Fiscal Year 2016
JCM Project Formulation Study for Realizing Low Carbon Cities in Asia
(Project for Developing Low-carbon biomass power generation using urban organic solid waste and rice husks to contribute a reduction for urban solid waste and taking adequate measures through the Joint Crediting Mechanism in Siem Reap)

Final Report

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Japan Development Institute Ltd.
Asian Gateway Corporation

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Abbreviation

AGC	Asian Gateway Corporation
BIPV	Building-Integrated Photovoltaic
C2CC	City-to-City Collaboration
CDM	Clean Development Mechanism
EDC	Electricite Du Cambodge
EPC	Engineering, Procurement and Construction
IPP	Independent Power Producer
ISPP	International School of Phnom Penh
JCM	Joint Crediting Mechanism
LCOE	Levelized Cost of Electricity
O&MM	Operation and Maintenance, Monitoring
PPA	Power Purchase Agreement
WTE	Waste to Energy

SUMMARY

This project is a study project in support of the development of a low carbon tourism city through the Joint Crediting Mechanism in Siem Reap Province in Cambodia.

The purpose of this study project was to establish the "Upper Tier City-to-City Collaboration (C2CC)" between the Siem Reap provincial government and Kanagawa prefectural government, and, to aim for the realization of a low carbon society - "as a whole city" - through comprehensive and continuous efforts for project formulation in Siem Reap city. Such collaboration would result in 'province-wide' emission reduction of CO2 coming from energy production sources. This will contribute directly to the protection of world heritage sites in the province through environmental conservation coincident with the development of a clean tourism city.

There were two objects of this study. The first object was to study the possibility and profitability of installing photovoltaic (PV) modules on rental rooftops of public high schools in Siem Reap city as a smart community project. The second was to study the suitability of installing biomass power generation using low carbon organic waste and rice husks, contributive to the reduction of urban waste. The study examined the possibility of constructing a show case resort village and hydroponic factory as zero-energy buildings with renewable energy technology, energy storage, and conservation in Siem Reap. The study also examined the possibility of collaboration with the "Eco-mobility (electric remork-motos (tuktuks)) project" implemented in FY2014, wherein the possibility of running electric tuktuks on electricity generated by rooftop PVs was studied.

The results of this study project are shown below.

1) We inspected the possibility and profitability of Low carbon biomass power generation project using urban organic solid waste and rice husks to contribute a reduction for urban solid waste and taking adequate measures as four viewpoints as follows.

The study about adequate measures of disposals of urban organic solid waste	With the increase in tourist visits and further economic development, the quantity of waste has reached 330t/day in Siem Reap. However, there is no systematic waste disposal system. A waste disposal company, GAEA, collects urban waste and disposes it into an open dump. KOICA, along with private venture capital, has been supporting GAEA and planning the relocation of the dumping site, and, the construction of centers for separation and recycling. Waste collected at hotels is classified into organic solid, paper, plastic, glass, wood, and metal. But GAEA disposes them mixed, and, all together.
Inspection of local rice mills and collectable possibility of rice husks	Thai buyers buy rice husks in Siem Reap and the price is getting higher year by year, currently 1.6 times higher than 2 years ago. It costs USD 15/t.
The technology of biomass power generation system	In this project, AGC establishes the facility which generates 200Kw. We chose a screw steam generator manufactured by company K and the generation method is a combination of Dry distillation gasification furnace and Steam boiler. The screw steam generator enables to generate constantly by pushing steam from boiler into a binary generator. It assumes the use of

	rice husks and organic solid waste collected at hotels as resources and the expected quantity is more than 25t/day in order to generate 200kw. The amount energy generated by the screw steam boiler and binary generator could be 236kw. Except general power consumption, about 116kw is possible amount to sell. It estimates that this system reduces emissions of CO2 by as much as 424 tons CO2/year. However, this number may change depending on the situation of operation and raw materials availability, especially the components of collectable combustibles. It will be necessary to examine and investigate the factors of effects. Installment cost except land is estimated around JPY40-60 million. We need further inspection about factors of possibility of materials' procurement, the situation of location, control system, and personnel expenses.
Fund raising and ensure of location for biomass power plant	AGC has concluded a cooperative business agreement with a biomass power plant company which generates 1.5MW in Kampong Thom province and gotten the partnership as a local EPC. In addition, AGC is allowed to use 2ha land in an Eco village by APSARA National Authority and gets the land for biomass power plant.

Disposal of urban organic solid waste in Siem Reap is the most important issue for the provincial and city governments which promote "clean city" and "green city." Developing a tourism city as a hub of Angkor heritage suffers from the serious problems of increasing urban waste from restaurants, hotels, and markets; and, the existing dumping site has overflowed. Some of the 5-star hotels sort waste, produce gas from organic solid waste, and sell plastics. Wastes are mixed during collection, and, scavengers collect plastics, while other debris is simply buried.

The amount of rice husks produced at local rice mills and moving milling services is about 20% of the total. However, Siem Reap province is not fertile rice cultivation land, and, irrigation has not been introduced. Furthermore, the land yields one crop a year and the production of rice husks is less.
Ironically, Thai rice husk brokers buy at a high price, and, the rice husks are used for biomass power generation in Thailand while Cambodia imports the electricity.
The JICA study project inspected incineration of medical wastes, and, this is the urgent topic to introduce into the disposal system cooperating with hospitals.

2) In order to achieve a low carbon society in Asian countries based on C2CC and secure the Joint Crediting Mechanism for the long term, it is necessary to establish cooperation in Cambodia. As at February 2017, a subsidiary of AGC is under the procedure of registration. The goal AGCC aims is to achieve a low carbon society by promoting local production of energy and food for local consumption. The main task of AGC is consulting on international development and conducting surveys for the project of Ministry of Environment or Ministry of Economy, Trade and Industry. The subsidiary of AGC is the entity which conducts adjustment, management, supervision, and monitoring of the projects with the local EPC especially it's important to negotiate with turnkey providers.

3) There are some derived project plans such as the introduction of a ground-solar farm which generates 10MW in Kampong Thom, 3MW solar PV in Poi Pet SEZ, solar LED streetlights at the developing area in Phnom Penh city, and the introduction of a solar PV system into the Nokor Tep Women's Hospital which is under construction. AGC is considering applying for JCM in 2017.

4) The Siem Reap provincial government and Kanagawa prefectural government agreed the "Upper Tier City-to-City Collaboration (C2CC)" in November 2015. The Siem Reap provincial and city governments request Japanese and Kanagawa prefectural governments to support capacity building, formulation of a

master plan and implementation of a pilot project officially. Both governments assigned the person in charge and two of them joined workshop in Japan twice this year and made presentations. They visited solar LED streetlights in Kanagawa, factories lending the rooftops, a Zero Energy Building, and Fintech facilities and participated in the international meeting related a JCM.

5) AGC promotes local production and local consumption in three ways. The first is solar PV and biomass power generation targeted hotels and governmental facilities as renewable energy, and, the second is Lithium ion battery energy storage. The last is the introduction of BIPV, double glazing and high efficient air conditioners and lighting as energy conservation. The introduction of smart grid systems with system interconnection leads moderation of balance of energy demand. Also, AGC promotes Electrical mobility with charging source produced by renewable energy to tourists as local consumption following the existing model project of EV in Hakone town, Kamakura, and Yokohama city in Kanagawa prefecture. AGC visualizes and monitors the effect of renewable energy and energy conservation by introduction of IoT into hotels and governments. These projects promote preservation of Angkor heritage and activate local economics and, in particular, the tourism industry.

From FY2017, Kawasaki city will join as a member of C2CC. With electric remork-motos with three wheels (tuktuks) manufactured by Kawasaki-based ElecTrike Japan Co.,Ltd, AGC reexamines and expands the possibility of collaboration with the "Eco-mobility (electric remork-motos (tuktuks)) project" implemented in FY2014, where the possibility of running electric tuktuks on electricity generated by rooftop PVs was studied. In addition, one of the Japanese major internet providers will examine the possibility of electric remork-motos manufactured by Japanese major manufacturers in 2017. Based on these two studies, AGC promotes the development of low-carbon transportation in Siem Reap.
Local production and local consumption of food concentrates on leaf vegetables. AGC established the indoor hydroponic factory using LED with a solar PV system as a Zero Energy facility. There are many factors of less cultivation of leaf vegetables such as the low level of PH, clay, heavy rain, strong radiation and high temperature in Cambodia. Then more than 90% are imported from Vietnam, China and Thailand. Despite the low market price, the quality and taste is bad. So that AGC cooperates with APSARA National Authority to improve the situation.

Considering above statements, AGC proposes three development projects for the Joint Crediting Mechanism in FY2017 as follows.

Eco mobility	The study of the possibility and profitability of electric remork-motos manufactured by the Japanese major internet providers, manufacturers and ElecTrike Japan Co., Ltd, and EV tourism with IoT technology
Buildings integrated renewable, storage and conservation energy	The study of the possibility and profitability of conducting energy saving diagnostics at 5-star hotels, introducing high efficiency chillers, and rooftop solar PV systems with cooperation of JASE-World and ECCJ. The construction of a show case for the development of resorts and proposals for legislation of environmental law.
Systematic disposals of urban waste transformed into energy	The problem of less inspection remained as FY2016 ended. With cooperation of HJA（Hayashida Japan Agriculture）which copes with recycling in Phnom Penh, AGC investigates the systems and the amounts of the reduction of GHG. In addition, AGC continues the study of FY2016 with Finetech Co., Ltd.

Main Report

1. Overview of Cambodia

1.1. General Situation

1.1.1. Political Situation

Politically, Cambodia has maintained a stable regime since 1998 by the Cambodian People's Party (CPP) let by Prime Minister Hun Sen. However, in the last general election held in July 2013, although the result was announced that CPP had majority of votes, there were some doubts that the opposition party, the Cambodia National Rescue Party (CNRP) may have out-numbered the CPP. Due to unsatisfactory result, CNRP hold demonstrations seeking for the re-election which caused political and social unrest. In the end, CPP incorporated some of the intention of CNRP such as increase of minimum wages and Prime Minister Hun Sen was officially re-elected for another 5-year regime. The next general election is scheduled in 2018 and political and business world is paying close attention to its prospect.

1.1.2. Economic Situation

Economic situation in Cambodia has been growing stably despite of the long civil war and the domestic turmoil over the past half-century. Cambodia has been successful in attracting foreign direct investments by establishing legislation to promote investments at the same time of joining ASEAN and WTO. GDP growth rate recorded double-digit from 2004 to 2007, and continued to sustain strong growth of 6-7.4% since 2010 after the Lehman shock, and it is expected to maintain 7% in 2017[1]. Foreign direct investment (FDI) was dropped to $500 million in 2009, but made a quick recovery and reached to $1.7 billion in 2015[2]. It is expected that the elimination of tariff barriers by ASEAN free trade agreement will stimulate the regional economic activities.

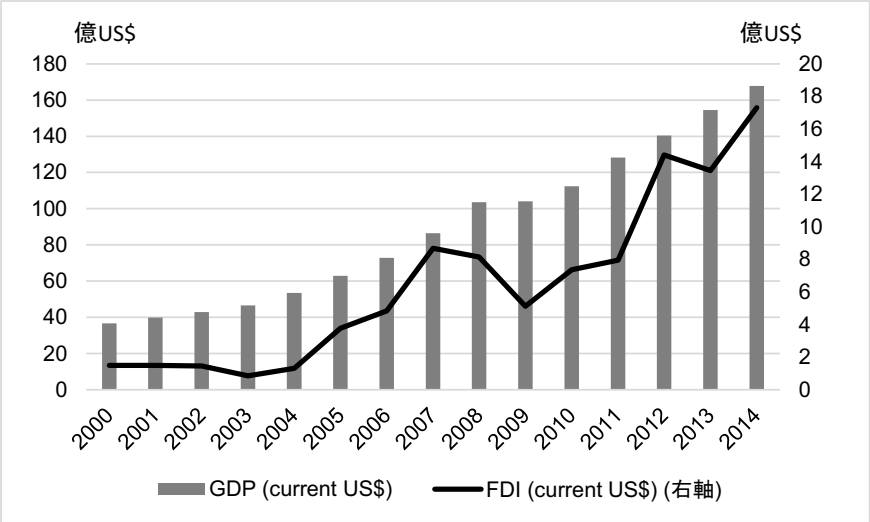


Figure 1-1：Trend of GDP growth and FDI inflow
(Source: World Development Indicators, World Bank 2015)

In terms of industrial composition of Cambodia, each sector accounts 28% for agriculture, 29% for manufacturing sector and 42% for service industry sector based on the GDP contribution[3]. From the investment view point, targeted sector for FDI has been diversified due to the shift of production area from neighboring countries to Cambodia. Not only the tourism and garment sectors, additionally automotive parts and agricultural processing sectors are getting more investment. However, tourism sector is still a driving

[1] ADB Key Indicators Cambodia 2015

[2] World Development Indicators, The World Bank 2016

[3] Key Indicators for Asia and the Pacific, ADB 2016

force of Cambodian economy since 24.8% of the total investment was directed to tourism in 2014[4], and foreign visitors reached to more than 478 million people in 2015[5].

1.1.3. Power situation

Due to a strong economic development and stable 1.3% annual population growth, power demand in Cambodia is rapidly increasing in industrial sector and urban residential use. It has been increasing 20% every year since 2010, especially increasing of garment factory which consume huge amount of electricity is one of the main reason of this rapidly power demand increase in Cambodia. However, power infrastructure development in Cambodia is far from the sufficient compare to the neighboring countries. Especially limited capacity of power supply and under developed transmission and distribution network is a serious issue in Cambodia. Since a small diesel generation is the major source of power supply at non-grid connected area, the electricity tariff is high in the neighboring region.

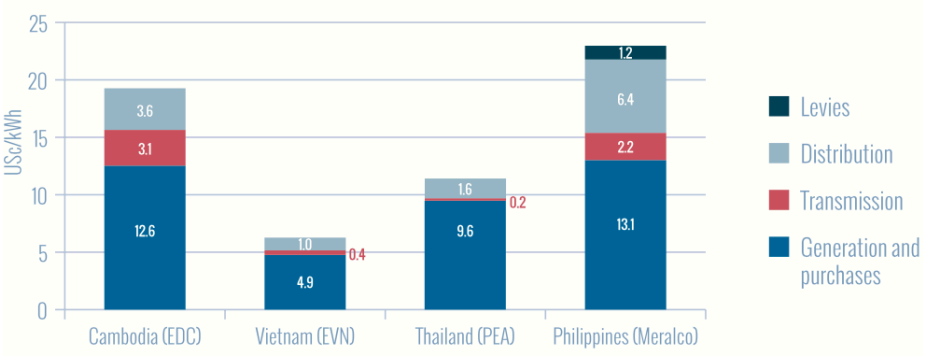


Figure 1-2：Electricity tariffs in Cambodia and ASEAN neighbors
（Source: Mekong Strategic Partners 2016.3）

[4] JETRO World Trade Investment Report 2015

[5] Ministry of Tourism Cambodia 2016

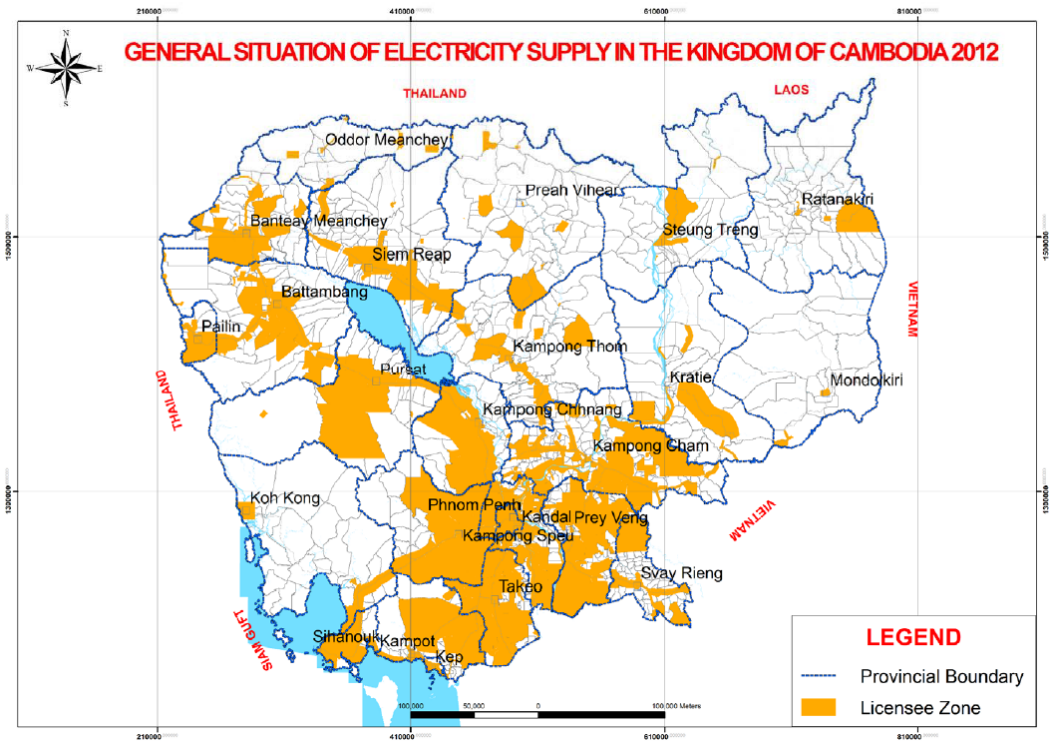


Figure 1-3：Electricity supply in Cambodia
(Source: EAC annual report 2012)

Total power generation capacity including the imported power is about 5000GWh in Cambodia. Cambodia started to import power from neighboring country since 2007 from Thailand, 2009 from Vietnam and 2010 from Lao. Imported power covered approximately 60% of total power generation in the Cambodia in 2010. However, the imported power covers only 25% in 2015, because of the strong effort to strengthen the domestic power generation capacity. It will be decrease significantly after 2017.

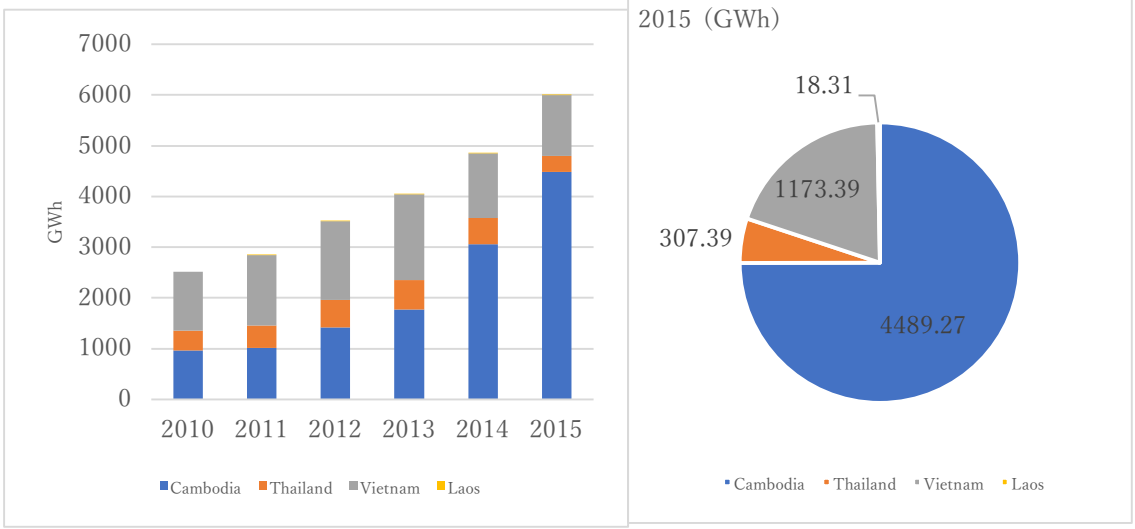


Figure 1-4： Power Supply Trend
(Source: EAC 2005-2015 Annual Report)

Table 1-1：Power generation development plan in Cambodia

No.	Generation Expansion Plan	Type of Fuel	Capacity (MW)	COD
1	Lower Stung Tatay Hydro Power Plant	Hydro	338	2015
2	700MW Coal Power Plant (Ⅱ) –Phase 1	Coal	270	2014~2015
3	700MW Coal Power Plant (Ⅱ) –Phase 2	Coal	100	2017
4	700MW Coal Power Plant (Ⅱ) –Phase 3	Coal	100	2018
5	200MW Coal Power Plant (Ⅰ) in Sihanouk Province – Phase 2	Coal	135	2016
6	Lower Se San Ⅱ Hydro Power Plant	Hydro	400	2017
7	700MW Coal Power Plant (Ⅱ) –Phase 4	Coal	100	2018
8	Stung Chay Areng Hydro Power Plant	Hydro	108	2019
9	700MW Coal Power Plant (Ⅱ) –Phase 5	Coal	100	2019
10	Sambor Hydro Power Plant	Hydro	450/2600	2019
11	Coal Power Plant (Ⅲ) or Gas Power Plant	Coal・Natural Gas	400	2020
12	Stung Treng Hydro Power Plant	Hydro	900	2020

(Source: MME Presentation 2016.12)

Before 2011, most of the power generated in Cambodia was relied on diesel power generation. In recent years, the development of large scale hydropower and coal power plant with the capacity of 200-300 MW were developed in order to meet the strong power demand in the country. The composition of the energy sources of domestic power generation are shifting as shown in below figure since those power plant started operation. Hydropower is covering 47%, coal power 19% and diesel power was reduced to 11% in 2015.

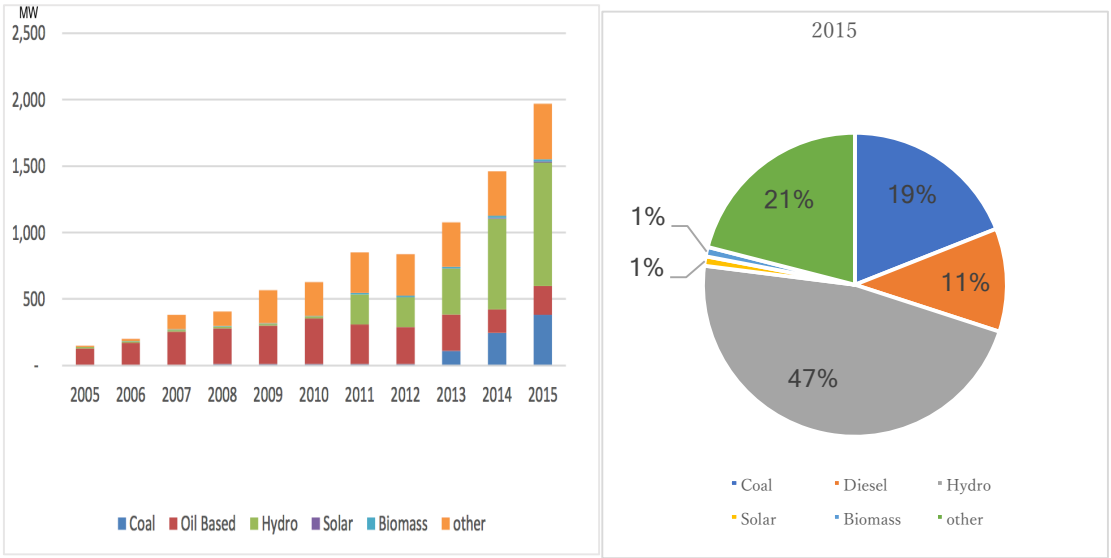


Figure 1-5：Power generated by energy sources
(Source: MME Presentation 2016.12)

Electricity in Cambodia is mainly supplied by the state-owned power company Electricite Du Cambodge (EDC) and Independent Power Producers (IPP). The composition of power installed capacity by the sources of supply are shown on below figure. IPP accounts for 91% of total electricity supply and the rest are EDC (7%) and others (2%). IPP has an important role in terms of the electricity supply in Cambodia.

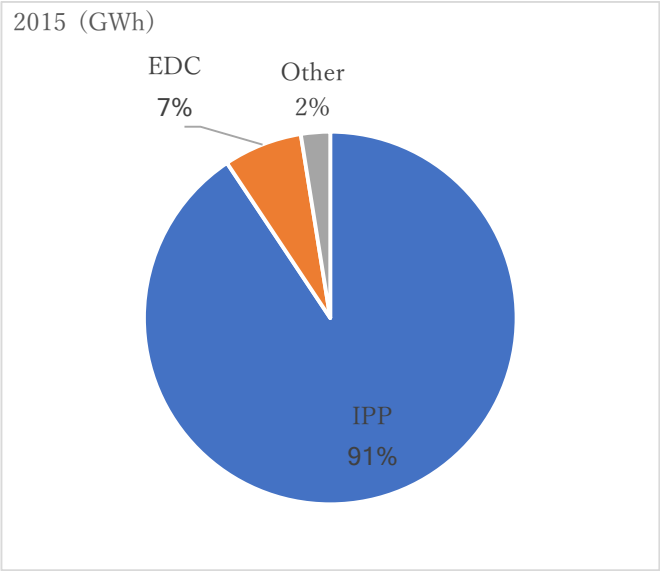


Figure 1-6：Breakdown of Installed Power
(Source: EAC 2015 Annual Report)

Power consumption is steadily increasing at the annual average of 20% since 2010. Power consumption in 2015 was 5,201GWh which is almost double of five years ago. In terms of power consumption in 2015, each sectors account for residential 30%, commercial 50%, industrial 20%. Compared with the situation in 2010, electricity consumption in the off-grid area is expanding through independent power distributors.

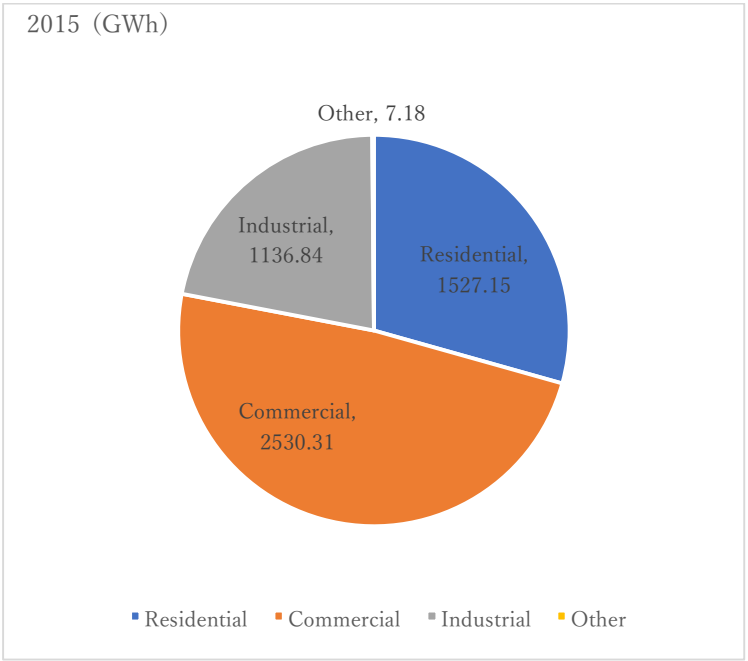
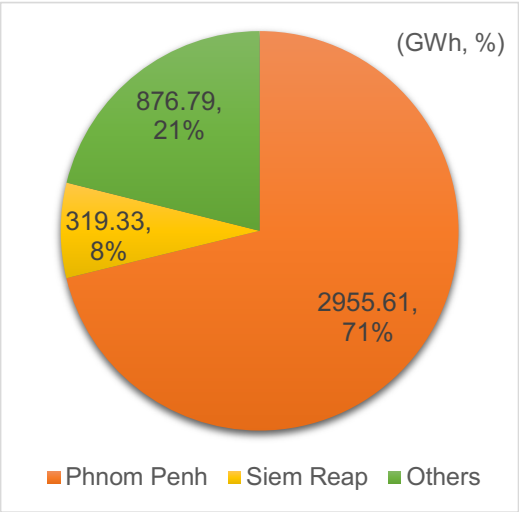


Figure 1-7：Sector wise electricity consumption
(Source: Cambodia National Energy Statistic, MME 2016)

Electricity consumption is centralizing in major cities, especially in Phnom Penh city. Based on the amount of electricity sold by EDC, electricity consumption in Phnom Penh city accounted for 71% which is 2,955.61GWh per year. Siem Reap province is 8% and other states area 21%.



	Province	Electricity sales (GWh)
1	Phnom Penh	2,955.61
2	Siem Reap	319.33
3	Battambang	161.16
4	Sihanoukville	141.27
5	Svay Rieng	129.07
6	Kampong Speu	84.50
7	Banteay Meanchey	71.32
8	Takeo	54.43
9	Kampot	44.34
10	Kampong Cham	43.35

Figure 1-8：Electricity Consumption
(Source: EDC 2014 Annual Report)

In the case of Siem Reap area, power capacity is 90.50MW, peak demand is 59.39MW and power supply amount is 346.46GWh. The sources of electricity are grid, imported from Thailand and diesel power generation. Electricity suppling capacity in the area has improved since the beginning of operation of large scale hydropower in Koh Kong province. However, the electricity price is still high in the rural area since it is off grid, and it is supplied by independent power distributor who often uses small diesel generator for power generation.

1.2. Energy Policy

1.2.1. Energy Policy

Power Sector Strategy 1999-2016 is the relevant energy policy in Cambodia. Its policy goals are listed as follows.

(1) Carry out the power supply at a reasonable price throughout Cambodia
(2) Realize a stable and low-cost power supply to attract investments and to promote economic development
(3) Promote the development of environmental and socially accepted energy resources
(4) Promote efficient power use with minimal impact on the environment

Rural electrification is positioned as an important component in the energy policy and Rural Electrification by Renewable Energy Policy which was formulated in 2007. The goal of rural electrification is to achieve that all villages will have the access to electricity by 2020, and 70% all rural household will have access to electricity as same as grid connection by 2030.
Power supply development plan and power transmission and distribution network development master plan until 2020 have being updated every year. Currently, power sector master plan was revised by MME and the latest edition was released in 2016. Since the growth of the current demand is larger than the assumption, it is mentioned on the revised master plan that the high demand case scenario is used for the base case of the demand forecast until 2035. Officially published base case scenario of the power demand forecast until 2035

is as follows.

Table 1-2：Power demand forecast in Cambodia

	Historical			Projection				Average Annual Growth Rates, %			
	1995	2005	2012	2015	2025	2030	2035	1995-2012	2012-2025	2025-2035	2012-2035
Industry	438	693	884	895	1,138	1,474	2,140	4.2	2.0	6.5	3.9
Transport	382	441	1,223	1,489	2,457	3,135	3,976	7.1	5.5	4.9	5.3
Other Sector	1,716	1,653	2,904	3,073	3,819	4,312	4,889	3.1	2.1	2.5	2.3
Commercial	3	20	72	91	192	262	343	21.2	7.8	6.0	7.0
Residential	1,712	1,629	2,822	2,971	3,601	4,014	4,498	3.0	1.9	2.2	2.0
Others	1	4	9	12	25	36	48	14.5	7.9	6.5	7.3
Non-energy	8	10	14	17	25	30	36	3.7	4.2	3.8	4.0
Total	**2,543**	**2,798**	**5,025**	**5,473**	**7,438**	**8,951**	**11,041**	**4.1**	**3.1**	**4.0**	**3.5**

(Source: Cambodia National Energy Statistic, MME 2016)

1.2.2. Energy Mix

Cambodia set a policy to achieve 100% power self-sufficiency in 2020 by reducing imported power. The latest plan of energy mix shows its intention to actively increase the capacity of hydroelectric power and also coal-fired power to supplement unstable power supply in the dry season. It is also considered that coal-fired power might be replaced by natural gas if the natural gas is available from 2024.

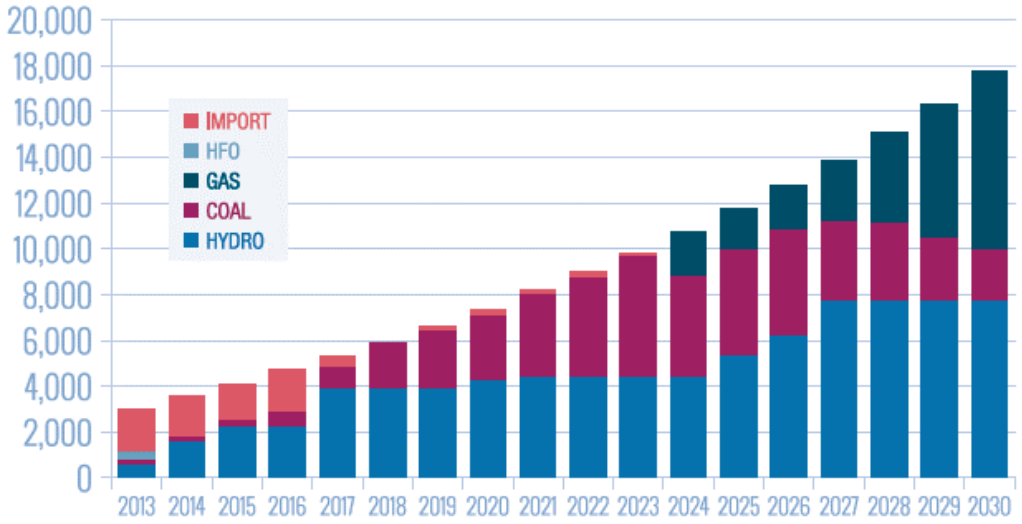


Figure 1-9：Outlook of electricity supply and the energy mix by 2030 (GWh)
(Source: Mekong Strategic Partners 2016.3)

Renewable energy in Cambodia is heavily relying on hydropower generation. The importance of solar and biomass power generation is recognized in the rural electrification policy. In order to secure the stable power supply in dry season, commercial scale renewable energy development except hydropower is discussed between the Cambodian government and international donors. Cambodian government mentioned that solar power, can cover 10% of the peak demand as a target until 2020 which is around 100MW.

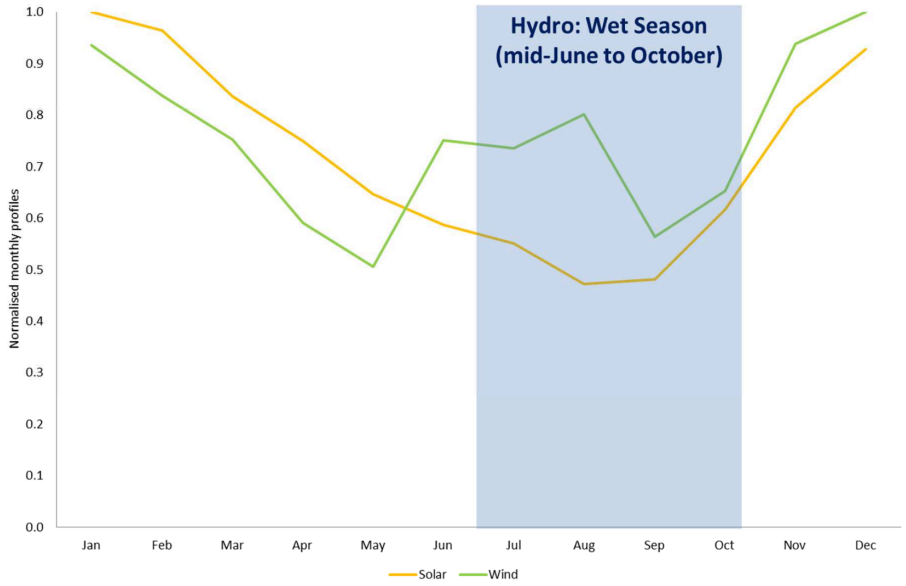


Figure 1-10：Complementally Energy mix of renewable energy
(Source: MME Presentation 2016.12)

Based on the report from ADB, Cambodia has a significant potential for biomass power generation, theoretically up to 15,000GWh per year. Especially, there are plenty amount of fuel such as rice husk or bagasse in surrounding area of Tonle Sap lake. The biomass material such as firewood or animal dung are used already in Cambodia for cooking or heating in a residential in rural area or charcoal production.

Table 1-3：Biomass Production

Unit: ton

Year	Firewood	Biogas
2007	4,272,869	621.57
2008	4,459,457	1,265.29
2009	4,583,360	1,413.93
2010	4,644,997	2,023.60
2011	4,856,076	2,608.41
2012	5,053,881	2,270.61
2013	5,262,683	602.65
2014	5,520,148	881.54
2015	5,681,802	-

(Source: Cambodia National Energy Statistics, MME 2016)

Table 1-4：Firewood Consumption for Transformation Process

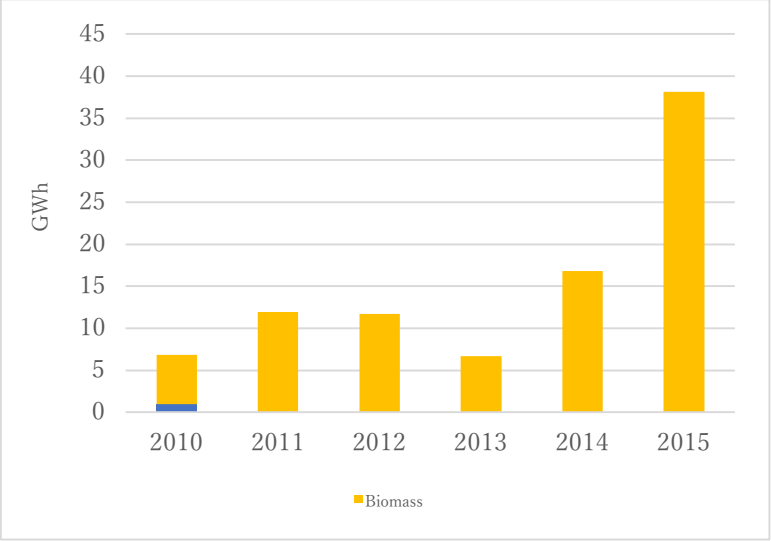
Unit: ton

Year	Electricity	Charcoal
2007	6,304	2,280,673
2008	5,438	2,380,875
2009	7,783	2,445,854
2010	6,983	2,479,230
2011	14,288	2,588,155
2012	14,096	2,693,994
2013	8,016	2,808,858
2014	20,148	2,940,000
2015	48,562	2,984,159

(Source: Cambodia National Energy Statistics, MME 2016)

The utility scale of biomass power plant in Cambodia is limited now. For example, there is a biomass power plant in Kampong Speu province and Kratie province totally 25MW which is using bagasse for the fuel, and 1.5MW biomass power plant in Kampojng Tom province which is using rise husk.

Figure 1-11：Electricity output from biomass power plant



(Source: EAC 2015 Annual Report)

On the other hand, urban waste in Siem Reap city is significantly increasing due to the huge amount of tourists 5 million people in annual. It may increase the risk of the health of people, and serious environmental impact. Siem Reap government is trying to make a master plan related to this issue with local waste management company Global Action for Environmental Awareness (GAEA) to aim for holistic solution of urban waste management. However, the waste management issue is becoming serious year by year. Government implement a solution technology, though the policy and regulations are undeveloped yet, and the understanding and cooperation with residents in the city is not managed well. Total waste amount is over 350 ton per day. Existing garbage site is full already, holistic waste management system and proper disposal system are not implemented. Siem Reap government mentioned that it is one of the highest priority issue in this area. Appropriate usage of urban waste for the fuel of biomass power plant is strongly needed in Siem Reap.

1.2.3. Pricing Policy

Cambodia is trying to reduce electricity tariff to attract FDI and to promote economic growth and industrial development. The government has announced that they gradually decrease the electricity tariff as shown in below table by upcoming further hydropower developments. Furthermore, the target for the end user price is 750 riel/kWh by minimizing the price gap between urban and rural areas by 2020.

Table 1-5：Plan for Reduction of Prices and Price Gap for Large Commercial and Industrial Usage (Unit: US$/kWh)

	2015	2016	2017	2018	2019	2020
From Sub-station	0.129			0.126		
From Phnom Penh main line	0.177	0.172	0.167	0.165	0.163	0.162
From Provincial main lines	0.1725	0.1675	0.165	0.164		

(Source: SREP Investment Plan 2015.5)

1.3. Policy on Climate Change

1.3.1. Related policy and plan

Cambodia has been developing domestic laws and policy towards a low-carbon development. Rectangular strategy III and National Strategic Development Plan 2014 - 2018 are the fundamental of the national development strategy. National Strategic Plan on Green Development 2013 - 2023 and the Cambodia Climate Change Strategic Plan 2013 - 2023 are the focal policies for the climate change. JCM and CDM are positioned as part of the specific schemes for the implementation of the projects.

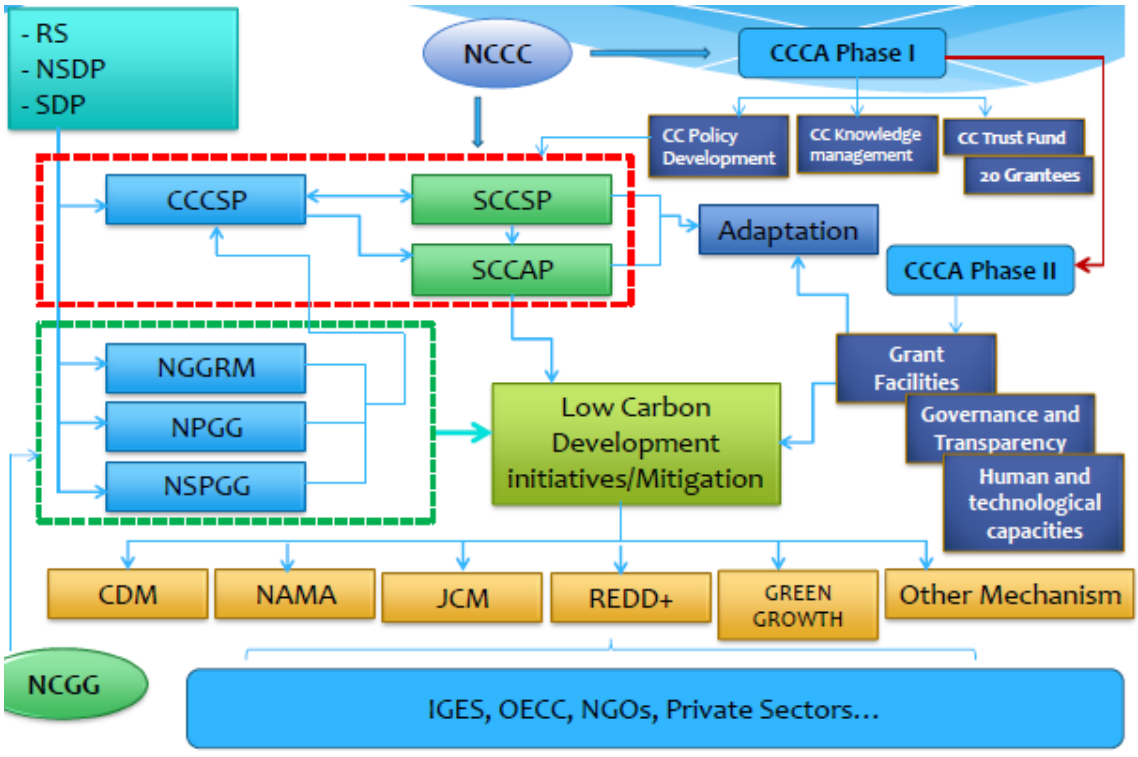


Figure 1-12：Strategy for Low Carbon Strategy in Cambodia

(Source: Towards Low Carbon Strategy in Cambodia, Seminar document of LoCARNet, 2014)

National Policy on Green Growth and National Strategic Plan on Green Growth (NGGSP) 2013-2030 was formulated in March 2013. NGGSP put emphasis on the balanced development between economic

development and environmental protection, cultural preservation, social stability and sustainable consumption of natural resources. NGGSP also includes the promotion of green investment by utilizing green technology.
In addition, “Cambodia Climate Change Strategic Plan (CCCSP) 2014-2023” was formulated and was positioned in the national policy in October 2013 for the climate change adaptation. The objective of this plan is to contribute to low-carbon development by reducing GHG in cooperation with the international society by considering the impact on national development and climate change. The detail action plan by each ministry was made in 2016. Following table shows the summary of CCCSP.

Table 1-6：Summary of CCCSP

Strategic Objective	Implementation Phase
1. Promote climate resilience through improving food, water and energy security 2. Reduce sectoral, regional, gender vulnerability and health risks to climate change impacts 3. Ensure climate resilience of critical ecosystems (Tonle Sap Lake, Mekong River, coastal ecosystems, highlands, etc.), biodiversity, protected areas and cultural heritage sites; 4. Promote low-carbon planning and technologies to support sustainable development; 5. Improve capacities, knowledge and awareness for climate change responses; 6. Promote adaptive social protection and participatory approaches in reducing loss and damage due to climate change; 7. Strengthen institutions and coordination frameworks for national climate change responses; and 8. Strengthen collaboration and active participation in regional and global climate change processes.	Immediate term (2013-2014) • putting in place institutional and financial arrangements for the implementation of the CCCSP • development of national monitoring and evaluation (M&E) frameworks and indicators • development of climate change action plans (2014-2018) by line ministries Medium term (2014-2108) • accreditation of the Adaptation Fund and Green Climate Fund • research and knowledge sharing and capacity development • launching some high priority projects/programmes in key sectors Long term (2019-2023) • research and learning to scale up success cases • mainstreaming climate change into national and sub-national programmes

(Source: CCCSP 2014-2023)

Cambodian government submitted mitigation plan for climate change to COP 21 under the framework of UNFCCC. Following table shows the priority actions and CO2 reduction target identified in each industrial sector.

