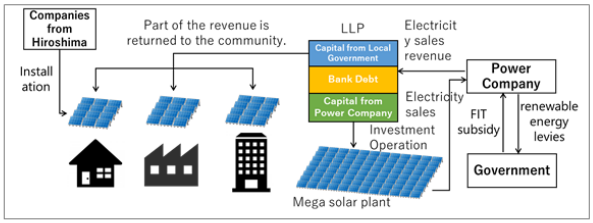
1

2. Project Overview

① Establishing a mechanism to continuously create projects through the establishment of the "Hiroshima-Soc Trang City to City Collaboration Council".

② Knowledge transfer on the know-how of Hiroshima Prefecture to introduce community-based renewable energy

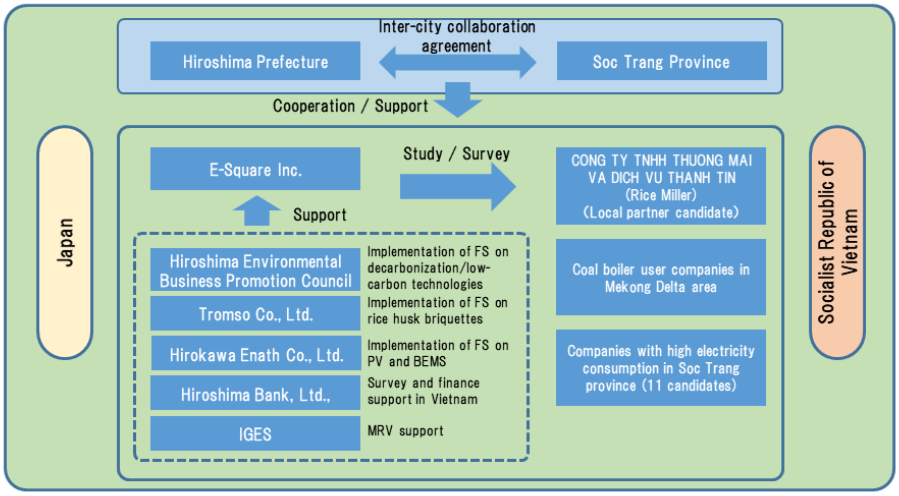




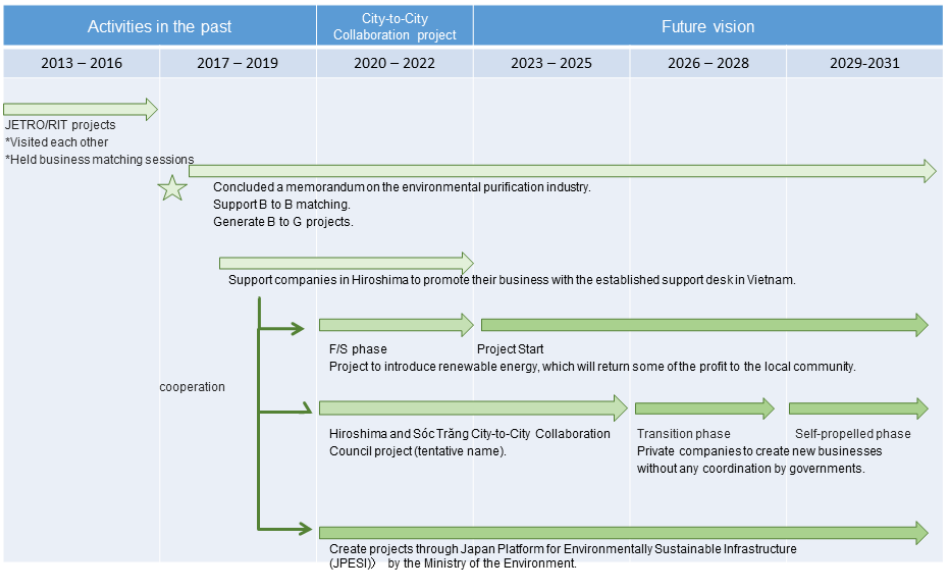
③ Implementation of FS by companies in Hiroshima Prefecture with decarbonization and low-carbon technologies

Companies from Hiroshima with decarbonization and low-carbon technology conduct FS. In FY2020, FS for a fuel conversion project for a coal boiler that uses rice husk briquettes (Tromso Co., Ltd.) and PV system and BEMS introduction project (Hirokawa Enath Co., Ltd.) will be carried out. From FY2021 onwards, feasibility studies on projects created from the "Hiroshima-Soc Trang City to City Collaboration Council" will be carried out.

3. Project Implementation System



4. Collaboration plan of Hiroshima and Soc Trang Province



Thank you very much
for your attention!

E-SQUARE

7. Attachment

(1) **Collaboration between Hiroshima Prefecture and Soc Trang Province**

Collaboration between Hiroshima Prefecture and Soc Tran Province

Hiroshima Prefectural Government
Foreign business division in Commerce, Industry and Labor Bureau

Activities of Soc Trang Province and Hiroshima Prefecture for Support, Cooperation, Project Research, etc.

2013	April	Application for and adoption of the Japan External Trade Organization (JETRO) Regional Industry Tie-up (RIT) preliminary survey program targeting southern Vietnam [Purpose] Survey on environmental needs in the Mekong Delta region
	July	Held a business meeting in Ho Chi Minh (12 Hiroshima companies, 28 local companies, 51 business talks) * Staff of the Soc Trang Province People's Committee attended the business meeting. Interviewed them about environmental issues in the province.
	October	Staff of the Prefectural Government and JETRO visited Can Tho City and Soc Trang Province. [Purpose] Survey on whether there are specific needs that can be matched with local companies in the prefecture [Results] Understood needs for securing water purification in rural areas, effective use of rice husks, high-quality compost manufacturing technology, and pollution control of aquaculture ponds
2014	January	Staff of the Prefectural Government and JETRO visited Can Tho City and Soc Trang Province. [Purpose] To request, in both regions, implementation of the FY2014 RIT program and cooperation [Results] There were no exchanges with other specified regions in Japan, and they agreed to engage in exchanges with the prefecture.
	April	Application for and adoption of the JETRO RIT program with Can Tho City and Soc Trang Province
	June	Invited executives of Soc Trang Province to Hiroshima Prefecture (People's Committee Vice Chairman Tri, Deputy Director of Resources and Environment Department Thanh) [Purpose] To promote facilities and local companies in the prefecture to executives of Soc Trang Province in preparation for future exchanges
	July	Held a business meeting in Soc Trang Province
	August	Staff of the Prefectural Government and local companies in the prefecture visited Soc Trang Province. [Purpose] Discussion on the shrimp farm water purification project [Results] Agreement to conduct a demonstration project
	October	Staff of the Prefectural Government and local companies in the prefecture visited Soc Trang Province. [Purpose] Discussion on contracts for small water purifiers [Result] Contract agreement (Agricultural Water Center, Soc Trang Province)
	November	Invited executives of Soc Trang Province and local companies in the province to Hiroshima Prefecture (People's Committee Vice Chairman Tri, Director of Resources and Environment Department Anh, four executives of local companies in Soc Trang Province) [Purpose] Business meetings with local companies [Results] Signed memoranda of understanding regarding the sale of small water purifiers and demonstration tests for water purification at shrimp farms

Activities of Soc Trang Province and Hiroshima Prefecture for Support, Cooperation, Project Research, etc.

2015	January	Prefectural government staff visited Soc Trang Province. [Purpose] Detailed discussions on contracts for small water purifiers and demonstration tests for water purification at shrimp farms [Results] Agreement on contract details, and detailed discussions on the demonstration test
	March	Staff of the Prefectural Government and local companies in the prefecture visited Soc Trang Province. [Purpose] Detailed discussions on contracts for small water purifiers and demonstration tests for water purification at shrimp farms [Results] Agreement on contract details, and detailed discussions on the demonstration test
	April	Prefectural government staff visited Soc Trang Province. [Purpose] Discussions on FY2015 program
	June	Prefectural government staff visited Soc Trang Province. [Purpose] Selection of companies to be invited to Hiroshima (by using the JETRO RIT program) [Results] Interviewed seven companies selected by Soc Trang Province and selected five companies with a high probability of concluding a contract
	July	Prefectural government staff visited Soc Trang Province. [Purpose] Discussions on invitation to Hiroshima and applications of small water purifiers in other facilities [Results] Agreed to hold a seminar on the environmental products and technologies of companies in Hiroshima for environmental sanitation and water purification centers in each province of the Mekong Delta region. Signed a contract for sales of small water purifiers (Soc Trang Province Rural Environmental Sanitation and Water Purification Center and Emax Co., Ltd.)
	August	Invited executives of Soc Trang Province and local companies in the province to Hiroshima Prefecture (People's Committee Vice Chairman Tung, Deputy Director of Resources and Environment Department Tang, four executives of local companies in Soc Trang Province)
	September	Prefectural government staff visited Soc Trang Province. [Purpose] Discussions on a seminar for water purification centers, detailed discussions on demonstration tests for water purification at shrimp farms, and discussions on demonstration tests to spread rice husk fermented liquid
	November	Staff of the Prefectural Government and local companies in the prefecture visited Soc Trang Province. [Purpose] To witness the demonstration test for water purification at shrimp farms
	November	**Held a seminar in Soc Trang Province to spread water purifiers**
	December	Invited Mr. Dung, Director of Soc Trang Province Rural Environmental Sanitation and Water Purification Center to Hiroshima

Activities of Soc Trang Province and Hiroshima Prefecture for Support, Cooperation, Project Research, etc.

