Asia-Pacific
Economic Cooperation

EWG 20/2012A

APEC Low Carbon Model Town (LCMT) Project Phase 3

Finalization of Feasibility Study Report with Executive Summary

November, 2013

NEWJEC Inc.

Abbreviation Table

Abbreviation	Full Description in English
ADEME	Environment and Energy Management Agency
AIT	Asian Institute of Technology
APEC	Asia-Pacific Economic Cooperation
AUDEC	Asia Urban Development Consulting Consortium, Japan
BAU	Business As Usual
BDF	Bio Diesel Fuel
BOD	Biochemical Oxygen Demand
BRT	Bus Rapid Transit
CC	Climate Change
CDM	Clean Development Mechanism
COD	Chemical Oxygen Demand
DaCRISS	The Study on Integrated Development Strategy for Da Nang City and Its Neighboring Area in the Socialist Republic of Viet Nam
DAWACO	Da Nang Water Supply Company
DNPC	Da Nang People's Committee, Da Nang City
DOC	Department of Construction, Da Nang City
DOF	Department of Finance, Da Nang City
DOFA	Department of Foreign Affairs, Da Nang City
DOIT	Department of Industry and Trade, Da Nang City
DONRE	Department of Natural Resources and Environment, Da Nang City
DOT	Department of Transport, Da Nang City
DPI	Department of Planning and Investment, Da Nang City
EPRC	Environmental Protection Research Center, Viet Nam
EWG	Energy Working Group
FDI	Foreign Direct Investments
FS	Feasibility Study
GHG	Greenhouse Gas
GMS	the Great Mekong Subregion
ICT	Information and Communication Technology
IE	Institute of Energy, Viet Nam
JETRO	Japan External Trade Oeganization
JICA	Japan International Cooperation Agency
JPY	Japanese Yen
LCMT / LCT	Low Carbon Model Town / Low Carbon Town
METI	Ministry of Economy, Trade and Industry, Japan
MOIT	Ministry of Industry and Trade, Viet Nam
NEDO	New Energy and Industrial Technology Development Organization, Japan
NHSD	Ngu Hanh Son District
ODA	Official Development Assistance, Japan
TPP	Thermal Power Plant
URENCO	Urban Environmental Company
UNFCCC	United Nations Framework Convention on Climate Change
VND	Vietnamese Dong
WB	World Bank

Contents

Phase 4 Finalization of Feasibility Study Report with Executive Summary

Executive Summary

Outline of APEC Low Carbon Model Town (LCMT) Project Phase 3

The key objective of the Project is to provide a Feasibility Study on the Re-development which deals with existing urban districts in Da Nang (Viet Nam), with a large focus on Ngu Hanh Son District. This will be done by investigating CO2 reduction visions, and verifying how to develop attractive, low-carbon development plans.

The Feasibility Study will provide central and local Viet Nam government officials, as well as the developer of the Da Nang low-carbon town project with valuable advice on how to design an attractive and innovative low-carbon development plan. This will be achieved by providing a specific selection of mitigation measures in buildings, means of transportation, energy management systems, area energy networks, untapped energy resources, and renewable energy sources, etc. It will be based on an analysis of CO2 reductions and the investment costs of these potential measures provided by the Consultant. The study also includes implementation methodology for the proposed mitigation measures, including potential implementers and funding sources. This study will help promote low-carbon development concepts throughout the APEC region in order to reduce greenhouse gas emissions associated with traditional approaches to town planning. These concepts will be promoted through sharing the best practices and real-world experiences of low-carbon development with relevant planners and policy makers.

CO2 Emission Estimation in the Base Year 2010

Estimated CO2 emissions for the base year 2010 in Ngu Hanh Son District totaled 95,720 tonnes of CO2 equivalent.

CO2 emissions from the "manufacturing industries" subsector account for 31.57% of the total district wide emissions. CO2 emissions from the "residential" subsector and CO2 emissions from the "transport" subsector account for 24.28% and 17.75%, respectively.

Approach for Achieving the CO2 Reduction Target of the LCT

According to the “National Green Growth Strategy”, greenhouse gas (GHG) emission reduction targets are set out in terms of intensity of GHG emissions and GHG reductions compared to Business As Usual (BAU) emissions, rather than the base year emissions.

In accordance with this national strategy, one approach for reaching the CO2 reduction target of the low-carbon town in Ngu Hanh Son District would be a voluntary reduction target of 10% from the CO2 emission levels of a BAU scenario for 2020 and that of 20% from the CO2 emission levels of a BAU scenario for 2030. In the case of BS-H (*1), this would require a reduction of 28kt-CO2 in 2020 and 152kt-CO2 in 2030 from the corresponding BAU emissions levels.

(*1) A BAU scenario with high growth that is fundamentally the same as Scenario-3 in “Da Nang Urban Development Plan Until 2030” (Department of Construction, Da Nang). This scenario is based on a highest growth rate case in the DaCRISS (The study on integrated development strategy for Da Nang City and its neighboring area in the socialist republic of Viet Nam) model, and urban development plans in the foreseeable future have been incorporated.

Measures that were selected in this project

The project proposed possible low-carbon 23 measures in Ngu Hanh Son District. The following six measures out of 23 are identified as particularly effective measures for Da Nang City through meetings with the Da Nang People’s Committee from 4 viewpoints of CO2 reduction, cost, problem-solving and charm improvement.

(1) Buildings: Introduction of a system of comprehensive environmental benchmarks that target buildings

(2) Transportations - Motorcycles: Facilitation of the spread of electric motorcycles and charging facilities

(3) Transportations - BRT: Introduction of a Bus Rapid Transit (BRT) system

(4) Untapped Energy - Waste Water: Purification and power generation utilizing of biogas (digestive gas)

(5) Untapped Energy - Garbage: Biomass generation from kitchen garbage

(6) ICT Control: Optimum management and energy conservation of the street lights through LED lighting

(1) Buildings

As a result of building research in Da Nang City, most of the surveyed buildings have been ranked in a lower than moderate class with CASBEE's criteria for building environment performance. This shows that there is the potential of possible CO2 reduction by increasing the rank of these kinds of buildings to the top class (S class) with further energy saving measures.

In the future, more building construction will spread over the City corresponding with population and economic growth. As a counter measure against CO2 emissions due to building construction, the introduction of a comprehensive environment assessment system to buildings would be the most effective and economical way to reduce CO2 emissions.

(2) Transportations - Motorcycles

This project attempts to reduce CO2 emission through shifting a means of everyday transportation of the citizen from gasoline to electric motorcycles.

It is supposedly difficult to have a shift from gasoline motorcycles to gasoline automobile due to Vietnam's unique environment. The Vietnam's unique environment includes: automobile is expensive compared to household income, financial system for loan and installment sale is not common, a number of parking areas is inadequate, improvement of roadway infrastructure is inadequate, and it is difficult to get driver's license (long application process and high costs).

As government policies toward a low-emission society, this measure examined the action plan for the diffusion of electric motorcycles that require no fossil fuel, are convenient, and need low upkeep costs.

(3) Transportations - BRT

This measure attempts to reduce CO2 emission through shifting from gasoline motorcycles and automobiles to BRT system with low-emission vehicles.

Currently, the main means of transportation in Da Nang City is gasoline motorcycle. However, it is not user-friendly in rain or when carrying a large quantity of bags. On the other hand, there are not many users of local buses due to its unpunctuality, slow speed, and unclean vehicles.

In addition to overcome these weak points, BRT contributes to form a sustainable, low-carbon city and to improve the travel convenience in the city by offering a bus service that provides high-speed, punctual operation.

Moreover, by carrying forward deliberate urban development coupled with a BRT-centered transportation system, a low-carbon compact city structure is effectively achieved.

(4) Untapped Energy - Waste Water

This is to reduce CO2 emission by generating electricity with methane gas recovered from sewage sludge.

At the moment, the amount of the sewage, including rainwater, accounts for about 15% of the whole household waste water.

The Biochemical Oxygen Demand (BOD) water quality at Ngu Hanh Son sewage plant is really low because the sewage is overflowed water from septic tanks. Even though the capacity at Ngu Hanh Son plant is already full, constructing a new plant costs a lot of money and time. Thus, direct collection of sewage sludge from each house's septic tank should be prioritized.

(5) Untapped Energy - Garbage

Biomass generation is carried out by accumulating kitchen garbage and storing the methane produced from the garbage.

To increase the effect of the recovery of methane gas, garbage separation is indispensable. However, at the present time, rubbish separation is not carried out in Da Nang city. In addition, the amount of garbage has been increasing every year. Because of this, it will only be possible to run the Kanson disposal plant for six years more. Decreasing the amount of garbage is the urgent task. Accordingly, this biomass power system which involves separating rubbish and utilizing the garbage in Ngu Hanh Son District is a solution for decreasing the amount of garbage as well as for reducing CO2 emission.

(6) ICT Control

This measure intends to reduce CO2 emission through reducing the power consumption of street lights and upgrading street light management by replacing the existing street lights with LEDs and by introducing optimal control through ITC. Some light sources for street lights include mercury lamps, high-pressure sodium lamps, and LED lamps. In recent years replacement of the existing lamps with LEDs has been taking place. These light sources for street lights are also being placed in Da Nang City, including Ngu Hanh Son District.

Roadmap for reducing CO2 by implementing the six countermeasures to Ngu Hanh Son District

The feasibility of each of the six countermeasures was studied, and the roadmap for reducing CO2 by each of the countermeasures over the period of 2015 to 2030 was proposed.

When the six countermeasures are implemented to Ngu Hanh Son District over the period of 2015 to 2030, the total amount of CO2 emission reduction is 54,097t-CO2 (19% reductions from the BS-H emissions level) and 167,680t-CO2 (22% reductions from the BS-H emissions level) by 2020 and 2030, respectively.

In comparison with the proposed CO2 emission reduction targets, the total amount of reductions by the six countermeasures exceeds the target (10% reductions) for 2020 and the target (20% reductions) for 2030.

1. Outline of APEC Low Carbon Model Town (LCMT) Project Phase 3

1.1 APEC Low Carbon Model Town (LCMT) Project Phase 3

The key objective of the Project is to provide a Feasibility Study on the Re-development which deals with existing urban districts in Da Nang (Viet Nam), with a large focus on Ngu Hanh Son District (NHSD). This will be done by investigating CO2 reduction visions, and verifying how to develop attractive, low-carbon development plans.

The Feasibility Study will provide central and local Viet Nam government officials, as well as the developer of the Da Nang low-carbon town project with valuable advice on how to design an attractive and innovative low carbon development plan. This will be achieved by, providing a specific selection of mitigation measures in buildings, mean of transportation, energy management systems, area energy networks, untapped energy resources, and renewable energy sources, etc. It will be based on an analysis of CO2 reductions and the investment costs of these potential measures provided by, the Consultant. The study also includes implementation methodology for the proposed mitigation measures, including potential implementers and funding sources. This study will help promote low-carbon development concepts throughout the APEC region in order to reduce greenhouse gas emissions associated with traditional approaches to town planning. These concepts will be promoted through sharing the best practices and real-world experiences of low-carbon development with relevant planners and policy makers.

1.2 Scope of Work Outline

The overall feasibility study will be undertaken according to the following procedure. (Fig 1.2.1)

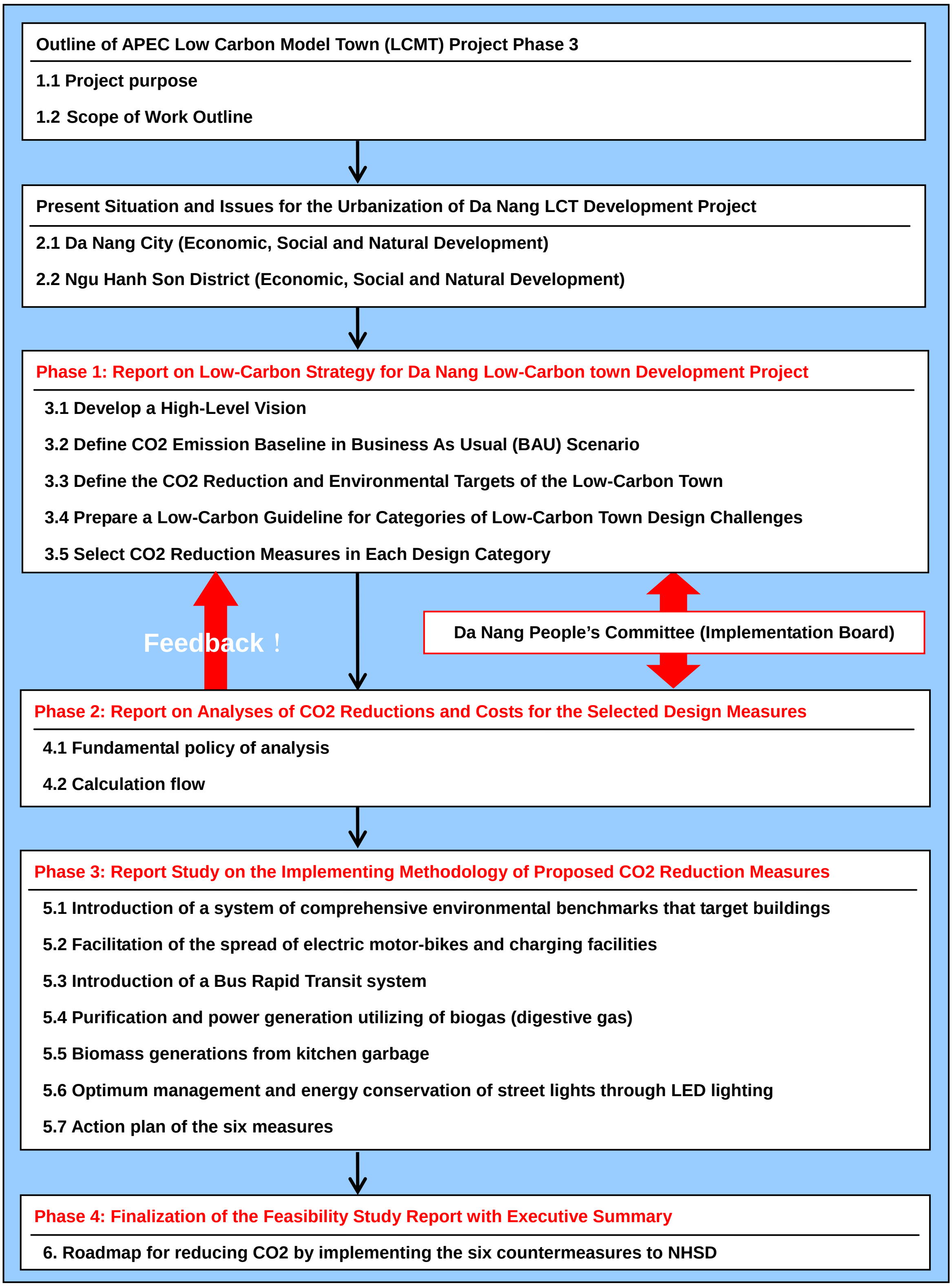


Fig 1.2.1 Scope of work Outline

2. Present Situation and Issues for the Urbanization of Da Nang LCT Development Project

2.1 Da Nang City

The characteristics of Da Nang City are as follows:

- It is located in the middle of the economy which stretches long, north to south (Fig 2.1.1). From a socio-economic viewpoint, it is vital for the unification of Northern and Southern Viet Nam.
- It is one of five cities that are under direct jurisdiction of the central government. It is the cultural and economic center of Viet Nam. In the suburbs there are famous tourist spots including the ancient city of Hue.
- It is the trading center of Central Viet Nam with an international airport and harbor. It also functions as a gateway to the East-West Economic Corridor which plays a crucial role in the development of the GMS economic zone (the Great Mekong Sub region).

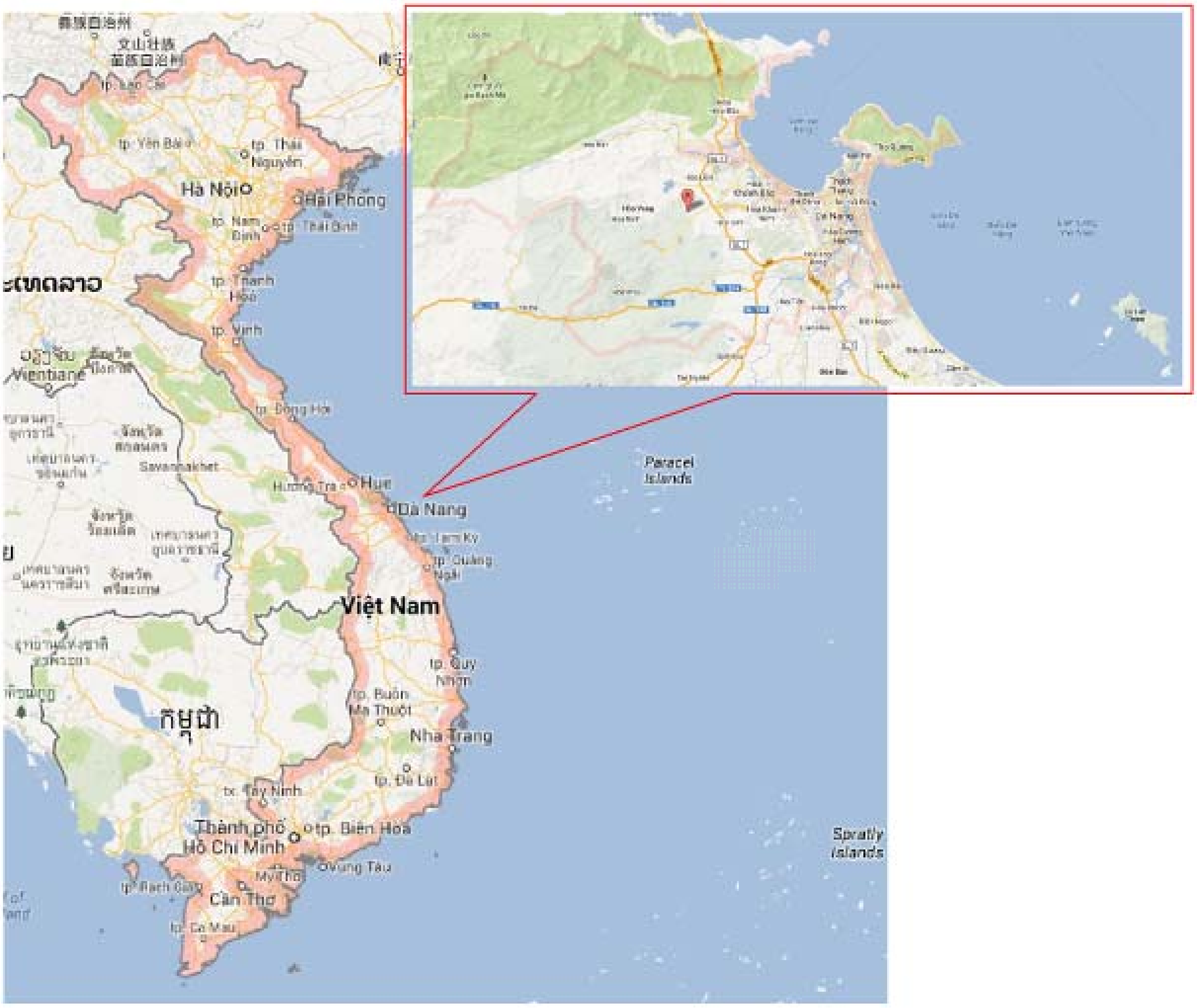


Fig.2.1.1 Location of Da Nang City

2.1.1 Social Development

(1) Area and Population

Da Nang City is the largest city in the central region of Viet Nam. The area and population of Da Nang city and its districts are shown in Table 2.1.1. The administrative area of Da Nang City is composed of 6 districts and 2 suburb districts (one of them an island suburb with an area of 305 km^2) with an area of 1,285.43 km^2. The population of the city is 951,684 persons, and the population density is 740.36 persons / km^2.

Table 2.1.1 The area and population of Da Nang City and its districts

	Area Sq.km	Population Pers.	Population density Pers./km2	Number of communes,precints	
				Total	Of which: Precints
WHOLE CITY	1,285.43	951,684	740.36	56	45
I URBAN	245.54	828,660	3,374.80	45	45
1.Hai Chau	23.28	199,183	8,554.98	13	13
2.Thanh Khe	9.44	181,239	19,192.74	10	10
3.Son Tra	59.32	137,080	2,310.86	7	7
4.Ngu Hanh Son	39.12	70,667	1,806.52	4	4
5.Lien Chieu	79.13	142,577	1,801.88	5	5
6.Cam Le	35.25	97,914	2,777.49	6	6
II RURAL	1,039.89	123,024	118.31	11	-
1.Hoa Vang	734.89	123,024	167.41	11	-
2.Hoang Sa	305.00	-	-	-	-

Source : DANANG STATISTICAL YEARBOOK 2011

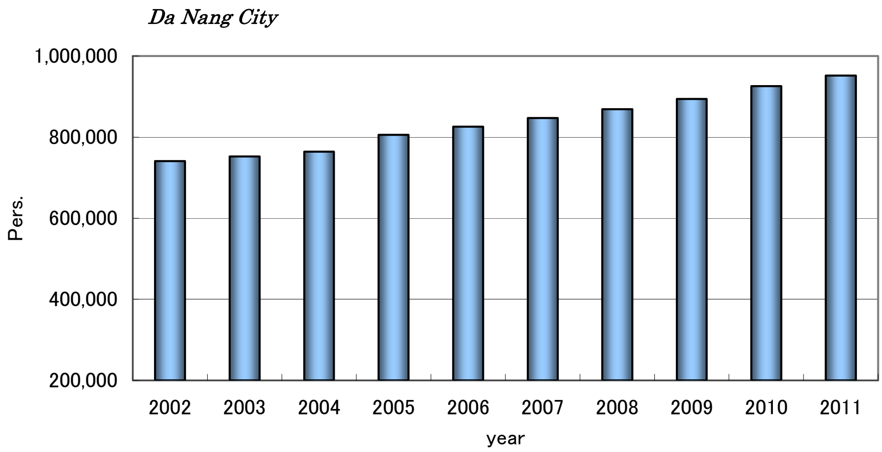
The change of the population in Da Nang City between 2002-2011 is shown in Table 2.1.2 and Fig.2.1.2. From 2002 to 2011, the population of Da Nang City increased by approximately 1.3 times.

Table 2.1.2 Change in the population of Da Nang City (2002- 2011)

Unit:Pers.

Year	Da Nang City
2002	741,214
2003	752,439
2004	764,549
2005	805,683
2006	825,937
2007	847,487
2008	868,783
2009	894,508
2010	926,018
2011	951,684

Source: DA NANG STATISTICAL YEARBOOK(2011,2009,2006,2002)



Source: DA NANG STATISTICAL YEARBOOK 2011, 2009, 2006 and

Fig.2.1.2 Change of the population

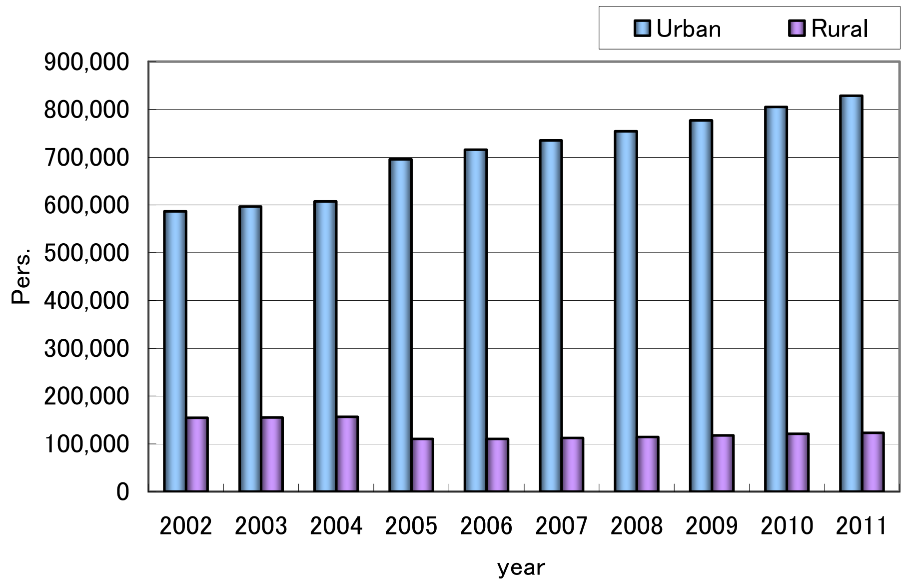
The change in the average population of urban and rural areas of Da Nang City between 2002 and 2011 is shown in Table 2.1.3 and Fig. 2.1.3. The population of the urban area in Da Nang City displays an obvious increasing trend, with the population in 2011 reaching 828,660 persons. On the other hand, the population of the rural areas of Da Nang City has flat lined since 2005, with the population in 2011 leveling at 123,024 persons.

Table 2.1.3 Average urban and rural population 2002-2011

Unit: Pers.

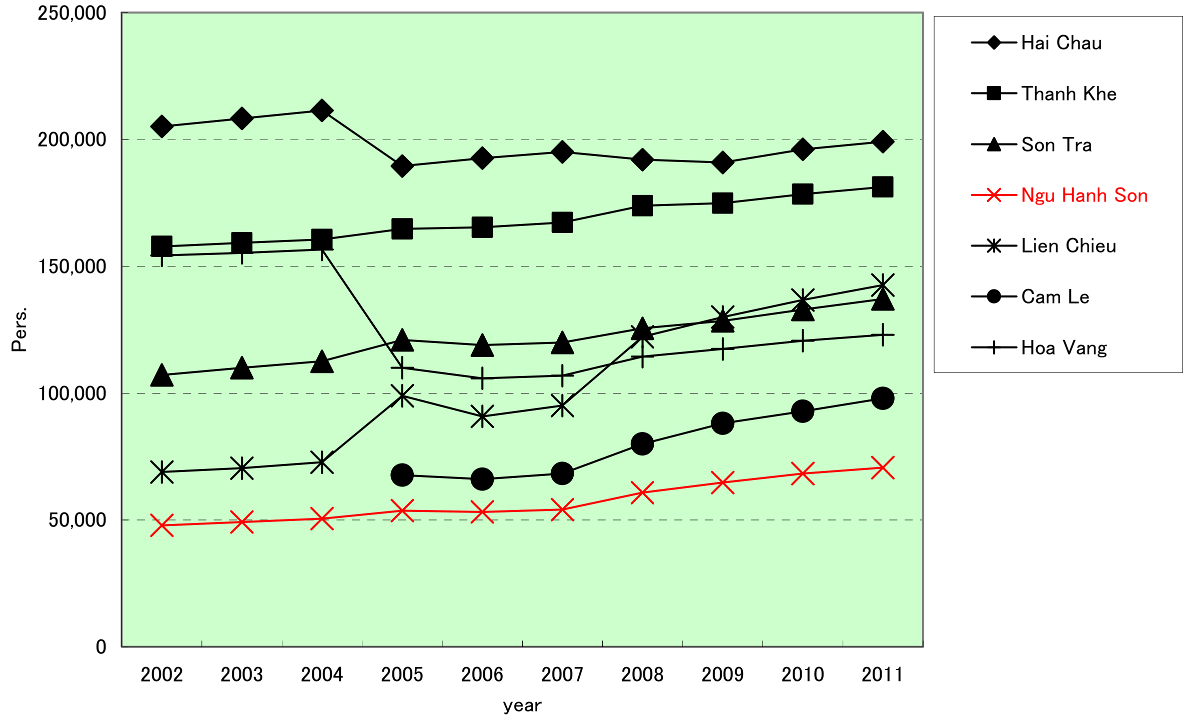
year	Average population	By urban, rural	
		Urban	Rural
2002	741,214	586,954	154,260
2003	752,439	597,152	155,287
2004	764,549	607,897	156,652
2005	805,683	695,663	110,020
2006	825,937	715,632	110,305
2007	847,487	735,178	112,309
2008	868,783	754,395	114,388
2009	894,508	777,055	177,453
2010	926,018	805,320	120,698
2011	951,684	828,660	123,024

Source: DA NANG STATISTICAL YEARBOOK (2011, 2009, 2006, 2002)



Source: DA NANG STATISTICAL YEARBOOK (2011, 2009, 2006, 2002)
Fig. 2.1.3 Average population by urban and rural area

The changes in the population of each district of Da Nang City in 2002-2011 are shown in Fig. 2.1.4. The population of Hai Chau District, the center of Da Nang City, has been flat since 2002, but the populations of neighboring districts, including NHSD, have increased.



Source: DA NANG STATISTICAL YEARBOOK (2011, 2009, 2006, 2002)
Fig. 2.1.4 Average population by district in Da Nang City, in 2002-2011

(2) Land use

The characteristics of Da Nang, outlined in the general land-use plan 2011-2015, are as follows:

- Agricultural land: Although the agricultural economy only contributes a small part of the city's GDP structure, it still plays an important role in overall economic development through food security and satisfying agricultural demand. With this consideration, agricultural land occupies 5,711.86 ha up to 2020.

- Non-agriculture land: In the future, the development priority will focus on exploiting the available potential of tourism and trade. By 2020, non-agricultural land will increase to 7,258.69 ha.

- Urban land: Urban land will be expanded to the Northwest, South and Southwest from the metropolitan area, increasing to about 1,041 ha by 2020.

- Land for conservation areas and tourism: The area will increase from 4,371 to 22,000 ha in the Son Tra natural reserve area and from 8,609.5 to 30,206.3 ha in the Ba Na nature reserve area. In particular, the demand for tourist land will increase to about 1,881.6 ha by 2020.

- The structure of land use in Da Nang City is shown in Fig. 2.1.5. In Da Nang City, agricultural and forestry land is 55%, non-agricultural land is 43%, and unused land is 2%.

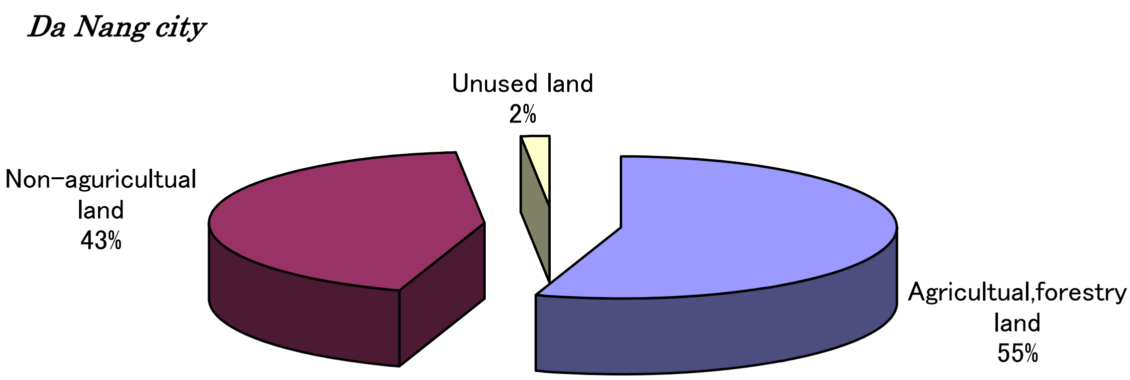


Fig. 2.1.5 Land use in Da Nang City

(3) Infrastructure

1) Transport system

Urban transportation in Da Nang City is primarily composed of road transportation.

On the other hand, since the city was assigned the significant function of administrative and economic center of central Viet Nam, the suburbs possess all modes of transportation including roads, rail, and shipping which serve both passenger and cargo transport.

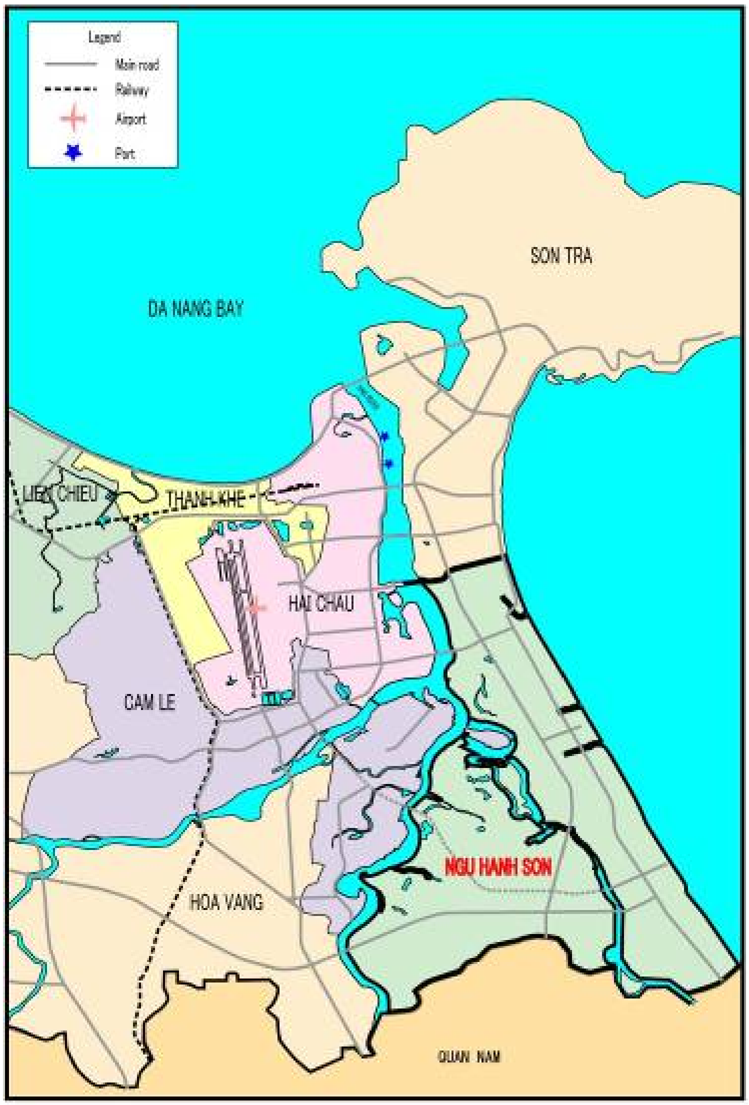


Fig. 2.1.6 Road and railway network in Da Nang City

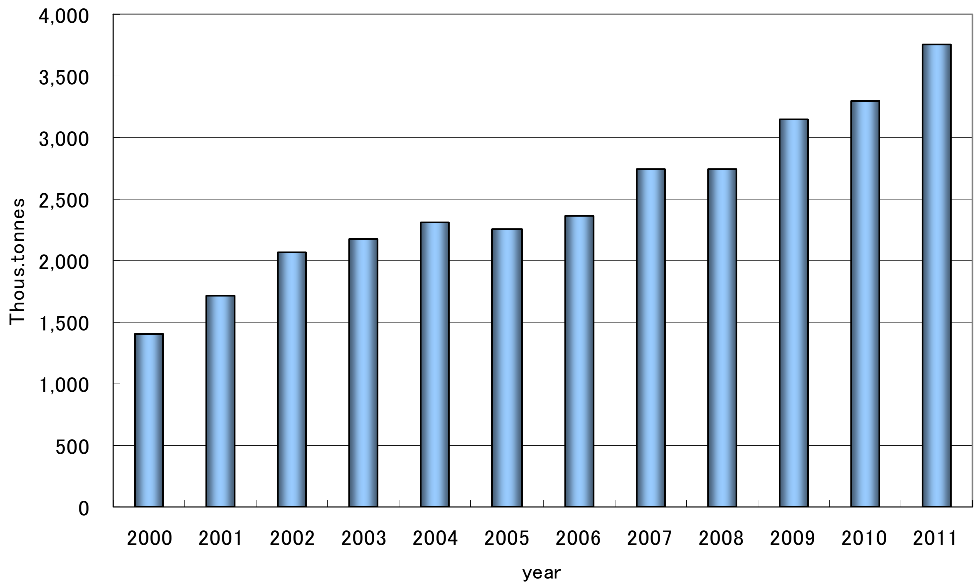
a. Roads

- According to Da Nang City portal site (www.danang.gov.vn), the total length of roads in Da Nang City in 2010 was 848 km, and the road density, 4.72 km/km2. National Highway 1A and 14B pass through Da Nang City. National Highway 1A is the main connecting road between the north and the south. The section across Da Nang City is 38.2 km and plays an important role in connecting other local areas. National Highway 14B connects the west and the east and its length is 32.8 km.
- Urban road transportation services are mostly carried out using private transportation. Current conditions are characterized by the dominance of motorcycles, a fast-growing number of cars, and a decreasing number of bicycles. Public transportation services are provided by taxi and motorcycle taxi. However, their share in urban transportation is low.

Fig 2.1.7 Traffic growth

b. Seaway

- Da Nang City has the biggest seaport in central Viet Nam and the fourth largest seaport in the economy. Da Nang Port is the only gateway port in the city and is composed of two terminals: Tien Sa port and Han River port. Da Nang has the advantage of natural conditions conducive for developing a network of harbors and river ports along the Han River. In Da Nang port, freight of approximately 3 million tonnes per year is handled and it serves as a gateway to Japan, China, Chinese Taipei, and Korea. The volume of freight handled by Da Nang Port in 2000-2011 is shown in Fig. 2.1.8.

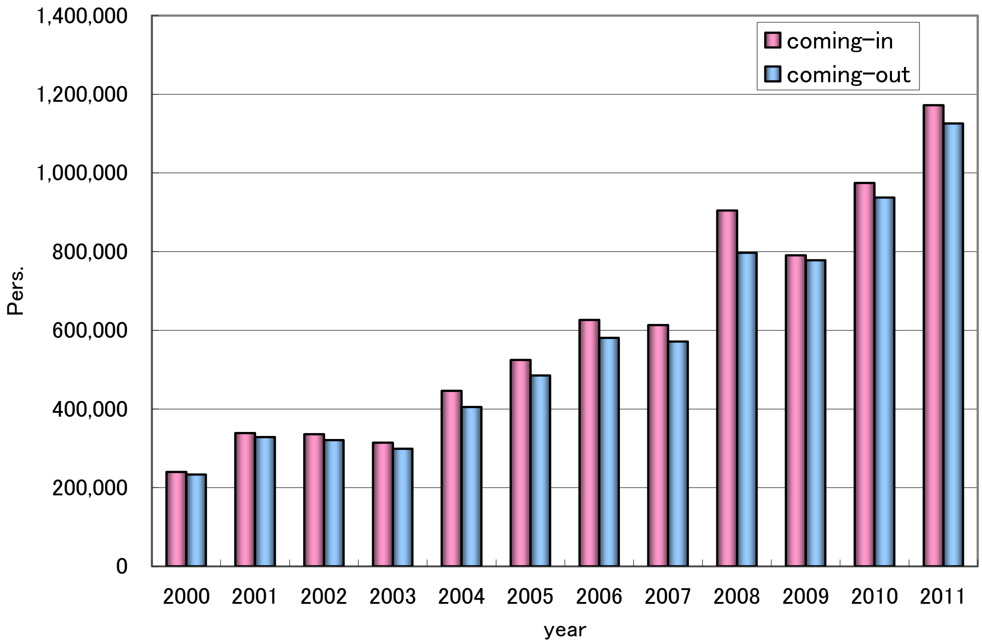


Source: DA NANG STATISTICAL YEARBOOK 2011

Fig. 2.1.8 Volume of cargo handled at Da Nang harbor

c. Airlines

- The Da Nang International Airport is located near the inner-city and it is one of the biggest airports in Viet Nam. It plays an important role in the civil airport network in Viet Nam. The change of passenger numbers between 2000-2011 is shown in Fig. 2.1.9. The passengers in 2000 were only around 240,000, but drastically increased to over 1,100,000 in 2011.

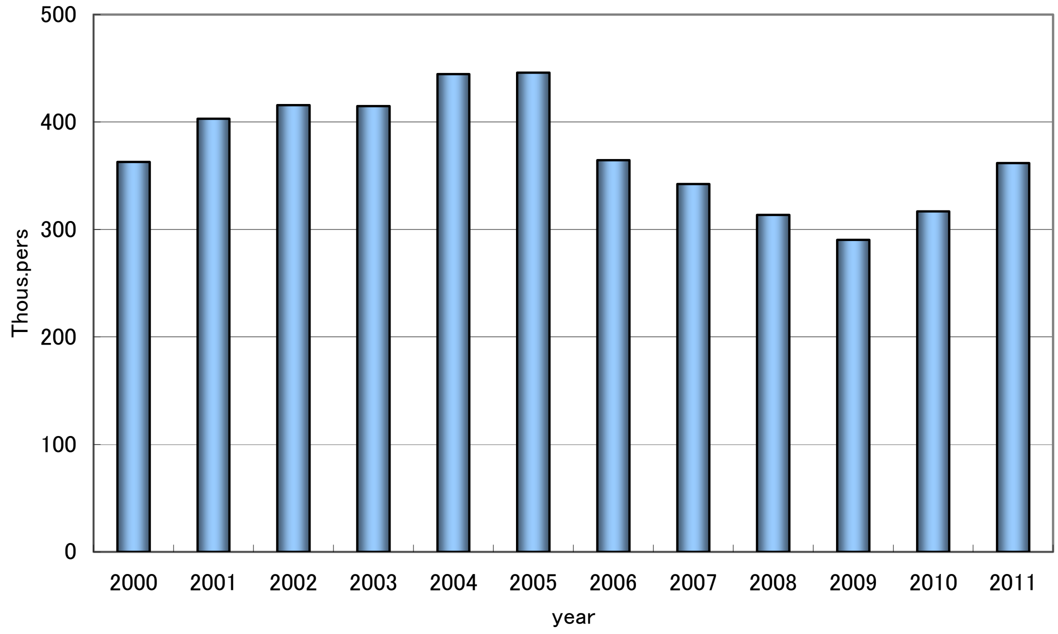


Source: DA NANG STATISTICAL YEARBOOK 2011

Fig. 2.1.9 Passengers arrival Da Nang airport

d. Railroad

- The North-South line of the Viet Nam railway runs across Da Nang City at a length of 42 km. Within the city, there are five railway stations including Da Nang Station which is located in the center of the city. The change of passenger numbers at Da Nang station between 2000-2011 is shown in Fig. 2.1.10. The number of passengers at Da Nang station has been decreasing since its peak in 2005.

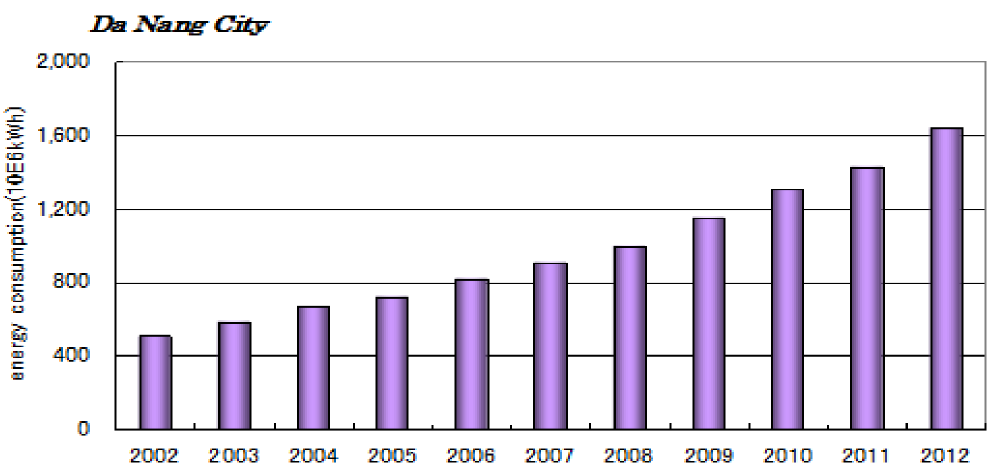


Source: DA NANG STATISTICAL YEARBOOK 2011

Fig. 2.1.10 The number of passengers at Da Nang station

2) Electricity supply

- Da Nang City receives electricity supply through a power transmission line of 110 kV provided by the Central Region Power Company. The changes in the power consumption of Da Nang City between 2002-2012 are shown in Fig. 2.1.11.
- The electricity consumption of Da Nang City has been increasing.



Source: DANANG POWER COMPANY

Fig.2.1.11. Consumption of electricity in Da Nang City.

2.1.2 Economic development

(1) Economy

It is anticipated that Da Nang City will develop as the socio-economic core in the following ways: achieving annual average GDP growth rate of 12-13%; economic earnings of 4,500-5,000 USD per capita; increasing exports at a rate of 19-20% a year; and new job creation of 30,000 jobs a year (Viet Nam's Economic Research Center: Material from Da Nang's diplomatic mission in Japan). Furthermore, Da Nang City has a strategy to develop the IT, culture, and tourism industries,.

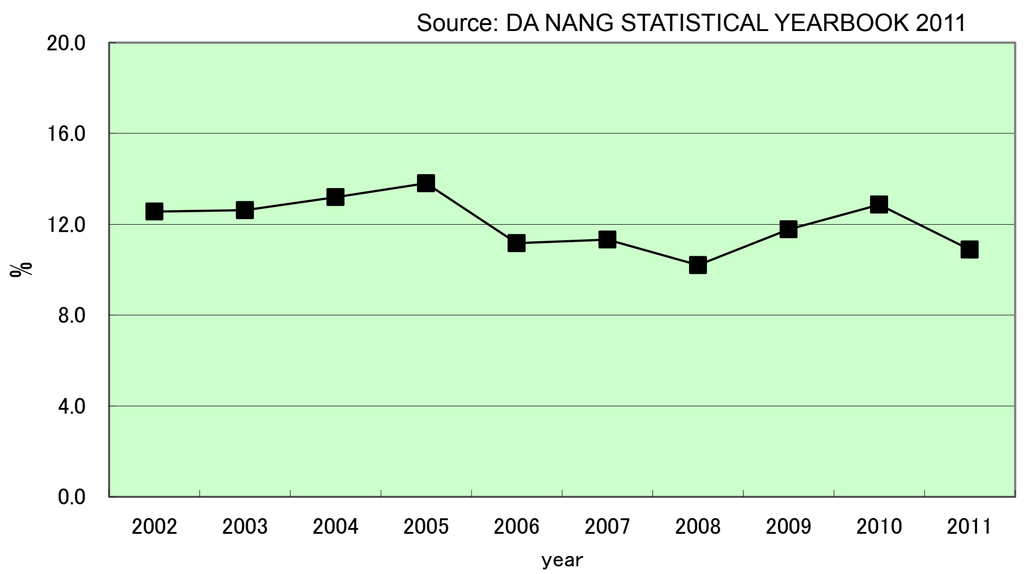
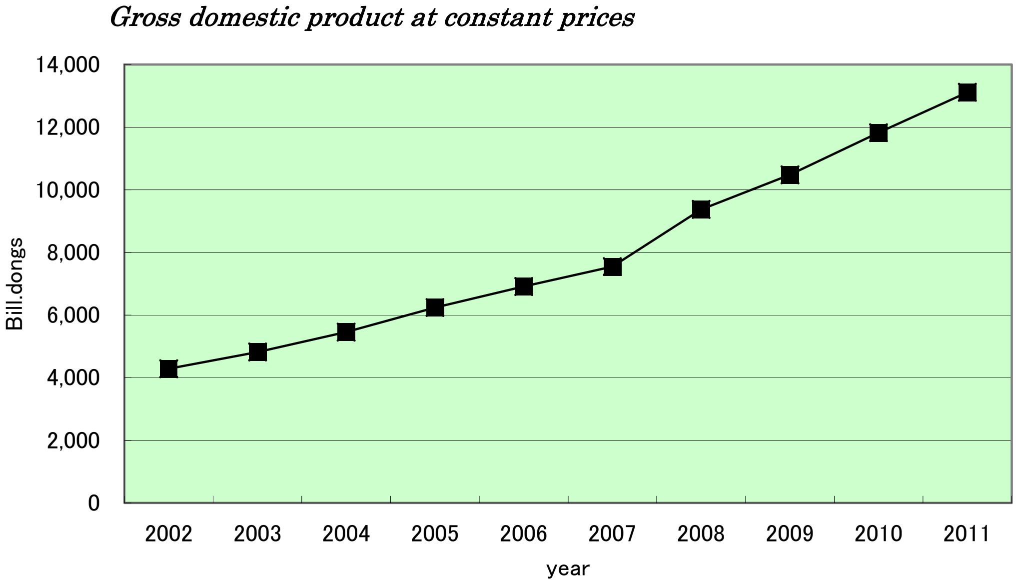


Fig.2.1.12 Changes in the GDP growth rate (at constant 1994 prices)

- The changes in the GDP growth rate (at constant 1994 prices) of Da Nang City from 2002 through to 2011 is shown in Fig. 2.1.12. The GDP growth rate for 10 years is about 12% and was 10.89% in 2011.