Table 1-7：Mitigation actions in key sectors – aggregate reductions by 2030

Sector	Priority actions	GgCO2eq Reduction

Energy Industries	• National grid connected renewable energy generation (solar energy, hydropower, biomass and biogas) and connecting decentralized renewable generation to the grid. • Off-grid electricity such as solar home systems, hydro (pico, mini and micro). • Promoting energy efficiency by end users.	1,800 (16%)
Manufacturing Industries	• Promoting use of renewable energy and adopting energy efficiency for garment factory, rice mills, and brick kilns.	727 (7%)
Transport	• Promoting mass public transport. • Improving operation and maintenance of vehicles through motor vehicle inspection and eco-driving, and the increased use of hybrid cars, electric vehicles and bicycles.	390 (3%)
Other	• Promoting energy efficiency for buildings and more efficient cookstoves. • Reducing emissions from waste through use of biodigesters and water filters. • Use of renewable energy for irrigation and solar lamps.	155 (1%)
Total Savings		3,100 (27%)

(Source: Intended Nationally Determined Contribution to the UNFCCC submitted to COP21, 2015)

At COP22 in 2016 held in Morocco, Cambodian environmental minister Mr. Say Samal has mentioned that the implementation of CCCSP is important to achieve the target of INDC's. Furthermore, he also mentioned that Cambodia should make a long-term road map until 2030. On the other hand, he added more financial support is necessary for the mitigation of climate change, thus Cambodian government will simplify the process of applying to Green Climate Fund.

1.3.2. Related organizational structure

As an organization for implementing above policy and strategy, National Climate Change Committee (NCCC) and National Council of Sustainable Development (NCSD) were established at initial stage. However, the responsible organization for planning and implementing climate change related policy and program is now integrated into only NCSD due to the task duplication between NCCC and NCSD. NCSD is a cross cutting organization of several ministries and other related agencies such as MOE, MME, EDC, EAC and MOEF, chaired by Prime Minister Hun Sen and Minister of the Environment.

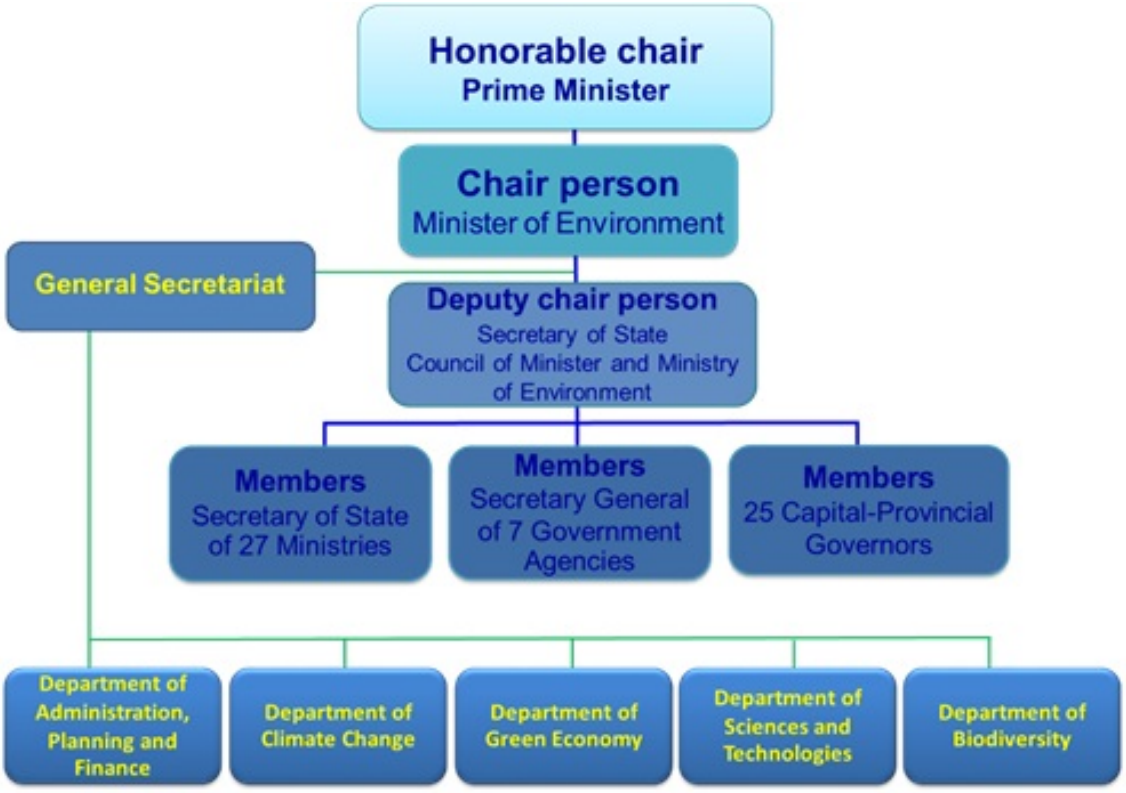


Figure 1-13：NCSD formation
(Source: Department of Climate Change website)

1.3.3. Policy for renewable energy business promotion

As a preferential treatment for promoting the renewable energy business, import duty of solar power generation equipment has been reduced from 30% to 7% in 2009. However, further policy support is necessary for the deployment of renewable energy business in Cambodia. At this moment, exemption of the import duty for the renewable energy-related equipment has been discussing in Cambodian government initiated by donor agencies.

Cambodian government also announced that they are promoting 10MW solar project at Bavet in Cambodia. According to EDC, with the support of ADB and AFB, they can complete this project and feasibility study for connecting solar generated electricity to national grid by the middle of 2017. Depend on this feasibility study result, they will make a conclusion of grid connection from solar and also FIT system. Solar Energy Association Cambodia has sent a proposal of net metering system to MME to start FIT in Cambodia as soon as possible.

2. Survey outline

2.1. Survey background and objective

2.1.1. Survey background

Siem Reap City locates north-west part of the Kingdom of Cambodia, 314km far from Phnom Penh capitol city, using National Road No, 6. According to the document from Mr. Sophean, who attended the City to City Collaboration Seminar in Japan, Siem Reap City has a land area of 10,299km^2, and has a population of 1,042,286. About the growth rate of population, it is increasing by 3%. The overview is as follows:

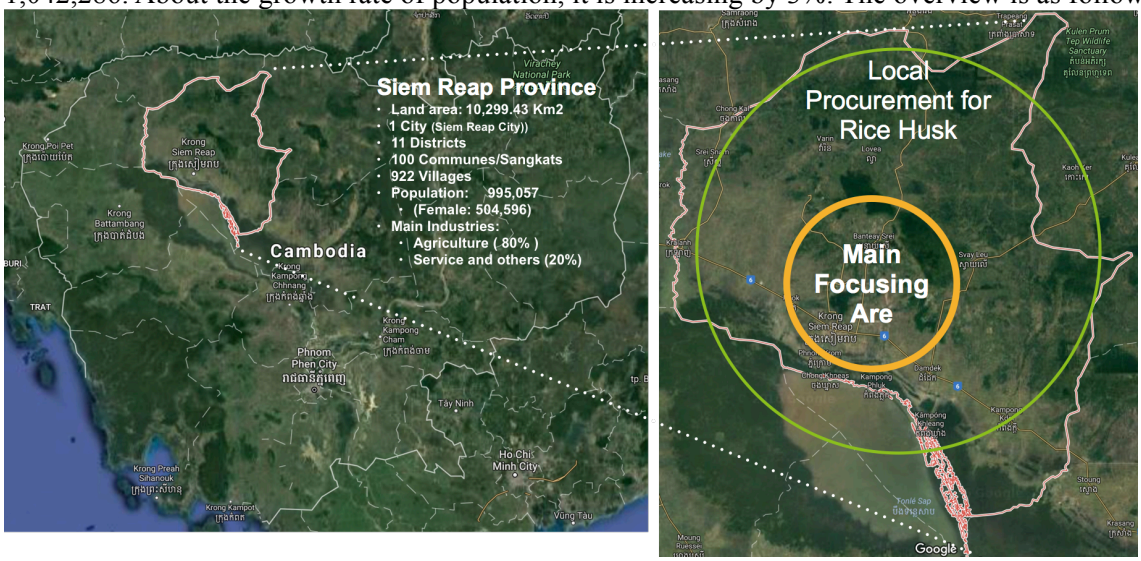


Figure 2-1 : Siem Reap Province and Main Focusing Area

Angkor Wat, world heritage site, is a temple complex located at the suburb of Siem Reap city. The population of the city is about 256,018 in 2015. Buildings and arts from the Khmer dynasty (during 9th to 14th century) are remained in Angkor Wat which was registered as a World Cultural Heritage of the United Nations Educational, Scientific and Cultural Organization (UNESCO) in 1992. Angkor Wat is a major tourist destination of Cambodia where annual tourist reached about 5.02 million in 2014, out of which 2.35 million tourists were from overseas. It has a great presence in the tourism sector which is a leading industry in Cambodia which accounts for over 10% of GDP.

However, due to rapid increase of the population and tourists, Siem Reap city and surrounding area of Angkor Wat are facing challenges of developing adequate infrastructures and environmental facilities such as: water supply, electricity and roads, waste disposal and wastewater treatment. In addition, air pollution is becoming a serious issue which is caused by the exhaust from vehicles without sufficient emission control measures, large diesel generators used in the hotel and open burning of the accumulated wastes. In order for Siem Reap city to achieve sustainable development as an attractive tourist city, the city is required to take actions to establish a low-carbon society.

The governor of Siem Reap province and the mayor of Siem Reap city have formulated a city master plan focusing on the improvement of "environment", "transportation", and "issue of squatters" to be the model "low-carbon tourism city" in Asia. Based on this masterplan, an individual action plans are being implemented. For its execution, experiences and know-how from Japan's local governments and Japanese private companies is strongly expected.

On the other hand, Japanese government is establishing a bilateral credit system called Joint Crediting Mechanism (hereinafter called JCM) to complement the scheme of "Clean Development Mechanism (hereinafter called CDM) in order to actively promote the deployment of Japanese low-carbon technologies and products to developing countries to contribute to the mitigation of global warming in a global scale. A bilateral document on the JCM scheme was already signed between Japanese Government and 17 countries

in Asia and Africa. Cambodian government is also starting to implement specific projects under JCM scheme and there is a great expectation in the deployment of Japanese carbon technologies in Cambodia.

During this project, the United Nations Framework Convention on Climate Change 21th Conference of the Parties (COP21) was held in Paris France from 30 November to 12 December 2015. The Japanese government delegation led by Mr. Maruyama, Minister of the Environment, praised the fact that COP decision including "Paris agreement", the legal framework, was adopted, and that it will be a fair and effective framework agreed by the participants from all countries.

22th Conference of the Parties (COP22) was held in Morocco Marrakech from 7th November, and Mr. Yamamoto, Minister of the Environment, as a representative of Japanese government, contracted “Paris agreement”. In the conference, Japan as a country assured to promote JCM more as one of the most significant issue. It is important to continue negotiation on the implementation guidelines of the Paris Agreement.

2.1.2. Survey Objective

Based on the mentioned background above, following survey objective were set for the “Fisical Year 2016, JCM Project Formulation Study for Realizing Low Carbon Cities in Asia, Project for Developing Low-CarbonTourism Cities through the Joint Crediting Mechanism in Siem Reap (thereafter called “the project”).

- Reduce the amount of energy-origin CO2 through “whole city approach”, faceted deployment and continuous project formulation in Siem Reap City. Performing two investigations for possibility survey, “Project for Installing photovoltaic (PV) modules on Rental rooftops of public high school”, and “Project for Developing Low-carbon biomass power generation using urban organic solid waste and rice husks to contribute a reduction for urban solid waste and taking adequate measures”
- Conduct survey to understand their needs as JCM Project Formulation Study for Realizing Low-Carbon Tourism City, for MME (Ministry of Mines and Energy), EAC (Electricity Authority Cambodia), EDC (Electricite Du Cambodge), and MOE (Ministry Of Environment)
- Conduct survey for Rooftop solar on the 5star Hotels and Hydroponic cultivation machinery in Eco village, aiming to acquire the Joint Crediting Mechanism in Siem Reap
- Conduct survey to apply for an equipment subsidy project using credits between 2 countries for next FY2017 (hereinafter JCM equipment subsidy).
- Conduct survey for realizing JCM equipment subsidy, “Survey to detect projects for installing solar power generation”, “Survey to promote eco mobility project and to improve the situation of tourism city traffic”, and “Survey to realize the indoor hydroponic farming using LED lighting”, as to seek the potential for JCM equipment subsidy collaterally

2.2. Survey item and methodology

2.2.1. Survey item

In order to move toward to the "low-carbon tourist city (low carbon tourist city formation that utilize JCM)" of Siem Reap City, the agreement for inter-regional local government cooperation was made between Siem Reap Province and Kanagawa Prefecture. Under the guidance of Kanagawa Prefecture, a grant application to the JCM equipment introduction project was attempted by targeting two sectors "distributed and independent renewable energy project (hereinafter called “renewable energy facilities introduction project”)" and “tourist city transport development project". In particular, renewable energy equipment introduction project targeted the "solar power generation facilities introduction project" and “Biomass power generation facilities introduction project”.

The Project carried out a review of the revised plan and future plans of energy sector and transport sector of the Siem Reap City Master Plan and proposed a strategy for low-carbon city development. However, for the

implementation of the Project, it was inevitable to examine entire region targeting not only neighboring provinces but the whole country. As a result, the Project also conducted JCM project formation feasibility study in Phnom Penh, Bavet and Poipet.

Asian Gateway Corporation (hereinafter AGC) implemented to consult for Global Environmental Center Foudation (hereinafter GEC) to realize the project, in order to apply for the JCM equipment subsidy for FY2017. Furthermore, AGC prepared to establish its subsidiary inside of Cambodia, in order to implement solar power generation facilities introduction projects in Siem Reap Province as well as within Cambodia.

The contents of the survey of this project are summarized as follows:

(1) Project for Developing Low-carbon biomass power generation using urban organic solid waste and rice husks to contribute a reduction for urban solid waste (hereinafter survey to introduce Biomass power generation equipment)

- Surveyed to realize the Biomass power generation equipment, sorting organic garbage from municipal waste and mixed-burning with rice husk.
- Surveyed the mixtured waste and the situation of fractionation in 5 star hotels
- Inspected dumping sight, and surveyed the real situation for urban waste processing
- Interviewed some urban waste processors and investers, and discussed improvement plan for urban waste processing system. Surveyed the development of fractionating center and recycle center, and reclaiming and renewing of the dumping sight.
- Visited rice mills in Siem Reap province, and surveyed the possibility for supplying rice husk.

(2) Surveys on the needs of potential JCM project

- For the "Tourist city transport development project", the survey was conducted last year to introduce of electric vehicle (Electric Rumomoto (Cambodia para-transit vehicle)) to improve the mobility of foreign tourists. This year, the survey team attempted to procure finances and prepared to establish operating company for the commercialization of "Angkor Mobility Service". As a complementary policy of "Tourist city transport development project", following potential investigation was carried out.
  - Feasibility study for the promotion of 2 wheeled electric bikes
  - Feasibility study for the promotion of 3 wheeled electric bikes

(3) Realization of inter-regional municipality cooperation

- Cooperation was achieved between Siem Reap province and Kanagawa Prefecture who has the know-how of establishing a low-carbon society. To promote the recognition of the meaning and purpose of this cooperation, kick-off meeting and seminars were conducted and action policy was organized.
- Surveyed to realize the low carbon tourism city using renewable-energy and saving-energy technology, introduced by Japanese government Kanagawa prefecture and its municipalities' law and technology.
- Attended to the JCM Seminar in Japan two times, from October 17th to 22th 2016, January 23th 2017, hosted by Ministry of Environment Japan.

2.2.2. Survey method and Survey outline

Survey procedures and outline of the survey content are summarized as follows.
As shown in the figure bellow, we surveyed focusing on 3 areas, inside of the Siem Reap city.

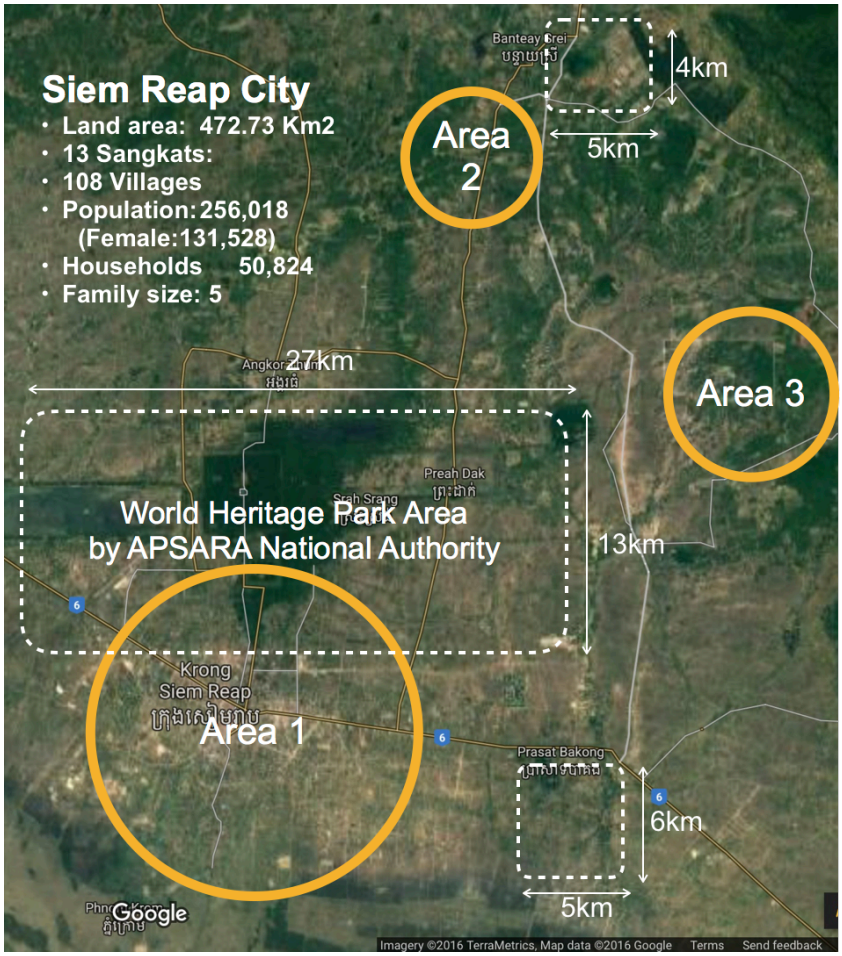


Figure 2-2: Area Map
(Source：Google Map, and edited)

Survey to introduce Biomass power generation equipment (Targeted sights are Area 1, 2 and 3 in the upper source.)

Through this project, aiming to realize the low carbon city to reduce the amount of energy originated CO2 in Siem Reap city by continuing project formulating. Continuing to propose for JCM facility support project by seeking the possibility to promote renewable energy and energy efficiency except rooftop solar power. Surveyed the existing and future projects about energy, environment and transportation in Siem Reap city, as follow:

1. Biomass power generation equipment installing project
2. Biomass power generation equipment installing project, mixed combustion urban waste and rice husk
3. Amorphous transformer installing project makings sure of interconnection from biomass power generation system

Summarizing the needs survey method for each potential project, as follow:

(a) Considering to realize the JCM project for biomass power generation system using rice husk

Some rice husk biomass power generation already started operation in Cambodia. However, profitability of biomass power generation is bad, and new comer for this business is not enough. Because the amount of rice husk is not enough and yielding is not stable, depending on situation through a year.

Through this project, gather rice husk from Siem Reap province and neighboring provinces, such as

Battambang and Banteay Mienchey, in one place in Area2 or Area3 in Siem Reap province. Implemented survey by setting a hypothesis that developing a biomass power generation using co-combustion of rice husk and urban waste, and supplying biomass powered electricity for local people and hydroponic indoor farming by LED. Implemented survey the possibility to install Japanese high technological rice husk biomass power generator into Cambodia.

Based on above consideration, investigated to realize the project for installing biomass power generation using co-combustion of rice husk and urban waste.

Surveyed the possibility for joint venture with local company which has interest for biomass power generation using rice husk, by considering the difficulty for fundraising. Reported these results for Siem Reap province and neighboring provinces, confirmed the contribution for the situation of electricity supplying, and got support to realize this project.

Implemented a chain of survey to realize the project of installing biomass power generation using co-combustion of rice husk and urban waste, and establishing AGC's subsidiary in Cambodia, as following figure. In parallel, surveyed to realize the project for community solar at same time.

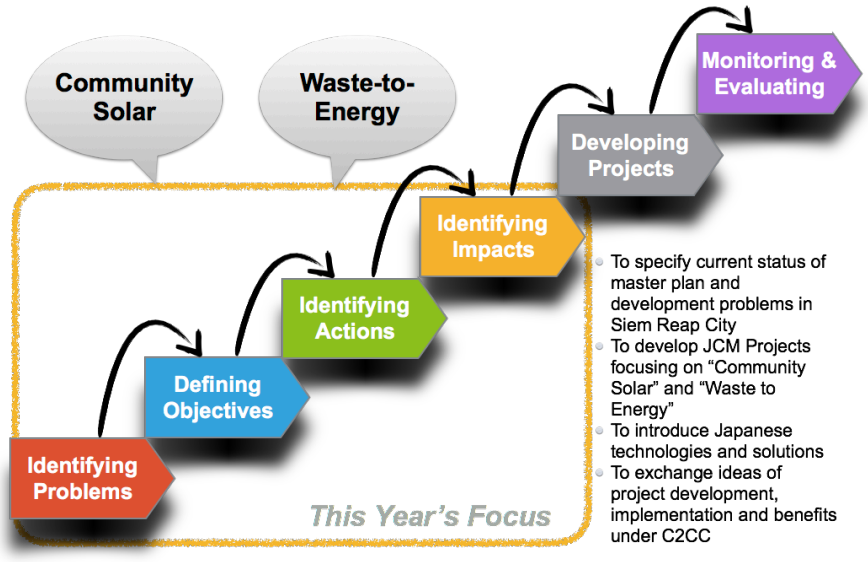


Figure 2-3: Methodology for the research

Outline for the project is systemized as follow. We had a kick off meeting with Siem Reap provincial government at May 20th, 2016, and shared the purpose and policy for this project together. Subsequently, we implemented each factor "Indentifying Problems", "Defining Objectives", "Indentifying Actions" and "Identifying Impact".

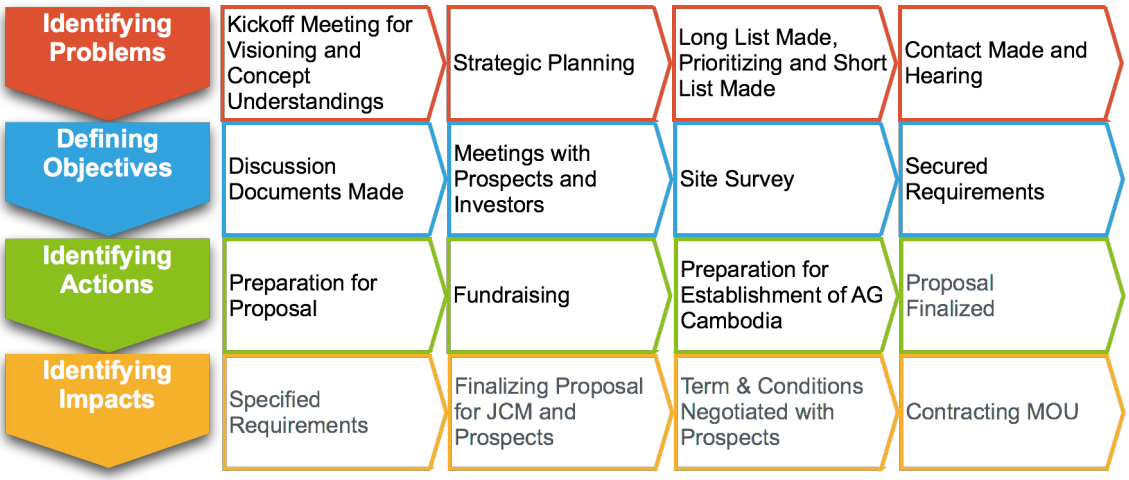


Figure 2-4: outline for the research

Inside of this outlines, important points are follow:

(i) Reviewed existing project and future plan of energy supply in Siem Reap city and within Cambodia, condition of connecting solar power to the grid, sales price and other related laws and regulations through interviewing EDC, MME and EAC etc.

(ii) Surveyed for the land which has the possibility to install the biomass power generation, and the company which has the possibility to have responsibility for EPC, in Siem Reap. Verifying problem in the case for connecting biomass power generation system into national grid, and anticipating for specification and the amount of generating electricity by solar power generation system.

(iii) Collaborated with Kanagawa prefecture as City to City Collaboration (hereinafter C2CC), we invited the very important 2 persons from Siem Reap province to Japan twice, introduced Kanagawa's experience and implemented case study for them by visiting certain companies. The 2 person joined to the seminar in Japan, and they had a presentation about "Green City" which tries to realize the low carbon society, and also explained about the system of waste treatment in a city, eco-mobility and installing solar panel on the rooftop.

(iv) Surveyed the possibility to collaborate with a local EPC partner and a turnkey provider which come from foreign country (including EPC and O&M, and they also provide project financing). Implemented the due diligence especially for financing with turnkey provider.

(v) Started to register AGC's subsidiary in order to implement JCM facility support project in Cambodia. The business plan for AGC's subsidiary will include EPC for rooftop solar (installing project), direct power marketing as Independent Power Provider (hereinafter IPP) including O&M, providing energy efficiency equipment, Hydroponic indoor farming using LED lighting and electric mobility, as they are all integrated. To have a clear view for those project, we implemented formulation of the projects, considering the risk and counterplan, financial projection and financial planning.

(vi) Prepared for the JCM facility support project, we signed cooperative business partnerships between some EPC partners and turnkey providers, and considered to make business plans and financing plans to install solar panels, depending on each prospective. Constituted International Consortium for each projects as an organization to implement JCM facility support projects.

(vii) Experienced to formulate performances and skills, and constructed implementation system to become a representative of International Consortium.

(viii) Considered whether to utilize the financial supporting scheme (such as JCM facility support project by MOEJ, cooperation project with JICA and Japan Fund JCM by ADB) with installer project, direct power marketing as IPP and Integration project.

(ix) MRV and PDD was done mailnly by OECC with JDI. Calculated the reduction amount of energy

origin GHG emission based on JCM's MRV methodology. About the MRV methodology, we prepared in English to be able to submit to JCM joint committee after requiring from MOEJ immediately. About PDD methodology, we also prepared in English to be able to submit to the third party selected by JCM joint committee immediately.

Other investigations to realize this project are summarized as bellow:

(b) Considering to realize JCM financing project for biomass power generation equipment using urban waste and rise husk
Consulted with Siem Reap city mayor many times to promote the city master plan and project management for the future. Figure out that there are 250 tons urban waste in a day and it continues to be increased every year. Proved that management for separation and collection, and straging and disposing for urban waste have a lot of problems. Suggested to install biomass power generation equipment, with arranging for current situation and solving problem, consulting with waste collection and transportation contractors. Implemented the survey to realize the biomass power generation equipment by using Japanese style.

(c) Considering the project to install high efficiency transmission and distribution equipment (hereinafter amorphous transformer) to realize as JCM
Implemented the survey to realize installing amorphous transformer, which needs Japanese technical skill, to Cambodia, and focused especially on cooperating with local company technically. Some suppliers, such as ABB, Thai Patanakit and THIBIDI, already implemented to import normal transformer to EDC.

(d) Considering the tourism city transportation development project to realize as JCM
Prepared for the survey to manage the running of e-moto and to promote the reuse of batteries by introducing e-moto in a 5star hotel in Siem Reap city and renting it for tourist. Suggested big companies and schools board member a business model to purchase e-moto for renting it for employees and staffs to commute. Fundraised to stat the project. Considered to change the situation for mobility service, by use e-trike as a substitute for Rumork-moto which is para transit. Elected good driver, supported by Rumork-moto association.

(e) Reporting for JCM potential project plan, MRV and PDD
Utilized gathered information, reported for JCM potential project plan. Through consulting for Japanese concerning companies, local concerning companies, neighbor concerning companies and international organization such as JICA and ADB, implemented survey about supporting scheme to realize the project such as JCM facility support project, JICA's cooperation project and JFJM by ADB, and all scheme are supported by MOEJ.

2.2.3. Survey Implementation Arrangement

(i) Implementation agency

Cambodia:	Siem Reap provincial government, Siem Reap city council, and APSARA Authority
Japan:	Japan Development Institute Ltd., Asian Gateway Corporation (AGC), Asahi Glass Co., Ltd, Finetech Co., Ltd, and Overseas Environmental Cooperation Center (OECC)

(ii) Relevant government agencies

Cambodia:	Electricite Du Cambodge (EDC), Electric Authority Cambodia (EAC), Ministry of Mines and Energy (MME), Ministry of Environment (MOE), Siem Reap rice millers association, and Siem Reap Tuk Tuk drivers Association

(iii) Municipality

Energy Department, Industry and Labor Bureau, Kanagawa Prefecture

(iv) Relevant donors
Japan International Cooperation Agency (JICA), United Nations Educational, Scientific and Cultural Organization (UNESCO)

Implementation arrangement is as follow:

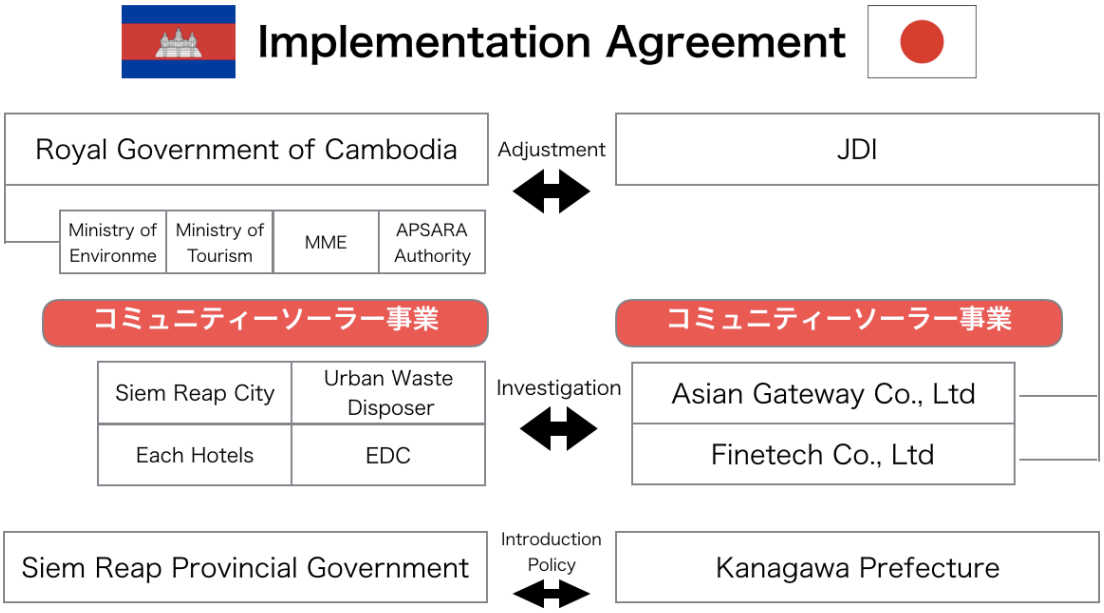


Figure 2-5: Implementation arrangement

2.2.3. Survey Schedule

Survey implementation list for this year is follow:

Day	JCM Formulation survey	Seminar on policies and regulations, Training in Japan	Presentation in the seminar specified by MOEJ
April, 2016	・ Considering the strategy to realize the low carbon tourism city using JCM scheme ・ Discussing with Japanese and Cambodian institution, and agreed for the investigation plan	・ Preparing and adjustment for kick off seminar	
May, 2016 (1st Visit)	・ Evaluated existing projects in Siem Reap City, and forecasted for future supply and demand ・ Implemented survey for connecting Biomass energy to the national grid, the electric price, and the other law concerning project	・ Kick off meeting with Siem Reap Provincial government	-

June,2016 (2nd Visit)	・ Implemented survey about garbage from Hotels in Siem Reap ・ Surveyed the possibility to cooperate with local companies (In Siem Reap and Bangkok) ・Discussed with Siem Reap city government how to proceed ・Survey for new project in Phnom Penh and Bavet	・ Exchanging opinion between Siem Reap Provincial government ・ Briefing Session in a hotel	-
July, 2016 (3rd Visit)	・ Surveyed the possibility to cooperate with local company (in Siem Reap and Bangkok) ・On site verification in certain 5 hotels ・Surveyed to realize the project in Area 2 and Area 3 ・ Considered the possibility to collect garbage from Hotels in Siem Reap city ・ Fundraising(in Bangkok and Phnom Penh) ・Investigated new project in Poi Pet	・Shared statement with Siem Reap Provincial and City government ・Kick off seminar in Cambodia	・ Prepared interim reporting to MOEJ
August, 2016 (4th Visit)	・On site verification to certain 5 star hotels ・Surveyed to realize cooperation with local company (In Siem Reap, Bangkok and Singapore) ・Surveyed to realize the project in Area2 and Area3 ・ Fundraising (in Bangkok, Singapore and Phnom Penh) ・ Fundraising for AGC's subsidiary (by angel investor)	・Shared statement with Siem Reap Provincial and City government ・ Prepared for seminar in Japan	・ Interim reporting to MOEJ
September, 2016 (5th Visit)	・ Produced planning for solar power project ・Surveyed to realize the project in Are 2 and Area 3 ・ Investigation MRV and PDD scheme ・Inspected for Poi Pet ・ Fundraising (in Bangkok, Sinpapore and Phnom Penh) ・ Fundraising for AGC's subsidiary (by angel investor)	・Shared statement with Siem Reap Provincial and City government ・ Prepared for seminar in Japan	-

October, 2016 (6th Visit)	・Offered advice for Japanese company ・Surveyed to realize the project in Area 2 and Area 3 ・Fundraising (in Bangkok and Phnom Penh) ・Fundraising for AGC's subsidiary (by angel investor)	・Shared statement with Siem Reap Provincial and City government ・Prepared for seminar in Japan ・Shared statement with Kanagawa-prefecture and Yokohama-city ・Inspection for companies in Kanagawa-prefecture	・Attended City to City Collaboration seminar in Kita-Kyushu-city
November, 2016 (7th Visit)	・Surveyed to realize the project in Area 2 and Area 3 ・Fundraising (in Bangkok and Phnom Penh) ・Offered advice for Japanese company ・Considering the project risk and countermeasure ・Made financial planning and financial planfor this project ・Prepared to establish AGC's subsidiary	・Shared statement with Siem Reap Provincial and City government	・Interim reporting to MOEJ
December, 2016 (8th Visit)	・Surveyed to realize the project in Area 2and Area 3 ・Considering project with turnkey provider ・Considered MRV and PDD scheme ・Agreed establishing AGC's subsidiary with local invester and made a contract	・Shared statement with Siem Reap Provincial and City government	-
January, 2017 (9th Visit)	・Surveyed to realize the project in Area 2and Area 3 ・Discussed to realize project with concerning companies ・Considering project with turnkey provider ・Started preparation for registering AGC's subsidiary ・Consolidating the result of investigation ・Considering MRV and PDD	・Attended to Seminar in Japan ・Shared statement with Siem Reap Provincial and City government	・Final reporting to MOEJ

	scheme		
February, 2016 (10th Visit)	・Considering project with turnkey provider ・ Consolidating the result of investigation ・ Started preparation for registering AGC's subsidiary ・ Wrote final report	・ Shared statement with Siem Reap Provincial and City government	

Table 2-1: Survey Implementation List

3. Investigate the suitability of installing biomass power generation using low carbon organic waste and rice husks, contributive to the reduction of urban waste.

This project is to set and manage the biomass power generation as one of renewable energy in Siem Reap province. As biomass power generation is significant for effective use of resources and does not discharge GHG, it suits for the concept of carbon newtral. The system of biomass is basically same as thermal power generation, and it uses biomass which means biological originated resources. There are some biomass types, one is woody biomass by using lumber waste and construction waste, other is bio-ethanol by using plants and another is bio-gass. Through this project, examined how to gather the resource and how it works for economic, and targeted for combustible urban waste and rice husk discharged from rice mill. Biomass power generation will success if securing for biomass fuel is good economically and continuously. Implemented survey to realize this project from the view of effective utilization of resources. Implemented technical survey for co-combustion burnable waste and rice husk.

3.1. Survey for the possibility to gather biomass fuel

To increase combustion efficiency, only burnable urban waste is not enough. Thus surveyed the possibility by setting hypothesis that it is better to co-combust rice husk, which is more than 80% of total, and urban waste together.
Considered the following points as the main investigation:

(i) Transition for the amount and price of rice husk imported to Thailand from domestic rice mill
(ii) Possibility to secure stable amount of rice husk in Siem Reap province
(iii) Types and amount of waste, and current processing system in 5star hotels in Siem Reap city
(iv) System of processing for urban waste, and the amount and cost of organic waste which can be separated
(v) Cost of securing and transportation for fuel, and cost for saving and storaging

3.2. Survey for the possibility to secure stable amount of rice husk

This survey is for the stable acquisition of rice husk in Siem Reap and to be use the main fuel to power up the Rice-Husk Powered Electric Generator and to supply stable and cheaper electricity within the vicinity of the proposed Eco Village in Siem Reap.

Siem Reap and its neighboring provinces has the full capability to supply enough rice-husk to power-up the entire Eco Village Community for at least 1 year. Cambodia needs more sources of cheap electricity and the use of rice husks as a renewable form of bio-fuel energy source is a big help to produce cheap electricity.

Through this research, AGC positioned ourselves as buyers and were classified as a direct-competitor for the local brokers. The Research team have visited 12 districts of Siem Reap province with a total of more than 500 km of road; tried to get in touch with association leaders, members of association and random residents to complete this report and finally, to take some pictures that will help to illustrate the research.

3.2.1. Schedule for the survey

Day 1: 20, November, 2016

Planned schedule and transportation to go to each area, with president of Commercial Chamber of Siem Reap province.

Day 2: 21, November, 2016

Siem Reap and Bakong area

No Rice Association Bakong, but close to Siem Reap and Sotr Nikum.
Surveyed with a member of Commercial Chamber of Siem Reap province, and president of rice miller association of Siem Reap province.

Day 3: 22, November, 2016

Surveyed Sotr Nikum and Svay Leu area
Surveyed with a member of Rice Leader Association of Sotr Nikum, and Elected Rice Leader Association of Svay Leu.

Day 4: 23, November, 2016

Chhea Kranh, boundary to Kampong Thom Province
Surveyed with a member of Rice Leader Association of Chhea Kranh.

Day 5: 24, November, 2016

Kralanh and Srei Snom area
No Rice Association Srei Snom, but close to Kralanh
Surveyed with a member of Rice Leader Association of Kralanh.

Day 6: 25, November, 2016
Pouk and Angkor Thom area
No Rice Association Angkor Thom, but close to Pouk and Siem Reap
Surveyed with a member of Rice Leader Association of Pouk.

Day 7: 26, November, 2016

Angkor Chum area
Surveyed with a member of Rice Leader Association of Angkor Chum.

Day 8: 27, November, 2016

Banteay Srei and Koulen area
No Rice Association, but close to Svay Leu and Sotr Nikum District.

Day 9: 28, November, 2016

Varin, boundary to Oddormeanchey province

No Rice Association, but close to Angkor Chum.

3.2.2. Investigation result

Gathered strong evidence that majority of Rice Mill Operators in Siem Reap Province prioritizes the supply of rice husks to Thailand, because of good buying pricing from Thai brokers. However, it is also obvious of their support and the willingness to cooperate to share their Rice Husk Supply to local operators, and they will use the rice husk to reduce the price of electricity as a common benefit for the people in Siem Reap.

Surveyed there is no contract and clause for the majority. Figured out that the operators was avoiding themselves to be locked from any fixed agreement and don't want to be blocked themselves from earning more as a result from the heavy demand of Thailand for rice husk.
However, our research also showed that operators are willing to reconsider the option of supplying their rice husk if the price is right, meaning similar pricing or better higher than Thailand buyers. The flexibility of Rice Mill Operators was clearly brought out and their willingness to support the good objective of our project is clearly mentioned in the research. Cooperation and negotiation can be done. As operators are willing to reduce the pricing, it should be proved that the rice husk can be used for a good cause with direct effect to the end consumer. Surveyed their disbelief for non-support by a domestic company, due to the poor coordination and weak relationship. Also figured out that a company gives cheaper pricing to rice mill operators compared to the price in Thailand. One of the biggest issue is that there is no rice husk market, answered by majority, and it simply explains that rice mill operators cannot expand their operation because of less demand on the rice export. According to the operators, what they milled is majority for local consumption only, and other countries like Thailand and Vietnam have overtaken Cambodia on the business of rice exportation to other countries.

Through constant interview with Rice Mill operators, visited a project site that has been operating for over 5 years, managed by Ied (Invest at Klong Village, Char Chhuk Commune, Angkor Chum District). They are using rice husk and fire burned wood for producing electricity to supply for town of Angkor Chum District. The people who managed the site refused to offer additional information, thus asked the residents for some questions pertaining to iED Invest.

Figured out that there are competitive local brokers who are willing to buy rice husk from rice mill operators with a higher price and sell it to Thailand brokers. These local brokers have their trucks and staff who are ready to collect the rice husk from rice mill operators. However, mobile rice millers are not the target of local brokers due to the less volume that they are producing. Mobile rice millers can contribute to the success of this project, if a proper distribution center or network will be created.

The largest benefit to be involved in such projects is to show to the public our positive stance on the ideology of local production for local consumption and the justification of support to the environment and clean development. To achieve public participation, it must be established a committee who will help and organize between international and local developers and local people, and they will also help to evaluate environmental issues appropriately from this project.

In this regard, it is important for local government to play its role to achieve the objective of this project, such as setting up proper tariffs, regulating supply for neighboring countries, and offering subsidies or less taxes for rice mill operators. They wish to contribute a significant volume supply of rice husk to be used as fuel on producing cheap electricity for people in eco-village and neighboring districts that don't have any electricity. Through acceptance and implementation of this project, it will contribute and be considered as a strong driving force on promoting green investment in Cambodia.

3.2.3. SWOT Analysis

SWOT analysis was brought up in this report to support the foundation for the steady domestic

acquisition for rice husk for local consumption, such as cheap electricity.

Strength:

- Rice Husk was proven as another good source of income for farmers and mill operators
- Rice husk market is mature and considered to be known by all farmers and mill operators
- Rice husk is a good source in Cambodia and has ability to supply for neighbor countries and local market, farmers and livestock operators
- Rice Husk was internationally recognized on the following uses:
  - Renewable fuel
  - Building material, such as fiber boards
  - White-ash and pure silica
  - Production of furfural which is industrial solvent
  - Cattle feed
  - Biodegradable tableware

Weakness:

- Part of the objections on the sales process, following weaknesses are recognized:
  - Limited resources in domestic, because of exporting to Thailand
  - Requires heavy machineries to collect
  - High cost for production fee, because of electricity from millers
  - High cost for logistics fee due to distance and collecting centers
  - Soft government regulation
  - Local governments set legal rules each other
  - Lack of patent protection

Opportunities:

- Influenced by the external environment, such as legal, political, technological, and cultural factors:
  - Soft governmental regulation, and political and legal rulings
  - Advanced technology and new usage for rice husk
  - Producing of new substitute
  - Growing trend and customer base
  - Unstable and unfixed tariff of market pricing
- Understandable that big rice millers hold the big volume of rice husk supply. Mobile rice millers also have big capacity of producing rice husk, but they only supply on spot delivery

Threats:

- Pointed below are about the production and sales process:
  - Price competition vs. Local brokers
  - Price competition vs. International brokers
  - Scarcity of supply
    - Due to high pricing and high demand on neighboring countries
    - Due to land and real estate development
- Storage and distribution by rice miller operators

3.2.4. Complemental information

Table3-1: Membership Association of Siem Reap Province

	District	Remarks
1	Siem Reap	- Pouk District is considered to be the biggest producer, while Sotr Nikum District is considered to be the second biggest producer of rice in Siem Reap Province. - Siem Reap rice miller association has added information that Oddormeanchey Province and one district from Banteay Meanchey, named Phnom Srok Disrtrict,is also included as the member of the association.
2	Sotr Nikum	
3	Chhea Kranh	
4	Kralanh	
5	Pouk	
6	Svay Leau	
7	Angkor Chum	

Table3-2: The List of non-membership districts in Siem Reap province

	District	Remarks
1	Bateay Srei	- They are considered not to be listed due to their small capacity of rice production. And any individual wants to invest for building rice mill to cater the farmers.
2	Angkor Thum	
3	Varin	
4	Srei Snom	
5	Prasat Bakong	

Illustrating the districts, which have their own formed association, are colored green, while the districts, which do not have or didn't joined the association, are marked in red. Showing the matter for the rice husk business operation.