2016	January	Staff of the Prefectural Government and local companies in the prefecture visited Soc Trang Province. [Purpose] To witness the demonstration test for water purification at shrimp farms
	March	Prefectural government staff visited Soc Trang Province. [Purpose] Discussions on the demonstration test to spread rice husk fermented liquid and the promotion of water purifiers
	June	Staff of the Prefectural Government and local companies in the prefecture visited Soc Trang Province. [Purpose] Visit to People's Committee Vice Chairman Tri, Resources and Environment Department, and water purification centers
	July	Prefectural government staff visited Soc Trang Province. [Purpose] Selection of companies to be invited to Hiroshima (by using the JETRO RIT program) [Results] Interviewed five companies selected by the Soc Trang Province People's Committee and selected three companies with a high probability of concluding a contract
	August	Staff of the Prefectural Government and local companies in the prefecture visited Soc Trang Province. [Purpose] Interview with two companies selected by the Soc Trang Province People's Committee
	September	Invited executives of Soc Trang Province and three promising local companies to Hiroshima Prefecture (using the JETRO RIT program)
	November	**Held the Mekong Delta Business Matching Seminar in Soc Trang Province** **(Participants from Vietnam: 63 people from administrative organizations, 75 people from companies / 25 participants from Japan (six companies))**
2017	February	Staff of the Prefectural Government and local companies in the prefecture visited Soc Trang Province. [Purpose] Visit to water purification centers
	March	Staff of the Prefectural Government and local companies in the prefecture visited Soc Trang Province. [Purpose] Visit to People's Committee, Resources and Environment Department, Natural Environment Center, and Shrimp Association
	June	Invited executives of Soc Trang Province to Hiroshima (People's Committee Vice Chairman Hieu, Deputy Director of Resources and Environment Department Dan) Invited executives of Soc Trang Province to Hiroshima Prefecture using the Promising Asian Leader Invitation Program of the Institute for International Studies and Training, and introduced technologies of local companies in the prefecture
	June	Prefectural government staff visited Soc Trang Province. [Purpose] Visit to Resources and Environment Department and water purification centers
	September	**Held the Mekong Delta Business Matching Seminar** **(Participants from Vietnam: 60 people from administrative organizations, 180 people from companies / 37 participants from Japan (eight companies))** **Signed a memorandum of understanding with Soc Trang Province regarding cooperation in the field of the environmental purification industry**
	November	Staff of the Prefectural Government and local companies in the prefecture visited Soc Trang Province. [Purpose] Visit to People's Committee, Resources and Environment Department, Rural Development Department, water purification centers, Water Supply Public Corporation, and Waste Management Public Corporation

Activities of Soc Trang Province and Hiroshima Prefecture for Support, Cooperation, Project Research, etc.

2018	January	Staff of the Prefectural Government and local companies in the prefecture visited Soc Trang Province. [Purpose] Visit to Resources and Environment Department, water purification centers, and shrimp farming companies
	March	Staff of the Prefectural Government and local companies in the prefecture visited Soc Trang Province. [Purpose] Visit to Resources and Environment Department and larval shrimp farming companies
	May	Prefectural government staff visited Soc Trang Province. [Purpose] Visit to People's Committee Vice Chairman Hieu, Resources and Environment Department, Fisheries Department, water purification centers, and Soc Trang Province Industrial Park
	August	Staff of the Prefectural Government and local companies in the prefecture visited Soc Trang Province. [Purpose] Visit to People's Committee Vice Chairman Hieu, Resources and Environment Department, Fisheries Department, Rural Development Department, and shrimp farms
	December	Staff of the Prefectural Government and local companies in the prefecture visited Soc Trang Province. [Purpose] Visit to People's Committee Vice Chairman Hieu, Resources and Environment Department, Waste Management Public Corporation, and shrimp farms
2019	January	Invited staff of Soc Trang Province Resources and Environment Department using the "Pilot Training for Building a Low-carbon Society" sponsored by the Ministry of the Environment and the Institute for Global Environmental Strategies
	February	**Held the "Seminar on Environmental Technologies for Sustainable Shrimp Aquaculture" in Soc Trang Province (Participants from Vietnam: 53 people from administrative organizations, 101 people from companies / 35 participants from Japan (16 companies))**
	May	Staff of the Prefectural Government and local companies in the prefecture visited Soc Trang Province. (Visit to People's Committee Vice Chairman Hieu, Resources and Environment Department, Soc Trang Province waste disposal site, and food processing factories)
	August	Staff of the Prefectural Government and local companies in the prefecture visited Soc Trang Province. (Visit to People's Committee Vice Chairman Hieu, Resources and Environment Department, shrimp farms, and Soc Trang Province Industrial Park)
	December	Staff of the Prefectural Government and local companies in the prefecture visited Soc Trang Province. (Visit to People's Committee Vice Chairman Hieu, Resources and Environment Department, Fisheries Department, and water purification centers)
2020	January	Invited waste collection and transportation companies in Soc Trang Province to Hiroshima Prefecture Visit to waste collection and transportation companies in the prefecture
	February	Invited staff of Soc Trang Province Resources and Environment Department using the "Workshop for Promoting Inter-city Collaboration for Building a Decarbonized Society" sponsored by the Ministry of the Environment and the Research Institute for Global Environmental Strategies

Major Exchange Activities between Hiroshima Prefecture and Soc Trang Province

	Event	Overview
November 2015	Held a seminar for rural environmental sanitation and water purification centers	Introduction of water purification technologies of local companies in the prefecture to rural environmental sanitation and water purification centers in six provinces in the Mekong Delta region
November 2016	Held the Mekong Delta Business Matching Seminar	A business matching seminar between administrative personnel and companies of 13 municipalities in the Mekong Delta region and local companies in Hiroshima Prefecture, all of which are related to environmental technologies and services At the beginning of the seminar, the Hiroshima Prefectural Government and Soc Trang Province signed a cooperation agreement in the field of the environmental purification industry.
September 2017	Held the Mekong Delta Business Matching Seminar Signed a cooperation agreement with Soc Trang Province in the field of the environmental purification industry	
February 2019	Held a seminar on environmental technologies for sustainable shrimp aquaculture	With the aim of transforming the shrimp farming business into a sustainable industry, a business matching seminar was held for shrimp farming companies and administrative personnel in the Mekong Delta region, and local companies in Hiroshima Prefecture possessing unique environmental technologies. At the seminar, a greeting speech was given by Mr. Kawakami, Japanese Consul General in Ho Chi Minh City.

A greeting speech by Mr. Kawakami, Japanese Consul General in Ho Chi Minh City. (Feb,2019)

MoU signing ceremony at the Mekong Delta Business Matching Seminar (Sep.2017)

(2) **Presentation materials by Hiroshima Prefecture at the 3rd Japan Platform for Redesign: Sustainable Infrastructure (JPRSI) seminar for members**

Promotion of Overseas Development of Environmental Infrastructures through City-to-City Collaboration: Initiatives in Hiroshima Prefecture

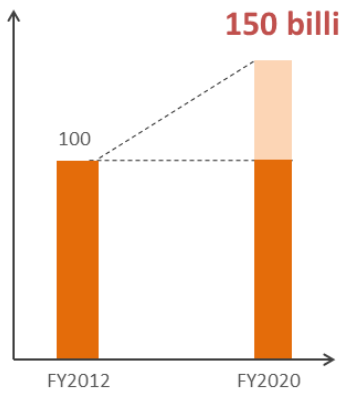
January 2021
Foreign Business Division,
Commerce, Industry and Labor Bureau
Hiroshima Prefectural Government

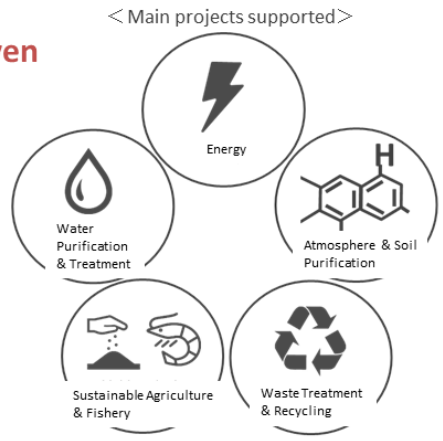
1

Environmental Remediation Industrial Cluster Formation Project

HIROSHIMA

- Basic policy of the initiative
  ①Business development utilizing the excellent environmental technologies and production capabilities possessed by companies in the prefecture
  ②Business development with a focus on Asia, where environmental problems are becoming more serious
- Business target (sales of environment-related companies in the prefecture)
  FY 2012: 100 billion yen → FY 2020: 150 billion yen





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Past Activities

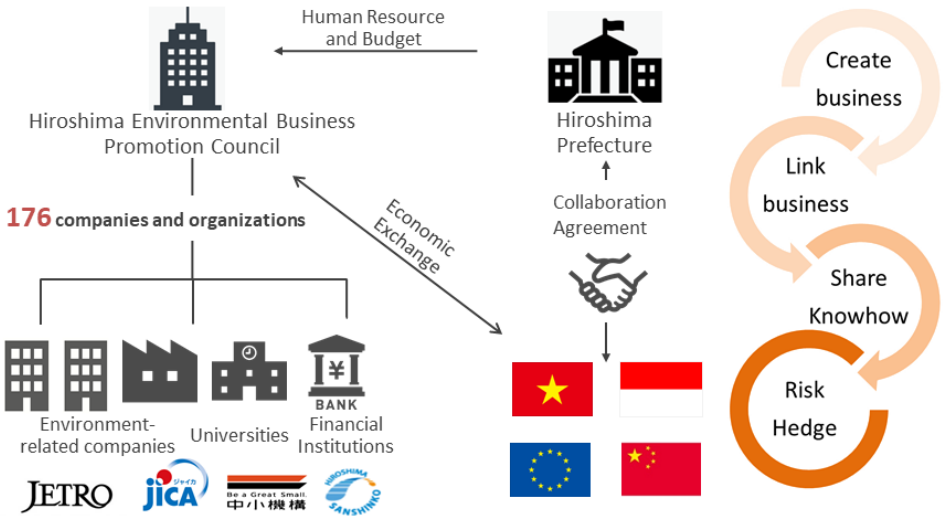
HIROSHIMA

	2012～2014 Foundation Building for Overseas Business Development	2015～2017 Acceleration of Overseas Business Development	2018～2020 Self-reliant Growth of the Clusters
Foundation Building	● Establishment of a promotion system (Hiroshima Environmental Business Promotion Council) ● Conclusion of MoU with overseas cities and organizations ● Building Relationships with Overseas Cities (JETRO Regional Industry Tie-Up (RIT) Program, JICA Grassroots Technical Cooperation Project)		
Business Support	● Foster momentum for overseas expansion (Participation in exhibitions, business meetings, etc.) ● Subsidy for overseas business development activities (market research, local promotions, etc.)	● Business model development (Supporting discovery of individual projects) ● Subsidy for overseas development activities (Demonstration projects, establishment of bases, etc.)	● Full-scale corporate activities (Utilization of city-to-city collaboration projects, etc.) ● Supporting expansion of new business partners (Europe, etc.)
Focused Areas	● China (Sichuan Province) ● Vietnam (Can Tho City, Soc Trang Province) ● Indonesia (West Java Province)	● Europe	