- The changes in GDP, the gross output of industry and the gross output of agriculture, forestry, and fisheries over 10 years in Da Nang City are shown in Fig. 2.1.13, Fig. 2.1.14 and Fig. 2.1.15, respectively. The GDP of Da Nang City in 2002 was 4,283 Bill.VNDs and was 13,115 Bill.VNDs in 2011 . The GDP of Da Nang City in 2011 rose 3 times as much as in 2002.



Source: DA NANG STATISTICAL YEARBOOK 2011

Fig. 2.1.13 Gross domestic product in Da Nang City (2002-2011)

The gross output of industry in Da Nang City increased by approximately 30% in the last 10 years, but the gross output of agriculture, forestry and fisheries was flat in the same period.

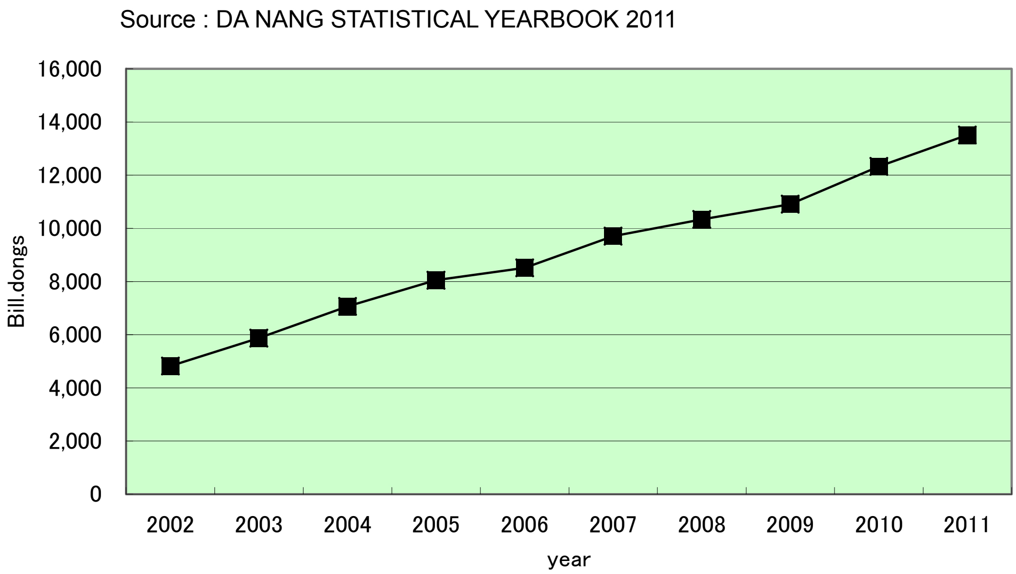


Fig. 2.1.14 Gross output of industry in Da Nang City (2002-2011)

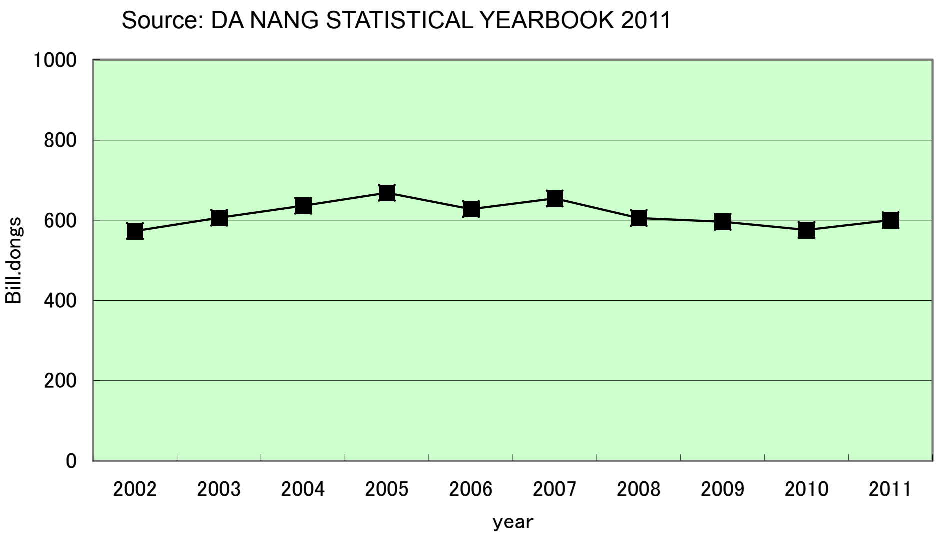


Fig. 2.1.15 Gross output of Agriculture, forestry, and fisheries in Da Nang City (2002-2011)

- The gross output of each industry in Da Nang city in 2008-2011 is shown in Table 2.1.3. The total industrial turnout in 2011 was 87,288,991 Mill. VND, and increased approximately 1.9 times over 2008. The outputs of manufacturing and construction accounted for approximately 50% out of the total. The types of industries with particularly large growth rates in output between 2008-2011 were real estate, public administration and requisite defense, social security, and hotels/restaurants.

Table 2.1.3 Gross output at current prices in Da Nang (2008-2011)

Mill. VND

	2008	2009	2010	2011
TOTAL	45,093,465	53,767,925	68,126,438	87,288,991
Agriculture,forestry,fishing	1,370,887	1,587,743	1,943,659	2,586,174
Minig	208,897	247,195	327,008	355,915
Manufacturing	16,609,424	19,447,754	24,510,450	31,133,192
Electricity,gas supply	2,037,900	2,641,646	3,680,717	4,740,027
Water supply and waste treatment,waste water	168,855	186,130	228,966	294,862
Construction	7,127,119	8,401,978	11,081,835	14,387,356
Retail and wholesale,repair of automobiles,motorcycles and other motor	4,326,677	4,577,275	5,374,251	6,828,428
Transport	2,482,169	3,140,516	4,438,169	5,562,576
Hotels,restaurant	1,446,233	1,443,411	2,171,680	3,468,591
Communication	3,342,197	4,054,846	4,927,039	6,052,528
Financial activities,banking,insurance	1,680,280	1,997,791	2,648,682	3,463,201
Real estate;Renting business activities	387,545	592,211	796,678	1,132,001
Scientific activities and technology	582,881	576,082	745,045	1,052,187
Public administration and defence compulsory social security	379,691	509,246	712,844	932,906
Activities of Party and activities of membership organization	529,121	654,441	734,079	951,382
Education,training	925,485	1,139,261	1,373,375	1,783,864
Health and social work	588,527	722,926	927,400	1,379,579
Recreational,culture and sporting activities	311,935	368,933	460,570	562,493
Other services	242,735	287,200	249,307	339,638
Extra-territorial organizations and bodies	20,425	23,544	27,553	38,774
Activities of organizations and international agencies	-	-	-	-

Source：DANANG STATISTICAL YEARBOOK 2011

- The change in the average number of employees in each industry between 2009-2011 is shown in Table 2.1.4. In Da Nang City, the types of industries with the highest number of employees were manufacturing, retail and wholesale, repair of automobiles, motorcycles and other types of motors, and construction, which accounted for approximately 40% of the total.

Table 2.1.4 Average number of employees in 2009-2011 by type of economic activity in Da Nang

Thous.pers.

	2009	2010	2011
TOTAL	410.15	433.28	446.78
Agriculture,forestry,fishing	39.15	38.52	38.00
Minig	0.67	0.70	0.70
Manufacturing	86.65	89.46	90.00
Electricity,gas supply	8.90	9.14	9.93
Water supply and waste treatment,waste water	1.50	1.60	1.70
Construction	41.93	46.86	48.50
Retail and wholesale,repair of automobiles,motorcycles and other	74.28	83.70	87.00
Transport	26.05	27.30	28.00
Hotels,restaurant	38.94	42.00	46.70
Communication	7.93	7.40	8.00
Financial activities,banking,insurance	5.52	5.80	6.00
Real estate;Renting business activities	3.24	3.10	3.00
Scientific activities and technology	1.91	2.09	2.00
Public administration and defence compulsory social security	4.91	4.96	4.50
Activities of Party and activities of membership organization	14.65	14.60	14.00
Education,training	23.45	23.38	24.00
Health and social work	6.83	7.40	7.55
Recreational,culture and sporting activities	5.49	5.70	6.20
Other services	13.69	14.20	14.30
Extra-territorial organizations and bodies	4.26	5.17	6.50
Activities of organizations and international agencies	0.20	0.20	0.20

Source : DANANG STATISTICAL YEARBOOK 2011

- The change in the number of companies in Da Nang City between 2006-2010 is shown in Table 2.1.5. In recent years, the number of Non-state enterprises increased rapidly. The number of enterprises in 2010 was 7,004, and was approximately twice as much as in 2008. The type of industries with the most number of enterprises was retail and wholesale, repair of automobiles, motorcycles and other types of motors, which accounting for approximately 40% of the total.

Table 2.1.5 Annual number of enterprises as of 31st Dec.

Enterprise

	2006	2007	2008	2009	2010
TOTAL	3,273	4,032	4,451	6,010	7,148
BY OWNERSHIP					
Sector of state	104	92	83	78	76
Non state	3,131	3,899	4,322	5,864	7,004
Foreign investment enterprise	38	41	46	68	68
BY KIND OF ECONOMIC ACTIVITY					
Agriculture,forestry,fishery	4	9	16	35	32
Mining	25	24	41	35	43
Manufacturing	523	573	635	738	779
Electricity,gas supply	12	16	18	14	18
Water supply and waste treatment,waste water	2	5	7	6	6
Construction	420	517	591	931	1,118
Retail and wholsale,repair of automobiles,motorcycles and other motor	1,569	1,916	2,067	2,691	3,027
Transport,storage	242	300	279	319	621
Hotel,restaurant	152	219	246	376	409
Information and communication	32	46	60	85	97
Finance,Banking and Insurance	4	3	2	1	7
Real estate;Renting business activities	33	43	42	65	81
Scientific activities and technology	146	187	241	367	488
Administrative and operational support services	54	93	88	195	233
Education and training	17	24	38	76	74
Health and social work	7	3	4	9	14
Recreational,culture and sporting activities	14	20	21	24	26
Other service activities	17	34	42	52	74
Hiring activities do housework in the household	-	-	1	1	1

Source : DANANG STATISTICAL YEARBOOK 2011

The change in the amount of production of the main industrial products in Da Nang City between 2005-2011 is shown in Table 2.1.6. The products with the highest production were cement, steel and frozen seafood.

Table 2.1.6 Main industrial products

	2005	2008	2009	2010	2011
Frozen aquatics products(Ton)	13,898	13,561	14,569	24,814	25,053
Beer(Thous.litres)	47,265	41,740	41,286	56,539	56,623
Fabric of all kinds(Thous.m)	7,931	12,607	16,689	6,448	6,425
Ready made clothes(Thous.pieces)	28,256	27,214	49,435	38,736	43,324
Sport shoes(Thous.pairs)	3,051	2,112	1,206	1,275	1,350
Cover of all kinds(Ton)	16,402	24,865	22,677	20,028	21,230
Chemical fertilizers(Ton)	23,255	13,034	8,462	7,305	7,520
Medicinal ampoules(Central state)(Thous.tubes)	9,869	14,949	19,250	230ton	235ton
Medicinal tablets(Central state)(Thous.pills)	719,000	684,000	527,000		
Washing preparations(Ton)	4,136	1,195	402	8	-
Cement(Thous.tons)	766	1,473	1,665	1,797	1,845
Bricks(Thous.pieces)	103,641	128,335	251,477	160,210	166,666
Ceramic(Thous.m2)	2,755	2,577	2,034	2,336	2,420
Steel(Thous.tons)	62	74	105	104	115
Motobicycles(Thous.pecies)	-	8	4	2	1

Source : DANANG STATISTICAL YEARBOOK 2011

(2) Tourism and cultural heritage

Da Nang City is one of the national tourist sites with diverse tourist potential in terms of nature and culture. According to the Da Nang statistical yearbook 2011, the number of foreigners visiting Da Nang city has been increasing (Table 2.1.7)

Table 2.1.7 Activities of tourism in area

	2005	2008	2009	2010	2011
A.TURNOVER(Mill.dongs)					
－ Hotel	286,320	432,120	502,218	714,785	1,256,498
－ Travel	82,812	274,272	265,100	379,991	484,096
B.NUMBER OF VISITOR ARRIVALS					
I Number of visitors(visitor)					
1.By tour businesses	46,133	120,066	134,158	141,241	173,660
Of which:Foreign visitors	24,619	65,705	42,049	91,463	82,510
2.By dwelling businesses	698,621	867,512	996,946	1,357,969	1,753,889
Of which:Foreign visitors	114,336	191,488	113,863	199,470	259,620
II Length of stay(Day)					
1.By tour businesses	187,510	495,745	389,767	596,566	727,714
Of which:Foreign visitors	99,783	265,063	174,006	399,824	365,815
2.By dwelling businesses	1,008,524	926,785	1,012,994	1,874,244	2,711,605
Of which:Foreign visitors	195,541	252,737	175,547	301,399	497,150

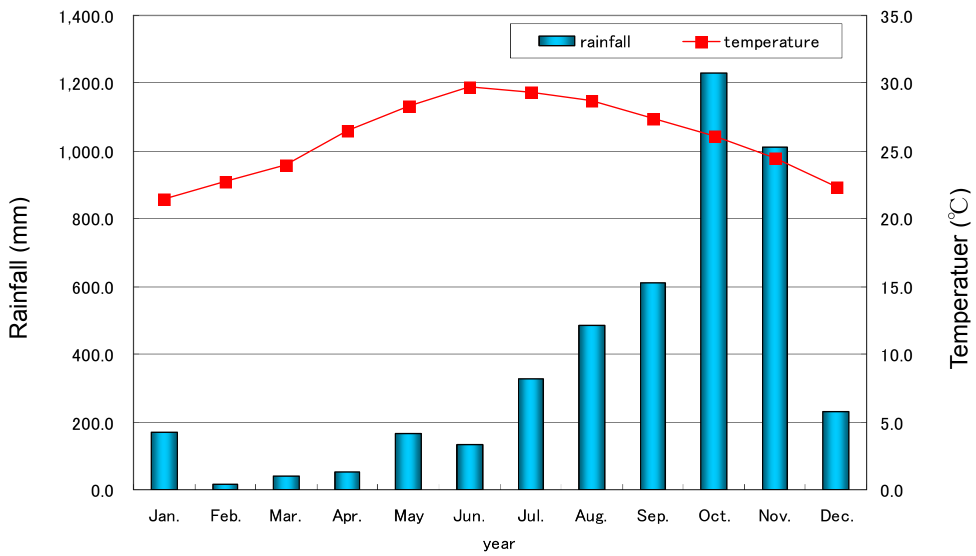
Source：DANANG STATISTICAL YEARBOOK 2011

2.1.3 Natural conditions

(1) Climate

Da Nang City is in the Central Coast of Viet Nam's typical tropical monsoon zone, where the climate characteristics are mixed between those of the north and the south of Viet Nam. The city has two seasons in a year with the rainy season usually lasting from August to December and the dry season from January to July.

Monthly rainfall and air temperature averages in Da Nang City during the last 10 years are shown in Fig. 2.1.16. The annual average rainfall was 4,716 mm, and the annual average air temperature was 25.9^{o}C during the last 10 years. The rainfall is significantly different between the dry and rainy seasons.



Source: DA NANG STATISTICAL YEARBOOK 2011

Fig.2.1.16 Monthly rainfall and air temperature in Da Nang

(2) Topography

Da Nang City has both mountains and plains. High mountainous regions are located in the west and northwest part of the city. The plain is narrow and lies between the hills and the coast in the south and southeast and is separated by the May Rivers and streams. This area contains many areas for agriculture, industry, military, domestic land and other functional zones of the city.

(3) Hydrography

Da Nang City is a coastal city, hydrologically supplied by the Cu De River and the Han River (downstream of the Vu Gia River). Most of the rivers in Da Nang belong to the downstream basin of the Vu Gia-Thu Bon Rivers. These are the main drinking water sources of Da Nang City.

(4) Environmental state

Although the environmental quality of Da Nang City has been considerably improved over the past 10 years, there still exist a number of environmental issues that have not been fully resolved. In the meantime, the city's environment has been degrading rapidly in the course of urbanization.

1) Water quality

Domestic and industrial wastewater is responsible for the degradation of the rivers in Da Nang City due to eutrophication. The rivers are polluted due to pollutants such as coliform, nitrogen and oil. In particular, the Phu Loc River has been seriously polluted by micro-organisms and heavy metals. The overall quality of coastal water is still good in condition. However, some sites in Da Nang Bay, near discharge points for domestic wastewater, are highly contaminated by coliform. There are 42 lakes and ponds in Da Nang City, and these lakes and ponds are polluted in terms of organic parameters such as BOD and COD. The ground water in some regions, including the Hoa Khanh, Ngu Hanh Son, and Cam Le Districts, is partially polluted. Most of the ground water in the city is polluted with high levels of coliform.

2) Air quality

The air quality of Da Nang City is still clean overall. In the surrounding commercial centers, traffic interchanges and industrial zones, the concentration of dust and noise has been increasing along with increases in traffic vehicles. CO pollution has yet to occur. The dust concentration at some transport intersections in the center of Da Nang City is 2-3 times higher than the Viet Nam standard.

Untreated smoke from some enterprises is directly discharged into the atmosphere and causes some environmental pollution.

3) Soil quality

The rapid urbanization of Da Nang City resulted in changes in the land area as well as in the physical and chemical characteristics of the soil. Various physical impacts have resulted from soil erosion and mineral exploitation. There are chemical influences such as solid wastes, waste water, air pollutants and hazardous wastes. These wastes could accumulate inside the soil and will cause environmental risks, pollute the ground water and affect human health.

2.1.4 Future development issues of Da Nang City

Da Nang City makes a future urban development plan every five or ten years. The city has two urban development plans.

The social economic plan by 2020 (Department of Planning and Investment, issued in 2011)

The urban development plan by 2030 (Department of Construction, established in 2012 and applied for PM's approval)

The city has established a detailed development plan related to the entirety of urban development, addressing issues of population, industry, traffic, electricity, water supply and treatment, environment, land use, etc. Da Nang has a clear vision for its industry development strategy which focuses on the industries of Information Technology (IT) and tourism while remaining harmonious with other sectors and the environment. One of the important indexes for indicating the scale of development is <u>population forecasts</u>. The city studied several population forecast scenarios and, in collaboration with JICA (DaCRISS project), considered their urban development and evaluated them below.

(1) Forecast of population growth rate

Population change is one of the key issues affecting the condition of city development. Population growth involves an increase in the migration rate as well as the natural growth rates of population. An increase in the migrant rate emerges from a difference between the immigrant population from surrounding provinces and the emigrant population out of Da Nang city. However, this is not always represented in the statistic data of the population. The previous survey of Da Nang city reveals that the immigrant population ratio accounts for about 20% of the statistic population. This 20% population should be added to the conventional data of population statistics.

The population growth rate is presently around 1.2%, but it is predicted that the rate shall decrease to 1.0%. However, the growth rate in the emigrant population will probably increase to 3.9% in 2020 from 0.51%.

(2) Immigrant situation

#1 Major regions of immigrants

The major regions of immigrants are the areas near Da Nang City such as Hue City, Quang Nam Province, Quang Ngai Province, Quang Tri Province.

#2 Principal reasons for immigration into Da Nang

Economic incentives, job opportunities,

Better conditions due to transportation advances facilitates easy access to the city,

Close communication between residential areas.

#3 Characteristics of the immigrants and immigration

The younger generation makes up the major proportion.
Single and/or small families are the majority.
Temporal stay due to job opportunities
They rely on relatives and acquaintances.

(3) Some scenarios for the development plan

Da Nang City has studied three scenarios as shown in Table 2.1.8.

Table 2.1.8 Three scenarios for the development of Da Nang city with a vision for 2025

		Scenario 1	Scenario 2	Scenario 3
Statistic	Population (1000)	1,213 (YR 2025)	1,500 (YR 2025)	2,117 (YR 2025)
	Urban area (ha)	20,572	24,028	25,043
	Density (Person/ha)	59	62	85
Sustainability	**Economy** # Diversity in industries # Attractiveness for Investment # Relations in the regions	**Low** # Inefficient land use # Decline in investment incentives # Decline in regional relations	**Medium** # Spontaneous exploitation # Shortage of midtown competitive investment # Linked to the urban areas of adjacent provinces	**High** # Modern and compact establishment of urban district centers, # Strategic arrangement of new industries, # Linked to the urban areas of adjacent provinces
	Society # Equality # Job # Access to service	**Low** # Decline in job opportunities # Decline in population ratio	**Medium** # Inconvenient access to public transport	**Medium – High** # Strong workforce # Convenient access to public transport # Firm community
	Environment # Pollution level # Ecosystem # Disaster protection	**Low** # Pollution expansion # Negative impact to ecosystem # Subject to disaster	**Medium – High** # Considering environment conservation	**Medium – High** # Little pollution # Protection of ecosystem # Improved facilities
(DaCRISS report in 2010 JICA and Da Nang PC)				

The Da Nang People's Committee (DNPC) is adopting scenario 3. This scenario indicates a modified natural population increase adding a 20% rise by immigrants from other regions, resulting in a population of 2.5 million in 2030 as shown in Fig. 2.1.17. We estimate the reduction targets and BAU scenario in consideration of this fastest growth scenario.

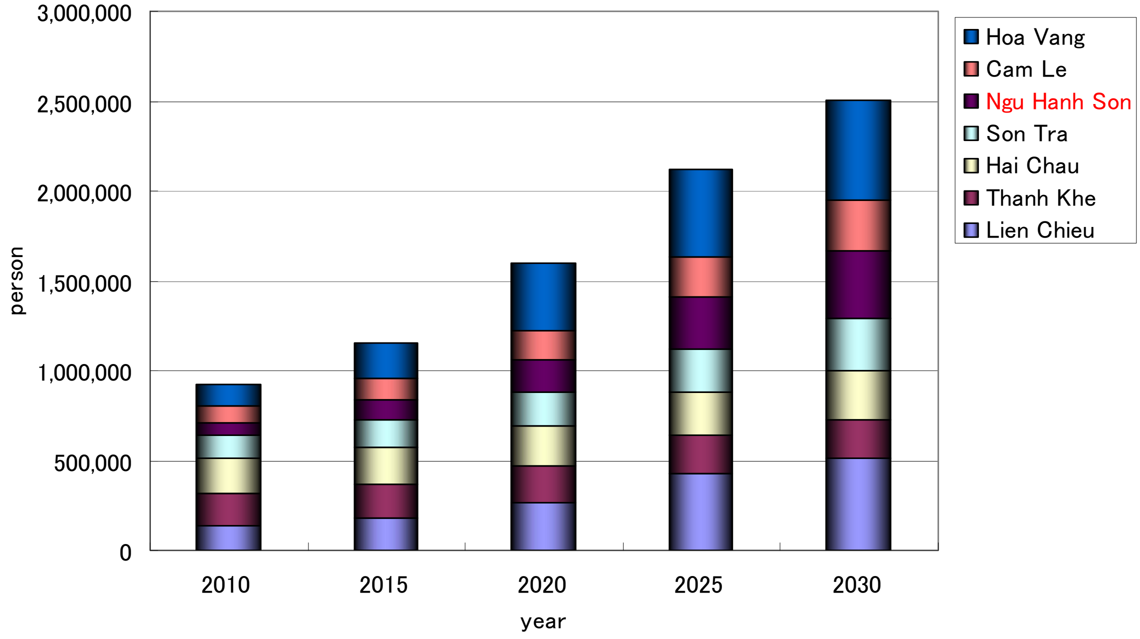


Fig.2.1.17 Population forecast in Da Nang City

2.2 Ngu Hanh Son District

Ngu Hanh Son, the district that is the target of this Project, is a long, skinny district between the East Sea and the Han River. It is also a district that is blessed with the amazing scenery of some of the world's leading white sand beaches that stretch for 70 km to the Son Tra Peninsula (Fig 2.2.1). NHSD is 39.12 km^2 in area and the population of the district is 70,667 persons, with a population density of 1,806.52 persons / km^2. NHSD has the smallest population among the citadel districts.

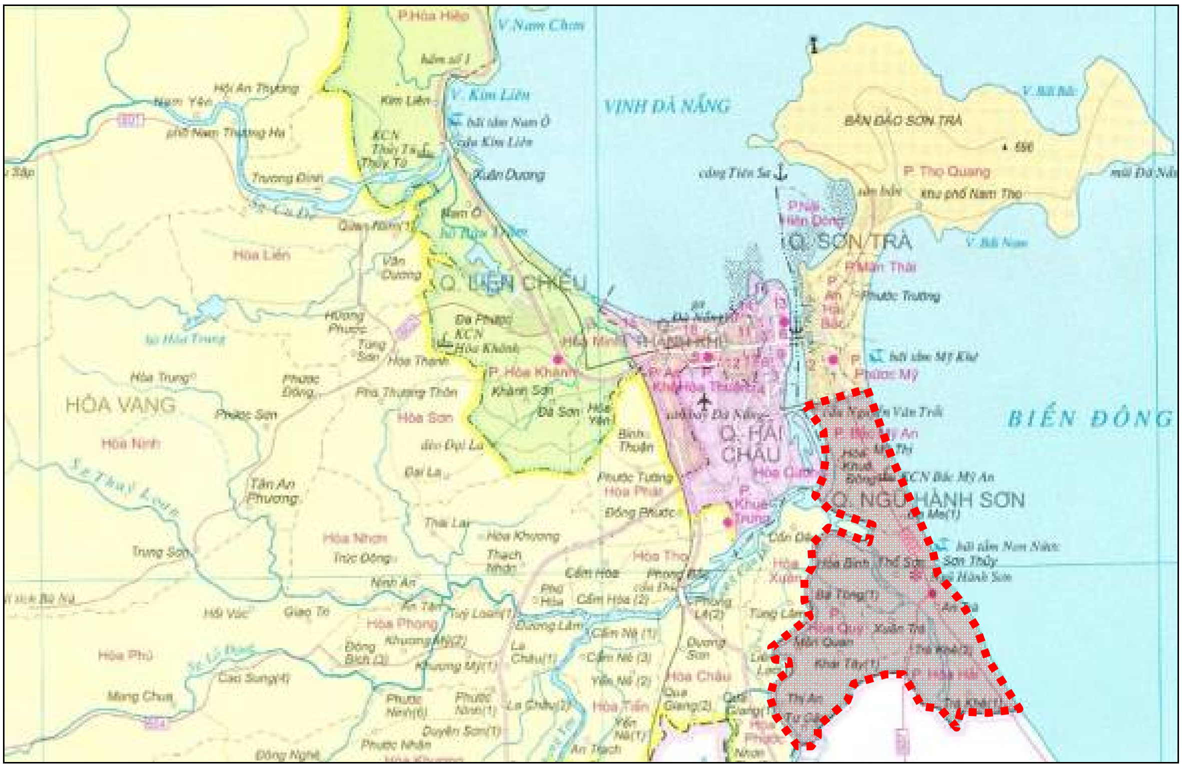


Fig 2.2.1 Ngu Hanh Son District

This region is at the center of the tourist industry, and along the coast's sandy beaches large casinos, golf courses, and other amusement (recreational) facilities etc. are under construction. At the same time, residential district school zones for middle and high schools, as well as colleges are under development. This district is predicted to have the largest population increase within Da Nang City. Nonetheless, in the near future there will be problems with the numerous issues associated with rapid urban development. These problems include: a worsening of the landscape and environment due to a surge of new buildings founded on a vision of profitability and economic gain; a shortage of waterworks and electricity, and an excess of sewage and waste beyond treatment capacity; increases in traffic amounts due to both large numbers commuting to work from the old town across the river, as well as the increased movement of tourists, etc. There is a concern that there will be a spread of re-development (land that can only be used considerably below its potential value or land that is not usable).

2.2.1 Social Development

(1) Population

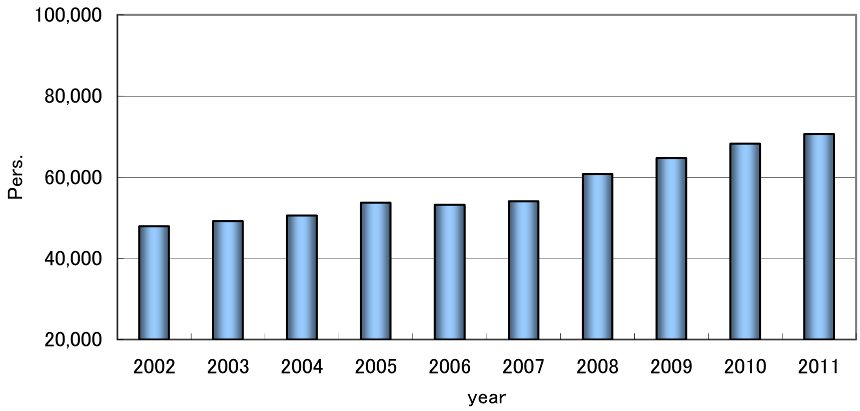
The change in population of NHSD from 2002 through to 2011 is shown in Table 2.2.1 and Fig. 2.2.2. Up to 2011, the population of NHSD has increased approximately 1.5 times in comparison with 2002.

Table 2.2.1 Change in the population of NHSD (2002- 2011)

Unit:Pers.

Year	Ngu Hanh Son District
2002	47,878
2003	49,180
2004	50,531
2005	53,691
2006	53,166
2007	54,066
2008	60,768
2009	64,722
2010	68,270
2011	70,667

Source: DA NANG STATISTICAL YEARBOOK(2011,2009,2006,2002)



Source: DA NANG STATISTICAL YEARBOOK 2011, 2009, 2006 and

Fig. 2.2.2 Change of the population in NHSD

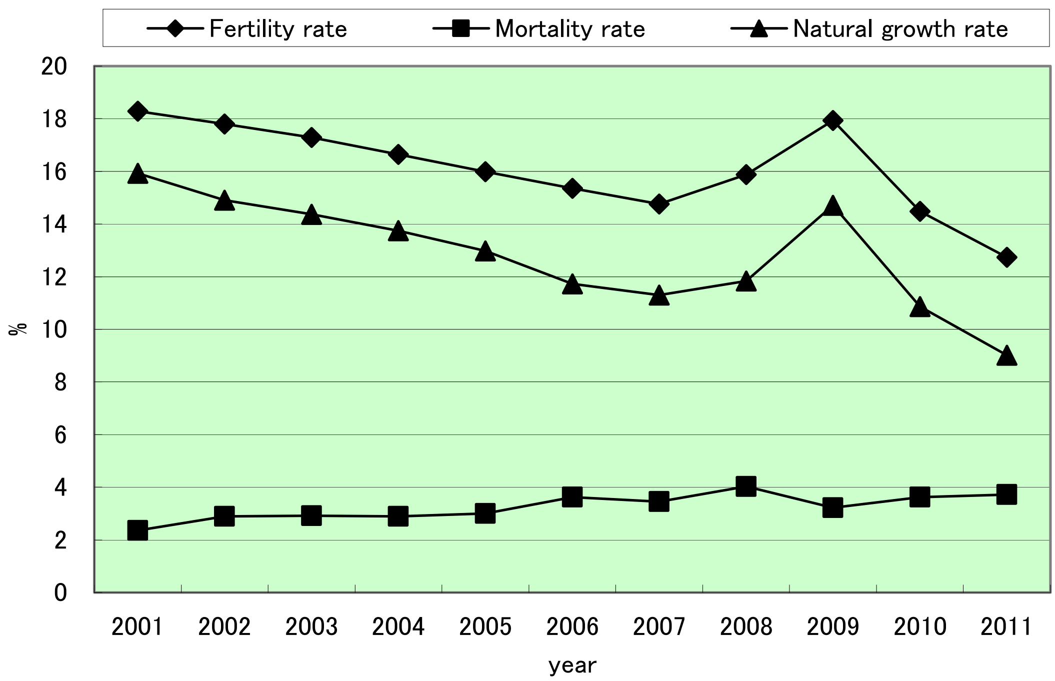
Changes in the fertility, mortality and natural growth rates for NHSD from 2001 through to 2011 are shown in Table 2.2.2 and Fig. 2.2.3. In NHSD, the fertility rate has decreased, the mortality rate has leveled off or even increased, and the natural growth rate has decreased.

Table 2.2.2 Fertility, mortality and natural growth rate of the population in NHSD

Unit : %

	Fertility rate	Mortality rate	Natural growth rate
2001	18.29	2.36	15.93
2002	17.80	2.90	14.90
2003	17.29	2.92	14.37
2004	16.64	2.89	13.75
2005	15.99	3.01	12.98
2006	15.35	3.62	11.73
2007	14.76	3.46	11.30
2008	15.87	4.03	11.84
2009	17.93	3.22	14.71
2010	14.48	3.62	10.86
2011	12.74	3.72	9.02

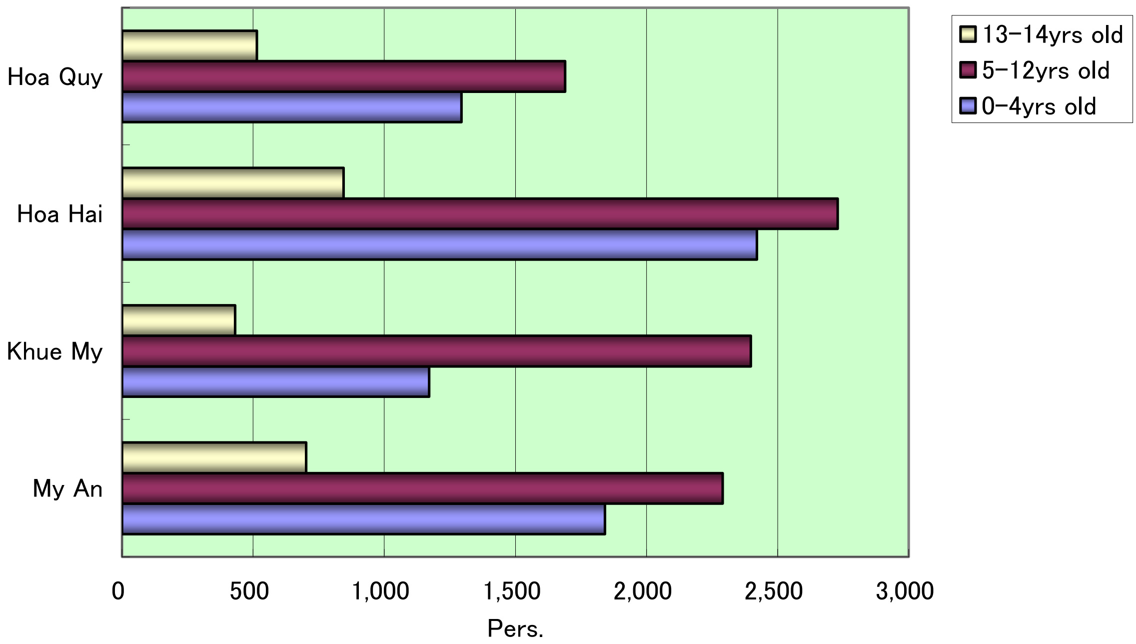
Source：NGU HANH SON STATISTICAL YEARBOOK 2011



Source: NGU HANH SON STATISTICAL YEARBOOK 2011

Fig. 2.2.3 Change in the fertility, mortality and natural growth rate of NHSD

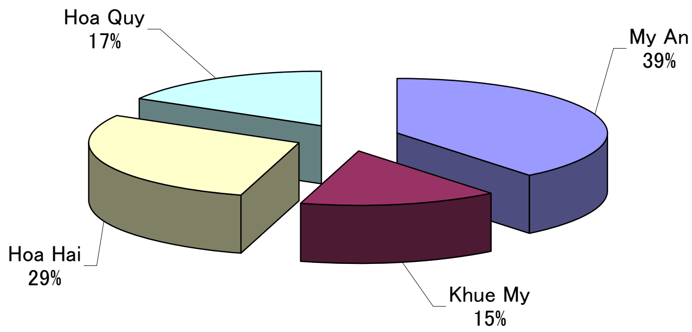
The age structure of populations in 2011 by precinct in NHSD is shown in Fig. 2.2.4. In each precinct, the proportion of the population aged between 5 years old and 12 years old is large.



Source: NGU HANH SON STATISTICAL YEARBOOK 2011

Fig. 2.2.4 Age structure of populations by precinct in NHSD

The proportion of the working population by precinct in NHSD is shown in Fig. 2.2.5. In NHSD, My An has the largest working population (39%).

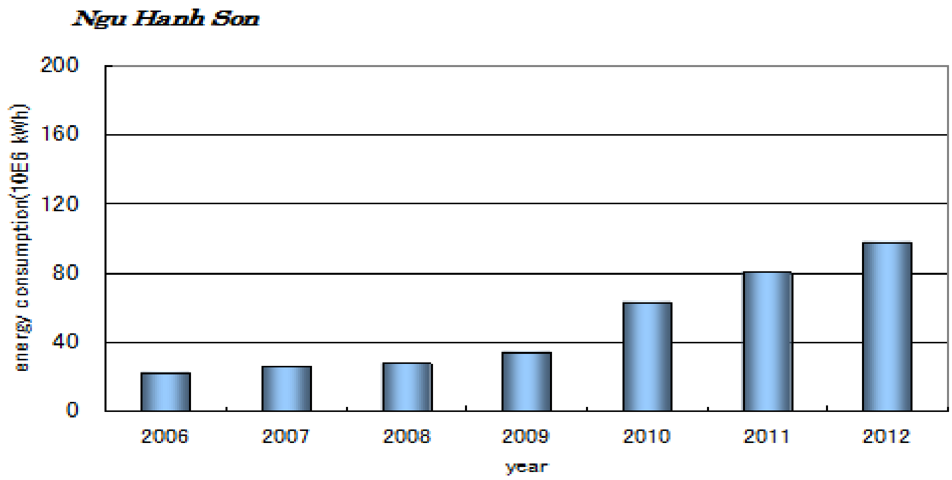


Source: NGU HANH SON STATISTICAL YEARBOOK 2011

Fig. 2.2.5 Distribution of working population by precinct

(2) Electricity supply

The change in the power consumption of NHSD from 2006 through to 2012 is shown in Fig. 2.2.6. The electricity consumption of NHSD has been increasing over this period.

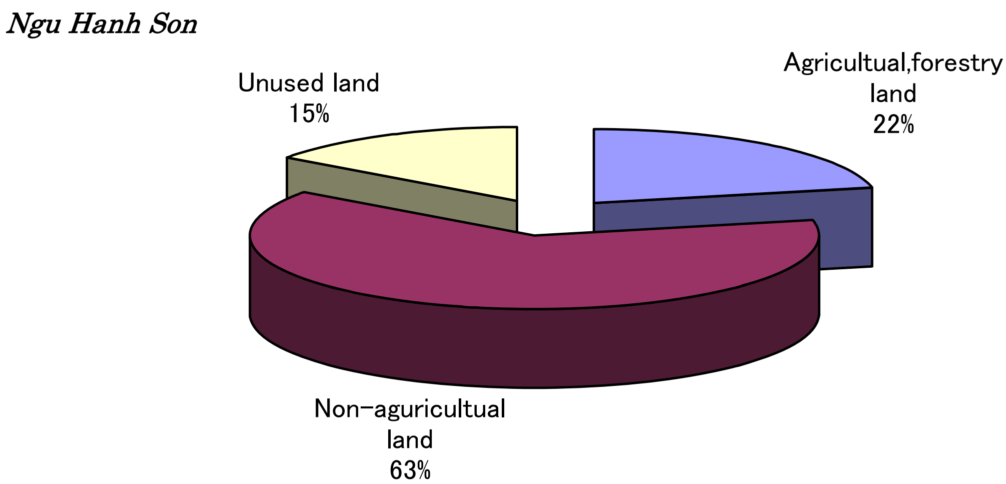


Source: DANANG POWER COMPANY

Fig. 2.2.6 Change in electricity consumption in NHSD

(3) Land use

The land use in NHSD is shown in Fig. 2.1.8. NHSD's agricultural and forestry land account for 22%, non-agricultural land 63%, and unused land 15%. The ratio of unused land in NHSD is relatively high.

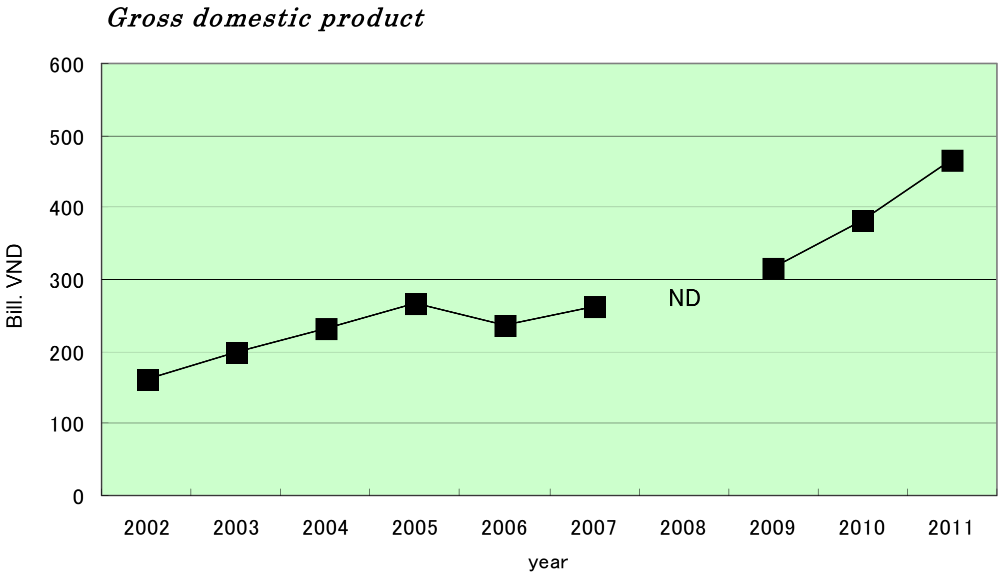


Source: DA NANG STATISTICAL YEARBOOK 2011

Fig. 2.2.7 Land use in NHSD

2.2.2 Economic development

According to the Ngu Hanh Son Statistical Yearbooks of 2005, 2007, 2010 and 2011, the GDP in 2011 was 467 Bill. VND and is approximately 3 times as much as that in 2002 (Fig. 2.2.8).



Source: NGU HANH SON STATISTICAL YEARBOOK(2005, 2007, 2010, 2011)

Fig.2.2.8 Gross domestic product in NHSD (2002-2011)

2.2.3 Future Development issues in Ngu Hanh Son District

(1) Social Economic Plan with a vision for 2020

In the social economic plan (Department of Planning and Investment, 2011 issue) of the Ngu Hanh Son district with a vision for 2020, a detailed development plan was established.

The Da Nang PC has studied three scenarios to determine future targets, focusing on raising the annual per capita GDP to the same level as that of the center district of Da Nang City. These were based on the functions and resources of Ngu Hanh Son District.

Scenario 1 : Foreign investment is subdued and mainly domestic finance and resources are utilized. As service sector areas are individually developed, the investment scale is small. It is presumed that the population[1] will be 90,709 per capita, GDP will be 5,400US$ in 2020.

Scenario 2 : Foreign investment is positively introduced. An epoch-making project is attracted in the industrial sectors of commerce and service, economic growth shall develop with a good balance between the manufacturing and service industries maintaining high economic growth. The presumed population is 105,656 and the per capita GDP 3,750US$ by 2020. The per capita GDP is less than scenario 1 because the population rises over scenario 1.

Scenario 3 : Investment is introduced from inside and outside the country, with a preference for development in the service sector. Subsequently, manufacturing, transportation infrastructure and all other sectors will follow. It is predicted that the population will be 90,709, and the per capita GDP quite high at 7,700US$ in 2020. A huge amount of investment is required for the development of scenario 3.

The Da Nang PC will adopt scenario 2 as a suitable target and draw up a future plan as outlined below.

This plan clarifies that tourism will be encouraged in Ngu Han Son district as the core of industry. Right up to the Son Tra peninsula, Ngu Hanh Son district aims at raising the level of tourism to the international standard by 2020. It will take every measure to explore a variety of tourism resources, establishing infrastructure (hotel, commercial facilities and transportation) and personal training.

In the industries of engineering and construction, the local manufacturers involved in marble processing and marble statues will be highly encouraged as a typical local industry in Ngu Hanh Son district, and subsequent promotion will be organized in an overseas market.

Transportation will be encouraged for expansions of waterways (sea, river) as well as land routes. Because of the rapid population increase over ten years, all infrastructure will be changed through industrialization centered on tourism.

The culture park of Ngu Hanh Son will be constructed for protecting the environment and landscape around Marble hills.

[1] It is a natural growth of population forecast without considering a emigrant increase rate.

(2) Urban Development Plan with a vision for 2030

The urban development plan predicts the population in Ngu Hanh Son District to rise to about 170,000 by year 2020 and proliferate further to 370,000 by the year 2030 after recalculating and adding in factors of policies and immigration to the natural growth of population indicated in scenario 2. The result is shown in Fig. 2.2.9.