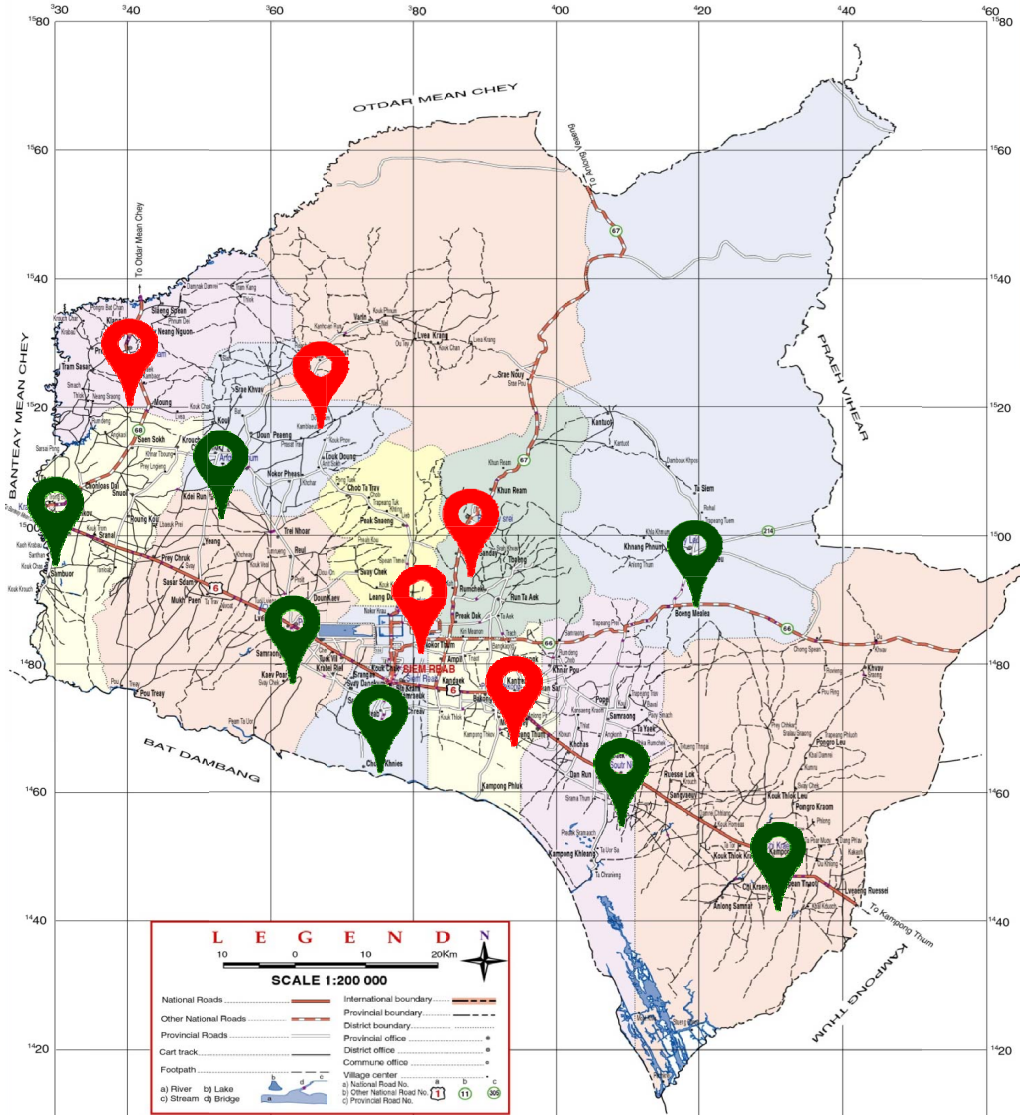


Figure3-1: Mapping for membership and association

Important photos during survey

Sample of Mobile Rice Millers

In districts, which are not associated in the rice mill association, majority of farmers rely on mobile rice millers. Surveyed that 1 basin filled with rice costs 1,000 Riels. Estimated that there are hundreds of mobile rice millers and farmers are willing to sell their rice husk for our biomass project.

Figure3-2: Mobile rice miller

Figure3-3: Back side of mobile rice miller

Figure3-4: Front side of mobile rice miller

Sample of Rice Husk (ash)

Rice operators are using rice husk ash as a fertilizer and their main buyers are local farmers. Selling by 1,000 Riel for a 25kg sack.

Figure3-5: Rice husk ash

Figure3-6: Rice husk sack

Sample of rice husk being delivered to Thailand boarder

Truck weighing 12 tons of rice husk at Pouk district, ready for embarkation

Figure3-7: Truck weighing 12 tons of rice husk

Sample of rice husk being delivered to Thailand boarder

Truck weighing 16 tons of rice husk, using pay loader at Sotr Nikum district, ready for embarkation

Figure3-8: Truck weighing 16 tons of rice husk

Biomass Gasification Power Plant

Invested by iED Cambodia, in partnership with iED France, at Klong village, Char Chhuk ommune, and

Angkor Chu district

Figure3-9: Signboard of iED at biomass gasification power plant

Biomass Gasification Power Plant

Ash and burning wood

Figure3-10: Biomass gasification power plant

3.3. Biomass Power Generation System by Finetech

3.3.1. Estimation of required amount for power generation

We try to install 200kW capacity of biomass power generation system. The biomass materials are rice husk and organic waste. Dry distillation gas is produced, by mix burning those materials in the dry distillation gasifier. And use it for boiler fuel to produce energy.

3.3.2. Materials

1) Material: Rice Husk

Rice husk is a good efficiency fuel for burning since it has less water content. However, it is important to secure the airflow path to burn the rice husk efficiently, because the bulk of rice husk is too light. It is the best way to pelletizing it or mix with other solid fuel.

Table 3-3: Composition of Rice Husk

Water	Ash (d.b.)	Volatile (d.b.)	Fixed Carbon (d.b.)	Heat Generation (kJ/kg)		Sulfur	Chlorine
				High	Low		
11.9	19.2	68.6	12.2	16,260	15,120	0.05	0.07

※d.b.：dry base、単位：%

2) Material: Organic Waste

Organic waste is discharged from hotel and house. Below data is from normal incineration facility in Nagano city. However, this data is for reference purpose only because the organic waste is hard to correct stably.

Table 3-4 : Composition of Organic Waste

Material (kh-wet)	Material (kg-dry)	Moisture Content (%)	Ash (%-wet)	Heat Generation (kJ/kg-wet)
1.000	0.528	47.0	5.0	7,740

3.3.3. Estimation of required material amount

We did an estimation of required material amount with a typical type of generator. We use four

type of generator for this estimation, binary generation, steam turbine generator, stirring engine generator, and screw type steam generator by company K. These are the typical generator in Japan.

1) Condition

Below table shows the generation efficiency for each generator type. This is for reference purpose only because the data can fluctuate depend on the condition of material.

Table 3-5 : Generation Efficiency, Machine Size and Generation Capacity

Generator Type	Generation Efficiency (%)	Generation Capacity （kW）	Machine Size
Binary Generator	3～10	dozens to several hundreds	small / medium
Stirring Engine Generator	10～20	dozens	small
Steam Turbine Generator	15～30	More than several hundreds	big
Screw Type Steam Generator	―――	dozens to several hundreds	small

Below table shows the specification of each materials

Table 3-6 : Specification of Materials

material	Lower Heating Value （kJ/kg）	Moisture Content (%)
Rice Husk	15,120	10～15
Organic Waste	7,740	45～65

2) Required material amount for each generator type

Table 3-5 to 3-7 shows that the required amount of materials in the case of single material burning and mixing materials burning for over 200kW power generation for each generator type. Percentage of each materials for mixing burning is fifty-fifty. The efficiency is calculated at the end of the system and using lower number of Table 3-3.

Table 3-7 : Required material amount for Binary Generator (Efficiency 3%)

	Single Burn		Mix Burn (% : fifty-fifty)
	Rice Husk	Organic Waste	
Amount (ton/day)	54	105	**71**
Power Generation(kW)	202.0	201.1	**200.8**

Table 3-8 : Required material amount for Stirling Engine Generator (Efficiency 10%)

	Single Burn		Mix Burn (% : fifty-fifty)
	Rice Husk	Organic Waste	
Amount (ton/day)	40	78	**53**
Power Generation(kW)	201.3	200.9	**201.6**

Table 3-9 : Required material amount for Steam Turbine Generator (Efficiency 15%)

	Single Burn		Mix Burn (% : fifty-fifty)
	Rice Husk	Organic Waste	
Amount (ton/day)	27	52	**36**
Power Generation(kW)	203.8	200.9	**205.4**

Table 3-10 : Required material amount for Screw Type Steam Generator (Efficiency 14%)

	Single Burn		Mix Burn (% : fifty-fifty)
	Rice Husk	Organic Waste	
Amount (ton/day)	20	39	**27**
Power Generation(kW)	140.9	140.6	**143.8**

The most efficient system is steam turbine generator as mentioned above tables. However, this system is normally used for the huge capacity such as mega wat level. 200kW is not impossible but it might cost a lot for initial investment and operation cost despite of the small power generation.

3) Operation Condition

Operation condition for the system are as below.

① Daily 24h and annually 300days operation. Alternately use the two dry distillation gasifier system. (8h per one system × 3 batches)
② Switching of dry distillation gasifier must be done at non-fluctuate moment of gas emission. (stabilization of steam amount)
③ Fuel for rising temperature, incinerate temperature down, circulating water, and labor cost needs to be considered separately.
④ Organic waste must be similar variety each time.
⑤ Water source must be secured for each generator.

3.3.4. Power Generation Experiment with expected waste

We had a power generation experiment with expected waste. Experiment was divided into two parts with binary generator and stirring engine generator. We expect the type of waste and corrected it in Japan. This experiment has also a purpose of effectiveness evaluation of carbonizing machine.

We used a semi-carbonizing machine to evaluate the increase of burning efficiency. It is expected that the burning efficiency can be improved by increase the energy density of material by semi-carbonizing it. Energy density can be increased to 120% to 140%, but depend on the materials.

Below photo is a mobile semi-carbonizing machine.

Figure 3-11 : Mobile Semi-Carbonizing Machine

Below figure is a structure of this system.

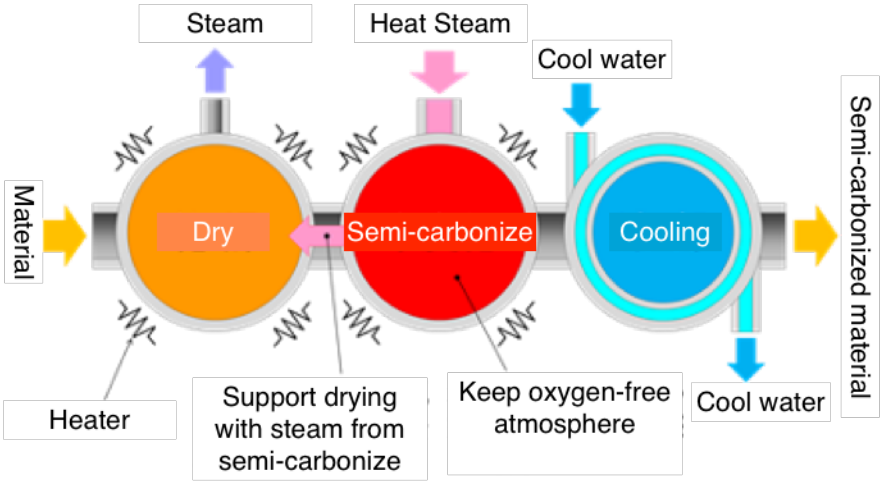


Figure 3-12 : Semi-carbonized machine structure

Semi-carbonizing has several superiorities compare to conventional dry or carbonized method as below.

- Reduce the volume and weight without losing material energy
- Easy for transportation by reducing volume and weight
- Reduce the fuel cost by shorten the processing time
- Possible to store in outside because the semi-carbonized material has better

hydrophobicity

Below photo is a pelletizer machine and produced pellet made of the organic waste and rice husk.

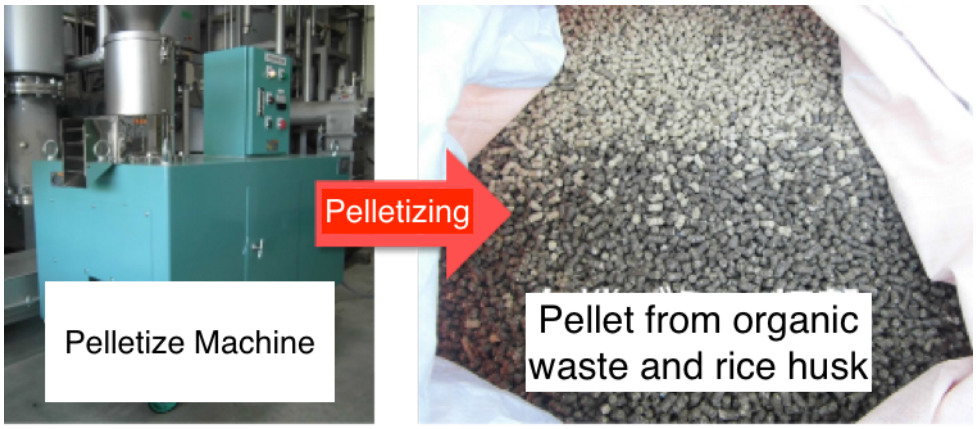


Figure 3-13 : Pelletize of organic waste and rice husk

Mobile Semi-Carbonizing Machine has below advantages.

- It is safety even in the case of gas leaking because it is using just a heat steam for drying and heating of material. Also, is has a sterilization function with 200℃ temperature
- It is possible to carry this machine to the material site in the case of the material cannot bring out to outside of the facility

There are several disadvantages of this machine which should be considered carefully with other equipment.

- Incineration without semi-carbonizing is less operation cost in the case of huge material consumption (over 10 ton/h) or high temperature combustion (over 1,000℃) facility.
- Semi-carbonization machine itself doesn't have a function for palletization. It is required to prepare palletization machine with this machine.
- The moisture content of material going to nearly 0% by semi-carbonizing it. However, it requires water about 10% to pelletize it. (wasting carbonizing energy)

3.3.5 Power Generation Experiment with dry distiller gasifier + binary generation

1) Experiment method and system

Generate the power from the dry distiller gasifier by following material producing method.

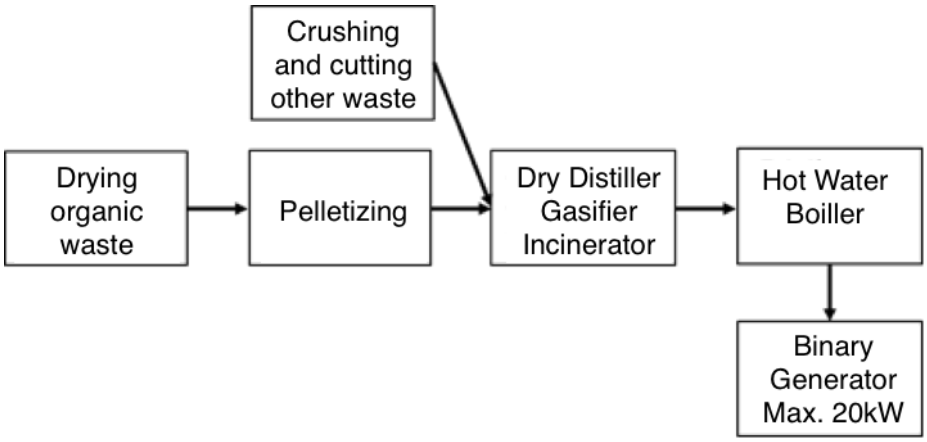


Figure 3-14 : Experiment method

Below figure shows that the system of dry distiller gasifier and binary generator

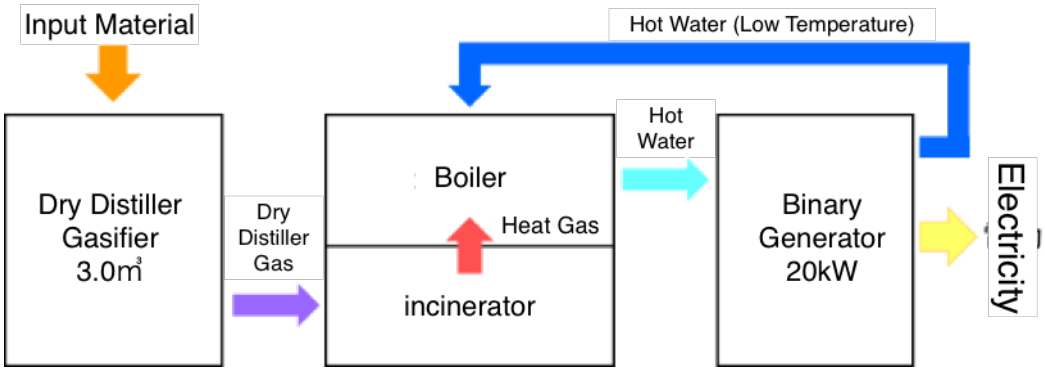


Figure 3-15 : System Structure of dry distiller gasifier and binary generator

a) Panoramic View

b) Incinerator

c) Gas Correcting

d ） Window of Incinerator

e ） Binary Generator

Figure 3-16 : Dry Distiller Gasifier and Binary Generator

This system is suitable for mixing many variety of materials. However, if the moisture level is high in its material, it produces less energy. Thus, we used a semi-carbonized and pelletized material by using semi-carbonizing machine by company FTC.

The organic waste components in that case is as below.

Table 3-11 : Waste from Kitchen

Name	Vegetable-1	Vegetable-2	Fruits	Vegetable-3	Meats
Weight Ratio (%)	18	18	10	10	8
Weight (g)	3,600	3,600	2,000	2,000	1,600
Name	Fish	Egg	Crops	Kitchen Garbage	Oils

Weight Ratio (%)	10	2	20	4	Certain amount
Weight (g)	2,000	400	4,000	800	Certain amount

※ Total Weight Ratio：100%, Total Weight：20,000g

The contents of material that we input into the dry distiller gasifier are states as below table.

Table 3-12: Contents of materials

Input Order	Name	Input Weight （kg）	Weight Ratio （wt%）
11	Food Waste / Wood Pellet	45.0	7.6
10	Natural Rubber Board, EPT Rubber Board	17.6	3.0
9	Cardboard Box	9.5	1.6
8	RFP	54.7	9.2
7	Industrial Waste	58.7	9.8
6	Cardboard Box	18.5	3.1
5	Food Waste / Wood Pellet	73.0	12.2
4	Natural Rubber Board, EPT Rubber Board	51.8	8.7
3	RFP	182.0	30.5
2	Industrial Waste	20.3	3.4
1	Cardboard Box	45.0	7.6
———	Wood Pallet, Newspaper (For ignition)	20.0	3.4
Total		596.1	100.0

Material photos are as below.

Figure 3-17 : Food Waste / Wood Pellet

Figure 3-18 : Natural Rubber Board, EPT Rubber Board

Figure 3-19 : RFP

Figure 3-20 : Industrial Waste

Figure 3-21: Cardboard Box

Figure 3-22 : Wood Pallet, Newspaper (For ignition)

2) Product from each organic waste

Organic waste such as food waste consists a lot of moisture inside, and the mixed products has a viscosity. The high moisture ratio and high viscosity of material decreased the efficiency of semi-carbonized process. High moisture content required much heat for drying, and high viscosity is disadvantage for transporting, and it is bad heat transfer coefficient for heating source such as heater or heating steam.

- Materials are 80% consisted by waster, and productive ratio compare to input amount is small
- Heating level is same as normal semi-carbonize machine, and it can be used as fuel
- Size of organic waste is varying. Moisture content and condition after the process are varying as well.

3) Experiment Result

① Ignitability

Material Ignite Time: 10:40am

Self-ignition Start Time: 11:44am

Duration until self-ignition: 64min

The material in this experiment has good ignitability

② Condition of self-ignition

Self-sustained combustion: 3h 22min.

Combustion Temperature: Keep 1,000℃

Combustion Gas Amount: Average 1,009Nm^3/h

Figure 3-23 : Temperature Control Meter

③ Heat Recovery

Power generation during the self-combustion was 12.8kWh.

④ Condition of ash

Calcification over all. Ignition loss was good number (4.0wt%) measured by electric furnace.

Table 3-13: Condition of Ash

Ash Weight	52.6 kg
Ash Volume	0.19 m^3
Residue Rate (weight)	8.8 wt%
Residue Rate (volume)	6.4 vol%

Figure 3-24 : Ash

⑤ Exhaust Gas Components

Concentration of SO_2 and HCl which can be a reason of corrosive gas were low level. The average during the self-combustion measured at chimney are shown at below table.

Table 3-14: Emission Gas Components

CO Concentration (ppm)	HCl Concentration (ppm)	NO Concentration (ppm)	SO_2 Concentration (ppm)
2	5	203	18

⑥ Conclusion

Generation Output: Max.10kW (Average 3.3kW)

Total Generation: 26.8kWh (Self-combustion 12.8kWh)

Generation Efficiency: About 1.4% (estimate)

- Normally, generation efficiency is high when the system size is large and material is single. In the reference in Europe, 13% by boiler and organic ranking cycle. In this experiment, the small quantity and many variety of materials is not efficient. Binary generation cannot be expected to increase the efficiency increase.
- Some of the material in this experiment was high calorie and big difference of size and calorie by each material, and caused unstable operation control. Thus, the amount of gas was higher than planned, and not good efficiency.

3.3.6. Power Generation Experiment with Dry Distiller Gasifier and Stirring Engine Generator

1) Experiment method and system

Generate the power from dry distiller gas as below.

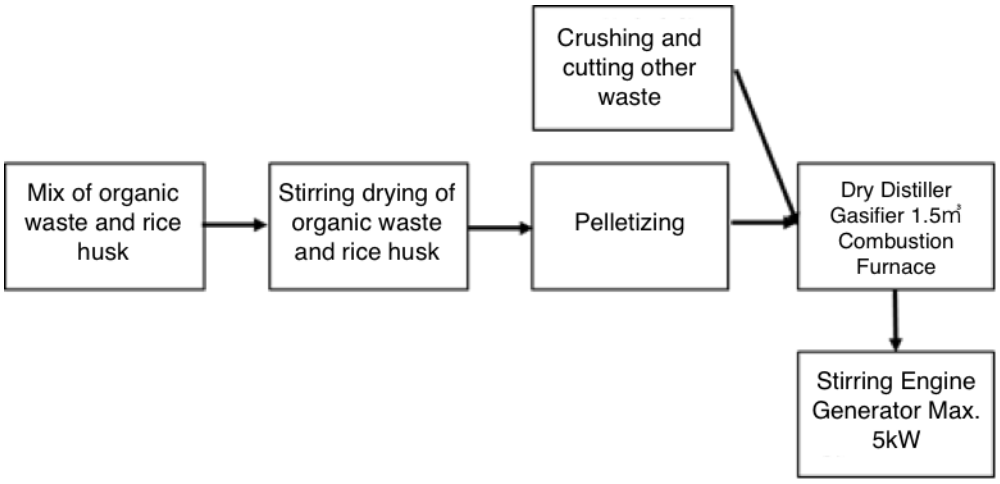


Figure 3-25 : Experiment Method

Below figure states that the equipment system with dry distiller gasifier and stirring engine generator.

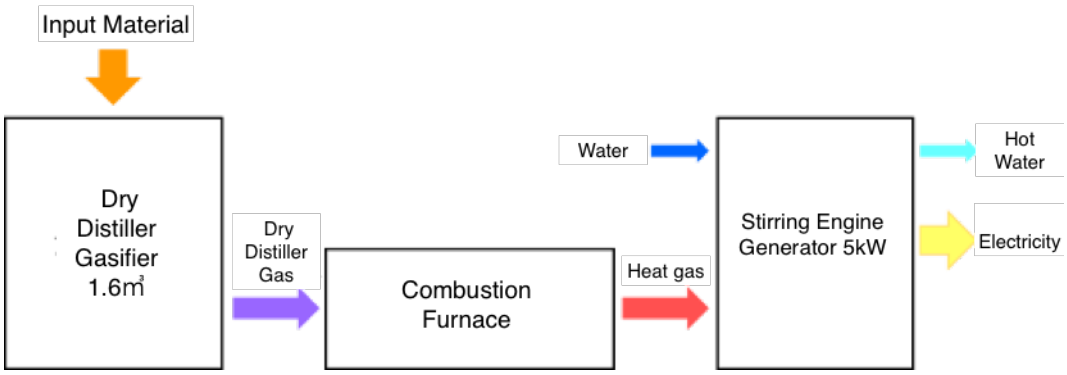
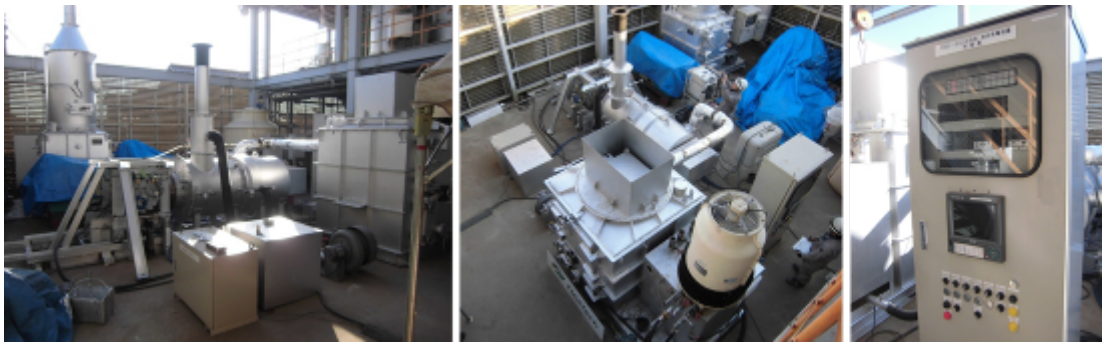


Figure 3-26: System Structure of Dry Distiller Gasifier and Stirring Engine Generator



a） Panoramic View　　b） Panoramic View (Above)　　c） Controlling Box

d） Stirring Engine Generator Controlling Panel　　e） Dry Distiller Gasifier Temperature Measure

Figure 3-27 : Dry Distiller Gasifier and Stirring Engine Generator

Available food waste, rice husk, and wood pellet is used to make a mix material as a fuel of power generation experiment. Mixing amount for each are 25kg of organic waste, 37.5kg of rice husk, and 9kg of wood pellet. The components and photo of each materials are as showed in below.

Table 3-15: Food Waste Components and weight

Name	Crops	Noodle	Meat	Fish	Bean
Weight percentage (%)	70	3	6	3	5
Weight (g)	7,000	300	600	300	500
Name	Vegetable	Egg	Fruit	Sea Weeds	Oil
Weight percentage (%)	5	1	2	4	1
Weight (g)	500	100	200	400	100

※ Total Weight Percentage 100%, Total weight 10,000g

Figure 3-28 : Food Waste

The materials that inputted into the dry distiller gasifier for power generation area as below.

Table 3-16: Inputted Materials

Input Order	Name	Input Weight (kg)	Weight Ratio (wt%)
6	RPF	90.0	30.0
5	Food Waste / Wood Pellet	71.5	23.8
4	Natural Rubber Board	18.0	6.0

3	EPT Rubber Board	14.0	4.7
2	Industrial Waste	12.0	4.0
1	Food Waste / Wood Pellet	92.5	30.8
———	Newspaper (for ignition)	2.0	0.7
Total		300.0	100.0

Inputted materials are shown as below.

Figure 3-29 : RPF

Figure 3-30 : Food Waste / Wood Pellet

Figure 3-31: Natural Rubber Board

Figure 3-32 : EPT Rubber Board, Industrial Waste

2) Product from each organic waste

By mixing the rice husk uniformly into mixed materials, the materials can control the moisture and restrain the high viscosity. It has a better efficiency than the material of experiment with dry distiller gasifier and binary generation.

- Stable product by restraining the moisture and viscosity
- Heating level is same as normal semi-carbonize machine, and it can be used as fuel
- Rice husk has much ash, and it is not changed after the process. Total calorie is lower than normal fuel.

3) Experiment Result

① Material Amount

Total Weight: 300kg

Input Volume: 0.666 m^3

Bulk Specific Gravity: 0.450 t/m^3

② Operation duration, power generation amount

Operation duration and power generation amount are shown as below table.

Table3-17: Operation duration, power generation amount, fuel amount

	Warming up	System start	Self-combustion	Incineration	Cooling

Duration	1.1hr only burner	0.6hr Ignition to self-combustion	7.2hr	2.0hr 21:00 Forced Outage	2.6hr
SE generation amount	0.4kWh	2.3kWh	24.3kWh	6.4kWh	0.4kWh

① Exhaust Gas Constitute

Below table shows that the average concentration of exhaust gas during the self-combustion.

Table 3-18: Average Concentration of Exhaust Gas During the Self-combustion

NO instantaneous magnitude	SO_2 instantaneous magnitude	CO instantaneous magnitude	O_2	(CO_2 conjecture)	(N_2 conjecture)
128 ppm	0 ppm	20 ppm	7 vol%	13.95 vol%	79.05 vol%

② Combustion Condition

Combustion Temperature (Stirring Engine Entrance Temperature): 795℃ (Average during the self-combustion)

Stirring Engine Exit Temperature: 636℃ (Average during the self-combustion)

Exhaust Gas Amount (at chimney ejector) : 284～245Nm^3/h、average 264.5Nm^3/h

③ Conjecture of Gas Calorie

Gas specific heat is set as below based on exhaust gas constitution.

Gas Specific Heat : at 800℃ : 0.3875kcal/Nm^3・℃

Engine Entrance Gas Calorie

= Temperature 795℃ × Gas Amount 265.4Nm^3/h × Gas Specific Heat 0.3875kcal/Nm^3・℃

= 81’759.8kcal/h = 95.1kW

④ Engine Cooling Water

Circulation Water: 30L/min.

Temperature Engine Entrance: 14.2℃

Engine Exit: 19.4℃

⊿T: 5.2℃

⑤ Condition of Ash Residue

Condition of ash residue is described as below.

Table 3-19: Condition of Ash Residue

Weight of ash residue	47.0kg	Decrease percentage	84.3wt%
Volume of ash residue	0.145m^3	Decrease percentage	78.2vol%

⑥ Conclusion

Generation Output: During Self-Combustion Max. 5.010kW (Average 4.740kW)

Total Generation: 43.2kWh (Self-combustion 34.3kWh)

Generation Efficiency: About 4.3% (estimate)

- There is a possibility of power generation using exhaust gas. Because the generator input heat gas temperature was 800℃, and temperature after the replacement of generator was 640℃. It is possible to improve the total efficiency by connecting same type of generator on the back side and use exhaust gas.
- The capacity size of this system "Dry Distiller Gasifier + Stirring Engine Generation" is still small since it's under development process. It is expected to improve the efficiency by enlarge the capacity size in the future.

3.3.7. Comparison of dry distiller gasifier system

The capacity of 200kW of power generation is needed in this project. Single power generation capacity for each generator is as below.

Table 3-20: Single Capacity of Each Generator

Generator Type	Generation

	Capacity
Binary	～200kW
Stirring Engine	～50kW
Steam Turbine	100kW～
Screw Steam※1	132kW、160kW

※1　Catalog of Screw Steam Generator by Company-K

1)　Binary Generator

Only one system can produce 200kW, however, it requires the largest amount of materials compare to other system. Initial cost is the lowest compare to other, and installing land size can be small.

2)　Stirring Engine Generator

In Japan, under 10kW is treated as a normal electrical handicraft since 2014, lots of products are sold and it doesn't need any notification or appointing chief engineer. But, if the total capacity requires 200kW, it is unreal to install 20 system of 10kW (9.9kW) generator.

3)　Steam Turbine Generator

It is possible to produce over 100kW by single system. This is the highest efficiency system compare to other system. Initial cost is the highest and installation land is large. However, installing only one steam turbine generator is much less expensive rather than installing several stirring engine generators.

4)　Screw Steam Generator

This is a system manufactured by only company-K. They have a reference plant of generation combination with their binary generator on proposal leaflet "Direct Combustion Type High Efficiency Small Size Biomass System".

3.3.8.　Selection of generation System

Based on this study, we select Screw Steam Generator because it is well distributed and save much space. And we selected Dry Distiller Gasifier and Steam Boiler for producing steam system. We choose a hybrid generation type with binary power generator from a reference of company-

K.

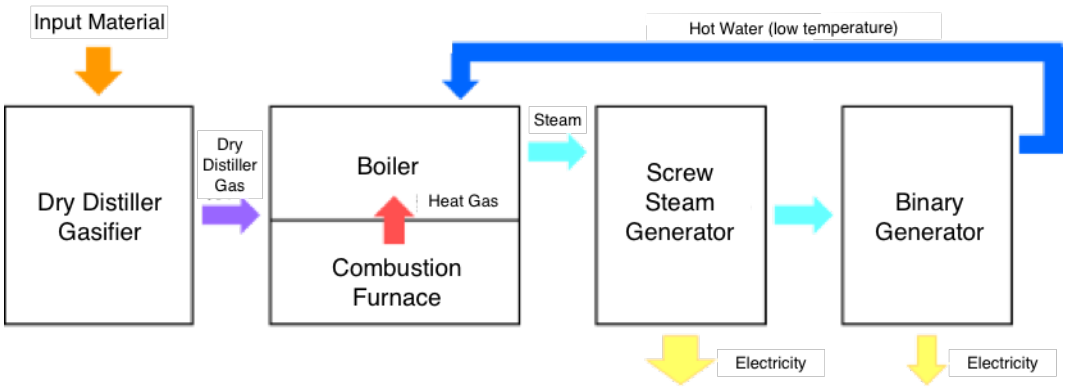
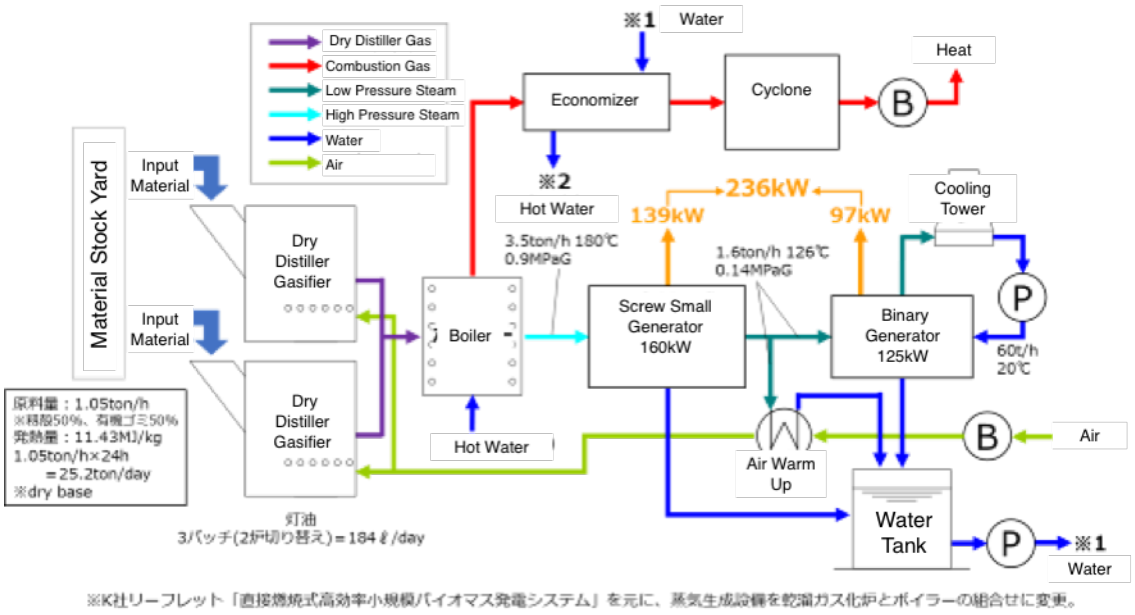


Figure 3-33: Generator Hybrid System

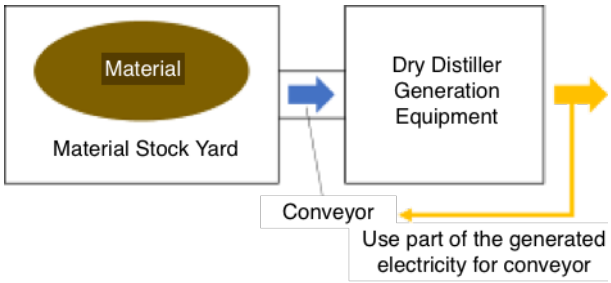
It is possible to reduce the non-generation time by running only binary power generation by bypassing screw steam generator in the case that it cannot sustain the steam amount or pressure into screw steam generator because of the lack of materials or heating level from materials. (It is no problem if the components or amount of material is stable)

3.3.9. Generation System

System structure of total equipment in this project is described as below figure. Dry distiller gasifier is batch type, thus single operation assumes that 8hours cycle of “Warming Up → Combustion → Cooling”. We use two dry distiller gasifiers by replacing each other since it is a 24hour operation.



a ） Generation System : Generation Equipment



b ） Generation System : Material Stockyard

Figure 3-34 : Generation System and Material Stockyard

1) Consumption of Fossil Fuel

This system uses kerosene as a fossil fuel to use the burner to ignite the material in dry distiller gasifier. Usage amount is 184L/day. This is a case of using two dry distiller gasifier system by switching each other in three batches per day.

We did incineration in the experiment. However, we assumed that it does not do the incineration in the actual project but take a carbon residue and use it for soil improvement material for farm in surrounding area. This carbon residue is made from rice husk that contains the silicon which is useful for growing the plant.

2) Sellable Electricity

The electricity produced in this plant is partly consumed in this machine, and rest is sold to surrounding residence or facilities. Below calculation is a simulation for selling electricity.

Electricity Generation: 139kW (Screw Power Generator) + 97kW (Binary Power Generator) = 236kW

Electricity Consumption: 100kW (Generation Equipment) + 20kW (Stockyard) = 120kW

Selling Electricity: 236kW – 120kW = 116kW

3) Initial Cost

Engineering fee, machine and other material cost are totally assumed as below.

Materials	：$4.0 million
(including machine, pipe, cable, utility, engineering fee)	
Construction	：$1.0 million
Total	：$5.0 million

Above cost might have a possibility for reconsideration in the case of procuring some part of material in local to reduce the cost or improve the CO2 reduction efficiency. Labor for operating this system requires 3 people × 3 shift = 9 people totally. However, we need a further research about the labor cost and lighting or fuel expenses.

3.10. Organizing MRV methodology for biomass power generation

Decided to implement survey at eco village as a candidate site of biomass power generation, however we could not make as a result, as follow:

(i) Fundraising

(ii) Specifying off takers and Anticipating the amount of electricity consumption

(iii) Procurement rout for organic waste and ensuring to get stable amount of rice husk

(iv) Procurement route for rice husk and ensuring to get stable amount of rice husk

(v) Detailed estimation for EPC cost

Thus, MRV methodology and PDD for this survey are based on hypothesis. The results are shown as follow:

3.10.1 MRV methodology for biomass power generation

A. Title of the methodology

Biomass Power Generation using Organic Wastes

B. Terms and definitions

Terms	Definition
Biomass power generation	Taking organic resources derived from organisms such as cereals and waste food as a source/fuel (biomass), and directly combusting it, or gasifying it and then combusting it, to turn a rotating body using the vapor or gas produced, in order to generate electricity.
Dry distillation (carbonization) gasification furnace	Pyrolytic equipment (dry distillation) to heat (in an absence of oxygen) husks and organic wastes in a furnace so that they burn (spontaneous combustion). As a result of pyrolysis, water, carbon dioxide and flammable gas are produced, with carbon and carbonates left over as residue.
Compact screw-type steam generator	This generator is driven by torque provided by steam which expands as it passes through a screw from the air inlet to the exhaust. Its power generating efficiency is high because, unlike the conventional steam turbines, there is no need to inject steam at high speed from a nozzle, and thus there is minimal losses such as pressure loss etc.
Binary generator	Using the thermal energy (heat source) of steam or hot water at a relatively low temperature (around 100℃), this equipment generates electricity from a turbine propelled by a medium with a low boiling point.

C. Summary of the methodology

Items	Summary
GHG emission reduction measures	While the hydroponic farming and nearby residents would rely on the micro-grid power supplied by a diesel-fueled power generation system if the present biomass power generation system is not introduced, GHG emission is reduced by partly displacing the power generated by the diesel-fueled system with the power delivered at the transmission point from the present biomass system. In order to measure GHG emission reduction according to the MRV methodology, the total amount of electricity delivered by the biomass power generation system is monitored at the transmission point after deducting the in-house consumption. All other monitoring items will be the default values in principle. However, the present MRV does not prevent from reviewing these default values when found reasonable, taking into consideration the impact on the overall reduction while upholding the conservative principle as well as the robustness to withstand the evaluation by third party entity.
Calculation of reference emissions	Reference emission is the CO2 emission from the electricity generated by the diesel-fueled power generation system, which is equivalent to the electricity delivered to the micro-grid at the transmission point by the biomass power generation system.
Calculation of project emissions	(1) GHG emissions in exhaust gas from dry distillation gasification power generation (biomass power generation) using husks and organic wastes (2) GHG emissions from kerosene used in dry distillation gasification furnace

<table>
<tr><td></td><td>(3) GHG emissions from trucks carrying husks and organic wastes</td></tr>
<tr><td>Monitoring parameters</td><td>Monitoring parameters and measuring frequencies
<table>
<tr><th>Parameter</th><th>Measuring frequency</th><th>Explanation</th></tr>
<tr><td>Amount of electricity delivered to the micro-grid at the transmission point by the biomass power generation system</td><td>Hourly/Daily</td><td>Net power generation after deducting in-house power consumption</td></tr>
<tr><td>Volume of husks delivered</td><td>Daily</td><td>Measured at intake hopper</td></tr>
<tr><td>Volume of organic wastes delivered</td><td>Daily</td><td>Measured at intake hopper</td></tr>
<tr><td>Volume of husks transported</td><td>At time of each delivery</td><td>Weighed at truck scale</td></tr>
<tr><td>Volume of organic waste transported</td><td>At time of each delivery</td><td>Weighed at truck scale</td></tr>
<tr><td>Amount of kerosene consumed</td><td>At time of each purchase</td><td>Based on purchase slip</td></tr>
</table></td></tr>
</table>

D. Eligibility criteria

This methodology is applicable to projects that satisfy all of the following criteria.

Criterion 1	Husks from rice mills (50%) and organic waste from urban areas (50%) is fed into gasifying furnace as feed stock, and a boiler is introduced, which uses the gas generated from such gasifying furnace.
Criterion 2	A biomass power generation system is introduced equipped with a compact steam generator which uses the steam generated by the boiler and a binary

	generator which uses the exhaust heat (exhaust steam) from the compact steam generator.
Criterion 3	The electricity supplied to hydroponic farming and residents in unelectrified area by an existing diesel-fueled power generation system is partly displaced.
Criterion 4	Biomass power generation system takes into consideration air pollution caused by exhaust gas from the boiler by using a dust collector. Also, the system takes into account the necessary environmental consideration, such as emissions to other environmental media.
Criterion 5	It is confirmed that there are no GHG emissions from storing, operating and disposing the gasifier's feed stock.

E. Emission Sources and GHG types

Reference emissions	
Emission sources	GHG types
Power generated by diesel-fueled power generation system	CO_2
Project emissions	
Emission sources	GHG types
Kerosene for heating gasifying furnace	CO_2
GHG in the exhausting gas from the combustion of the boiler	CO2, CH4, N2O
Trucks carrying waste (husks and organic wastes)	CO_2

F. Establishment and calculation of reference emissions

F.1. Establishment of reference emissions

In this MRV's project, the electricity delivered from the biomass power generation system partly displaces that is supplied by the diesel-fueled power generation system in the existing micro-grid, and thus reference emission is from the electricity generated by the diesel-fueled power generation system to the extent displaced by the biomass power generation system.
The total amount of electricity delivered by the biomass power generation system is monitored

at the transmission point.

Note that in this methodology, it is assumed that there is no methane emission from the organic waste treatment prior to the launch of the project. Therefore, methane emission is not included in the reference emission.

F.2. Calculation of reference emissions

ACM0022 is considered to be the closest to the CDM methodology relevant to this project.
(P.26, 5.3.3.1. Procedure (C.1): Separate generation of electricity and heat)
According to ACM0022, four baseline sources are considered, but the methodology in this project allows the assumption that there is no methane gas emissions from organic wastes prior to the launch of the project – therefore, of the four baseline sources in ACM002, only REE ,p is calculated.
Consequently, in calculating reference emissions, Procedure C.1 of ACM0022 (equation 14 of item 57 of methodology) is referred to, and the following equation is used for calculation.
$REEN$,p = $REEC$,p + $REHG$,p
Where,

$REEN$,p	Reference emission (tCO2) accompanying energy consumption during period p.	
$REEC$,p	Reference emission (tCO2) accompanying electricity consumption during period p.	
$REHG$,p	Reference emission (tCO2) accompanying heat consumption during period p..	

Furthermore, this project only considers power supply and consumption (heat supply and consumption are not considered).
Therefore, the $REEC$,p item is calculated as follows.

$RE_p = RE_{EC,p} = EG_{DEL}$ x EF_{fuel}

RE_p	Reference emission during the period p	(tCO_2/p)
EG_{DEL}	The total quantity of the electricity delivered in the project during the period p	(MWh/p)
EF_{fuel}	CO2 emission factor of the fuel used in the diesel-fueled power	(tCO_2/MWh)

generation system, which supplies power prior to the launch of the project

G. Calculation of project emissions

In the calculation of project emission of this project, the CDM methodology (applying the syngas burning case in ACM0022, and referring to items 85 through to 88 [equations 22 and 23] in the methodology) is used.

Consequently, calculations for project emissions are as follows.

$PE_p = PE_{FC,p} + PE_{COM\_CO2,p} + PE_{COM\_CH4,N2O,p} + \sum PE_{TR,p,j}$

Where

PE_p : Emissions accompanying project activity during the period p

$PE_{FC,p}$: Emissions accompanying kerosene burned for gasifying furnace during the period p (tCO2/p)

$PE_{COM\_CO2,p}$: Emissions of CO2 in boiler exhaust gas during the period p (tCO2/p)

$PE_{COM\_CH4,N2O,p}$: Emissions of CH4 and N2O in boiler exhaust gas during the period p (tCO2/p)

$PE_{TR,p,j}$: Emissions accompanying transport of wastes during the period p (tCO2/p)

j : Waste type 1: Husks, 2: organic wastes

$PE_{FC,p}$ = FCp x NCVp x EFCO2,p

FCp : Fossil fuel (kerosene) consumption during the period p [GJ/t]

NCVp : Fossil fuel (kerosene) calorific value during the period p [GJ/t]

EFCO2,p : CO2 emission factor for fossil fuel (kerosene) during the period p [tCO2/TJ]

$PE_{COM\_CO2,p} = EFF_{COM,p} \times \frac{44}{12} \times \sum Q_{j,p} \times FCC_{j,p} \times FFC_{j,p}$

EFFCOM,p : Combustion efficiency of gasifying furnace during the period p (= 100%)

Qj,p : Weight [t] of waste j delivered during period p

FCCj,p : Fraction of total carbon content [tC/t] in waste j delivered during period p

FFCj,p : Fraction of fossil carbon in total carbon content [%] of waste type j delivered

during the period p

$PE_{COM\_CH4,N2O,p}$ = Q2,p x ($PE_{COM\_CH4,N2O,p}$ x GWPN20 + EFCH4 x GWPCH4)

Q2,p : Weight of waste delivered during period p (Case j = 2 only)

EFN2O : Emission factor of N2O from combustion of delivered waste (tN2O/t waste)

GWPN2O : Global warming potential for N2O

EFCH4 : Emission factor of CH4 from combustion of delivered waste (tCH4/t waste)

GWPCH4 : Global warming potential for CH4

$PE_{TR,p,j} = \sum \left(\frac{M_{j,p}}{TL_{p,}} \text{ x } AVD_{j,p} \text{ x } EF_{tr,CO2}\right)$

Mj,p : Amount of transported waste j during the period p

TLj,p : Average truckload amount of waste j during period p (ton/truck)

AVDj,p : Average transportation distance of waste j by truck from its emission sources to the project site (km/truck)

(20km/truck; default value)

EFtr,CO2 : CO2 emission factor for trucks (tCO2/km)

H. Calculation of emissions reductions

The emission reductions are the differences between reference emissions and project emissions, which are calculated by below formula.