3

Environmental Business Promotion System

HIROSHIMA



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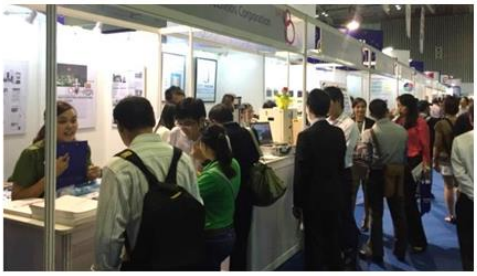
Examples of the Council's Activities

＜Environmental Technology Business Meeting in Vietnam＞



＜Participation in Overseas Exhibitions＞

＜Training for Indonesian Administrative Staff in Hiroshima＞

＜General Meeting (Business Report Meeting) in Hiroshima＞

5

Overseas Support System and Partners which Agreement Concluded

Focused Countries/Areas	Support System	Overseas Partner Cities and Organizations
Vietnam	Support Desk	・Soc Trang Province (Bureau of Natural Resources and Environment) ・Can Tho City (Bureau of Natural Resources and Environment)
Indonesia	Coordinator	・Indonesian Association of Environmental Pollution Managers (APPLI) ・Indonesian Agency for Technology Evaluation and Application (BPPT)
China	Hiroshima-Sichuan Business Exchange Office	・Sichuan Province (Agency of Ecology and Environment)
Europe	Coordinator	・Greentech Cluster (Graz, Austria) ・Greentech Initiative East Germany (Dresden, Germany)

- **Outline of the partners which agreement concluded**

✓ Soc Trang Province: A province located in the Mekong Delta in southern Vietnam. Population: 1.62 million

✓ Can Tho City: The largest city in the Mekong Delta in southern Vietnam. Population: 1.19 million

✓ Indonesian Association of Environmental Pollution Managers (APPLI): Pollution control managers' organization (about 1,800 members)

✓ Indonesian Agency for Technology Evaluation and Application (BPPT): Government research organization that evaluates and applies technologies needed in the country

✓ Sichuan Province: An inland province of China. Population: 82.62 million. Sichuan is the recipient of Hiroshima Prefecture's friendship and economic exchange agreements. Provincial capital: Chengdu

✓ Greentech cluster: 270 environment-related member companies (waste treatment, renewable energy, etc.)

✓ Greentech Initiative East Germany: Approx. 3,000 environment-related member companies (water treatment, waste treatment, etc.)

6

Details of Collaboration with Overseas Cities in Vietnam

- Partners which Agreement Concluded: Can Tho City (Bureau of Natural Resources and Environment), Soc Trang Province (Bureau of Natural Resources and Environment)
- Method of Relationship Building: JETRO Interregional Exchange Support Project (2013-2016)
- Date of the Agreement Concluded: September 2017
- Details of the agreement: Cooperation on economic exchange in the field of environmental remediation

＜Agreement signing ceremony with Can Tho City and Soc Trang Province＞

＜Environmental Business Seminar at Can Tho City＞

Case Studies of Environmental Challenges in Can Tho City and Soc Trang Province

＜Reduction of waste plastic from drinking water bottles＞

＜Effective use of rice husks＞

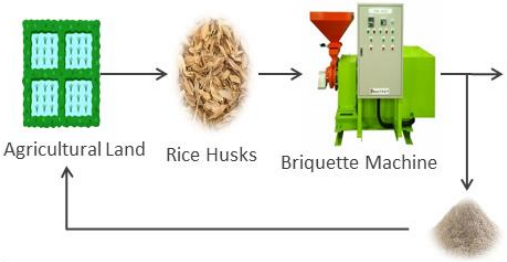
＜Purification of water quality in shrimp ponds and surrounding rivers＞

Examples of Solutions by Local Businesses in Hiroshima Prefecture at Vietnam

HIROSHIMA

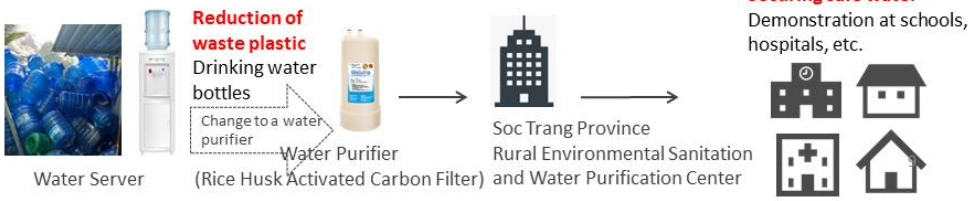
- **Creating a low-carbon, recycling-oriented society through the utilization of rice husks**

  Ministry of the Environment: City-to-City Collaboration Project for Realization of a Decarbonized Society (2019-)



- **Preventing Infectious Diseases by Spreading the Use of Water Purifiers Using Rice Husk Activated Carbon**

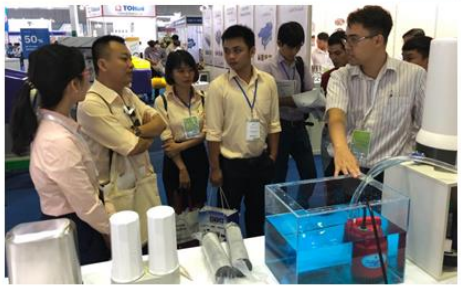
  UNIDO: Project to support overseas Japanese companies through demonstration and transfer of STePP technology for the prevention of infectious diseases in developing countries (2020-)



Activities of Local Businesses of Hiroshima Prefecture in Vietnam

HIROSHIMA

＜City-to-City Collaboration Seminar in Can Tho City＞



＜VIET Water 2019＞

＜Business meeting at Soc Trang Provincial Rural Environmental Sanitation and Water Purification Center＞

＜Training for Vietnamese Companies in Hiroshima＞

10

Details of Colladoration with Overseas Cities (Organizations) in Indonesia

HIROSHIMA

- Partners which Agreement Concluded: Indonesian Association of Environmental Pollution Managers (APPLI), Indonesian Agency for Technology Evaluation and Application (BPPT)
- Method of Relationship Building: JETRO Inter-regional Exchange Support Business (2015-2018), JICA Grassroots Technology Collaboration Business (2016-2018)
- Date of the Agreement Concluded: May 2019- (APPLI), December 2016- (BPPT)
- Details of the agreement: Cooperation on economic exchange in the field of environmental remediation (APPLI) Support for market research and technical evaluation of introduced technologies (BPPT)

＜Agreement signing ceremony with APPLI in Bandung＞

＜Environmental Business Seminar in Bandung＞

11

Case Studies of Environmental Challenges in Indonesia

HIROSHIMA

＜Purification of Dyeing Wastewater from Chitarum River and Other rivers＞

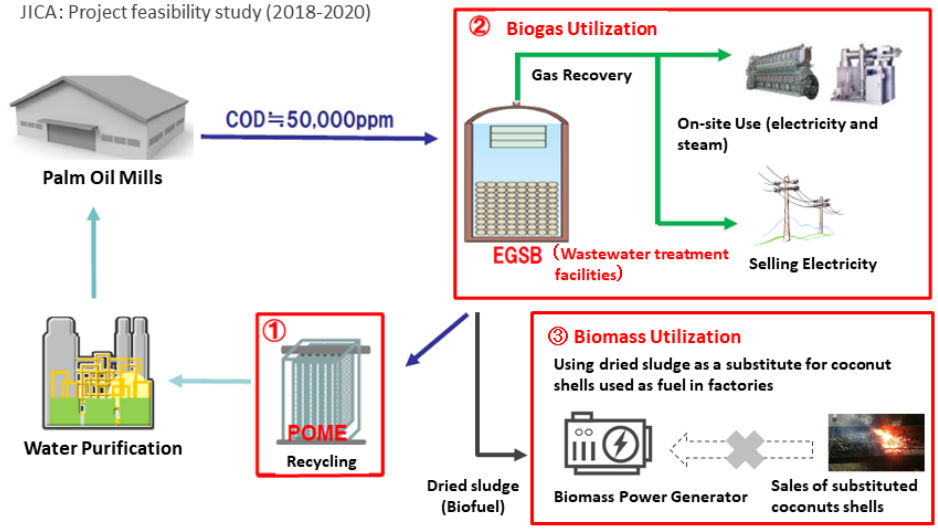
＜Industrial Wastewater Treatment in Palm Oil Mills＞

12

Examples of Solutions by Local Businesses of Hiroshima Prefecture in Indonesia

HIROSHIMA

- **Highly concentrated wastewater treatment with biogas recovery in a palm oil mill**
  Ministry of the Environment: Project for the promotion of co-benefits-based environmental pollution control in Asia (2017-2018)
  JICA: Project feasibility study (2018-2020)



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Activities of Local Businesses of Hiroshima Prefecture in Indonesia

HIROSHIMA

＜Dewatered Sludge in the EGSB Pretreatment Process＞

＜Group Photo after the Meeting at the State-owned Palm Oil Mill (PTPN7)＞

＜Demonstration of Decolorization Technology for Dyeing Wastewater at NEDO＞

14

Conclusion

HIROSHIMA

- **Challenges Recognized by Hiroshima Prefecture**

✓ Establishment of a system to conduct continuous sales activities for the dissemination of the technology

✓ Create a system that enables us to propose high value-added solutions

✓ Propose a business model based on the experience of public infrastructure and environmental policy in the prefecture

✓ Support for the creation of new environmental technologies that will become the core of future industries, etc.

- **Expectations for the Japan Platform for Redesign: Sustainable Infrastructure (Ministry of the Environment)**

✓ Sharing of effective means, support systems, know-how, etc. for overseas development of environmental infrastructure

✓ Promotion of collaboration among companies and local governments for overseas deployment of environmental infrastructure

✓ Sharing information on environmental needs and technology trends in overseas cities, etc.