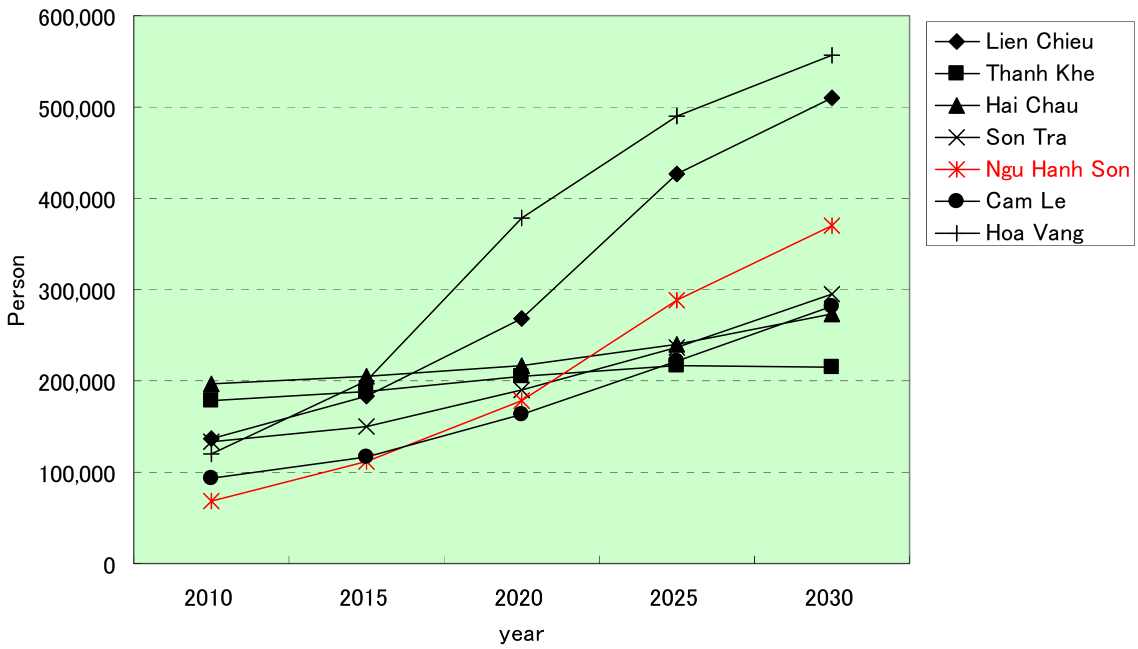


Fig.2.2.9 Population forecast for Da Nang City

The forecast involves the population change due to immigration and policies. (Source: Urban Development Plan with the vision of 2030)

3. Low-Carbon Strategy for Da Nang Low-Carbon Town Development Project

3.1 Develop a High-Level Vision

3.1.1 Legal Framework and Policies in National Level

(1) Overview

Viet Nam is considered to be one of the economies most strongly affected by climate change. This is especially true for the Mekong River delta and coastal areas which are the most vulnerable to rising sea levels.

Climate change also directly threatens energy security, industrial development, transportation due to energy supply interruptions, increasing energy demand for cooling, changes in the performance of motors and generators when the temperature is increased, etc.

Awareness of climate change adaptation is a hot issue which draws the attention of the political system. Viet Nam has approved the National Target Program on Climate Change (2008) and National Strategy on Climate Change (2011) with a long-term strategic vision. One of the important tasks set out in the strategy is to build regulation on climate change.

Implementation of UNFCCC and Kyoto Protocol in Viet Nam: In recent years, with the cooperation of ministries, agencies, local authorities and the support of related economies and international organizations, Viet Nam has implemented a series of activities in the field of climate change and CDM. These include the completion of the Viet Nam Initial National announcements No. 1 and No. 2 for the UNFCCC secretariat, creating greenhouse gas inventories, proposing greenhouse gas mitigation and climate change adaptation measures, and the building and implementing of some projects in the field of climate change.

(2) GHG emission reduction targets

The GHG emission reduction targets of the Government of Viet Nam was mentioned in the "**National Green Growth Strategy"**[2] and summarized as below:

1) Strategic tasks:

- "Reduce the intensity of greenhouse gas emissions and promote the use of clean and renewable energy according to the following essential targets"

<u>2011-2020</u>: Reduce the intensity of greenhouse gas emissions by 8-10% from the 2010 level; reduce energy consumption per unit of GDP by 1-1.5% per year.

Reduce GHG from energy activities by 10% to 20% compared to the business as usual

[2] Decision of the Primer Minister No. 1393/QĐ-TTg, dated 25th September, 2012 on the Approval of the National Green Growth Strategy

case. This commitment includes a voluntary reduction of approximately 10%, and an additional 10% reduction with additional international support.

Orientation towards 2030: Reduce annual greenhouse gas emissions by at least 1.5 - 2%; reduce greenhouse gas emissions in energy activities by 20 to 30% compared to business as usual. Of this commitment, the voluntary reduction will be approximately 20%, and 10% is dependent on additional international support.

Orientation towards 2050: Reduce greenhouse gas emissions by 1.5-2% per year.

2) Green production

Implementation of a "clean industrialization" strategy is conducted via review and existing sectorial master plans are adjusted to ensure economic and efficient use of natural resources; this encourages the development of green industry and green agriculture based on environmentally friendly structures, technologies and equipment; enhancing investment in natural capital; pro active prevention and treatment of pollution.

Key targets for green production towards 2020 are: Increases in the value of high-technology and green technology so that it will make up a 42-45% share of GDP; the rate of commercial manufacturing facilities that meet environment standards will reach 80%; application of clean technologies will reach 50%; development investment that supports sectors to protect the environment and enrich natural capital will reach 3-4% of GDP. The main solutions are indicated as below.

a. Communication: awareness raising and encouragement of support implementation

- Organize communication, education and awareness raising activities for individuals and communities on the role and meaning of green growth as well as pragmatic actions that will contribute to the implementation of green growth.
- Encourage and provide technical assistance to individuals and communities in order to implement and expand production and consumption models which are economic, safe, civilized, respectful of ethnic groups, harmonious and nature friendly.
- Promote and support communities to develop models for an eco-city, green rural areas, green housing, waste sorting at the source through the approach of reduce-reuse-recycle (3R), and improve energy efficiency.

b. Improve energy productivity, energy use efficiency, and reduce energy waste in production activities, transportation and trade

- Innovate technologies and apply advanced management and operational procedures for efficient and effective use of energy in production, transmission and consumption. Focus particularly on large production facilities where energy consumption is high.
- Establish and publicly announce fuel consumption rate standards, produce a roadmap to remove obsolete and energy consuming technologies used in energy production and consumption systems.
- Develop a legal basis to prepare for the application of technologies to capture, restore and trade various types of greenhouse gases.

c. Change the fuel structure in manufacturing and transportation

- Assure national energy security by developing different energy sources simultaneously; exploit and use economically domestic energy sources; reduce reliance on petroleum products; gradually decrease the volume of coal export and import to an appropriate amount while creating links with energy systems in neighbouring economies.
- Change the energy structure so that the share of energy which originates from fossil fuels is gradually decreased, while encouraging the exploitation and use of new, renewable and low greenhouse gas emitting energy sources.
- In the transport sector, encourage buses and taxis to shift to the use of compressed and liquefied petroleum gas (LPG). Implement a quality management system which is based on fuel gas emissions standards and vehicle maintenance.
- Apply market instruments to promote changes in the energy structure and increase energy efficiency, encourage the use of clean energy, support the development of renewable energy, build a roadmap to phase out subsidies for fossil fuels, and assure principles of competitiveness, transparency and efficiency.
- Label energy saving equipment, issue national standards for the quality of equipment.

d. Promote effective exploitation and increase the proportion of new and renewable energy sources in the nation’s energy production and consumption.

- Establish and implement financial and technical policies to promote research and application of appropriate advanced technologies which exploit and optimize the potential of renewable energy sources both on grid as well as off grid.

- Develop a renewable energy technology market which propels domestic industries to commence the production of renewable energy equipment and provide related services in the economy.

e. Reduce greenhouse gas emissions through the development of sustainable organic agriculture and improve competitiveness of agricultural production.

- Study the adjustment of master plans, shift animal husbandry and crop production structures, crop planting seasons, livestock, forestry, aquaculture, irrigation and non-farming activities in rural areas.
- Research and apply production processes and economic technologies that efficiently use seedlings, feed, agricultural materials, soil, water, etc., and reduce greenhouse gas emissions from agricultural production.
- Replicate widely technologies that treat and reuse by-products and waste from agriculture production to produce animal feed, mushrooms, raw materials for industry, biogas and organic fertilizer while also reducing greenhouse gas emissions.
- Speed up the progress of afforestation and reforestation projects: encourage enterprises to invest in production forests to increase forest coverage to 45% by 2020; improve forest quality; enhance carbon sequestration capacity of forests and increase standing biomass; secure timber production and consumption.
- Implement programs to reduce greenhouse gas emissions through efforts in Reducing Emissions from Deforestation and Forest Degradation (REDD); sustainable forest management in combination with diversifying livelihoods of rural people.

(3) Low -carbon urban planning policies at the national strategy level

Up to now, there has not been any detailed low – carbon urban planning policies. However, there are some national strategies that have been approved by the Prime Minister and mentioned as issues of city development in the The National Green Growth Strategy. The main issues related to low – carbon urban planning mentioned in the Green Growth Strategy[3] are as below are:

1) Urban planning and planning management

- Review urban master plans through a sustainable urban development approach (green,

[3] Decision of the Primer Minister No. 1393/QĐ-TTg, dated 25th September, 2012 on the Approval of the National Green Growth Strategy

ecological and economic urban areas, etc.) with a focus on sustainable use and management of natural resources for all people living in the applicable cities; revise overall master plans for 2020 when cities should achieve at least an average level on the Green City Index; avoid over-populating cities beyond that which the environment and socio-economic infrastructure can sustain.

- Ensure that urban spatial planning has economic and ecological efficiency which is favorable to public transportation development; increase the attractiveness of cities; create competitive and environmentally friendly cities; reduce the travelling time for inhabitants.

2) Development of technical infrastructure

- Ensure that basic infrastructure, such as houses, transportation, energy, water supply, drainage and waste treatment are accessible to all people and have an acceptable level of quality. Also reduce costs from pollution and reduce traffic jams.
- Develop and implement master plans for rainwater drainage systems, urban waste, waste water collection, and transportation and treatment systems. In areas which are highly vulnerable to climate change, infrastructure should be adapted to climate change to minimize economic losses. Gradually develop these systems in cities of grade II or higher.
- Introduce the application of a rating system for energy efficiency and green urban infrastructure to increase energy saving and reduce greenhouse gas emissions in urban areas.

3) Develop green cities, ecological urban areas and green works

- Study and issue a system of standards on urban planning, architecture, design, use of environmentally friendly green materials and construction measures; save energy and natural resources; minimize greenhouse gases; and develop appropriate technological solutions to urban waste.
- Promulgate regulations aimed at investors which set the compulsory application of green building measures in new commercial buildings and renovations to existing apartment blocks in urban areas.
- Apply economic and technical instruments to encourage and support enterprises producing products and services for green constructions.

4) Urban transportation

- Invest in renovation and development of technical infrastructure systems for urban transportation to achieve at least the average level of development achieved by other advanced economies in the region.

- Prioritize the development of public transportation in urban areas with involvement from all economic sectors both in terms of investment in fuel efficient vehicles and exploitation of public transportation.
- Use economic instruments and technical standards to control the quantity of production of individual motorized vehicles in large and medium cities, allocating special routes for non-motorized vehicles.

5) Greening of urban landscape

- Prioritize the allocation of public land to quickly expand the areas for green space and water in urban areas. Meet the standards set for each city grade level.
- Stimulate investment and development of green spaces in urban projects and encourage communities, enterprises and households to mobilize resources for the greening of urban landscapes.

(4) Plan for electricity demand and supply

Approval of the Master Plan for the National Power Development Plan for the Period 2011 - 2020 with a Perspective to 2030 (herein after referred to as "Power Development Plan VII[4]) with the main contents as follows:

Objectives are as below.

General objectives:

- Efficient use of domestic energy resources in combination with importing primary energy for electricity production; sufficient supply of electricity at a higher quality and reasonable price for socio-economic development; ensuring national energy security.

Specific objectives:

- Sufficient supply of electricity for domestic demand with electricity production and import of about 194-210 billion kWh by 2015, 330-362 billion kWh by 2020 and 695-834 billion kWh by 2030.
- Priority is given to the development of renewable energy resources for electricity production with the share of electricity produced from renewable energy resources increasing from 3.5 % of total electricity production in 2010 to 4.5 % in 2020 and 6.9% in 2030.

[4] Decision of the Prime Minister No. 1208/QĐ-TTg, dated 21 July, 2011 on the Approval of the National Power Development Master Plan of Viet Nam

- Average elasticity ratio of electricity/GDP will be reduced from 2.0 at present to 1.5 in 2015 and 1.0 in 2020.
- Rural electrification programs will be promoted in rural, mountainous and island areas so that by 2020, most rural households will have access to electricity.

1) Development orientations:

- Balanced development of power generation resources in each region (North, Central and South) ensuring the reliability of electricity in each power system in order to reduce transmission loss while also ensuring sharing of reserve capacity and effective operation of hydropower plants in season.
- Development of new power plants in parallel with deep investment; technology renovation of existing power plants; meeting of environmental standards; using advanced technology in new power plants.
- Diversification of investment in different forms for power generation development in order to increase competitiveness and economic benefits.

2) Power generation development plan:

a. Renewable energy power generation: Priority is given to rapid development of renewable energy power generation (wind power, solar power, biomass power, etc.); step by step increase in the share of electricity produced from renewable energy resources:

- Total wind power capacity will be increased from the negligible level at present to about 1000 MW by 2020 and 6,200 MW by 2030. Electricity produced from wind farms will account for 0.7% in 2020 to 2.4 % in 2030.
- Biomass power, cogeneration in sugar plants will be developed with a total installed capacity of about 500 MW in 2020, increased to 2,000 MW in 2010. The share of electricity production from these power plants will be increased from 6.6% in 2020 to 1.1 % in 2030.
- Priority is given to the development of hydropower plants, especially those that have multi-purposes such as flood control, water supply, and electricity generation. The total capacity of hydropower plants will be increased from 9,200 MW at present to 17,400 MW in 2020.
- A study will be carried out on adequately putting pumped storage hydropower plants into operation for the development of a power network that increases the efficiency

of power grid operation. The capacity of pumped storage hydropower plants will be 1,800 MW by 2020 and increase to 5,700 MW by 2030.

b. Development of thermal power plants (TPP) at an adequate share to suitably fuel supply and distribution:

Natural gas fired power plants: By 2020, TPPs using natural gas will have capacities of about 10,400 MW and electricity production of about 66 billion kWh, accounting for 20% of the total electricity production. The development orientation for these power plants intends for their total capacity to be about 11,300 MW and their electricity production about 73.1 billion kWh by 2030, . This would account for 10.5% of total electricity production of the whole economy.

For the South East area: A stable gas supply will be ensured for power plants located in Ba Ria, Phu My and Nhon Trach.

For the South West area: Gas transported from Block B to land will be available by 2015, which is supplied to power plants at the O Mon thermal power complex with a total capacity of about 2,850 MW. The capacity of the power plants in this area will be increased to 4,350 MW in 2016, consuming about 6.5 billion m^3 of gas and producing 31.5 billion kWh per year.

Central area: It is anticipated that one thermal power plant with a capacity of about 1,350 MW will be developed after 2020, with gas consumption of about 1.3 billion m^3/year.

Coal fired power plants: The domestic coal resources will be maximally exploited for development of thermal power plants in the northern region. By 2020, the total capacity of coal fired power plants will be about 36,000 MW, with electricity production of about 156 billion kWh (accounting for 46.8% of total electricity production of the economy) and coal consumption of 67.3 million tonnes. By 2030, total capacity of coal fired power plants will be about 75,000 MW, electricity production will be about 394 billion kWh (accounting for 56.4% of total electricity production of the economy), and coal consumption will be 171 million tonnes. Because of limitations on domestic coal resources, consideration needs to be given to construction and putting into operation imported coal fired power plants using imported coal from 2015.

c. Development of nuclear power plants in order to ensure a future stable power supply when domestic primary energy resources are exhausted: the first unit of the Viet Nam nuclear power plant will be put into operation in 2020; by 2030 nuclear power plants will have a capacity of 10,700 MW and electricity production of about 70.5 billion kWh (accounting for 10.1% of total electricity production of the whole economy).

d. Development of LNG fired power plants in order to diversify the fuel supply for electricity generation and ensure electricity and fuel gas supply security. Capacity of LNG fired power plants will be about 2,000 MW by 2020 and will increase to 6,000 MW by 2030.

e. Electricity import and export: To carry out effective electricity exchange with economies in the region, ensure benefits for each party; enhance electricity exchange in order to ensure power system safety; promote electricity import from economies which have a high potential of hydropower, first from Laos, then Cambodia and China. The anticipated capacity of imported power is about 2,200 MW by 2020, which will increase to about 7,000 MW by 2030.

3) Structure of power resources:

a. By 2020: Total capacity of power plants will be about 75,000 MW, of which: Hydropower accounts for 23.1%; pumped storage hydropower 2.4%; coal fired power 48.0%; gas fired power 16.5% (of which LNG power is 2.6%); renewable energy power 5.6%; nuclear power 1.3 % and imported power 3.1%.

By 2020, electricity production and import will be about 330 billion kWh, of which: Hydropower will account for 19.6%; coal fired power 46.8%; gas fired power 24.0% (of which LNG fired power is 4.0%); renewable power 4.5%; nuclear power 2.1 % and imported electricity 3.0%.

b. By 2030: Total capacity of power plants will be about 146,800 MW, of which: Hydropower accounts for 11.8%; pumped storage hydropower 3.9%; coal fired power 51.6%; gas fired power 11.8% (of which LNG power is 4.1%); renewable energy power 9.4%; nuclear power 6.6 % and imported power 4.9%.

By 2030, electricity production and import will be about 695 billion kWh, of which: Hydropower accounts for 9.3%; coal fired power 56.4%; gas fired power 14.4% (of which LNG fired power is 3.9%); renewable power 6.0%; nuclear power 10.1 % and imported electricity 3.8%.

4) Plan implementation solutions:

a. Solutions for ensuring electricity supply security:

- The following corporations are mainly responsible for the development of power generation: Electricity of Viet Nam Group, Petro Viet Nam, and the Viet Nam National Coal and Minerals Industries Group (VINACOMIN). The National Power Transmission Corporation is responsible for ensuring development of the national power transmission network.
- To actively explore additional gas resources because existing ones will be reduced and exhausted in the future. To speedily promote negotiations with other economies for entering into long term coal import contracts for supplying coal for thermal power plants.
- To promote development of the nuclear energy sector and the construction of nuclear power plants. To cooperate with foreign economies and international organizations in development of nuclear energy, step by step master technology and the development of nuclear power for peace.
- To apply preferential policies on financing and expansion of international cooperation in order to enhance coal exploration to increase coal reserves and coal exploitability of coal, gas and renewable energy, ensuring security of fuel supplies for electricity production.

b. Solutions for mobilizing capital for power sector development:

- Step by step increase in capability to mobilize the economy's finances for enterprises in the power sector through the following initiatives: To increase the efficiency and effectiveness of operation in power sector enterprises; ensure accumulation and equity securing for development investment in accordance with the demand of domestic and international financing institutions; come to the point where the main financing resource for development of power projects will be the economy's own accumulated funds for enterprises.
- To develop Groups and Corporations which operate in the power sector. Have high financial ability in reducing costs of capital mobilization for power plant projects which can self-mobilize capital without requiring Governmental financial security.
- Enhancing mobilization of capital through issuing bonds inside and outside the economy for investment in power projects, shifting domestic money deposits into investment capital for infrastructures. In the initial stage, the State will guarantee issuance of bonds for urgent power projects.

- Implementing joint ventures between domestic and foreign companies in order to attract domestic and foreign investors in development of power projects.
- Implementing equitization of enterprises in the power sector so that it is not necessary for the State to hold 100% capital share.
- Enhancing attraction of Foreign Direct Investments (FDI) in the development of power projects. Priority will be given to FDI projects which can make payments in the domestic currency or through barter and that do not require Government guarantee.
- Enhancing attraction for foreign investments including: Preferential ODA and non ODA resources, foreign commercial loans etc.

(5) Energy – saving policies

1) Energy price

- The most notable thing in Viet Nam's energy policy is the energy price. Viet Nam's energy prices have remained at low levels for a long time, through various measures such as price-fixing, price stabilization funds or intervention in price negotiations. According to the Law on pricing[5], prices for electricity, gasoline, and liquefied petroleum gas are still objects of State price stabilization which means the selling price of these items is always maintained at a low level by the State through administrative and economic measures. Specifically, Viet Nam's electricity prices are calculated according to the State tariff schedules and are considered not sufficient for recovering production costs. Oil & gasoline prices are proposed by petroleum enterprises but approved by the Ministry of Finance. The Ministry of Finance also intervenes in coal price negotiations between enterprises.
- According to the National Energy Strategy in 2007, energy pricing policy and the energy market will break through in the market direction and deregulate prices, which will lead to increased prices and reduced energy use. However, concrete steps to achieve this have been very slow and not deployed as expected. In certain periods, the price of gasoline is operated under a mechanism in which enterprises determine selling prices in a range of flexible price margins set by the State. However, with this mechanism, gasoline price increases become shunting costs causing slow growth and raised inflation, and the government must control pricing

[5] Law No. 11/2012/QH13 dated 26/06/2012 by the National Assembly: Law on prices (effective from 01/01/2013)

in order to keep gasoline prices at a low level. With the present energy pricing mechanism, controlling energy use in order to mitigate GHG emissions is extremely difficult.

2) Energy efficiency and energy conservation

- An increasing concern is the issue of energy efficiency and energy conservation in a number of areas. The *National target energy efficiency and conservation program for period 2012-2015*[6] and the *Law on Energy Efficiency and Conservation*[7] issued in 2010, along with the relevant guidelines, have created a legal framework for regulating energy use in Viet Nam. This program set targets as follows: energy saving will be 3-5% of total energy consumption for the period 2006-2010, and 5-8% for the period 2011-2015. The notable proposed solutions include models of energy consumption management in energy designated enterprises, a construction code on energy use in buildings and a suitable pricing policy.

- The *Law on energy efficiency and conservation* focuses on regulating the rights and obligations of energy users in a variety of sectors such as industry, construction, public lighting, transportation, agriculture, service activities and households, investment projects, and units using the State budget. The tools specified in the laws include energy audits, the removal of vehicles and equipment that have an energy efficiency below the required minimum energy efficiency level, energy labeling, incentives for energy efficient activities, science and technology development and dissemination, education, and consultancy service development.

3) Energy labeling

- The regulation for energy labeling is a bright point in the *Law on energy efficiency and conservation* and provides detailed guidelines for implementing the law such as the *Decree on details and measures for implementing Law on energy efficiency and conservation*[8]*, the Prime Minister's Decision on the list of facilities and equipment which have to be labeled, the application of minimal energy efficiencies and implementation roadmap*[9] and *Circular of the Ministry of Industry and Trade on*

[6] Decision No. 1427/QD-TTg dated 02/10/2012 by Prime Minister on approving National target program on energy efficiency and conservation for period 2012-2015.

[7] Law No. 50/2010/QH12 dated 17/06/2010 by National Assembly: Law on energy efficiency and conservation.

[8] Circular No. 21/2011/ND-CP dated 29/03/2011 by the Government on guidelines for implementation of the law on energy efficiency and conservation

[9] Decision No. 51/2011/QD-TTg dated 12/09/2011 by the Prime Minister on a list of equipment and

energy labeling of energy using equipment and facilities[10]. However, the list of products mandatory for energy labeling is still limited. From 2013, energy labeling will be applied to five groups of products: household appliances, office and commercial equipment, industrial equipment, transportation means, energy efficiency materials and products.

4) Urban lighting

- In the field of urban lighting and traffic, energy saving measures were proposed. The *Decree on urban lighting*[11] has stipulations on energy efficiency and conservation in urban lighting works through technical requirements for street lighting equipment such as lights, lampshades etc. The operation of the lighting system is also directed towards automation in order to avoid wasting money.

5) Energy audit

- Regulations on energy efficiency is a great step in the *Law on Energy Efficiency and Conservation.* According to this regulation, It will be compulsory for designated energy consuming enterprises, especially big factories, to carry out energy audits. The *Circular on planning, reporting implementation of energy efficiency and conservation plans and energy audits*[12] is the guideline for implementation of this regulation. Energy audits help the State manage energy use in designated energy consuming enterprises and help them save energy. However, the liability of enterprises which use energy in an inefficient way has not been sufficiently addressed, especially for state owned enterprises. Regulations on publishing results of energy audits has also not been specified, therefore, it does not respond to the pressure of public opinion and consumers on designated energy consuming enterprises.

6) Energy effiency in Buildings

- Energy use in daily life and in buildings accounts for a significant portion of the total energy consumption in Viet Nam. At present in Viet Nam, the share of energy consumption in buildings (excluding houses) accounts for 15-20% of total energy

facilities compulsory for energy labeling and the implementation roadmap.

[10] Circular No. 07/2012/TT-BCT dated 04/04/2012 by the Ministry of Industry and Trade on Energy labeling of energy using equipment and facilities.

[11] Decree No. 79/2009/ND-CP dated 28/09/2009 by the Government on urban lighting management.

[12] Circular No. 09/2012/TT-BCT dated 20/04/2012 by Ministry of Industry and Trade on preparation of report, reporting energy efficiency and conservation plan, energy audit implementation

consumption[13]. In the law on energy efficiency and conservation, there is a stipulation on the installation of electrical measurement instruments for electricity, heat, and equipment for controlling room temperature. Electricity supply systems and heat in buildings shall comply with weather conditions and their individual purpose. More specifically, there is a *technical regulation on energy efficiency in buildings*[14]. However, the application of technical regulations does not affect the construction permit; therefore, many buildings do not comply with it. Moreover, according to reviews by experts, the technical regulations are quite complex and difficult to implement. So, in reality, there isn't a great deal of energy efficient buildings[15].

- In the transportation sector, policy and legislation for energy efficiency and conservation has been promulgated. A typical example is the *Circular on energy efficiency and conservation in the transportation sector*[16]. Unfortunately this circular only sets out the provisions of principles and does not specify targets and measures.

7) Industry

- The policy on industrial production in Viet Nam set the orientation for a change of technology aiming to conserve energy and reduce greenhouse gas emissions. This is shown in the Viet Nam chemical sector development strategy for the period up to 2010, with a vision for 2020[17]; the Viet Nam chemical industry development plan for the period up to 2010, with a vision fot 2020[18]; and Viet Nam's steel sector industry development plan for the period 2007-2015, with a vision for 2025[19]. The common point of these plans is that they emphasize technological innovation

[13] Website Sài Gòn Giải phóng online (http://www.sggp.org.vn/xahoi/2012/9/299810/) Article: "Energy saving in buildings needs harmonious measures" dated 24/09/2012 by Hà Phương.

[14] Viet Nam construction codes – Energy efficient project, promulgated by Ministry of Construction in 2005 (QCXD 09:2005) along with Decision No. 40/2005/QD-BXD on promulgation of QCXDVN09:2005

[15] Website of Vietnam electricity, http://www.tietkiemnangluong.vn/Home/Detail/tabit/84/itemId/2562/view/2/cateId/language/vi-VN/Default.aspx) article "Energy saving in construction projects is not really effective" dated 23/10/2012 by people representative

[16] Circular No. 64/2011/TT-BGTVT dated 26/12/2011 by Ministry of Transport on energy efficiency and conservation in transportation activities

[17] Decision No. 207/2005/QD-TTg dated 18/08/2005 by Prime Minister on approving Chemical sector development strategy for period up to 2010, (vision to 2020)

[18] Decision No. 343/2005/QD-TTg dated 26/12/2005 by Prime Minister on approving Chemical sector development plan for period up to 2010.

[19] Decision No. 145/2007/QD-TTg dated 04/09/2007 by Prime Minister on approving Vietnam steel industry development plan for period 2007-2015, vision to 2025.

towards environmental pollution reduction and sustainable development. According to conventional interpretation, this content does not include GHG emissions reductions. Meanwhile, the development and application of low greenhouse gas emissions technologies are considered to be the future of global industrial production. Thus, in consideration of this factor, the policies and laws are still only slowly changed in order to keep up with world trends, and are not aimed towards a green economy, green industry and low carbon economy.

8) In the Green Growth Strategy[20]:

Energy infrastructure

- Develop power supply sources to ensure an adequate supply for domestic demand, improve the efficient use of the power grid and reduce elasticity of electricity/GDP from 2.0 at present to 1.0 in the year 2020.
- Apply modern technologies to improve the quality of power distribution networks, reduce power losses, increase electricity use efficiency and move towards the construction of smart-grids.

(6) Renewable energy policies

Viet Nam has a policy to develop renewable energy which is specified in Article 11 of the Law on Environmental Protection 1993[21], Article 33 of the Law on Environmental Protection 2005[22] and the Electricity Law 2004[23]. However, in general, before 2005, energy policy only paid attention to energy security and the energy market. After 2005, the specific regulations for implementing the policy on development of renewable energy appeared frequently in the legal system of Viet Nam. The *National Energy Development Strategy for the period up to 2020, with a vision for 2050*[24] states that the State will prioritize the development of new energy, renewable energy, bio-energy and nuclear power. Specific targets decreed that the percentage of new and renewable energy sources will increase by about 3% of the total commercial primary energy by 2010, by 5% in 2020, and about 11% in 2050. This viewpoint continues to be expressed more specifically in the National Power Development Master Plan for the period 2011-2020, with

[20] Decision of the Primer Minister No. 1393/QĐ-TTg, dated 25th September, 2012 on the Approval of the National Green Growth Strategy

[21] Law No. 29-L/CTN dated 27/12/1993 by the National Assembly: Law on environmental protection 1993

[22] Law No. 52/2005/GH11 dated 29/11/2005 by the National Assembly: Law on environmental protection 2005

[23] Law No. 28/2004/GH11 dated 03/12/2004: by the National Assembly: Electricity Law 2004

[24] National energy development strategy for the period up to 2020, with a vision for 2050 promulgated along with Decision No. 1855/QD-TTg dated 27/12/2007 by the Prime Minister on approving a National energy development strategy for the period up to 2020, with a vision for 2050.

consideration for a period up to *2030*[25]. In particular, the share of renewable energy for electricity generation will be increased from 3.5% in 2010 to 4.5% in 2020 and 6% in 2030.

At the national level, the Power Sector Development Master Plan objectives were indicated in the Decision No. 1208/QD-TTg issued by the Prime Minister on 12 July 2011 for approving the National Power Development Master Plan for the period of 2011 – 2020 with a vision for 2030. It gave priority to development of available renewable energy resources in the economy in order to increase the ratio of power using renewable sources from the existing negligible level to 5.6% and 9.4% by the years 2020 and 2030, respectively (in terms of installed capacity).

In Viet Nam 8 types of renewable energy have been identified among which only 2 have been supported by price related mechanisms, namely i) small hydro power (refer to Decision 18/2008/QD-BCT dated 18/07/2008 on the avoided cost tariff), and ii) wind power (refer to Decision 37/2011/QD-TTg dated 29/6/2011). Biomass electricity has been considered through a roadmap of development indicated in the Power Sector Development Master Plan No. 7. However, there is not yet any price subsidy scheme for this type of renewable energy. Therefore, many projects on electricity generation from rice husks, sugarcane bagasse or other biomass are not moving beyond investment reports or an investment proposal stage because investors are still waiting for a price subsidy mechanism to support their investment ideas.

The legal documents concerned are summarized in Appendix 3.1.1.

(7) Environmental policies relating to CO_2 emissions reduction

1) Environmental protection tax

The Law on environmental protection tax[26], to become effective from the beginning of 2012, stipulates the tax levels for petroleum products (except ethanol gasoline), coal and gas. Before 2012, there were fees on petroleum products in Viet Nam but not on coal and gas. The current tax is calculated based on production and in the range of 2-5% of product selling price. It should be noted that the environmental protection tax is levied on goods whose use causes environmental pollution. The concept of environmental pollution, which includes carbon emissions, is not clearly outlined in the law. However, because this taxation is not applied to carbon emissions activities, it can be understood that the tax on petroleum products, coal, and natural gas is not aimed at carbon emissions.

[25] The National power development plan for the period up to 2011-2020, with a vision for 2030 promulgated along with Decision No. 1208/QD-TTg dated 21/07/2011 by the Prime Minister for approving the National Power Development Plan for the period 2011-2020, with a vision to 2030.

[26] Law No. 57/2012/QH12 dated 15/11/2010 by the National Assembly: Law on Environmental protection taxes.

2) In the National Green Growth Strategy

In the National Green Growth Strategy for promoting recycling and waste reuse within the economy it outlines:

- The establishment and issue of a law on waste recycling and waste treatment to develop waste into a resource and minimize the amount of waste that needs to be disposed at landfills.
- The development of a modern and environmentally friendly recycling industry, while researching methods to mainstream this into the environment industry master plan.
- The Application of waste sorting and recycling technologies in new urban and industrial areas to turn waste into energy, construction materials and micro-bio-fertilizers.
- The provision of technical and financial support to modernize waste recycling activities in trade villages. By 2020, it will phase out obsolete technologies, including those that are harmful to workers' health and pollute the environment, in craft and trade villages.

3.1.2 Legal Framework and Policies in Da Nang City

(1) Legal framework for a low-carbon city and CO2 emissions reduction

1) Da Nang's master plan for socio-economic development up to 2020

The master plan, implemented by the Da Nang PC (DNPC) and the Department of Planning and Investment (DPI), formulated a fundamental plan of social and economic development in Da Nang City between the years of 2011-2020. It aims at a large breadth of targets involving social development, economic development, the environment, infrastructure development, population, etc.

The goal is to develop Da Nang into a major city of the economy and a socio-economic center of central Viet Nam which plays an importantly strategic position in the region's national defense and security.

Development perspectives

a. To develop Da Nang into a dynamic urban centre and driving engine of regional development, to focus on spatial development which links other key economic zones in central Viet Nam;
b. To develop Viet Nam's society and economy in a rapid and sustainable way by shifting the economic structure towards service-industry-agriculture, and utilizing the city's potential and advantages;
c. To develop urban space and invest in infrastructure;
d. To develop health care, culture and education in order to improve people's living

standard and knowledge.

e. To integrate economic development while protecting natural resources and the ecological environment through sustainable development. To integrate economic development with the implementation of social justice, social harmony, political stability, national defense and security.

Regarding the environment plan, the master plan states that Da Nang City shall advance to become The Environmental City by 2020.

2) A General Plan for 2000 - 2020 in Da Nang City

A plan of urban construction based on the national-based urban planning system and Law of Construction.

3) An Environmental City

The DNPC Committee promulgated a comprehensive plan with regard to the environment in Da Nang City in August, 2008. The DNPC committed to "Building Da Nang City as An Environmental City" (No.41/2008/ QD-UBND). They set 2020 as a vision for many different environmental issues such as: air pollution reduction, waste treatment and recycling, energy conservation, and renewable energy.

The plan for an Environmental City is based on Agenda 21 of the Viet Nam government (Prime Ministerial Decision, 2004[27]) and Vietnamese environmental standards[28], etc., aiming at sustainable development with a target year of 2020.

a. General Goals

- An environmental city, the criteria of which are assuring land, water and air quality, and providing a safe and healthy environment for people.
- To prevent environmental pollution and degradation
- To make the people of Da Nang aware of environmental protection and Da Nang's development as an environmental city.

b. Specific Goals

The period of the plan is divided into three terms of 2008-2010, 2011-2015 and 2016-2020. The 1st term of 2008-2010 will focus on resolving urgent environmental problems, the 2nd term of 2011-2015 is to achieve the reduction of environmental loads, and the final term of 2016-2020 is to complete the targets. The plan formulates the quantitative targets of environmental standards in each category including transportation control, energy saving, etc. It predicts the budgets for each category.

[27] Prime Ministerial Decision No 153/2004/QD-TTg dated on 17 August, 2004 promulgating the orientation of the sustainable development strategy in Vietnam (the Agenda 21 of Vietnam)

[28] Ministry of Natural Resources and Environment Decision No 22/2006/QD-BTNMT dated 18 December 2006 guiding the application of Vietnamese Environmental Standards.

However, concerning climate change issues, the plan for an Environmental City and other legal policies has not yet concretely indicated any scope or measure for challenging GHG emissions reductions and creating a low-carbon city.

(2) Research projects focusing on climate change and a low-carbon city

After this, Da Nang City has taken initiatives to collaborate with international organizations and the ODA, etc. in order to realize an environmental city. These initiatives are outlined below:

1) The study on an integrated development strategy for Da Nang City and its neighboring areas in the Socialist Republic of Viet Nam (DaCRISS) in cooperation with the Japan International Cooperation Agency (JICA)
The transportation system and the necessary infrastructure improvements for the developing strategy were implemented.（2009 to 2010）

2) The “Carbon Emission Situation Study at Da Nang City, Viet Nam”(2011) in cooperation with the Asian Institute of Technology (AIT). It was the first comprehensive study of carbon emissions in Da Nang City performed by the Department of Natural Resources and Environment and the DNPC under the technical assistance and funds of the Asian Institute of Technology, Thailand. The carbon balance was analyzed using a tool named “Bilan Carbone (Regional Module)” from the French Environment and Energy Management Agency (ADEME). The amount of CO2 emissions were estimated on the basis of YR 2010 and covered all sectors such as energy, transportation, agriculture, etc. The project calculated total carbon emissions at about 2.0 million t-C/year (equivalent to 7.3 million t-CO2 / year). The project suggested that future programs make efforts towards creating a low-carbon city.

3) The "Action Plan Responding to Climate Change (CC) and Sea Level Rises for Da Nang up to 2020" financed by the Rockefeller Foundation GOAL. The goal of this action plan is to strengthen response capacities to climate change in Da Nang city by: (1) assessing the vulnerability to CC in the city’s sectors, districts, natural resources, environment, ecology, society and sensitive population groups; and (2) creating and implementing programs, plans and projects for responding to CC. The project analyzed implementation measures and evaluated climate change projects.

4) The "Sustainable Urban Energy Program" (2011 to 2013) in cooperation with Aus AID and the World Bank: The project is ongoing and was initiated by the Department of Industry and Trade of Da Nang PC. The program is designed to establish the current status of energy use and greenhouse gas emissions, and identify a range of policy and technical measures that will enable them to formulate long term sustainable urban energy developing strategies in the context of the city' overall development plans. The GHG emission amount was calculated on the basis of YR 2010 emissions covering all energy-consuming sectors and CH4 emitted from biomass waste. It indicated 1.5 million t-CO2 / year. The project promoted the energy efficiency action plan.

5) Asian Development Bank's "National Target Program Challenging Climate Change Mitigation"(2011 to 2013): Estimation of all of the GHG emission amounts for each sector.

3.1.3 Approach to a High-Level Vision

As mentioned in 3.1.2, the efforts of Da Nang City against climate change and global warming are still relatively new activities, and consequently the policies of CO2 emissions reduction have not yet been formally authorized. In this context, the APEC study of a low-carbon town could take an important role in supporting Da Nang City's induction of low-carbon town measures into coming policies.

In NHSD where rapid development is ongoing, according to the decision reached in the Low-carbon town development plan, CO2 reduction is not the only aim. It is important to make a plan that contributes to increasing Da Nang's attractiveness as a tourism city. This plan should also increase urban amenities as well as support economic development.

The approach of the Low-carbon town in Da Nang is to solve the challenges that the region currently faces. Moreover, measures should be selected which deal with these from the viewpoint of increasing the appeal of the region as well as reducing carbon emissions. These viewpoints are set as the standard (Fig 3.1.1).

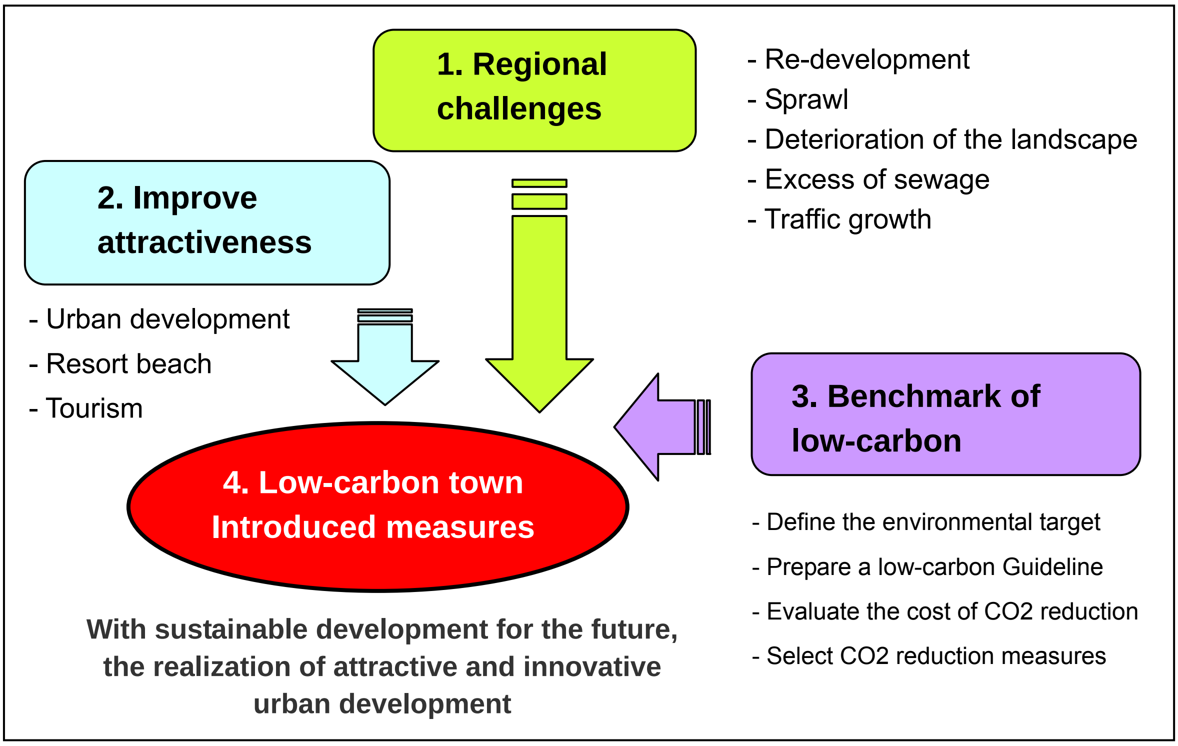


Fig. 3.1.1 Scheme of the high-level vision for Low-carbon town in Da Nang

Also, several policies are being proposed which aim at the Low-carbon Town in Da Nang City. Each of theses policies shouldn't be implemented individually and separately, but rather the policies should be incorporated with each other. The feasibility study will be carried out based on this philosophy (Fig 3.1.2)

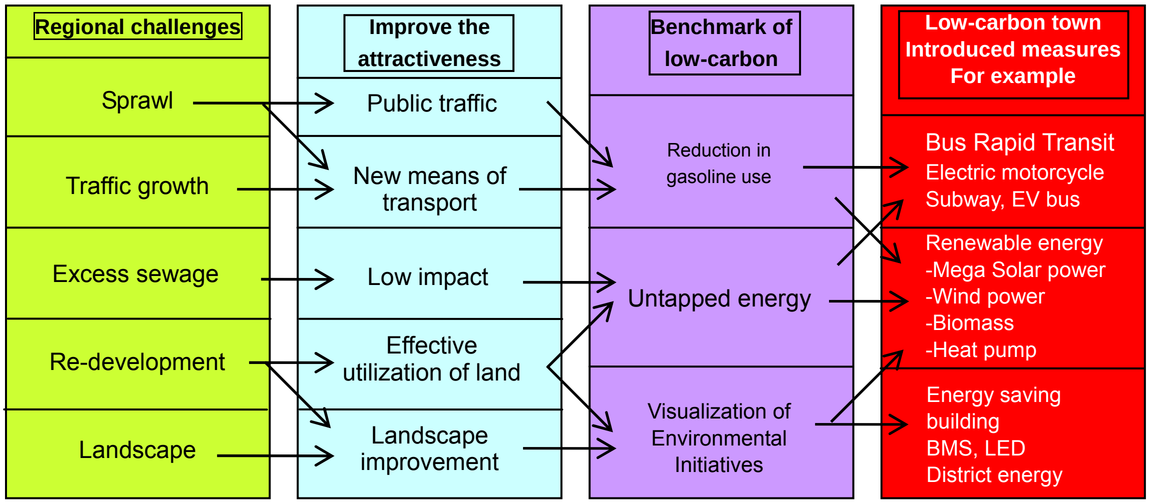


Fig. 3.1.2 Screening procedures of the introduced measures for Low-carbon town in Da Nang

3.2 Define CO2 Emission Baseline in Business As Usual (BAU) Scenario

3.2.1 CO2 Emission Estimation in the Base Year

Estimated CO2 emissions for the base year 2010 in Da Nang City and Ngu Hanh Son District totaled 1,601,580 and 95,720 tonnes of CO2e (CO2 equivalent) (hereafter "t-CO2"), respectively. Tables 3.2.1 and 3.2.2 show CO2 and CH4 emissions estimated by category (sector and subsector) for these two administrative boundaries. A report funded by the World Bank (Sustainable urban energy program, draft final report: Da Nang, Vietnam) (AusAID, 2011) reported a total figure (1,547,132 t-CO2 for 2010) similar to our estimation in the present report.

CO2 emissions from the "transport" subsector account for 37.12% of the total citywide emissions. CO2 emissions from the "manufacturing industries" subsector and CO2e emissions from the "wastewater handling" subsector account for 21.79% and 9.80%, respectively. CO2 emissions from the "other sectors" ("commercial/institutional" and "residential") totaled 25.51% of the overall CO2e emissions, whereas only 5.77% originated from the "solid waste disposal on land" subsector.

Table 3.2.1 CO2 emissions by category in the base year 2010 in Da Nang City.

[Da Nang City]	Greenhouse Gas Emission			Percentage [%]	
Category (sector - subsector)	CO_2 [k tonnes]	CH_4 [k tonnes]	CO_2e [k tonnes]		
1. Energy	1,352.19	0.00	**1,352.19**	84.43	
- Manufacturing industries	349.06		349.06	21.79	○
- Transportation	594.53		594.53	37.12	◎
- Commercial/institutional	93.40		93.40	5.83	
- Residential	315.20		315.20	19.68	
2. Waste	0.00	11.88	**249.39**	15.57	
- Solid waste disposal on land		4.40	92.38	5.77	
- Managed waste disposal on land		3.82	80.27	5.01	
- Unmanaged waste disposal sites		0.58	12.11	0.76	
- Other		0.00	0.00	0.00	
- Wastewater handling		7.48	157.01	9.80	
- Industrial wastewater		0.73	15.37	0.96	
- Domestic and commercial wastewater		6.49	136.27	8.51	
- Other (Landfill leachate treatment)		0.26	5.37	0.34	
Total	1,352.19	11.88	**1,601.58**	100.00	

Table 3.2.2 CO2 emissions by category in the base year 2010 in Ngu Hanh Son District.

[Ngu Hanh Son District]	Greenhouse Gas Emission			Percentage [%]
Category (sector - subsector)	CO_2 [k tonnes]	CH_4 [k tonnes]	CO_2e [k tonnes]	
1. Energy	77.34	0.00	77.34	80.79
- Manufacturing industries	30.22		30.22	31.57 ◎
- Transportation	16.99		16.99	17.75
- Commercial/institutional	6.89		6.89	7.19
- Residential	23.24		23.24	24.28 ○
2. Waste	0.00	0.88	18.39	19.21
- Solid waste disposal on land		0.32	6.81	7.12
- Managed waste disposal on land		0.28	5.92	6.18
- Unmanaged waste disposal sites		0.04	0.89	0.93
- Other		0.00	0.00	0.00
- Wastewater handling		0.55	11.58	12.09
- Industrial wastewater		0.05	1.13	1.18
- Domestic and commercial wastewater		0.48	10.05	10.50
- Other (Landfill leachate treatment)		0.02	0.40	0.41
Total	77.34	0.88	95.72	100.00

3.2.2 CO2 Emission Estimation in BAU Scenario for YR2030

The following two kinds of BAU scenarios are examined in this report:

(1) A BAU scenario with trend of growth (BS-T) based on a trend that best fits the past ten-year statistical data (population, GDP, industrial production). Either a linear function or an exponential function was chosen that best fit the statistical data.