$ER_p = RE_p - PE_p$

ER_p Emission reduction during the period p

I. Data and parameters fixed *ex ante*

The source of each data and parameter fixed *ex ante* is listed as below.

Parameter	Description of data	Source

EF_{fuel}	CO2 emission factor of the fuel used in the diesel-fueled power generation system, which supplies power prior to the launch of the project	IPCC default value
NCVp	Fossil fuel (kerosene) calorific value during the period	IPCC default value
EFCO2,p	CO2 emission factor for fossil fuel (kerosene) during the period p	IPCC default value
EFFCOM,p	Combustion efficiency of gasifying furnace during the period p (= 100%)	IPCC2006 guideline CDM methodology ACM0022
FCCj,p	Fraction of total carbon content in waste j delivered during period p [tC/t]	IPCC2006 guideline CDM methodology ACM0022
FFCj,p	Fraction of fossil carbon in total carbon content of waste j delivered during the period p [%]	IPCC2006 guideline CDM methodology ACM0022
Global warming potential for N2O (GWPN2O)	298 tCO2/tN2O	IPCC2006 guideline CDM methodology ACM0022
EFN2O	Emission factor of N2O from combustion of delivered waste (tN2O/t waste) Assumed to be zero as a default value for the simplifying purpose (the actual value is significantly small)	IPCC2006 guideline CDM methodology ACM0022
Global warming potential for methane (GWPCH4)	25 tCO2/tCH4	IPCC2006 guideline CDM methodology ACM0022

EFCH4	Emission factor of CH4 from combustion of delivered waste (tCH4/t waste) Assumed to be zero as a default value for the simplifying purpose (the actual value is significantly small)	IPCC2006 guideline CDM methodology ACM0022
Distance of transporting waste j (AVD,j,p)	Average transportation distance of waste j by truck from its emission sources to the project site (km/truck) Additional distance of the project *ex post*	Default value set by the project
CO2 emission factor for trucks (EFtr,CO2)	CO2 emission factor for trucks (t-CO2/km)	IPCC default value

3.10.2. Project Design Document Form

A. Project description

A.1. Title of the JCM project

Low carbon biomass power generation project using urban organic solid waste and rice husks to contribute to the reductions of urban solid waste and CO2

A.2. General description of project and applied technologies and/or measures

The purposes of the proposed JCM project are to generate electricity by gasifying biomass which consists of rice husks and urban solid waste generated and brought from nearby urban areas to supply for the targeted electricity consumers. The key technologies are the dry distillation gas furnace, the distilled gas combustion boiler, small scale steam-electric generator driven by the saturated steam from the combustion boiler and the binary generator of which heat source is exhaust-steam of the steam-electric generator. The generated electricity from above-stated system is to be mainly consumed at the hydroponical farming system and displaces the electricity supplied by the existing diesel-fueled generating system. The surplus electricity is distributed to the neighboring households to

substitute a part of their electricity consumption normally depending on the diesel-fueled generating system. The proposed JCM project will utilize the rice husk brought from the rice mills and the organic wastes collected from nearby urban areas.

A.3. Location of project, including coordinates

Country	Cambodia
Region/State/Province etc.:	Siem Reap Province
City/Town/Community etc:	N/A
Latitude, longitude	North Latitude: 13°21’ 44” East Longitude: 103°51’ 35”

A.4. Name of project participants

The Republic of Kingdom of Cambodia	
Japan	Japan Development Institute Ltd., (JDI) Asian Gateway Corporation (AG) Finetech Co. Ltd.

A.5. Duration

Starting date of project operation	
Expected operational lifetime of project	

A.6. Contribution from Japan

The biomass power generating system from waste which has been developed by the Japanese project participants; JDI, AG and Fintech Co. Ltd. is introduced in the proposed project. The Japanese project participants transfer the operational technology through training to the Cambodian project participants. The Japanese side provides financial support to the project.

B. Application of an approved methodology(ies)

B.1. Selection of methodology(ies)

Selected approved methodology No.	
Version number	
Selected approved methodology No.	N/A
Version number	N/A
Selected approved methodology No.	N/A
Version number	N/A

B.2. Explanation of how the project meets eligibility criteria of the approved methodology

Eligibility criteria	Descriptions specified in the methodology	Project information
Criterion 1	Husks from rice mills (50%) and organic waste from urban areas (50%) is fed into gasifying furnace as feed stock, and a boiler is introduced, which uses the gas generated from such gasifying furnace.	The project installs new gasification furnace and generated gas combustion boiler. Materials fed to the furnace is confirmed as rice husks and urban solid waste only and the scheme of pre-confirmation for the predefined ratio of supplied materials is well established.
Criterion 2	A biomass power generation system is introduced equipped with a compact steam generator which uses the steam generated by the boiler and a binary generator which uses the exhaust heat (exhaust steam) from the compact steam generator.	The design document is confirmed that the system of the project consists of gasification furnace, gas-fueled boiler, steam-electric generator and binary generator.
Criterion 3	The electricity supplied to hydroponic farming and residents in unelectrified area by an existing diesel-fueled power generation	One electricity meter is installed to measure the delivered electricity which is net supply from steam-electric generator and binary generator, not including in-

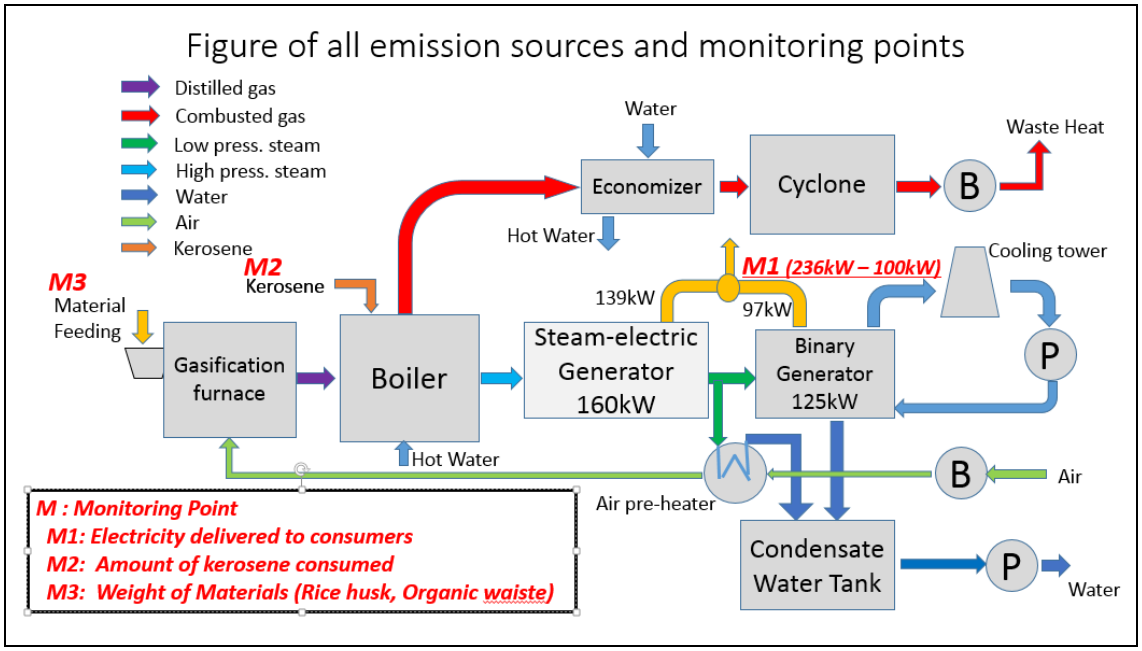
	system is partly displaced.	house consumption.
Criterion 4	Biomass power generation system takes into consideration air pollution caused by exhaust gas from the boiler by using a dust collector. Also, the system takes into account the necessary environmental consideration, such as emissions to other environmental media.	It is confirmed that the measures for prevention of pollutant emissions such as cyclone is installed.
Criterion 5	It is confirmed that there are no GHG emissions from storing, operating and disposing the gasifier's feed stock.	It is confirmed that there is no GHG emission through the process of storing, managing and treatment of materials involved in the system.

C. Calculation of emission reductions

C.1. All emission sources and their associated greenhouse gases relevant to the JCM project

Reference emissions	
Emission sources	GHG type
Power generated by diesel-fueled power generation system	CO_2
Project emissions	
Emission sources	GHG type
Kerosene for heating gasifying furnace	CO_2
GHG in the exhausting gas from the combustion of the boiler	CO2, CH4, N2O
Trucks carrying waste (husks and organic wastes)	CO_2

C.2. Figure of all emission sources and monitoring points relevant to the JCM project



C.3. Estimated emissions reductions in each year

Year	Estimated Reference emissions (tCO_{2e})	Estimated Project Emissions (tCO_{2e})	Estimated Emission Reductions (tCO_{2e})
2018	551	211	340
2019	551	211	340
2020	551	211	340
Total (tCO_{2e})	1,653	633	1,020

D. Environmental impact assessment	
Legal requirement of environmental impact assessment for the proposed project	Yes

E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

Local stakeholder consultation is to be concluded.

E.2. Summary of comments received and their consideration

Stakeholders	Comment received	Consideration of comments received
Siem Reap provincial government	Urgent for optimizing urban waste disposal	Implement survey in a C2CC collaboration to realize the low carbon city, FY2017
	Effective practical use for rice husk, which is brought out for outside of the province, in biomass power generation	Same as above
	In a consistent of clean city project, eager to implement the control for urban waste and the awareness change for waste separation	Same as above
APSARA authority	Biomass power generation is supposed to contribute for the development of eco village, however countermeasure for smell and sound should be done	Candidate sight for biomass power generation, where APSARA gives permission to use, is near from central of village, thus re-considering to move for distant sight. Possible to move to other candidate sights , then continue survey for the eligibility of new sight.
Local partners	Purchase price for rice husk is increased by broker. Movement from provincial government to develop the ordinance is needed.	Implement survey in a C2CC collaboration to realize the low carbon city, FY2017.

3.11. Economical effect

3.11.1. Effect by installing biomass power generation

In Siem Reap province, 2 biomass power generations exist already, however they are small scale and no contribution for linking to urban waste transaction, and local production and local

consumption of rice husk. Thus planning to promote economic effect and change the awareness of local residence.

(i) Improving effect for energy local production and local consumption

(ii) Improving citizen consciousness for clean city and economical effect

(iii) Improving the value as a tourism city by promoting clean city

(iv) Improving the less usage of fossil fuels for diesel power generation used in a countryside of Siem Reap city

(v) Improving the amount of CO2 emission control

(vi) Improving the quality of life and industrial promotion by using biomass power generation in no electricity area

3.11.2. Economical effect for other

Considering the economic effect for other, these are needed as follow, simulation for system operation, examination of system price, and organizing every connected person. Through this survey, ended to summarize the points as follow:

(i) Simulation for system operation

Estimation for operational effects are as follow:

a. Setting a risk of stable securement for rice husk
b. Setting a rate of purchasing price for rice husk
c. Setting a rate of transportation for rice husk
d. Progress of minimum wage method
e. Clarify a condition of rate for land lease fee

(ii) Investigate the price for system

a. Designation of local EPC trader
b. Designation of local C&M trader
c. Investigating the price to sell electricity for EDC

(iii) Forecast for investment recovery

Surveyed in next fiscal year.

4. Significance and Action Policy of City to City Cooperation Between Kanagawa Prefecture and Siem Reap Province

4.1. Purpose of City to City Cooperation

4.1.1. Purpose

To cooperate for the development of both the prefecture and province through low-carbon tourism city development while deepening mutual understanding and friendship

4.1.2. Terms of the agreement

- Siem Reap Province: Utilization of renewable energy and introduction of energy-saving equipment
- Kanagawa Prefecture: Advices on promotion of low-carbon tourism city, especially for promoting utilization of renewable energy such as PVs, improvement of efficiency in energy-consumption, and promotion of EVs.
- Assistance to economic cooperation among private companies of both countries

(Source: http://www.pref.kanagawa.jp/prs/p975449.html)

4.2. Capacity Building

4.2.1. Invitation to Japan

2 persons of Siem Reap Province were invited to Kanagawa Prefecture from 16th -22nd October 2016. They learned related institutions of the Prefecture in order to apply it in Cambodia in the future. During this training program, they exchanged opinions with the Industry and Energy department, the Industry and Labor Bureau of Kanagawa Prefecture and went to inspection.

4.2.2. Workshop in Cambodia

Several seminars were organized for the related organizations (Siem Reap Provincial Government, Siem Reap City Government, APSARA authority) in order to introduce policies and institutions of Kanagawa Prefecture. The kick-off seminar with 50 participants was held in 20th May. After that, meetings were held every month and the final seminar was in 17th February.

4.2.3. Presentation at High Level Seminar on Environmentally Sustainable Cities in Kitakyushu, Japan

The study team made a presentation in order to disseminate the activities of this project at High Level Seminar on Environmentally Sustainable Cities in Kitakyushu, Japan from 20th and 21st

October 2016.

We introduced our projects and discussed the significance of C2CC for a low-carbon society. (Appendix number is)

4.3. Action Policy in Future

Based on the MOU between Kanagawa prefecture and Siem Reap province, the action policy includes the following activities.

1) Support to instruct prevalence of community solar PV on rental rooftops
   - A community development for a low-carbon city as a whole
   - Capacity building for implementing and managing the community
   - Invitation of Siem Reap Provincial staff to Kanagawa prefecture and practical training on policy development and administrative guidance

2) Support to promote tourism city transport
   - Introduction of EV vehicles for tourism activation which is conducted in Hakone town, Kanagawa
   - Inspection and promotion of EV mobility and system such as EV taxi, EV bike, EV rental, and EV sharing
3) Disposal system of urban waste
   - Introduction of systematic disposal
4) Assistance to Formulation of the Master Plan of Siem Reap City
   - For the above two sectors, Kanagawa prefecture is to advise based on the present situation of the master plan.
   - Project finding for the formulation of the master plan.

5. Policy Proposals

There are mainly four living areas in Siem Reap province: the urban area including the Siem Reap city, the World Heritage area controlled by APSARA authority, the surrounding agricultural area and the fishing area near Tonle Sap Lake. In the province, there are many areas with no connection to the national grid. Besides, the land is not fertile and disparity is serious. The common issues throughout the four areas are underdevelopment of 1) urban transport infrastructure, 2) environment and energy policy, 3) policies for income enhancement for the poor. This City to City Cooperation focuses on 1) and 2) and proposes “local production for local consumption of energy” as a solution to the issue.

As an increase of tourists in recent years, the problems of disposals of urban waste is getting worse. In conclusion, important policy proposal is disposal system utilizing organic solid waste for a low-carbon society.

Tentative schedule of a study tour in Japan
16 October - 22 October 2016

Participant: Mr. Sophean Ung and Mr. Kemchun Chek/Ms. Chandany Sen No. of participants : 3 persons

Duration: From 16 Octoberr to 22 Octoberr 2016 Language: Khmer-English-Japanese

As of September 24 2016

Date	Time			Contents	Person in charge	Place	Stay
17-Oct (Mon)	19:00 (16-Oct)	~	11:00	Siem Reap > Phnom Penh > Narita > Yokohama	-		Washington Hotel Yokohama Sakuragicho (http://yokohama-s.washington-hotels.jp)
	12:00	~	13:30	Lunch	-	Minato Mirai	
	13:30	~	15:00	Solar and Wind Hybrid LED Street Lighting at Minato Mirai	Mr. Kimura and Mr. Nagata of Asian Gateway	Shin Takashima Station	
	15:00	~	17:00	Workshop with Kanagawa Pref. and Yokohama City	Ms. Matsuura of Kanagawa Prefecture	Kanagawa Prefecture Government Hall	
	18:00	~	20:00	Dinner	-	Minato Mirai	
18-Oct (Tue)	10:00	~	12:00	Taisei ZEB (Zero Energy Building) in Totsuka	Mr. Kawaguchi of Kanagawa Prefecture	Totsuka	Washington Hotel Yokohama Sakuragicho (http://yokohama-s.washington-hotels.jp)
	12:00	~	13:00	Lunch	-		
	13:00	~	15:00	Smart House and Solar LED Street Lighting by Mitsubishi Electric	Mr. Kojima of Mitsubisi Electric	Ohfuna	
	16:00	~	17:30	Solar Energy and Energy Saviing at KIRIN Beer	Mr. Kawanobe of Asahi Glass	Namamugi	
	18:00	~	20:00	Welcom Diner	-	Namamugi	
19-Oct (Wed)	9:00	~	11:00	Move to Ashikaga City of Tochigi Prefecture	-	Ashikaga	Rihga Royal Hotel Kokura (http://www.rihga.com/kitakyushu)
	11:00	~	12:00	Finetech Smart Green Park in Kitakanto	Mr. Okada of Finetech		
	12:00	~	13:00	Lunch	-		
	13:00	~	14:00	Weast to Energy in Finetech Smart Green Park	Mr. Okada of Finetech		
	14:00	~	17:00	Move to Haneda Airport	-	Haneda	
	17:00	~	19:00	Fly to Kitakyusyu City from Haneda	-	Kitakyusyu City	
20-Oct (Thu)	9:00	~	17:00	**JCM-C2CC Workshop**	IGES	Kitakyusyu City	Rihga Royal Hotel Kokura (http://www.rihga.com/kitakyushu)
21-Oct (Fri)	9:00	~	17:00	**JCM-C2CC Workshop**	IGES		Rihga Royal Hotel Kokura (http://www.rihga.com/kitakyushu)
22-Nov (Sat)				Kitakyusyu > Narita > Phnom Penh > Siem Reap			

二国間クレジット制度（JCM）都市間連携ワークショップ

10 月 20 日（木）　JCM 都市間連携ワークショップ

●場所：リーガロイヤルホテル小倉 「オーキッド」（3階）

〒 802-0001　北九州市小倉北区浅野 2-14-2　TEL：（093）531-1121（代）

アクセスマップ：http://www.rihga.co.jp/kokura/access/index.html

●目的：

・ 主として都市間連携 F/S 参加の自治体の都市間連携事業に関する理解を深め、円滑な事業運営を図ることを目的とする。（先行事例については、F/S 及び事業化に向けた課題や解決策を中心に提供してもらい、新規（後発）事業は、活動内容と課題の共有を図り、それぞれの事業運営に役立ててもらう。）

・ 特に、海外の自治体には JCM 資金支援事業の概要や都市間連携 F/S の狙いをきっちり理解してもらい、事業を円滑に進めるために自らがどのような行動を起こすべきかについて考えてもらう機会とするとともに、アジアの都市間で低炭素化に向けた取り組みについて情報交換をすることで、自らの取りくみの更なる推進を図る動機付けとする。

・ 日本の自治体については、相互の事業進捗や展開についての情報交換の場とする（特に新規参入自治体）

●プログラム（案）

※日英同時通訳付

9:30　開会挨拶（環境省）

9:35　JCM 都市間連携事業及び JCM 資金支援スキーム

①JCM 都市間連携事業概要と期待されるアウトプット（環境省）（10 分）
②資金支援スキーム：設備補助事業（GEC）（10 分）
③資金支援スキーム：JFJCM（環境省）（10 分）

（時間があれば、質疑の時間をとる（5 分程度））

10:10　JCM 設備補助事業に進んでいる成功例に学ぶ、JCM 事業の案件化事例
（日本自治体又は担当事業者（企業））（発表 15 分＋質問 5 分×2 件）
①北九州市／ハイフォン市、スラバヤ市の設備補助事例（NTT データ経営を想定）
②横浜市／ダナン市、バタム市、（バンコク都）の設備補助事例（企業を想定）

10:50　コーヒーブレイク（15 分）

11:05　話題提供：一般廃棄物処理における技術選択と予算化～一般廃棄物処理を事例に～
（北九州市） 25 分＋質疑応答 15 分＝40 分

11:45　平成 28 年度都市間連携事業に参加の海外自治体の取組事例紹介①（各 10 分×4 都市＋質疑 5 分）

各都市の低炭素化計画・指針、その計画や指針（方針）における JCM 都市間連携事業の位置づ

け、期待について紹介いただく。

12:30　昼食休憩（会場「クリスタル」（3 階））

13:30　平成 28 年度都市間連携事業に参加の海外自治体の取組事例紹介②（続）
（各 10 分×5 都市＋質疑 5 分）

14:30　ディスカッション1：「F/S 調査実施の状況及び事業化等における課題」
（北海道庁/札幌市、福島市、神奈川県の 3 事業から 2 名ずつ登壇いただき、パネル形式で実施）

- 今年度の活動予定と目標
- JCM 活用の可能性
- アジア都市の低炭素化を進める上での都市間連携の意義など

15:30　コーヒーブレイク（15 分）

15:45　ディスカッション 2 「F/S 調査実施・事業化における課題と解決策」
（川崎市、横浜市の 2 事業から 2 名ずつ、北九州については 4 事業から 2 名程度に登壇いただき、パネル形式で実施）

- 参加者間における運営課題共有（事前質問への回答を含む）
- 先行事例から課題克服のための取組の紹介
- アジア都市の低炭素化を進める上での都市間連携の意義など
  （具体的な解決を図るために、都市間連携の枠組みをどのように活用できるか？）

17:30　閉会

18:00　歓迎レセプション（リーガロイヤルホテル小倉 「リーガトップ」（29 階））

10 月21日（金） 視察：日本の自治体の低炭素化の取組（北九州の事例）

●プログラム（案）

★逐次通訳

9:00　リーガロイヤルホテル発

9:30　環境ミュージアム

09:30-10:15　ミュージアム見学（45 分程度）

10：20　環境ミュージアム発

11：00　エコタウンセンター着（別館）

11:00-11:30　レクチャー（マスタープランに基づいた低炭素化社会への取組（仮題））

11:30-11:45　質疑応答

11:45　昼食　（弁当） ※エコタウンセンター別館の利用は 12:30 まで

12:30　エコタウンセンター本館へ移動（徒歩）・本館 1 階展示見学など

12:45　次世代エネルギーパーク

12:45-13:00　次世代エネルギーパーク概要説明（エコタウンセンター本館）

13:00-14:30　視察

①市民太陽光発電所

②風力発電

③EV バス充電ステーション

14:30　次世代エネルギーパーク発

15:00　皇后崎工場着・視察

16:30　皇后崎工場発

17:00　リーガロイヤルホテル着／解散

上記プログラムは変更となることがあります。

○　それでは、低炭素観光都市づくりのための神奈川県の取組について、
　　太陽光発電の普及と電気自動車を活用した観光振興の取組を中心にご説明いたします。

○まず、神奈川県の概要を簡単にご説明します。

神奈川県は、人口が約９１０万人で４７都道府県のうち全国２位ですが、面積は２，４１６ｋ㎡で、全国４３位、５番目に小さい県です。

○シェムリアップ州は、世界遺産であるアンコールワット遺跡など、
世界各地からたくさんの観光客が訪問されていますが、
神奈川県にも、古いお寺や大仏で有名な鎌倉、
夜景のきれいな横浜や温泉で知られている箱根など
たくさんの観光資源があります。

○神奈川県では、産業経済の発展だけでなく、
こうした観光資源を守るために、
環境に配慮した低炭素型の街づくりを進めています。

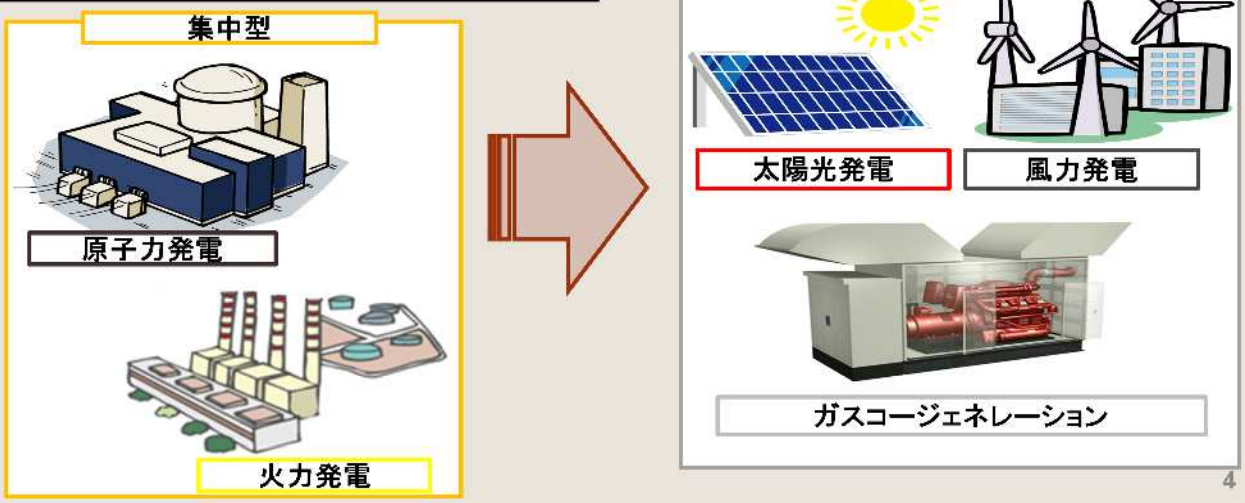
かながわスマートエネルギー計画

○　策定の経緯

平成25年７月に制定した「神奈川県再生可能エネルギーの導入等の促進に関する条例」に基づき、エネルギー政策に関する基本的な計画として策定

３つの原則

- ○ 原子力に過度に依存しない
- ○ 環境に配慮する
- ○ 地産地消を推進する

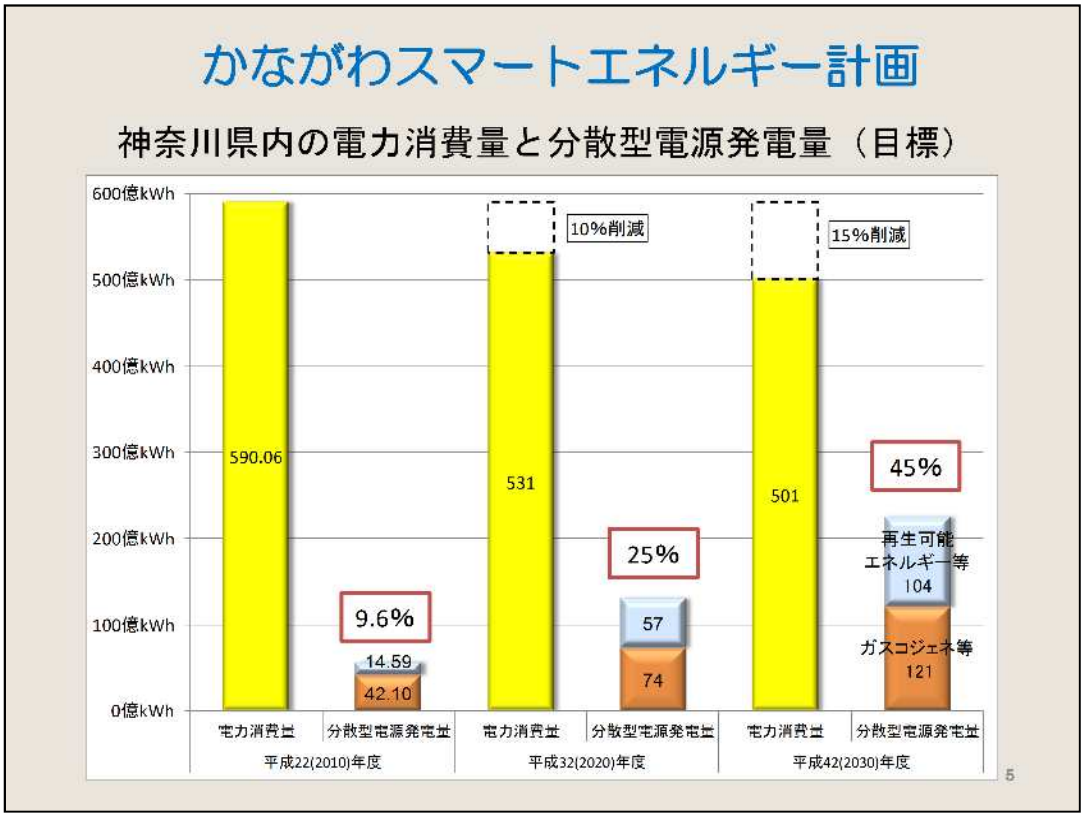


○皆さまは、２０１１年３月に起こった、東日本大震災をご存知でしょうか。

○日本は、電力系統が安定しているので、停電はほとんど起きないのですが、
　この東日本大震災のときには、原子力発電が停止し、電力供給が不足したために、広い範囲で計画的に停電が実施されました。
　神奈川県内でも、市街地も観光地も、停電になりました。

○そこで、この経験を契機として、安定した電源を確保するために、
　神奈川県では、「かながわスマートエネルギー計画」を策定しました。
　この計画は、　「原子力に過度に依存しない」、
　「環境に配慮する」、　「エネルギーの地産地消を推進する」
　という、３つの原則に基づいた内容となっています。

○左側の図のような、遠くの原子力発電所や火力発電所で作った電気を
　消費地に送る集中型の電力システムから、右側の図のような太陽光発電など、
　電気を使う場所の近くで発電する分散型システムへの転換を進めています。
　分散型のシステムは、エネルギーを地産地消するので、

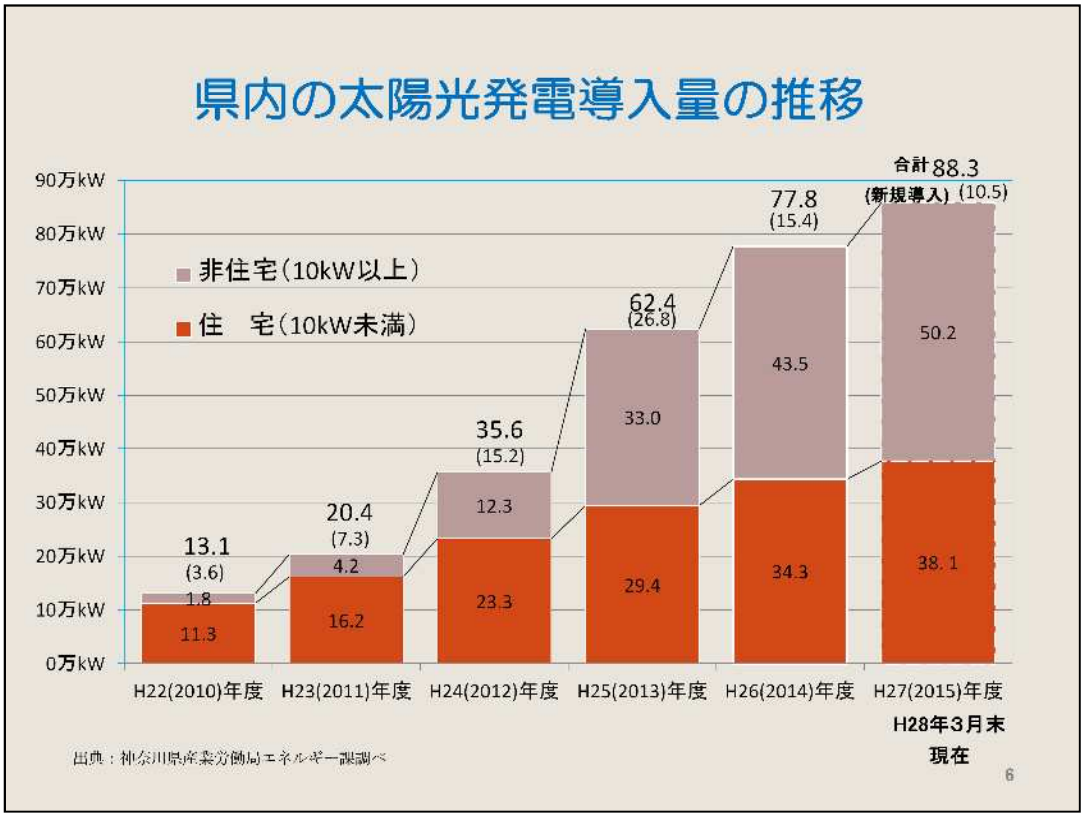


○「かながわスマートエネルギー計画」では、県内の電力消費量を、

２０３０年度には、２０１０年度に比べて、１５%削減するという目標を立てています。

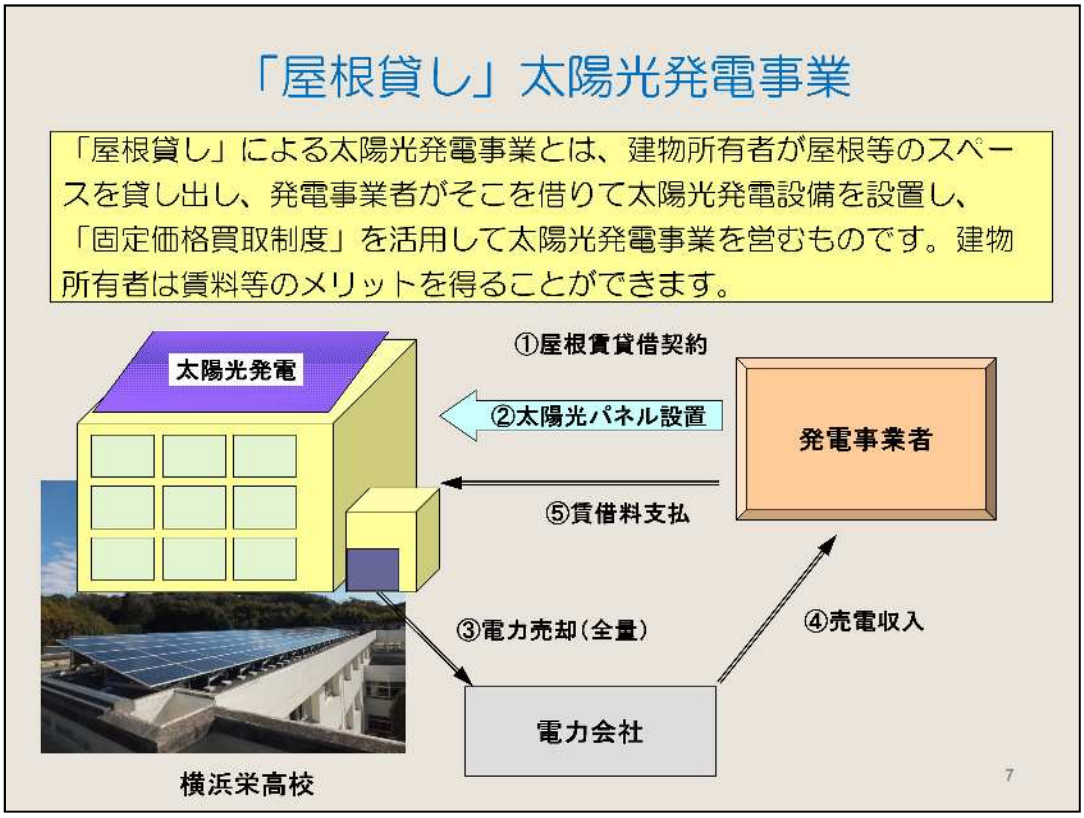
さらに、先ほどご説明した分散型電源による発電量を、

電力消費量の４５%まで増やすという目標も立てています。



○分散型電源の中の太陽光発電の県内の導入量は、ご覧のとおりです。

○２００９年度に県が補助制度を開始して、少しずつ増えていき、
東日本大震災後の２０１１年度から急速に増えています。
２０１３年度には、太陽光で発電した電気を
国が高い価格で買い取る「固定価格買取制度」がスタートした影響で、
増加が加速しました。



○神奈川県が実施する太陽光発電の普及拡大の取組をいくつか、ご紹介いたします。

広い土地があるところでは、地面に直接太陽光発電設備を設置できますが、神奈川県は、空いている広い土地が少ないので、建物の屋根への設置を進めています。

○神奈川県では、建物の所有者が屋根を発電事業者に貸し出し、

発電事業者がその屋根に太陽光発電設備を設置して作った電気を売電し

収益の中から建物所有者に賃料を支払う、「屋根貸し太陽光発電事業」を進めています。

この屋根貸し太陽光発電事業は、神奈川県が全国に先駆けて、県の施設で実証し、事業モデルとして成立することが確認でき、

全国の自治体や民間事業者に、この事業モデルが広がっていきました。

○次の取組ですが、神奈川県には工場や倉庫がたくさんありますが、

こうした建物は、耐荷重が低いために、通常の太陽光パネルを設置できないことがあります。

そこで、従来の太陽光パネルよりも薄くて軽い薄膜太陽電池の導入に力を入れています。

○薄膜太陽電池は、工場の屋根だけでなく、今まで太陽光パネルが設置できなかった、窓ガラスや、岸壁の壁面、マンションのバルコニーの手すりなどにも設置することができます。

神奈川県では、こうした薄膜太陽電池の設置費用の1/3を補助し、さまざまな場所への設置を促進し、薄膜太陽電池のＰＲをしています。

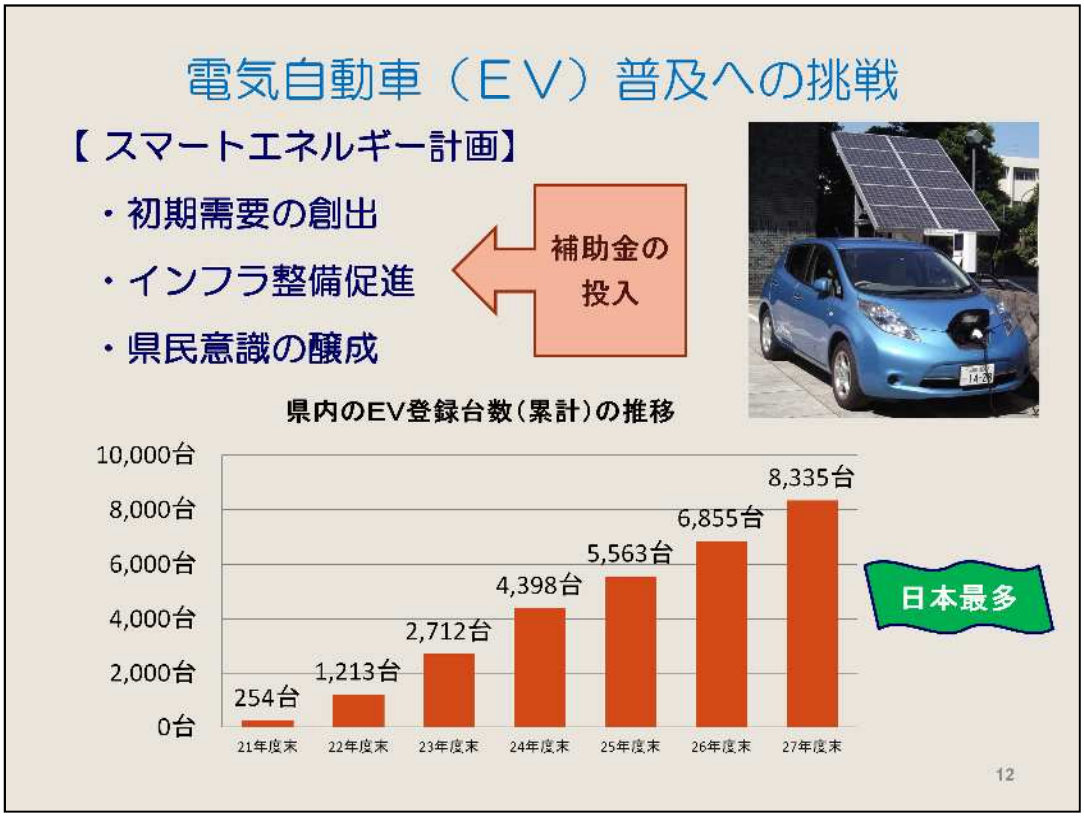
○上の写真は、通常のパネルが設置できない工場の屋根に設置した事例です。

**　下の写真は、鉄道の法面に、草が生えるのを防ぐシートと一体になった薄膜太陽電池を設置した事例です。**

**　こうして、いろいろな場所に太陽光発電設備を設置できることをPRすることで、太陽光発電の導入が加速していくことを期待しています。**

○このほか、土地の有効活用という観点で、平面の駐車場に屋根を設置し、
その屋根に太陽光パネルを載せて発電する、ソーラーパーキング事業にも
取り組んでいます。
駐車場や駐輪場に屋根をつけることで、日除けや雨除けになり、
発電した電気を売電した収入で、屋根の設置費用を回収できます。

○農地の有効活用として、農地で農業を続けながら、
その上に太陽光パネルを設置する「ソーラーシェアリング」事業にも
取り組んでいます。

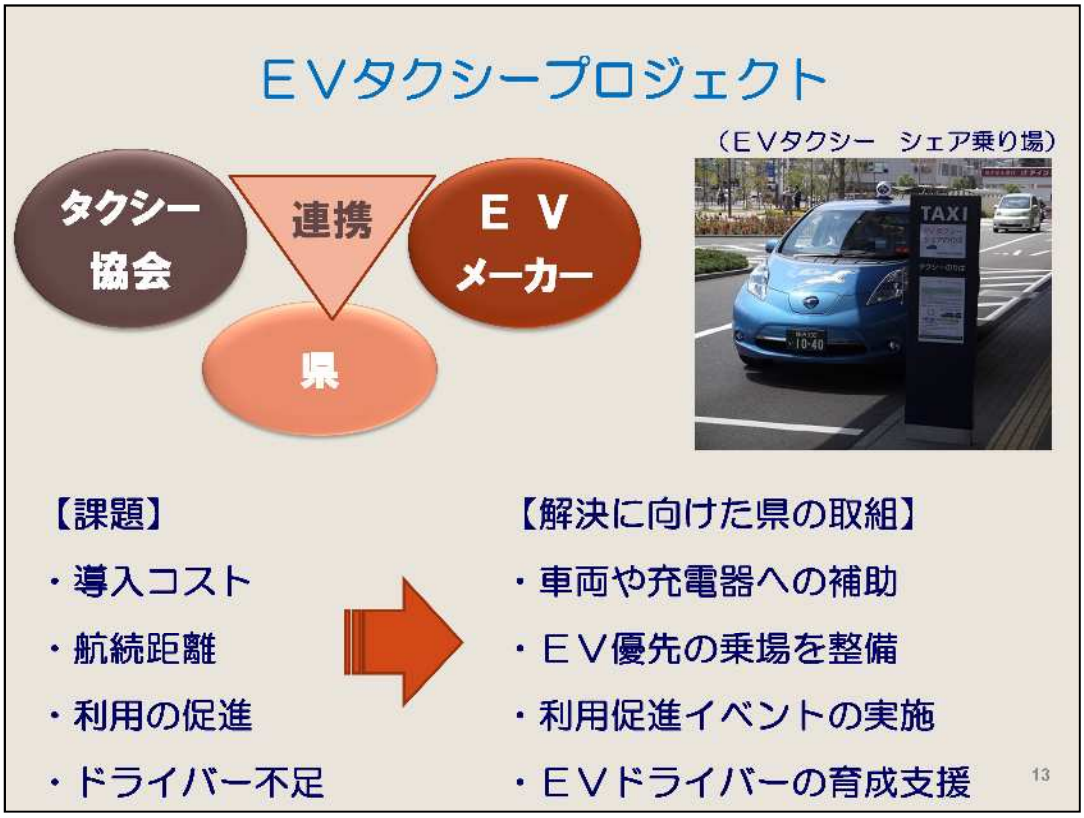


○次に、低炭素型の街づくりのために、神奈川県が力を入れている電気自動車の普及の取組についてご説明します。

電気自動車は、日本では、２００９年に一般に発売されましたが、神奈川県では、その発売前から、民間企業や大学等と連携して、普及に向けた検討を始めました。

県民や県内企業が、電気自動車を購入する場合や、急速充電器を設置する場合には補助する制度を立ち上げて、積極的な取組を展開しました。

その結果、２０１５年度末には県内の電気自動車の普及台数は8,335台となり、日本の都道府県の中で最多となっています。



○さらに、県民の方に電気自動車に乗る機会を増やすために、タクシーに電気自動車を導入するプロジェクトを実施しました。

電気自動車をタクシーに導入する場合、課題がいくつかありました。

・通常の車に比べて、電気自動車の価格が高いので導入コストがかかる

・１回の充電で走れる航続距離が２００キロメートル程度と短い

・ＥＶタクシーが知られていないので、利用を促進する必要がある

・ＥＶタクシーの特徴を上手く利用できるノウハウを持ったドライバーがいない　などの課題です。

○そこで、解決に向けて、

・車両や充電器への補助、

・ＥＶタクシーのための乗場の整備、

・ＥＶタクシーの利用促進のイベントの実施、

・ＥＶドライバーの育成の支援　などの取組を実施しました。

EVを活用した観光モデル

観光資源の保全

電動車両の導入

観光施設

観光事業者

協力

（観光地で使えるｰポン）

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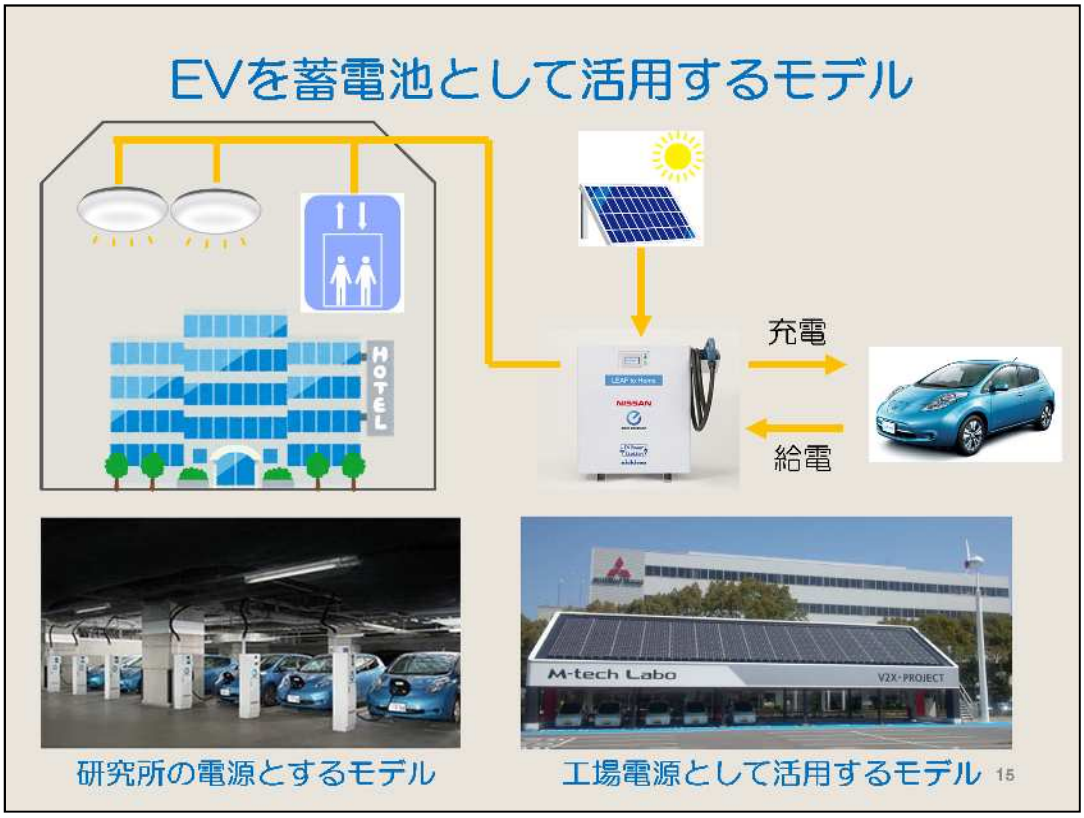
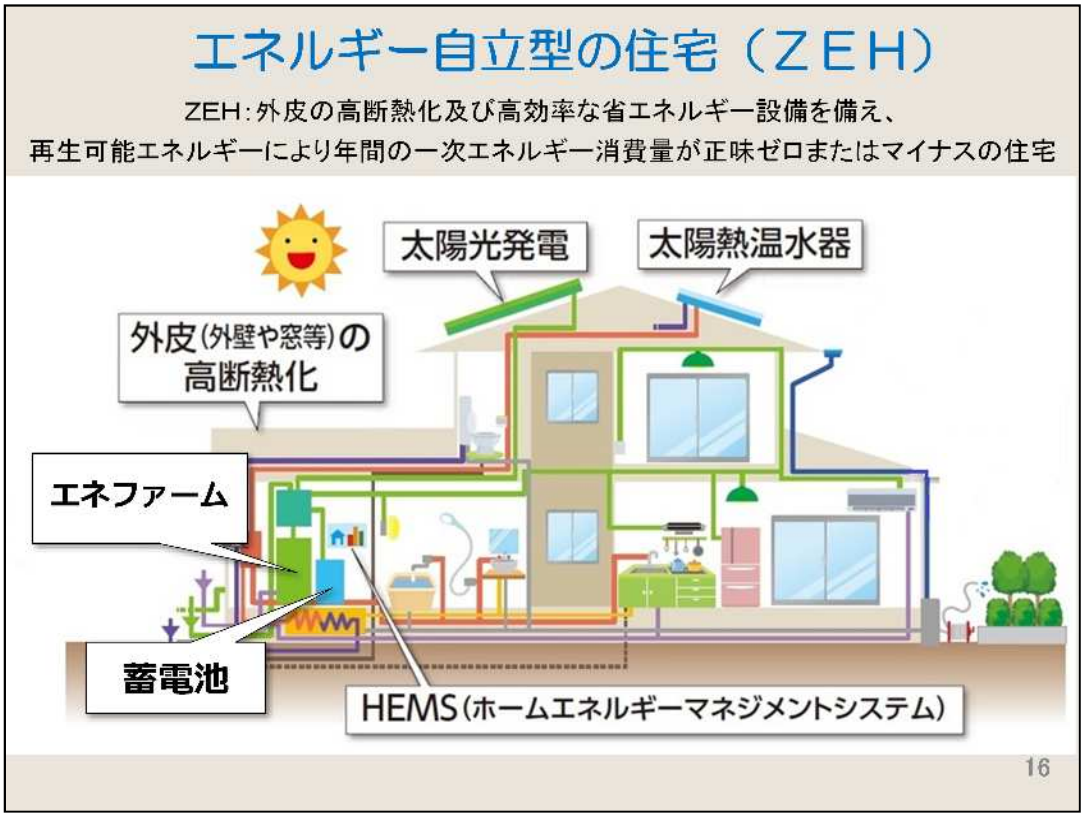