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(3) **Compositional analysis data on rice husk solid fuel and rice husk**

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	mg／100ｇ	mg／100ｇ	mg／100ｇ	mg／100ｇ									
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手順 (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: mg／100ｇとは、1gの容器を750℃で燃焼させ100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												
	Fe_2O_3	CaO	SiO_2	Al_2O_3	MgO	MnO	P	TiO_2					
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

様式 F5

分析試験結果報告

ご依頼元	（株）ハリソン産業	様
品　目	脱酸含水率	

報告日　：　2008/5/26
整理番号：F0800260

試料記号	分析項目												
	Moisture												
単位	%												
耕盤	11.90												
【備考】	[分析方法] 乾燥温度：105℃												

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

(4) **Questionnaire of energy intensive companies in Soc Trang**

SAO TA FOODS JOINT STOCK COMPANY

NỘI DUNG KHẢO SÁT
調査票

1. Thông tin chung về doanh nghiệp
会社概要：

- Tên công ty/会社名: CÔNG TY CỔ PHẦN THỰC PHẨM SAO TA (SAO TA FOODS JOINT STOCK COMPANY)
- Địa chỉ/住所: Km 2132, National Road 1A, Ward 2, Soc Trang Province
- Tên người đại diện pháp luật/代表者/Representative: PHAM HOANG VIET
- Ngành nghề hoạt động/業種: 水産加工/Fishery processing

2. Thông tin về nhà máy sản xuất:
工場の概要：

a. Tên sản phẩm và sản lượng/生産品名・生産量

STT	Tên sản phẩm 生産品名 Production item	Sản lượng trung bình (tấn/tháng) 生産量（トン/月）Production
1	加工したエビ（エビフライ、ノバシ等）/ Shirimp	1200 (ton/month)
2		
3		
4		
5		
...		

b. Chế độ thời gian làm việc/操業状況:

- Số ca làm việc trong 1 ngày/1 日のシフト数: 1 シフト 1 shift / day
- Thời gian làm việc (VD: 8:00~17:00)/工場作業時間: 7:00～17:00 operation hour
- Số ngày làm việc trong 1 tháng/一月の稼働日数：24 日 operation days per month

c. Danh sách thiết bị, máy móc phục vụ sản xuất chính/重要設備リスト:

STT	Tên máy móc, thiết bị 機器名 Machinery	Số lượng 台数 Number	Công suất 定格出力 (kW)	Thời gian hoạt động 稼働時間 (...giờ/ngày) （時間/日） Operation hour
1	refrigeration compressor	30	90	8
2	Máy cấp đông Freezer	10	30	8
3	Kho lạnh Cold storage	06	15	8
4	Máy hấp Steamer	01	15	2
5				
6				
7				
8				
9				
10				
...				

d. Thông tin về loại hệ thống điều hòa công nghiệp đang sử dụng/業務用空調設備情報: (không tính loại máy điều hòa nhỏ dạng gia đình/家庭用の小型なものは除く)

- Tên hãng sản xuất/メーカー名/Manufacturer: GUNTNER
- Công suất (kW)/容量/Capacity: 3
- Số lượng máy/台数/Number: 50

e. Lượng điện tiêu thụ hàng tháng trong năm 2020:

2020 年の電気使用量と電気代

Tháng 月	Lượng điện tiêu thụ 電気使用量/Consumption (kW)	Chi phí tiền điện 電気代/Electricity bill (VND)
1	1,482,800	2,798,498,120
2	1,609,700	3,042,270,330
3	1,853,100	3,717,382,130

4	1,972,900	3,638,655,570
5	2,076,100	3,541,831,920
6	2,348,600	4,035,068,620
7	2,408,200	4,291,103,850
8	2476800	4,694,080,160
9	2,585,200	4,908,525,160
10	2,480,000	4,779,148,000
11	2,576,600	5,005,966,460
12		

3. Kế hoạch đầu tư thiết bị, máy móc phục vụ trong tương lai

工場設備の増設等の将来計画(規模含め)

- Quý công ty có dự định sẽ đầu tư, mua sắm thêm thiết bị máy móc sản xuất trong thời gian tới hay không? Future plan for expansion

将来に新しい設備を導入する計画有無

回答：なし / none

- Nếu có, xin vui lòng chia sẻ thông tin về các loại máy móc, thiết bị mà quý công ty dự định sẽ đầu tư.

有る場合、導入予定の設備情報を教えてください。/ plan for new facility

STT	Tên máy móc, thiết bị 機器名	Số lượng 台数	Công suất 容量 (kW)
1			
2			
3			
4			
5			
...			

4. Mức độ quan tâm đến điện năng lượng mặt trời

太陽光発電の関心度 / interest in installing PV system

a. Quý công ty có quan tâm đến công nghệ điện năng lượng hay không?

太陽光発電に関心を持っていますか。Do you have interest in installing PV system?

Trả lời/回答：持っている。Yes

b. Quý công ty có dự định sẽ đưa công nghệ điện năng lượng mặt trời vào sử dụng hay không?
太陽光発電設備を導入する予定がありますか。Do you have such plan?
Trả lời/回答：ある。Yes

Nếu có thì diện tích mặt bằng dành cho thiết bị điện năng lượng mặt trời dự tính khoảng bao nhiêu m2?
太陽光発電設備の設置する用地の面積 How much space do you have for such plan?
Trả lời/回答: 6,000m2

VIET NAM CLEAN SEAFOOD CORPORATION

NỘI DUNG KHẢO SÁT
調査票

1. Thông tin chung về doanh nghiệp
会社概要：

- Tên công ty/会社名: CÔNG TY CỔ PHẦN THỦY SẢN SẠCH VIỆT NAM (VIET NAM CLEAN SEAFOOD CORPORATION)
- Địa chỉ/住所:Lot F, An Nghiep Industrial Park, Chau Thanh District, Soc Trang Province
- Tên người đại diện pháp luật/代表者/representaive: VO VAN PHUC
- Ngành nghề hoạt động/業種: 冷凍エビの加工 / Processing frozen shrimp

2. Thông tin về nhà máy sản xuất:
工場の概要：

a. Tên sản phẩm và sản lượng/生産品名・生産量

STT	Tên sản phẩm 生産品名 Production item	Sản lượng trung bình (tấn/tháng) 生産量（トン/月） Production amount
1	冷凍エビ/frozen shirimp	1,000 (t/month)
2		
3		
4		
5		
...		

b. Chế độ thời gian làm việc/操業状況:

- Số ca làm việc trong 1 ngày/1 日のシフト数: 3 シフト 3 shift / day
- Thời gian làm việc (VD: 8:00~17:00)/工場作業時間: シフト①：6:00～14:00、シフト②：14:00～22:00、シフト③：22:00～6:00
- Số ngày làm việc trong 1 tháng/一月の稼働日数：30 日 working days per month

c. Danh sách thiết bị, máy móc phục vụ sản xuất chính/重要設備リスト:

STT	Tên máy móc, thiết bị 機器名 Machinery	Số lượng 台数 Number	Công suất 定格出力 (kW)	Thời gian hoạt động 稼働時間 (...giờ/ngày) （時間/日） operation hour
1	Mycom compressor	13	110	8
2	Mycom compressor	04	240	24
3	IQF line freezer	02	1,000kg/h	8
4	IQF line freezer	01	1,200kg/h	8
5	IQF line freezer	03	750kg/h	8
6	IQF line freezer	04	650kg/h	8
7	Steamer	01	1,000kg/h	8
8	Steamer	02	500kg/h	8
9	Flake ice machie	05	28 tons/ngày	12
10	Flake ice machie	02	20 tons/ngày	12
11	Vacuum sealer (真空シーラー)	09		
12	Metal detector	18		
13	Packing machine	12		
14	Máy niền thùng	14		
15	Sortor	09		
16	Boiler	01	1,000 kg/h	8
17	Boiler	02	500 kg/h	8
18	Shrink wapping equipment	03		
19	Conveyor	49		
20	Printer	12		
21	Bread crumb blender	02		
22	Dough mixer	03		

d. Thông tin về loại hệ thống điều hòa công nghiệp đang sử dụng/業務用空調設備情報/Air conditioner:

(không tính loại máy điều hòa nhỏ dạng gia đình/家庭用の小型なものは除く)

- Tên hãng sản xuất/メーカー名/Manufacturer: GUNTNER
- Công suất (kW)/容量/Capacity: 1,000kW
- Số lượng máy/台数/Number: 02

e. Lượng điện tiêu thụ hàng tháng trong năm 2020:

2020 年の電気使用量と電気代

Tháng 月 Month	Lượng điện tiêu thụ 電気使用量(kW) Electricity onsumption	Chi phí tiền điện 電気代(VND) Electricity bill
1	1,110,000	1,894,457,200
2	1,080,900	1,835,267,100
3	1,217,700	2,078,796,300
4	1,154,700	1,910,483,100
5	1,343,200	2,046,466,200
6	1,743,200	2,693,666,000
7	1,800,100	2,894,936,900
8	1,852,400	3,174,934,000
9	1,752,100	3,013,576,700
10	1,650,300	2,828,263,700
11	1,496,200	2,555,766,200
12	1,381,700	2,353,343,900

3. Kế hoạch đầu tư thiết bị, máy móc phục vụ trong tương lai

工場設備の増設等の将来計画(規模含め)

- Quý công ty có dự định sẽ đầu tư, mua sắm thêm thiết bị máy móc sản xuất trong thời gian tới hay không? Do you have any plan to expand in the future?

将来に新しい設備を導入する計画有無

回答：有り / Yes

- Nếu có, xin vui lòng chia sẻ thông tin về các loại máy móc, thiết bị mà quý công ty dự định sẽ đầu tư.

有る場合、導入予定の設備情報を教えてください。

STT	Tên máy móc, thiết bị 機器名	Số lượng 台数	Công suất 容量 (kW)
1			
2			
3			
4			

5			
...			

4. Mức độ quan tâm đến điện năng lượng mặt trời

太陽光発電の関心度

c. Quý công ty có quan tâm đến công nghệ điện năng lượng hay không?