(2) A BAU scenario with high growth (BS-H) that is fundamentally the same as Scenario-3 in “Da Nang Urban Development Plan Until 2030” (Department of Construction, Da Nang). This scenario is based on a highest growth rate case in the DaCRISS model (see Table 2.1.8), and urban development plans in the foreseeable future have been incorporated.

Figure 3.2.1 shows population projections based on BS-H towards 2030 by district in Da Nang City. With BS-H, the population of the city could go beyond 2.5 million people in 2030, and that of Ngu Hanh Son District could reach 370,000 people (over a fivefold increase from the present population) by 2030, growing much faster than the city.

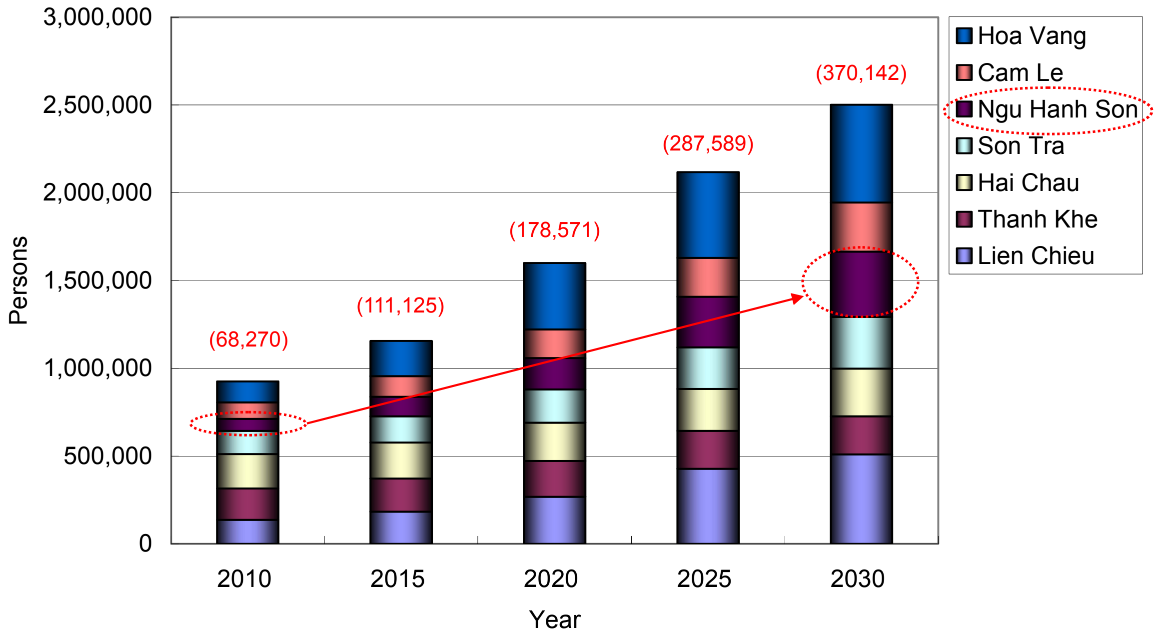


Figure 3.2.1 Population projections based on BS-H towards 2030 by district in Da Nang City with red figures in parentheses for Ngu Hanh Son District.

Tables 3.2.3 and 3.2.4 show projections of CO2e emissions in these two BAU scenarios (with no additional countermeasures introduced) from 2010 through to 2030 in Da Nang City. The CO2 emission estimation in BS-H indicates that emissions may double sometime between 2015 and 2020, and the CO2 emissions would reach 10,354 thousand tonnes of CO2 (hereafter "kt-CO2") in 2030, or 6.46 times as much as those in the base year 2010.

Tables 3.2.5 and 3.2.6 show projections of CO2e emissions in the two BAU scenarios (with no additional countermeasures introduced) from 2010 through to 2030 in Ngu Hanh Son District. The CO2 emission estimation in BS-H indicates that emissions may double sometime between 2020 and 2025, and that the CO2 emissions would reach 760 kt-CO2 in 2030, or 7.94 times as much as those in the base year 2010.

Appendix 3.2.1 shows an overview spreadsheet of our estimations and projections for CO2 emissions by category in Da Nang City and Ngu Hanh Son District, along with the nationwide estimations by the government organizations as well as the citywide estimations by the World Bank.

Table 3.2.3 Projections of COe2 emissions by category towards 2030
in Da Nang City according to BS-T.

[Da Nang City]	Emissions in CO_2e [k tonnes]				
Category	2010	2015	2020	2025	2030
1. Energy	1,352	2,045	2,675	3,387	4,123
- Manufacturing industries	349	478	607	736	866
- Transportation	595	981	1,134	1,311	1,516
- Commercial/institutional	93	146	289	474	688
- Residential	315	440	645	865	1,054
2. Waste	249	185	179	181	186
- Solid waste	92	0	0	0	0
- Wastewater	157	185	179	181	186
Total	1,602	2,231	2,854	3,568	4,309
% of 2010 base year emissions	100%	139%	178%	223%	269%
Population [persons]	926,018	1,065,862	1,230,478	1,420,517	1,639,907

Table 3.2.4 Projections of COe2 emissions by category towards 2030
in Da Nang City according to BS-H.

[Da Nang City]	Emissions in CO_2e [k tonnes]				
Category	2010	2015	2020	2025	2030
1. Energy	1,352	2,384	4,038	6,473	9,535
- Manufacturing industries	349	637	1,164	2,126	3,882
- Transportation	595	1,069	1,484	1,976	2,383
- Commercial/institutional	93	173	440	849	1,295
- Residential	315	505	950	1,523	1,974
2. Waste	249	332	436	600	820
- Solid waste	92	134	191	282	413
- Wastewater	157	198	245	318	407
Total	1,602	2,716	4,474	7,074	10,354
% of 2010 base year emissions	100%	170%	279%	442%	646%
Population [persons]	926,018	1,156,380	1,600,286	2,118,865	2,502,566

Table 3.2.5 Projections of COe2 emissions by category towards 2030
in Ngu Hanh Son District according to BS-T.

[Ngu Hanh Son District]	Emissions in CO_2e [k tonnes]				
Category	2010	2015	2020	2025	2030
1. Energy	77	107	153	207	264
- Manufacturing industries	30	41	53	64	75
- Transportation	17	20	25	31	39
- Commercial/institutional	7	11	24	40	59
- Residential	23	34	52	72	90
2. Waste	18	25	29	35	45
- Solid waste	7	11	14	19	28
- Wastewater	12	14	15	16	18
Total	96	132	183	242	309
% of 2010 base year emissions	100%	138%	191%	253%	323%
Population [persons]	68,270	83,242	104,248	130,554	163,499

Table 3.2.6 Projections of COe2 emissions by category towards 2030
in Ngu Hanh Son District according to BS-H.

[Ngu Hanh Son District]	Emissions in CO_2e [k tonnes]				
Category	2010	2015	2020	2025	2030
1. Energy	77	126	237	436	662
- Manufacturing industries	30	31	32	33	34
- Transportation	17	27	43	69	131
- Commercial/institutional	7	18	52	120	197
- Residential	23	50	110	214	300
2. Waste	18	32	45	71	98
- Solid waste	7	13	21	38	61
- Wastewater	12	19	24	33	37
Total	96	158	283	508	760
% of 2010 base year emissions	100%	165%	295%	530%	794%
Population [persons]	68,270	111,125	178,571	287,589	370,142

3.3 Define the CO2 Reduction and Environmental Targets of the Low-Carbon Town

3.3.1 Approach for Achieving the CO2 Reduction Target of the LCT

According to the "National Green Growth Strategy", greenhouse gas (GHG) emission reduction targets are set out in terms of intensity of GHG emissions and GHG reductions compared to BAU emissions, rather than the base year emissions. For example, this strategy aims at reductions of annual GHG emissions by at least 1.5-2.0% and the reductions of GHG emissions in energy activities by 20-30% from BAU emissions by 2030. It should be noted that the commitment for this GHG reductions target includes the following breakdown:

(A) Voluntary reduction (domestic effort):
   10% in 2020
   20% in 2030
(B) International support (depending on financing and technology from outside the country):
   10% in 2020
   10% in 2030

   20% in 2020 (Total: 10%+10%)
   30% in 2030 (Total: 20%+10%)

In accordance with this national strategy, one approach for reaching the CO2 reductions target of the LCT in Da Nang City would be a voluntary reduction target (A) of 10% from the CO2 emission levels of a BAU scenario for 2020 and that of 20% from the CO2 emission levels of a BAU scenario for 2030. In the case of BS-H, this would require a reduction of 447kt-CO2 in 2020 and 2,071kt-CO2 in 2030 from the corresponding BAU emissions levels (Figure 3.2.2).

If the above reduction targets are interpreted in comparison with the base year emission level, the targets require that emissions be kept within 151% of the base year emission level in 2020 and within 417% in 2030, respectively.

In the remaining text of this report, let us adopt BS-H for our BAU scenario as a working scenario for our study unless otherwise stated.

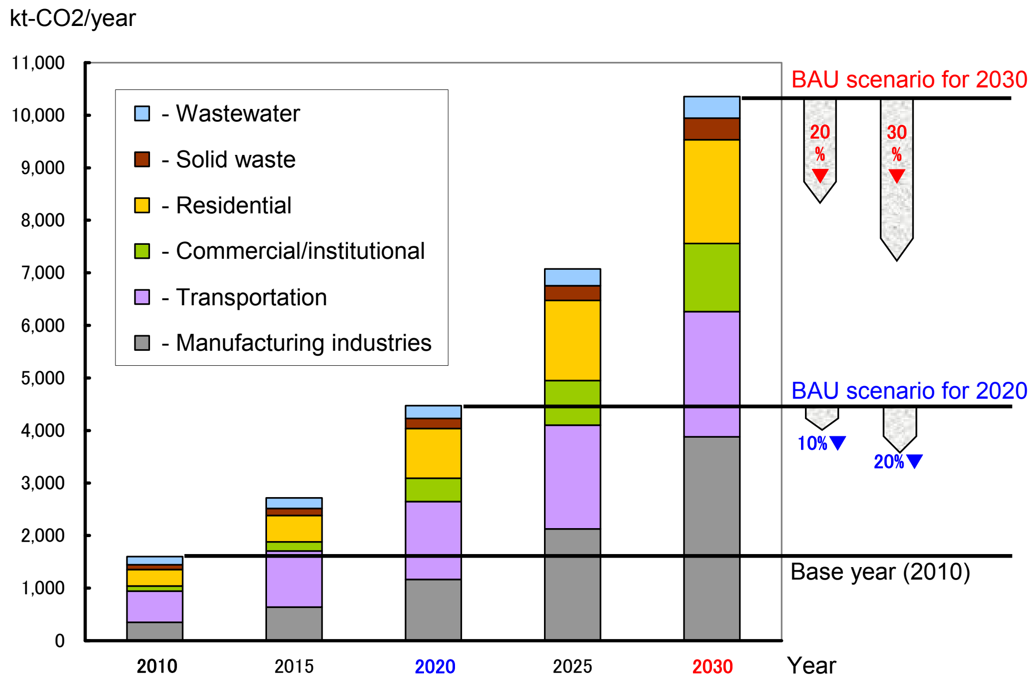


Figure 3.2.2 One approach for setting out CO2 emissions reduction targets towards 2030 in accordance with the “National Green Growth Strategy”.

Table 3.2.7 indicates three different options (A - C) for emission reduction targets (from 10% up to 30% reductions) compared with the BAU emission level of BS-H. The present feasibility study attempts to provide options for a set of possible countermeasures for reducing CO2 emissions towards 2030 so that Ngu Hanh Son District may set out its emission reduction targets for 2020 and 2030 on the basis of an introduced set of possible countermeasures towards the target years.

As summarized in Chapter 6, our feasibility study suggests that emission reductions by approximately 22% from the BAU emission level may be possible by 2030 if several countermeasures, such as electric motorbikes, BRT systems, energy-saving green buildings and waste methane recovery/utilization facilities, have been introduced by 2030.

Table 3.2.7 Emission reduction targets (total emissions and emission intensity per person) in BS-H for Da Nang City and Ngu Hanh Son District. The targets of the voluntary reduction listed in the "National Green Growth Strategy" are indicated in boldface.

BS-H (BAU Scenario - High Growth)

Options for CO2e emission reduction targets

Da Nang City

Option	Target	Content	Target Year 2020	Target Year 2030
A	10 % from BAU	Reductions from BAU	**447** ktCO2e	1,035 ktCO2e
		% above base year level	**151** %	482 %
B	20 % from BAU	Reductions from BAU	895 ktCO2e	**2,071** ktCO2e
		% above base year level	123 %	**417** %
C	30 % from BAU	Reductions from BAU	1,342 ktCO2e	3,106 ktCO2e
		% above base year level	96 %	353 %

Ngu Hanh Son District

Option	Target	Content	Target Year 2020	Target Year 2030
A	10 % from BAU	Reductions from BAU	**28** ktCO2e	76 ktCO2e
		% above base year level	**166** %	615 %
B	20 % from BAU	Reductions from BAU	57 ktCO2e	**152** ktCO2e
		% above base year level	136 %	**535** %
C	30 % from BAU	Reductions from BAU	85 ktCO2e	228 ktCO2e
		% above base year level	107 %	456 %

Intensity of CO2e emissions per person

Da Nang City

	2010	2015	2020	2025	2030
Population [persons]	926,018	1,156,380	1,600,286	2,118,865	2,502,566
CO2e emissions [ktCO2/year]	1,601.58	2,715.70	4,473.93	7,073.71	10,354.16
Emission Intensity [tCO2e/year/person]	1.73	2.35	2.80	3.34	4.14
			2.52		**3.31**

Ngu Hanh Son District

	2010	2015	2020	2025	2030
Population [persons]	68,270	111,125	178,571	287,589	370,142
CO2e emissions [ktCO2/year]	95.72	157.76	282.80	507.58	760.04
Emission Intensity [tCO2e/year/person]	1.40	1.42	1.58	1.76	2.05
			1.43		**1.64**

N.B. Target figures indicated in blue and red are in accordance with the voluntary reduction target listed the "National Green Growth Strategy"

3.3.2 The Target with Consideration for Environmental Mitigation

In order to develop the quantitatively determined CO2 reduction targets into concrete measures and policies for Da Nang City and Ngu Hanh Son District, a line of policy that could act as a basis for these measures and policies will be set out as an environmental vision. When setting up this environmental vision, the Low-carbon town measures and policies that will lead to the development of Da Nang City and Ngu Hanh Son District as well as attractive urban planning should be considered. For example, in order to realize the CO2 reduction target in the transportation sector, the vision is not merely to reduce the number of automobiles and two wheel vehicles but rather, to convert means of transportation to more environment-friendliness options and, at the same time, increase mobility. The environmental targets should be set along these lines.

3.4 Prepare a Low-Carbon Guideline for Categories of Low-Carbon Town Design Challenges

3.4.1 Potential approaches for the selection of CO2 reducing measures

The selection of CO2 reduction measures will be made according to the following six steps (Fig.3.4.1).

Step 1: Set through a category approach to form a low carbon city.
Step 2: Estimate the area's current status, development plan and future
Step 3: Have an exchange of ideas/conference with the Implementation Board
Step 4: List model measures to be introduced to Da Nang City.
Step 5: Evaluate comprehensively based on guidelines (Detail provided in Chapter 3.4.2)
Step 6: Select priority measures

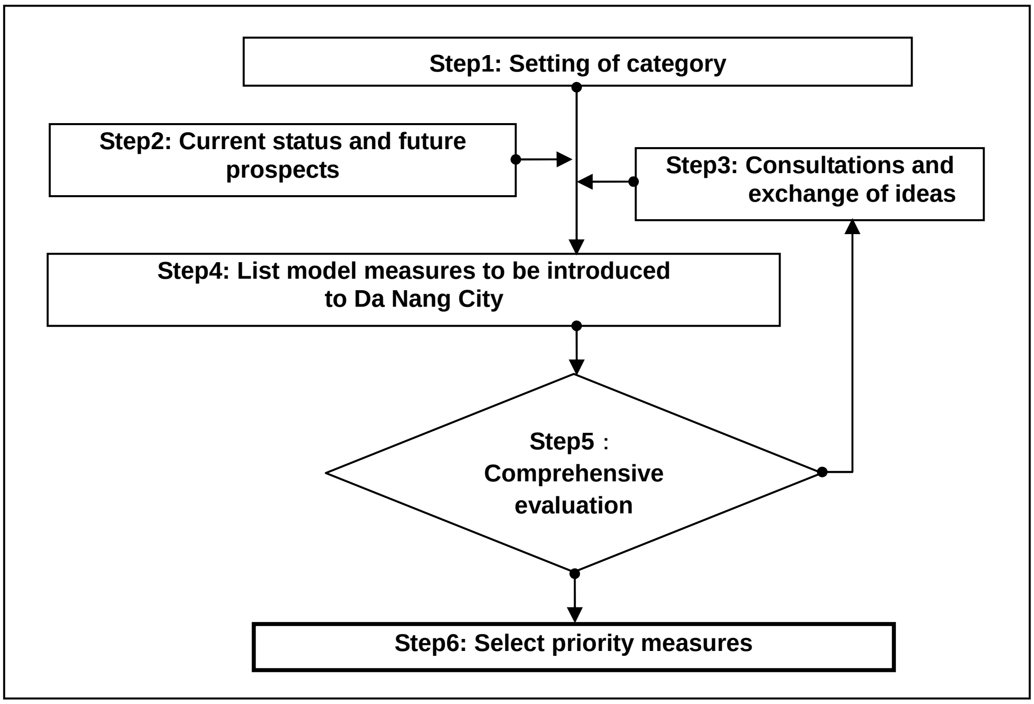


Fig.3.4.1 Selection flow of CO2 reduction measures.

3.4.2 Four Viewpoints for Determining Guidelines

The amount and cost of CO2 reductions versus their effects have been raised as quantitative assessment items to accomplish carbon emission reduction goals.

However, in regards to “Re-development,” in consideration of the characteristics of the NHSD’s business model, in addition to carbon reduction it is essential to select measures that could contribute to the resolution of challenges, and increase the attractiveness and sustainable development of this region.

With these ideas in mind, the following four points are established as a guideline (evaluation viewpoints) in order to create a low carbon town in NHSD (Fig.3.1.1).

Viewpoint 1: measures through which a large volume of CO2 reductions are expected.

Viewpoint 2: measures whose cost-effectiveness is large.

Viewpoint 3: measures that may contribute to solving the area's current challenges in addition to global warming. (*1)

Viewpoint 4: measures that may lead to sustainable development and increase attractiveness. (*2)

(*1) The main current challenges are Re-development, Sprawl, Deterioration of the landscape and the Energy supply.

(*2) The main attractiveness is being a Low carbon town, Resort beach, Tourist location and Sustainable city.

3.4.3 Selection of Design Challenges that Function as Model Measures

In order to efficiently and steadily achieve CO2 emission reduction goals, a comprehensive evaluation based on the above-mentioned four viewpoints is to be initiated. Categories and policies relating to countermeasures will be clarified.

When the evaluation is carried out, a process will be formulated in order to select measures that respond to the area's actual conditions and have a high likelihood of being realized. This process will proceed with an exchange of ideas with the Implementation Board.

When this process is implemented, the Low-Carbon Guidelines will be prepared in an effort to realize a low carbon model town in Da Nang City. At the same time, it should be kept in mind that Da Nang could serve as a model for other areas that may have characteristics of overall similarity to Da Nang (Re-development).

3.5 Select CO2 Reduction Measures in Each Design Category

3.5.1 Category Establishment for Creating a Low Carbon Town

Possible low carbon measures for NHSD in Da Nang City can be divided into nine categories listed below:

(1) Buildings
(2) Transportation
(3) Energy - Energy Management System
(4) Energy - Area Energy Network
(5) Energy - Untapped Energy
(6) Energy - Renewable Energy
(7) ICT Control
(8) Environment
(9) Water Supply and Sewage

The details of these categories are given below.

(1) Buildings

Many different large and small scale resort hotels will be continually developed along Marble Beach. Keeping this in mind and to also actualize a sustainable environmental city, it is particularly necessary to have environmental regulations for large-scale buildings.
Therefore, measures for building category planning have been selected.

(1)-1 Introduction of a system of comprehensive environmental benchmarks that target buildings (1)-2 Deciding on an energy-saving architectural plan that considers reducing the thermal load

(2) Transportation

There has been a rapid increase in the population and economic growth of Da Nang City. If development occurs in response to demand with little environmental considerations, it is probable that the city will grow into an urban sprawl, which results in inefficiency with corresponding negative impacts on the environment.
In order to realize a low-carbon model town and to solve these envisaged problems, it is necessary to investigate two measures: one for private transportation (short term) and the other for public transportation (mid to long term).

(2)-1 Facilitation of the spread of electric motor-bikes and charging facilities (2)-2 Introduction of a Bus Rapid Transit system (2)-3 Introduction of a subway system

(3) Energy - Energy Management System

In this category, measures are proposed that are expected to reduce CO2 emissions improve the efficiency of power generation and stabilize the power supply.

(3)-1 Stabilization of the electric power supply through a high capacity electrical storage facility
(3)-2 Optimization of power generating facilities by peak power limitation

(4)Energy - Area Energy Network

In this category, the proposed measures are district heating and cooling systems as well as energy-saving facilities in stand-alone buildings.

(4)-1 A heat pump style cooling system that uses river water and ocean water
(4)-2 Utilization of waste heat

(5) Energy - Untapped Energy

Options for utilizing untapped energy are listed as follows. Along with an increase in population, there is an increase in domestic garbage as well as an increase in the amount of polluted water in sewage (treatment) plants, which will pose an environmental burden to the city infrastructure. Utilizing these resources (biomass including plants) to generate energy is a possible measure in this category.

(5)-1 Purification and power generation utilizing biogas (digestive gas)
(5)-2 Biomass generation from kitchen garbage
(5)-3 Utilizing BDF by purification of Jatropha plant oil

(6) Energy - Renewable Energy

In this category, proposed measures involve creating power supply using renewable energy available in the area.

(6)-1 Power supplied by renewable energy such as wind power and solar power
(6)-2 Introduction of an ocean water pumped storage power station that guarantees stability in the power supply

(7) ICT Control

In this category, a proposed measure is to introduce ICT control in the following manners.

(7)-1 Optimum management and energy conservation of street lights through LED lighting
(7)-2 Integrated management of multiple building groups
(7)-3 Optimized control of traffic flow due to an ITS (Intelligent transportation system)
(7)-4 Integrated management by a Smart Meter

(8) Environment

Da Nang City is a region that is vulnerable to damage caused by typhoons due to its maritime climate. Therefore, preservation of the natural environment and greening that act as a windbreak is necessary. In this category, proposed measures aim at environmental preservation and greening.

(8)-1 Environmental education for townspeople (8)-2 Visualizing environmental initiatives (8)-3 Preservation of the natural environment and planting trees

(9) Water Supply and Sewage

In this category, proposed measures are aimed at managing the waterworks and maintaining an efficient supply while utilizing biomass of water treatment sludge.

(9)-1 Efficient management of waterworks and the water supply as well as urine power generation (9)-2 Bio generation through utilizing of water treatment sludge

(1) - 1 Introduction of a system of comprehensive environmental benchmarks

Measures Category	Buildings
Supply or Demand	Demand sides

Summary and Specific Measures

Summary of Building Assessment System

In the target area of Ngu Hahn Son District, economic development is expected in conjunction with the economic growth expected in the whole of Da Nang City. With the increase of building development in this area, CO_2 reduction initiatives will be required so as to promote the environmental city of Da Nang.

The selected measure is a method for evaluating and rating the environmental performance of buildings and the built environment. This is not only a CO_2 reduction evaluation, but it also covers a comprehensive assessment of the quality of a building, and evaluates features such as interior comfort and scenic aesthetics. This kind of environmental assessment system for buildings is widely used all over the world in places such as LEED in the USA, BREEAM in the UK, and CASBEE in Japan.

Evaluation and rating criteria for introduction of the system and performance targets

Prospective CO_2 emissions reduction through the introduction of an environmental assessment system in Ngu Hahn Son District shall be simulated in reference to the CASBEE system mentioned above, with consideration given to the results of site investigation.

Evaluation criteria for the assessment system are as follows;

1) Assessment; ranked in five grades by environmental point scoring; Superior(S), Very Good(A), Good(B+),Slightly poor (B-),Poor(C) ,reference to the CASBEE system
2) Target building; large scale buildings(exceed 2,000m2 in total floor area, for instance)
   Measure; S-rank in CASBEE applied to the buildings covered
3) When it comes to institutionalization of the assessment system, evaluation items and a scoring system shall be considered and selected to suit local conditions.

Showcasing Examples or Other Projects in Viet Nam

CASBEE initiative in Japan source; IBEC in Japan

Development of CASBEE

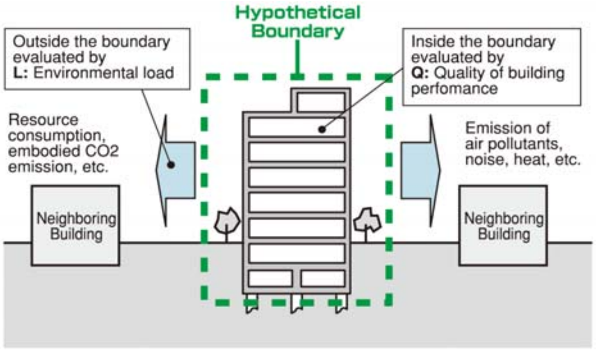
・CASBEE had been developed by a research committee established in 2001. The first assessment tool, CASBEE for office, was released in 2002. Since then, improvements have been made on new editions for easy use.

・CASBEE assessment tools were developed on the basis of the following three principles;
(1) Comprehensive assessment throughout the life cycle of the building.
(2) Assessment of the Built Environment Quality and Built Environment Load
(3) Assessment on the Built Environment Efficiency (BEE)

・Under CASBEE, two factors of Q(Quality) and L(Load) are categorized, and evaluated separately. BEE（Built Environment Efficiency) is calculated with Q as the numerator and L as the denominator.

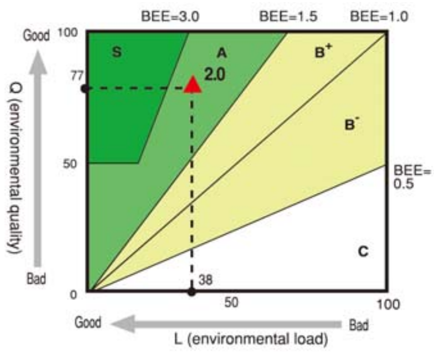
Built Environ Efficiency(BEE) = Q(Built Environment Quality) / L(Built Environment Load)

- CASBEE can serve as an assessment tool for the designer and the construction administrator, and can be used for labeling buildings when they are valued as assets.
- Outline of CASBEE is shown below;



Definition of Q and L through hypothetical boundary

$$\text{Built Environment Efficiency (BEE)} = \frac{\text{Q (Built Environment Quality)}}{\text{L (Built Environment Load)}}$$



Definition of BEE and the graph

BEE value and Ranks of CASBEE

Ranks	Assessment	BEE value, etc.	Expression
S	Excellent	BEE >= 3.0, Q >= 50	★★★★★
A	Very Good	3.0 > BEE >= 1.5	★★★★
B+	Good	1.5 > BEE >= 1.0	★★★
B-	Slightly Poor	1.0 > BEE >= 0.5	★★★
C	Poor	BEE < 0.5	★

<u>Reporting Systems for Environment Assessment by Administrative Initiative</u>

The reporting systems enacted by the local government oblige building owners intending to newly build or reconstruct a building to submit a planning document assessing the environmental performance of the building. In some cities that have introduced CASBEE, several incentives for construction deregulation are provided. By 2012, about 9,000 buildings had been reported in accordance with instructions given by the municipal authority of CASBEE, .

<u>Assessment Certification System</u>

The assessment certification system was established to ensure the reliability of environment assessment results and increase transparency. The certificate is issued by a registered accredited professional organization and the performance results are published on their web site. About 160 buildings had been published by 2012.

Viewpoint 1			Viewpoint 2	
tCO2/year	Project Period	tCO2/total	Initial Cost (USD)	tCO2/ 1,000USD
11,764.1	15	176,461.5	975,000 (37,601,000)	181.0 (4.7)

Viewpoint 3 (Resolve an issue)							
Re-development	◎	Sprawl	△	Landscape	◎	Energy Supply	○

Viewpoint 4 (Increasing attractiveness)							
LCT	◎	Resort Beach	○	Tourism	○	Sustainable	◎

Evidence

Viewpoint 1 : Calculation of CO2 reduction

Through the introduction of this measure, CO2 emissions in the building sector can be reduced as simulated using the estimated conditions shown in the table below.

	Item	Unit	Quantity	Remarks	Calculation
Calculation of effect target floor area					
A	Prospective floor area	m2	2,264,652	on 2030,result from simulation	(Note)
B	Target floor rate	%	25	Application 50% × Achievement 50%	
C	Effect target floor area	m2	566,163		A*B
Calculation of Primary Energy reduction					
D	Primary Energy Consumption Rate on Standard Building	MJ/m2·year	1,500	survey result on DaNang	
E	Reduction rate	%	25	performance value on Japan	
F	Primary Energy reduction per unit area	MJ/m2·year	375		D*E
Evaluation					
G	Reduction on Primary Energy	GJ/year	212,311		C*F
H	Emission Factor	kgCO2/MJ	0.0554	0.5408[kgCO2/kWh]/9.76[MJ/kWh]	
I	CO2 Emissions Reduction	tCO2/year	11,764.1		G*H
J	Project Period	years	15		
K	Life Cycle CO2 Emissions Reduction	t-CO2	176,461.5		I*J

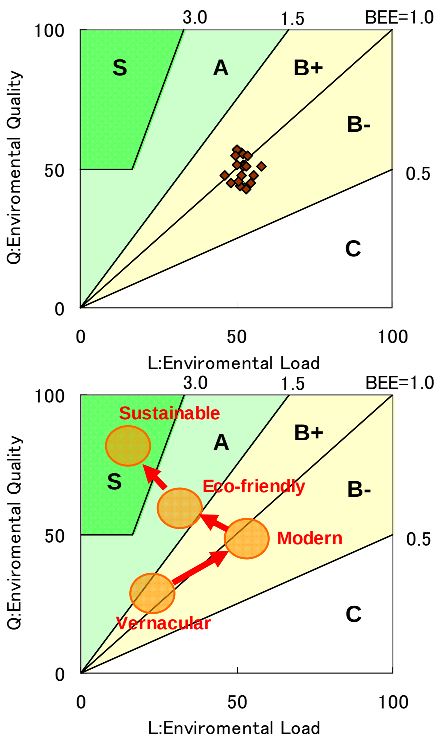
Note : Simulation is based on Population ,and Floor Area per Person ,and each Rate of Change.

- Building Survey in DaNang City

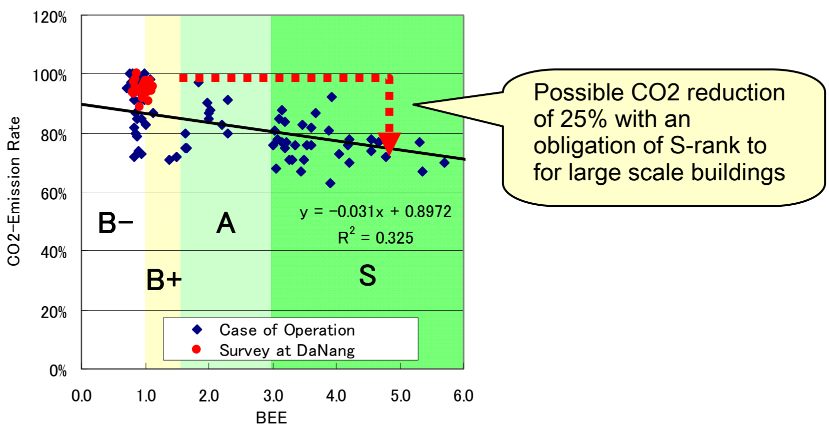
Building Surveys were carried out at 20 (twenty) buildings in DaNang City in order to understand the situation and evaluate the quality of these building based on the CASBEE system. As a result, all the surveyed buildings were ranked between B+ ～ B- as shown below. Further, supposing these buildings were ranked in the S class, approximately 25% of CO2 reduction could be expected if statistic points of the performance from buildings in Japan are used.

Evaluation result and Ranking of each building

No.	Building Name and Classification	CASBEE Evaluation (Brief for DaNang)			
		Q:Built enviroment quality	L:Built enviroment load	BEE	Rank
1	L-office	51.2	52.2	0.98	B−
2	K-office	47.7	46.4	1.03	B+
3	U-office	43.3	52.9	0.82	B−
4	H-hotel	44.9	48.5	0.93	B−
5	T-office	42.4	52.9	0.80	B−
6	I-office	43.6	51.4	0.85	B−
7	L-school	55.7	51.7	1.08	B+
8	W-hall	45.4	50.7	0.89	B−
9	S-school	55.0	52.0	1.06	B+
10	P-office	44.9	54.9	0.82	B−
11	D-hospital	56.6	50.3	1.13	B+
12	S-office	47.8	51.7	0.92	B−
13	A-office	50.6	52.0	0.97	B−
14	D-office	50.7	52.9	0.96	B−
15	S-hotel	50.9	58.1	0.88	B−
16	I-school	51.4	50.4	1.02	B+
17	B-office	47.7	55.8	0.86	B−
18	Q-school	54.6	49.6	1.10	B+
19	Y-office	54.8	53.7	1.02	B+
20	N-hotel	49.4	55.8	0.89	B−



Expected CO2 reduction effect based on the performance data



Viewpoint 2 : Calculation of cost

The cost of performing this measure is estimated using the conditions shown in the table below.

The following two cases are studied for reference

- Case A includes only municipal expenditure for development and operation of the environmental assessment system
- Case B includes additional costs for environmental designs of new government building construction, in addition to the costs in Case A (municipal expenditure)

	Item	Unit	Quantity	Remarks	Calculation
Calculation of cost target floor area					
A	Prospective floor area	m2	2,441,741	total from 2015 to 2030 result from floor area simulation	(Note)
B	Cost target floor rate	%	10	Government office area 20% × Application 50% × Achievement 100%	
C	Cost target floor area	m2	244,174		A*B
Calculation of additional cost for environment design					
D	Construction Cost for unit area	Mill.VND/m2	15	survey result on DaNang	
E	Additional Cost rate for Environment Design	%	20	performance value on model case	
F	Additional cost per unit area	Mill.VND/m2	3.0		D*E
①Calculation of cost for environment design					
G	Additional Cost for E.V. Design (VND)	Mill.VND	732,522	total from 2015 to 2030	C*F
H	Additional Cost for E.V. Design (USD)	USD	36,626,000	rate:1USD=20,000VND	①
②Calculation of cost for establishment evaluation index					
I	Cost for establishment evaluation index	USD	600,000	20pers.*100days*300USD	②
③Calculation of cost for administrative control					
J	Cost for administrative control	USD	375,000	2pers.*250days*15years*50USD	③
Evaluation Case A (only municipal expenditure for development)					
K	Life Cycle CO2 Emissions Reduction	t-CO2	176,461.5	from Viewpoint1	
L	Project cost A (only policy)	USD	975,000		②+③
M	Cost of CO2 Emissions Reduction A	USD/tCO2	6		L/K
N	CO2 Emissions Reduction per Cost A	tCO2/Thous.USD	181.0		K/L*1000
Evaluation Case B (includes additional cost for environmental design of government buildings)					
O	Life Cycle CO2 Emissions Reduction	t-CO2	176,461.5	from Viewpoint1	
P	Project cost B (include cost for E.V. Design)	USD	37,601,000		①+②+③
Q	Cost of CO2 Emissions Reduction B	USD/tCO2	213		P/O
R	CO2 Emissions Reduction per Cost B	tCO2/Thous.USD	4.7		O/P*1000

Note : Simulation is based on Population ,and Floor Area per Person ,and each Rate of Change.

Viewpoint 3 : Valuation Comments

This measure shall be mainly used for new building construction in order to contribute to CO2 reduction and improve the regional surroundings. However, it shall not be a measure for inhibiting sprawl.

Viewpoint 4 : Valuation Comments

This measure shall improve the quality of the environment in order to contribute to the promotion of a sustainable low carbon town.

(1) - 2 Deciding on an energy-saving architectural plan

Measures Category	Buildings
Supply or Demand	Demand sides

Summary and Specific Measures

Summary of Environmental Technology for Buildings

In order to promote low carbon town buildings, the environmental technology shall be effectively taken into account at the design stage, and the buildings shall be maintained in order to meet the environment design initiative. Further, it is believed to be possible to reduce CO2 emissions in existing buildings due to the fact that few buildings are well managed. It shall also be necessary for the people engaged in building construction and building management to be conscious of environmental considerations, including CO2 reduction.

Environmental technology for buildings shall be classified as follows;

1) Environmental technology for new construction and reconstruction
   - -long-life building structure for sustainable purpose
   - -heat insulation for ceilings and walls to decrease thermal load on air- conditioning
   - -facilitate energy saving equipment/machines as building services
   - -plant around the building site so as to harmonize with the surroundings
2) Environmental technology for repairing and renovating existing buildings
   - -renew air-conditioning units with high efficiency types (top runner)
   - -renewal of lighting fixtures with LED lamps
   - -replace window glass with Low-E (Low Emissivity) glass
3) Environmental technology for the building management of existing buildings
   - -Introduction of building energy management systems

From a view point of CO2 reduction in existing buildings, a case study for building an energy management system introduction measure shall be carried out on large scale existing buildings with the condition of 1% energy savings a year. Simulation results are sown below.

Showcasing Examples or Other Projects in Viet Nam

Energy Saving Initiative in Japan source; IBEC in Japan

Energy saving measure in Houses and Buildings

・New construction and/or reconstruction of buildings which have a floor area over 300m2, and large scale modifications exceeding 2,000m2

・Building owners are subject to notification and periodic reporting

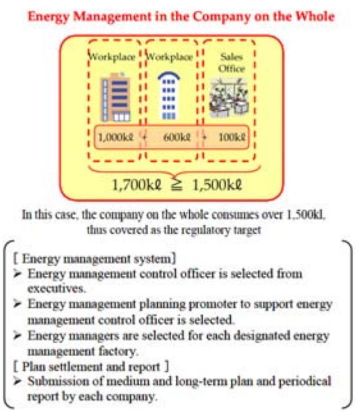
・Prime energy consumption and exterior wall insulation are below the standard value

Energy saving measures in Factories

・Exceed 1,500 liters in oil energy consumption a year

・Appointment of an energy manager; operation of a building energy management system; periodic reporting

・Reduction ratio on primary energy ; 1%(annual average)



Viewpoint 1			Viewpoint 2	
tCO2/year	Project Period	tCO2/total	Initial Cost (USD)	tCO2/ 1,000USD
2,575.2	15	38,628.0	375,000 (3,522,000)	103.0 (11.0)

Viewpoint 3 (Resolve an issue)							
Re-development	○	Sprawl	△	Landscape	○	Energy Supply	◎

Viewpoint 4 (Increasing attractiveness)							
LCT	◎	Resort Beach	△	Tourism	△	Sustainable	◎

Evidence

Viewpoint 1 : Prospective CO2 reduction

Through introduction of a BEMS (Building Energy Management System) to the existing buildings covered, CO2 emissions reduction is estimated using the assessing conditions shown in the table below.

	Item	Unit	Quantity	Remarks	Calculation
	Calculation of effect target floor area				
A	Existing area (a)	m2	120,138	on 2030,result from simulation	(Note)
B	Prospective Renewals area (b)	m2	88,462	on 2030,result from simulation	(Note)
C	Prospective Existing are (c)	m2	2,264,652	on 2030,result from simulation	(Note)
D	Target floor rate	%	25	Application 50% × Achievement 50%	
E	Target floor area (a)	m2	30,035		A*D
F	Same as above (b)	m2	22,116		B*D
G	Same as above (c)	m2	283,082	Target rate 50% on New Existing area	C*D*50%
	Calculation of Primary Energy reduction				
H	Primary Energy Consumption Rate on Standard Building (a)	MJ/m2･year	600	survey result on DaNang	
I	Same as above (b)	MJ/m2･year	1,000	survey result on DaNang	
J	Same as above (c)	MJ/m2･year	1,500	survey result on DaNang	
K	Reduction rate	%	10	survey result on DaNang	
L	Primary Energy reduction per unit area	MJ/m2･year	60		H*K
M	Same as above (b)	MJ/m2･year	100		I*K
N	Same as above (c)	MJ/m2･year	150		J*K
	Evaluation				
O	Reduction on Primary Energy	GJ/year	46,476		E*L+F*M+G*N
P	Emission Factor	kgCO2/MJ	0.0554	0.5408[kgCO2/kWh]/9.76[MJ/kWh]	
Q	CO2 Emissions Reduction	tCO2/year	2,575.2		O*P
R	Project Period	years	15		
S	Life Cycle CO2 Emissions Reduction	t-CO2	38,628.0		Q*R

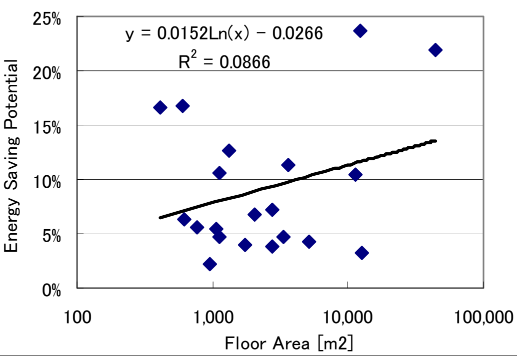
Note : Simulation is based on Population ,and Floor Area per Person ,and each Rate of Change.

◇Building Survey in DaNang City

A building survey was carried out at 20(twenty) existing buildings in DaNang City in order to evaluate possible CO2 reductions in existing buildings. As a result, it is expected that these buildings will have a potential to reduce CO2 by approximately 10% if they take the above mentioned measures.

Evaluation results and scatter plot

No.	Building Name and Classification	Total Floor Area[m2]	Energy Saving Potential [%]	No.	Building Name and Classification	Total Floor Area[m2]	Energy Saving Potential [%]
1	L-office	2,035	7%	11	D-hospital	43,706	22%
2	K-office	1,140	5%	12	S-office	944	2%
3	U-office	1,339	13%	13	A-office	622	6%
4	H-hotel	1,080	5%	14	D-office	1,746	4%
5	T-office	3,360	5%	15	S-hotel	12,177	24%
6	I-office	2,772	7%	16	I-school	12,560	3%
7	L-school	5,123	4%	17	B-office	3,640	11%
8	W-hall	763	6%	18	Q-school	11,254	10%
9	S-school	407	17%	19	Y-office	2,776	4%
10	P-office	1,120	11%	20	N-hotel	600	17%



Viewpoint 2 : Cost Estimation

Additional cost with the introduction of a building energy management system to existing buildings covered from 2015 to 2030 is estimated with the assessing conditions shown in the table below.

The following two cases are studied for reference

- Case A includes only municipal expenditure for the development and operation of an environmental assessment system
- Case B includes additional costs for environmental design of new government building construction in addition the costs in Case A(municipal expenditure)

	Item	Unit	Quantity	Remarks	Calculation
Calculation of additional cost for environment design					
A	Prospective Renewal floor area	m2	586,073	total from 2015 to 2030 result from floor area simulation	(Note)
B	Cost target floor rate	%	10	Government office area 20% × Application 50% × Achievement 100%	
C	Cost target floor area	m2	58,607		A*B
Calculation of additional renewal cost for environment design					
D	Construction Cost for unit area	Mill.VND/m2	15	survey result on DaNang	
E	Additional Renewal Cost rate for Environment Design	%	6	performance value on model case Cost rate for renewals 30% × Additional cost rate for environment 20%	
F	Additional cost per unit area	Mill.VND/m2	0.9		D*E
①Calculation of cost for environment design					
G	Project cost for Renewal (VND)	Mill.VND	52,746	total from 2015 to 2030	
H	Project cost for Renewal (USD)	USD	2,637,000	rate:1USD=20,000VND	①
②Calculation of cost for energy saving operation					
I	Effect target total floor area	m2	335,233	on 2030 from Viewpoint1 E+F+G	
J	Effect target government office area	m2	33,523		I*B
K	Unit-Cost for Operation	USD/m2·year	1.0	performance value on model	
L	Project cost for Operation per year	USD/year	34,000		J*K
M	Project cost for Operation	USD	510,000	Project Period=15years	L*pp ②
③Calculation of cost for administrative control					
N	Cost of administrative control	USD	375,000	2pers.*250days*15years*50USD	③
Evaluation Case A (only municipal expenditure for development)					
O	Life Cycle CO2 Emissions Reduction	t-CO2	38,628.0	from Viewpoint1	
P	Project cost A (only policy)	USD	375,000		③
Q	Cost of CO2 Emissions Reduction A	USD/tCO2	10		P/O
R	CO2 Emissions Reduction per Cost A	tCO2/Thous.USD	103.0		O/P*1000
Evaluation Case B (includes additional cost for environmental design of government buildings)					
S	Life Cycle CO2 Emissions Reduction	t-CO2	38,628.0	from Viewpoint1	
T	Project cost B (include cost for E.V. Design)	USD	3,522,000		①+②+③
U	Cost of CO2 Emissions Reduction B	USD/tCO2	91		T/S
V	CO2 Emissions Reduction per Cost B	tCO2/Thous.USD	11.0		S/T*1000

Note : Simulation is based on Population ,and Floor Area per Person ,and each Rate of Change.

Viewpoint 3 : Valuation Comments

This measure shall be mainly used for existing buildings in all locations in order to contribute to CO2 reduction and improvement in the local environment, but it shall not be a measure for inhibiting sprawl.

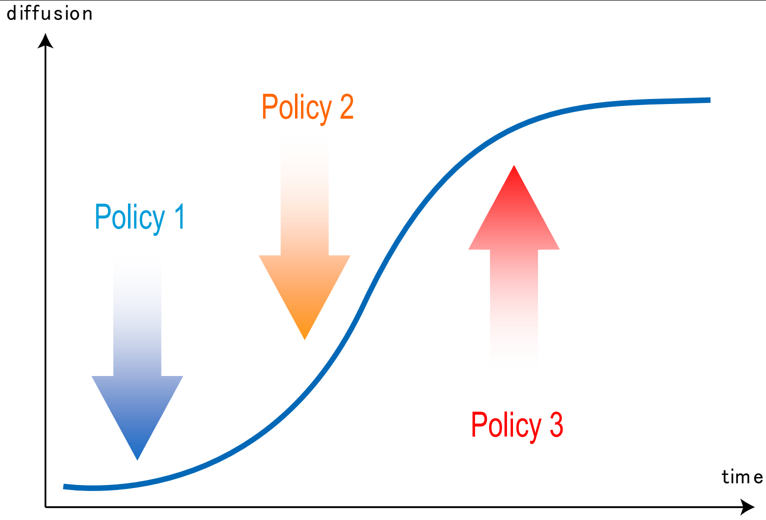
Viewpoint 4 : Valuation Comments

This measure shall contribute to the promotion of a sustainable low carbon town through methods of CO2 emission reduction. It is not expected to improve regional surroundings.