○さらに、ＥＶは、電気で走るだけでなく、搭載しているバッテリーから、家やビルに電気を供給することもできます。

急に停電したときにも、ホテルなどにＥＶから電気を供給することで、最低限の電源を確保することができます。

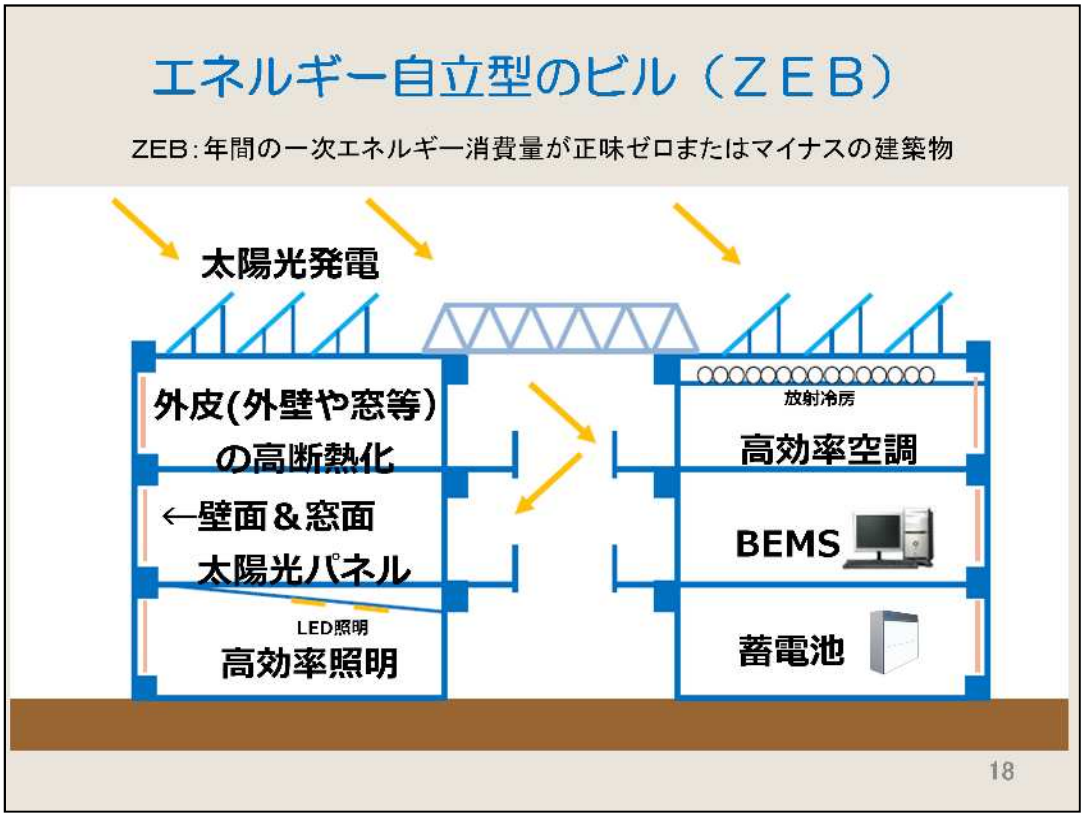
○日本では、いくつかの研究所や工場で、電気をたくさん使用する時間帯に、従業員が通勤で乗ってくるＥＶの電気を使い、帰宅する時間までにＥＶに充電するという仕組みが導入されています。



○今、日本では、太陽光発電で電気を作るとともに、
高断熱の壁や窓などで省エネ化をすすめることで、
エネルギー消費量がプラス、マイナスでゼロになる住宅、
ネット・ゼロ・エネルギー・ハウスの普及が進んできています。
国も神奈川県も、ＺＥＨ普及のために補助制度を実施しています。

○これは、神奈川県の藤沢市にある「藤沢サスティナブル・スマートタウン」です。

神奈川県は、この街のＺＥＨの整備を支援しています。



○住宅だけでなく、ビルについても、
エネルギー消費量がプラス、マイナスでゼロになるビル、
ネット・ゼロ・エネルギー・ビルの普及を進めるため、
国も神奈川県も補助制度を実施しています。

エネルギー自立型のビル（ＺＥＢ）

大成建設ＺＥＢ実証棟
（横浜市）

鈴廣蒲鉾本店本社
（小田原市）

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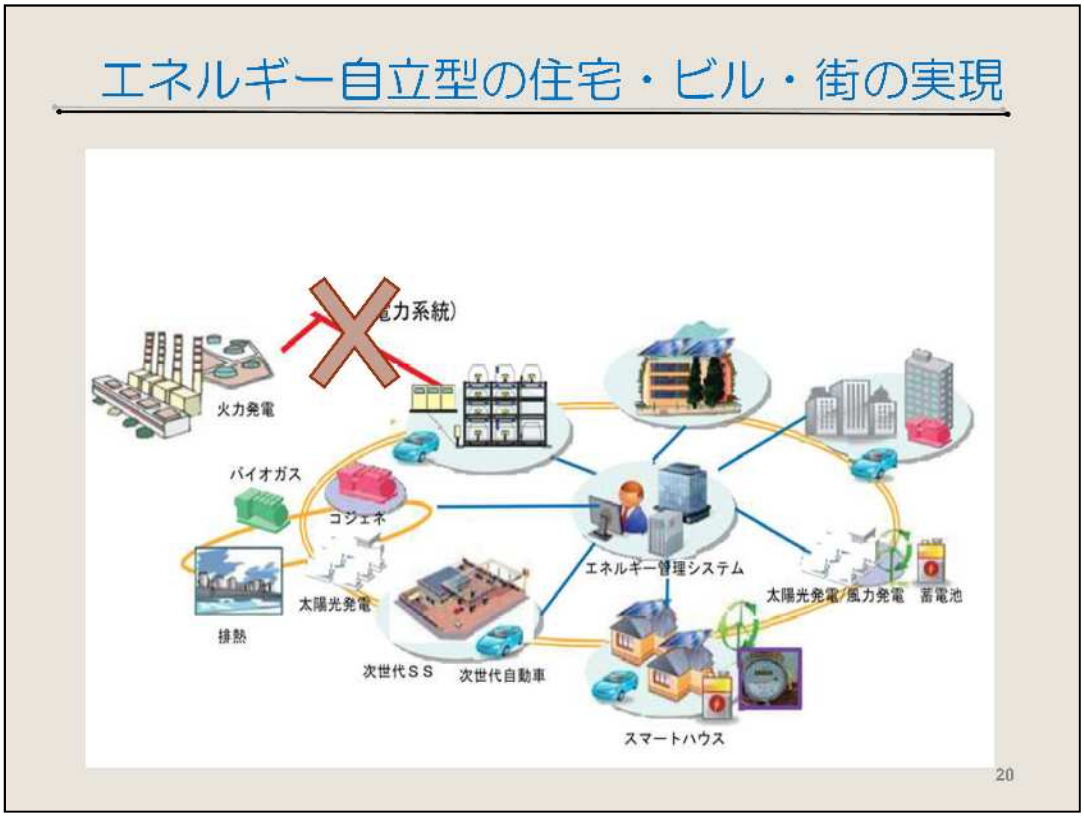
○神奈川県に既に整備されているZEBとして
明日、視察予定の横浜市内の大成建設の実証棟、
小田原市内の鈴廣蒲鉾本社ビルがあります。



○神奈川県は、こうしたエネルギー自立型の住宅やビルを増やし、
太陽光発電や電気自動車などをうまく使って、
遠くの発電所から送られてくる電気に頼る集中型電源システムから、
電気を使う場所の近くで作る分散型電源システムへの転換を図り、
エネルギー自立型の街を実現させることを目指しています。

○さて、2020年に、日本で、東京オリンピック・パラリンピックが開催されます。

世界中から多くのお客様にいらしていただき、快適に過ごしていただくためには、災害などが起きても、停電などの心配がなく、　安心して利用できる電源の確保が必要です。また、同時に自然や歴史的な遺産を保全していくためには、大勢の観光客を受け入れても、環境に与える影響をできるだけ少なくしていくことが重要です。

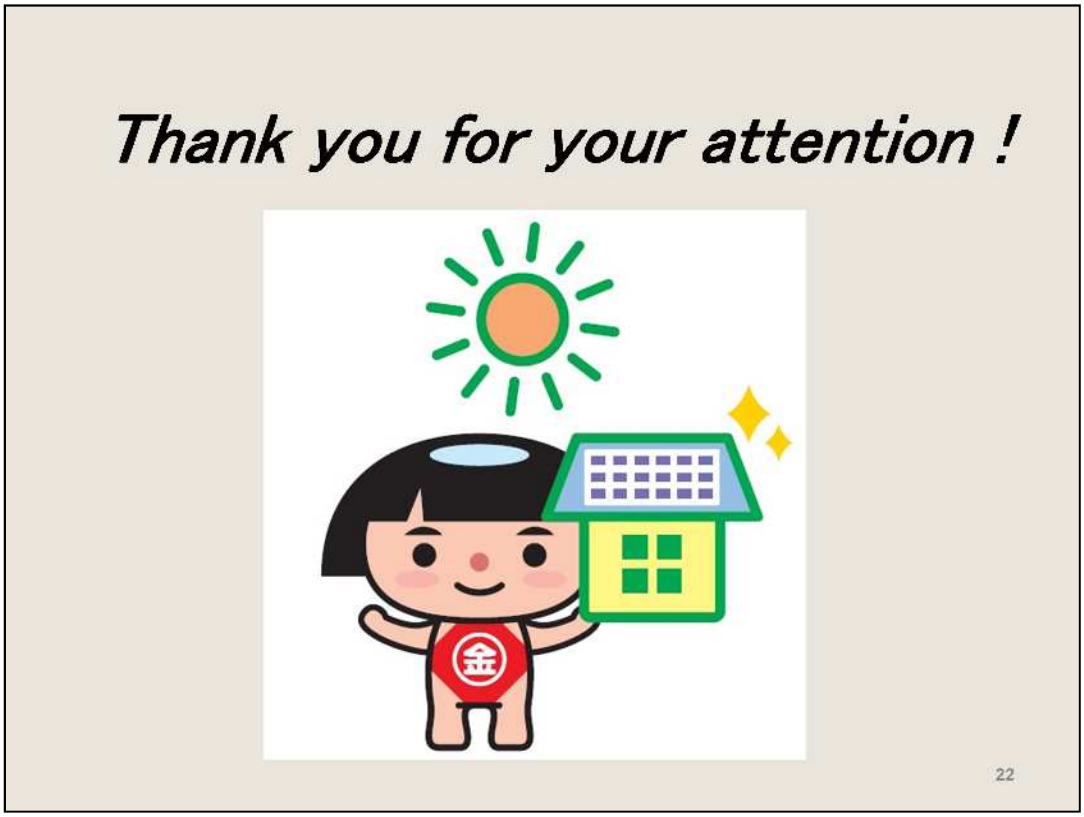
○私たち、自治体は、こうした課題解決に向けて

・中央政府と連携しながら、

・それぞれの地域にあった取組を

・住民の皆さんと一緒に進めていくために、努力しています。

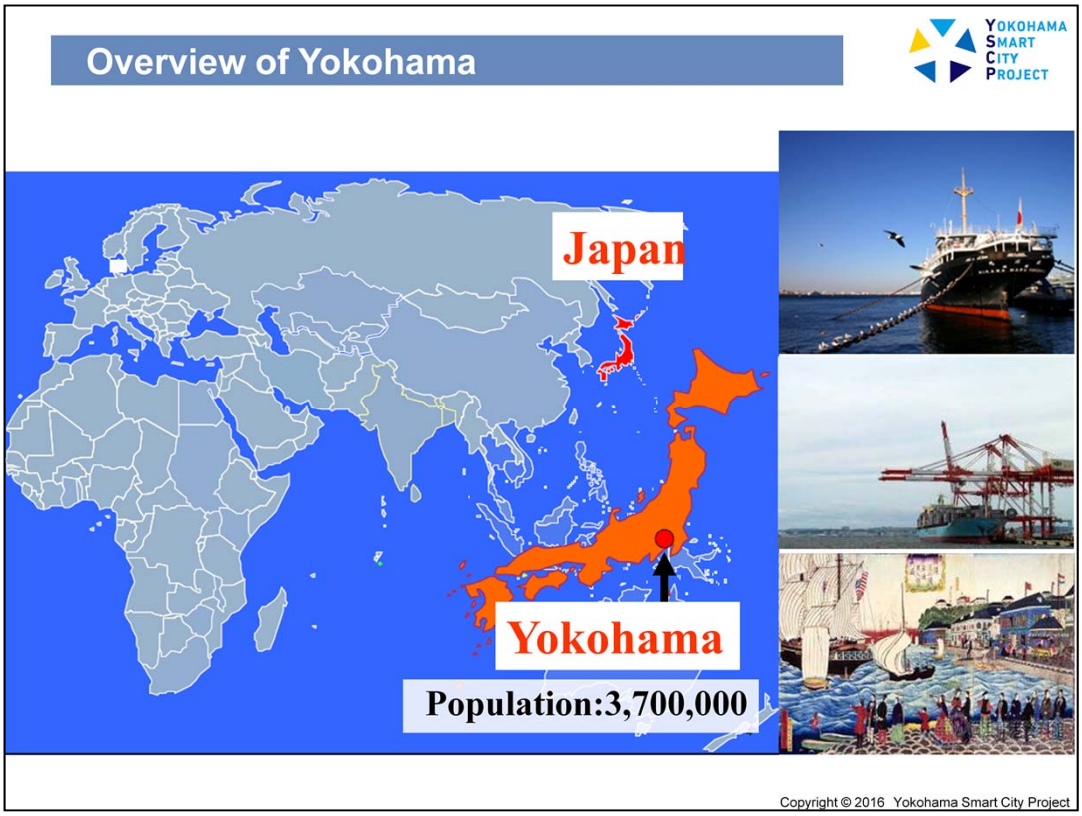
私たちの取組を、シェムリアップ州の低炭素観光都市づくりの参考にしていただけましたら光栄です。



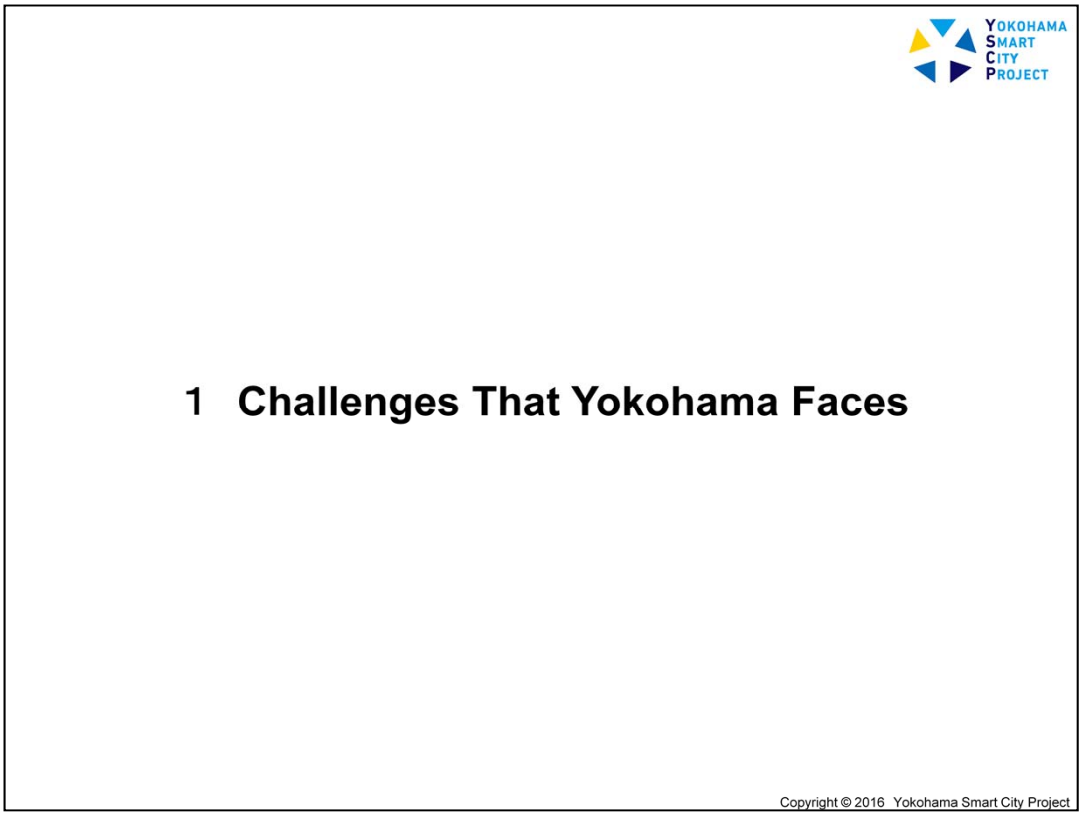
○ご清聴ありがとうございました。

Hello, my name is ○○○, I'm a manager of Climate Change Policy Headquarters at Yokohama City. Thank you for inviting this seminar.

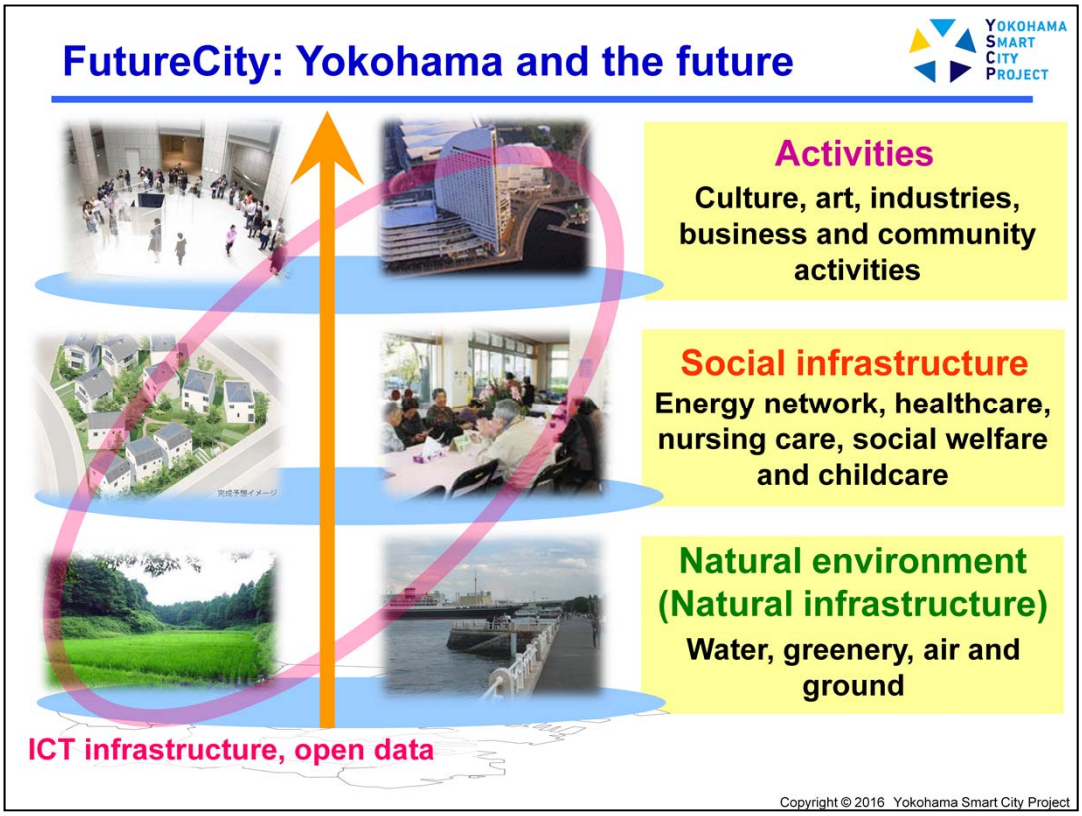
Today, I would like to explain our flagship project, the Yokohama Smart City Project.



At first, I'm going to introduce the city of Yokohama.
Yokohama is located in the center of Japan islands.
Yokohama was opend as a international port in 1859.
At that time, there were few dozen houses.
But Yokohama is growing as the second largest municipality in Japan,
with a population of 3.7 million.



We are currently faced with the several challenges, global warming, super-aging, and so on.

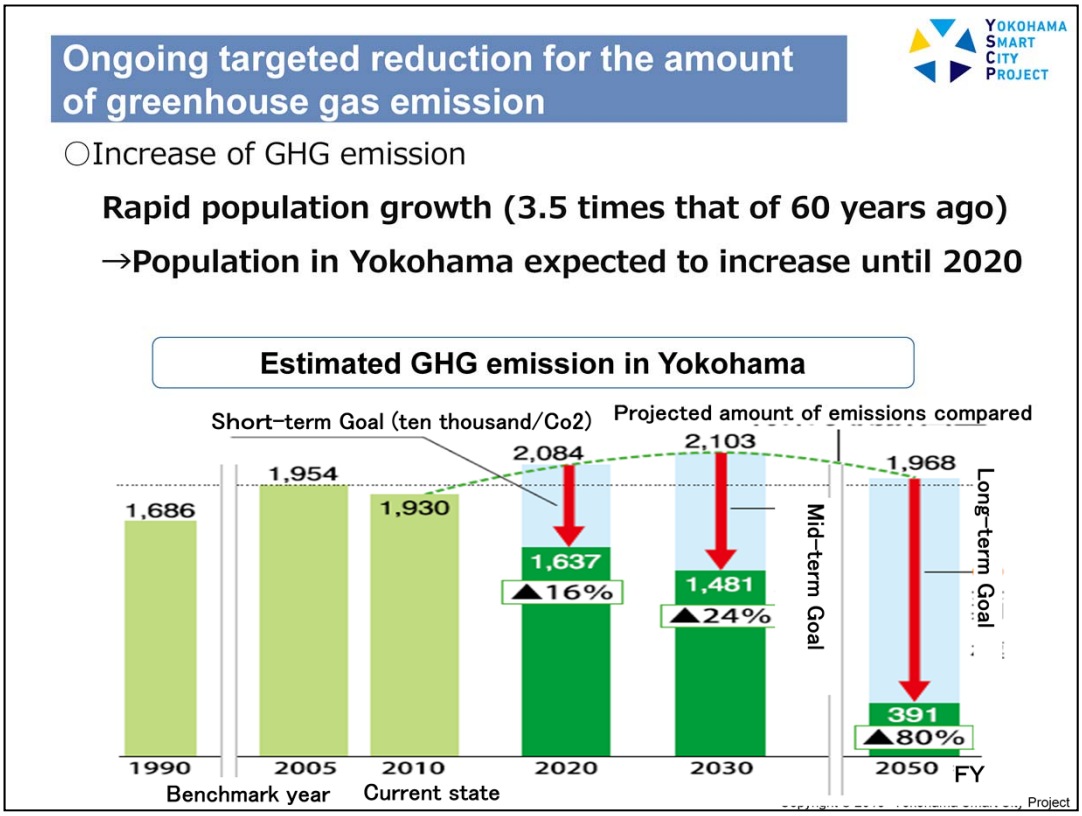


To solve these issues in a comprehensive manner, we promote the future initiatives by three areas.

First, at the very bottom is the natural infrastructure layer.
The second layer is man-made social infrastructure.
The third is visible, daily social activities.

Working together with citizens, local businesses, municipality,

We called these initiatives “Future City Yokohama" .



To mention about global warming, if we don't make the counterplan, Green House Gas emission will increase as growing the population.

In Japan, birth rate becomes low and elderly people are increasing.

But Yokohama's population is forecast to increase until 2020. The green dotted line is the forecasted CO2 emissions if we do not make counterplan to reduce CO2 emissions.

In 2020, the amount of CO2 emission will be 20.84 million tons.

In 2030, the amount of CO2 emission will be 21.03 million tons.

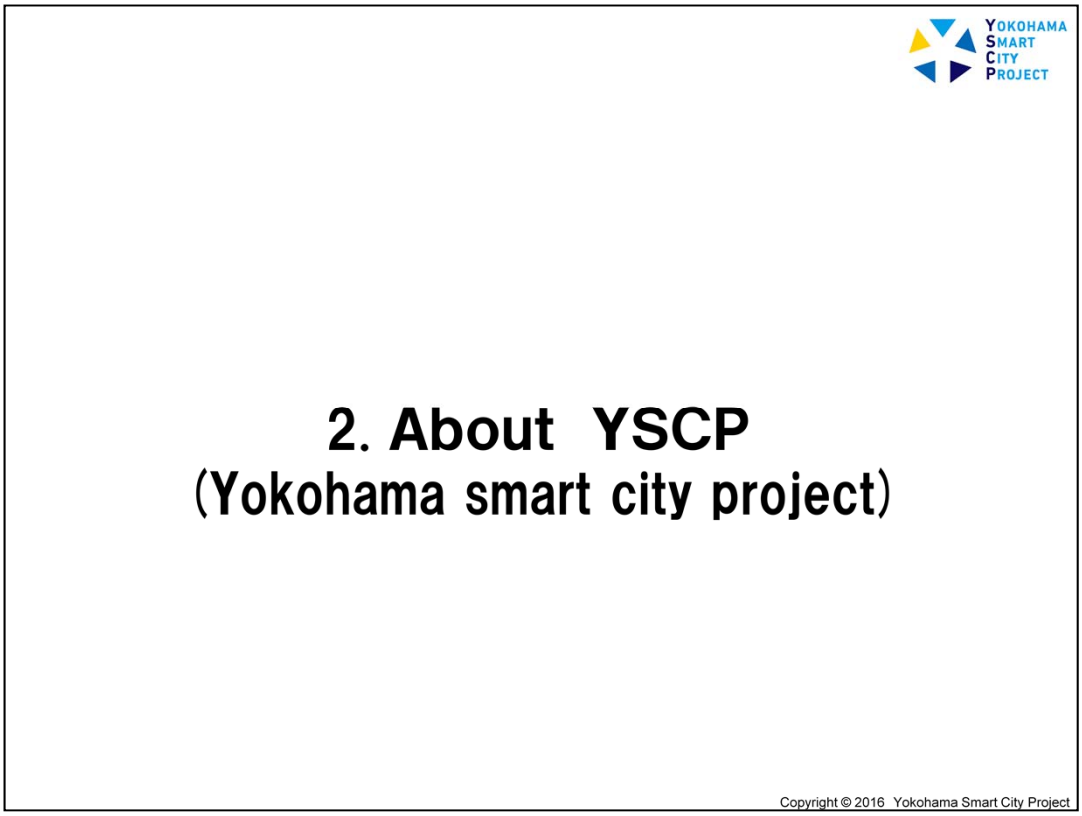
So, we make the climate change policy action plan.

(Not read)

On this plan, we set the amount of CO2 emission in 2005, as a standard amount.

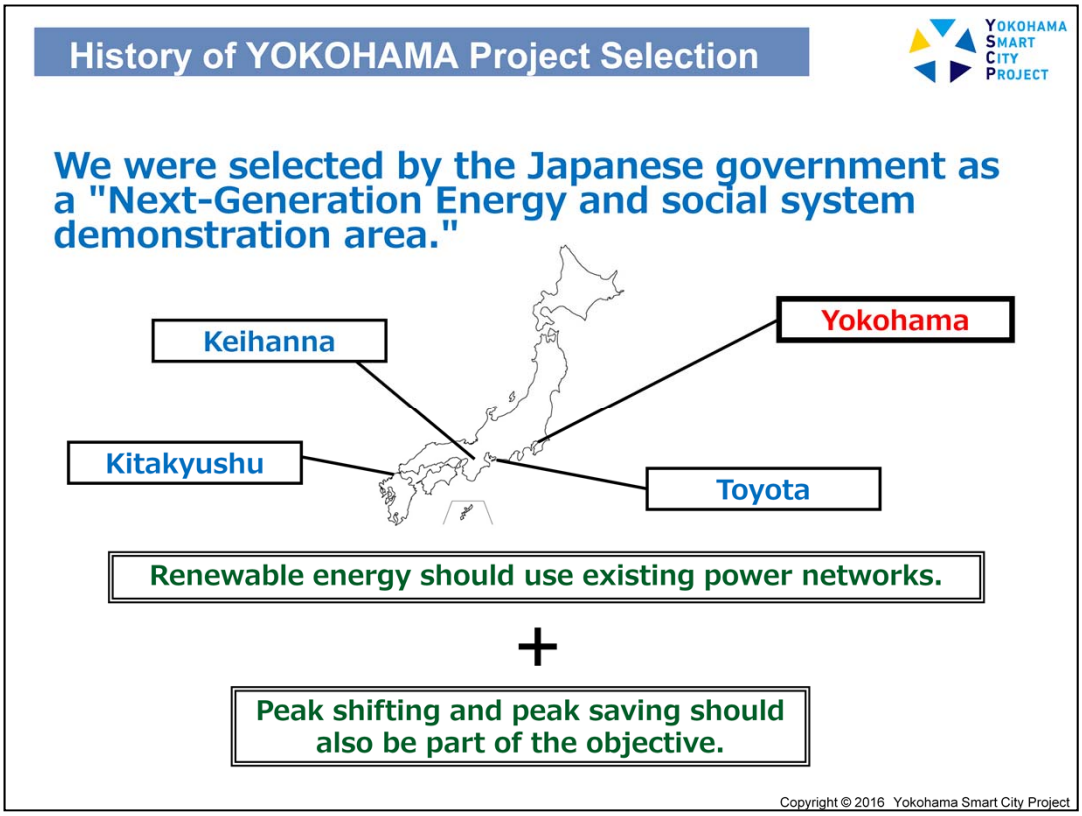
In 2020, we are going to reduce the 16% of CO2 emission amounts in 2005.

In 2030, we are going to reduce the 24% of CO2 emission amounts in 2005.



Now, I introduce the specific efforts about climate change policy, Yokohama Smart City Project.

Yokohama Smart City Project is being conducted as one major project.



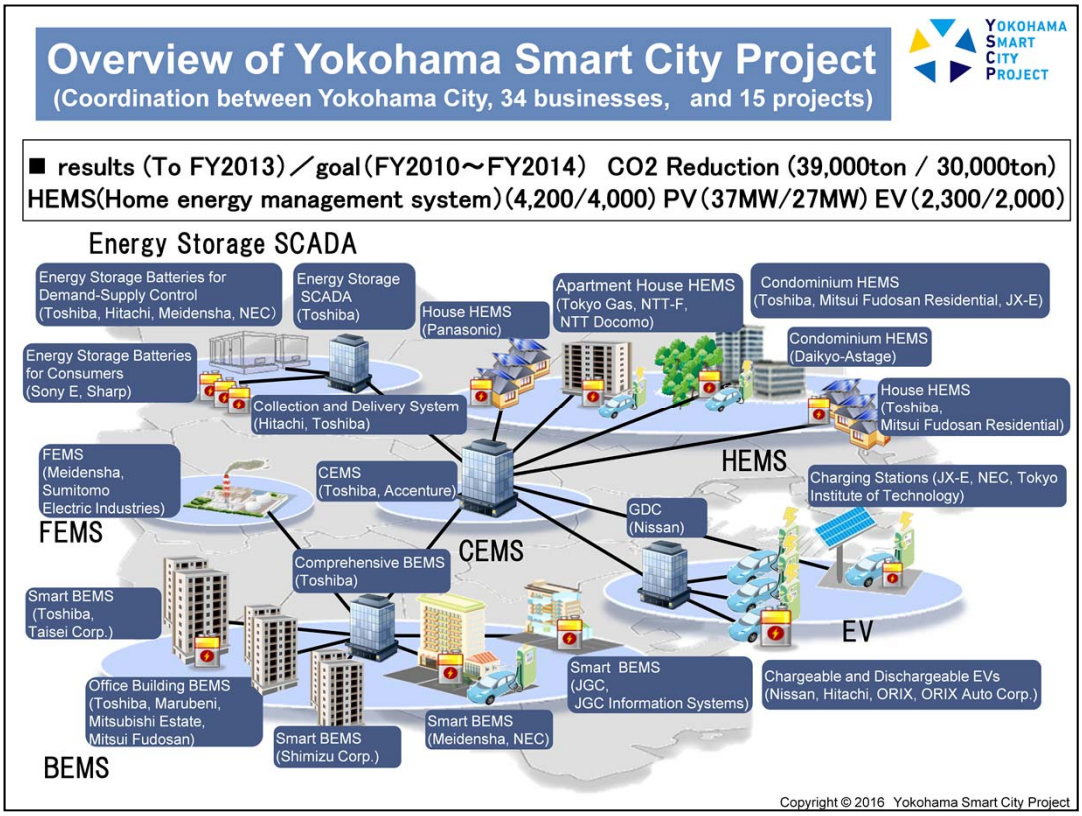
In 2010, Yokohama Smart City Project was selected by the Ministry of Economy, Trade and Industry.

As one project of Next-Generation Energy Infrastructure and Social Systems Demonstration Areas.
The initial theme was to spread renewable energy and stabilize the systems.

But, after the Great East Japan Earthquake march eleventh 2011,

It became increasingly important to distribute, decentralize the energy system, and power-saving, as disaster measures.

For this reason, we incorporated items such as cutting peak electricity into the demonstration project.



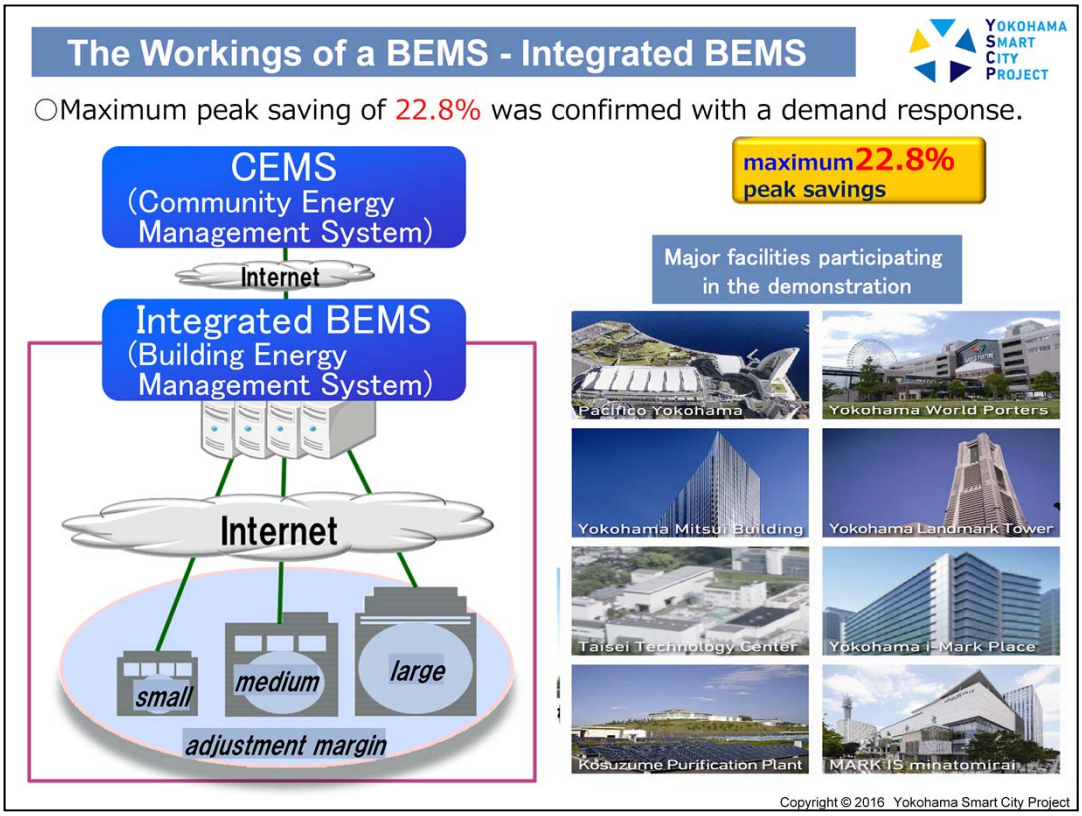
This picture is the overview of the energy management of this project.

The feature is a large-scale demonstration in existing urban areas.
From 2010 to 2014, we developed and tested a variety of technology.

HEMS, Electric Vehicles for households, BEMS for buildings, FEMS for factories and SCADA gathering small storage batteries, which were linked with CEMS for community-wide energy management.
We reached our target a year ahead of schedule, introducing HEMS into around 4,200 households, 37 megawatts of solar panels and 2,300 electric vehicles.

The amount of CO2 reduction was 39,000 tons.

The CO2 reduction ratio was 29%



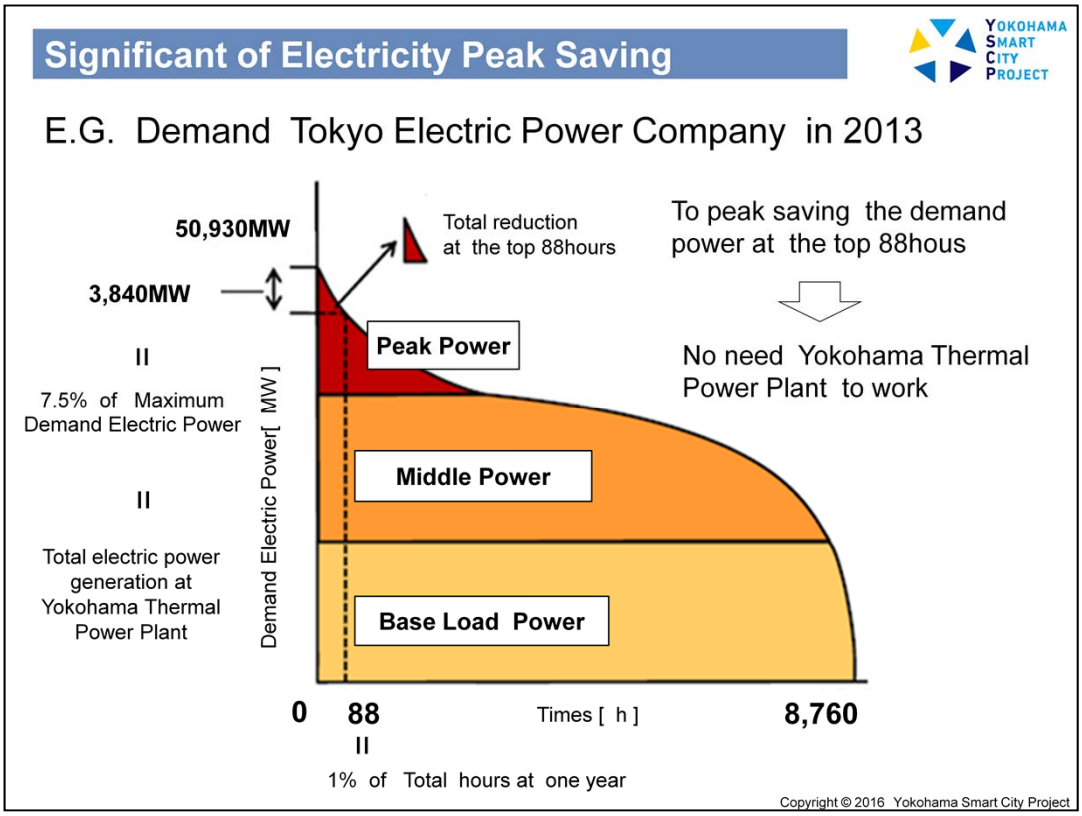
In regard to demonstration, I explain only about BEMS.

Because my presentation time is limited, I omit HEMS, PV, EV.

In the BEMS demonstration testing, we introduced a system that manages multiple BEMS as a group.

It called integrated BEMS, to manage buildings with varying characteristics, such as large office buildings, commercial buildings and water purification plants as a group.

It carried out the demand response demonstration aimed at cutting electricity peaks.
For the results, we achieved a maximum peak saving of 22.8% by demand response.



Then, I explain the importance of peak saving.

This graph is the electricity distribution for a year, demanded Tokyo Electric Power Company in 2013.

Horizontal axis is time scale, vertical axis is demand electric power.

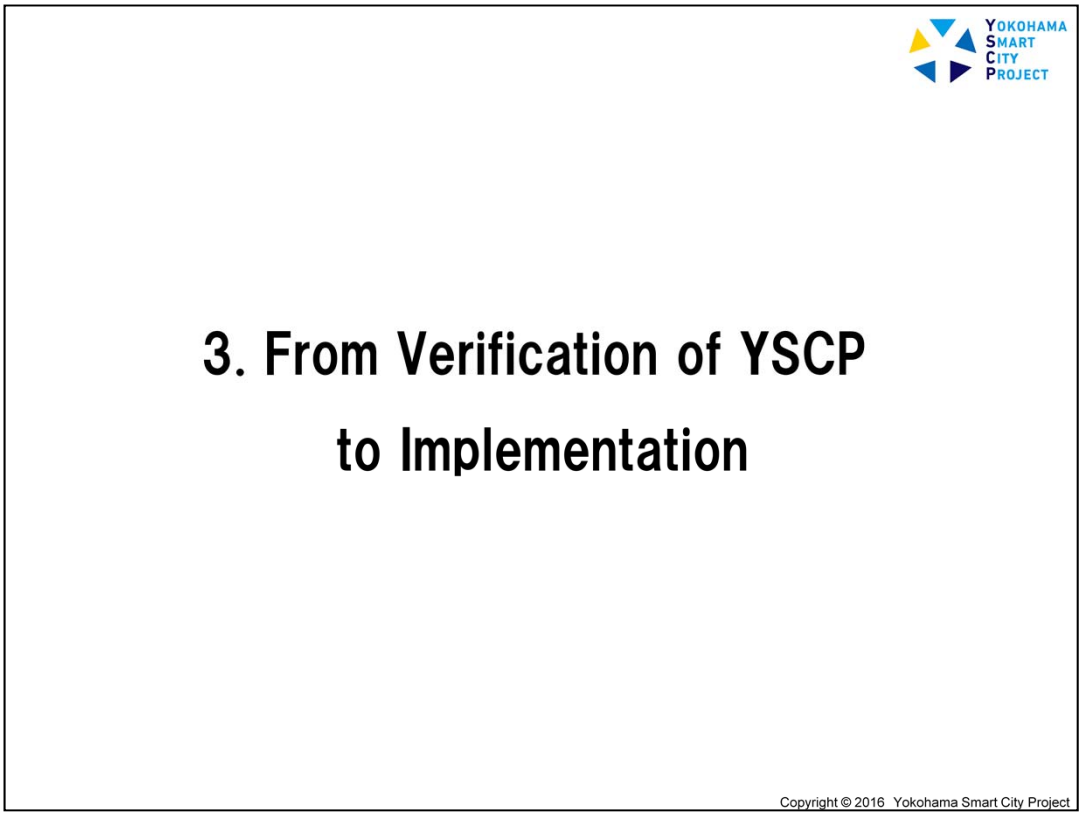
Between 0 and 88hours, the demand electricity is 3,840MW.