太陽光発電に関心を持っていますか。Do you have interest in installing PV system?

Trả lời/回答：持っている。Yes

d. Quý công ty có dự định sẽ đưa công nghệ điện năng lượng mặt trời vào sử dụng hay không?

太陽光発電設備を導入する予定がありますか。Do you have such plan?

Trả lời/回答：ある。Yes

Nếu có thì diện tích mặt bằng dành cho thiết bị điện năng lượng mặt trời dự tính khoảng bao nhiêu m2?

太陽光発電設備の設置する用地の面積 Do you have space for such plan?

Trả lời/回答:

加工工場は電量が追加で 500 ㎾必要で、150ha の養殖場もニーズがある。

Need additional 500kW for processing factory and more for fish culture site.

SOC TRANG HOSPITAL

NỘI DUNG KHẢO SÁT
調査票

1. Thông tin chung về doanh nghiệp
会社概要：

- Tên công ty/会社名: BỆNH VIỆN ĐA KHOA TỈNH SÓC TRĂNG (SOC TRANG HOSPITAL)
- Địa chỉ/住所:378 Le Duan, Ward 9, Soc Trang Province
- Tên người đại diện pháp luật/代表者/representative: NGUYEN THI LAC
- Ngành nghề hoạt động/業種/Business: 検診及び医療 / Hospital

2. Thông tin về nhà máy sản xuất:
工場の概要：

a. Tên sản phẩm và sản lượng/生産品名・生産量

STT	Tên sản phẩm 生産品名	Sản lượng trung bình (tấn/tháng) 生産量 （トン/月）
1		
2		
3		
4		
5		

b. Chế độ thời gian làm việc/操業状況/Operation:

- Số ca làm việc trong 1 ngày/1 日のシフト数: 24 時間 24h per day operation
- Thời gian làm việc (VD: 8:00~17:00)/工場作業時間: 24 時間 24h per day operation
- Số ngày làm việc trong 1 tháng/一月の稼働日数：休みなし No holiday

c. Danh sách thiết bị, máy móc phục vụ sản xuất chính/重要設備リスト:
回答なし

d. Thông tin về loại hệ thống điều hòa công nghiệp đang sử dụng/業務用空調設備情報/Air conditioner:

(không tính loại máy điều hòa nhỏ dạng gia đình/家庭用の小型なものは除く)

- Tên hãng sản xuất/メーカー名/manufacturer: TOSHIBA
- Công suất (kW)/容量/capacity: 1.8kW
- Số lượng máy/台数/number: 700

e. Lượng điện tiêu thụ hàng tháng trong năm 2020:

2020 年の電気使用量と電気代

Tháng 月 month	Lượng điện tiêu thụ 電気使用量(kW) Electricity consumption	Chi phí tiền điện 電気代(VND) Electiricty bill
1	390,500	712,623,450
2	406,500	741,821.850
3	432,300	788,904,270
4	494,500	902,413,050
5	542,400	989,825,760
6	346,200	631,780,380
7	459,300	838,176,570
8	473,600	864,272,640
9	493,100	899,858,190
10	425,800	777,042,420
11	500,900	914,092,410
12	419,100	764,815,590

3. Kế hoạch đầu tư thiết bị, máy móc phục vụ trong tương lai

工場設備の増設等の将来計画(規模含め)

- Quý công ty có dự định sẽ đầu tư, mua sắm thêm thiết bị máy móc sản xuất trong thời gian tới hay không? Do you have plan to install more facility?

将来に新しい設備を導入する計画有無

回答：なし None

- Nếu có, xin vui lòng chia sẻ thông tin về các loại máy móc, thiết bị mà quý công ty dự định sẽ đầu tư.

有る場合、導入予定の設備情報を教えてください。

STT	Tên máy móc, thiết bị	Số lượng	Công suất

	機器名	台数	容量 (kW)
1			
2			
3			
4			
5			

4. Mức độ quan tâm đến điện năng lượng mặt trời

太陽光発電の関心度

a. Quý công ty có quan tâm đến công nghệ điện năng lượng hay không?

太陽光発電に関心を持っていますか。Do you have interest in installing PV system?

Trả lời/回答：持っていない。None

b. Quý công ty có dự định sẽ đưa công nghệ điện năng lượng mặt trời vào sử dụng hay không?

太陽光発電設備を導入する予定がありますか。Do you have such plan?

Trả lời/回答：なし。None

Nếu có thì diện tích mặt bằng dành cho thiết bị điện năng lượng mặt trời dự tính khoảng bao nhiêu m2?

太陽光発電設備の設置する用地の面積 Do you have such space?

Trả lời/回答：用地なし No space

(5) Provisions on the incentive mechanism for solar PV in Vietnam (Summary)

Provisions on the incentive mechanism for solar power generation in Vietnam (No. 13/2020/QD-TTg) is a regulation decided by the Prime Minister in April 2020, which stipulates the eligibility and definition of solar power generation, the price of electricity, etc.

[The definition of "Solar Power Purchaser”]

“Power Purchaser”

① Vietnam Electricity Corporation (EVN), member companies with delegated authority from EVN
② Organizations or individuals that purchase electricity from power sellers.
③ Organizations that have accepted the rights and obligations of the above organizations in accordance with the provisions of laws and regulations.

“Power Seller”

① Organizations that sell electricity by using plants (power plants) and solar power generation systems.
② Organizations that accept the rights and obligations of the above-mentioned organizations in accordance with laws and regulations.
③ Organizations or individuals that participate in activities in the field of power generation from individuals.

[Definition of “Solar Power Project”]

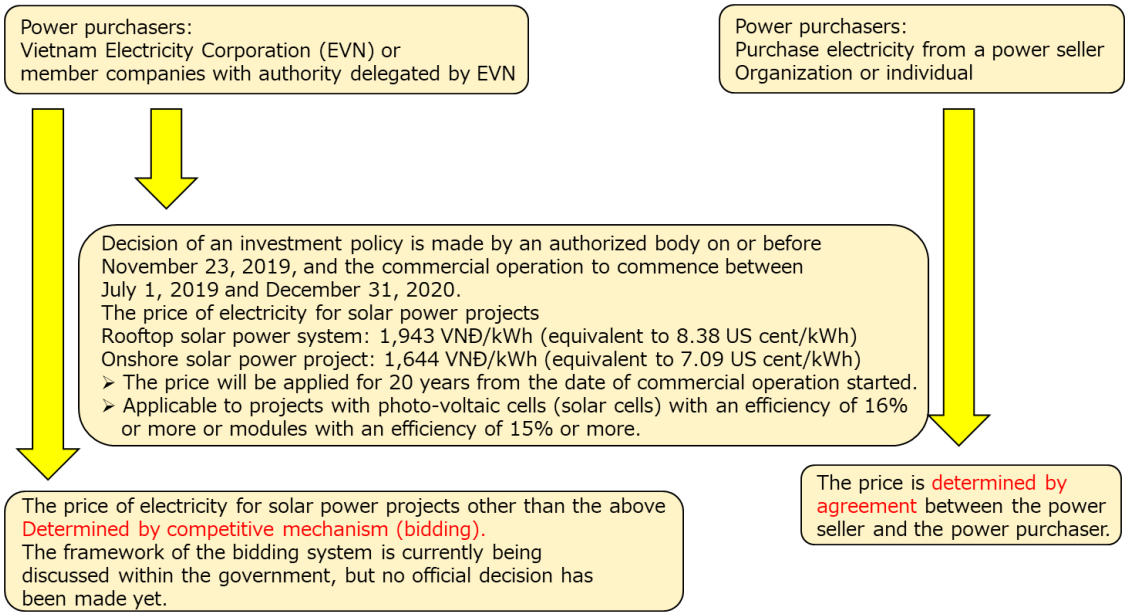
“Rooftop Solar Power System”

A photovoltaic power generation system with solar panels installed on the roof of a building with a capacity not exceeding 1 MW, directly or indirectly connected to the grid (transmission system, power grid) of a voltage level not exceeding 35 kV owned by a power purchaser.

"Onshore Solar Power Project”

A solar power project that is not a water-based solar power project and is directly connected to the national grid.

【About the Price of Electricity】



(6) **Provisions on the development of solar power projects and the format of power purchase agreements (summary)**

Provisions on Model Power Purchase Agreements Applicable to Project Development and Solar Power Projects (No. 18/2020/TT-BCT) is a regulation decided by the Prime Minister in July 2020, which stipulates the procedures for implementing solar power generation, the roles of each organization, and the format of power purchase agreements.

[Implementation Procedure for Rooftop Solar Power Generation System*]

*Exempted from the Electricity Business License

The power seller shall provide the power purchaser with each piece of information including the installation location, capacity scale (not exceeding 1MW and 1.25MWp), transmission lines, and planned connection points as a notification regarding the connection.

↓

If the power purchaser has any comments on the connection or transmission, it shall respond within five days from the date of receipt of the power seller's notification.

↓

The power seller and the power purchaser will implement an agreement on the connection of the PV system. The power purchaser will sign the agreement within 5 days from the date of receipt of the fulfilled documents.

↓

The power seller will implement the installation of a rooftop solar power system.

↓

The power seller shall send the power sales request documents for the rooftop solar power system. Power sales request documents (technical documents of the system): solar panels, electronic converter (inverter) from DC to AC, transmission line, transformer (if any), certificate of shipment from the factory, equipment quality certificate (copy).

↓

Each party shall conduct technical inspections, install meters to measure electricity production, read meters, sign the power purchase agreement, prepare for power supply, and operate the rooftop PV system. The power purchaser shall sign the contract within five 5 days from the date of receipt of the power seller's power sales request document.

↓

The power seller and the power purchaser shall carry out the respective works. The power seller shall install inverters, prevent any external factors from interfering with its business and operation or infringing on its monitoring rights, and comply with all standards, norms, and legal provisions regarding power quality.

【The role and implementation structure of each organization】

Electricity and Renewable Energy Agency (EREA)

- Dissemination, guidance and inspection on the implementation of the Circular.
- Dissemination, guidance and inspection of the implementation of the Circular, summarizing various obstacles and advising the Minister of Commerce and Industry to consider amendments and supplements to the Circular.