(2) - 1 Facilitation of the spread of electric motor-bikes and charging facilities

Measures Category	Facilitation of the spread of electric motor-bikes and charging facilities
Supply or Demand	Demand side

Summary and Specific Measures



- Motorcycles account for about 90% of all means of transportation for citizens of Da Nang and are a major source of CO_2 emissions in the city's traffic sector.
- On the other hand, the performance (maximum range, battery life, traveling speed, etc.) of electric motorcycles is rapidly improving due to technical innovation.
- With this in mind, measures for promoting their utilization and the establishing charging facilities are proposed as short-term feasible measures to reduce CO_2 emissions. This aims at facilitating a shift in the means of transportation from gasoline to electric motorcycles.
- As for a measure of promoting the utilization of electric motorcycles, the following three steps should be taken to facilitate a change in civil consciousness and behaviors.

(1) Diffusion and educational activities (Policy 1)

Build citizen recognition and enhance the image of electric motorcycles by installing symbolic charging equipment, exhibiting high-performance and stylish electric motorcycles, and engaging in other activities

(2) Preferential treatment concerning taxes and subsidies for purchase (Policy 2)

Impose more affordable taxes on electric motorcycles than on gasoline motorcycles at an early stage of diffusion, and facilitate purchase of electric motorcycles through subsidization.

(3) Parking areas for electric motorcycles (Policy 3)

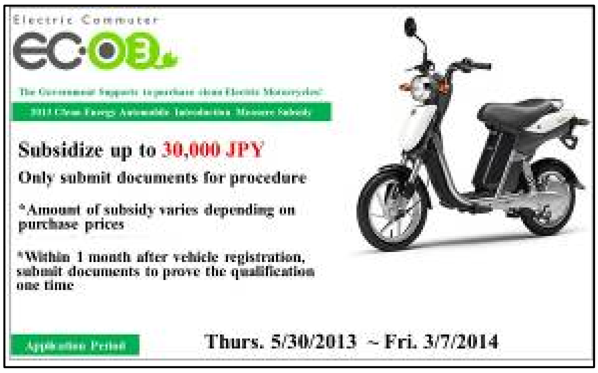
Set up parking areas for electric motorcycles on the street, large-scale shopping centers, motorcycle-parking areas for workers at factories, store fronts, and encourage gas stations to manage and operate charging equipment as well as battery swaps in the city.

Parking lot at a shopping center

Charging equipment in parking lot (Japan)

Showcasing Examples or Other Projects in Viet Nam

“EV/pHV Town Scheme” by METI, Japan



- The “EV/pHV Town Scheme” of METI is a measure that aims to generate the initial demand for EVs and pHVs that emit no CO2 when running on electricity and are energy efficient.
- METI implements model projects that intensively introduce vehicles, build charging facilities, and promote the diffusion of those vehicles in model towns.
- The Japanese government prepares measures for purchase subsidies and automobile weight tax exemptions when purchasing low-emission or EV vehicles.
- The government has also built a system to subsidize 30,000 JPY when purchasing electric motorcycles in Japan.

Diffusion program of high-performance electric motorcycles by Terra Motors in Vietnam

- Terra Motors Corporation in Japan has collaborated with Mitsubishi UFJ Morgan Stanley Securities CO., Ltd. to plan an expansion of sales of high-performance electric motorcycles in Vietnam. They are currently working on a project adopted in October, 2012 by NEDO in Japan.
- Terra Motors has built a factory in Long An Province in Mekong Delta Region to mount an effort to promote electric motorcycles.

<A4000i Specs>
Travel Distance by One-time charge: 65km
Max. Speed: 65km/hr.
Battery Life: 50,000km
Charging Time: 4.5 hours

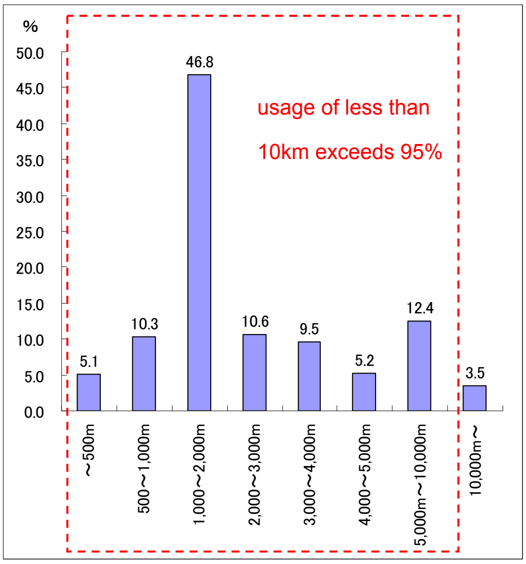
Viewpoint 1			Viewpoint 2	
tCO2/year	Project Period	tCO2/total	Initial Cost (USD)	tCO2/ 1,000USD
57,483.1	10 years	574,831.0	480,000	1,197.5

Viewpoint 3 (Resolve an issue)							
Re-development	◎	Sprawl	△	Landscape	○	Energy Supply	—
Viewpoint 4 (Increasing attractiveness)							
LCT	◎	Resort Beach	△	Tourism	◎	Sustainable	◎

Evidence

Viewpoint 1 : Calculation of CO2 reduction

- Based on OD traffic volumes sorted by means of transportation in the current conditions (2010) of Da Nang, the CO2 reduction amount is calculated by finding the difference between a case where electric motorcycles are not widely used and a case where 95% of motorcycle users shift to electric motorcycles due to future utilization promotion measures (2030).
- It is estimated that a shift to electric motorcycles will start from the purchase of a second motorcycle for each household because of repurchase demand. It is assumed that electric motorcycles will be used for short-distance trips whereas gasoline motorcycles will be used for long-distance trips.
- Conversion ratio is set at 95% because more than 95% of all users travel within 10km and more than 50% travel within 2km when counting trips by OD distances.
- It is highly possible that electric motorcycles will rapidly spread if the price of high-performance electric motorcycles decreases, charging facilities are built in the city, and assistance measures for introduction are prepared, not to mention the added motivation of escalating gasoline prices.



	Category		Unit	Quantity	Description	Calculation
A	Before Measure Total Travel Distance (Vehicle Kilo)	Automobile	Vehicle･km/Day	104,276.9		
B		Motorcycle	Vehicle･km/Day	552,074.2		
C		Bus	Vehicle･km/Day	147,453.4		
D		Truck	Vehicle･km/Day	73,210.6		
E	Conversion Ratio		%	95	shift from gasoline to electric motorcycle	
F	After Measure Total Travel Distance (Vehicle Kilo)	Automobile	Vehicle･km/Day	104,276.9		
G		Motorcycle	Vehicle･km/Day	27,603.7		
H		Bus	Vehicle･km/Day	147,453.4		
I		Truck	Vehicle･km/Day	73,210.6		
J		Electric Motorcycle	Vehicle･km/Day	524,470.5		
K	CO2 Emission Coefficient	Automobile	g-CO2/vehicle･km	253		
L		Motorcycle	g-CO2/vehicle･km	316		
M		Bus	g-CO2/vehicle･km	704		
N		Truck	g-CO2/vehicle･km	724		
O		Electric Motorcycle	g-CO2/vehicle･km	16	calculated from specs of Terra Motors' A4000i Battery	
P	CO2 Emission Amount before measure		t-CO2/yr.	130,592.3		(A*K+B*L+C*M+D*N)*365/1000000
Q	CO2 Emission Amount after measure		t-CO2/yr.	73,109.2		(F*K+G*L+H*M+I*N+J*O)*365/1000000
R	CO2 Emission Reduction Amount			57,483.1		P-Q

Viewpoint 2 : Calculation of cost

- It is important to gain the cooperation of manufacturers that hope to expand their sales of electric motorcycles in the market of Vietnam in order to promote their utilization.
- The project is implemented through the establishment of factories by manufacturers of electric motorcycles and associated parts in the industrial complex. This would be combined with providing public relations costs in the early stages and subsidiary measures prepared by the city of Da Nang.
- The establishment of facilities is achieved through approaching companies because building charging facilities for electric motorcycles does not only improve services for customers of shopping centers and workers at factories in the industrial complex, but it also leads to an image enhancement for these companies themselves.

<Public Relations Cost>

- Promotion is aimed at citizens and seeks to convey that electric motorcycles are high-performance, adequate for their everyday life and that the fuel costs (electricity cost) can be reduced by 90% compared to gasoline motorcycles.
- For such promotion, exhibitions or test-ride events are held in cooperation with manufacturers.
  Costs for holding exhibitions: 8 million JPY (8 times/yr. × 1 million JPY/event)
  Production costs (e.g. brochures) for a promotion measure: 2 million JPY

<Costs for setting charging stations>

- Well-designed charging stations for electric motorcycles will be built at selected locations, such as new city hall, the riverside of the Han River, and beach sides.
  Costs for building charging stations: 12 million JPY (100 thousand JPY/station)
- Construction cost: 20 thousand JPY × 100 unit

<Subsidy for purchasing electric motorcycles>

- A subsidy for purchasing is prepared in the early stages of electric motorcycle promotion
  : Subsidy for purchase: 12 million JPY (30 thousand × 500 unit)

Category	Unit	Quantity	Unit Price (Thousand JPY)	Price (Thousand JPY)	Offset	1USD=100JPY (Thousand JPY)	1USD=100JPY (Thousand USD)	Durable Period	Construction Cost / year (Thousand JPY)	Construction Cost / year (Thousand USD)
1. Public Relations Cost	Set	1	10,000	10,000	100%	10,000	100	5	2,000	20
2. Costs for Charging Stands										
Stand Price	Set	100	100	10,000	100%	10,000	100	10	1,000	10
Construction Cost	Set	100	20	2,000	100%	2,000	20	10	200	2
3. Subsidy	Set	500	30	15,000	100%	15,000	150	10	1,500	15
4. Reserve Fund	Set	1	12	1,200	100%	1,200	12	10	120	1
Total Project Cost (Above: K JPY, Below K USD)							38,200	Total Project Cost / year (Above: K JPY, Below K USD)		4,820
							382			48
t-CO2/Total Project Cost (Above: K JPY, Below K USD)	tCO2/yr.	57,483.1					11.926			
							1,192.596			
Total Project Cost/t-CO2 (Above: K JPY, Below K USD)	tCO2/yr.	57,483.1					0.084			
							0.001			

Viewpoint 3 : Valuation Comments

- This measure not only reduces CO2 emissions through a shift from gasoline to electric motorcycles, but also has the added effect of reducing noise and vibration while also acting as a countermeasure to air pollution.
- Appropriate and deliberate placement of motorcycle-parking areas will contribute to improving the scenery of the city.

Viewpoint 4 : Valuation Comments

- This measure not only has a great effect on reducing CO2 emissions, but also becomes a leading-edge approach for improving the environment of the city.
- It is assumed that the use of electric motorcycles will spread in ASEAN economies in the future, and thus this measure can become a leading-edge initiative for cities with a great number of motorcycles. This will contribute to Da Nang's image and promote tourism.
- This measure will contribute to long-term development of the city of Da Nang through generating new industries and attracting factories associated with electric motorcycles.
- In addition to electric motorcycles, a new type of compact electric vehicles called "ultra lightweight vehicles" are being developed and introduced around the world. Da Nang can expect an increase in visitors if the city is recognized as a city on the cutting edge of compact electric vehicles by engaging in the introduction of such vehicles.
- Although this report sets a conversion ratio (from gasoline to electric motorcycle) of 95% as a future policy goal (2030), the Da Nang People's Committee has pointed out, at the 2nd Implementation Board held in August 2013, that 50% is a more appropriate goal for 2030. Thus, the future policy goal shall be re-set after discussions with Da Nang's related authorities.

Nissan's ultra lightweight EV

Compact EV that can be used with motorcycle license (Japan)

(2) - 2 Introduction of a Bus Rapid Transit System

Measures Category	Transportation
Supply or Demand	Demand side

Summary and Specific Measures

In order to create a sustainable low-carbon city and increase mobility convenience in the city, this measure introduces a Bus Rapid Transit (BRT) system with low-emission vehicles equipped with air conditioners.
Unlike the existing local buses in Da Nang, BRT runs on the right-of-way in the middle of roads to ensure high-speed and punctual operations.
A low-carbon compact city structure is effectively achieved by carrying forward deliberate urban development coupled with a BRT-centered transportation system.
A BRT route at first runs from a bus terminal to Hoey Ann area via Ngu Hanh Son District, and feeder lines will be added as the number of passengers increase.
Signalized intersections introduce PTPS to ensure punctuality.

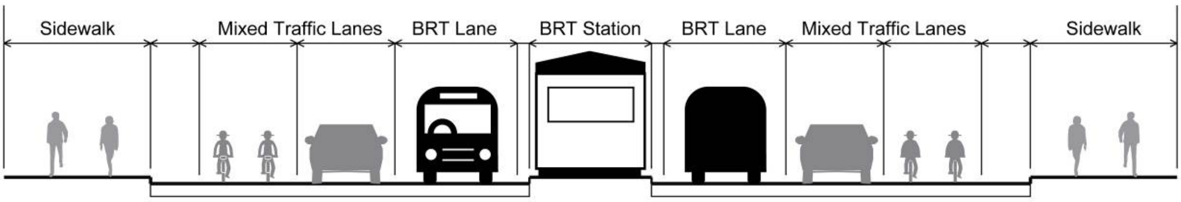


Image for introducing BRT

Route	City North Industrial complex / Da Nang engineering college ~ Da Nang Airport ~ inner city ~ Ngu Hanh Son District: approximately 22.3km
Space for Introduction	Right-of-way on roadside in inner city and in the middle of the arterial roads in Ngu Hanh Son District
Network	Location and number of bus stops will reflect the connectivity with the existing local buses in order to ensure the convenience of the public transportation network in the entire city
Cars	The 1st step: new symbolic cars will be introduced for image enhancement of the city and promote of utilization The 2nd step: sharing cars for BRT and local buses will be considered for general versatility
Carbarn & maintenance factory	These facilities for the existing local buses will be utilized to reduce the cost of upgrading

Showcasing Examples or Other Projects in Viet Nam

The first BRT in the world appeared in Curitiba, Brazil in 1973.
Currently, BRT has been spread around the world to places such as the USA, Canada, Great Britain, France, Netherland, Germany, Australia, Columbia, Ecuador, China etc.

BRT running in the middle of the road (Ecuador)

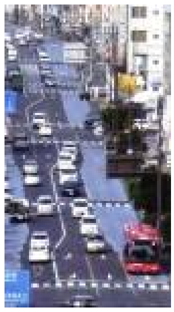
BRT running in the middle of the road (India)

The City of Seoul restructured its bus network and introduced BRT due to worsening problems such as sprawl in the commuting area, heavy congestion, and a decrease in bus passengers with an increase in the automobile traffic volume.
Introduction of BRT with right-of-ways achieves an increase in travel speed and the number of passengers while also reducing travel time. It also contributes to a convenient traffic network in combination with the railway network.
Many cities in Germany have succeeded in revitalizing their inner city by prohibiting vehicles in the central area.

BRT on the right-of-way (Seoul, Korea)

Transit Mall in Freiburg, Germany

BRT is currently operated in five cities in Japan (Fujisawa, Atsugi, Machida, Nagoya, and Gifu).



Viewpoint 1			Viewpoint 2	
tCO2/year	**Project Period**	**tCO2/total**	**Initial Cost (USD)**	**tCO2/ 1,000USD**
21,934.7	**30 years**	**658,041.0**	**42,450,000**	**15.5**

Viewpoint 3 (Resolve an issue)							
Re-development	◎	Sprawl	◎	Landscape	○	Energy Supply	-

Viewpoint 4 (Increasing attractiveness)							
LCT	◎	Resort Beach	○	Tourism	◎	Sustainable	◎

Evidence

Viewpoint 1 : Calculation of CO2 reduction

BRT will start its operation five years later
After 15 years of BRT's start, the subway will start its operation.
Distance between bus stops: 500 ~ 600m

	Category		Unit	Quantity	Description	Calculation
A	Before Measure Total Travel Distance (Vehicle Kilo)	Automobile	Vehicle・km/Day	104,276.9		
B		Motorcycle	Vehicle・km/Day	552,074.2		
C		Bus	Vehicle・km/Day	147,453.4		
D		Truck	Vehicle・km/Day	73,210.6		
E	Conversion Ratio		%	50	shift from aubomobile & motorcycle to BRT	
F	After Measure Total Travel Distance (Vehicle Kilo)	Automobile	Vehicle・km/Day	97,579.3		
G		Motorcycle	Vehicle・km/Day	358,544.4		
H		Bus	Vehicle・km/Day	147,453.4		
I		Truck	Vehicle・km/Day	73,210.6		
J		BRT	Vehicle・km/Day	200,227.4		
K	CO2 Emission Coefficient	Automobile	g-CO2/vehicle・km	253		
L		Motorcycle	g-CO2/vehicle・km	316		
M		Bus	g-CO2/vehicle・km	704		
N		Truck	g-CO2/vehicle・km	724		
O		BRT	g-CO2/vehicle・km	14	a vehicle is a 80-seater	
P	CO2 Emission Amount before measure		t-CO2/yr.	130,592.3		(A*K+B*L+C*M+D*N)*365/1000000
Q	CO2 Emission Amount after measure		t-CO2/yr.	108,657.6		(F*K+G*L+H*M+I*N+J*O)*365/1000000
R	CO2 Emission Reduction Amount		t-CO2/yr.	21,934.7		P-Q

Viewpoint 2 : Calculation of cost

Cost for purchasing cars: interviews to manufacturers

Cost for constructing bus stops: estimated based on past projects by our company

Cost for upgrading road: estimated based on past projects by our company

Cost for PTPS traffic light equipment: estimated from Toyama Light Rail

*costs for carbarn and a maintenance factory are excluded because the existing facilities for local buses are utilized

Construction Category	Unit	Quantity	Unit Price	Price	Offset	1USD=100JPY		Durable Period	Construction Cost / year	
			(Thousand JPY)	(Thousand JPY)		(Thousand JPY)	(Thousand USD)		(Thousand JPY)	(Thousand USD)
1. Direct Construction Cost										
BRT cars	Car	10.0	25,000	250,000	100%	250,000	2,500	10	25,000	250
Bus stop	Site	39.0	14,000	546,000	100%	546,000	5,460	30	18,200	182
Road upgrade	km	23.0	50,000	1,150,000	100%	1,150,000	11,500	30	38,333	383
PTPS signals	Intersection	25.0	20,000	500,000	100%	500,000	5,000	10	50,000	500
						0	0			
2. Design Cost	Set	1.0	50,000	50,000	100%	50,000	500	30	1,667	17
3. Reserve Fund	Set	1.0	15,900	249,600	100%	249,600	2,496	30	8,320	83
Total Project Cost (Above: K JPY, Below: K USD)							2,745,600 27,456	Total Project Cost / year (Above: K JPY, Below K USD)		141,520 1,415
tCO2/Total Project Cost (Above: K JPY, Below: K USD)	tCO2/year	21,934.7					0.15 15.50			
Total Project Cost/tCO2 (Above: K JPY, Below: K USD)	tCO2/year	21,934.7					6.45 0.06			

Viewpoint 3 : Valuation Comments

More than 90% of travel is by motorcycles in Da Nang, however, it is inconvenient to ride motorcycles with a lot of bags/luggage or on rainy days.

There are not many passengers for local buses because of unpunctual operation, unclean vehicles, and other reasons.

BRT, a mass transportation means with punctuality and speed, can solve these problems associated with travel behaviors of citizens and contribute to the control on energy demand and reduction of environmental loads.

Public transportation service of the entire city of Da Nang will significantly improve by connecting the inner city with new residential area in Ngu Hanh Son District as a means for commuting.

Viewpoint 4 : Valuation Comments

A modal shift from motorcycles and automobiles to BRT is carried forward, that can not only contribute to reduce CO2 emission but also improve city environments, such as reducing traffic noise and air pollution.

By accomplishing deliberate TOD (Transit Oriented Development) coupled with BRT, an excessive use of automobiles will be eliminated and a sustainable environmentally-friendly city can be formed.

BRT contributes to image enhancement of the city and tourism promotion by increasing convenience of mobility for tourists through creating a route along resort beaches.

Moreover, the Da Nang People’s Committee has indicated that the city is currently carrying out more detailed studies on BRT. Therefore, project team shall take the city’s BRT plan into consideration and carry out a feasibility study on BRT in the next report.

(2) - 3 Introduction of a subway system

Measures Category	Transportation
Supply or Demand	demand side

Summary and Specific Measures

(1) Premise of implementation

A subway line will be constructed (partially elevated) along a BRT line after the carrying capacity of BRT reaches its limit due to progress in TOD (Transit Oriented Development) (assumed to be 15 years later).

(2) Outline of the Railway System

A railway line will be underground from a bus station west of the airport to the right bank of Han River. The railway line will be above the ground from the east of the Han River and be an elevated track to the south.

- Length: 17.6km (underground 7.6km; elevated 10.0km)
- Stations: 14 Stations（underground : 7）
- Average station spacing: 1.35km
- Total required time: 28 minutes

(Scheduled speed: 37.7km/h)

- Operation Plan: three-car train runs at 10-minute intervals during off-peak hours and at 7.5-min intervals during peak hours.
- The number of required cars: three-car train × (9 + 1 backup) = 30 cars

We assume a railway operation with three-car trains, which is equivalent to the one planned in Ho Chi Minh.

- Area for carbarn: approximately 5ha

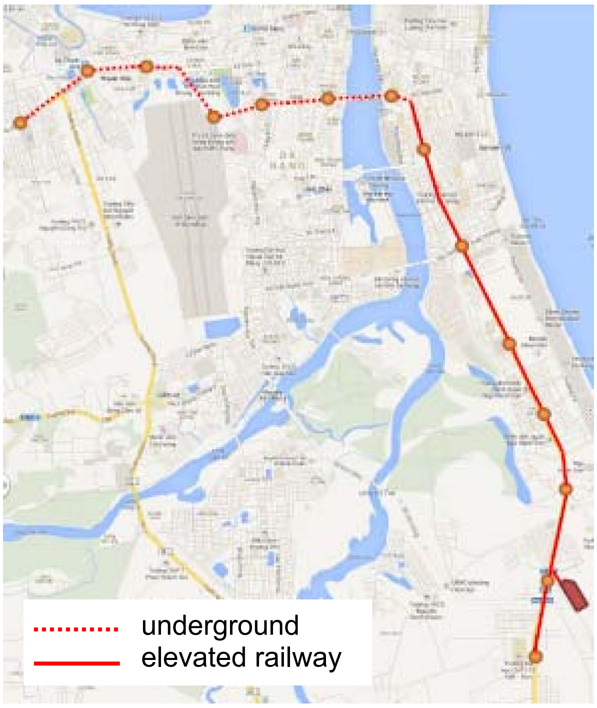


Figure. Plan of Subway System

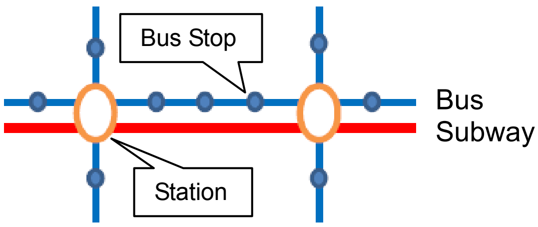


Figure. Image of Bus and Subway system

(3) Functional division with BRT (bus)

Making in-between station distance long (average 1.5km) for high-speed travel and an express service in elevated sections, so that the subway has a mutually complementary relationship with BRT which has short in-between bus stop distance. Feeder bus routes from subway stations are subsequently set up so that the public transportation system contributes to TOD-based, deliberate city formation.

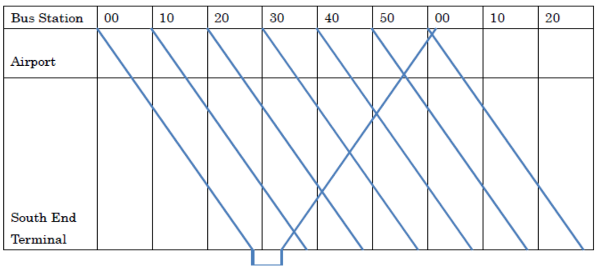


Figure. Diagram (at 10 minute intervals)

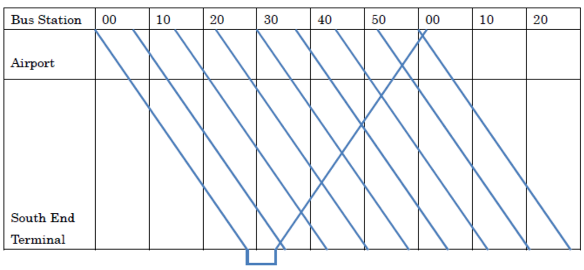


Figure. Diagram (at 7.5 minute intervals)

Showcasing Examples or Other Projects in Viet Nam

Subway projects in Japan, Belgium, Germany, and France

- In recent years, subways with a relatively small number of cars but with mass transport are being implemented.
- In Japan, case examples include subways in the cities of Kobe and Osaka and the Oedo line in Tokyo.
- Some case examples include a subway system whose carrying capacity was LRT at first, but was later the subway system was upgraded when demand increased. (e.g. ‘Premetro’ in Antwerpen, Belgium)
- Many railways run underground in inner cities and above ground in suburbs (e.g. ‘Astram Line’ in Hiroshima, Japan)

‘Linear-metro’ Kobe,Japan

‘Premetro’ Antwerpen,Belgium

‘U-Bahn’ Frankfurt(Main),Germany

‘Métro de Lyon’ Lyon,France

‘Astram line’(elevated&underground) Hiroshima,Japan

Viewpoint 1			Viewpoint 2	
tCO2/year	Project Period	tCO2/total	Initial Cost (USD)	tCO2/ 1,000USD
21,934.7	30 years	658,041.0	1,971,990,000	0.3

Viewpoint 3 (Resolve an issue)							
Re-development	○	Sprawl	◎	Landscape	△	Energy Supply	○
Viewpoint 4 (Increasing attractiveness)							
LCT	△	Resort Beach	△	Tourism	○	Sustainable	△

Evidence

Viewpoint 1 : Calculation of CO2 reduction

The subway will start its operation twenty years later.
(BRT will start its operation five years later.)
(After 15 years (BRT's initial operation), the subway will start to operate.)

Viewpoint 2 : Calculation of cost

- Based on recent subway projects in Japan, the construction costs for underground space was estimated to be 2 billion USD/km
- Construction costs for above-ground space, a carbarn, railcar shop, and a set of facilities were presumed to be the same as a subway project in Ho Chi Minh. (2.4 billion USD for 19.7km with 14 stations)

■Summary of project costs for a subway system in Ho Chi Minh

Construction costs for elevated tracks (17.2km) & carbarn (21ha): 626 million USD
Costs for a set of facilities (cars, signaling system, communication system, ticket-vending machines, etc.): 370 million USD

(Reference)
http://business.nikkeibp.co.jp/article/emf/20130613/249629/?bpnet
http://www.viet-jo.com/news/nikkei/120517111129.html

Construction Category	Unit	Quantity	Unit Price	Price	1USD=100JPY		Durable Period	Construction Cost / year	
			(Thousand JPY)	(Thousand JPY)	(Thousand JPY)	(Thousand USD)		(Thousand JPY)	(Thousand USD)
Underground space	Set	1	152,000,000	152,000,000	152,000,000	1,520,000	50	3,040,000	30,400
Elevated tracks, carbarns, railcar shop	Set	1	34,000,000	34,000,000	34,000,000	340,000	30	1,133,333	11,333
A set of facilities	Set	1	36,000,000	36,000,000	36,000,000	360,000	15	2,400,000	24,000
Total Project Cost (Above: K JPY, Below K USD)						222,000,000	Total Project Cost / year (Above: K JPY, Below K USD)		6,573,333
						2,220,000			65,733
t-CO2/Total Project Cost (Above: K JPY, Below K USD)	tCO2/yr.	21,934.7				0.003			
						0.334			
Total Project Cost/t-CO2 (Above: K JPY, Below K USD)	tCO2/yr.	21,934.7				299.677			
						2.997			

A set of facilities include: cars, signaling system, communication system, electric substation equipment, platform screen doors, ticket-vending machines, turnstiles, carbarns, etc.

Viewpoint 3 : Valuation Comments

This measure introduces a mass transit system, whose role should be divided off from that of the BRT which targets people with short-distance trips. In the future, a mass transit network should be created by connecting feeder buses to subway stations.

By bringing TOD forward with a mass transit network, disordered development can be avoided. TOD centered with a mass transit network would be effective for energy and CO2 emission reductions as per person transportation energy efficiency is high.

Viewpoint 4 : Valuation Comments

Coupled with the BRT system, a subway system helps develop an arterial traffic network and is geared toward creating a convenient Da Nang urban area.

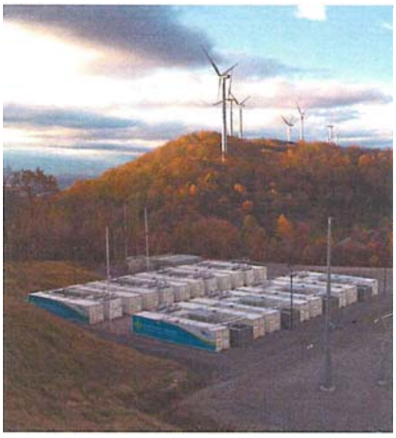
A subway system is estimated to have a great effect on the vitalization of tourism development in the future by connecting the airport, inner city, coastal resort development areas, and suburban development areas.

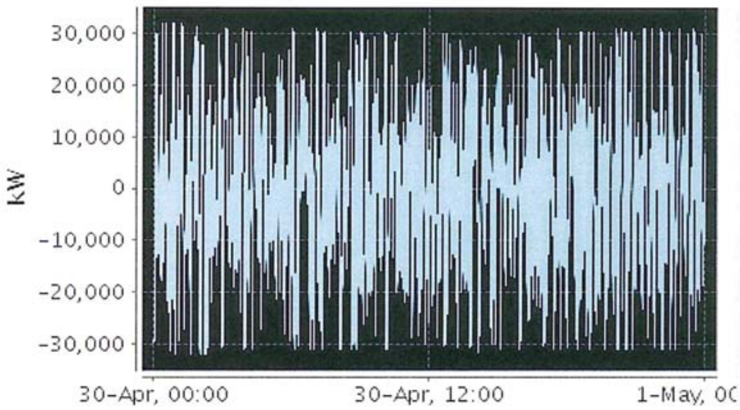
(3) - 1 Stabilization of the electric power supply through a high capacity electrical storage facility

Measures Category	Energy Management System
Supply or Demand	Both supply and demand sides

Summary and Specific Measures

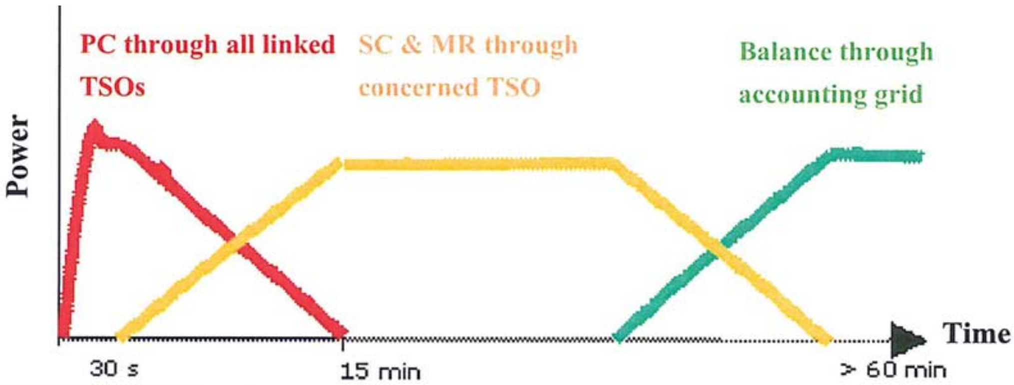
High capacity electrical storage facilities can stabilize the electric power supply. Renewable energy, such as solar and wind, deliver fluctuating power. So it is very important to stabilize the electric power supply by maintaining power quality, especially when huge renewable energy facilities are installed. Renewable energy installation requires energy grids to be transformed into bi-directional. In a bi-directional grid, being able to secure the power supply at any moment through electrical storage is indispensable.





There are two kinds of electrical storage. One is long-duration energy storage which balances between supply and demand in the long term such as in hours, days and months. Pumped storage power is the best in this class so far. There are also many kinds of batteries in development, including NAS batteries. The other kind of energy storage is short-duration energy storage which balances between supply and demand within minutes. Battery use is the best method in this class so far. The flywheel method is another example.

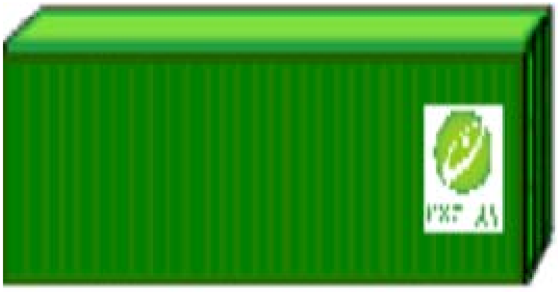
In particular, the primary frequency control (hereafter referred to as “PC”) and secondary frequency control (hereafter “SC”) are the two main stabilizations in short term applications. PC instantaneously balances between supply and demand. PC is required to respond with full power within 30 seconds and to output power for 15 minutes. SC balances between supply and demand in real time. SC is required to respond within 5 minutes and to output power for 4 hours.



Showcasing Examples or Other Projects if possible in Viet Nam

Energy Power Systems are constructed using large scale battery and power conditioners. Photo shows one module with power of 450kW and energy of 450kWh>

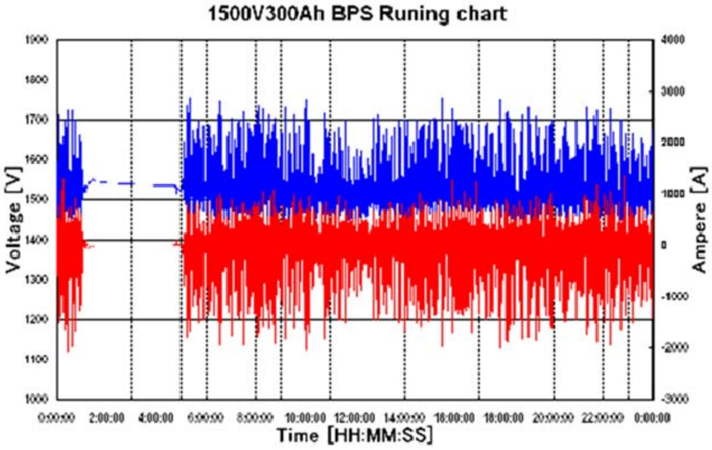
Standard Exergy Power System is shown in the photo below. A battery is installed in a 20ft container.



Discharging time,power,energy
(bench test)

time [minutes]	energy [MWh]	power [MW]
167	0.41	14.91
375	0.43	6.93
750	0.46	3.70
993	0.47	2.87
1500	0.50	2.00
1723	0.51	1.77
2628	0.53	1.20
5325	0.54	0.61

The following chart shows battery voltage [V], current [A] (Discharging, positive and charging, negative), when the battery is operating at a railway's power line. The battery voltage is almost always at 1500V with batteries which are directly connected to the power line. In this case batteries achieve power saving of 1.6GWh/year.
(This is roughly calculated next: 450kW×12h/day×365day/year)



Viewpoint 1			Viewpoint 2				
tCO2/year	Project Period	tCO2/total	Initial Cost (USD)		tCO2/ 1,000USD		
4,737.0	10 years	47,370.0	2,000,000		23.7		
Viewpoint 3 (Resolve an issue)							
Re-development	△	Sprawl	△	Landscape	△	Energy Supply	◎
Viewpoint 4 (Increasing attractiveness)sea							
LCT	○	Resort Beach	△	Tourism	△	Sustainable	○
Evidence							

Viewpoint 1 : Calculation of CO2 reduction

When using 500kWh Energy Power Systems, CO2 emission reductions can be expected.

(the power of this systems is 2MW, and energy is 500kWh)

We used 0.5408tCO2/MWh when calculating CO2 reduction.

If charge and discharge power is 2MW, the calculation is as below.

2MW × 12h/day × 365day/year=8760MWh/year

8760MWh/year × 0.5408tCO2/MWh=4737tCO2/year

Viewpoint 2 : Calculation of cost

Construction cost of Exergy Power System is 1000US$/kW. So 2MW power system's price is 2Million US$. So tCO2/US$ is 2.4. (4737/2,000)

Viewpoint 3 : Valuation Comments

Exergy Power System can be transported as to container and settled.

20ft container 6,096L × 2,438W × 2,591H 20t

Viewpoint 4 : Valuation Comments

Exergy Power System can connect up to 1TWh.

(3) - 2 Optimization of power generating facilities by peak power limitation

Measures Category	Energy Management System
Supply or Demand	Demand sides
Summary and Specific Measures	

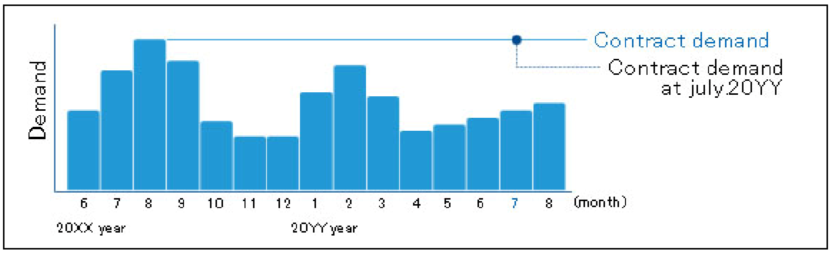
This measure is adopted for cutting down the electricity tariffs of customers by controlling the "maximum demand".

What is "maximum demand"?

"Maximum demand" is the biggest demand at the month, which is measured every thirty minutes. The more Electric equipment, the bigger the "maximum demand" becomes.

Method of determination

In Japan the contract demand between customers and supplier is the "maximum demand in the last year. When "Maximum demand" becomes bigger, so does the contract demand. As electricity tariffs depend on the contract demand, controlling the "maximum tariff" is useful for reducing electricity tariff.

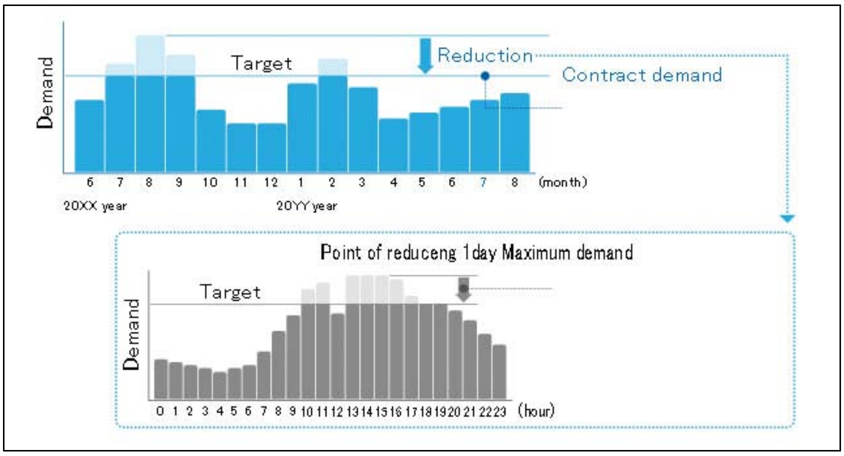


Source: TEPCO (Tokyo electric Power Company Co,. Ltd.)

What is the demand control system?

The demand control system involves customers setting the lower target of demand and controlling the lower consumption of electric equipment, so that "maximum demand" as well as contract demand is kept low.

Showcasing Examples or Other Project if possible in Viet Nam



Source: TEPCO

System outline

Demand control system monitors electricity consumption and checks and records the demand data.

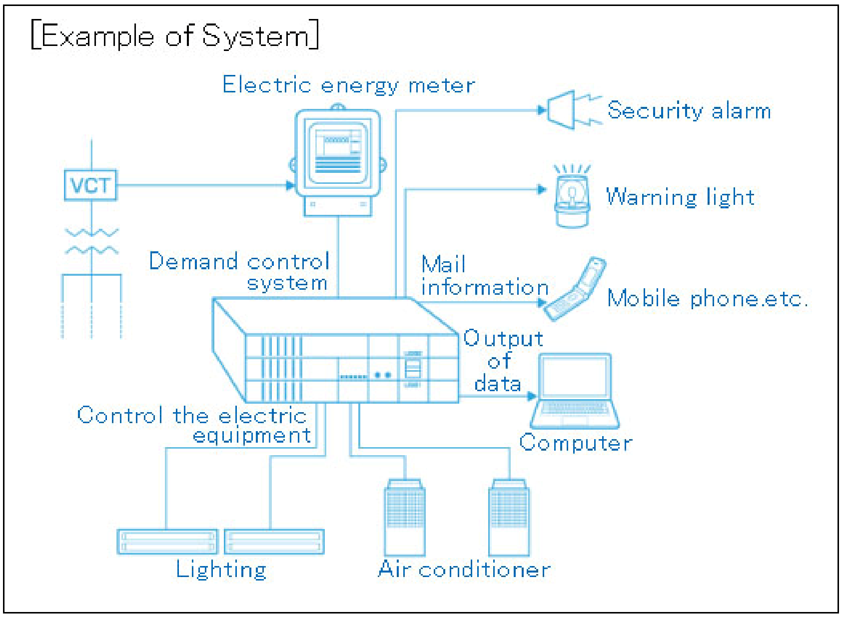
There are 2 types of systems. One type is manually operated, the other is automatically operated.

Manually operated type

This system raises an alarm when electric consumption reaches an established target. Handling of the mechanics is done manually by customers.

Automatically operated type

Electric equipment is controlled automatically. This system raises an alarm, when electricity consumption goes beyond an established target. Electric equipment is adjusted automatically in order of priority.



Source: TEPCO

<table>
<tr><th colspan="4">Viewpoint 1</th><th colspan="4">Viewpoint 2</th></tr>
<tr><th>tCO2/year</th><th colspan="2">Project Period</th><th>tCO2/total</th><th colspan="2">Initial Cost (USD)</th><th colspan="2">tCO2/ 1,000USD</th></tr>
<tr><td>-</td><td colspan="2">15 years</td><td>-</td><td colspan="2">4,700</td><td colspan="2">-</td></tr>
<tr><th colspan="8">Viewpoint 3 (Resolve an issue)</th></tr>
<tr><td>Re-development</td><td>◎</td><td>Sprawl</td><td>◎</td><td>Landscape</td><td>○</td><td>Energy Supply</td><td>△</td></tr>
<tr><th colspan="8">Viewpoint 4 (Increasing attractiveness)sea</th></tr>
<tr><td>LCT</td><td>△</td><td>Resort Beach</td><td>○</td><td>Tourism</td><td>○</td><td>Sustainable</td><td>△</td></tr>
<tr><th colspan="8">Evidence</th></tr>
</table>

Viewpoint 1 : Calculation of CO2 reduction

It can not be expected as feasible to reduce CO2 reduction by using these types of demand control systems. This is due to the fact that these types of systems are only intended to shift the peak demand to other time, not to overcome the peak demand. Thus the volume of CO2reduction is small.

When peak demand becomes small and base demand becomes large, efficient thermal powers work more than usual. This means that CO2 reduction becomes a little larger qualitatively.

In addition, customer's expenses become lower than usual.

Viewpoint 2 : Calculation of cost

An example of the installation costs of a demand control system is as follows,

Overall cost is 4.7 thousand US$ in Vietnam (0.47 million JPY in Japan) per block of mansions.

Reduced cost achieved by a demand control system is 1.9 thousand US$ (0.19 million JPY) per block of mansions. Thus the recompense period of this example would be 2.5 years.

But because the CO2 reduction volumes of demand control systems is relatively small, the CO2 reduction ratios (tCO2/US$) for this example are insufficient.

We adopt a ratio between Vietnamese prices and Japanese prices in construction costs as follows,

The exchange rate is set at 0.01 US$/JPY and the Electrical･Mechanical equipment rate is 0.01 US$/JPY.

Viewpoint 3 : Valuation Comments

This type of measure is suitable for green or re-development.

There are many candidate mansions around Ngu Hahn Son District in the future.

The landscape will remain virtually unchanged.

This type of measures has no energy supply. Its function is only demand control.

Viewpoint 4 : Valuation Comments

This type of measures is not suitable for LCT.

It has very few effects on the Resort Beach and Tourism.

None of the structures of these measures are not sustainable.

(4) - 1 A heat pump style cooling system that uses river water and ocean water

Measures Category	Area Energy Network
Supply or Demand	Demand sides

Summary and Specific Measures

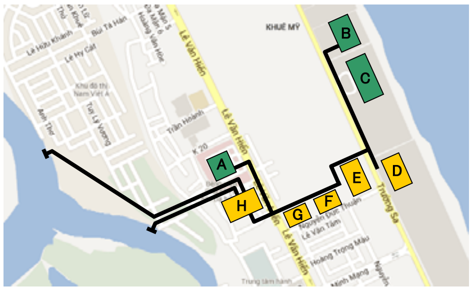
Introduction of a District Air-cooling System utilizing River Water

The applicable site of Ngu Hanh Son District is located near the sea and a river, which is a good environment for utilizing river/sea water as an untapped energy resource. Introduction of a district air-cooling system shall promote Da Nang's transformation into a low carbon environmental city as well as contribute to CO_2 reduction. Expected effects from the introduction of the measure are as follows;

(1) High efficiency in the air-conditioning heat source system through use of untapped energy
(2) Reduction of cooling capacity by consolidation of heat sources
(3) Peak shift operations by large scale thermal storage tanks
(4) Landscape friendly due to no outdoor units on the exterior of buildings.

The district intended for the introduction is shown on the schematic drawing below as a model case. The applicable buildings shall consist of five new buildings and three existing buildings. The introduced system shall be of a cool heat supply system that consists of a heat pump utilizing nearby river water and thermal storage tanks. Prospective CO_2 reduction through introduction of the measure in estimated below.

building No.	status	classification	total floor area [m2]	request of heat source [kW]	[MWh/year]
A	existing	hospital	40,000	2,400	3,600
B	existing	hotel	20,000	800	800
C	existing	hotel	30,000	1,200	1,200
D	new	apartment	20,000	800	800
E	new	office	20,000	1,600	2,400
F	new	office	20,000	1,600	2,400
G	new	office	20,000	1,600	2,400
H	new	office	40,000	3,200	4,800
total			210,000	13,200	18,400



Showcasing Examples or Other Projects in Viet Nam

District Air Conditioning System in Nakanoshima , Osaka Japan

The system was introduced along with the redevelopment of the Nakanoshima 3 Chome district, which comprised of reconstructing several high-rise buildings. A heat supply plant composed of screw heat pumps using water heat, electric turbo chillers and a large ice thermal storage tank was facilitated in the KANSAI head office building to keep electric-load level. Water from a river near the site was used as cooling water as well as the heat source. These measures which utilized waste heat from a sub-station made it possible to save energy of approximately 15% compared with an ordinary air heat souse system.