It is almost equal the total power generation at Yokohama Thermal Power Plant.

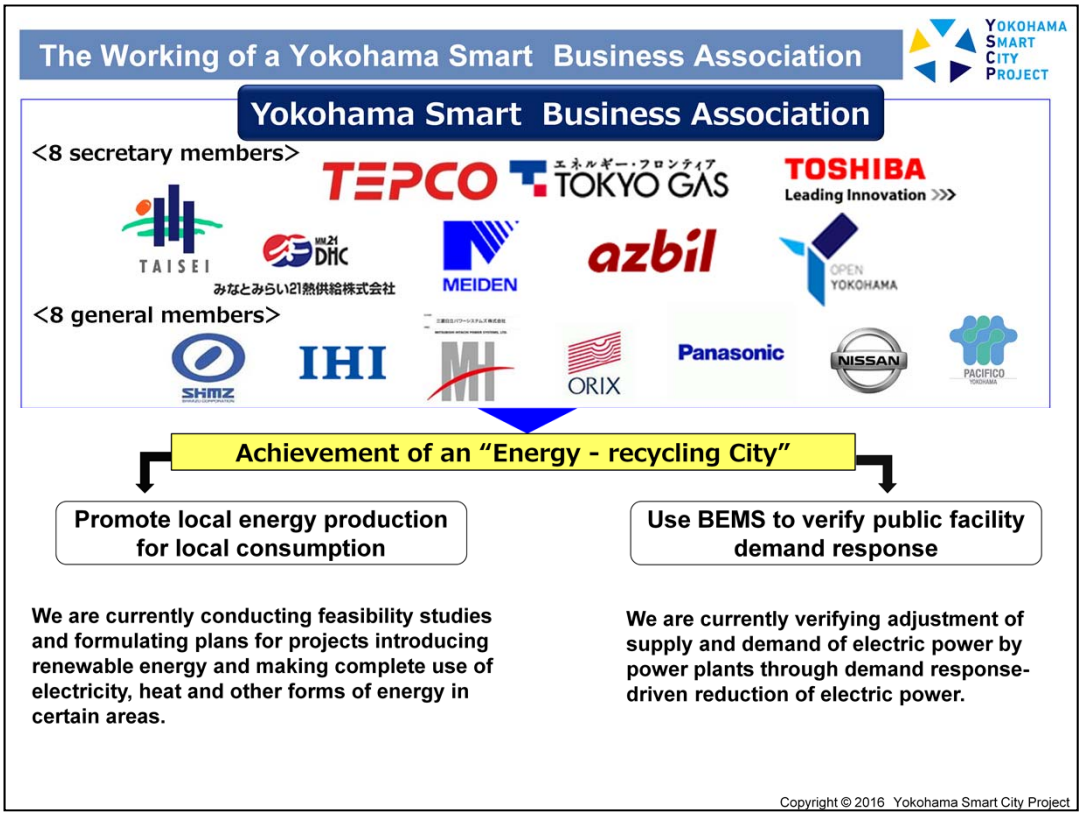
If we reduce the consumption at the top 88 hours, it is not necessary to work the thermal power plant to cover peak electricity.

So, we think it is useful to reduce CO2 exhausts.

That's why we promote peak saving by demand response.



Thus far, I explained the demonstration of YSCP.
From now I explain about the implementation of YSCP.



Since April 2015, we established the association to achieve an energy recycling city.

It named Yokohama Smart Business Association, with 15 representative Japanese companies including Toshiba, TEPCO, Tokyo Gas, and Taisei Corporation, have joined with Yokohama to promote the project.

We conduct two efforts, mainly.

One is to promote local energy production for local consumption.

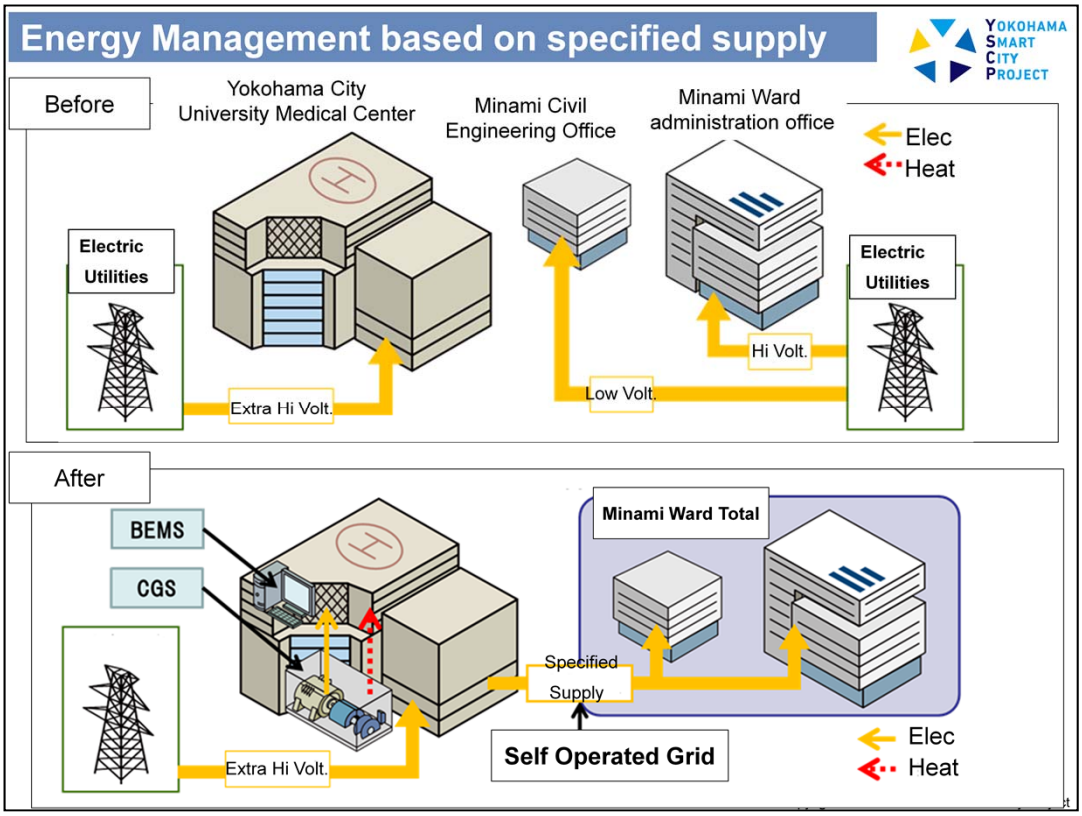
We are moving forward with the conducting of feasibility studies and the formulation of plans for projects to be implemented next fiscal year and beyond.

The other is to use BEMS to verify public facility by demand response.

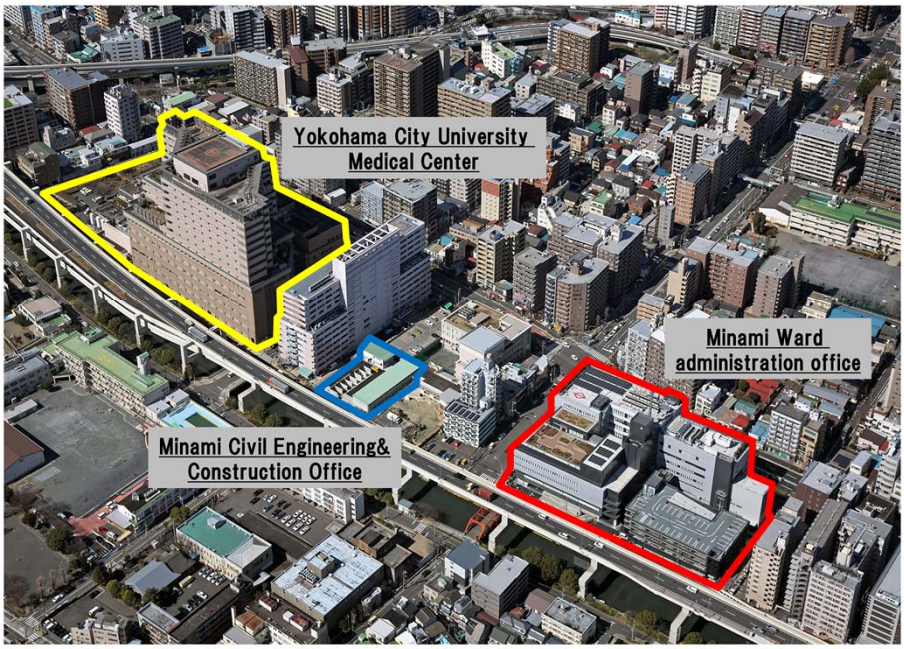
It is thought that the social environment surrounding energy will change in the future, for example with the forecast liberalization of electricity and gas retailing.

We will be working through public-private partnerships to construct business models.

And we utilize technology and expertise gleaned the demonstration, such as optimization energy use throughout consolidating the amounts of customer power saved.


Energy Management based on specified supply
YOKOHAMA SMART CITY PROJECT
Before
Yokohama City University Medical Center
Minami Civil Engineering Office
Minami Ward administration office
Elec
Heat
Electric Utilities
Extra Hi Volt.
Low Volt.
Hi Volt.
Electric Utilities
After
BEMS
CGS
Minami Ward Total
Specified Supply
Self Operated Grid
Extra Hi Volt.
Elec
Heat

energy management based on specified supply

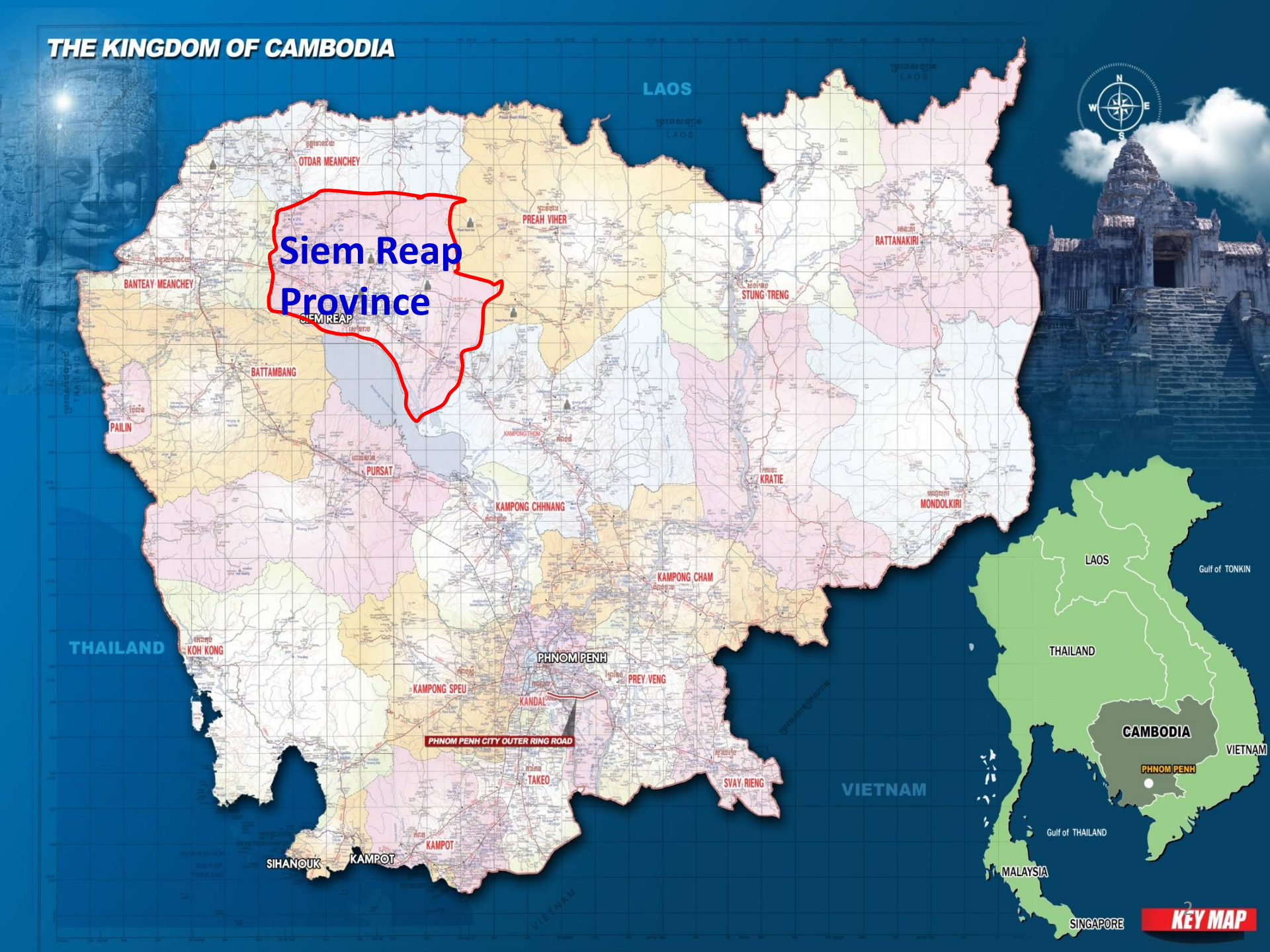


Workshop on Joint Crediting Mechanism (JCM) City-to-City Collaboration Projects

Siem Reap City
Siem Reap Province

Presented by Mr. Ung Sophean,
Director of Inter-Sectoral Division,
Siem Reap Provincial Administration
Kingdom of Cambodia

20 October 2016
Kitakyushu, Japan


THE KINGDOM OF CAMBODIA
LAOS
Siem Reap Province
OTDAR MEANCHEY
PREAH VIHER
RATTANAKIRI
BANTEAY MEANCHEY
STUNG TRENG
SIEM REAP
BATTAMBANG
PAILIN
PURSAT
KRATIE
MONDOLKIRI
KAMPONG CHHNANG
KAMPONG CHAM
THAILAND
KOH KONG
PHNOM PENH
PREY VENG
KAMPONG SPEU
KANDAL
PHNOM PENH CITY OUTER RING ROAD
TAKEO
SVAY RIENG
VIETNAM
KAMPOT
SIHANOUK
KAMPOT
LAOS
Gulf of TONKIN
THAILAND
CAMBODIA
VIETNAM
PHNOM PENH
Gulf of THAILAND
MALAYSIA
SINGAPORE
KEY MAP

I-Brief Outline

Siem Reap Province

- Land area: 10,299.43 Km2
- 1 City (Siem Reap City))
- 11 Districts
- 100 Communes/Sangkats
- 922 Villages
- Population: 995,057
  (Female: 504,596)
- Main Industries:
  - Agriculture (80%)
  - Service and others (20%)
- Angkor Wat (world heritage)
  Tourists: 3,019,280 (2015)
  (International: 1,105,680)

Siem Reap City

- Land area: 472.73 Km2
- 13 Sangkats:
- 108 Villages
- Population: 256,018
  (Female:131,528)
- Households 50,824
- Family size: 5

II. low-carbon policies/strategies/action plans in Siem Reap city

1. City Overall Visions

- Town of Water
- **Town of Green**
- Town of Culture and Education
- Town of Tourism Assets

2. City Development Plan

- Environmental development plan (Priority Plan)
- Introduction of Environmental public transport in the Angkor Archeology Park (AAP): Battery Car / Electric bus, Traditional transport (Horse cart, Elephant ,.)

3. Public Awareness Raising Mechanism

- Environmental Campaign/Environmental Day
- Training/workshops
- Banners (Public)

4. Waste Management

Recycling and Reusing Activities

Animal Feeding

Plastic Battle Reproduction

Composting

III. Expectation to the JCM City-to-City Collaboration Project

1. Process of sustainable development
2. City overall visions for Low-Carbon policy, strategy and action plan
3. Lesson learn and reality of low-carbon implementation process
4. Legal procedure for low-carbon
5. Local participation and collaboration process
6. Roles and responsibilities of local government.

IV. Roles of Siem Reap Administration for Low-Carbon Implementation Policy

1. Support city development plan implementation
2. Provide capacity development and human resources
3. Strengthening roles and responsibility of city administration on low-carbon policy/strategy and action plan
4. Provide technical support
5. Cooperated with development partners for low-carbon project implementation
6. Improve local participation and understanding on environmental protection process

V. Difficulties/Barriers in Implementation

1. Lack of legal and institutional arrangements
2. Lack of human resources at local administration
3. Lack understating on environmental issues and protection
4. Lack of financial support from government on environment protection process
5. Lack of participation from development actors (civil societies and development partners)
6. Disadvantage of development process


Thank You for Your Consideration

C2CC with Siem Reap and Kanagawa

Tomonori KIMURA
CEO
Asian Gateway Corporation

October, 2016

3-7-2, KANDANISHI CHO, CHIYODA-KU, TOKYO

PUBLISHED OCTOBER 2016
WWW.ASIANGATEWAY.CO.JP

PPP Scheme

PPP approach like Bilateral Cooperation with Siem Reap and Kanagawa (Nov. 2015)

PPP Scheme

- G2G
- LG2LG
- B2B

- National Strategic Development Plan
- Government Aid Policy
- JCM(Joint Crediting Mechanism)

- City to City Collaboration
- EV Tourism and Renewable Energy

- International Consortium for JCM
- Business Partnership with Asian Gateway
- Consulting and Trading for Sustainable Energy

PPP: Public-Private Partnership

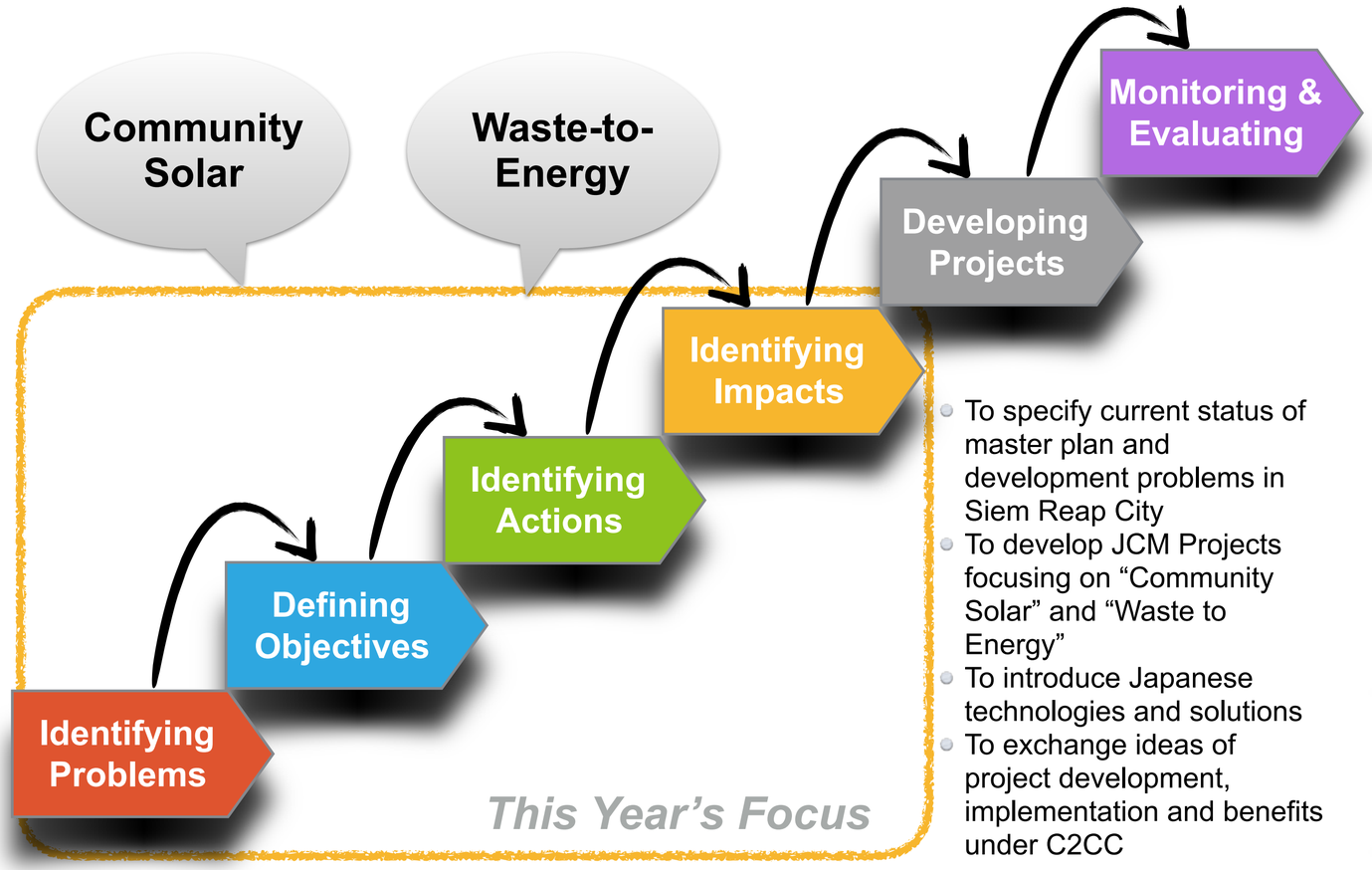
C2C Cooperation with Siem Reap and Kanagawa

Objectives

- Creating low-carbon tourism city (Green City) development in Siem Reap Province;
- Benefitting from the results of Feasibility Studies on Joint Crediting Mechanism Projects;
- Aiming to promote mutual understanding and friendship; and,
- Undertaking development of the two regions in collaboration

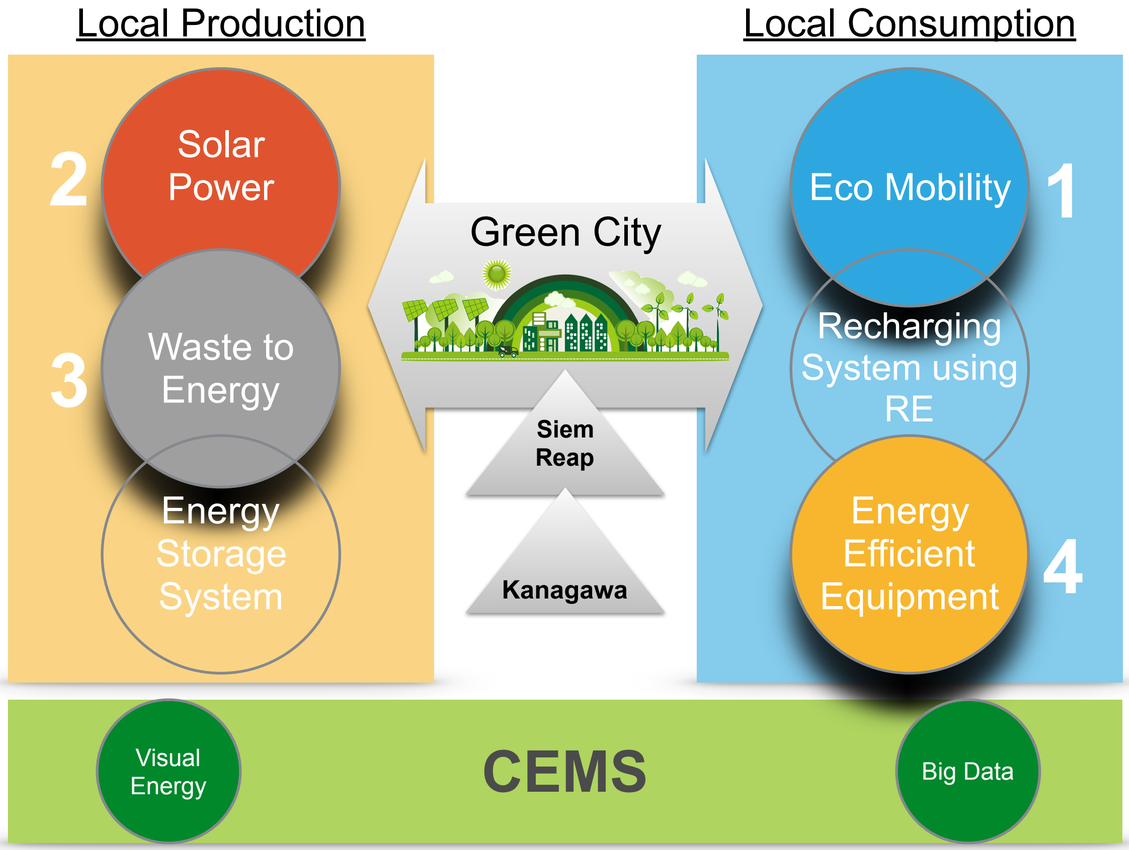
Strategical Steps for C2C Cooperation in 2016

Strategical Steps for C2C Cooperation in 2016



- To specify current status of master plan and development problems in Siem Reap City
- To develop JCM Projects focusing on "Community Solar" and "Waste to Energy"
- To introduce Japanese technologies and solutions
- To exchange ideas of project development, implementation and benefits under C2CC

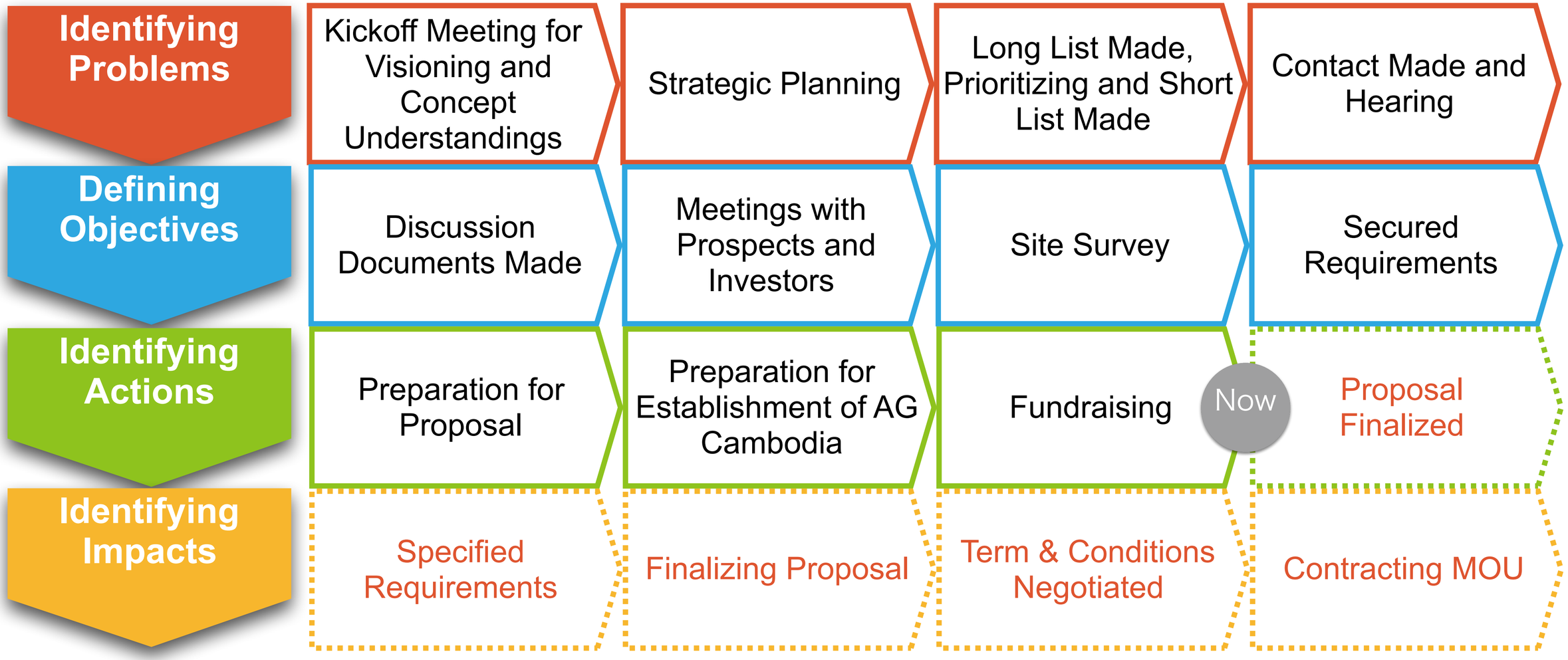
Vision: Local Production for Local Consumption



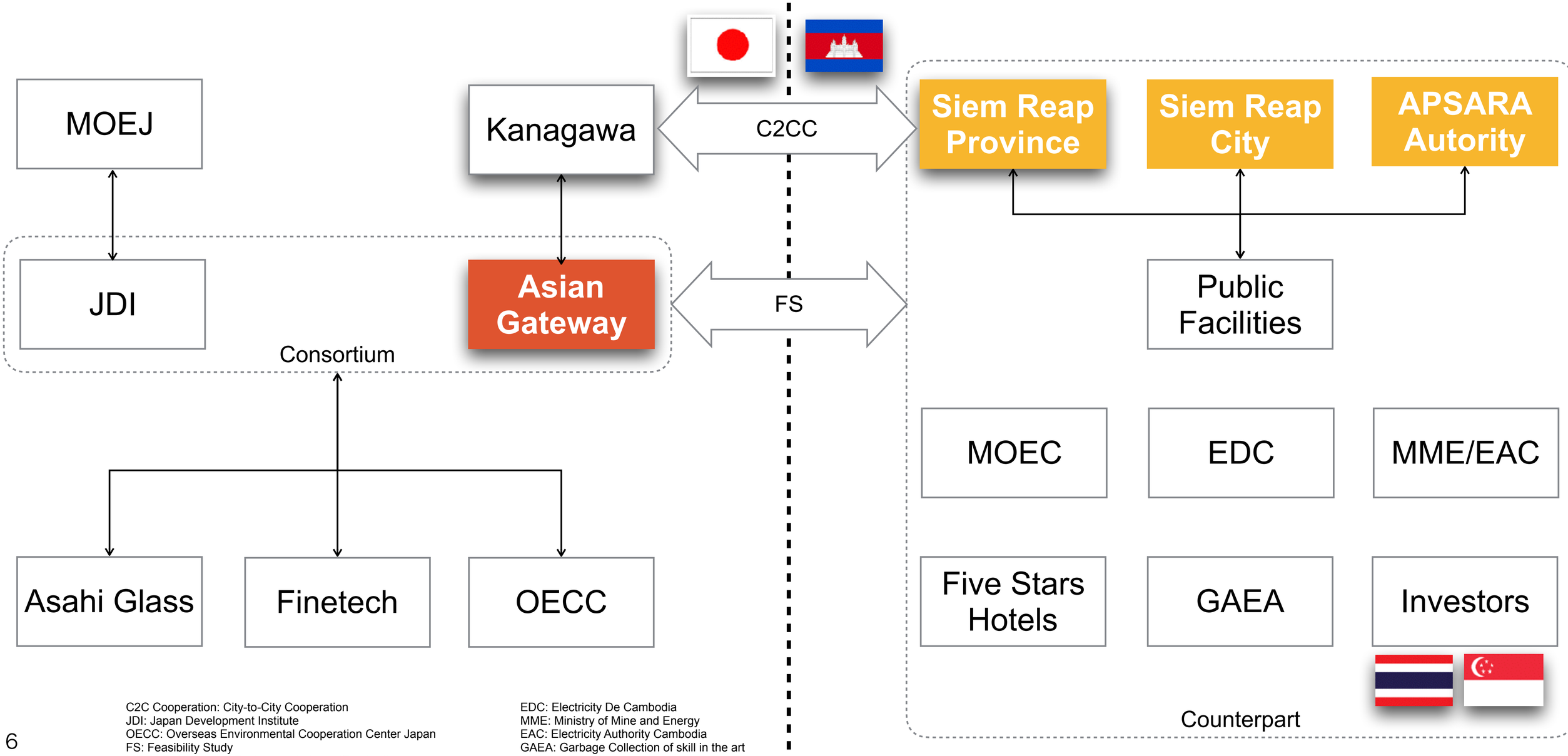
C2C Cooperation: City-to-City Cooperation
CEMS: Community Energy Management System

Strategic Steps for C2CC

As is October 2016



FS Formation for C2CC

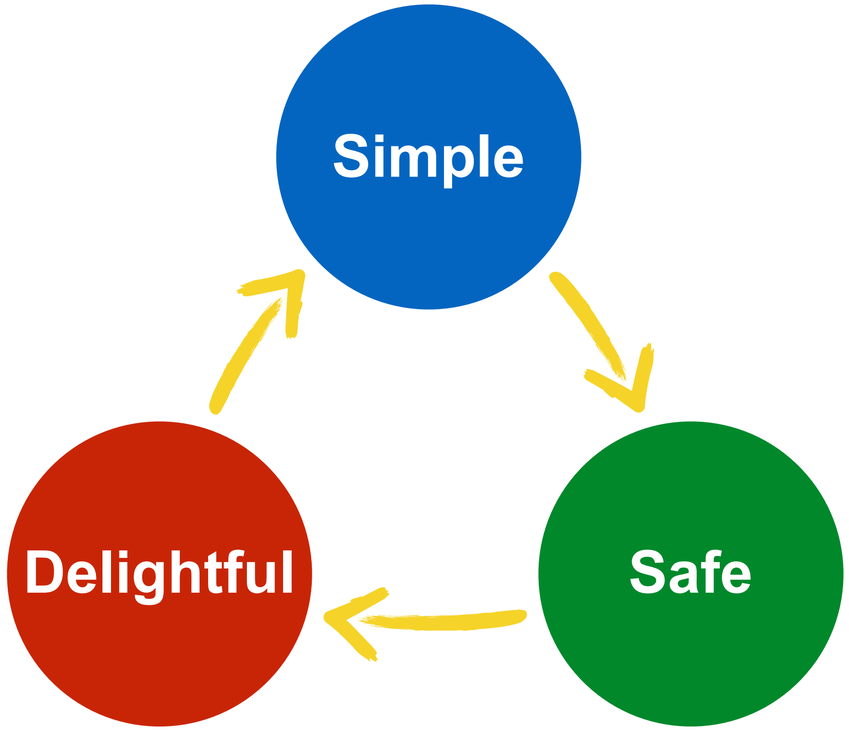


C2C Cooperation: City-to-City Cooperation
JDI: Japan Development Institute
OECC: Overseas Environmental Cooperation Center Japan
FS: Feasibility Study
MOEJ/C: Ministry of Environment, Japan/Cambodia

EDC: Electricity De Cambodia
MME: Ministry of Mine and Energy
EAC: Electricity Authority Cambodia
GAEA: Garbage Collection of skill in the art

e-Mobility in Siem Reap

- Angkor Mobility Service (AMS) is a simple, safe, and delightful way to experience the Angkor Complex.

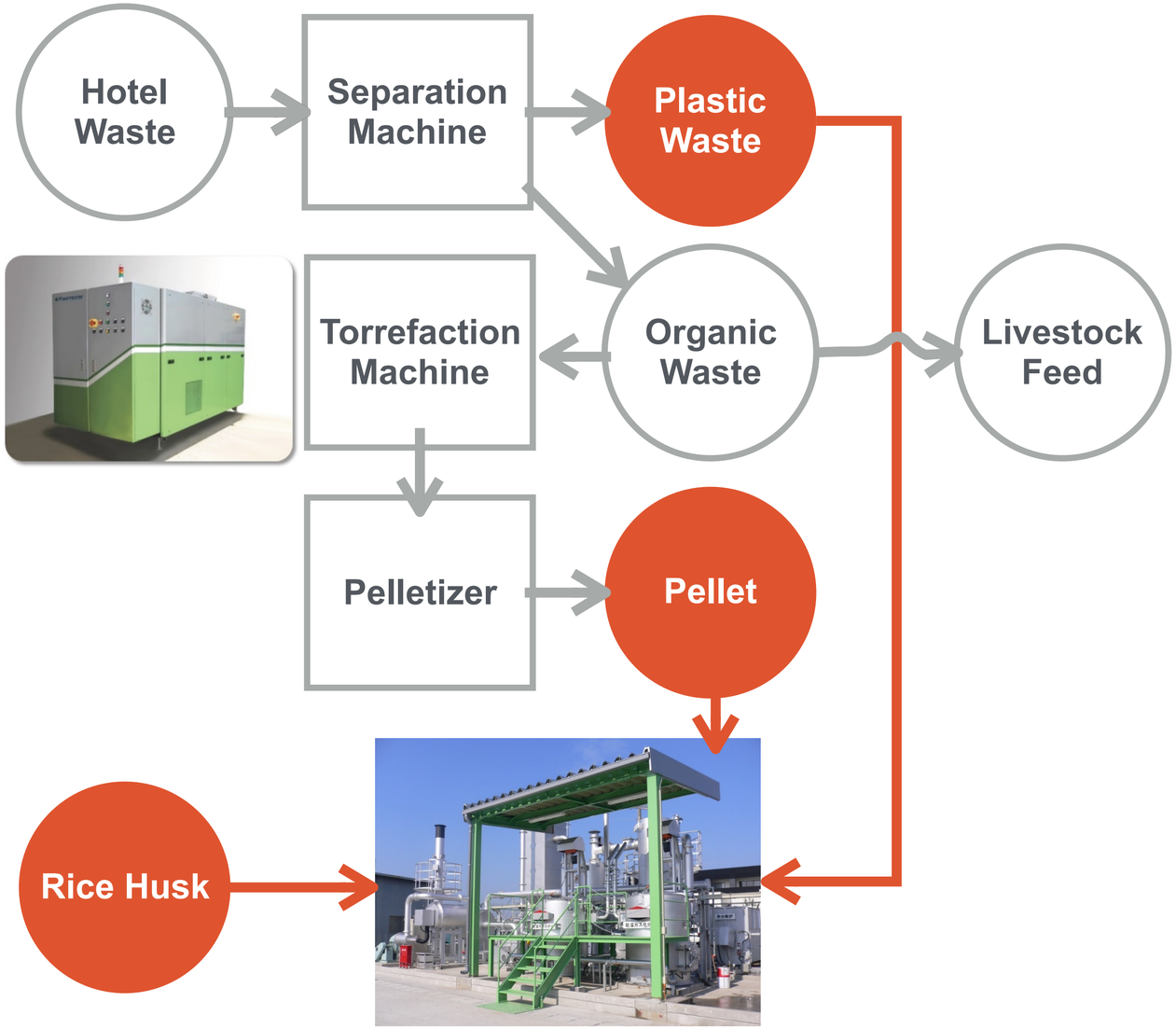


Rooftop Solar Energy in Siem Reap

- Community Solar with rooftop solar energy at five stars hotels and public facilities.
- Encourage self-consumption first and enable to sell excess power.

Aim	Target Group	Target
• Reduce day-peak of electricity • Reduce loss in electricity grid • Lead to self-sufficient power consumption society • Job and business creation	• Area-based • Electricity consumption-based • Electricity user type	• Country peak load • Area Electricity profile
Investment	**Power purchasing model**	**Incentive Measures**
• Self investment • Investment with loan • Leasing	• Feed-in Tariff • Retail price • Net Metering	• Subsidy (Partly) • Tax incentive • Non-tax incentive • Soft loan (ex, IDA (International Development Association))

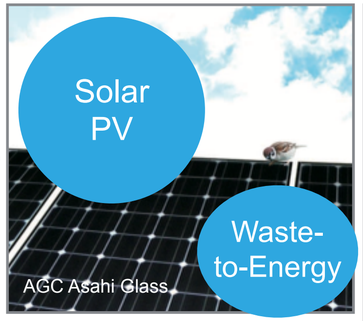
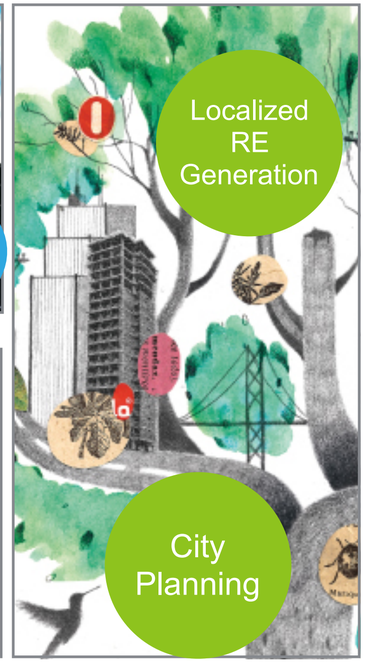
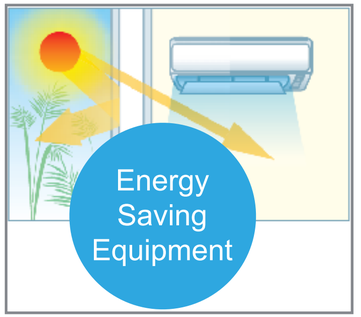
Waste to Energy in Siem Reap



Biomass Power Generation System

ZEB in Siem Reap

- Zero Energy Building for 5 stars hotels based on RE/EE.
- New Project in 2017

	Functions	X	Infrastructure	X	Behavior
Renewable Energy(RE)					• Decentralization by Rooftop Solar Energy in city • Electrification • Reliable and Affordable
Energy Efficiency & Conservation					• Efficient Applications • Integration of architecture and energy saving equipments

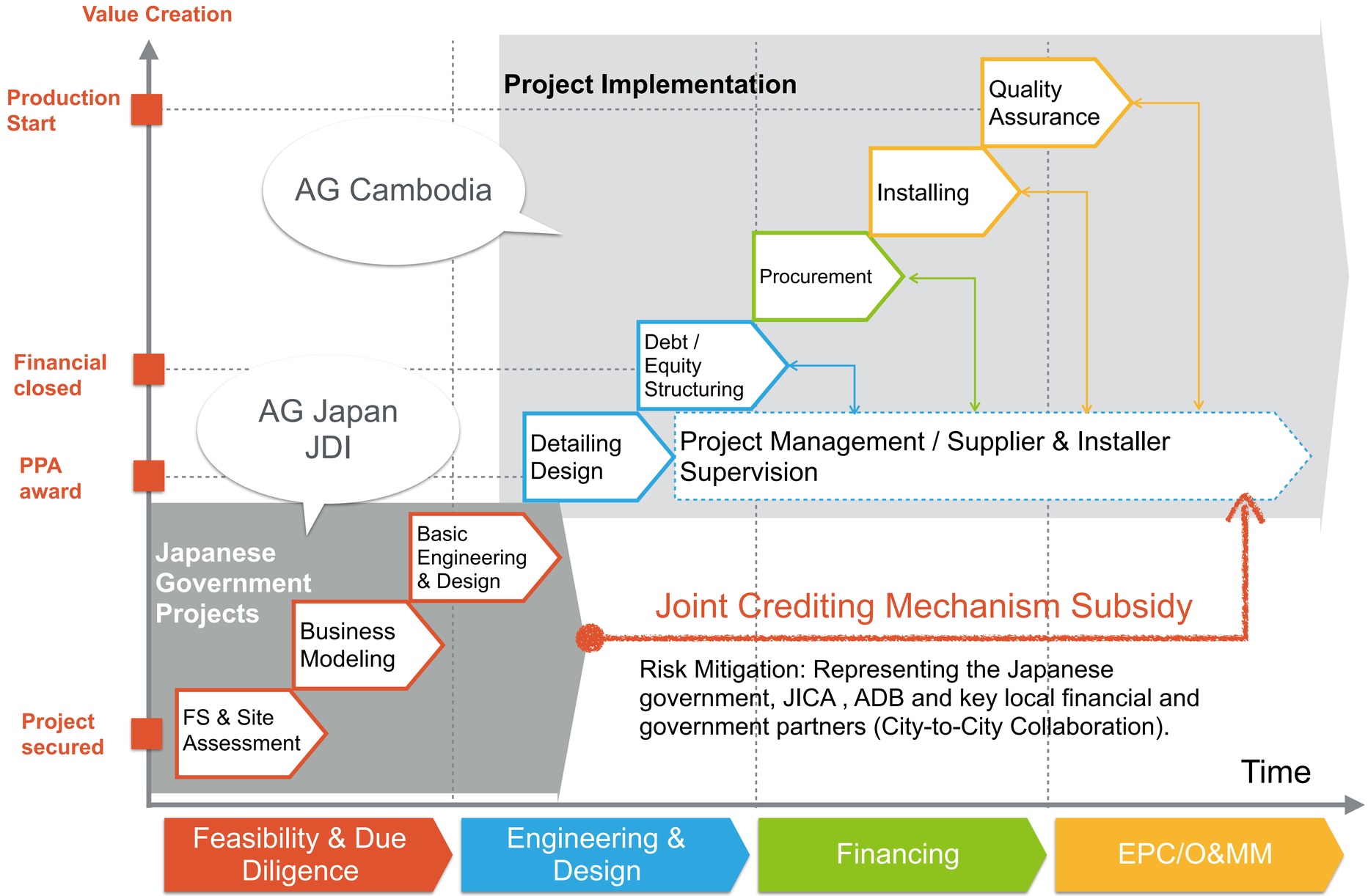
Eco Village controlled by APSARA Authority

- The Run Ta-Ek village Development project, which encompasses 1,012 hectares of land 33 kilometers outside Siem Reap town, was set up by the Apsara Authority, which administers the Angkor temple complex, in an effort to limit the amount of housing within the temple park and along the Siem Reap River.