Provincial People's Committees

- Monitoring, inspection and audit of PV development in provinces in accordance with the provisions of the existing laws and regulations.
- Send reports on investment registration activities and implementation deployment status of PV projects to the Ministry of Industry and Commerce for monitoring and management by January 15 every year.

Power Purchaser

- The Electricity of Vietnam (EVN) will publish the application details of the agreement on connection, testing, signing of power purchase agreement and acceptance of the agreement to start operation for rooftop PV system.
- Every six months, a summary and report on the development status of rooftop PV systems nationwide will be conducted and sent to the Ministry of Industry and Commerce.
- It will be responsible for inspecting and monitoring the operation activities of each solar power plant, detecting unauthorized access from outside, and suspending the connection to the power system if the power plant activity equipment monitoring software of the power seller contains illegal content, and make a record and report to the Ministry of Commerce for processing.

Electricity sellers

- Comply with the regulations on power system operation and regulation, transmission system regulations, and distribution system regulations promulgated by the Ministry of Commerce and Industry.
- Constantly inspect the operation activities, PV equipment activity monitoring software, and have measures to prevent illegal interference and intrusion from the outside.
- It is required not to violate any of the provisions of laws and regulations regarding the assurance of information security.
- Conduct operations related to environmental protection, fire and explosion prevention, and power safety in accordance with legal provisions.

(7) **Simulation of solar power generation system introduction in Soc Trang Province(720kW)**

720kW の太陽光発電システムを導入することにより、

1,226,690 **kWh／年の電力削減効果**

408,488 **kg-CO_2／年 の二酸化炭素削減効果**

10,794,872 **万円／年 の売電収入** を見込むことができます。

・太陽光発電システムの発電量算出方法

太陽光発電システム 720 kWpを設置した場合に得られる電力量は、以下の通りになります。

月	1月	2月	3月	4月	5月	6月	7月	8月	9月	10月	11月	12月	合計
月日数	31	28	31	30	31	30	31	31	30	31	30	31	365
傾斜面日射量 [kWh/㎡・日]	5.73	6.51	6.76	6.78	5.43	4.86	5.01	4.94	4.58	4.33	4.75	5.03	5.39
1日の太陽電池発電量 [kWh/日]	3589.8	4056.5	4167.6	4165.3	3372.6	3051.4	3145.5	3101.6	2875.6	2718.6	2982.3	3158.1	3365.4
1ヶ月の太陽電池発電量 [kWh/月]	111,284.00	113,582.00	129,196.00	124,959.00	104,551.00	91,542.00	97,511.00	96,150.00	86,268.00	84,277.00	89,469.00	97,901.00	1,226,690

南南 傾斜角度 10°

平均傾斜面日射量 : **5.39** [kWh/m^2・日]

1日の平均太陽電池発電量 : **3365.4** [kWh/日]

(発電量計算式) $Q_m=(P_p\times\frac{Q_d}{P_o})\times K\times S$

Qm：太陽光発電量 [kWh/月]

Pp：太陽電池容量 720 [kW]

Qd：傾斜面日射量 [kWh/m^2・日]

Po：太陽電池の基準日射量 1 [kW/m^2]

K ：システム効率（＝K1 × K2 × K3）

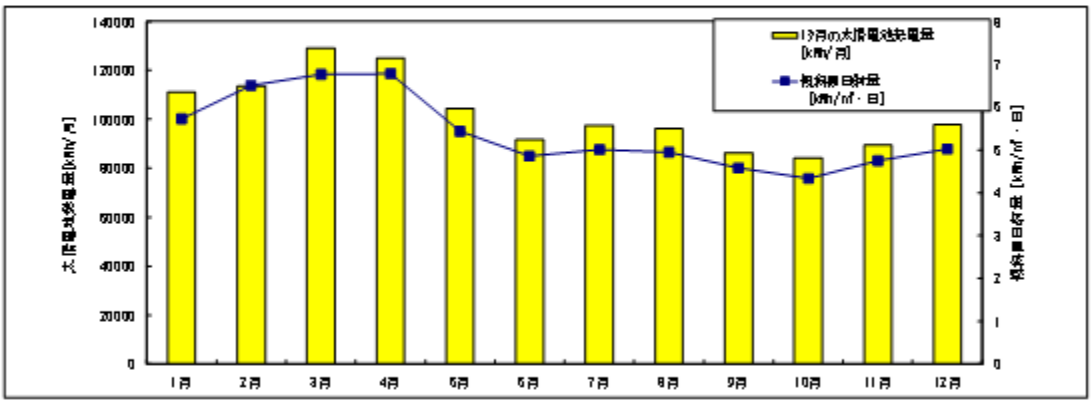
K1：太陽電池損失／温度補正係数

	1月	2月	3月	4月	5月	6月	7月	8月	9月	10月	11月	12月
温度損失	0.93	0.92	0.91	0.91	0.92	0.93	0.93	0.93	0.93	0.93	0.93	0.93

K2：パワーコンディショナ効率 0.987

K3：その他の損失係数（受光面汚れ、配線・回路ロス等） 0.95

S ：月の日数 [日]



従って、年間発電量は 1,226,690 kWh/年となり、

本システムの導入によるCO_2の年間削減量は、 408,488 kg-CO_2/年 となります。

(換算係数は、0.333kg-CO_2/kWh を使用しています。)

(8) **Hiroshima Prefecture's approach to renewable energy**

Hiroshima Prefecture's Approach to Renewable Energy

2019.October.29

Environmental Policy Section,
Environment and Citizens Affairs Bureau,
Hiroshima Prefecture

1

Description

1. At the beginning

2. Energy Policy of our country

3 Efforts by Hiroshima Prefecture

2

1 Current Status of Global Warming Issues

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

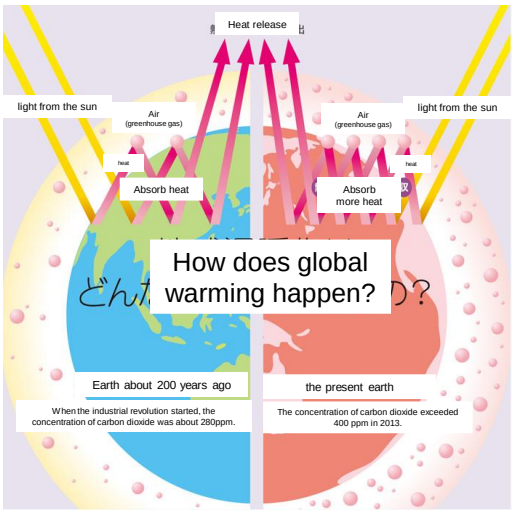
Mechanism of the greenhouse effect

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.



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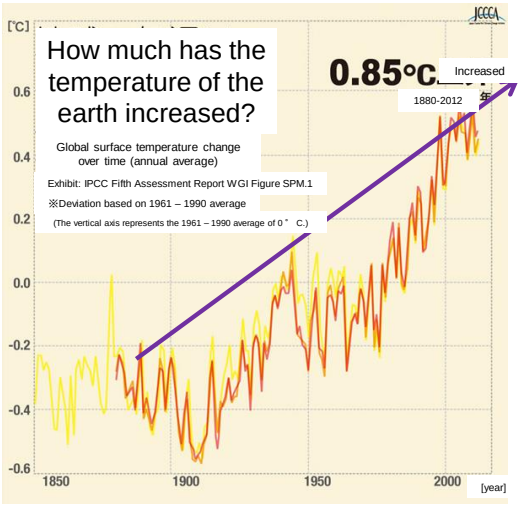
1 Current Status of Global Warming Issues - Progress of Global Warming -

■ 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.



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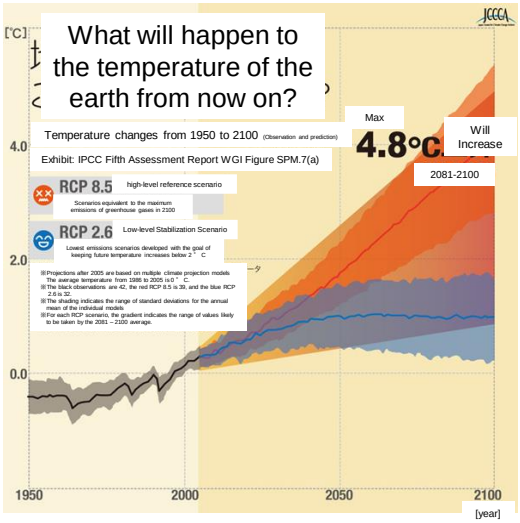
1 Current Status of the Global Warming Problem
- Prospects for Further Progress -

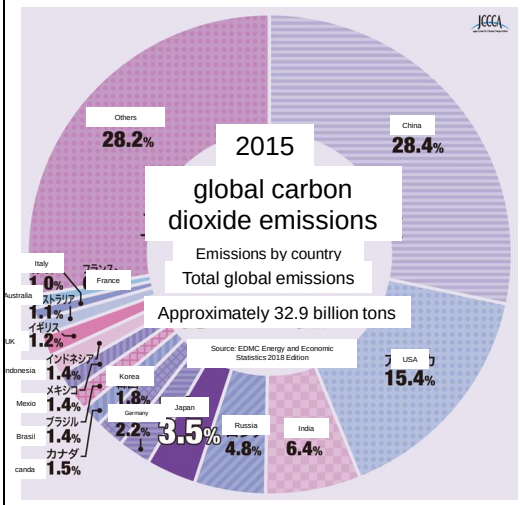
■Unless stringent measures are taken, temperatures are expected to rise by up to 4.8 ° C by the end of this century.

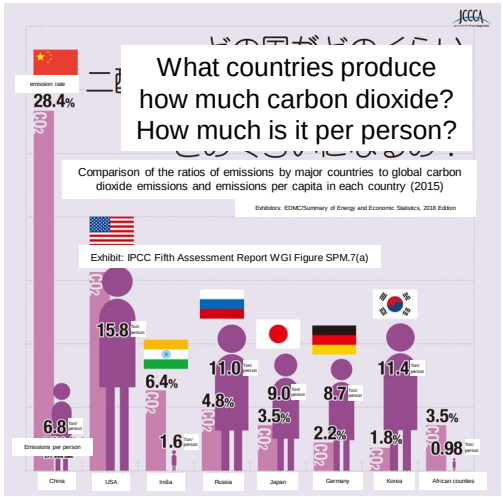


1 Current Situation of Global Warming
-Ratio of Carbon Dioxide Emissions by Country

■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.