Supply area; 2.5ha　Total floor area to be supplied; 237,000m2
Supply temperature; cold water 3~5℃⇒13~15℃、hot water45~49℃⇒38~42℃
Cool heat plant; Water souse heat pump, cold water 3,082MJ/h ×8 sets
Water souse heat pump, hot water 837MJ/h ×1 set
Electric turbo chiller, cool water 5,063MJ/h
Ice thermal storage tanks; 100m3 ×8 units

Viewpoint 1			Viewpoint 2	
tCO2/year	Project Period	tCO2/total	Initial Cost (USD)	tCO2/ 1,000USD
995.1	15 years	14,926.5	12,883,000	1.2

Viewpoint 3 (Resolve an issue)							
Re-development	○	Sprawl	△	Landscape	○	Energy Supply	◎
Viewpoint 4 (Increasing attractiveness)							
LCT	◎	Resort Beach	△	Tourism	△	Sustainable	◎

Evidence

Viewpoint 1 : CO2 reduction

(1) Reduction effect of heat source capacity is assumed at 20% through means of heat source consolidation.

(2) COP (Coefficient Of Performance) based on the past results;

-2.5 to the district cooling system

-2.0 to the individual heat source

	Item	Unit	Quantity: Separate heat source system	Quantity: District heating and cooling system	Remarks	Calculation
A	Capacity of heat source	kW	13,200	10,560	Aggregated effect -20%	
B	Request of heat source	MWh/year	18,400	18,400		
C	Equipment configuration		Installing a heat source equipment to individual buildings	Inverter centrifugal chiller 600USRT*5units +Water thermal storage tank 7,000m3		
D	System COP of year		2.0	2.5	performance value on model case	
E	Electric energy of year	MWh/year	9,200	7,360		B/D
F	Emission factor	kg-CO2/kWh	0.5408	0.5408		
G	CO2 Emissions	t-CO2/year	4,975.4	3,980.3		E*F
H	CO2 Emissions Reduction	t-CO2/year		995.1		Difference G
I	Project Period	years		15		
J	Life Cycle CO2 Emissions Reduction	t-CO2		14,926.5		H*I

Viewpoint 2 : Cost Estimation

(1) Durable years for machine/equipment;15 years

	Item	Unit	Quantity: Separate heat source system	Quantity: District heating and cooling system	Remarks	Calculation
A	Capacity of heat source	kW	13,200	10,560	Aggregated effect -20%	
B	Cost of heat source	Thous.JPY	396,000	316,800	30 Thous.JPY/kW *1	unit-price*A
C	Cost of auxiliary equipment	Thous.JPY		52,800	5 Thous.JPY/kW *1	unit-price*A
D	Cost of pipe	Thous.JPY		1,100,000	500 Thous.JPY/m *1	unit-price*2,200m
E	Total (JPY)	Thous.JPY	396,000	1,469,600		B+C+D
F	Price correction rate	%	120	120	*2	
G	Total (USD)	USD	4,752,000	17,635,000	rate:1USD=100JPY	E*F*rate
H	Increased cost	USD		12,883,000		Difference G
I	Life Cycle CO2 Emissions Reduction	t-CO2		14,926.5	from Viewpoint1	
J	Cost of CO2 Emissions Reduction	USD/tCO2		863		H/I
K	Cost of CO2 Emissions Reduction	tCO2/Thous.USD		1.2		I/H*1000

Note *1 Surface utilization introduction of untapped energy guideline: Agency for Natural Resources and Energy (Japan)
*2 Adding cost of transportation and tax and so on

Viewpoint 3 : Evaluation Comments

Friendly landscaping due to the fact that there will be no installation of outdoor air conditioning units on building exteriors.

Viewpoint 4 : Evaluation Comments

This measure shall contribute to the promotion of a Low Carbon Town due to highly efficient operation utilizing untapped energy resources.

(4) - 2 Utilization of waste heat

Measures Category	Area Energy Network
Supply or Demand	Demand sides

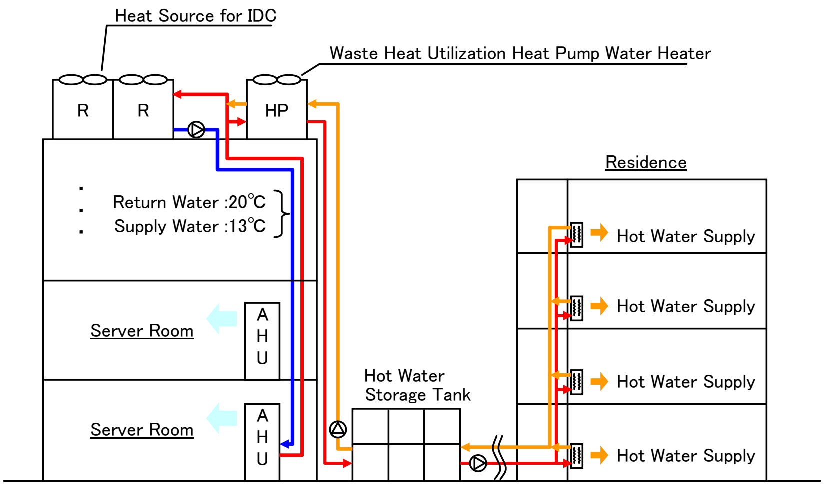
Summary and Specific Measures

Introduction of a Hot Water Supply utilizing Exhaust heat from the Data Center Building

It will be efficient to use heat exhausted from the plants, the power station, the substation, the subway and the building equipment as an untapped energy resource. These shall help to create an efficient energy supply and contribute to energy savings and CO2 reduction.

As a model case for utilizing exhaust heat, CO2 deduction effects shall be examined in the hot water supply system utilizing heat exhausted from an internet data center (total floor area; 10,000m2) which consumes a lot of power energy. The scheme of the system is shown below.

Item	Unit	Quantity
◇IDC Specification		
Total floor area	m2	10,000
Heat source equipment		Air cooled chiller unit 100USRT*4
Cold water flow	lit/h	12,000
Cold water temperature	℃	13→20
◇Demand for hot water Specification		
Number of households		200
Household members		4
Supply personnel		800
Hot water load per person	MJ/pers.day	30
Hot water load	MJ/day	24,000
Hot water load (60℃)	m3/day	127



Showcasing Examples or Other Projects in Viet Nam

Exhaust Heat Utilizing System from The Transformer in the Substation of KANSAI

source: NEWJEC design works

The covered building is the primary substation and company apartment complex. Hot water utilizing exhaust heat is supplied to the apartment rooms. Exhaust heat from cooling water used by the transformer installed at the basement floors is used as a heat source for the heat pump hot water supply system. The machine's COP (Coefficient Of Performance) performs an annual 3 point reduction; it achieves a 60% energy saving compared with an ordinary electric boiler system.

Viewpoint 1			Viewpoint 2	
tCO2/year	Project Period	tCO2/total	Initial Cost (USD)	tCO2/ 1,000USD
261.1	15	3,916.5	2,400,000	1.6

Viewpoint 3 (Resolve an issue)

Re-development	○	Sprawl	△	Landscape	△	Energy Supply	◎

Viewpoint 4 (Increasing attractiveness)

LCT	◎	Resort Beach	△	Tourism	△	Sustainable	◎

Evidence

Viewpoint 1 : CO2 reduction

① COP(Coefficient Of Performance) of the system is based on past results;

- 0.7 to individual electric boiler , -1.2 to heat pump hot water supply system

	Item	Unit	Quantity: Separate heat source system	Quantity: Utilization of waste heat system	Remarks	Calculation
A	Hot water load	MJ/day	24,000	24,000		
B	Equipment configuration		Electric water heater installed in each residence 460lit(5.4kW)*200	Water heat source heat pump hot water supply 250kW*2 +Hot water storage tank 50m3		
C	System COP of year		0.7	1.2		
D	Electric energy of day	kWh/day	9,524	5,556	for peak	A/3.6/C
E	Electric energy of year	MWh/year	1,159	676	Utilization rate 1/3	D*365/3
F	Emission factor	kg-CO2/kWh	0.5408	0.5408		
G	CO2 Emissions	t-CO2/year	626.6	365.5		E*F
H	CO2 Emissions Reduction	t-CO2/year		261.1		Difference G
I	Project Period	years		15		
J	Life Cycle CO2 Emissions Reduction	t-CO2		3,916.5		H*I

Viewpoint 2 : Cost Estimation

① Durable years for machine/equipment ; 15 years

	Item	Unit	Quantity: Separate heat source system	Quantity: Utilization of waste heat system	Remarks	Calculation
A	Number of households		200	200		
B	Cost of electric water heate	Thous.JPY	80,000		List price *50% *1	unit-price*A
C	Cost of heat source	Thous.JPY		140,000	total List price *50% *1	
D	Cost of auxiliary equipment	Thous.JPY		20,000	100 Thous.JPY/residence	unit-price*A
E	Cost of pipe	Thous.JPY		120,000	200 Thous.JPY/m *1	unit-price*600m
F	Total (JPY)	Thous.JPY	80,000	280,000		B+C+D+E
G	Price correction rate	%	120	120	*2	
H	Total (USD)	USD	960,000	3,360,000	rate:1USD=100JPY	F*G*rate
I	Increased cost	USD		2,400,000		Difference H
J	Life Cycle CO2 Emissions Reduction	t-CO2		3,916.5	from Viewpoint1	
K	Cost of CO2 Emissions Reduction	USD/tCO2		613		I/J
L	CO2 Emissions Reduction per Cost	tCO2/Thous.USD		1.6		J/I*1000

Note: *1 List price and unit price are based on manufacturer data in Japan
*2 Adding cost of transportation and tax and so on

Viewpoint 3 : Evaluation Comments

Introduction of the heat pump system will contribute to energy saving, however it will be necessary for the installed heat source equipment and the hot water storage tanks to have friendly landscaping.

Viewpoint 4 : Evaluation Comments

This measure shall contribute to the promotion of a Low Carbon Town due to high efficient operation through the introduction of a heat pump utilizing exhaust heat.

(5) - 1 Purification and power generation utilizing of biogas (digestive gas)

Measures Category	Untapped Energy
Supply or Demand	Both supply and demand sides

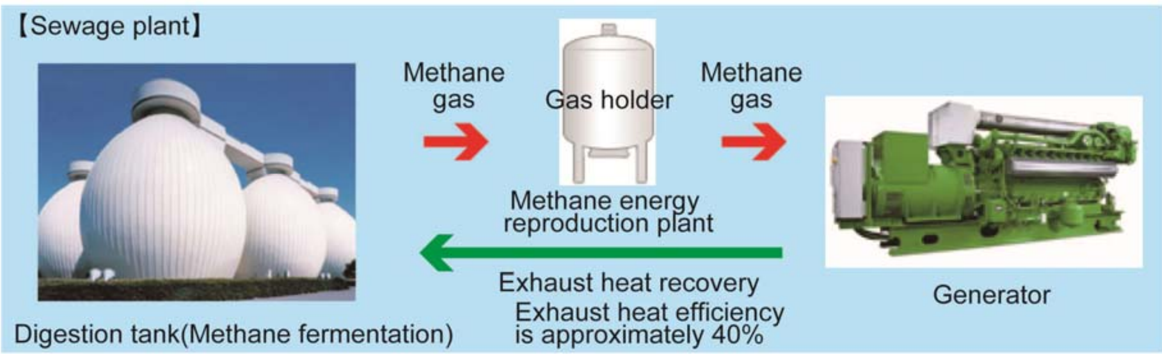
Summary and Specific Measures

The methane included in kitchen waste will be collected. In the same manner as water treatment it will undergo methane fermentation. An investigation of power generation with efficient utilization of methane gas with a power generator will be conducted.

- Cooperation will be obtained with manufacturers and universities who have advanced waste processing technologies etc. Then a basic strategy for utilizing biomass energy (sewage sludge) in Da Nang City will be established.
- For water treatment facilities that have insufficient capacity, concrete strategies will be established to increase sophistication and functionality. Particularly, valid utilization plans of sewage sludge will be compiled that keeps in mind the current method of household sewage water collection and the traits of sewage pollution's impact.

There are two processing plants in NHSD that will be the subject of facility investigations. These investigations willconsider effective utilization of biomass energy which will be brought about by methane gas emission reductions.

-Project target is Ngu Hanh Son Sewage (treatment) Plant



Showcasing Examples or Other Projects in Viet Nam

Project for outfitting power generation facilities using digestive gas from sewage plants in TSUMORI, Japan

This is a project where digestion gas that arose in the water treatment process was used to generate power. The digestion gas sent from the water treatment facility was used to its maximum extent to generate power. Along with supplying electric power within the facility, the waste heat was used and warm water was supplied. This was used to add heat to a digestion basin to promote the release of gas. The result of this was that the energy cost was reduced by approximately 1.7 billion yen over twenty years. The reduction in environmental impact was a cut in greenhouse gases of 4200 t CO_2/ year.

Viewpoint 1			Viewpoint 2	
tCO2/year	Project Period	tCO2/total	Initial Cost (USD)	tCO2/ 1,000USD
39,748.1	15 years	596,221.5	9,120,000	65.4

Viewpoint 3 (Resolve an issue)							
Re-development	○	Sprawl	○	Landscape	○	Energy Supply	◎

Viewpoint 4 (Increasing attractiveness)							
LCT	◎	Resort Beach	◎	Tourism	○	Sustainable	◎

Evidence

Viewpoint 1 : Calculation of CO2 reduction

The calculated CO2 emissions from power generation using bio gas recovered.

Contents	Unit	2010	2030	N B
popluration	person	926,018	2,502,566	Da Nang City
methane-gas volume	tCH4/year	7,476.74	12,573.88	
CO2 weight conversion	tCO2/year	157,011.54	264,051.43	greenhouse effect factor 21
volume conversion of methane weight	m3/year	11,328,393.94	19,051,329.90	Density 0.66kg/m3
methane-gas volume	m3/day	31,036.7	52,195.4	
power generator utility factor	kWh/m3	2.42	2.42	Results data 800/330
generation volume	kWh/year	20,129,159.4	33,851,864.4	80%
emission factor	tCO2/kWh	0.000541	0.000541	Viet Nam
CO2 conversion	tCO2/year	10,889.9	18,313.9	
total CO2 emission volume	t/year	167,901.4	282,365.3	Methane recovery activities+ Grid power alternative activities

Contents	Unit	2010	2030	N B
popluration	person	68,270	370,142	Ngu Hanh Son District
methane-gas volume	tCH4/year	551.22	1,770.00	
CO2 weight conversion	tCO2/year	11,575.56	37,170.06	greenhouse effect factor 21
volume conversion of methane weight	m3／year	835,177.56	2,681,822.20	Density 0.66kg/m3
methane-gas volume	m3／day	2,288.2	7,347.5	
power generator utility factor	kWh/m3	2.42	2.42	Results data 800/330
generation volume	kWh/year	1,484,007.6	4,765,267.4	80%
emission factor	tCO2/kWh	0.000541	0.000541	Viet Nam
CO2 conversion	tCO2/year	802.8	2,578.0	
total CO2 emission volume	t/year	12,378.4	39,748.1	Methane recovery activities+ Grid power alternative activities

Viewpoint 2 : Calculation of cost

(1) Initial Cost USD 9,120,000-
(2) tCO2 Emission / year 39,748.1 tCO2 / year
(3) Project Period 15 years

Item	Unit	Quantity	Unit cost	Cost	Rate	USD$1=JPY100	
			JPY	JPY		JPY	USD
1. Direct Construction Costs							
Power generation facilities	set	1.0	600,000,000	600,000,000	100%	600,000,000	6,000,000
(20,000m3/day)							
2. Design Cost	set	1.0	600,000,000	600,000,000	12%	72,000,000	720,000
3. Preliminary Cost	set	1.0	1,200,000,000	1,200,000,000	20%	240,000,000	2,400,000
Total Project Cost	JPY						**912,000,000**
	USD						**9,120,000**

1. Unit cost was calculated with reference to the performance of the Japan Sewage Works Agency.
2. Ratio was referring to the number of reports from previous years (2011 METI Project).
3. Ratio was referring to the number of reports from previous years (2012 METI Project).

Viewpoint 3 : Valuation Comments

This measure is a renewable energy initiative that uses sewage sludge, and it contributes to stabilizing the power supply. It also contributes to the utilization of re-development and visualizes the results of renewable energy to make the landscape better.

Viewpoint 4 : Valuation Comments

This measure reuses sewage sludge. It is a component of LCT, and there is the sustainability of using resources that are never exhausted. And by doing appropriate water treatment, the water quality will get better and it leads to a more beautiful resort beach scenery and increasing tourists.

(5) - 2 Biomass generation from kitchen garbage

Measures Category	Untapped Energy
Supply or Demand	Supply sides

Summary and Specific Measures

The methane included in kitchen waste will be collected. In the same manner as with water treatment it will undergo methane fermentation. An investigation of the amount of bio-gas created and the amount of power generated with efficient utilization of bio-gas with a power generator will be conducted.

There is one processing plant in Da Nang that will be the subject of facility investigations. These investigations will consider effective utilization of biomass energy brought about by kitchen waste and methane gas emission reductions.

The amount of generated waste(t/year)

Types of waste	2005	2006	2007	2008	2009
City life	204,066	218,235	186,055	188,956	203.516
Industry	4,189	4,481	3,820	3,880	4,500
Medical	1,257	1,344	1,146	1,164	1,257

Showcasing Examples or Other Projects in Viet Nam

Vietnam's first industrial waste power generation plant model project

NEDO, MONRE, and the Hanoi Peoples' Committee (HPC) have signed the formal Memorandum of Understanding (MOU) on international cooperation to promote energy efficient technologies in Viet Nam. The MOU paves the way forward for model projects of industrial waste power generation plants which feature rotary kilns and stoker incinerators with a capacity of 75 tons per day. The technology validation and feasibility study for the industrial waste power generation technology will be conducted by Hitachi Zosen, which was previously awarded the contract via a public tender process. The facility represents the first ever industrial waste incinerator and power generator built in Viet Nam. It will help to alleviate energy shortages while reducing environmental pollution by burning 75 tons per day of industrial waste that would normally go to landfill sites in Ha Noi and use the recovered waste heat to generate 1,960 kW of power. Dioxin output will be well below the designated medical waste restriction of 2.3ng-TEQ/m3N, said to be the strictest in Viet Nam, and below the equivalent Japanese regulatory limit of 0.1ng-TEQ/m3N. The following is a summary of this project.

1. Client: New Energy and Industrial Technology Development Organization (NEDO)
2. Location: Nam-son waste treatment facility (approx. 30 km north of Hanoi)
3. Plant Capacity: Rotary kiln and stoker type incinerator = 75 t/day, power generation = 1,960 kW
4. Period: Two years (2012 – 2014)

Viewpoint 1			Viewpoint 2	
tCO2/year	**Project Period**	**tCO2/total**	**Initial Cost (USD)**	**tCO2/ 1,000USD**
29,868	**15 years**	**448,020.0**	**461,365,691**	**1.0**

Viewpoint 3 (Resolve an issue)							
Re-development	○	Sprawl	◎	Landscape	○	Energy Supply	◎
Viewpoint 4 (Increasing attractiveness)							
LCT	◎	Resort Beach	○	Tourism	○	Sustainable	◎

Evidence

Viewpoint 1 : Calculation of CO2 reduction

①Calculations for CO2 emissions are generated from the present waste disposal site.

②The calculated CO2 emissions from power generation (60% methane) using bio gas recovered.

contents	unit	2010	2015	2020	2025	2030	NB
population	person	68,270	111,125	178,571	287,589	370,142	Ngu Hanh Son District
Total volume of waste	t/day	46.2	85.0	152.7	287.6	444.2	Analysis from EPRC report
(organic material)	t/day	34.5	63.5	114.0	214.7	331.6	74.7%
basic unit of CO2 emission from landfill	t/year/person	0.09976	0.11374	0.11679	0.12503	0.14696	Analysis from EPRC report
Decomposition rate	%	15.67	15.67	15.67	15.67	15.67	Ministry of the Environment (Japan)
Amount of decomposition	t/day	2.20	4.05	7.27	13.70	21.16	
Methane gas incidence output level	tCH4/t	0.13	0.13	0.13	0.13	0.13	Ministry of the Environment (Japan)
Methane gas emissions	t/day	0.286	0.526	0.945	1.781	2.751	
	t/year	104.5	192.2	345.1	650.1	1,004.0	
CO2 emission from landfill (A)	t/year	2,194.3	4,035.4	7,246.4	13,652.2	21,084.6	
generation incidence	kWh/t	182.7					Average performance in Japan (Ministry of the Environment)
generation volume	kWh/day	6,304.4	11,594.2	20,819.7	39,224.3	60,578.4	
emission factor	tCO2/kWh	0.000541					Viet Nam
CO2 emission volume (B)	t/day	3.4	6.3	11.3	21.2	32.8	100%
	t/year	914.1	1,681.0	3,018.6	5,687.1	8,783.1	80% Electricity volume to national grid
CO2 emission Volume (A)+(B)	t/year	3,108.4	5,716.4	10,265.0	19,339.3	29,867.8	

Viewpoint 2 : Calculation of cost

Item	Unit	Quantity	Unit cost	Cost	Rate	USD$1=JPY100	
			JPY	JPY		JPY	USD
1. Construction Costs							
Waste power generation pla	y/t	331.6	91,535,000	30,353,006,000	100%	30,353,006,000	303,530,060
331.6t(organic waste)/day							
2. Design Cost	set	1.0	30,353,006,000	30,353,006,000	12%	3,642,360,720	36,423,607
3. Preliminary Cost	set	1.0	60,706,012,000	60,706,012,000	20%	12,141,202,400	121,412,024
Total Project Cost	JPY	**46,136,569,120**					
	USD	**461,365,691**					

The average unit price of 3 plants in Japan(Ministry of the Environment Japan)

Viewpoint 3 : Valuation Comments

This measure is a renewable energy that uses kitchen waste, and it contributes to stabilizing the power supply. It also contributes to utilization of re-development and visualizes the result of renewable energy to make the landscape better.

Viewpoint 4 : Valuation Comments

This measure reuses kitchen waste. It is a component of LCT, and there is a sustainability of using resource that will never be exhausted.

(5) - 3 Utilizing BDF by purification of Jatropha plant oil

Measures Category	Untapped Energy
Supply or Demand	Both supply and demand sides

Summary and Specific Measures

< Summary >

An oil-rich plant, *Jatropha curcas*, is planted and BDF (biodiesel fuel) produced from its seed oil is used as a fuel for garbage trucks in Da Nang City.

<Specific Measures>

Oilseeds of *Jatropha curcas* planted in the Provinces of Quang Nam and Quang Tri are purchased in amounts of up to 500 tons per year.

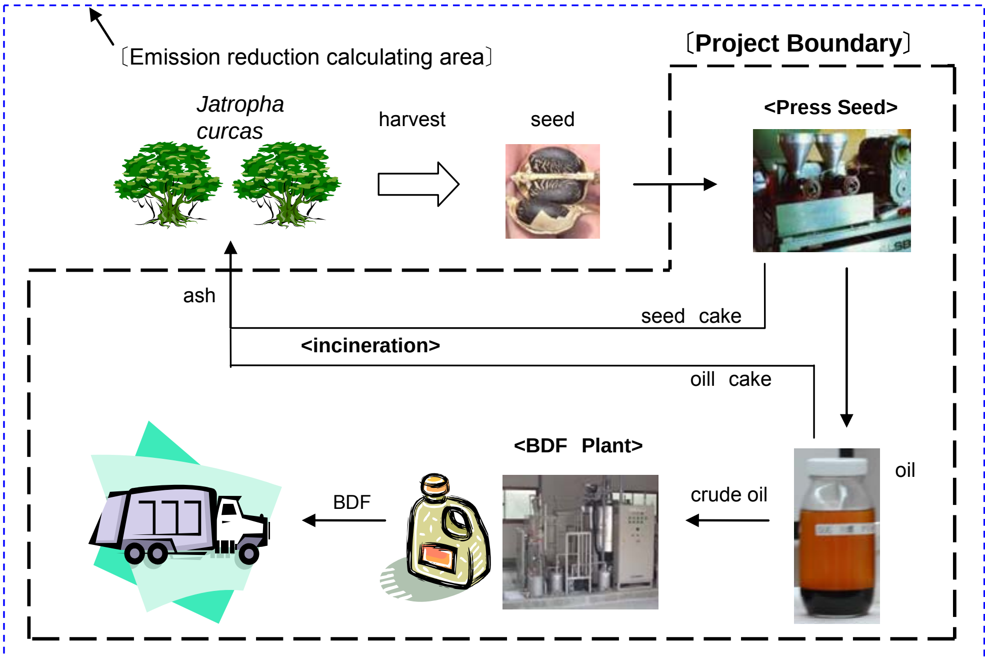
A processing plant of oil-seeds is installed in Da Nang City to press the oil-seeds.

Processed oil is transported to a biodiesel production plant where the oil is made into biodiesel.

BDF may be mixed with diesel oil (up to 20% to secure the quality) and used as a fuel for garbage trucks in Da Nang City.

Seed cakes and oil cakes are burned into ashes that may be applied to the soil of original plantations as a fertilizer.

In addition, in the case of calculating emission reductions, emissions associated with establishing a plantation and collecting oilseeds are taken into account to cover all possible factors that emit greenhouse gasses in the process of producing BDF.



Showcasing Examples or Other Projects in Viet Nam

Forest Science Institute of Vietnam planted thousands of hectares of *Jatropha curcas* in the Provinces of Ninh Thuan, Binh Dinh, Quang Nam, Quang Tri, Thua Thien Hue, Phu Tho and Son La.

PetroVietnam has been doing research to report on investments in biodiesel producing projects with a capacity of 100,000 tons/year using *Jatropha* plants from the North and the Central regions.

A Japanese company “Idemitsu Kosan Co., Ltd.” started a test cultivation of *Jatropha curcas* in June 2011 in cooperation with PV Oil in Binh Dinh.

A Japanese company “Revo International” and Vietnam Railways signed a memorandum of understanding for test runs using BDF made from *Jatropha curcas*.

Viewpoint 1			Viewpoint 2	
tCO2/year	Project Period	tCO2/total	Initial Cost (USD)	tCO2/ 1,000USD
66.9	30 years	2,007.0	89,517.5	0.8

Viewpoint 3 (Resolve an issue)							
Re-development	△	Sprawl	△	Landscape	△	Energy Supply	◎

Viewpoint 4 (Increasing attractiveness)							
LCT	◎	Resort Beach	○	Tourism	○	Sustainable	◎

Evidence

Viewpoint 1 : Calculation of CO2 reduction

<Precedent Conditions>

- Emission reductions are calculated through CDM methodology AMS III.AK "Biodiesel production and use for transportation applications" (Ver.1.0).
- As all the BDF produced is used as a fuel for garbage trucks, it is assumed that the quantity of BDF produced will equal that of BDF consumed.

<Emission Reductions>

Emission reductions are obtained by subtracting project activity emissions from baseline emissions.

1. Baseline Emissions

	Item	unit	Numbers in Ngu Hanh	Remarks	Calculation
1．	Baseline emissions				
A	Quantity Jatropha oil-seeds	t	500		
B	Quantity of BDF production per 1 ton of oil-seeds	tonne BDF (tonne Jatropha seeds.)-1	0.27	Reference 1	
C	BDF consumption	t	135		A*B
D	Emission factors of diesel oil	tCO_2/GJ	0.0741	The IPCC 2006 Guidelines	
E	Calories of BDF	GJ/tonne	37.62	Reference 2	
F	Baseline emissions	tCO_{2e}	376.33		C*D*E

Reference 1 : CRIEPI Reserch Report Y08032 "Evaluation of Potential of Jatropha Oil for Biofuel - A Case Study in Lombok, Indnesia - (2009)
2 : CDM Feasibility Study for Biodiesel Fuel (BDF) Production from Organic Oils of Jatropha and Usage for Transportation Vehicles in Viet Nam (GEC, 2010)

2. Project activity emissions

Based on "AMS III.AK "Biodiesel production and use for transportation applications" (Ver.1.0）, it is necessary to consider the following five factors as emission sources from the project.

The factor "b: Emissions due to transportation" are not included here because of the uncertainty and insignificance of the extent of emissions.

In addition, it is not necessary to consider the factor "e: CH4 emissions due to waste and drainage" as biomass wastes such as oil cakes and seed cakes are burnt up into ashes and then put back to the original plantation field.

a: Emissions associated with the cultivation of land to produce oilseeds used for the production of biodiesel/plant oil;

b: Emissions due to transportation of feedstock sources from their originating sites to the biodiesel production facility;

c: Emissions from energy use for biodiesel production;

d: Emissions from fossil fuel carbon in biodiesel due to the use of methanol from fossil origin in the trans-esterification process;

e: In certain situations CH4 emissions will be caused by stockpiling, land filling of solid waste generated by the project and from the waste water generated in the biodiesel production facility;

Item		unit	Numbers in Ngu Hanh Son	Remarks	Calculation
2．	Project activity emissions				
（1）	Cultivation of Jatropha				
G	Quantity of Jatropha oil-seeds Per 1 ha	t /ha	5	Reference 1	
H	Jatropha plantation area	ha	100		A/G
I	Default values of emission factors of oil-seed (this time : Jatropha) by climate of plantation	tCO_{2e}/ha	1.76	Default value (tropical moist) of the CDM methodology AMS III.AK “Biodiesel production and use for transportation applications”(Ver.1.0)	
J	Emissions due to cultivate Oilseed（Jatropha）	tCO_{2e}	176		H*I
（2）	Oil press and production of BDF				
K	CO_2 emissions due to processing oil-seeds	tCO_{2e}	92.1	Reference 2	
L	CO_2emissions due to BDF production	tCO_{2e}	22.8	Reference 2	
（3）	Methanol				
M	Methanol volumes consumed in the BDF production plant	t	13.5	Reference 2	C*0.1
N	Carbon emission factors of methanol	tC/tMeOH	0.375	12/32	
O	CO_2emissions due to the methanol used in the trans-esterfication process	tCO_{2e}	18.56		M*N*44/12
（4）	Project activity emissions	tCO_{2e}	309.43		

3． Emission Reductions

As mentioned above in 1 and 2, emission reductions are as follows.

376.33－309.43 ＝ 66.90 tCO_2e

View Point 2: Calculations of Cost

According to the report of CRIEPI (Reference 1), the BDF production cost (this includes the cost of harvesting collecting and processing oil-seeds, the construction cost of the BDF production plant, the cost of purchasing methanol and the cost of maintenance and administration of the facilities) amounts to US$0.61/L.

In this project, though oil-seeds are obtained by purchasing and not by harvesting and transporting, the cost is calculated by assuming that the cost of harvesting and transporting oilseeds is equal to the cost of purchasing them.

- BDF production volumes（L）

Item		Unit	Numbers	Numbers in Ngu Hanh Son	Remarks	Calculations
P	production volumes per 1 ton of oil-seed	L/oil-seed t	293.5	—	Reference 1	
Q	BDF Production Volumes	L	146,750	—		G*H*P

- Cost

Item	Unit	Numbers	Unit Price (US$)	Total cost (US$)	Remarks
BDF production cost	L	146,750	0.61	89,517.5	P*Q
Total cost per tCO_{2e} (US$)	US$ $(tCO_{2e}\cdot year)^{-1}$	66.9		1,338.0	
Emission reductions per US$1	tCO_{2e}(US$·year)−1			0.000747	

Viewpoint 3 : Valuation Comments

This project plants *Jatropha curcas* in the Provinces of Quang Nam and Quang Tri and utilizes BDF produced in Da Nang City, and thus does not contribute a great deal to the utilization of re-development, reduction in Sprawl or improvement in the landscape. The project, however, contributes to the utilization of renewable energy.

Viewpoint 4 : Valuation Comments

This project is regarded as a component factor a LCT and a sustainable society. If BDF utilization is promoted effectively to the public, it may lead to increasing the value of the resort beach and attracting more tourists.

(6) - 1 Power supplied by renewable energy such as wind power and solar power

Measures Category	Renewable Energy
Supply or Demand	Supply sides

Summary and Specific Measures

Energy that exists in nature and can be used repeatedly is called renewable energy. It includes wind energy and solar energy.

Wind power for electricity generation in urban areas is most often supplied by large-scale wind turbines that feed power into a power grid from rural locations. Wind energy production applies a technology which converts kinetic energy from wind to electrical energy. The technology consists of generating electricity by means of a wind mill which moves a turbine.

Solar energy is technology used to harness the sun's energy in the form of solar radiation and make it useable.

Besides being a clean type of energy, it also is an endless source, as opposed to other sources, such as oil and coal. The use of wind and/or solar power contributes to reducing the dependency and consumption of fossil energies and consequently reduces the corresponding gas emissions that are produced through their combustion and result in the greenhouse effect.

Wind power can be an excellent complement to a solar power system. When the sun isn't shining, the wind is usually blowing. Wind power is especially helpful in the winter to capture the both ferocious and gentle mountain winds during times of least sunlight and highest power use. In most locations wind is not suitable as the only source of power due to the inconsistency of wind conditions and its availability. Hence, it is recommended that wind energy be integrated with other renewable energy systems such as solar energy.

It is hard to expect a good result with wind power generation since the yearly average of wind velocity is only around 1.7m/s. And a huge wind power facility is inappropriate for creating scenery appropriate for a beach resort.

The yearly average solar radiation is 4.89kWh/m2/d. The numerical value is high enough to expect good results in solar power generation. Since power distribution and the electricity utility industry is a national project, it is hard to inject the power generated through solar power into a power distribution grid. Therefore, at this time, it would be hard to introduce solar power as a city project. On the other hand, the possibility of the introduction of a biogas power plant using sewage sludge is high.

Showcasing Examples or Other Projects in Viet Nam

When the solar power is introduced it is often far from a transmission network.

Viewpoint 1			Viewpoint 2	
tCO2/year	Project Period	tCO2/total	Initial Cost (USD)	tCO2/ 1,000USD
450.0	15 years	6,750.0	9,120,000	0.7

Viewpoint 3 (Resolve an issue)							
Re-development	○	Sprawl	△	Landscape	○	Energy Supply	◎

Viewpoint 4 (Increasing attractiveness)							
LCT	◎	Resort Beach	△	Tourism	○	Sustainable	◎

Evidence

Viewpoint 1 : Calculation of CO2 reduction

(1) Calculate the amount of solar power (50m times 100m) per 5,000 m2

(2) The calculated CO2 emissions from power generation (60% methane) using bio gas recovered.

Assumption

Scale facility: 100m×50m＝5,000m2

Power Output：5000m2×1kW/m2×12%＝600kW

Daily solar radiation-horizontal：4.89kWh/m2/day

Comprehensive design factor ：0.7

Emission factor ：0.000541 tCO2/kWh

Calculation

Generation volume：600kW×4.89kWh/m2/d×0.7×365/year÷1kW/m2

＝749,637kWh/year

CO2 emission Volume：0.000541 kgCO2/kWh×749,637kWh/year＝405tCO2/year

Viewpoint 2 : Calculation of cost

Item	Unit	Quantity	Unit cost JPY	Cost JPY	Rate	USD$1=JPY100 JPY	USD$1=JPY100 USD
1. Construction Costs							
Photovoltaic installation (600kw)	y/kw	600.0	1,000,000	600,000,000	100%	600,000,000	6,000,000
2. Design Cost	set	1.0	600,000,000	600,000,000	12%	72,000,000	720,000
3. Preliminary Cost	set	1.0	1,200,000,000	1,200,000,000	20%	240,000,000	2,400,000
Total Project Cost	JPY						**912,000,000**
	USD						**9,120,000**

Viewpoint 3 : Valuation Comments

This measure contributes to a reduction in greenhouse gas emissions. It also utilizes the re-development and visualizes the results of renewable energy.

Viewpoint 4 : Valuation Comments

There is sustainability in this measure since the power will never be exhausted.

(6) - 2 Ocean water pumped storage power station

Measures Category	Renewable energy
Supply or Demand	Both supply and demand sides

Summary and Specific Measures

A pumped storage power station (hereafter "PSPS") is like an enormous storage battery. It can supply electricity by generating when demand in the power grid is large and it can consume electricity by pumping up when demand in the power grid is small (See Figure "Demand Curve"). In this way PSPS can control the power voltage and frequency in the power grid. PSPS also serves as an emergency power source when nuclear or thermal power units goes offline because the start-up time for a PSPS is effectively zero and attaining full generating capacity takes only several minutes.

A typical and conventional PSPS is shown below in figure "Birds-eye view of PSPS". That PSPS has two dams (upper and lower reservoir) and uses river water. Figure "Birds-eye view of PSPS" shows "Okochi PSPS" (Hyogo Pref., Japan) of KEPCO (Kansai Electric Power Company Co,.Ltd.) who's specifications are as follows,

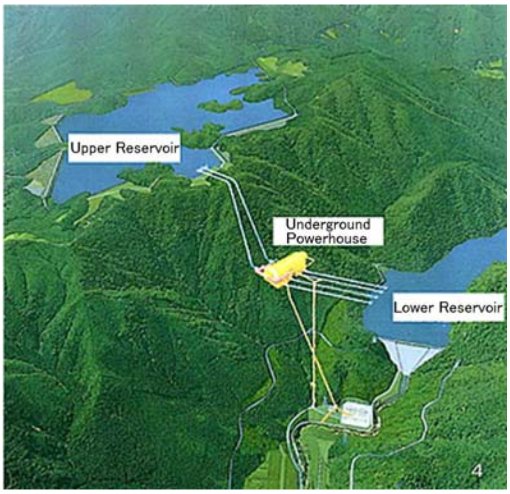
- Generating capacity-1,280MW・Maximum water discharge-382m3/s・Effective head-395m
- Generating time-6hours

If labile power sources like wind power and photovoltaic power are set up in large numbers for the LCMT or other projects, this battery type power source will be necessary in the power grid.

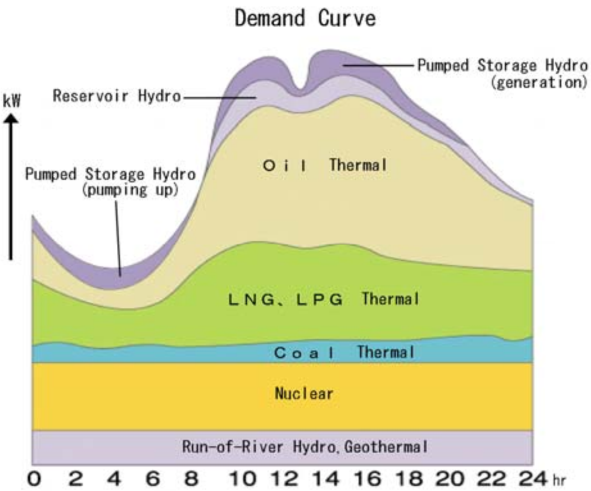
But there are no candidate sites of this type of PSPS in Ngu Hahn Son District or its surrounding areas.

Only new types of PSPS have the possibility of being constructed in this area. A new type of PSPS is Seawater PSPS. Seawater PSPS has only one dam (upper reservoir) and uses sea water.

The only candidate site of this type of PSPS is Son Tra peninsula.



Source: KEPCO



Source: Federation of electric Power Companies

Showcasing Examples or Other Projects if possible in Viet Nam

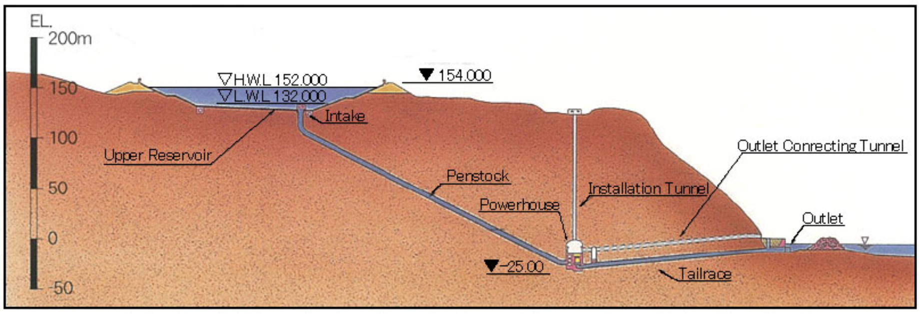
A New type PSPS is the "Okinawa Yanbaru Seawater PSPS" (Okinawa Pref., Japan) established by J-POWER (Electric Power Development Co., Ltd.) and it is the only seawater PSPS in the world.

Seawater PSPS is shown in the photo below but only the upper reservoir and outlet of PSPS is visible in the photo. The figure is general vertical section of PSPS which shows from upper reservoir to outlet. The specification of this Seawater PSPS are as follows,

- Generating capacity-30MW ・Maximum water discharge-26m3/s・Effective head-136m
- Generating time-6hours

If we were to construct Seawater PSPS in Son Tra peninsula, it would be necessary to change the upper reservoir from a reservoir type to a tunnel type because the Son Tra peninsula is not suitable for constructing a reservoir type.

Source: J-POWER



Source: Okinawa Yanbaru Seawater Pumped Storage Power Station Pamphlet

<table>
<tr><th colspan="5">Viewpoint 1</th><th colspan="3">Viewpoint 2</th></tr>
<tr><th colspan="2">tCO2/year</th><th colspan="2">Project Period</th><th>tCO2/total</th><th colspan="2">Initial Cost (USD)</th><th>tCO2/ 1,000USD</th></tr>
<tr><td colspan="2">-</td><td colspan="2">40 years</td><td>-</td><td colspan="2">256,000,000</td><td>-</td></tr>
<tr><th colspan="8">Viewpoint 3 (Resolve an issue)</th></tr>
<tr><td>Re-development</td><td>○</td><td>Sprawl</td><td>○</td><td>Landscape</td><td>◎</td><td>Energy Supply</td><td>○</td></tr>
<tr><th colspan="8">Viewpoint 4 (Increasing attractiveness)sea</th></tr>
<tr><td>LCT</td><td>△</td><td>Resort Beach</td><td>○</td><td>Tourism</td><td>○</td><td>Sustainable</td><td>◎</td></tr>
<tr><th colspan="8">Evidence</th></tr>
</table>

Viewpoint 1 : Calculation of CO2 reduction

We can't expect to reduce CO2 merely by constructing and operating one Seawater PSPS. This is because the ratio of energy generation to pumping up energy at one PSPS is 70%(generating energy / pumping up energy =0.7). But adoption of a PSPS at a constant ratio is necessary for the power grid to control power supply, power demand, stabilize power voltage and frequency and respond to emergency situations.

A small amount of adoption of PSPS may occur as CO2 increases but a large amount of adoption of PSPS may occur with CO2 reduction in the future. For example, a power grid which has only big thermal power plants and PSPS reduces CO2 emission more than now and a power grid which has only nuclear power plants and PSPS emits no CO2 emissions.

Viewpoint 2 : Calculation of cost

Example construction costs of a PSPS are as follows,

A seawater PSPS ("Okinawa Yanbaru Seawater PSPS") is 256 million US$ in Vietnam (32 billion JPY in Japan). Typical and conventional PSPS ("Okochi PSPS") is 1,398 million US$ in Vietnam (184 billion JPY in Japan). But because the CO2 reduction volume of both types of PSPS is quite limited, the CO2 reduction ratios (tCO2/US$) relative to construction costs is also quite small.

For reference, the performance as a storage battery is as follows,

A seawater PSPS is 8.5 thousand US$/kW (1.1 million JPY/kW) and 1.4 thousand US$/kWh (0.18 million JPY/kWh). A typical and conventional PSPS is 1.1 thousand US$/kW (0.14 million JPY/kW) and 0.18 thousand US$/kWh (0.024 million JPY/kWh).

In the above calculation we adopted a ratio between the Vietnamese price and the Japanese price in construction costs as follows,

The exchange was set at 0.01 US$/JPY, the civil facility rate at 0.006 US$/JPY and the Electrical・Mechanical equipment rate at 0.01 US$/JPY.

Viewpoint 3 : Valuation Comments

A PSPS is needed to be constructed when towns are developed and the demand curve becomes more complicated.

There is only one candidate site around Ngu Hahn Son District.

Almost all structures are built underground.

The function of a seawater PSPS is not only energy supply but also energy demand. It is an enormous storage battery.

Viewpoint 4 : Valuation Comments

PSPS in not related to a LCT but is involved in the power grid.

As almost all structures are built underground, there are few adverse effects on the Resort Beach and Tourism.

Almost all structures of PSPS are built underground.

PSPS is an almost Sustainable battery.

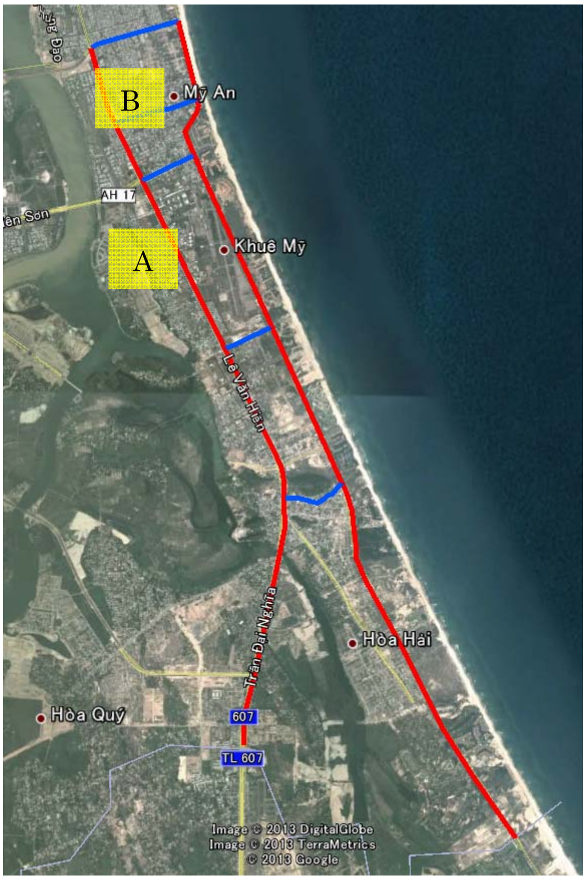
(7) - 1 Optimum management and energy conservation of street lights through LED Lighting

Measures Category	ICT Control
Supply or Demand	Demand side
Summary and Specific Measures	

- This measure reduces the power consumption of street lights and upgrades street light management by replacing the existing street lights with LEDs and by introducing optimal control through ITC.
- Some light sources for street lights include mercury lamps, high-pressure sodium lamps, and LED lamps. In recent years replacement of the existing lamps with LEDs has been taking place.
- These light sources for street lights are also being placed in Danang City, including Ngu Hanh Son District. This measure intends to reduce CO2 through reducing the energy consumption of street lights in the area through the following initiatives.