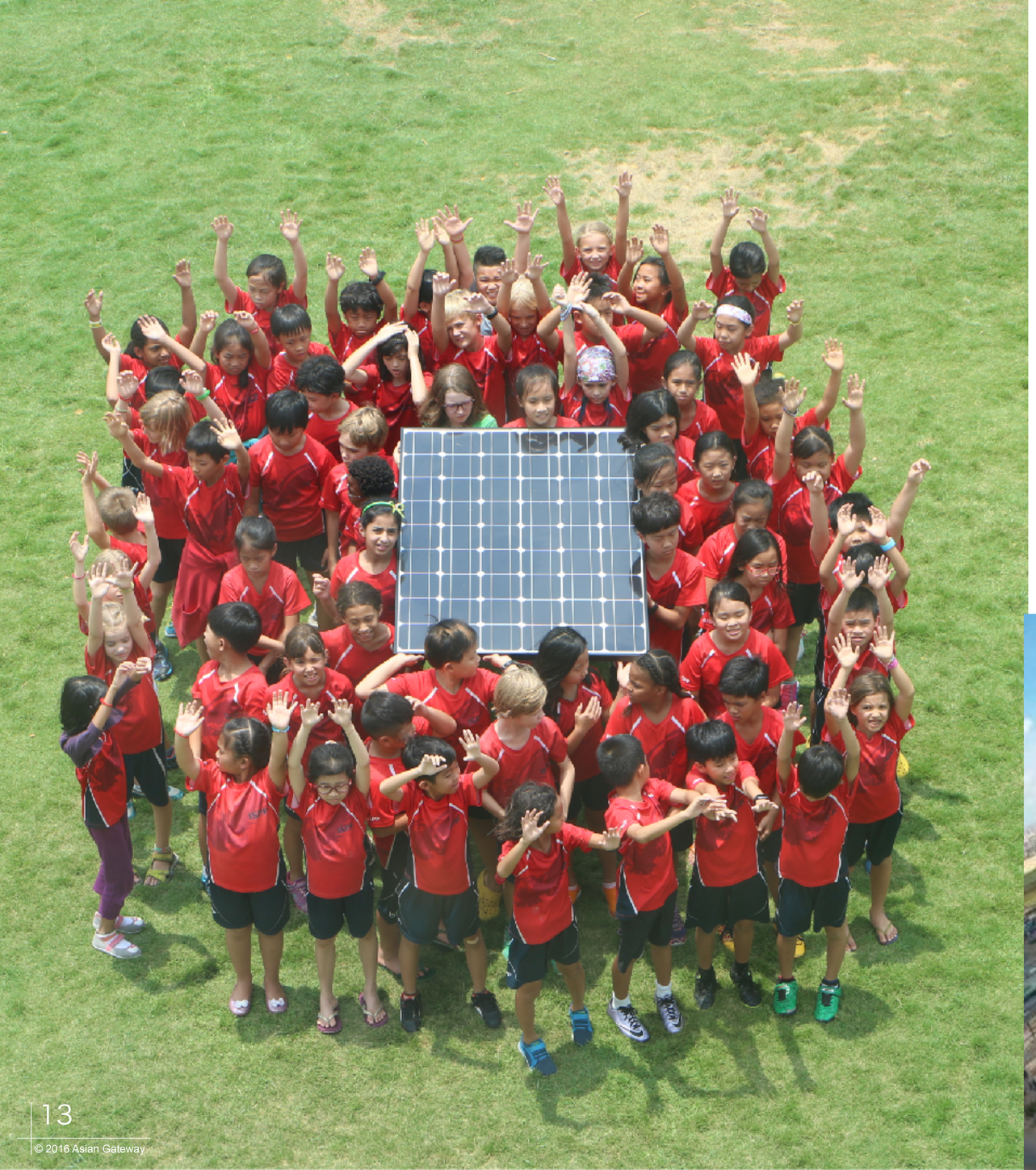
AG Japan and AG Combodia

Doing Business by AG Cambodia

Consulting by AG Japan and JDI



AG: Asian Gateway
JDI: Japan Development Institute



ISPP (International School of Phnom Penh)

- 5.4ha of land
- 200kW + 800kW (Max. 1MW)
- 830 students
- The first GEC JCM Project in Cambodia Solar Market

Target Domain by Cambodia Sun Power

Integrated Solar Energy and Sunshine Power aiming to Local Production for Local Consumption

Food

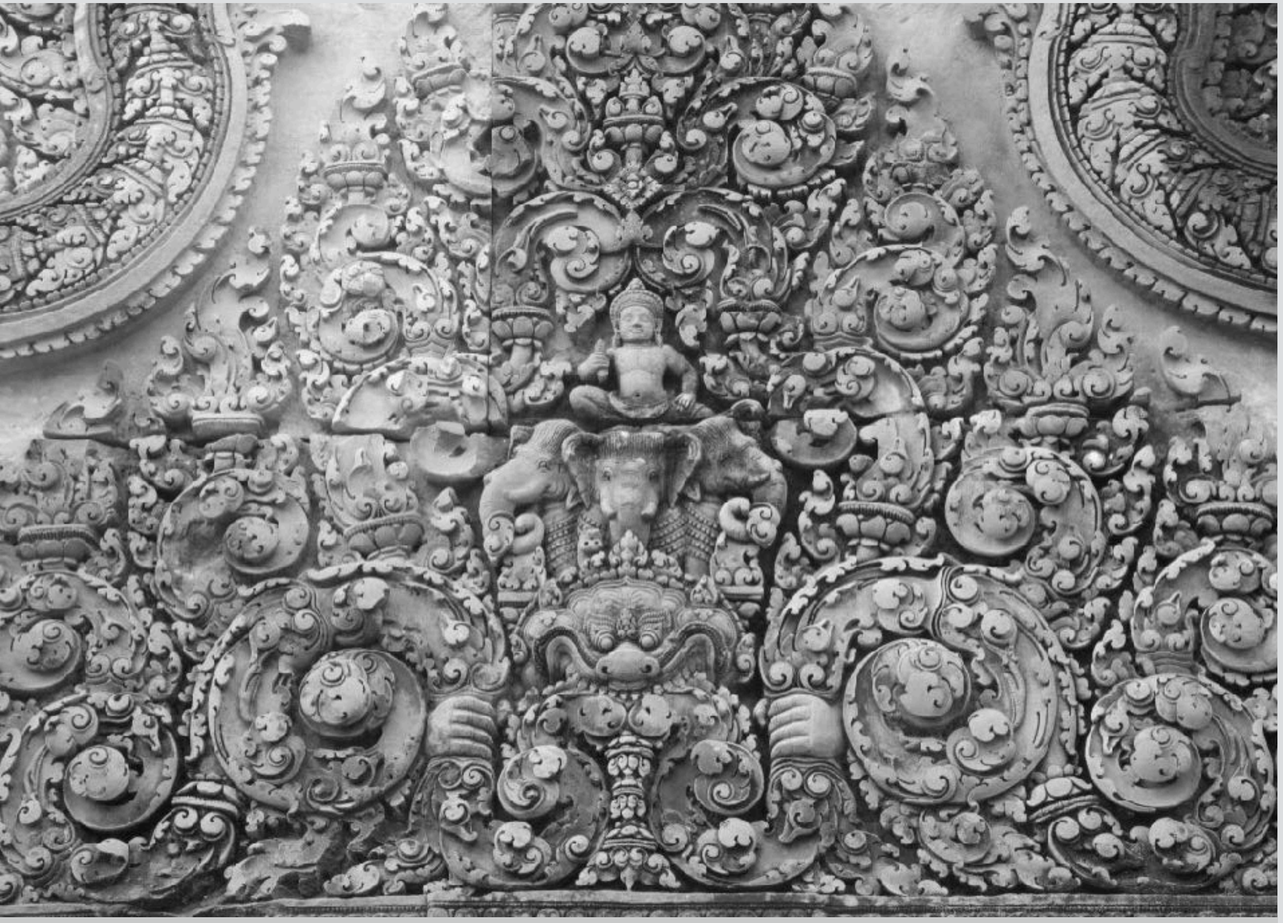
Synergy

Energy

IoT

IoT: Internet of Things

THANK YOU! FOR YOUR ATTENTION



We would like to hear from you and answer any questions that you might have. info@asiangateway.co.jp

2017.1.19

非公開セミナー：都市間連携に基づく JCM 案件形成可能性調査の進捗報告及び活用が想定される資金支援スキーム

日時： 2017 年 1 月 23 日(月)、09:00-11:00 (受付：08：30-)
場所： TKP 新橋カンファレンスセンター 3 階 ホール 3A
主催： 環境省
共催： (公財)地球環境戦略研究機関(IGES)
言語： 日英同時通訳

アジェンダ：

09:00-09:05 主催者挨拶 (会場：3階ホール3A)
水谷 好洋 (環境省 地球環境局 国際連携課 国際協力室長)

09:05-09:10 会場移動(グループ B のみ)

09:10-10:10 第Ⅰ部：案件報告会(60 分)

グループ A (会場：3階ホール3A)	グループ B (会場：4階ルーム4A)
− カンボジア・シェムリアップ市(2) アジアゲートウェイ(株) 代表取締役社長 木村 友則	− インドネシア・バタム市(4) 日本工営(株) 環境・水資源事業部-環境技術部 齋藤 哲也
− インドネシア・バリ州(1) JFE エンジニアリング(株) 都市環境本部 海外事業部 統括スタッフ 樋口 真司	− ミャンマー・ヤンゴン市(2) 日本工営(株) 環境事業部 環境技術部 副参事 清水 幸代
− ミャンマー・エーヤワーディ管区(2) (株)三菱総合研究所 環境・エネルギー事業本部 主席研究員 小島 浩司	− タイ・バンコク都(1) 横浜港埠頭(株) 事業営業部 事業営業課長 尾崎 克行
− タイ・ラヨン県(2) (株)エックス都市研究所 代表取締役会長兼 CEO 大野 眞里 (株)NTT データ経営研究所 社会・環境戦略コンサルティングユニット シニアコンサルタント 山川 まりあ／網代 睦	− モンゴル・ウランバートル市(3) (一社)海外環境強力センター 次長／主席研究員 西村 真琴
− カンボジア・プノンペン都(2) ㈱日建設計シビル エンジニアリング部門 環境計画部 計画主管 藤尾 健太 (株)NTT データ経営研究所 シニアコンサルタント 山川 まりあ／網代 睦	括弧内の数字は調査案件数。1 案件あたり発表時間は 5 分を想定。(例：バタム 4 案件×5 分＝20 分) 各グループには各都市で行われている調査案件の関係者が参加。
− ベトナム・ハイフォン市(1) (株)NTT データ経営研究所 シニアコンサルタント 山川 まりあ／網代 睦	
− マレーシア・イスカンダル開発区(1) (株)NTT データ経営研究所 シニアコンサルタント 山川 まりあ／網代 睦	

10:10-10:30 休憩(20 分)

10:30-11:00 第Ⅱ部：資金支援スキームの概要説明(各発表＋質疑応答 10 分)(会場：3階ホール3A)

① 設備補助事業
坂内 修 ((公財)地球環境センター 東京事務所 事業第一グループ 総括主任)

② JCM 日本基金 (JFJCM)
手島 裕明 (アジア開発銀行 持続可能な開発・気候変動局 気候変動・災害リスク管理課 環境専門官)

③ 緑の気候基金(GCF)
丸山 出 (三菱 UFJ モルガン・スタンレー証券㈱ クリーン・エネルギー・ファイナンス部 コンサルタント)

(11:00- 昼食) (会場：1階ホール1A)

✓ 希望者は第Ⅱ部発表者との個別面談
✓ パネルディスカッション登壇者の打合せ

公開セミナー：アジアにおける低炭素社会実現のための都市間連携セミナー

日時：　2017 年 1 月 23 日(月)、14:00-17:00 （受付 13：30-）
場所：　イイノホール＆カンファレンスセンター　4 階 Room B
主催：　環境省
共催：　(公財)地球環境戦略研究機関(IGES)
言語：　日英同時通訳

アジェンダ：

14:00-14:10　主催者挨拶(10 分)
梶原　成元 （環境省 地球環境審議官）

14:10-15:00　第Ⅰ部　アジアの都市の低炭素化を推進する支援スキームと事例の紹介
① 都市間連携を活用したアジアの都市の低炭素化を進める取組(15 分)
佐井　祐介 （環境省 地球環境局 国際連携課 国際協力室 環境専門調査員）
② 設備補助事業(10 分)
坂内　修 （(公財)地球環境センター 東京事務所 事業第一グループ 総括主任）
③ JCM 日本基金(10 分)
手島　裕明 （アジア開発銀行 持続可能な開発･気候変動局 気候変動･災害リスク管理課 環境専門官）
④ 緑の気候基金(GCF)(10 分)
丸山　出 （三菱 UFJ モルガン･スタンレー証券㈱ クリーン･エネルギー･ファイナンス部 コンサルタント）
質疑応答(5 分)

15:00-15:45　第Ⅱ部　都市間連携事業の参加都市による取組事例紹介
① インドネシア国バリ州における廃棄物発電事業(10 分)
大島　健太郎 （東京二十三区清掃一部事務組合 清掃事業国際協力室 清掃事業国際協力課 清掃事業国際協力係 主任）
② タイ国における JCM を活用した港湾の低炭素･スマート化支援調査事業(10 分)
奥野雅量 （横浜市 国際局 国際協力課 国際技術協力担当課長）
鈴木明広 （横浜市 港湾局 賑わい振興課長）
③ エーヤワディの低炭素化に向けた JCM 案件形成調査事業(10 分)
アウン･ミン･ナイン （ミャンマー国エーヤワディ管区 開発局長）
宍戸　亮 （福島市 環境部 環境課長）
④ ハイフォン市･低炭素化促進事業(10 分)
グエン･トルン･ヒウ （ベトナム国ハイフォン市 外務局 副局長）
質疑応答(5 分)

15:45-16:00　休憩(15 分)

16:00-17:00　第Ⅲ部　パネルディスカッション(60 分)
モデレーター：
水谷　好洋 （環境省 地球環境局 国際連携課 国際協力室長）
パネリスト：
天野　一　（神奈川県 産業労働局 産業部 エネルギー課長）
浦崎　真　（北海道 総合政策部 国際局 国際課 プロモーショングループ 主幹）
大橋　武郎（札幌市 経済観光局 国際経済戦略室 経済戦略推進課 戦略推進担当係長）
深堀　孝博（川崎市 経済労働局 国際経済推進室 課長補佐）
園　順一　（北九州市 環境局 環境国際戦略部 環境国際戦略課 アジア低炭素化センター特区プロジェクト担当課長）
ソフェン･ウング （カンボジア国シェムリアップ州政府 地区共通課長）
バツク･ボロルトヤ （モンゴル国ウランバートル市 自然環境局 自然環境資源部長）
ポンピロドム･パニット （タイ国ラヨン県行政機構 県環境科学官）

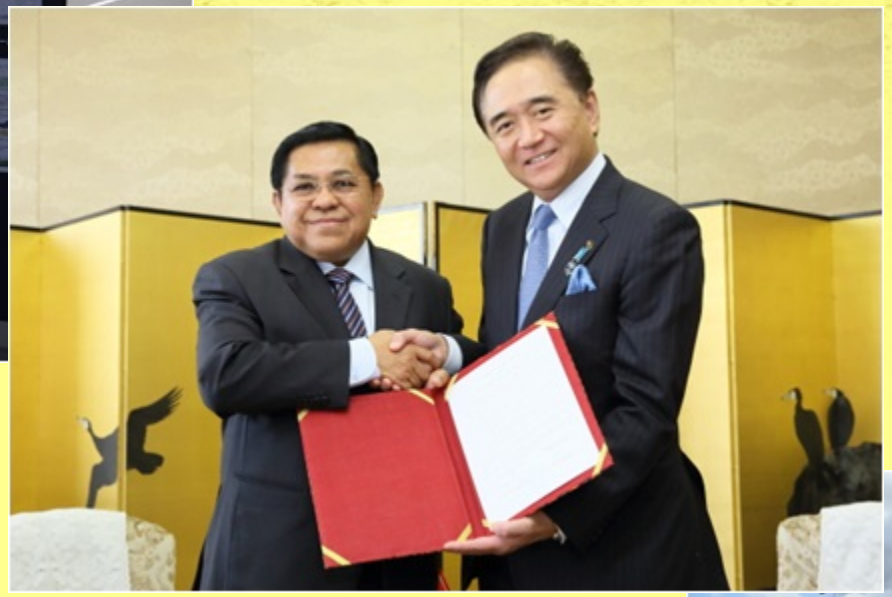
① カンボジア・シェムリアップ州における都市間連携によるJCM案件形成可能性調査事業　神奈川県／シェムリアップ州 （5 分）
② モンゴル・ウランバートル市における都市間連携による JCM 案件形勢可能性調査事業　北海道／札幌市 （5 分）
③ ミャンマー・ヤンゴン市における都市間連携による JCM 案件形成可能性調査事業川崎市（5 分）
④ タイ・ラヨン県における都市間連携によるJCM案件形成可能性調査事業　北九州市 （5 分）

＜発表・討議のポイント＞
・自治体の政策におけるJCM案件形成調査の位置づけ
・今年度の案件形成調査の活動を振り返って見えてきたこと
・都市間連携の意義、自治体にとってのメリット、課題と対応策

17:00　閉会挨拶
水谷　好洋 （環境省 地球環境局 国際連携課 国際協力室長）

18:00-19:30　歓迎レセプション
会場:ロッシニ(ROSSiNi) （東京都千代田区内幸町 2 丁目 2-2　富国生命ビル1階）

カンボジア・シェムリアップ州と神奈川県の取組について



神奈川県産業労働局産業部エネルギー課

取組のきっかけ

ＪＣＭ大規模案件形成可能性調査の一環で 2014年11月に訪日研修受入⇒その後、支援要請あり

本県のエネルギー施策について解説

シェムリアップ州の抱える課題

- 急速な都市化
- 輸入電力に依存
- ディーゼル発電による
  バックアップ

- 世界遺産等登録と観光
  客の急増
- ユネスコからの保全の
  要請（酸性雨対策等）

**低炭素観光
都市づくり
が急務**

かながわスマートエネルギー計画

策定の経緯

平成25年７月に制定した「神奈川県再生可能エネルギーの導入等の促進に関する条例」に基づき、エネルギー政策に関する基本的な計画として策定

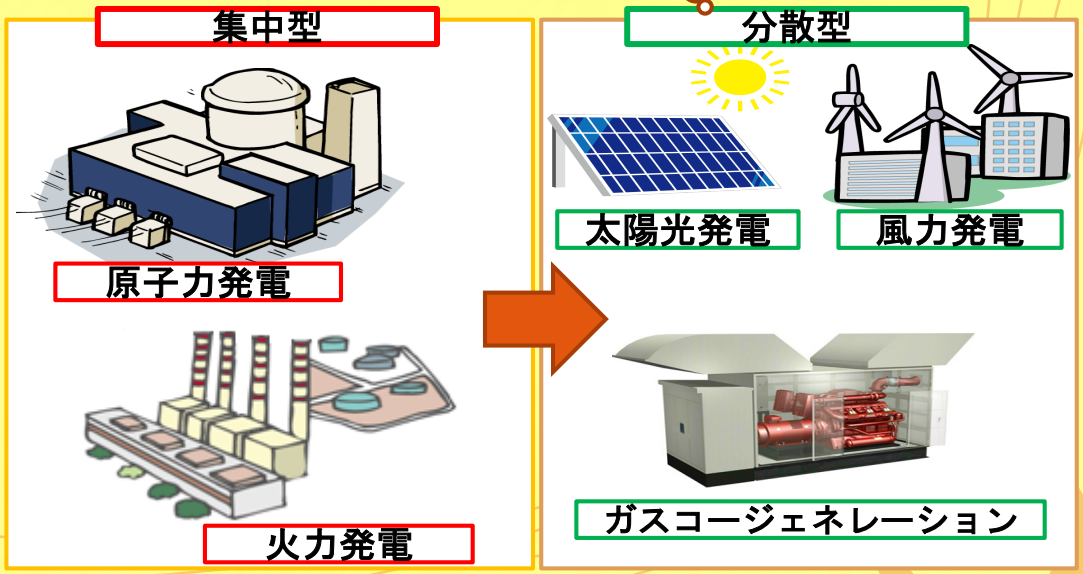
３つの原則

- ○ 原子力に過度に依存しない
- ○ 環境に配慮する
- ○ 地産地消を推進する

本県の取組がシェムリアップ州の課題解決に役立つのではないか・・・

5つの基本政策

- **○再生可能エネルギー等の導入加速化**
- **○安定した分散型電源の導入拡大**
- **○情報通信技術(ICT)を活用した省エネ・節電の取組促進**
- **○地域の特性を活かしたスマートコミュニティの形成**
- **○エネルギー産業の育成と振興**



出典：日本原子力発電株式会社、大阪ガス株式会社

今年度の主な取組

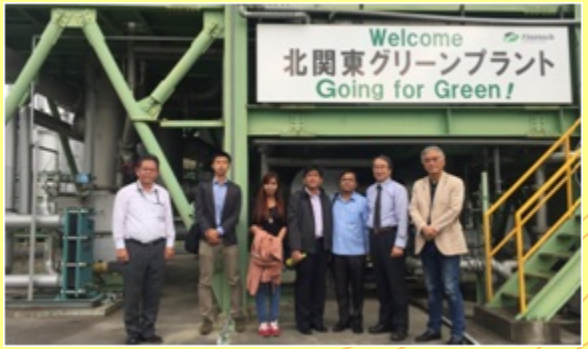
①コミュニティ型太陽光発電

企業現地調査

訪日研修（視察）

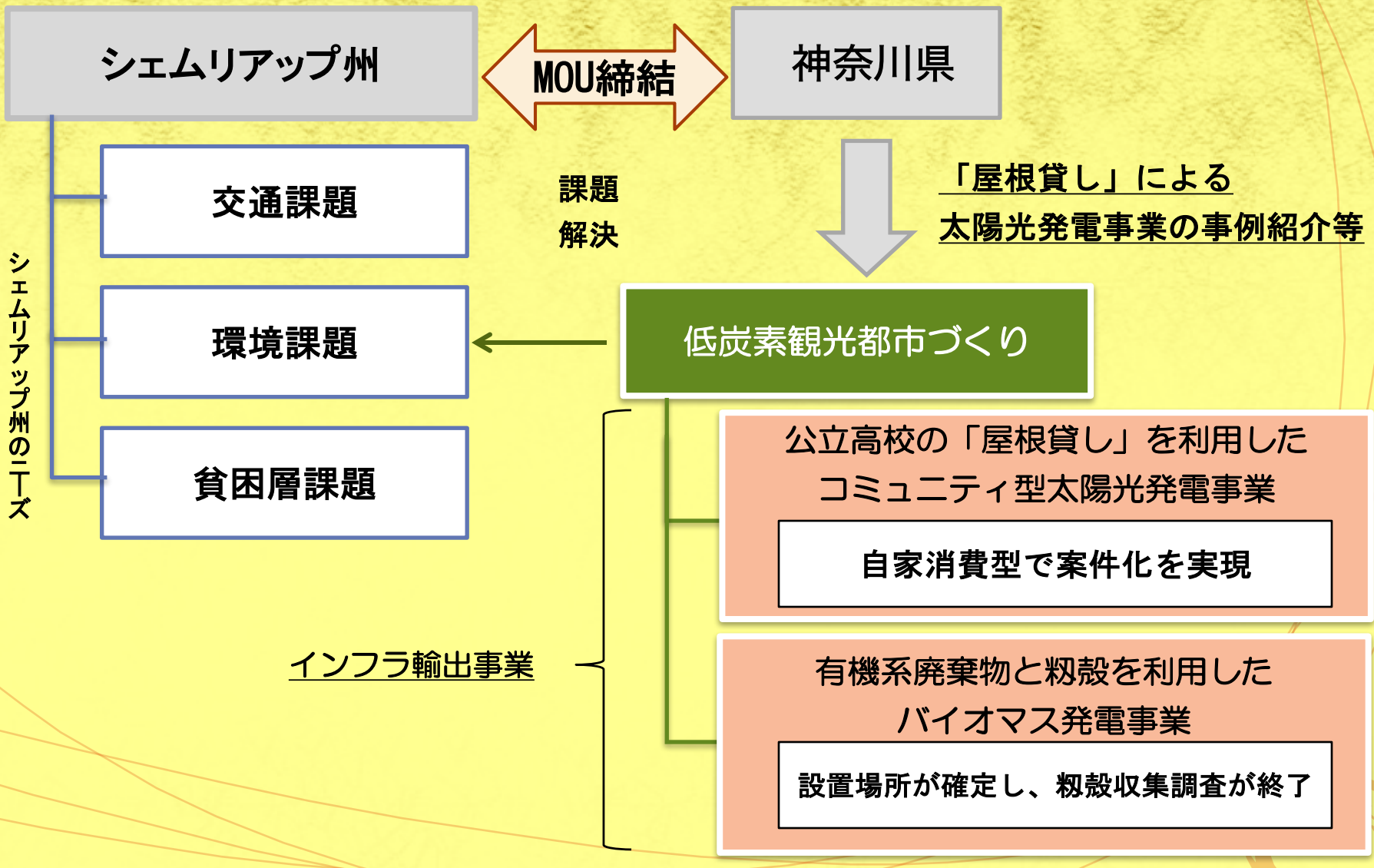
②有機系廃棄物と籾殻を利用したバイオマス発電

企業現地調査



訪日研修（視察）

本調査事業の全体像


シェムリアップ州
MOU締結
神奈川県
交通課題
環境課題
貧困層課題
シェムリアップ州のニーズ
課題
解決
「屋根貸し」による
太陽光発電事業の事例紹介等
低炭素観光都市づくり
公立高校の「屋根貸し」を利用した
コミュニティ型太陽光発電事業
自家消費型で案件化を実現
有機系廃棄物と籾殻を利用した
バイオマス発電事業
設置場所が確定し、籾殻収集調査が終了
インフラ輸出事業

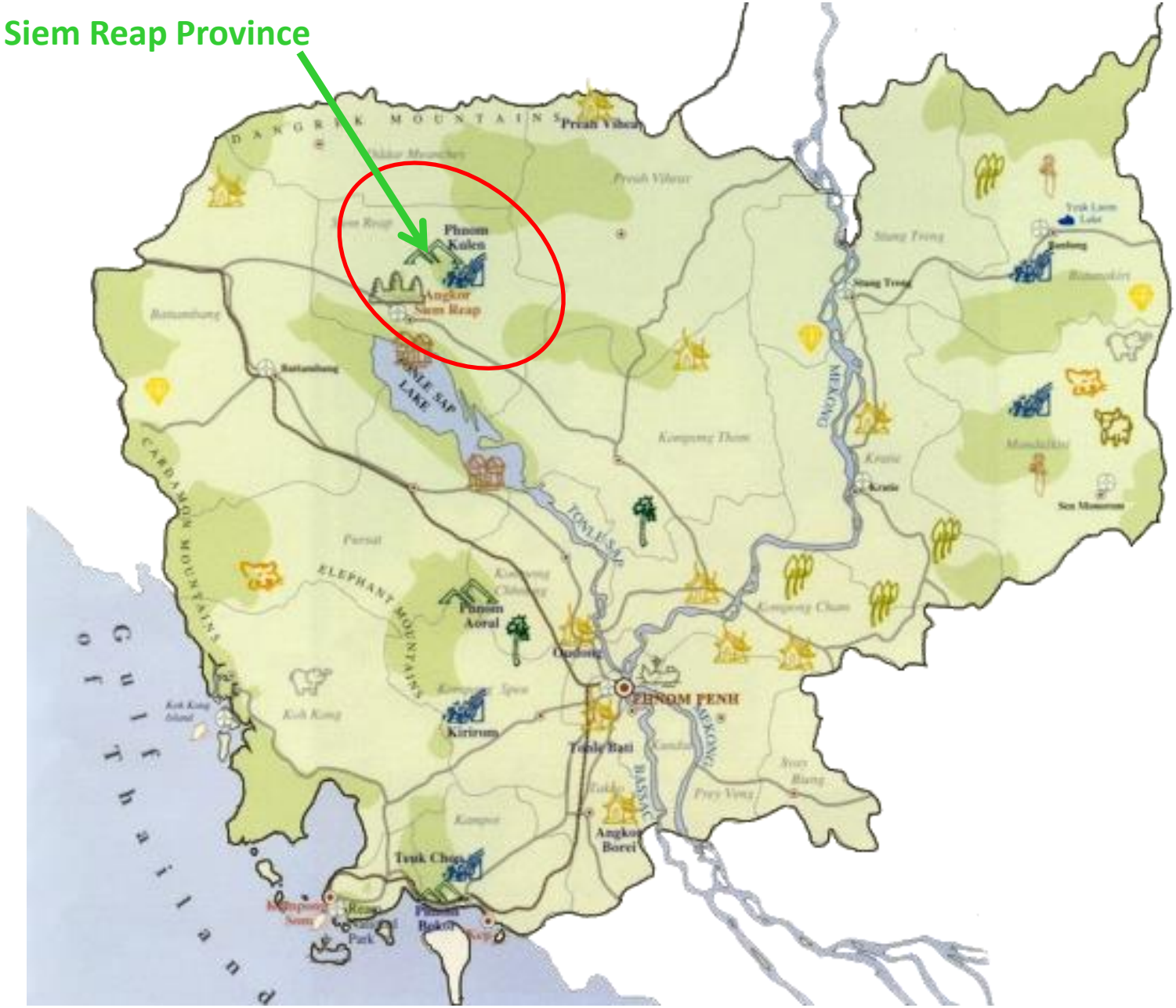
Seminar of Joint Crediting Mechanism (JCM) City-to-City Collaboration Projects

Siem Reap Province Cambodia

By Mr. Ung Sophean
Director of Inter-Sectorial Affairs

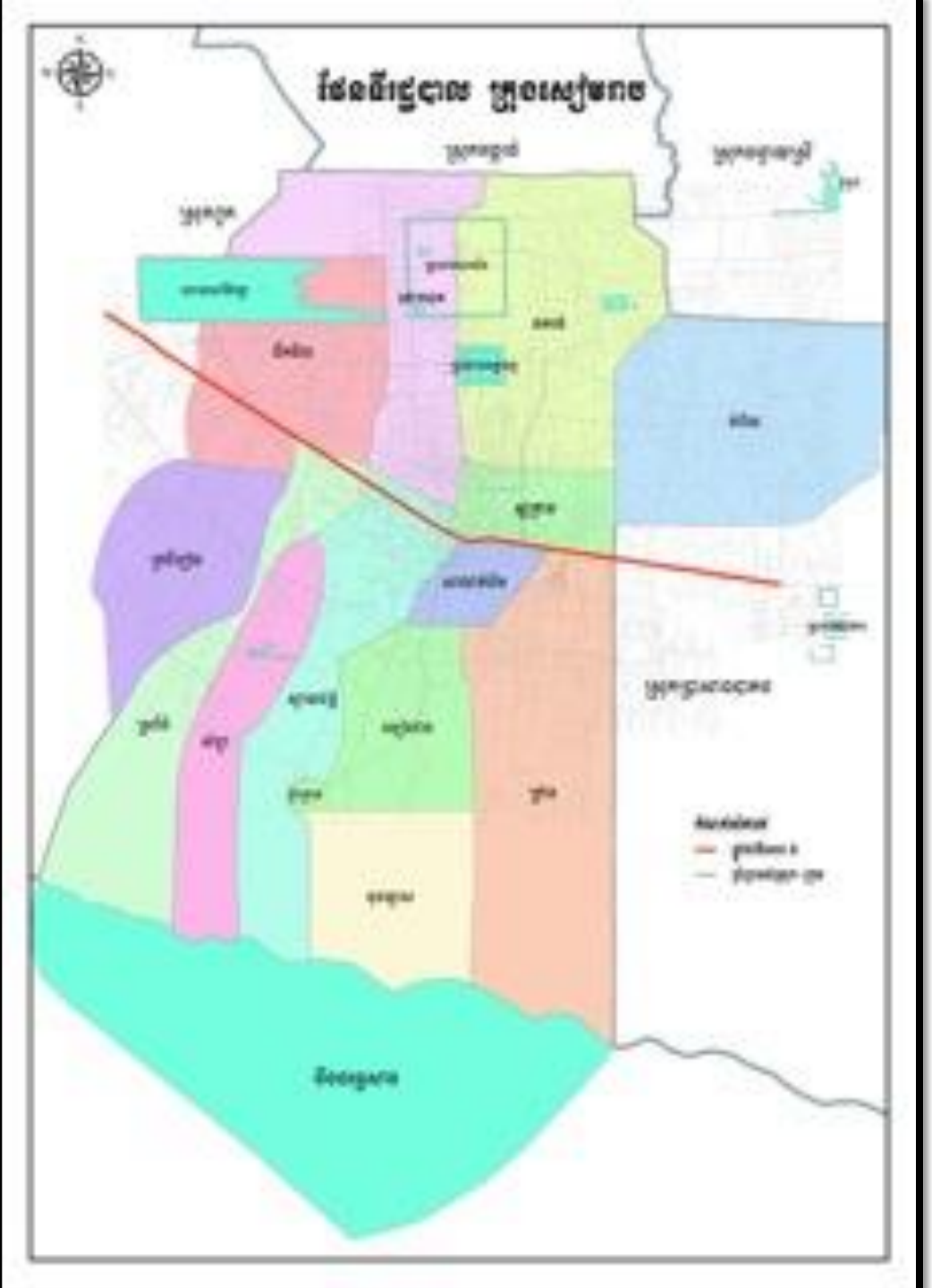
January 23, 2017
Tokyo, Japan

Siem Reap Province



Overview of the Province

- Total area of the province 10.299km ^{2}
- Population : 1.042.286 people
  - Female: 526,784)
  - 18 years old up: 712,658 (Female 415,079).
- Family : 206,385 families
- Population density : 101,2 People/km^2
- Population Increase : 3%



Overview of Siem Reap City

- Land area: 472.73 Km2
- 13 Sangkats:
- 108 Villages
- Population: 256,018 (Female:131,528)
- Households 50,824
- Family size: 5
- Tourists: 3.5 Millions

low-Carbon Policies/strategies/action Plans in Siem Reap City

1. City Overall Visions

- Town of Water
- **Town of Green**
- Town of Culture and Education
- Town of Tourism Assets

2. City Development Plan

- Environmental development plan (Priority Plan)
- Introduction of Environmental public transport in the Angkor Archeology Park (AAP): Battery Car / Electric bus, Traditional transport (Horse cart, Elephant ,.)

3. Public Awareness Raising Mechanism

- Environmental Campaign/Environmental Day
- Training/workshops
- Banners (Public)

Roles of Siem Reap Provincial Administration for Low-Carbon Implementation Policy

1. Support city development plan implementation
2. Provide capacity development and human resources
3. Strengthening roles and responsibility of city administration on low-carbon policy/strategy and action plan (Transfer from National administration to City administration)
4. Provide technical support to city administration (National/Provincial Administration)
5. Cooperated with development partners/private sector for low-carbon projects implementation
6. Improve local participations and understanding on environmental protection process (Environmental Campaign/Environmental Day, Training/workshops, Banners for public)

Waste Management

Recycling and Reusing Activities

Animal Feeding

Plastic Battle Reproduction

Composting

Waste Separation Management Project

Siem Reap City

Private Company

Electric Tourists Transportation

Private Companies Investment

← Asian Gateway

Request to the JCM City-to-City Collaboration Project

1. Develop City overall visions for Low-Carbon policy, strategy, guideline and action plan (National and Sub-national)
2. Implementation of low-carbon projects for sustainable development
3. Strengthening Roles and responsibilities of local government and local people .


Thank You for Your Consideration

Feasibility Study for C2CC-JCM 2016 in Siem Reap

Tomonori KIMURA
CEO
Asian Gateway Corporation

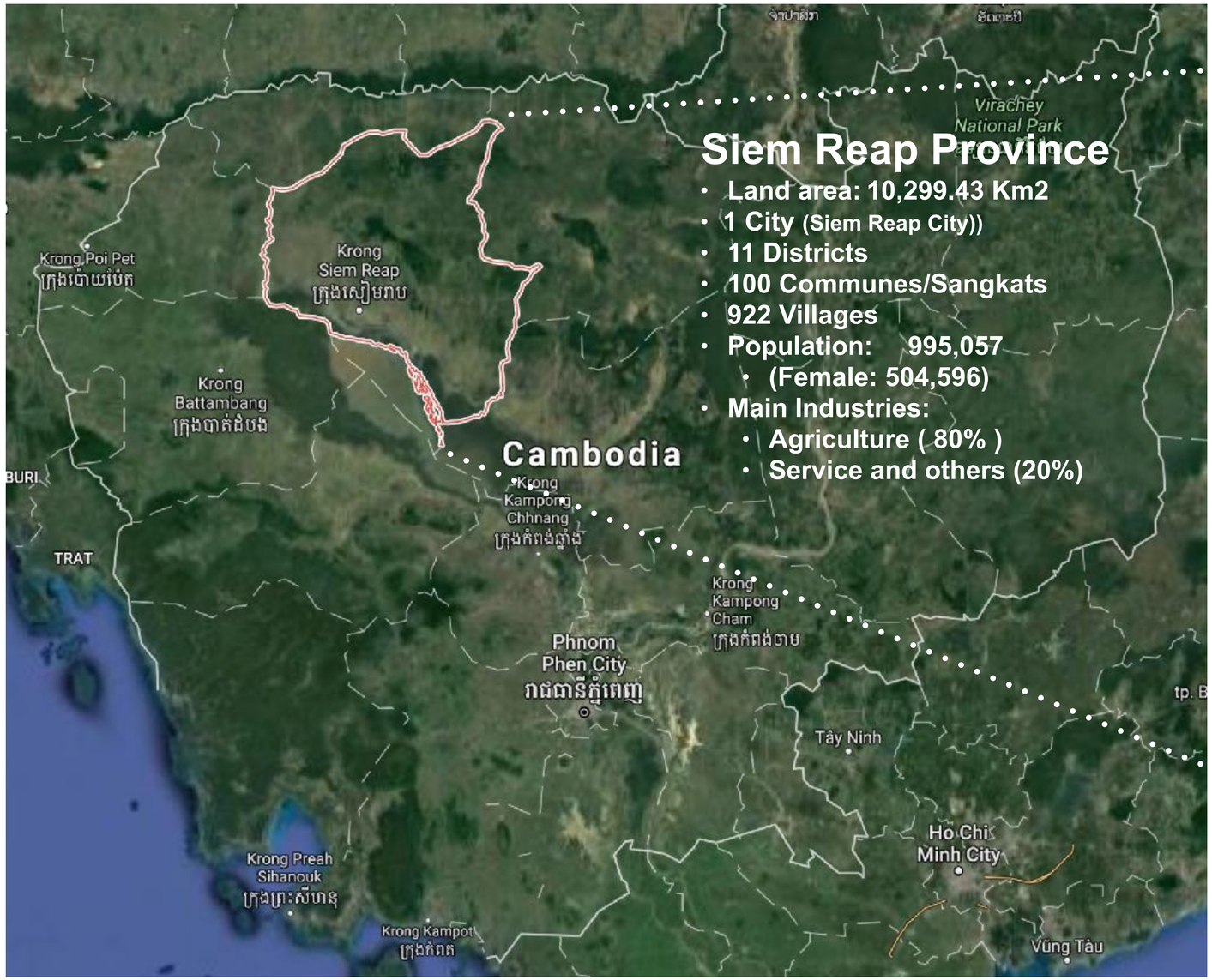
January 23, 2017

C2CC-JCM: City to City Cooperation-Joint Crediting Mechanism

3-7-2, KANDANISHI CHO, CHIYODA-KU, TOKYO

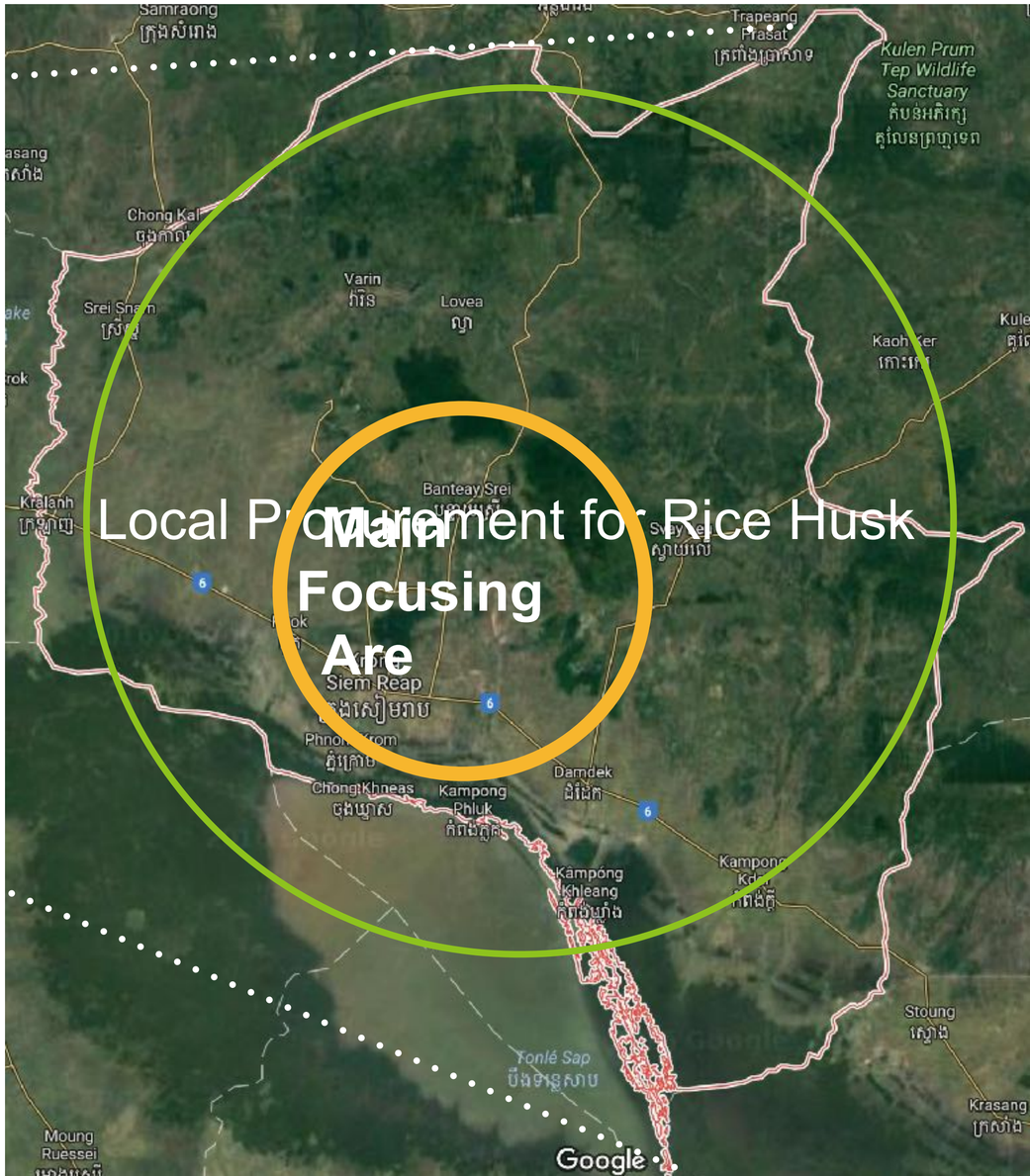
PUBLISHED JANUARY 2017
WWW.ASIANGATEWAY.CO.JP

Our project site in Sime Reap Province



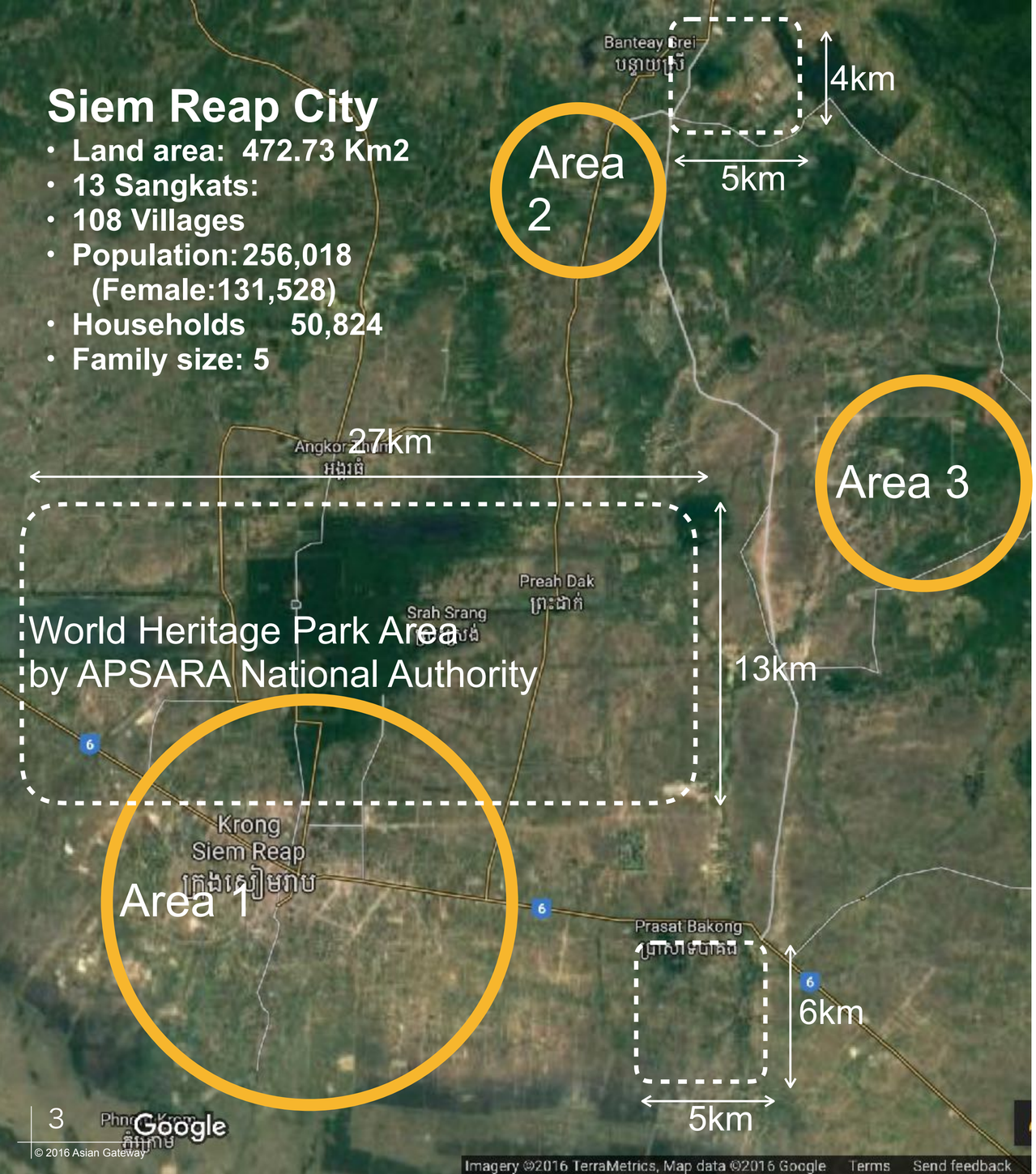
Siem Reap Province

- Land area: 10,299.43 Km2
- 1 City (Siem Reap City))
- 11 Districts
- 100 Communes/Sangkats
- 922 Villages
- Population: 995,057
  - (Female: 504,596)
- Main Industries:
  - Agriculture (80%)
  - Service and others (20%)