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Description

1. At the beginning

2. Energy Policy of our country

3 Efforts by Hiroshima Prefecture

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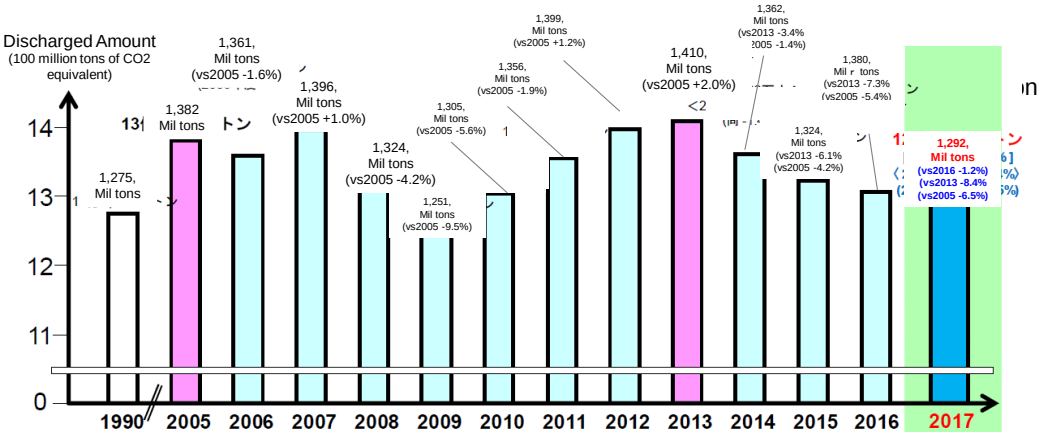
2 Our country's Energy Policy: Trends in Greenhouse Gas Emissions

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



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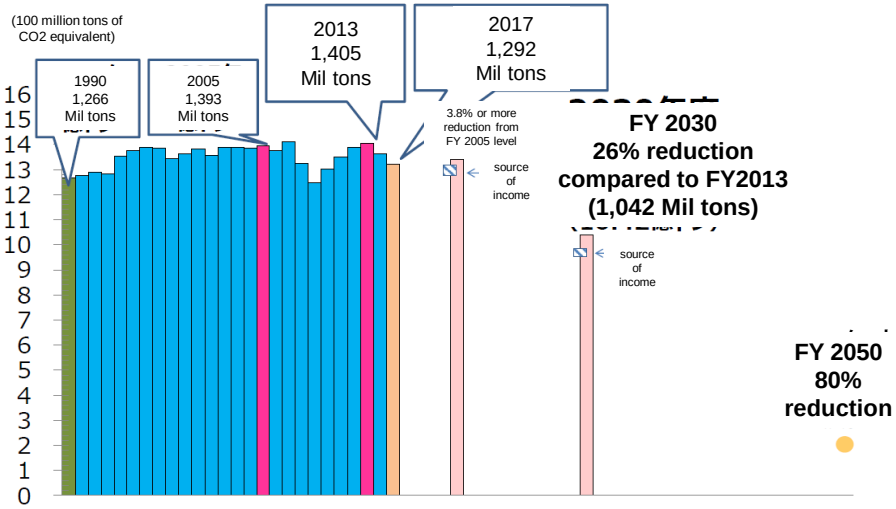
2 Energy policy in our country -Greenhouse Gas Emissions Targets under the National Global Warming Prevention Plan (2016.5)-

■ 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.



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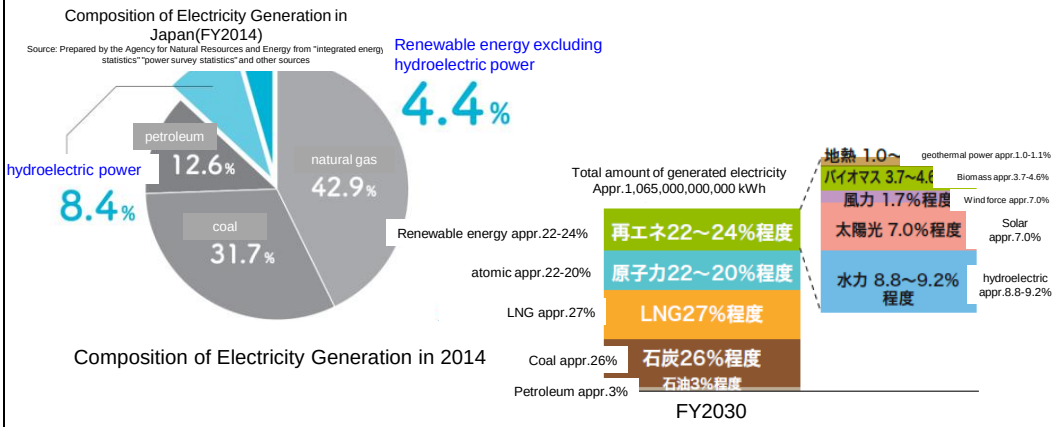
2 Energy policy in our country
- Amount of renewable energy introduced under the Fifth Basic Energy Plan -

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



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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	➡	394-490billion kWh (3.7-4.6%)
hydraulic power	849billion kWh	➡	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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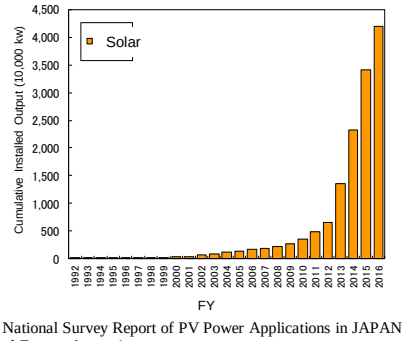
2 Energy Policy in our country
- Introduction of Photovoltaic and Wind Power Generation Systems -

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

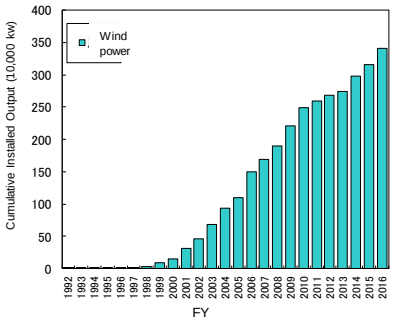
■Photovoltaic power generation, in particular, has rapidly increased in recent years due to the feed-in tariff system.

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))

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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

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3 Efforts by Hiroshima Prefecture

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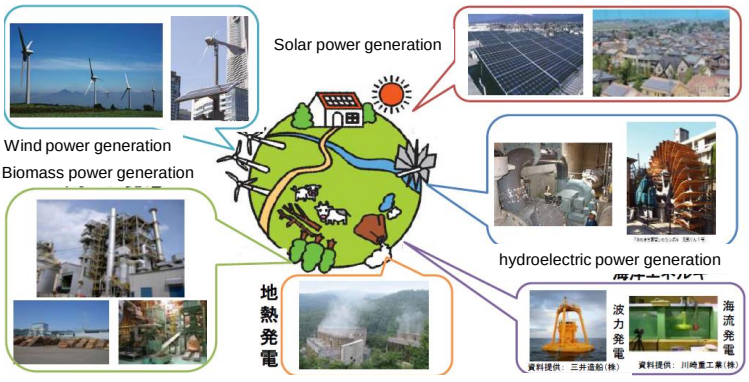
3 Efforts by Hiroshima Prefecture

- 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"



〈Source: Ministry of Economy, Trade and Industry〉

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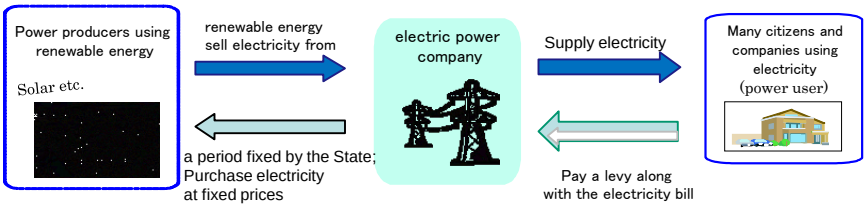
3 Efforts by Hiroshima Prefecture
- Projects to Introduce Renewable Energy Based on Local Reductions-

■ 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)

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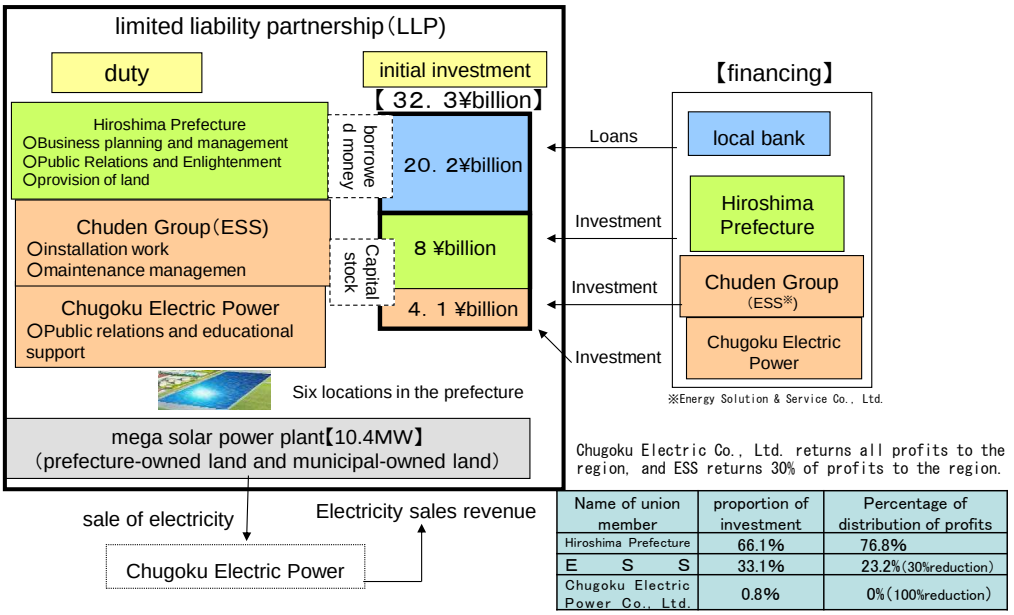
3 Initiatives by Hiroshima Prefecture
Project to Introduce Community-Based Renewable Energy (Business Frame)