(1) Modulate high-efficient lights, such as high-pressure sodium lamps that have been recently placed mainly along major roads, by using a remote automated control system, .
Distance for introduction: 2 routes totaling 20.3km (the red routes shown in Figure below)

(2) Replace those that are relatively easy to be replaced with LED lamps, such as lights on sidewalks, and effectively modulate them with a remote automated control system.
Distance for introduction: 5 routes totaling 4.3km (the blue routes shown in Figure below)

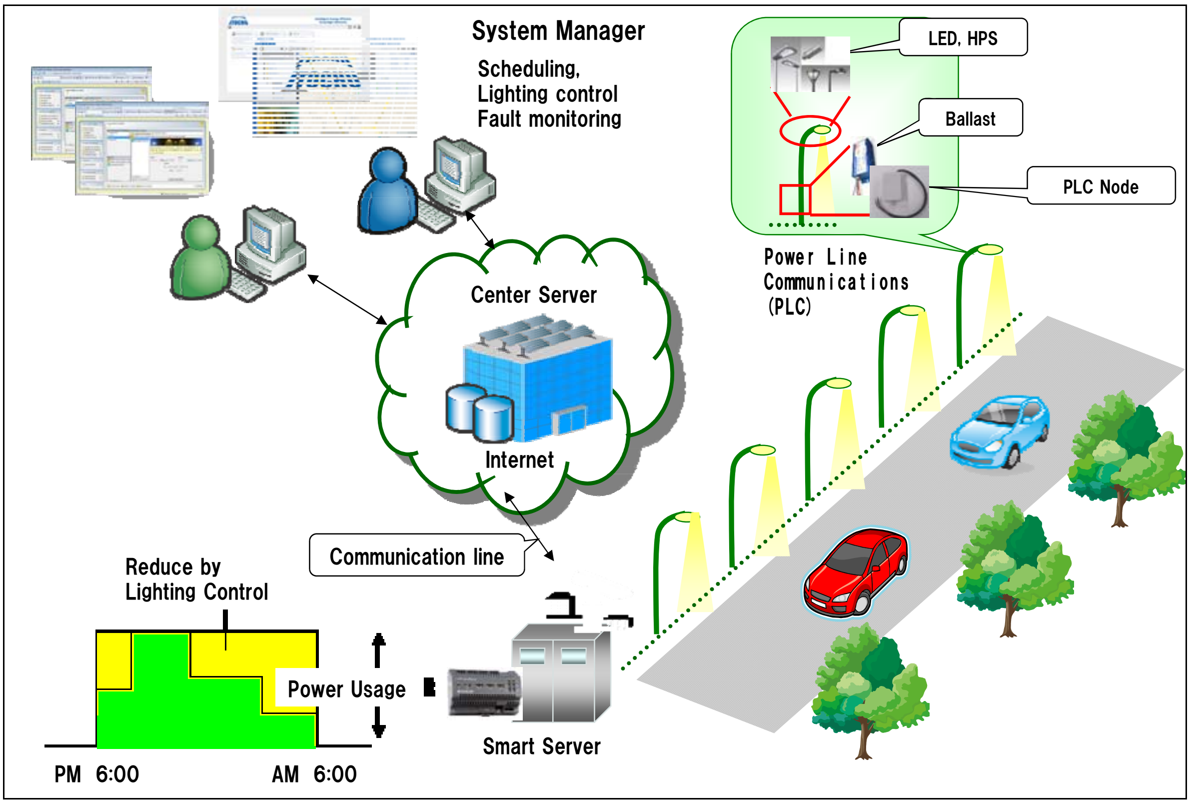


Street lights at location A

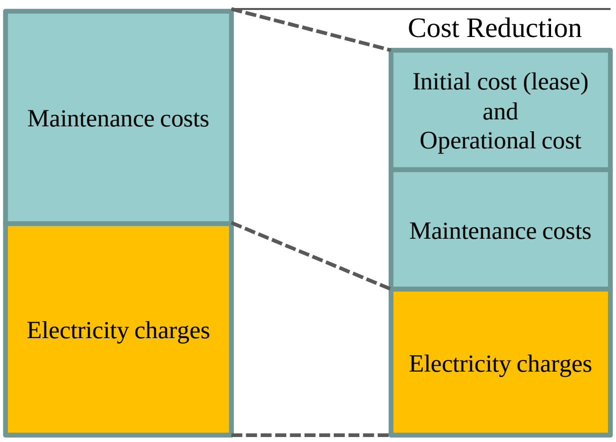
Target routes for the measure

Street lights at location B

- A smart street light system is a system that streamlines and optimizes operation using IT, through methods such as remote control of source, modulation, and fault detection.
- The system not only reduces electricity costs, but also has great effects of cost reduction on street light maintenance. Over 300 cities around the world, especially those in Europe, have adopted the system, and ITOCHU Corporation owns the system in Japan.
- In Europe, costs for system adoption are paid off within a few years due to the cost reduction effects on electricity usage and maintenance.



Source : Smart street lighting system ; ITOCHU Corporation,2012



- Costs for system introduction and operation vary depending on the areas and types of lights.
- Introducing the system reduces electricity charges and maintenance costs, thus, in most cases, the costs for system introduction and maintenance are covered by these savings.

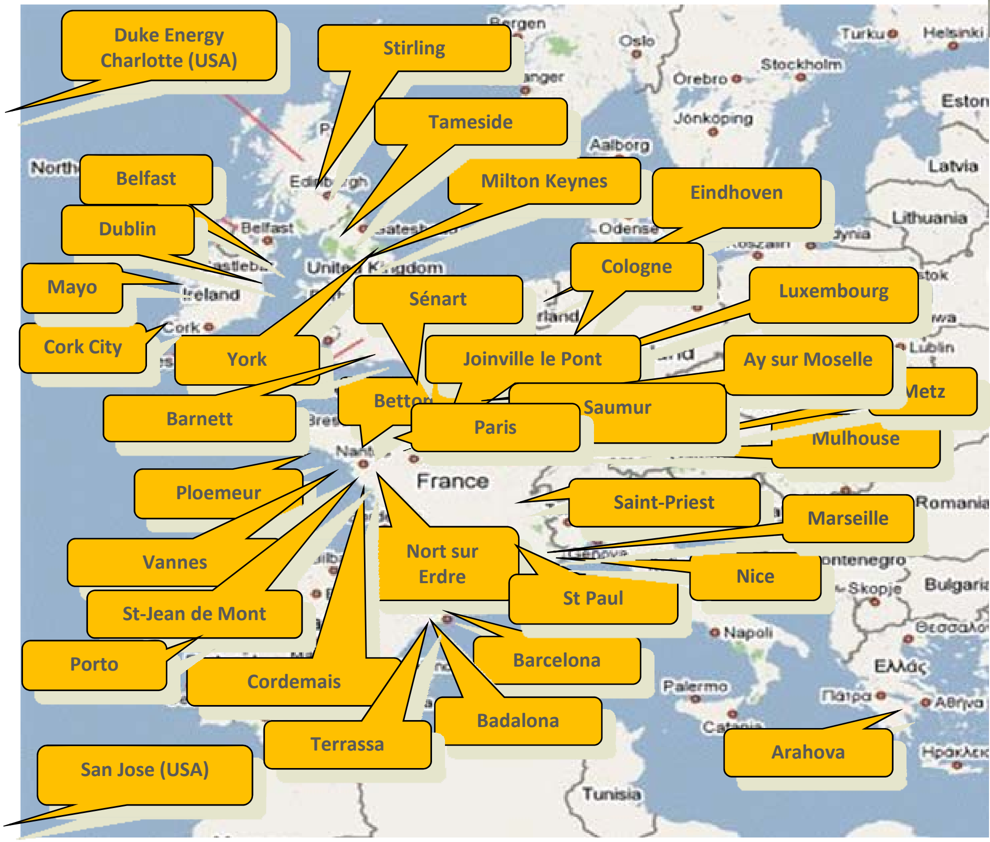
Showcasing Examples

Project: u-Poles along Cheonggyecheon in Seoul, Korea

- U-Poles (LED lamps) that can be remotely controlled were placed along the street in Cheonggyecheon when it was restored to its natural form from that of a culvert of an urban river.
- U-Poles have built-in access points (AP) for Wi-Fi and wireless mesh high functional communication networks, and they concurrently provide ubiquitous services around Cheonggyecheon, which is a tourist attraction.
- U-Poles have built-in LED lights on their sides and the tops, which can be remotely controlled to change colors in case of special events and emergencies.

Project: Introduction of smart street lights in Europe

- Over 300 cities around the world (e.g. Europe, the USA, and China) have adopted smart street lights.
- Cities in Europe that have adopted the lights are shown in the Figure below. Paris has adopted about 18,000 smart street lights with an average electricity reduction rate of 30%, and the investment is estimated to be paid off in about four years.



Case example in Paris
Average power consumption reduction rate: 30% Average light power: 200W
Average modulated light rate: 35% Payout time: about 4 years

Source：Smart street lighting system ; ITOCHU Corporation,2012

Viewpoint 1			Viewpoint 2	
tCO2/year	Project Period	tCO2/total	Initial Cost (USD)	tCO2/ 1,000USD
327.5	10 years	3,275.0	1,920,000	1.7

Viewpoint 3 (Resolve an issue)							
Re-development	○	Sprawl	○	Landscape	◎	Energy Supply	◎
Viewpoint 4 (Increasing attractiveness)							
LCT	◎	Resort Beach	◎	Tourism	○	Sustainable	◎

Evidence

Viewpoint 1 : Calculation of CO2 reduction

- 2 street lights are placed at 35m-intervals along arterial road A (20.3km). The power consumption averages 200W/light, totaling 232kw/h (1,160 lights), and these are controlled by smart street light controls.
- 2 street lights are placed at 35m-interval along arterial road B (4.3km). The power consumption averages 200W/light, totaling 49kw/h (245 lights), and these lights are replaced with LED, concurrently applied with smart street light control.
- As in Paris, we set the modulated light rate at 30% and the power consumption rate at 30% through smart street light control. In addition, replacement with LED reduces power consumption by 25%.
- Reduction amount in the power consumption of street lights through this measure totals approximately 327.5 tons/yr. as shown in the Table below.

	Category	Unit	Quantity	Description	Calculation
A	Arterial Road A Length	m	20,300	actual measurement of maps	
B	Arterial Road B Length	m	4,300		
C	Arterial Road A Street Lights	light	1,160	2 lights at 35m-interval	A/35
D	Arterial Road B Street Lights	light	245	3 lights at 35m-interval	B/35
E	Power consumption/light	W/h	300		
F	Lighting Time/day (average)	hour/day	10		
G	Annual Power Consumption of Lights	kWh	1,538,475		(C+D)*E*F*365
H	Reduction Rate by smart control	%	35	case example in Paris	
I	Annual Electricity reduced by smart control	kWh	538,466		G*H/100
J	Replacement with LED	本	245		D
K	Power Consumption Reduction Rate by LED	%	25	Specs of latest equipment	
L	Annual Electricity reduced by LED replacement	kWh	67,069		J*E*F*365*K/100/1000
M	Annual Total Power Reduction Amount	kWh	605,535		I+L
N	CO2 Emission Coefficient for Electricity	kgCO2/kWh	0.541		
O	CO2 Emission Reduction Amount	t/year	327.5		M*N/1000
	CO2 Emission Reduction Amount	t/year	327.5		

Viewpoint 2 : Calculation of cost

- Costs for facilities and construction of smart street lights: interviews with manufacturers
- Replacement of street lights with LED lamps: interviews with manufacturers

Construction Category	Unit	Quantity	Unit Price (K JPY)	Price (K JPY)	Offset	1USD=100JPY (K JPY)	1USD=100JPY (K USD)	Durable Period	Construction Cost / year (K JPY)	Construction Cost / year (K USD)
1. Direct Construction Cost										
Smart Street Light System	Set	1,405.0	1.2	1,686	100%	1,686	17	1	1,686	17
Street Lights	light	1,405.0	30	42,150	100%	42,150	422	10	4,215	42
Electric Facility	Site	1,405.0	10	14,050	50%	7,025	70	10	703	7
Replacement with LED (bulbs)	Light	245.0	400	98,000	100%	98,000	980	10	9,800	98
Electric Work for LED Replaceme	Site	245.0	10	2,450	50%	1,225	12	10	123	1
						0	0			
2. Design Cost	Set	1.0	10,000	10,000	100%	10,000	100	10	1,000	10
3. Reserve Fund	Set	1.0	16,834	16,834	100%	16,834	168	10	1,683	17
Total Project Cost (Above: K JPY, Below K USD)							176,920	Total Project Cost / year (Above: K JPY,		19,209
							1,769			192
tCO2/Total Project Cost (Above: K JPY, Below K USD)	tCO2/year	327.5					0.017			
							1.705			
Total Project Cost/tCO2 (Above: K JPY, Below K USD)	tCO2/year	327.5					58.65			
							0.59			

＊Total Project Cost/tCO2 does not include a decrease in electricity and maintenance costs

Viewpoint 3 : Valuation Comments

- This measure reduces CO2 emissions through street light control, while at the same time, it is expected to reduce maintenance costs through a remote monitoring system. The reduction of maintenance costs has significant value as roads are expected to extend in the future due to the rapid economic growth of Da Nang City.
- In particular, this system can expect to have the greatest effect if it is introduced to newly developed roads due to the fact that introduction costs can be reduced more than that of introduction to existing street lights.
- The system can also improve the area’s landscape and mitigate any adverse influences on the surrounding nature, plants, and animals because it contributes to the living environment of residential areas along the road through dimming the lights at night.

Viewpoint 4 : Valuation Comments

- In addition to street light control, this measure has great effects on developing an attractive town in the future by building on the communication infrastructure, through applications such as Wi-Fi, and adjusting the lights in tune with special events as has been done in Seoul, Korea.
- This measure has a variety of applications, such as utilizing the lights for anticrime measures by installing CCTV cameras and utilizing the lights as signals for disaster prevention.

(7) - 2 Integrated Management of Multiple Building Groups

Measures Category	ICT Control
Supply or Demand	Demand sides

Summary and Specific Measures

Integrated BEMS on Multiple Buildings

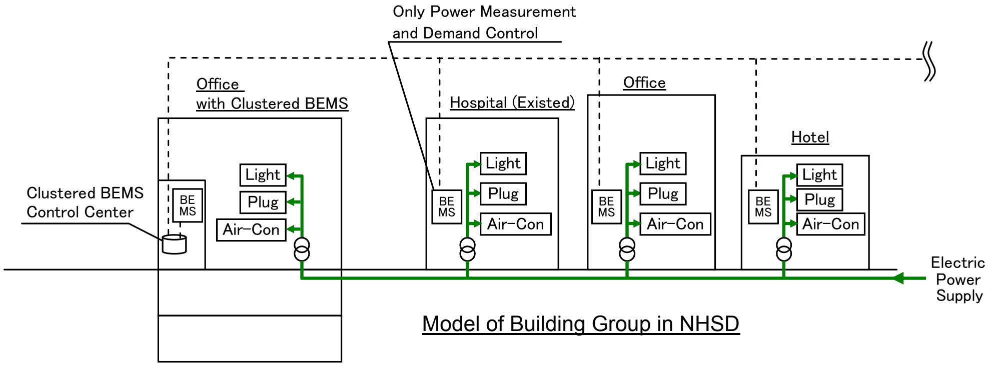
The total management of multiple buildings will make it possible for optimal allocation of power savings and maximization of demand response (DR) capabilities. An Integrated BEMS (smart BEMS) shall be effective in performing the total management system in the building cluster.

The following effects are expected through the introduction of Integrated BEMS.

- Optimal control of power storage /power generation equipment
- Peak cut operation by implementation of DR

The district anticipated for introduction is shown in the schematic drawing below as a model case. The covered buildings will consist of five newly constructed buildings and the three existing buildings. The CO2 reduction shall be examined in the case of installing an energy monitoring system for the existing buildings and the introduction of an Integrated BEMS for the newly constructed buildings.

building No.	status	classification	total floor area [m2]	Maximum Electric Power [kW]	Exited BEMS
A	existing	hospital	40,000	4,000	No
B	existing	hotel	20,000	2,000	No
C	existing	hotel	30,000	3,000	No
D	new	apartment	20,000	2,000	Yes
E	new	office	20,000	2,000	Yes
F	new	office	20,000	2,000	Yes
G	new	office	20,000	2,000	Yes
H	new	office	40,000	4,000	Yes
total			210,000	21,000	



Model of Building Group in NHSD

It should be noted that the effects of CO2 emissions reductions will be evaluated with the effects of introduction of an Integrated BEMS. The power savings effect shall be evaluated on the reduction achieved through peak cut operation.

Showcasing Examples or Other Projects in Viet Nam

Introduction of integrated BEMS on The Yokohama Smart City Project (YSCP)

"The Yokohama Smart City Project (YSCP)" has been promoted as the demonstration area for "Next Generation Energy and Social Systems" by the Japan Ministry of Economy, Trade and Industry (METI). An Integrated BEMS for multiple buildings has been introduced in the Project. DR demonstration tests for the purpose of maximizing the peak cut amount is also being carried out at the site.

source: Japan Smart City Portal website (http://jscp.nepc.or.jp/en/index.shtml)

Viewpoint 1			Viewpoint 2	
tCO2/year	**Project Period**	**tCO2/total**	**Initial Cost (USD)**	**tCO2/ 1,000USD**
90.9	**15 years**	**1,363.5**	**1,800,000**	**0.8**

Viewpoint 3 (Resolve an issue)							
Re-development	○	Sprawl	○	Landscape	△	Energy Supply	◎

Viewpoint 4 (Increasing attractiveness)							
LCT	○	Resort Beach	△	Tourism	△	Sustainable	○

Evidence

Viewpoint 1 : Calculation of CO2 reduction

1) The power saving effect of DR is examined with the following conditions shown in the table.
 - Required peak cut of 10%; duration; 20days, 4hours a day or more

	Item	Unit	Quantity	Remarks	Calculation
A	Maximum Electric Power	kW	21,000		
B	Equipment configuration		Clustered BEMS system hard and software *1unit Power measuring device to existing building *3unit Connect to the network *10unit		
C	Peak cut amount	%	10	estimated	
D	Peak cut time	hour/day	4	estimated	
E	Peak cut days	days/year	20	estimated	
F	Electric energy of peak cut	MWh	168		A*C*D*E
G	Emission factor	kg-CO2/kWh	0.5408		
H	CO2 Emissions Reduction	t-CO2/year	90.9		F*G
I	Project Period	years	15		
J	Life Cycle CO2 Emissions Reduction	t-CO2	1,363.5		H*I

Viewpoint 2 : Cost Estimation

1) Additional cost for introduction of Integrated BEMS is estimated the following conditions as shown in the table
 - Durable year for machine/ equipments; 15 years.

	Item	Unit	Quantity	Remarks	Calculation
A	Cost of Clustered BEMS system hard and software	Thous.JPY	50,000	Estimate price *50% *1	
B	Cost of Power measuring device to existing building	Thous.JPY	60,000	Estimate price *50% *1	
C	Cost of Connect to the network	Thous.JPY	40,000	Estimate price *50% *1	
D	Total (JPY)	Thous.JPY	150,000		A+B+C
E	Price correction rate	%	120	*2	
F	Total (USD)	USD	1,800,000	rate:1USD=100JPY	D*E*rate
G	Life Cycle CO2 Emissions Reduction	t-CO2	1,363.5	from Viewpoint1	
H	Cost of CO2 Emissions Reduction	USD/tCO2	1,320		F/G
I	CO2 Emissions Reduction per Cost	tCO2/Thous.USD	0.8		G/F*1000

Note: *1 Estimate price is based on manufacturer data in Japan
*2 Adding cost of transportation and tax and so on

Viewpoint 3 : Evaluation Comments

This measure shall contribute to stabilization of the energy supply in the region through DR. Further, the most energy savings can be expected if integrated with solar power and a battery system. Contribution to the landscape will not be expected due to ICT control.

Viewpoint 4 : Evaluation Comments

This measure shall contribute to the realization of an LCT through peak cut operation. Contribution to tourism and the resort shall not be expected due to the same reason mentioned above.

(7) - 3 Optimized control of traffic flow due to an ITS (Intelligent transportation system)

Measures Category	ICT Control
Supply or Demand	demand side

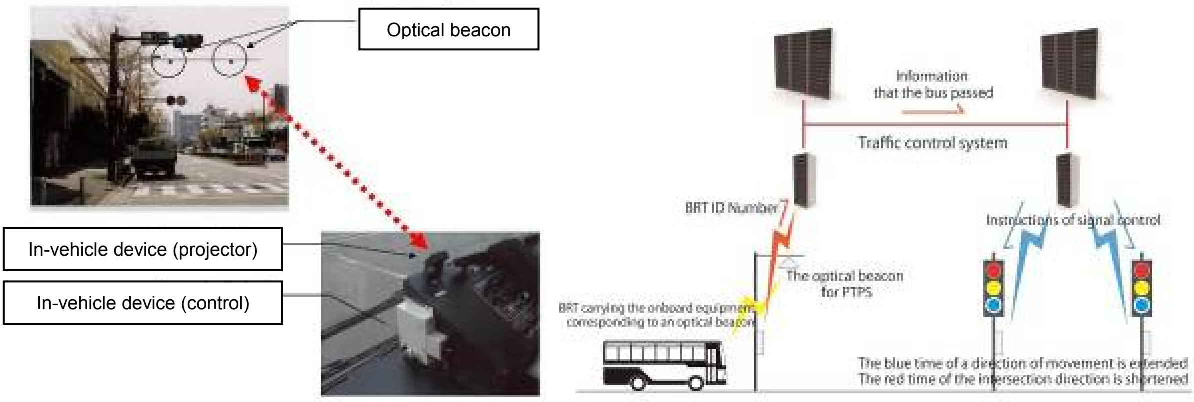
Summary and Specific Measures

- BRT is proposed as a transportation measure. To maximize the effects of BRT (speed, punctuality, high carrying capacity, etc.), optimal ICT control for traffic flows is implemented.
- An ITS (Intelligent Transport System) is a system that aspires to solve road transportation problems, such as traffic accidents, congestion, and environment improvement by networking people, roads and vehicles through ICT. Two specific measures are proposed below.

(1) Introduction of PTPS（Public Transportation Priority System）

An in-vehicle device of BRT and vehicle detectors on the street communicate bi-directionally, and traffic signals switch over to prioritize buses when BRT approaches intersections.

PTPS warns violators who drive on BRT lanes and provides notification at bus stops when buses approach.

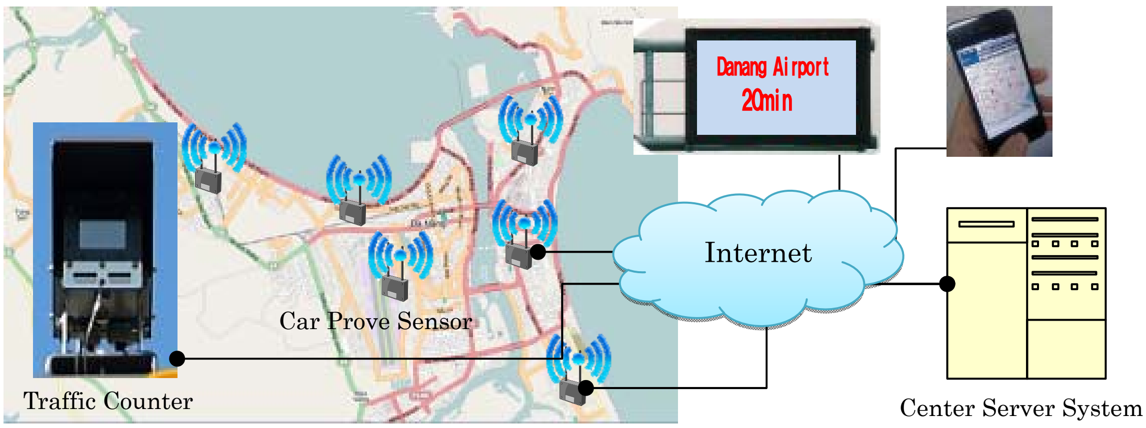


System diagram of PTPS

(2) Optimal control of traffic flow through collection & provision of road traffic information

Information (travelling speed) from GPS sensors of drivers' smartphones is collected and an information center processes the information. This is used to calculate congestion situations and the required travelling time between major locations.

Smooth traffic flows are achieved by displaying congestion sections on information boards on the street or on smartphones from collected data and by dispersing traffic flows (to avoid traffic concentration in particular roads).



Placement of road traffic sensors and ITS service in Danang

Showcasing Examples or Other Projects in Viet Nam

■Case examples of PTPS

- The first PTPS in Japan was introduced in 1995 in Sapparo, and it has been introduced across the economy due to its great effect and the demands of bus operators. (95 bus operators introduced PTPS in 40 prefectures by 2008 in Japan)
- PTPS, in combination with BRT operation, has also been introduced. (e.g. BRT in Ofunato, Japan)

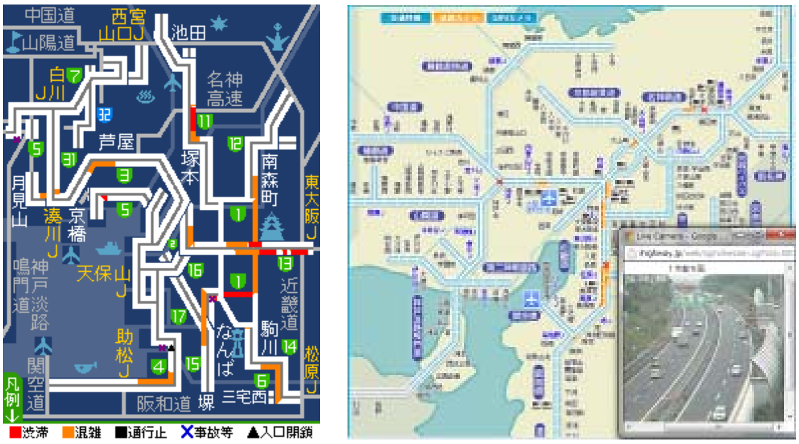
BRT in the city of Ofunato, Iwate in Japan

Traffic lights turn to green when a bus approaches

■Display information on required time to travel

- Against the backdrop of the rapid spread of smartphones in recent years, a system to distribute traffic information based on the information collected from GPS and an acceleration sensor on smartphones has been put to practical use.
- Google distributes information on congestion in major cities around the world, and the information on required time for traveling is calculated using signals from smartphones and then distributed (e.g. Calgary, CA).
- A system which displays the required time congestion points and guides to uncongested routes using traffic information from information centers has been applied in many cities around the world.

Road information provided by traffic information boards and smartphones in Japan



Distribution of information on traffic speed, travel time and accidents to cell phones (in Japan)

Viewpoint 1			Viewpoint 2	
tCO2/year	Project Period	tCO2/total	Initial Cost (USD)	tCO2/ 1,000USD
6,958.8	30 years	208,764.0	27,030,000	7.7

Viewpoint 3 (Resolve an issue)							
Re-development	△	Sprawl	△	Landscape	○	Energy Supply	△

Viewpoint 4 (Increasing attractiveness)							
LCT	◎	Resort Beach	○	Tourism	◎	Sustainable	◎

Evidence

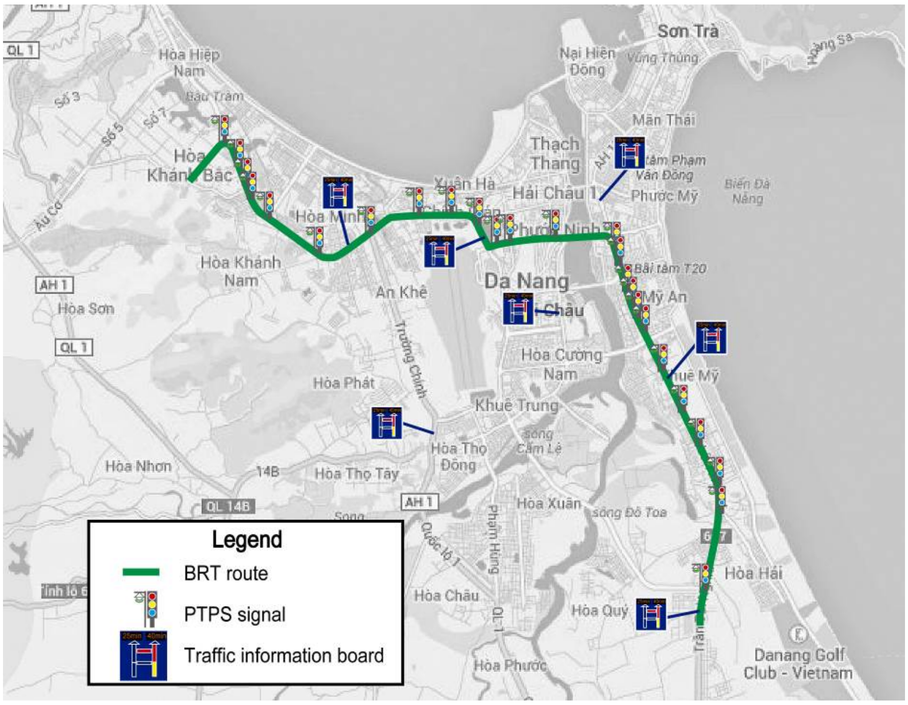


Image displaying the placement of PTPS signals and traffic information boards along the BRT line in Da Nang

<u>Viewpoint 1 : Calculation of CO2 reduction</u>

- Calculate the amount of CO2 reduction obtained through an increase of travel speeds (10 ~ 20%) of the BRT with PTPS, with a baseline of CO2 emissions set as that of the introduction of the BRT.
- Calculate CO2 reduction amounts which are obtained through an increase in the travel speeds of motorcycles and vehicles by collecting and providing travel time information.

	Category		Unit	Quantity	Description	Calculation
A	After Measure Total Travel Distance (Vehicle Kilo)	Automobile	Vehicle･km/Day	104,276.9	same as before measure	
B		Motorcycle	Vehicle･km/Day	552,074.2		
C		Bus	Vehicle･km/Day	147,453.4		
D		Truck	Vehicle･km/Day	73,210.6		
E	Before Measure CO2 Emission Coefficient	Automobile	g-CO2/vehicle･km	253	set to be 15km/h	
F		Motorcycle	g-CO2/vehicle･km	316		
G		Bus	g-CO2/vehicle･km	704		
H		Truck	g-CO2/vehicle･km	724		
I	Travel Speed Progress Rate		%	20	set from an actual case in Japan	
J	After Measure CO2 Emission Coefficient	Automobile	g-CO2/vehicle･km	239	set to be 18km/h	
K		Motorcycle	g-CO2/vehicle･km	299		
L		Bus	g-CO2/vehicle･km	668		
M		Truck	g-CO2/vehicle･km	688		
N	CO2 Emission Amount before measure		t-CO2/yr.	130,592.3		(A*E+B*F+C*G+D*H)*365/1000000
O	CO2 Emission Amount after measure		t-CO2/yr.	123,633.6		(A*I+B*J+C*K+D*L)*365/1000000
P	CO2 Emission Reduction Amount		t-CO2/yr.	6,958.8		N-O

Viewpoint 2 : Calculation of cost

- PTPS signals: obtained from past records of a light rail line in Toyama, Japan
- BRT in-vehicle device: obtained from past records in Japan
- Traffic flow control system: calculated based on past records from our company
- Information boards: past records of introduction in Japan

Construction Category	Unit	Quantity	Unit Price (Thousand JPY)	Price (Thousand JPY)	Offset	1USD=100JPY (Thousand JPY)	1USD=100JPY (Thousand USD)	Durable Period	Construction Cost / year (Thousand JPY)	Construction Cost / year (Thousand USD)
1. Direct Construction Cost										
PTPS signals	Intersection	25.0	20,000	500,000	100%	500,000	5,000	10	50,000	500
BRT built-in device	Car	9.0	100	900	100%	900	9	10	90	1
Traffic flow control system	Set	1.0	200,000	200,000	100%	200,000	2,000	10	20,000	200
Road Information Board	Site	8.0	20,000	160,000	100%	160,000	1,600	10	16,000	160
2. Design Cost	Set	1.0	30,000	30,000	100%	30,000	300	30	1,000	10
3. Reserve Fund	Set	1.0	27,010	89,090	100%	89,090	891	30	2,970	30
Total Project Cost (Above: K JPY, Below: K USD)							979,990	Total Project Cost / year (Above: K JPY, Below K USD)		90,060
							9,800			901
tCO2/Total Project Cost (Above: K JPY, Below: K USD)	tCO2/year	6,958.8					0.077			
							7.727			
Total Project Cost/tCO2 (Above: K JPY, Below: K USD)	tCO2/year	6,958.8					12.942			
							0.129			

Viewpoint 3 : Valuation Comments

Since heavy road traffic congestion does not occur currently in Da Nang City and Ngu Hanh Son District, there is no urgent need to introduce traffic flow optimal control. (However, it is desirable to make a plan at an early stage in expectation of heavy congestion brought about by an increase in vehicle traffic volumes.)

Viewpoint 4 : Valuation Comments

Introduction of PTPS, which is to be in combination with BRT, is an efficient measure to induce public transportation-oriented urban development that avoids road traffic congestion in the future. Traffic flow optimal control not only mitigates CO2 emissions by avoiding traffic congestion, but also creates an environment where tourists enjoy guidance and navigation on appropriate routes to their destinations and comfortably travel within the city. In addition, a traffic information system linked with tourist information has a great effect on the promotion of tourism.

At 2nd Implementation Board in August 2013, the Da Nang People’s Committee has stated that the ITC Center is currently being established. Da Nang city will further carry out projects regarding ITS.

(7) - 4 Integrated Management by a Smart Meter

Measures Category	ICT Control
Supply or Demand	Demand sides

Summary and Specific Measures

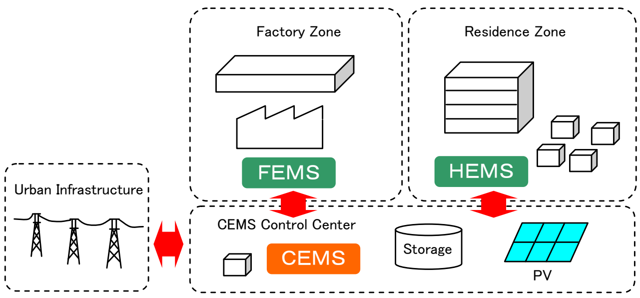
Introduction of Smart Meter and Energy Display System

A smart meter is of a digital power meter integrated with communication devices.

The Following effects are expected through the introduction of smart meters in residences.

- Automatic meter reading with the communication system
- Improvement of energy saving consciousness with visible power consumption
- Implementation of demand response (DR) through individual home networks and the internet service.
- Optimal control of power storage and power generation equipment such as solar panels.
- Stabilization and creation of an uninterruptable power supply through power storage equipment

Supposing HEMS is introduced in the industrial park including in the factories and residences in Ngu Hahn Son district, co2 reduction by HEMS shall be examined as shown below.



Item	Unit	Quantity
Industrial park area	m2	50,000
Residence area	m2	50,000
Number of firms		15
Worker population	person	250
Number of households		250
Maximum errectric power	kW	4,500
-Industry sector	kW	3,000
-Residence sector	kW	1,500
Errectric power of year	MWh	10,000
-Industry sector	MWh	9,000
-Residence sector	MWh	1,000

Model of Industrial Park in NHSD

It shall be noted that the effect of CO2 emissions reductions shall be evaluated with the effects of CEMS introduced. The power savings effect shall be evaluated for reductions through the peak cut operation and power saving effects in visible power consumption.

Showcasing Examples or Other Projects in Viet Nam

Introduction of HEMS in Kitakyushu Smart Community Project

"Kitakyushu Smart Community Project" has been promoted as the demonstration area of "Next Generation Energy and Social Systems" by the Japan Ministry of Economy, Trade and Industry (METI). HEMS with smart meters in residential areas has been introduced in the Project.

The following effects are expected with HEMS introduction.

- Increased efficiency of the meter reading business through remote meter reading
- Wireless two-way communication between control centers and homes
- Real-time displays on home monitor indicators concerning DR information
- Improvements in energy saving consciousness with visible power consumption

source: Japan Smart City Portal website (http://jscp.nepc.or.jp/en/index.shtml)

Viewpoint 1			Viewpoint 2	
tCO2/year	Project Period	tCO2/total	Initial Cost (USD)	tCO2/ 1,000USD
24.9	15 years	373.5	750,000	0.5

Viewpoint 3 (Resolve an issue)							
Re-development	○	Sprawl	○	Landscape	△	Energy Supply	◎
Viewpoint 4 (Increasing attractiveness)							
LCT	○	Resort Beach	△	Tourism	△	Sustainable	○

Evidence

Viewpoint 1 : CO2 reduction

1) The power saving effect of DR is examined with the following conditions shown in the table
   - Required peak cut; 10%; duration 60 days, more than 4 hours a day,
2) Power saving effect with a visible power consumption system is as follows;
   - 1% energy saving in the residential sector as annual amount of power.

	Item	Unit	Quantity	Remarks	Calculation
A	Maximum Electric Power	kW	1,500		
B	Electric power of year	MWh	1,000		
C	Equipment configuration		Smart Meter and Energy Display System for House *250unit		
D	Peak cut amount	%	10	estimated	
E	Peak cut time	hour/day	4	estimated	
F	Peak cut days	days/year	60	estimated	
G	Electric energy of peak cut	MWh	36		A*D*E*F
H	Reduction rate for Energy Display	%	1	estimated	
I	Electric energy of Conservation	MWh	10		B*H
J	Total of electric energy reduction	MWh	46		G+I
K	Emission factor	kg-CO2/kWh	0.5408		
L	CO2 Emissions Reduction	t-CO2/year	24.9		J*K
M	Project Period	years	15		
N	Life Cycle CO2 Emissions Reduction	t-CO2	373.5		L*M

Viewpoint 2 : Cost Estimation

1) Additional Cost of the introduction of a smart meter and the energy display system shall be estimated with the following conditions as shown in the table.
   - Durable years for machines/equipment; 15 years.

	Item	Unit	Quantity	Remarks	Calculation
A	Number of households		250		
B	Cost of Smart Meter and Energy Display System	Thous.JPY	62,500	Estimate price *50% *1	unit-price*A
C	Total (JPY)	Thous.JPY	62,500		B
D	Price correction rate	%	120	*2	
E	Total (USD)	USD	750,000	rate:1USD=100JPY	C*D*rate
F	Life Cycle CO2 Emissions Reduction	t-CO2	373.5	from Viewpoint1	
G	Cost of CO2 Emissions Reduction	USD/tCO2	2,008		E/F
H	CO2 Emissions Reduction per Cost	tCO2/Thous.USD	0.5		F/E*1000

Note: *1 Estimate price is based on manufacturer data in Japan
*2 Adding cost of transportation and tax and so on

Viewpoint 3 : Evaluation Comments

This measure shall contribute to the development of re-development as part of a smart city, and contribute to stabilization in the energy supply of the region from a view point of optimizing power storage control and demand control. Direct contribution to the landscape is not expected.

Viewpoint 4 : Evaluation Comments

This measure shall contribute to realization of LCT by the peak cut operation.
Contribution to the tourism and the resort shall not be expected so directly.

(8) - 1 Environmental education for townspeople

Measures Category	Environment
Supply or Demand	Both supply and demand sides

Summary and Specific Measures

In order to promote CO2 emission reduction measures aimed towards a LCMT, it is necessary for townspeople to enhance their understanding of environmental issues such as global warming, and to become responsible citizens. To achieve this, environmental education (EE) for townspeople is fundamentally important.
EE is one of educational systems that increases people's recognition and knowledge of environmental issues, and it is one way of fostering an environmentally responsible person.

1. Approach of Environmental Education (EE)
(1) Basic policy and system
- In EE, different approaches should be taken with different ages (sensitivity → knowledge →action). It is important to provide various opportunities to experience these approaches in nature, society, and daily life, depending on the region. Educating school pupils in particular would be effective in disseminating environmental awareness to families and the family's acquaintances in their residential area.
- Because EE is associated with various sectors such as community development, farming experience and consumer education, cooperation in the activities with other sectors are important.
- The EE approach requires a system that is functionally associated with talented people, products or services, capital, information and software.

(2) Human resources development
- In EE, the development of coordinators and facilitators who can support teachers and instructors at school and promote communication are necessary.

(3) Utilization of SNS and mass media
- In EE, the initiatives for utilizing SNS (Social Networking Services) or mass media such as television and radio are effective.

2. Presumable effects on other sectors
- Building: Environmentally educated people may prefer eco-friendly and energy-saving buildings to present energy-inefficient buildings.
- Transportation: Environmentally educated people may prefer public transportation and environmentally-friendly eco-vehicles to present traveling means.
- Energy: Energy-saving products and renewable energy will be increasingly introduced, which should reduce the overall consumption of fossil fuels.
- Waste: Environmentally-educated townspeople may contribute to downtown beautification and 3R (Reduce, Reuse, Recycle) activities.

3. Role of the local government

In EE, it is important for each sector of the central government, local governments, companies, NGOs and NPOs to work together. In particular, the role of local governments in EE is very important as indicated below.

- To show the direction and vision of environmental education based on national policies.
- To evaluate excellent initiatives and good practices from a neutral position.
- To promote EE based on the characteristics and diversity of the region.
- To provide the information about EE actively.
- To develop a sustainable community with citizen participation.
- To cooperate with relevant departments in the local government for promoting EE initiatives.

Showcasing Examples or Other Projects in Viet Nam

In Yokohama, in realizing a sustainable society, environmental education and environmental conservation activities have been promoted through voluntary collaboration and cooperation with each body such as citizens, schools, citizen's active groups, enterprises and local governments. The example of Yokohama City as an environmental model city in Japan is shown below.

(1) Documents related to environmental education

An environmental education master plan and environmental education action plan have been formulated.

(2) Delivery of an EE lecture

Staff of the Yokohama City government visit schools to give lessons on environmental issues.

(3) Eco forum for children

Workshops are held with children on topics of survey and action regarding the environment which encourages their sensitivity, capacity and performance of their own-initiatives regarding environment.

(4) Environment Month

Environmental events are held in June every year in the city.

(5) Center for environmental activities

Yokohama City provides places where people can perform environmental education and environmental activities.

(6) Information site

"Eco-porto" is a portal site for providing various types of information for those who want to know more about the environment and to take environmental actions.

(7) The Children's Eco club

This club is named "Kodomo Eco Club" and performs activities related to environmental issues. The contents of activities are decided by the club members. Yokohama City provides support for this eco club.

(8) The Yokohama environmental activities award

This award recognizes individuals, citizen's groups, enterprises or students who have made significant achievements related to environmental protection, environmental rehabilitation or environmental creation.

Delivery of an EE lecture (left) and the Yokohama environmental activities award (right)

Source: Yokohama City homepage site

Viewpoint 1			Viewpoint 2	
tCO_2/year	Project Period	tCO_2/total	Initial Cost (USD)	tCO_2/ 1,000USD
—	—	—	—	—

Viewpoint 3 (Resolve an issue)							
Re-development	○	Sprawl	○	Landscape	○	Energy Supply	○
Viewpoint 4 (Increasing attractiveness)							
LCT	○	Resort Beach	○	Tourism	○	Sustainable	◎

Evidence

Viewpoint 1 : Calculation of CO2 reduction

It is difficult to calculate the quantity of CO2 reductions resulting from environmental education. However, environmental education for townspeople is an initial approach for initiating other CO2 reduction measures aimed toward LCMT.

Viewpoint 2 : Calculation of cost

It is difficult to evaluate how much environmental education may cost us. There are various types of environmental education for townspeople, and the local government should prepare a variety of environmental education.

Viewpoint 3 : Valuation Comments

Environmental education for townspeople is the base initiative for resolving each issue in Viewpoint 3. It has very few immediate effects. However, we can expect effects in various sectors due to long-term actions.

Viewpoint 4 : Valuation Comments

Environmental education for townspeople is a basic approach for increasing the attractiveness of Viewpoint 4. It can accelerate the activities of a sustainable society.

Reference

・ Yokohama City home page ; http://www.city.yokohama.lg.jp/kankyo/kyouiku/

・ Ministry of the environment, Japan home page ;
https://edu.env.go.jp/team_rep/
http://www.env.go.jp/press/press.php?serial=15393

・ THE PLAN FOR “DEVELOPING DANNANG･THE ENVIRONMENTAL CITY”, The Department of Natural Resources and Environment 09/2008

(8) - 2 Visualizing environmental initiatives

Measures Category	Environment
Supply or Demand	Both supply and demand sides

Summary and Specific Measures

Visualizing is one way of promoting various environmental initiatives. It encourages townspeople and companies to understand and recognize the importance and need of challenging issues related to global warming (CO2 reduction). This is one form of environmental education and it may be applicable to various industrial sectors and all ages. It may lead to practical environmental education to display technical features and the principles of environmental initiatives. Visualizing environmental initiatives can be classified into three categories: visualizing low-carbon technology, visualizing energy utilization, and visualizing energy saving products and services.

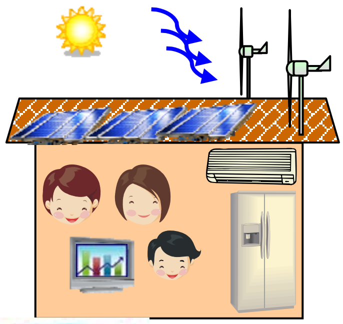
1. Making environmental initiatives visible

(1) Visualizing low-carbon technology

Visualizing low-carbon technology means making the technology of renewable energy, such as photovoltaic and wind power generation, visible at public facilities or public squares. Citizens can understand the effect directly by seeing these technologies.

(2) Visualizing energy utilization

Visualizing energy utilization means making the processes of energy consumption by home electronics as well as power generation by renewable energy visible through the displaying monitoring data. Citizens can control their energy consumption by monitoring their energy consumption.



(3) Visualizing energy saving products and services

Visualizing energy saving products and services means displaying environmental information of product items through labeling. This enables buyers to choose eco friendly services and energy-saving products when purchasing goods.

2. Effect on other sectors

- Building: The spread of eco-friendly buildings is expected through intensive introduction of advanced technology to public facilities or energy saving houses to a town.
- Transportation: The spread of eco-vehicles (eco-cars and electric motorcycles) and the use of public transportation are expected by introducing eco-vehicles into tourist spots and eco-friendly public transportation.

- Energy: The reduction of energy consumption and the use of renewable energy are expected to be brought about by installing displays for energy consumption into public facilities, factories, offices and houses.
- Waste: By providing consumers with the environment information of a product, people can come to understand understand garbage problems and the 3R principle better. Through this the formation of recycling-based society is expected.

3. Role of the local government

The role of the local government is listed below.

- To actively introduce the hardware for global warming countermeasures into public facilities
- To widely spread correct knowledge through environmental education.
- To collect and share information about visualization of environmental initiatives
- To introduce incentive policies for making environmental initiatives visible (e.g. an eco point system)

Showcasing Examples or Other Projects in Viet Nam

The example of Kitakyusyu City is shown below.

Kitakyushu City is an Eco-model city in Japan that has a system of realizing a low-carbon society through "seeing" and "feeling".

Kitakyushu City has introduced its city planning for a low-carbon society through the introduction of advanced technology energy saving houses and public transportation.