Local Procurement for Rice Husk

Main Focusing Are



Close up for our main focusing area and projects

AsianGateway

Area 1

- Downtown of Siem Reap City
- Rooftop Solar Implementation with Self-Sufficient and Off-Grid with turnkey provider
- Electric Mobility for Para Transit and Logistics

Area 2

- 30ha Land nearby Banteay Srey Temple
- Forest Resort Development as a showcase of Smart City with FCC (Foreign Correspondents Club)

Area 3

- Eco Village (1,000ha) managed by APSARA National Authority nearby Phnom Bok
- Solar Energy and Biomass Power Plant Development for Hydroponics with SOMA Group

PPP Scheme with C2CC

C2CC-JCM 2016

PPP approach like Bilateral Cooperation with Siem Reap and Kanagawa (Nov. 2015)

PPP Scheme

- **G2G**
- **LG2LG**
- **B2B**

- National Strategic Development Plan
- Government Aid Policy
- JCM(Joint Crediting Mechanism)

- City to City Collaboration
- EV Tourism and Renewable Energy
- International Consortium for JCM
- Business Partnership with Asian Gateway
- Consulting and Trading for Sustainable Energy

PPP: Public-Private Partnership
C2CC-JCM FS: City to City Cooperation-Joint Crediting Mechanism Feasibly Study

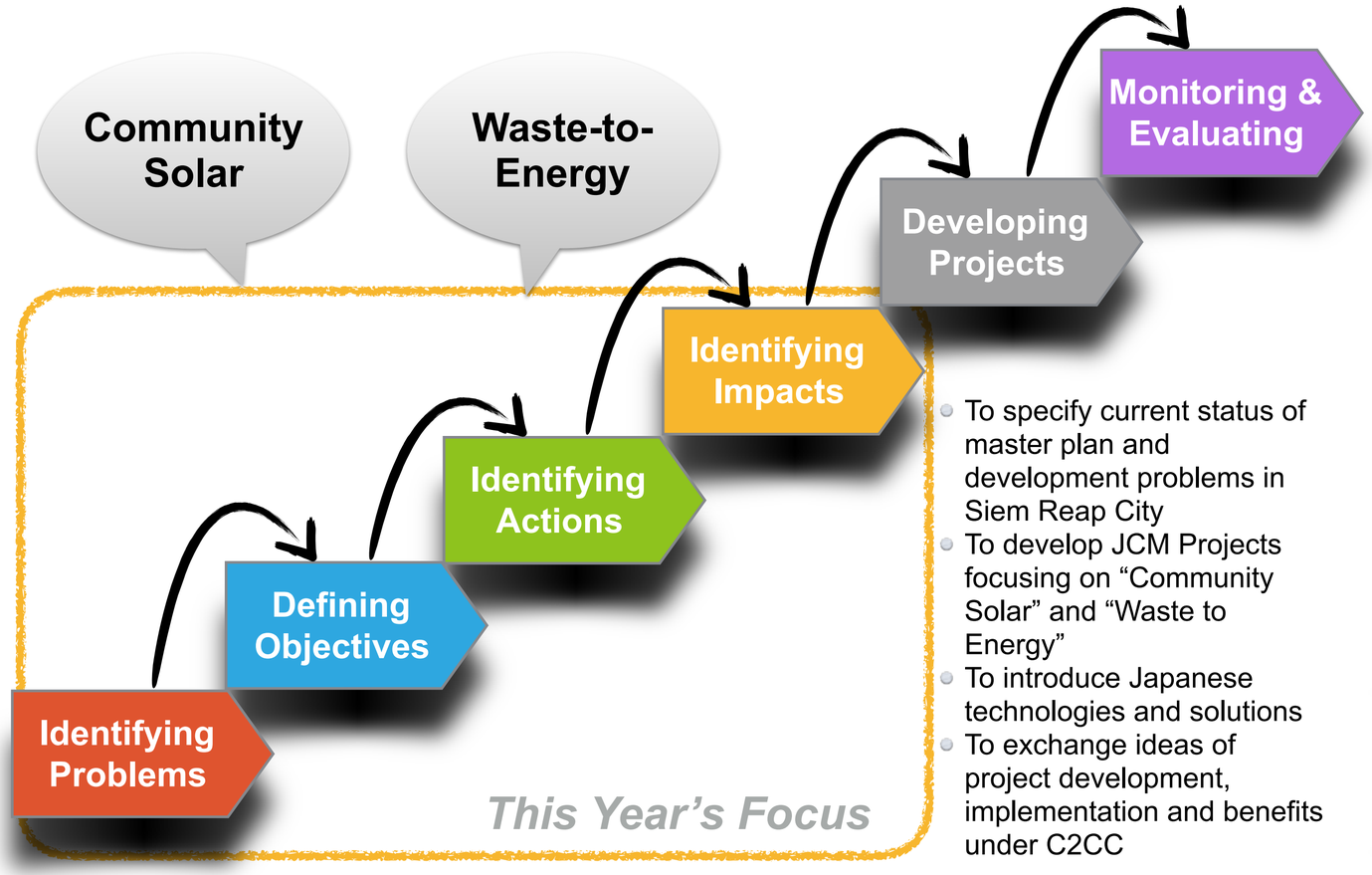
C2CC with Siem Reap and Kanagawa

Objectives

- Creating low-carbon tourism city (Green City) development in Siem Reap Province;
- Benefitting from the results of Feasibility Studies on Joint Crediting Mechanism Projects;
- Aiming to promote mutual understanding and friendship; and,
- Undertaking development of the two regions in collaboration

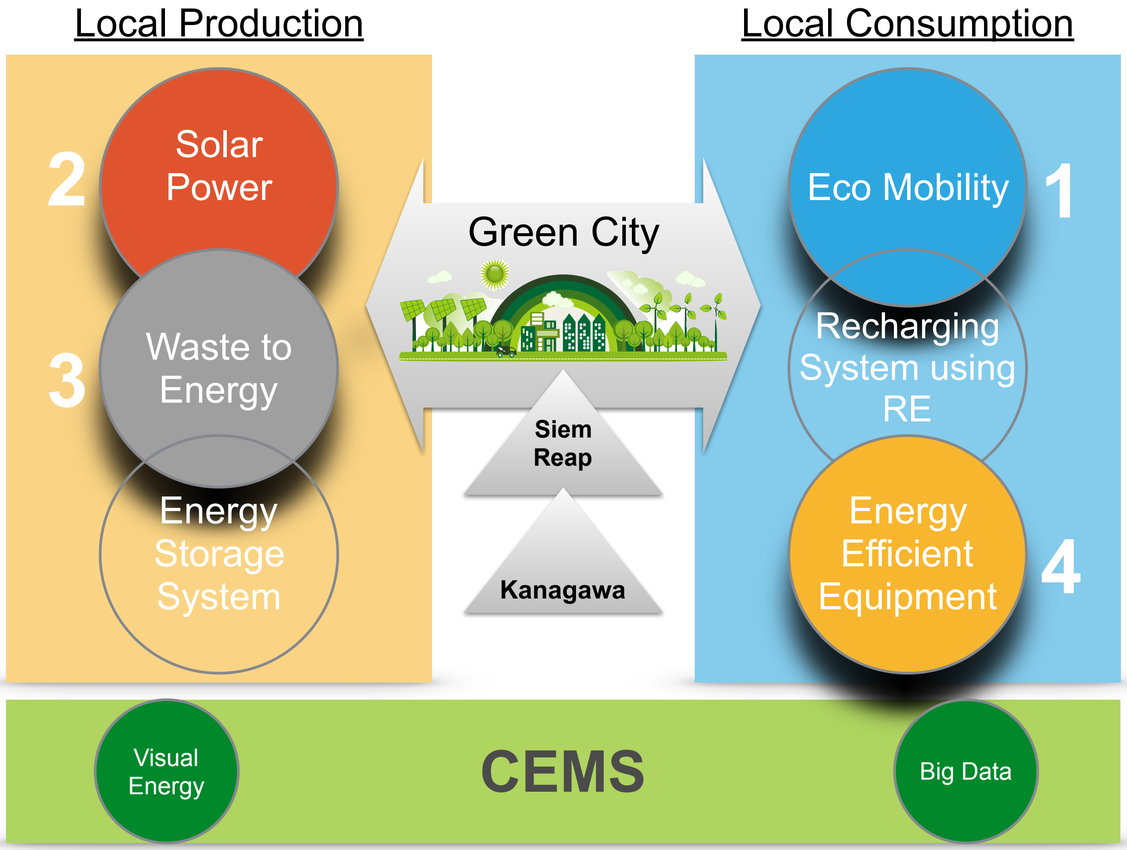
Strategical Steps for C2CC in 2016

Strategical Steps for C2C Cooperation in 2016



- To specify current status of master plan and development problems in Siem Reap City
- To develop JCM Projects focusing on "Community Solar" and "Waste to Energy"
- To introduce Japanese technologies and solutions
- To exchange ideas of project development, implementation and benefits under C2CC

Vision: Local Production for Local Consumption



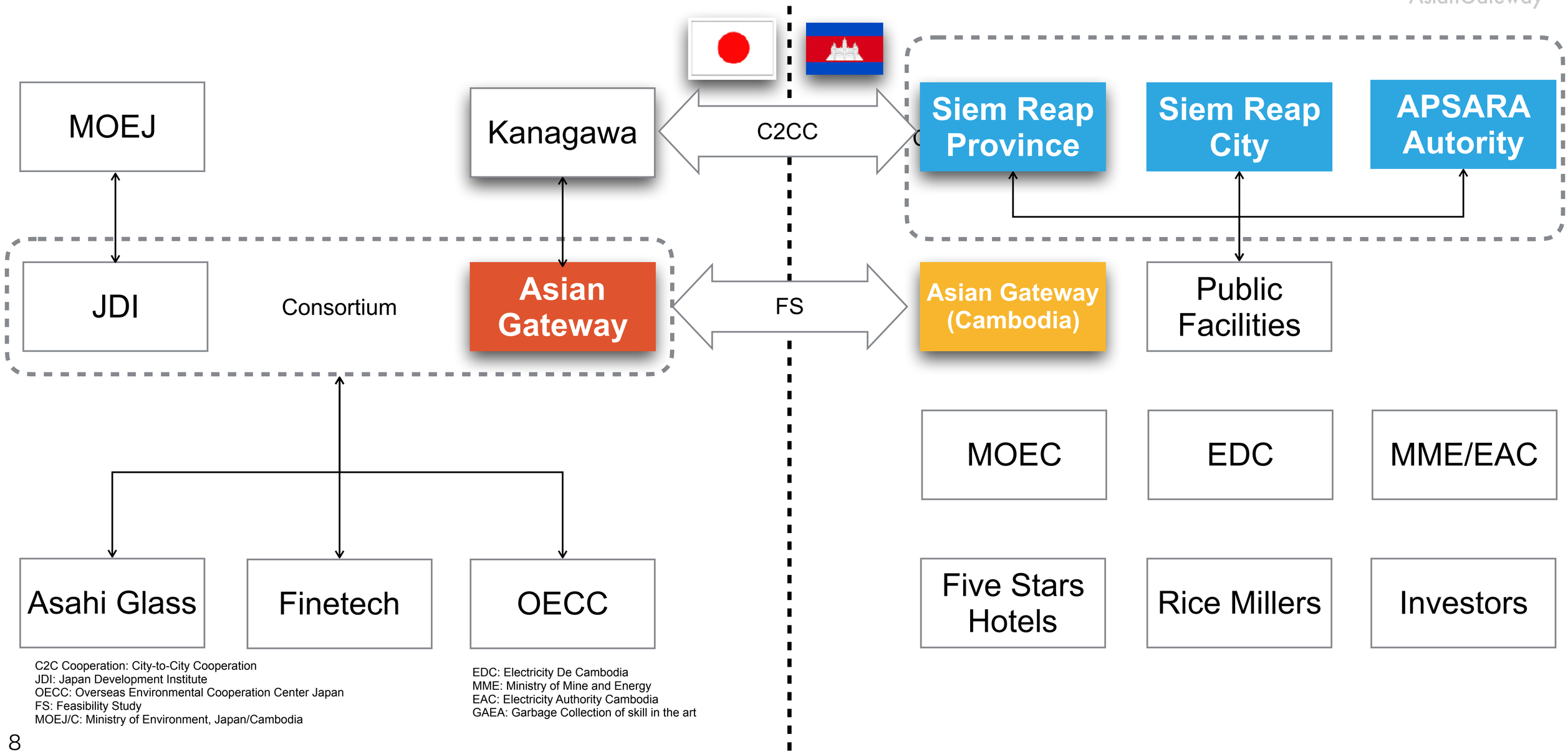
C2C Cooperation: City-to-City Cooperation
CEMS: Community Energy Management System

Strategic Steps for C2CC

Identifying Problems	Kickoff Meeting for Visioning and Concept Understandings	Strategic Planning	Long List Made, Prioritizing and Short List Made	Contact Made and Hearing
Defining Objectives	Discussion Documents Made	Meetings with Prospects and Investors	Site Survey	Secured Requirements
Identifying Actions	Preparation for Proposal	Fundraising	Preparation for Establishment of AG Cambodia	Proposal Finalized
Identifying Impacts	Specified Requirements	Finalizing Proposal for JCM and Prospects	Term & Conditions Negotiated with Prospects	Contracting MOU

As is January 2017

FS Formation for C2CC



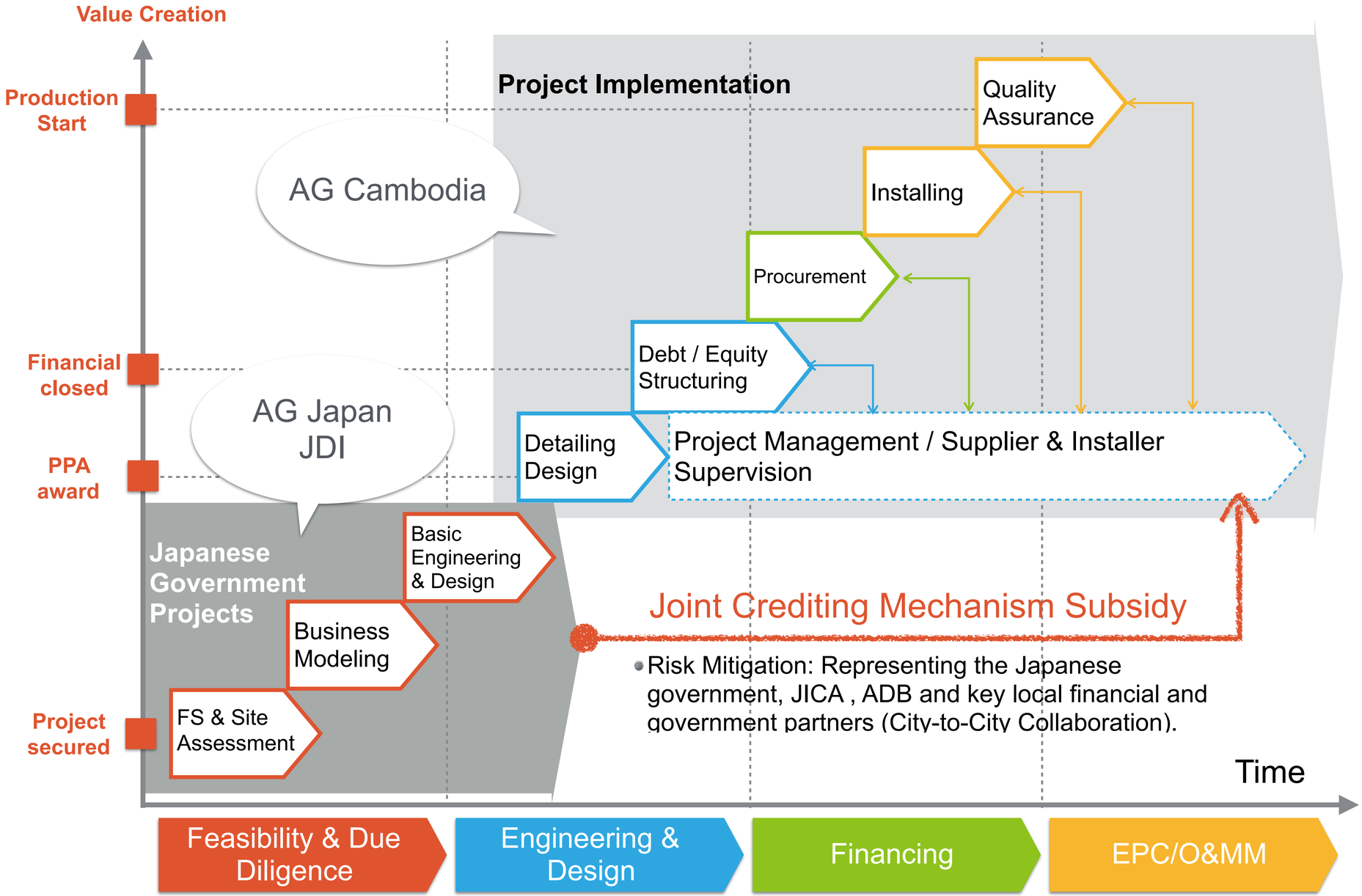
C2C Cooperation: City-to-City Cooperation
JDI: Japan Development Institute
OECC: Overseas Environmental Cooperation Center Japan
FS: Feasibility Study
MOEJ/C: Ministry of Environment, Japan/Cambodia

EDC: Electricity De Cambodia
MME: Ministry of Mine and Energy
EAC: Electricity Authority Cambodia
GAEA: Garbage Collection of skill in the art

AG Japan and AG Cambodia

Doing Business by AG Cambodia

Consulting by AG Japan and JDI



AG: Asian Gateway
JDI: Japan Development Institute

Rooftop Solar Implementation with Self-Sufficient and Off-Grid

Area 1

Rooftop Solar Implementation by SPV with AGC

Asian Gateway (Cambodia) Co., Ltd. is establishing SPV (Special Purpose Vehicle) to provide Solar energy hotel with PPA (power purchase agreement). There is no permission to connect solar energy to national grid controlled by EDC.

Renewable Energy

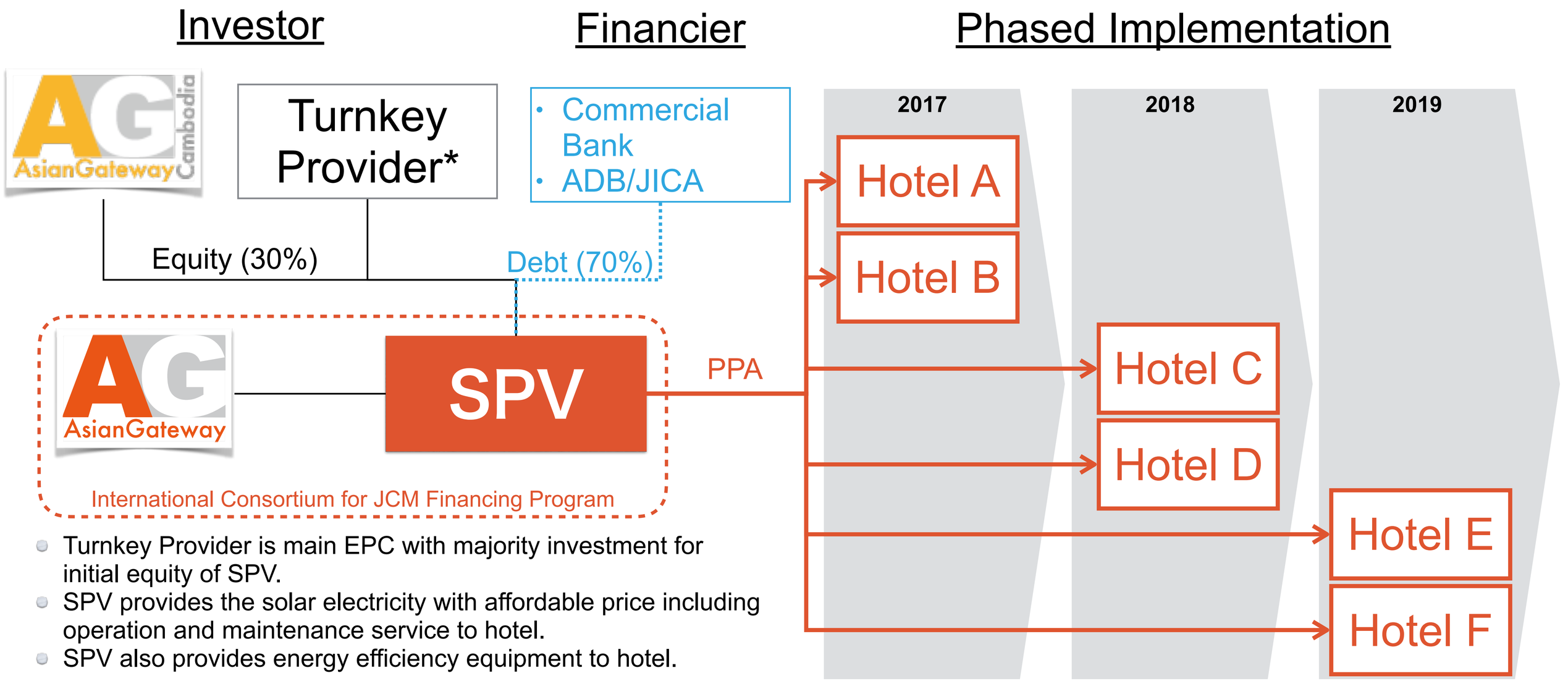
- Solar Energy
  - Rooftop
  - Ground Mounted
  - Floating
- Solar Financing
  - Joint Crediting Mechanism (JCM)
  - Solar Leasing
  - Fundraising Service
- Biomass Power Generation
  - Waste to Energy
  - Torrefaction
  - Pellet Exporting and Plelletization

Rooftop Solar Energy in Siem Reap

- Community Solar with rooftop solar energy at five stars hotels.
- Encourage self-consumption first and enable to sell excess power.

Aim	Target Group	Target
• Reduce day-peak of electricity • Reduce loss in electricity grid • Lead to self-sufficient power consumption society • Job and business creation	• Area-based • Electricity consumption-based • Electricity user type	• Country peak load • Area Electricity profile
Investment	**Power purchasing model**	**Incentive Measures**
• Self investment • Investment with loan • Leasing	• Feed-in Tariff • Retail price • Net Metering	• Subsidy (Partly) • Tax incentive • Non-tax incentive • Soft loan (ex, IDA (International Development Association))

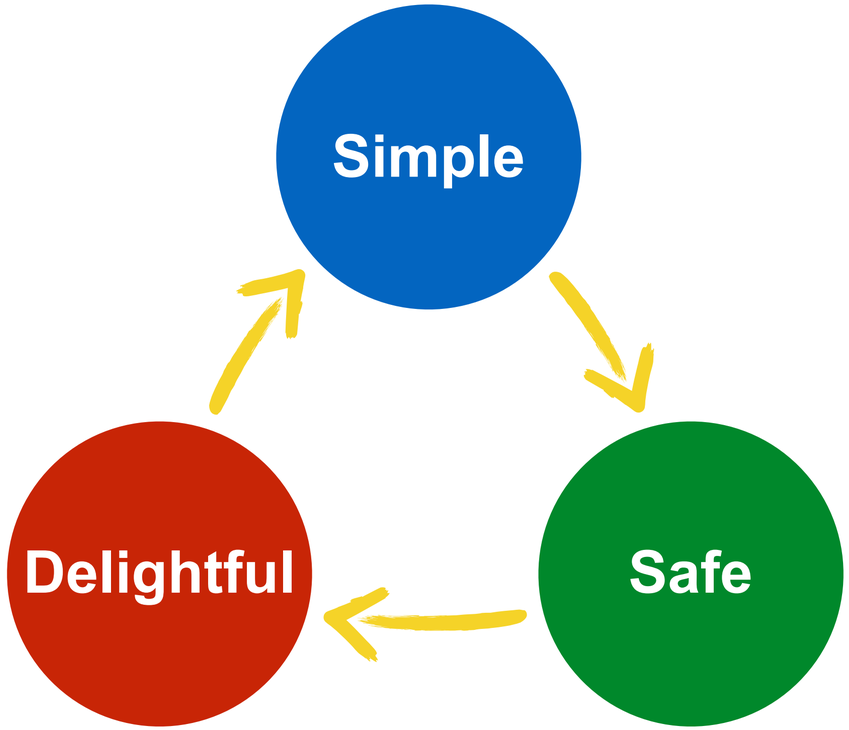
PPA based SPV with Hotels



- Turnkey Provider is main EPC with majority investment for initial equity of SPV.
- SPV provides the solar electricity with affordable price including operation and maintenance service to hotel.
- SPV also provides energy efficiency equipment to hotel.

e-Mobility in Siem Reap

- Angkor Mobility Service (AMS) is a simple, safe, and delightful way to experience the Angkor Complex.



Special Experience Just For You!

Forest Resort Development with FCC

AsianGateway

Area 2

FCC
HOTELS & RESTAURANTS

FCC Hotels & Restaurants

From our very first days in Phnom Penh and in Siem Reap, FCC has been the meeting place for intrepid adventurers, locals and visitors, from around the world. FCC brings together spirited people where, in colonial settings perfect for conversation, good food and drink have always been the order of the day. And, where sharing information and telling of stories both big and small, myths have been born.

Key facts and objectives

- Creating a fully energy neutral eco-resort and development
- Creating the most integrated resort for nature lovers
- Becoming a show case for sustainable tourism development

Basic Concept for Forest Resort

- Net-Zero Energy Resort
- Exclusive Luxurious Healing Space during long stays inside Angkor Forest

net zero asia

Eco Village

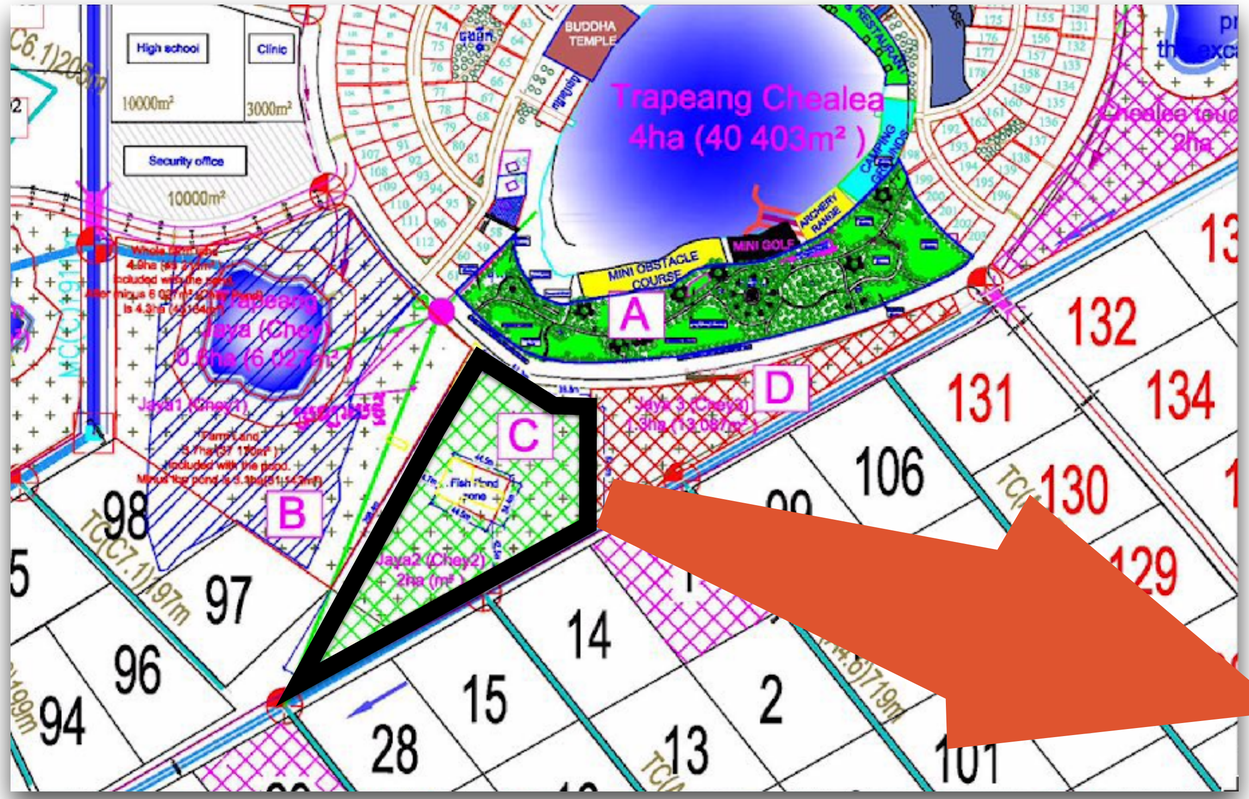
Our targeted land (2ha)

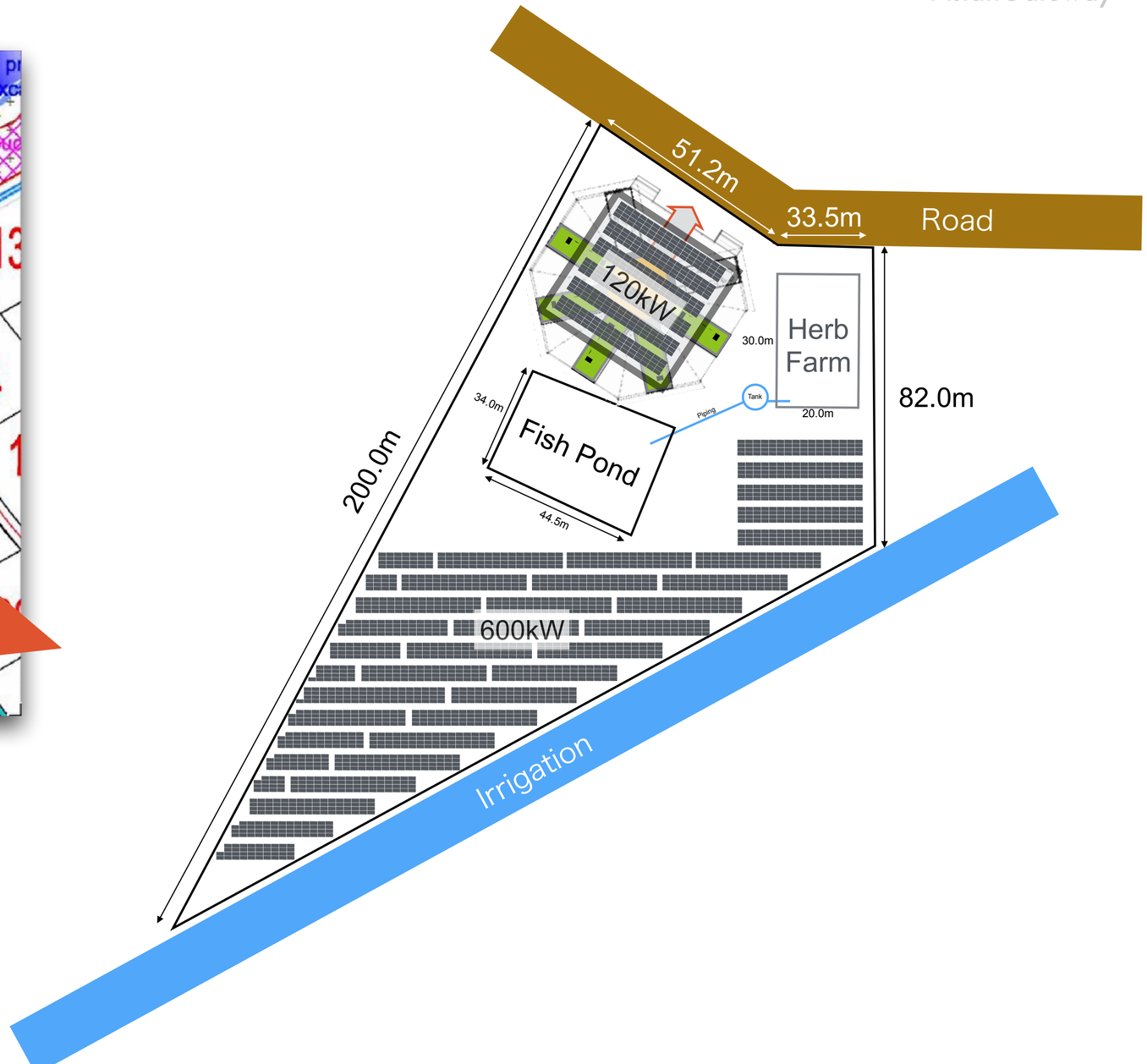
Area 3

Food and Agribusiness led by Asian Gateway (Cambodia) with APSARA National Authority

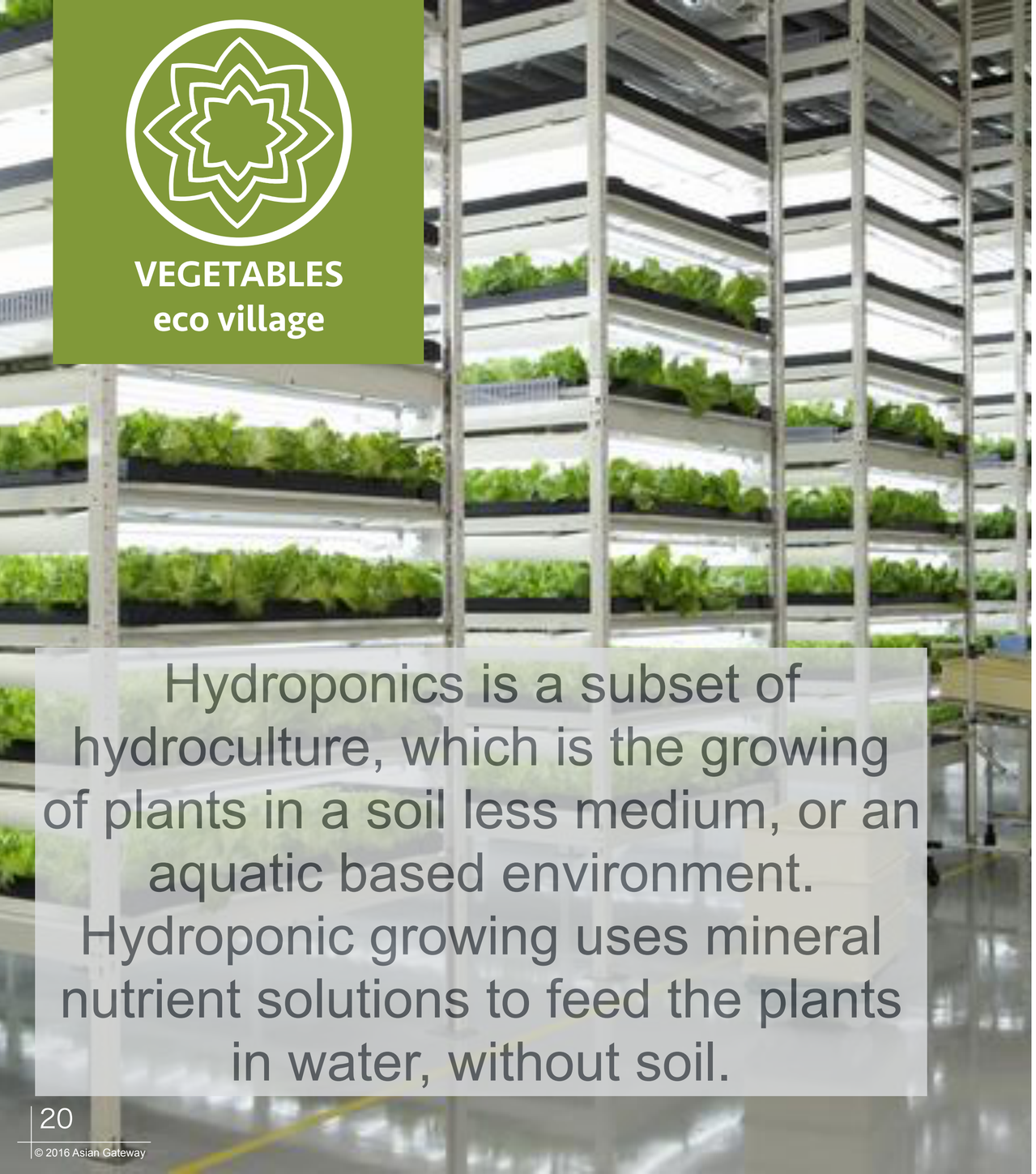
Asian Gateway (Cambodia) is developing new agribusiness using LED based Hydroponics using Biomass Power and Solar Power with Energy Efficiency equipment.

Project Site: Run Ta Ek EcoVillage





- 2ha land for our project
- Solar Farm
- Hydroponics Farm



Hydroponics is a subset of hydroculture, which is the growing of plants in a soil less medium, or an aquatic based environment. Hydroponic growing uses mineral nutrient solutions to feed the plants in water, without soil.

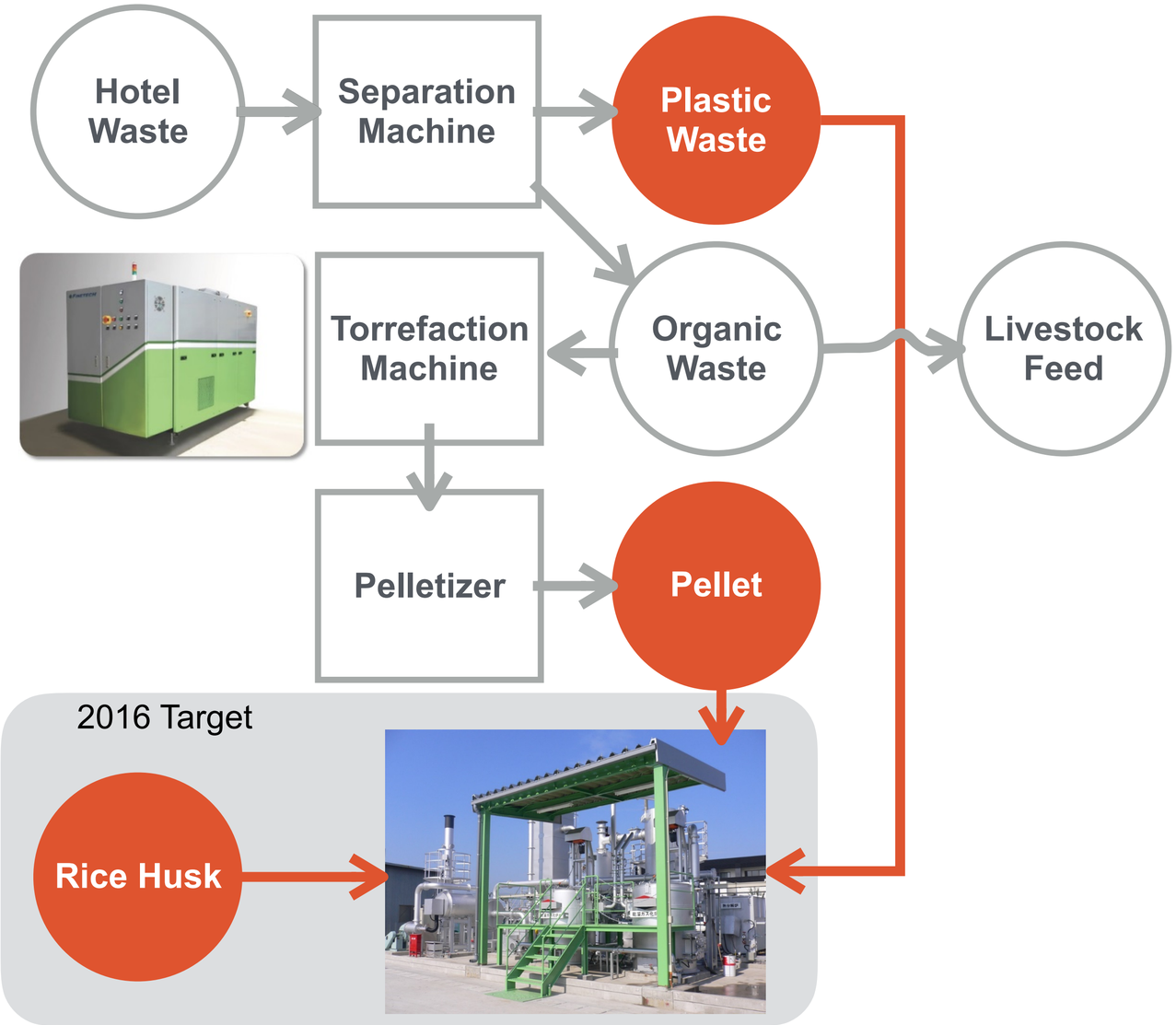
Hydroponics

AsianGateway

- Automatic cultivation with traceability
- Using Biomass Power and PV power electricity and energy efficiency equipment
- Cultivate, harvest and sell in the store
- Cultivate at central farm, and deliver to the restaurant
- Agriculture in REDA (Run Ta EK EcoVillage Development Area)

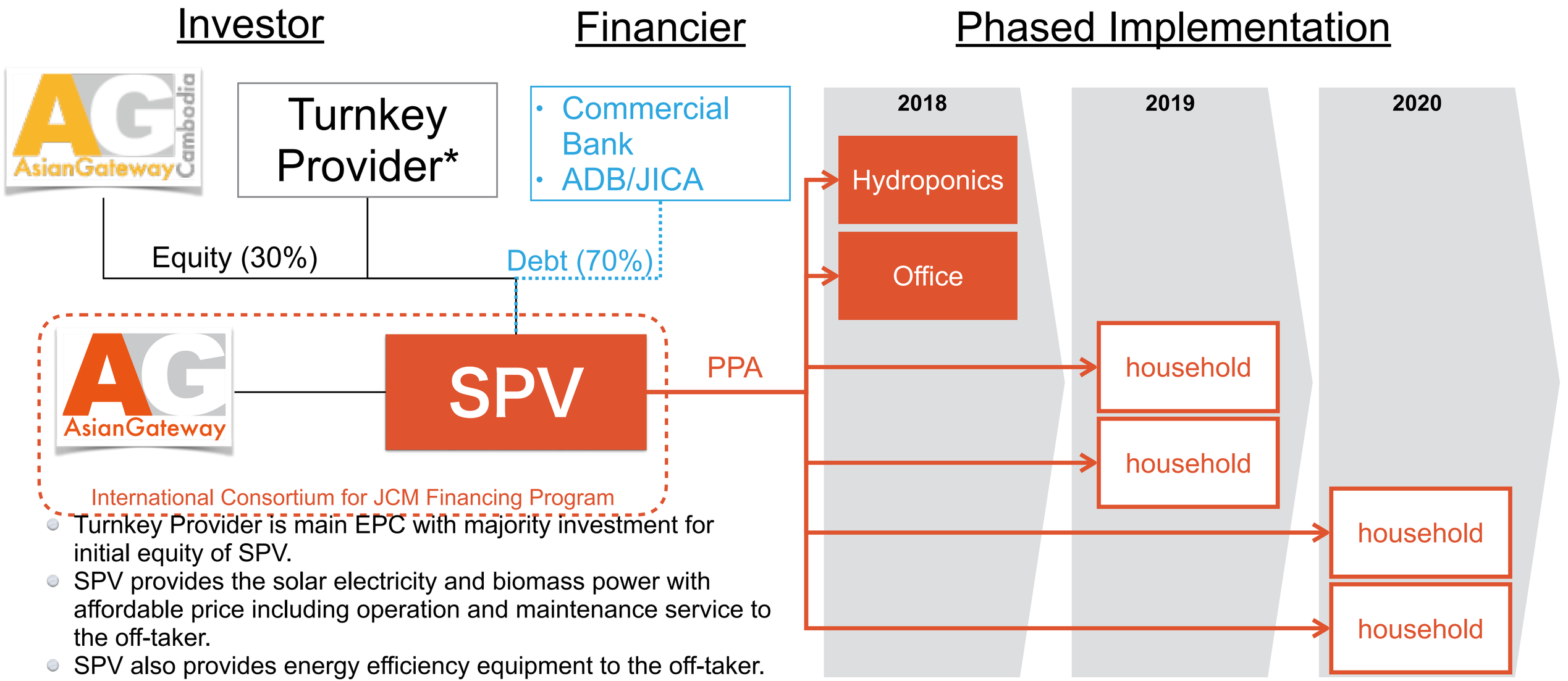
PV: Photovoltaic

Biomass Power Plant



Biomass Power Generation System

PPA based SPV in Eco Village



- Turnkey Provider is main EPC with majority investment for initial equity of SPV.
- SPV provides the solar electricity and biomass power with affordable price including operation and maintenance service to the off-taker.
- SPV also provides energy efficiency equipment to the off-taker.

THANK YOU! FOR YOUR ATTENTION

We would like to hear from you and answer any questions that you might have. info@asiangateway.co.jp

AsianGateway