■ 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

Daicho Area（1．0MW）

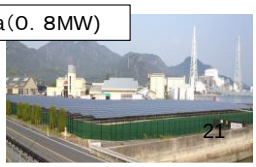
Shohara Area(2．5MW)

Fukutomi Area（No.1.：1．0MW）（No.2：2．3MW）

Ninga Area（0．6MW）

Ohno Area（2．2MW）

Takehara Area（0．8MW）



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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

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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

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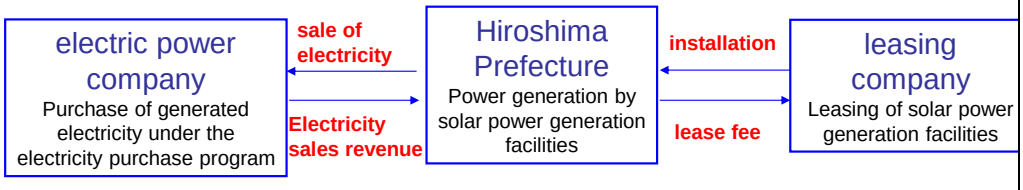
3　Initiatives by Hiroshima Prefecture

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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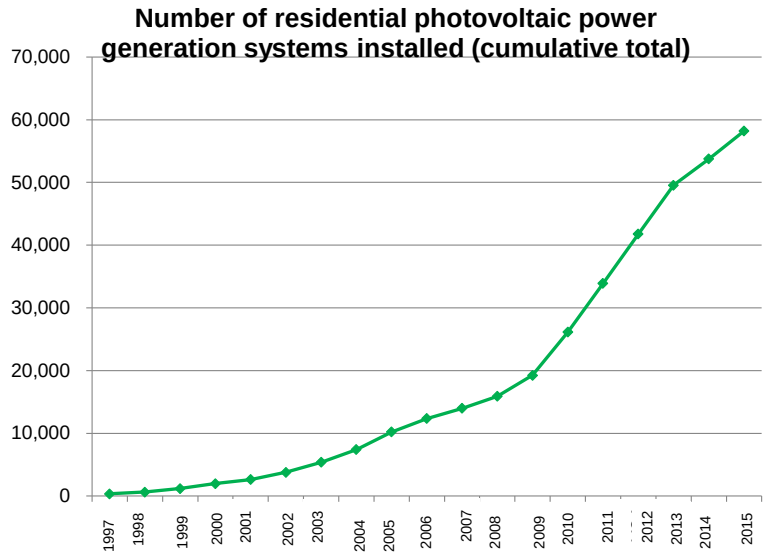
3 Efforts in Hiroshima Prefecture

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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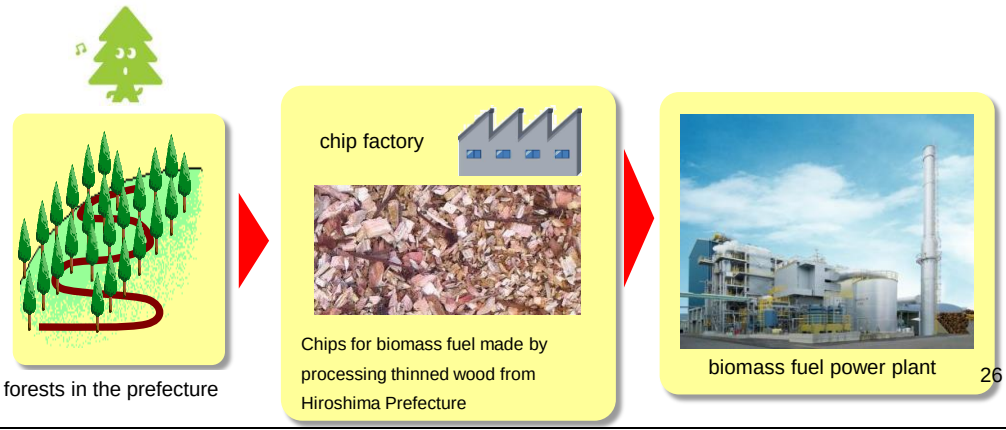
3 Efforts by Hiroshima Prefecture - Woody Biomass Power Generation -

■ 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



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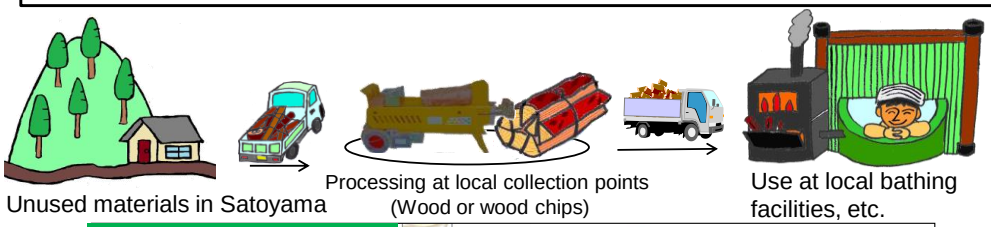
3 Efforts by Hiroshima Prefecture

- 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

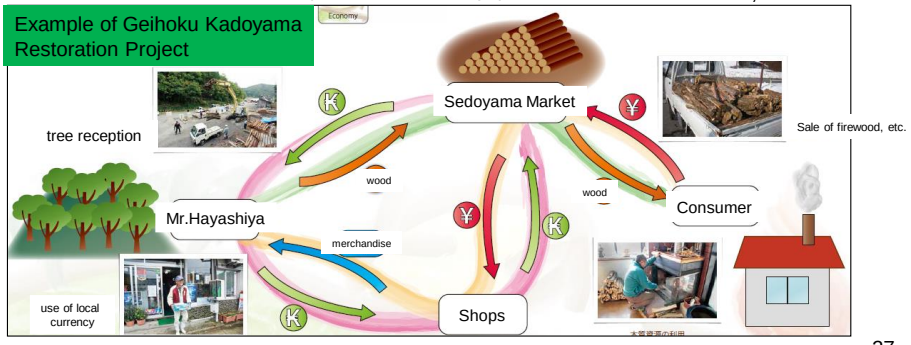


Unused materials in Satoyama

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.

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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

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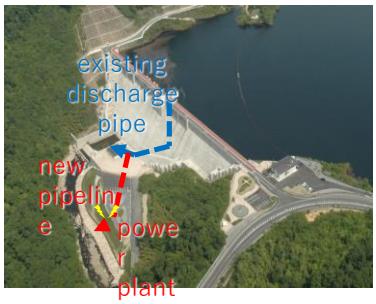
3 Efforts by Hiroshima Prefecture
Small Hydroelectric Power Generation

■ 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）

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(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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(9) **Introduction of Fukutomi Power station No.1 and No.2**

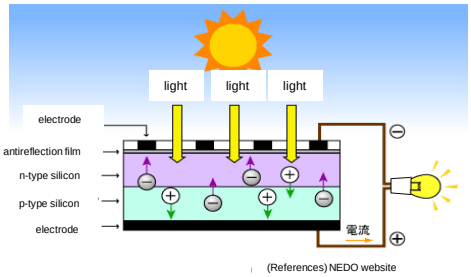
Name of power plant		Fukutomi Solar Power Station 1	Fukutomi Solar Power Station 2
location		2376 -1 Okurita, Hisayoshi, Fukutomi-cho, Higashihiroshima-shi	2375 -1 Okurita, Hisayoshi, Fukutomi-cho, Higashihiroshima-shi
panel footprint		約12,000㎡	約26,000㎡
Solar Power Station	panel capacity	950kW	2,280kW
	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.

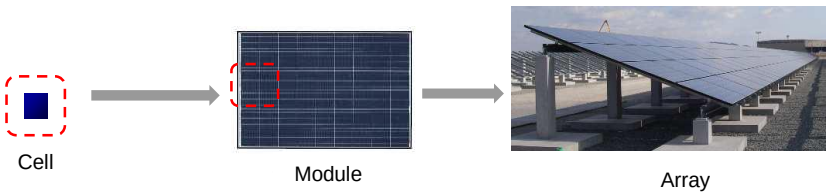
Principle of a solar cell

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.

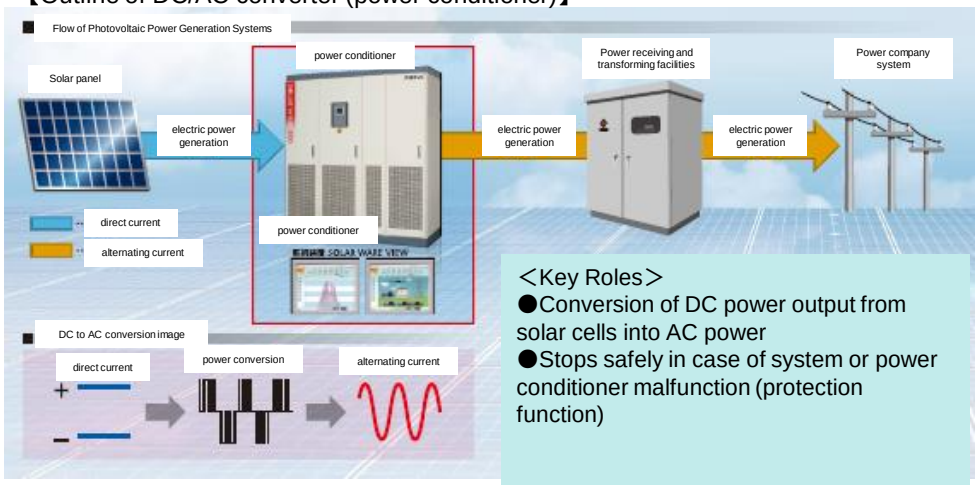


(References) NEDO website

【References】Names according to solar cell configuration



【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)