In addition, Kitakyushu City has developed a platform for environmental actions.

<table>
<tr><th colspan="3">Viewpoint 1</th><th colspan="2">Viewpoint 2</th></tr>
<tr><th>tCO2/year</th><th>Project Period</th><th>tCO2/total</th><th>Initial Cost (USD)</th><th>tCO2/ 1,000USD</th></tr>
<tr><td>—</td><td>—</td><td>—</td><td>—</td><td>—</td></tr>
</table>

<table>
<tr><th colspan="8">Viewpoint 3 (Resolve an issue)</th></tr>
<tr><td>Re-development</td><td>○</td><td>Sprawl</td><td>○</td><td>Landscape</td><td>○</td><td>Energy Supply</td><td>○</td></tr>
<tr><th colspan="8">Viewpoint 4 (Increasing attractiveness)</th></tr>
<tr><td>LCT</td><td>◎</td><td>Resort Beach</td><td>◎</td><td>Tourism</td><td>◎</td><td>Sustainable</td><td>◎</td></tr>
<tr><th colspan="8">Evidence</th></tr>
</table>

Viewpoint 1 : Calculation of CO2 reduction

It is difficult to calculate the quantity of CO2 reductions by making environmental initiatives visible. However, it will probably bring about actions for CO2 reductions.

Viewpoint 2 : Calculation of cost

It is difficult to calculate how much visualizing environmental initiatives costs. It can be classified into visualizing low-carbon technology, visualizing energy utilization and visualizing energy saving products and services. These costs of these are varied.

Viewpoint 3 : Valuation Comments

Visualizing environmental initiatives is part of environmental education. Therefore, it is not the kind of action that could resolve environmental problems immediately. However, it is an important initiative to promote the importance of urban development, landscape and energy.

Viewpoint 4 : Valuation Comments

Visualizing environmental initiatives could increase the attractiveness of the city by promoting LCT, resort beaches, tourism and a sustainable society, and it seems very effective in realizing these initiatives.

Reference

・Kitakyushu City home page (http://www.city.kitakyushu.lg.jp/kurashi/menu01_0457.html)

(8) - 3 Preservation of the natural environment and planting trees

Measures Category	Environmental Planning
Supply or Demand	—

Summary and Specific Measures

1. Preservation of the natural environment

Mt. Ngu Hanh Son and its neighboring environment is preserved and utilized as a citizen's oasis, making the citizens more conscious about their environment.

2. Planting trees

Broadleaf trees capable of resisting strong wind are planted on both sides and the center-safety-zone of the two major roads that run straight in the Ngu Hanh Son District (the seaside road is about 14km long, the land side road is about 9km long). The planting area totals 15mX23,000m = 345,000m^2 (= 34.5ha)

Showcasing Examples or Other Projects in Viet Nam

All Parties to the United Nations Framework Convention on Climate Change(UNFCCC) issue national inventories of greenhouse gas emissions and removals.

Land Use, Land-Use Change and Forestry (LULUCF) constitute a part of national inventories of greenhouse gas emissions and removals.

In the LULUCF sector, "settlement" is one of six land-use categories and it comprises of "parks and green areas" and "road sites".

Furthermore, the "Cao Phong Reforestation Project" in Vietnam has been registered as a CDM project.

Viewpoint 1			Viewpoint 2	
tCO_2/year	Project Period	tCO_2/total	Initial Cost (USD)	tCO_2/ 1,000USD
614.9	30years	18,447	1,294	480

Viewpoint 3 (Resolve an issue)							
Re-development	◎	Sprawl	◎	Landscape	◎	Energy Supply	△
Viewpoint 4 (Increasing attractiveness)							
LCT	○	Resort Beach	○	Tourism	○	Sustainable	○

Evidence

Viewpoint 1 : Calculation of CO2 reduction

1. Preservation of the natural environment

In regard to preservation of the natural environment, the main purposes of this project are to try to maintain the precious environment, secure biological diversity and, through these efforts, make citizens more conscious about their environment.

Emission reductions are not counted because preservation of the natural environment around Mt. Ngu Hanh Son does not lead directly to emission reductions or removals.

In addition, there is a concept called REDD, an abbreviation for “Reducing Emission from Deforestation and Forest Degradation”. REDD is not considered here as there exists no concrete plan to preserve a specific forest from destruction or logging.

2. Planting trees

Emissions reductions (emissions removals) through this planting project are calculated by using a default value of IPCC.

	Items	Unit	Numbers in Ngu Hanh Son	Remarks	Calculation
A	Above-ground net biomass growth	tonnes d.m. ha−1yr−1	8	The IPCC 2006 Guidelines default value (Tropical moist deciduous forest : Asia)	
B	Ratio of bellow-ground biomass to above-ground biomass	tonne root d.m. (tonne shoot d.m.)−1	0.24	The IPCC 2006 Guidelines default value (Tropical moist deciduous forest : above-ground biomass >125 tonnes ha−1)	
C	Net biomass growth	tonnes d.m. ha−1yr−1	9.92		A+A*B
D	Carbon fraction	tonne C (tonne d.m.)−1	0.49	The IPCC 2006 Guidelines default value (Tropical and Subtropical : wood, tree d ≥ 10 cm)	
E	Area	ha	34.5		
F	Emission reductions (removals)	tCO_{2e}/y	614.9		C*D*E*44/12

Viewpoint 2 : Calculation of cost

According to "*Eucalyptus* Plantations in Vietnam: Their History and Development Process - Tran Xuan Thiep", the planting cost of *Eucalyptus* plantations amounts to 700,000-800,000 dongs/ha. In this planting project for Ngu Hanh Son District, it is assumed that the cost of planting trees is much the same as *Eucalyptus* plantations, and so an average planting cost of 750,000 dongs /ha is used here.

Items	Unit	Numbers	Unit Price	Total cost (dong1=US$0.00005)	
			(dong)	(dong)	(US$)
Planting cost	ha	34.5	750,000	25,875,000	1,294
Total cost per tCO2 (US$)	US$(t$CO_{2e}$·year)−1	614.9			2.1
Emission reductions per US$1	tCO_{2e}(US$·year)−1				0.48

Viewpoint 3 : Valuation Comments

This project preserves the natural environment around Ngu Hanh Son District and plants trees along the roads.

This project contributes to the utilization of re-development, provides a 4solution of sprawl and improvement of landscape by carrying out the planned land-use.

Viewpoint 4 : Valuation Comments

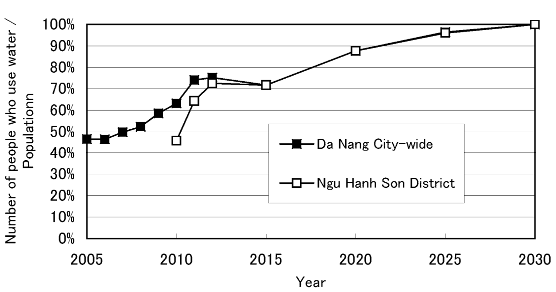
This project preserves or enlarges forests which results in the removal of CO2. Therefore, this project is regarded as a component factor of LCT and a sustainable society, which contributes to increasing the value of the resort beach and attracts more tourists.

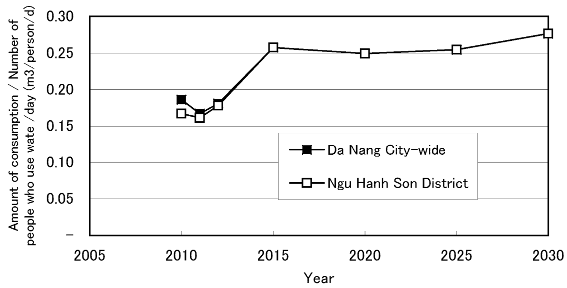
(9) - 1 Efficient management of waterworks and the water supply as well as urine power generation

Measures Category	Water Supply and Sewage
Supply or Demand	Both supply and demand sides

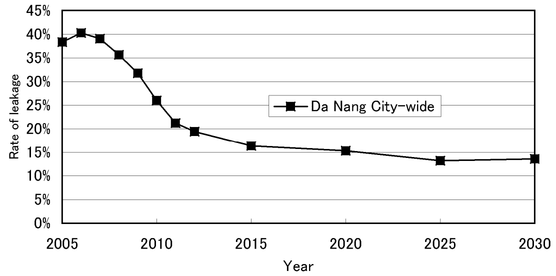
Summary and Specific Measures

The water suply coverage in Da Nang City was 63% in 2010. On the other hand, it was 46% in Ngu Hanh Son. DAWACO plans to bring th the water supply coverage up to 100% in 2030. The water consumption per person was 148L/person/day in 2005. With improvements in the standard of living, it increased to 181L/person/day in 2012. DAWACO predicts that it will be 277L/person/day in 2030 both in the whole of Da Nang City and Ngu Hanh Son.





The rate of leakage was 26% in 2010 in Da Nang City. DAWACO sets the desired rate of leakage in 2030 as 14%. This reduction of this was recommended from the perspective of conserving water resources. It also contributes to reducing consumption of power needed to implement the public water supply system. The power cost of water treatment was 0.23kwh/m3 in 2012 in Da Nang City.



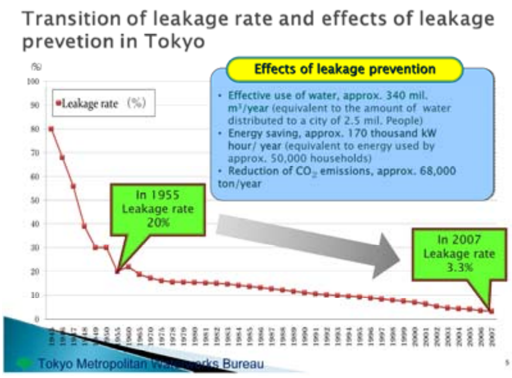
Showcasing Examples or Other Projects in Viet Nam

Transition of leakage rate and effects of leakage prevention in Tokyo

Effective use of water, approx, 340mil.m3/year (equivalent to the amount of water distributed) to a city of 2.5mil. People)

Energy saving, approx. 170thousand kWh/year (equivalent to the amount of energy used by approx. 50,000 households)

Reduction of CO2 emissions, approx. 68,000 t/year



Viewpoint 1			Viewpoint 2	
tCO2/year	Project Period	tCO2/total	Initial Cost (USD)	tCO2/ 1,000USD
577.0	1 year	577.0	-	-

Viewpoint 3 (Resolve an issue)							
Re-development	○	Sprawl	△	Landscape	○	Energy Supply	◎
Viewpoint 4 (Increasing attractiveness)							
LCT	◎	Resort Beach	△	Tourism	○	Sustainable	◎

Evidence

Viewpoint 1 : Calculation of CO2 reduction

Reducing the amount of power required for the water supply if the leakage rate is improved

contents	unit	2010	2015	2020	2025	2030	NB
population	人	68,270	111,125	178,571	287,589	370,142	Ngu Hanh Son District
basic unit of water use	m3/year/person	68.0	94.0	91.0	93.0	101.0	
The late of leakage (Current state)	%	26%	26%	26%	26%	26%	
The volume of leakage (Current state)	m3/year	1,207,014	2,715,895	4,224,990	6,953,902	9,719,929	
Electric power consumption	kWh/year	277,613	624,656	971,748	1,599,397	2,235,584	0.23kwh/m3(Y2010)
The volume of leakage (plan)	%	26%	16%	15%	13%	14%	
The late of leakage (Plan)	m3/year	1,207,014	1,710,754	2,489,289	3,529,687	5,081,665	
Electric power consumption	kWh/year	277,613	393,473	572,536	811,828	1,168,783	
Electric power reduction	kWh/year	0.0	231,182.5	399,211.3	787,569.5	1,066,800.6	
emission factor	tCO2/kWh	0.000541	0.000541	0.000541	0.000541	0.000541	
CO2 emission volume	t/year	0.0	125.1	216.0	426.1	577.1	

Viewpoint 2 : Calculation of cost

They are included in the water development construction costs that have already been scheduled. No special construction costs have been added.

Viewpoint 3 : Valuation Comments

This measure contributes to stabilization in the power supply.

Viewpoint 4 : Valuation Comments

This measure is a component of LCT. Water pipes embedded under ground are constantly subject to the danger of leakage, and when leakage occurs, these pipes pose the risk factors of secondary disasters such as poor water flow, sagging roads, inundation and so on. Leakage prevention measures are actively implemented as one of main initiatives of the Bureau since such measures have effects equivalent to a new water resources development and they prevent secondary disasters from occurring.

(9) - 2 Bio generation through utilizing of water treatment sludge

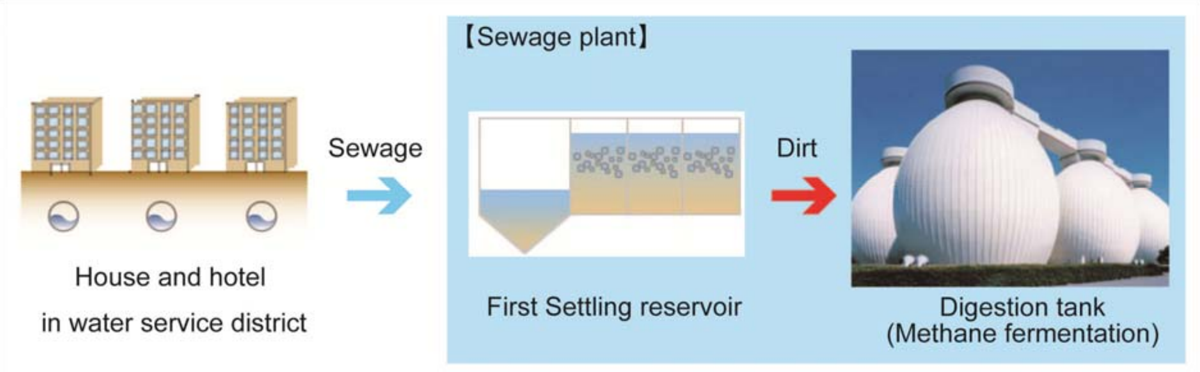
Measures Category	Water Supply and Sewage
Supply or Demand	Both supply and demand sides

Summary and Specific Measures

Processing the sewage drained from hotels and housing, generates a large amount of sludge. Generated sludge that undergoes anaerobic digestion for the purpose of stabilization and quality reduction produces biogas (about 60%methane, 40% carbon dioxide, and composed of hydrogen sulfide, etc. as well as equal amounts of methane). At the treatment plants in Da Nang, through the process of anaerobic treatment, greenhouse gas containing carbon dioxide and methane is being released into the atmosphere.

Therefore, this measure is aimed at recovering greenhouse gases that are now being released into the atmosphere and create purified biogas that can be used as fuel. In addition, It seeks to calculate the reduction of carbon dioxide associated with the recovery of greenhouse gases.

The Project target is Ngu Hanh Son Sewage (treatment) Plant.



Showcasing Examples or Other Projects in Viet Nam

The introduction of the “KOBE Bio-gas ” and a Bio-gas car project

Kobe has been taking out efforts to fuel natural gas vehicles to utilize the gas generated in the process of sewage.

This purified biogas was named "Kobe biogas." It was constructed in the processing hall eco station which supplied natural gas vehicles.

In order to promote the use of "Kobe biogas", the introduction of natural gas vehicles is being promoted for public vehicles such as dehydrated cake trucks for the sewer business and official vehicles of the city. Following completion of the facility, it will be possible to supply 2,000 m3 of "Kobe biogas" a day for fuel. This is the equivalent of fuel for 40 undoubling city buses (in the case of traveling 50km per day).

As for carbon dioxide emissions, a reduction of about 1,200 t per year is expected.

Viewpoint 1			Viewpoint 2	
tCO2/year	Project Period	tCO2/total	Initial Cost (USD)	tCO2/ 1,000USD
22,252.0	15 years	333,780.0	25,840,000	12.9

Viewpoint 3 (Resolve an issue)							
Re-development	△	Sprawl	○	Landscape	△	Energy Supply	◎
Viewpoint 4 (Increasing attractiveness)							
LCT	◎	Resort Beach	△	Tourism	△	Sustainable	◎

Evidence

Viewpoint 1 : Calculation of CO2 reduction

Calculation of CO2 emissions due in light of a (60% methane) recovery of bio gas being generated from Ngu Hanh Son sewage treatment plant through anaerobic treatment.

contents	unit	2010	2030	NB
popluration	person	926,018	2,502,566	Da Nang City
sewage output level	L/person･day	163.0	180.0	
water quality (BOD)	mg/L	38.0	200.0	average
sewage volume	m3	150,940.9	450,461.9	
water quality (BOD)	kg/day	5,735.8	90,092.4	
bio-gas incidence output level	m3/kg	0.55	0.55	results Data
bio-gas incidence volume	m3/day	3,154.7	49,550.8	
methane-gas emission volume	t/year	690,871.75	10,851,626.69	60 per of bio-gas
	t/year	455.98	7,162.07	density 0.66kg/m3
(1) CO2 conversion	t/year	9,575.5	150,403.5	greenhouse effect factor 21
power generator utility factor	kWh/m3	12.79	12.79	results Data
generation volume	kWh/yaer	13,516,637.6	212,307,864.4	335 day drive
emission factor	tCO2/kWh	0.000541	0.000541	Viet Nam
(2) CO2 conversion	t/year	7,312.5	114,858.6	
total CO2 emission volume	t/year	**16,888.0**	**265,262.1**	

contents	unit	2010	2030	NB
popluration	person	68,270	370,142	Ngu Hanh Son District
sewage output level	L/person･day	163.0	180.0	
water quality (BOD)	mg/L	38.0	200.0	
sewage volume	m3	11,128.0	66,625.6	
water quality (BOD)	kg/day	422.9	13,325.1	
bio-gas incidence output level	m3/kg	0.55	0.55	results Data
bio-gas incidence volume	m3/day	232.6	7,328.8	
methane-gas emission volume	t/year	50,934.01	1,605,009.74	60 per of bio-gas
		33.62	1,059.31	density 0.66kg/m3
(1) CO2 conversion	t/year	705.9	22,245.4	greenhouse effect factor 21
power generator utility factor	kWh/m3	12.79	12.79	results Data
generation volume	kWh/yaer	387.0	12,193.7	90% drive
emission factor	tCO2/kWh	0.000541	0.000541	Viet Nam
(2) CO2 conversion	t/year	0.2	6.6	
total CO2 emission volume	t/year	**706.2**	**22,252.0**	

Viewpoint 2 : Calculation of cost

(1) Initial Cost USD 25,840,000-

(2) tCO2 Emission / year 12,349.7 tCO2 / year (Average:2015-2030)

(3) Project Period 15 years

Item	Unit	Quantity	Unit cost	Cost	Rate	USD$1=JPY100	
			JPY	JPY		JPY	USD
1. Direct Construction Costs							
Gas Purification equipment	set	1.0	1,700,000,000	1,700,000,000	100%	1,700,000,000	17,000,000
(300m3/hr)×2							
2. Design Cost	set	1.0	1,700,000,000	1,700,000,000	12%	204,000,000	2,040,000
3. Preliminary Cost	set	1.0	3,400,000,000	3,400,000,000	20%	680,000,000	6,800,000
Total Project Cost	JPY						**2,584,000,000**
	USD						**25,840,000**

1. Unit cost was calculated with reference to the performance levels in Japan.
2. The ratio was referring to a number of reports from previous years (2011 METI Project).
3. The ratio was referring to a number of reports from previous years (2012 METI Project).

Viewpoint 3 : Valuation Comments

By using recovered greenhouse gases through the anaerobic process, purified biogas of a high purity, such as carbon dioxide and methane are generated , and this measure can be expected to improve the environment (such as air quality) near the treatment plant.

Viewpoint 4 : Valuation Comments

This measure intends to focus on existing resources in the sewage treatment plant in order to create a low-carbon treatment plant. More people can live using highly purified resources that will not be depleted. This measure can be used to take advantage of biogas as fuel for cars or buses, contributing to low carbon urban development.

3.5.2 Comprehensive Evaluation of Each Model Measure

The following table is a list of evaluating measures for each category from four viewpoints (Tables 3.5.1-3.5.4)

Table 3.5.1 Comprehensive Evaluation of Each Model Measure (1/2)

Model Measures		Viewpoint1 (tCO2/total)	Viewpoint2 (tCO2total /1,000USD)	Evidence
Buildings	Introduction of a system of comprehensive environmental benchmarks that target buildings	176,461.5	181.0	(1)-1
		◎	◎	
	Deciding on an energy-saving architectural plan that considers reducing the thermal load.	38,628.0	103.0	(1)-2
		○	○	
Transportation	Facilitation of the spread of electric motor-bikes and charging facilities	574,831.0	1,197.5	(2)-1
		◎	◎	
	Introduction of a Bus Rapid Transit system	658,041.0	15.5	(2)-2
		◎	○	
	Introduction of a subway system	658,041.0	0.3	(2)-3
		◎	△	
Energy Management System	Stabilization of the electric power supply through a high capacity electrical storage facility	4,7370.0	23.7	(3)-1
		○	○	
	Optimization of power generating facilities by peak power limitation	-	-	(3)-2
		-	-	
Area Energy Network	A heat pump style cooling system that uses river water and ocean water	14,926.5	1.2	(4)-1
		○	△	
	Utilization of waste heat	3,916.5	1.6	(4)-2
		△	△	
Untapped Energy	Purification and power generation utilizing of biogas (digestive gas)	596,221.5	65.4	(5)-1
		◎	○	
	Biomass generation from kitchen garbage	448,020.0	1.0	(5)-2
		◎	△	
	Utilizing BDF by purification of Jatropha plant oil	2,007.0	0.8	(5)-3
		△	△	

CO2 reduction is large ◎:3 Points, CO2 reduction is normal ○:2 Points,
CO2 reduction is small △:1 Point, No CO2 reduction or Carbon-neutral - :0 Point

Table 3.5.1 Comprehensive Evaluation of Each Model Measure (2/2)

Model Measures		Viewpoint1 (tCO2/total)	Viewpoint2 (tCO2total /1,000USD)	Evidence
Renewable Energy	Power supplied by renewable energy such as wind power and solar power.	6,750.0	0.7	(6)-1
		△	△	
	Introduction of an ocean water pumped storage power station that guarantees stability of the power supply	-	-	(6)-2
		-	-	
ICT Control	Optimum management and energy conservation of the street lights through LED lighting	3,275.0	1.7	(7)-1
		△	○	
	Integrated management of multiple building groups	1,363.5	0.8	(7)-2
		△	△	
	Optimized control of traffic flow due to an ITS (Intelligent transportation system)	208,764.0	7.7	(7)-3
		◎	○	
	Integrated management by a Smart Meter	373.5	0.5	(7)-4
		△	△	
Environment	Environmental education for townspeople	-	-	(8)-1
		-	-	
	Visualizing environmental initiatives	-	-	(8)-2
		-	-	
	Preservation of the natural environment and planting trees	18,447.0	480.0	(8)-3
		○	◎	
Water Supply and Sewage	Efficient management of waterworks and the water supply as well as urine power generation	557.0	-	(9)-1
		△	-	
	Bio generation through utilizing of water treatment sludge	333,780.0	12.9	(9)-2
		◎	○	

CO2 reduction is large ◎:3 Points
CO2 reduction is normal ○:2 Points
CO2 reduction is small △:1 Point
No CO2 reduction or Carbon-neutral - :0 Point

Table 3.5.2 Comprehensive Evaluation of Each Model Measure (1/2)

Model Measures		Viewpoint3				Total Score
		Re-develo pment	Sprawl	Deterioration of the Landscape	Energy Supply	
Buildings	Introduction of a system of comprehensive environmental benchmarks that target buildings	◎	△	◎	○	5
	Deciding on an energy-saving architectural plan that considers reducing the thermal load.	○	△	○	◎	6
Transportation	Facilitation of the spread of electric motor-bikes and charging facilities	◎	△	○	-	3
	Introduction of a Bus Rapid Transit system	◎	◎	○	-	5
	Introduction of a subway system	○	◎	△	○	4
Energy Management System	Stabilization of the electric power supply through a high capacity electrical storage facility	△	△	△	◎	2
	Optimization of power generating facilities by peak power limitation	◎	◎	○	△	5
Area Energy Network	A heat pump style cooling system that uses river water and ocean water	○	△	○	◎	4
	Utilization of waste heat	○	△	△	◎	3
Untapped Energy	Purification and power generation utilizing of biogas (digestive gas)	○	○	○	◎	5
	Biomass generation from kitchen garbage	○	◎	○	◎	6
	Utilizing BDF by purification of Jatropha plant oil	△	△	△	◎	2

To solve problems ◎: 2 points

To solve problems with conditions ○: 1 point,

To solve problem a little △: 0 point

Table 3.5.2 Comprehensive Evaluation of Each Model Measure (2/2)

Model Measures		Viewpoint3				Total Score
		Re-develo pment	Sprawl	Deterioration of the Landscape	Energy Supply	
Renewable Energy	Power supplied by renewable energy such as wind power and solar power.	○	△	○	◎	4
	Introduction of an ocean water pumped storage power station that guarantees stability of the power supply	○	○	◎	○	5
ICT Control	Optimum management and energy conservation of the street lights through LED lighting	○	○	◎	◎	6
	Integrated management of multiple building groups	○	○	△	◎	4
	Optimized control of traffic flow due to an ITS (Intelligent transportation system)	△	△	○	△	1
	Integrated management by a Smart Meter	○	○	△	◎	4
Environment	Environmental education for townspeople	○	○	○	○	4
	Visualizing environmental initiatives	○	○	○	○	4
	Preservation of the natural environment and planting trees	◎	◎	◎	△	6
Water Supply and Sewage	Efficient management of waterworks and the water supply as well as urine power generation	○	△	○	◎	4
	Bio generation through utilizing of water treatment sludge	△	○	△	◎	3

To solve problems ◎: 2 points
To solve problems with conditions ○: 1 point,
To solve problem a little △: 0 point

Table 3.5.3 Comprehensive Evaluation of Each Model Measure (1/2)

Model Measures		Viewpoint4				Total Score
		Low Carbon Town	Resort Beach	Tourism	Sustainable	
Buildings	Introduction of a system of comprehensive environmental benchmarks that target buildings	◎	○	○	◎	6
	Deciding on an energy-saving architectural plan that considers reducing the thermal load.	◎	△	△	◎	4
Transportation	Facilitation of the spread of electric motor-bikes and charging facilities.	◎	△	◎	◎	6
	Introduction of a Bus Rapid Transit system	◎	○	◎	◎	7
	Introduction of a subway system	△	△	○	△	1
Energy Management System	Stabilization of the electric power supply through a high capacity electrical storage facility	○	△	△	○	2
	Optimization of power generating facilities by peak power limitation	△	○	○	△	2
Area Energy Network	A heat pump style cooling system that uses river water and ocean water	◎	△	△	◎	4
	Utilization of waste heat	◎	△	△	◎	4
Untapped Energy	Purification and power generation utilizing of biogas (digestive gas)	◎	◎	○	◎	7
	Biomass generation from kitchen garbage	◎	○	○	◎	6
	Utilizing BDF by purification of Jatropha plant oil	◎	○	○	◎	6

Very effective in promoting improvement ◎: 2 points
Effective in promoting improvement ○:1 point
Effective in promoting improvement a little △: 0 point

Table 3.5.3 Comprehensive Evaluation of Each Model Measure (2/2)

Model Measures		Viewpoint4				Total Score
		Low Carbon Town	Resort Beach	Tourism	Sustainable	
Renewable Energy	Power supplied by renewable energy such as wind power and solar power.	◎	△	○	◎	5
	Introduction of an ocean water pumped storage power station that guarantees the stability of the power supply	△	○	○	◎	4
ICT Control	Optimum management and energy conservation of the street lights through LED lighting	◎	◎	○	◎	7
	Integrated management of multiple building groups	○	△	△	○	2
	Optimized control of traffic flow due to an ITS (Intelligent transportation system)	◎	○	◎	◎	7
	Integrated management by a Smart Meter	○	△	△	○	2
Environment	Environmental education for townspeople	○	○	○	◎	5
	Visualizing environmental initiatives	◎	◎	◎	◎	8
	Preservation of the natural environment and planting trees	○	○	○	○	4
Water Supply and Sewage	Efficient management of waterworks and the water supply as well as urine power generation	◎	△	○	◎	5
	Bio generation through utilizing of water treatment sludge	◎	△	△	◎	4

Very effective in promoting improvement ◎: 2 points

Effective in promoting improvement ○:1 point

Effective in promoting improvement a little △: 0 point

Table 3.5.4 Comprehensive Evaluation of Each Model Measure (1/2)

Model Measures		Viewpoint1 (tCO2/total)	Viewpoint2 (tCO2total /1,000USD)	View point 3	View point 4	Comprehensive Evaluation
Buildings	Introduction of a system of comprehensive environmental benchmarks that target buildings	176,461.5	181.1	5	6	20
		3	3			
	Deciding on an energy-saving architectural plan that considers reducing the thermal load.	38,628.0	103.0	6	4	14
		2	2			
Transportation	Facilitation of the spread of electric motor-bikes and charging facilities.	574,831.0	1,197.5	3	6	18
		3	3			
	Introduction of a Bus Rapid Transit system	658,041.0	15.5	5	7	18
		3	2			
	Introduction of a subway system	658,041.0	0.3	4	1	8
		3	1			
Energy Management System	Stabilization of the electric power supply through a high capacity electrical storage facility	4,7370.0	23.7	2	2	8
		2	2			
	Optimization of power generating facilities by peak power limitation	-	-	5	2	7
		0	0			
Area Energy Network	A heat pump style cooling system that uses river water and ocean water	14,926.5	1.2	4	4	10
		2	1			
	Utilization of waste heat	3,916.5	1.6	3	4	8
		1	1			
Untapped Energy	Purification and power generation utilizing of biogas (digestive gas)	596,221.5	65.4	5	7	18
		3	2			
	Biomass generation from kitchen garbage	448,020.0	1.0	6	6	15
		3	1			
	Utilizing BDF by purification of Jatropha plant oil	2,007.0	0.8	2	6	9
		1	1			

Comprehensive evaluation = Viewpoint 1×Viewpoint 2+ Viewpoint 3+ Viewpoint 4

Table 3.5.4 Comprehensive Evaluation of Each Model Measure (2/2)

	Model Measures	Viewpoint1 (tCO2/total)	Viewpoint2 (tCO2total /1,000USD)	View point 3	View point 4	Comprehensive Evaluation
Renewable Energy	Power supplied by renewable energy such as wind power and solar power.	6,750.0	0.7	4	5	10
		1	1			
	Introduction of an ocean water pumped storage power station that guarantees the stability of the power supply	-	-	5	4	9
		0	0			
ICT Control	Optimum management and energy conservation of the street lights through LED lighting	3,275.0	1.7	6	7	15
		1	2			
	Integrated management of multiple building groups	1,365.0	0.8	4	2	7
		1	1			
	Optimized control of traffic flow due to an ITS (Intelligent transportation system)	208,764.0	7.7	1	7	14
		3	2			
	Integrated management by a Smart Meter	373.5	0.5	4	2	7
		1	1			
Environment	Environmental education for townspeople	-	-	4	5	9
		0	0			
	Visualizing environmental initiatives	-	-	4	8	12
		0	0			
	Preservation of the natural environment and planting trees	18,447.0	480.0	6	4	16
		2	3			
Water Supply and Sewage	Efficient management of waterworks and the water supply as well as urine power generation	557.0	-	4	5	9
		1	0			
	Bio generation through utilizing of water treatment sludge	333,780.0	12.9	3	4	13
		3	2			

Comprehensive evaluation = Viewpoint 1×Viewpoint 2+ Viewpoint 3+ Viewpoint 4

3.5.3 Policy for Selecting Measures in This Project

Measures that have been selected as particularly effective for Da Nang City through meetings with the DNPC are listed in Table 3.5.6.

Table 3.5.6 Selecting measures in this project

Model Measures		Comprehensive Evaluation	Implementation Board	Selecting Measures
Buildings	Introduction of a system of comprehensive environmental benchmarks that target buildings	20	○	○
	Deciding on an energy-saving architectural plan that considers reducing the thermal load.	14		
Transportation	Facilitation of the spread of electric motor-bikes and charging facilities	18	○	○
	Introduction of a Bus Rapid Transit system	18	○	○
	Introduction of a subway system	8		
Energy Management System	Stabilization of the electric power supply through a high capacity electrical storage facility	8		
	Optimization of power generating facilities by peak power limitation	7		
Area Energy Network	A heat pump style cooling system that uses river water and ocean water	10		
	Utilization of waste heat	8		
Untapped Energy	Purification and power generation utilizing of biogas (digestive gas)	18	○	○
	Biomass generation from kitchen garbage	15	○	○
	Utilizing BDF by purification of Jatropha plant oil	9		
Renewable Energy	Power supplied by renewable energy such as wind power and solar power.	10		
	Introduction of an ocean water pumped storage power station that guarantees the stability of the power supply	9		
ICT Control	Optimum management and energy conservation of the street lights through LED lighting	15	○	○
	Integrated management of multiple building groups	7		
	Optimized control of traffic flow due to an ITS (Intelligent transportation system)	14		
	Integrated management by a Smart Meter	7		
Environment	Environmental education for citizens	9		
	Visualizing environmental initiatives	12		
	Preservation of the natural environment and planting trees	16		
Water Supply and Sewage	Efficient management of waterworks and the water supply as well as urine power generation	9		
	Bio generation through utilizing of water treatment sludge	13		

4. Analyze CO2 reductions and costs for the selected design measures

4.1 Fundamental policy of analysis

The project cost and the amount of CO_2 emission reduction are calculated for each of the six measures that have been selected (Table 4.1.1) (Appendix 4.1.1)

Table 4.1.1 The selected six measures in this project

Model Measures		Comprehensive Evaluation	Implementation Board	Selecting Measures
Buildings	Introduction of a system of comprehensive environmental benchmarks that target buildings	20	○	○
Transportation	Facilitation of the spread of electric motor-bikes and charging facilities	18	○	○
	Introduction of a Bus Rapid Transit system	18	○	○
Untapped Energy	Purification and power generation utilizing of biogas (digestive gas)	18	○	○
	Biomass generation from kitchen garbage	15	○	○
ICT Control	Optimum management and energy conservation of the street lights through LED lighting	15	○	○

The basis for calculating the amount of reduction of CO_2 emissions is the revised IPCC guidelines (Viet Nam Second National Communication to the UNFCC / 1996) adopted using the report on the latest calculations of greenhouse gas emissions in the economy as well as the guidance of the IPCC in a superior case. Also, by studying the selected measures for CO_2 emissions reduction and analogous CDM projects, there is a reference for CO_2 emission reduction calculations.

As far as possible, the basis for the calculations of operational expenses is the standard cost of construction commodities in Viet Nam. In addition, the necessary information for Da Nang city's particular price of commodities has been obtained. Regarding an estimate, if there is a preceding domestic Japanese case that could serve as a reference point, these operating costs will also considered.

4.2 Calculation flow

The calculation flow of project costs and the amount of CO_2 emission reduction are shown in Fig 4.2.1 and Fig 4.2.2 using the example of measures to introduce public transportation (Bus Rapid Transit system).

The calculation of cost and CO_2 emissions reduction were implemented on 23 measures, including measures which were not adopted. Each calculation result is shown in chapter 3.5, “Select CO_2 Reduction Measures in Each Design Category.” CO_2emission reduction is calculated as Viewpoint 1, and Cost is calculated as Viewpoint 2.

(1) Calculation of the amount of CO2 emissions reduction

Step1: Establishment of a target year

Step2: Deciding on a blueprint for measures to be taken

Establishment of
- Target range
- Installation space
- Scale of facility
- The level of operational service

Step3: Adjust the general situation of the area for the target year

Establishment of
- The increase in population and number of households
- The increase in tourists
- The increase in rate of automobile allotment

Step4: Calculate the amount of CO2 emission under the current trends.

- Establishment of a CO2 emission output level by mode of transportation
- Amount of traffic from automobiles and motorcycles etc

Step5: Change in the allotment of different modes of transit due to installation of public transportation.

Step6: Calculate the amount of CO2 emission when implementing these measures.

- Establishment of a CO2 emission output level by mode of transportation
- The amount of traffic from automobiles and motorcycles when implementing these measures.
- The traffic of public transportation etc

Step7: Calculate the amount of CO2 emissions reduction when implementing these measures.

- From a comparison of step 4 and step 6 the amount of CO2 emission reduction from implementing these measures is calculated.

Fig 4.2.1 Calculation of the amount of CO2 emissions reduction Flow

(2) Calculation of project expenses

Step1: Deciding on a blueprint for measures to be taken
Establishment of
- The target range
- Installation space
- The scale of facility
- The level of operational service etc

Step2: Cost estimate of the following items based on blueprints for measures to be taken
- Construct station buildings
- Facilities for electrical equipment and railroad tracks etc.
- Purchase railroad cars
- Development of an operational management system (ICT)
- Education of the organization's personnel
- Construction of proprietary company facility (company office building and garage)

Summarize the costs estimated

Step3: establishment of construction commodity costs by estimated items
- Vietnam's construction commodity costs
- Da Nang's construction commodity costs
- Japanese and foreign economies' construction commodity costs

Step4: calculation of the entirety of project expenses
- From steps 1 and 2 the costs related to implementing these measures by item and the entirety of operational costs are calculated.

※ the project cost and the amount of CO_2 emission reduction will be similarly calculated for other measures as well.

Fig 4.2.2 Calculation of the flow of project expenses

4.3 Result of calculation

Results of calculation of project costs and the amount of CO_2 emissions reduction are shown in Table 4.3.1 and Fig 4.3.1

Fig 4.3.1 is a figure showing the connection between initial cost and CO_2 emissions reductions achieved through the 23 measures. Marks which are either red or blue indicate the six measures which have been evaluated as having high importance and priority. The more in the upper left they are placed, the higher the CO_2 reduction effectiveness the measure has relative to cost.

Table 4.3.1 Result of calculations for the selected six measures in this project

Model Measures		Amount of CO2 emissions reduction CO2-t/year	Initial cost USD
Buildings	Introduction of a system of comprehensive environmental benchmarks that target buildings	11,764.1	975,000
Transportation	Facilitation of the spread of electric motor-bikes and charging facilities	57,483.1	480,000
	Introduction of a Bus Rapid Transit system	21,934.7	42,450,000
Untapped Energy	Purification and power generation utilizing of biogas (digestive gas)	39,748.1	9,120,000
	Biomass generation from kitchen garbage	29,868.0	461,365,691
ICT Control	Optimum management and energy conservation of the street lights through LED lighting	327.5	1,920,000
Total	The six measures which are analyzed with high importance and priority	**161,125.5**	**516,311,985**

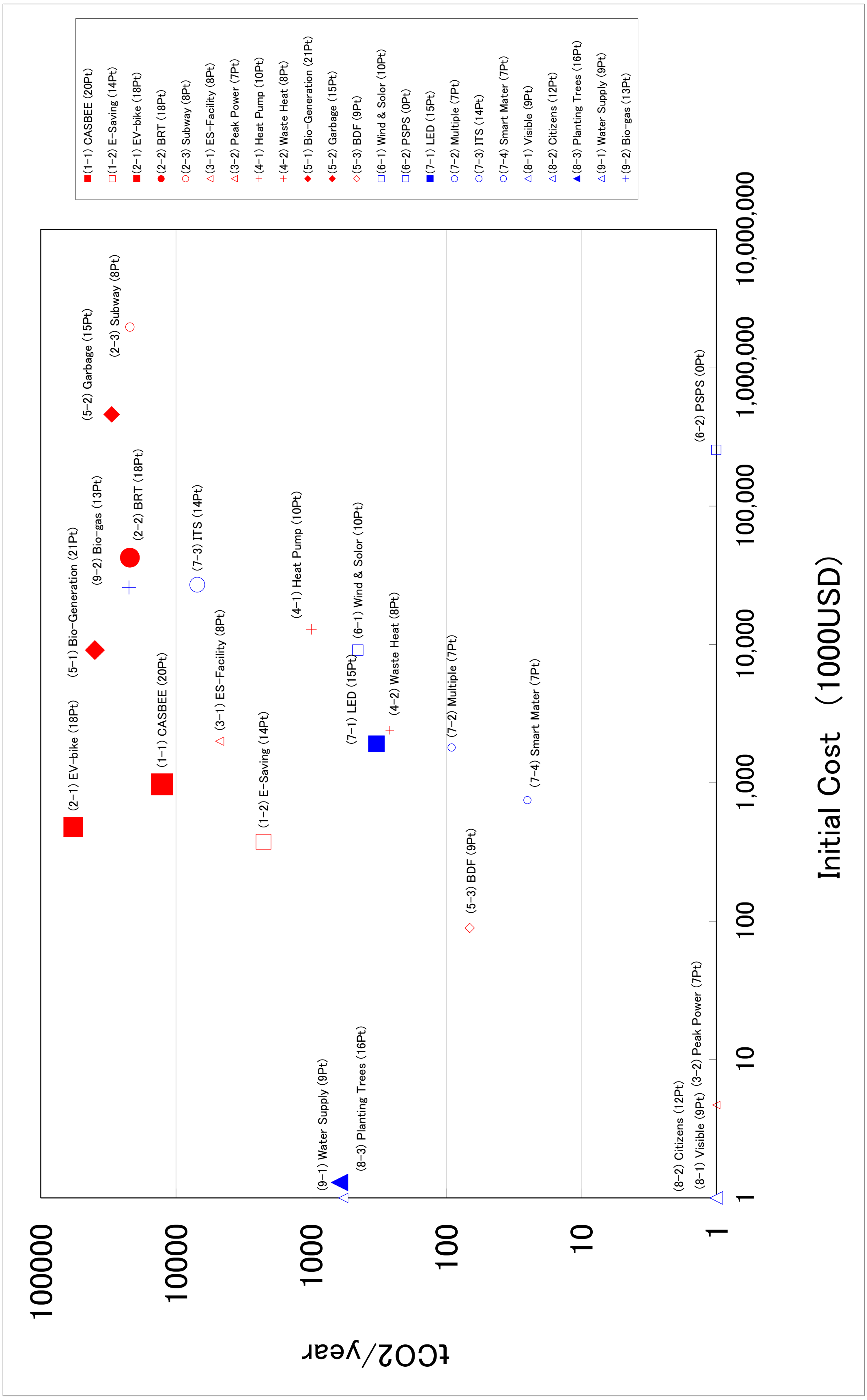


Fig 4.3.1 Results of calculation

5. Implementing Methodology of Proposed CO2 Reduction Measures

5.1 Introduction of a system of comprehensive environmental benchmarks that target buildings

5.1.1 Background of Introduction of a comprehensive environmental assessment system to buildings

As a result of building research in Da Nang City, most of the surveyed buildings have been ranked in a lower than moderate class with CASBEE's criteria for building environment performance. This shows that there is the potential of possible CO2 reduction by increasing the rank of these kinds of buildings to the top class (S class) with further energy saving measures.

In the future, more building construction will spread over the City corresponding with population and economic growth. As a counter measure against CO2 emissions due to building construction, the introduction of a comprehensive environment assessment system to building construction would be the most effective and economical way to reduce CO2 emissions.

5.1.2 Government Initiative for implementing measures

In order to create and maintain a sustainable environment city, government-led shall be inevitable to implement the measure of comprehensive environment assessment system to building construction.

Following three steps shall be proceeded by government initiative so as to implement effectively introduction of the comprehensive environmental assessment system.

- **Step1** Development of an Assessment System/ Tool for Building Environmental Performance
- **Step2** Administrative procedure of the Assessment System
- **Step3** Action plan of environmental public building construction

5.1.3 Development of Comprehensive Assessment System of Built Environment Performance Step1

(1) Development Criteria

It shall be useful and economical to develop the system /tool on a basis of the existing assessment tool; LOTUS by VGBC (Vietnam Green Building Council) to suit local condition. In addition, LCCO2 (Life Cycle CO2) emission factor dealt in CASBEE, Japan shall be taken into account as a development criteria so as to measure CO2 emissions from building construction.

(2) Development Organization

For development of the environmental assessment system/tool, a development committee shall be organized by government initiative. The committee members shall consist of professional experts of policy and construction sectors inclusive of the experts concerned to develop LOTUS and/or other environmental assessment systems, and government officials.

Scheme of the committee is shown herein below.

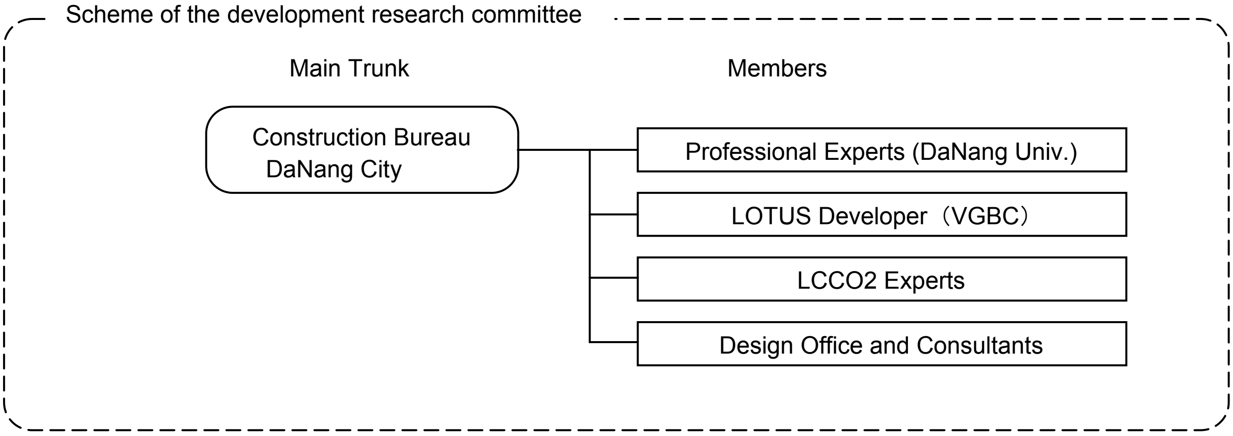


Fig 5.1.1 Scheme of the Development Research Committee

5.1.4 Administrative Procedure Step2

In order to make effective use of the assessment tool/ system developed to building construction, it may be regulated/ enacted with construction grant as an administrative procedure. When it comes to regulation of the system, following items shall be taken into account for easy spread and for system maintenance.

-Scope of application; new construction, renovation, etc/ office, factory, housing, others
-Building scale targeted; mainly to large scale office buildings
-Application procedure; simple application procedure
-Introduction incentives; incentive to eco-friendly building design
-Reporting system; annual reporting system about energy consumption
-Evaluation system; commendation/ award to buildings with superior low-carbon performance

5.1.5 Promotion Scenario on Public Building Construction as a model case Step3

In order to promote an environmental assessment system for the private sector, public buildings such as government offices, schools, hospitals and so on shall be recommendable to build by government initiative as model cases of eco-friendly building.

(1) Implementation of an environmental public building as a model case

From a view point of procurement of construction budget, alternatives to implement environmental public buildings construction are as follows;

A As a public work project; environmentally sound building constructed by a local government fund

B As a PFI project; environmentally sound building constructed by SPC and established by private corporations

As another option, Joint Crediting Mechanism (JCM) would be available for construction budget procurement subject to agreement between parties concerned.

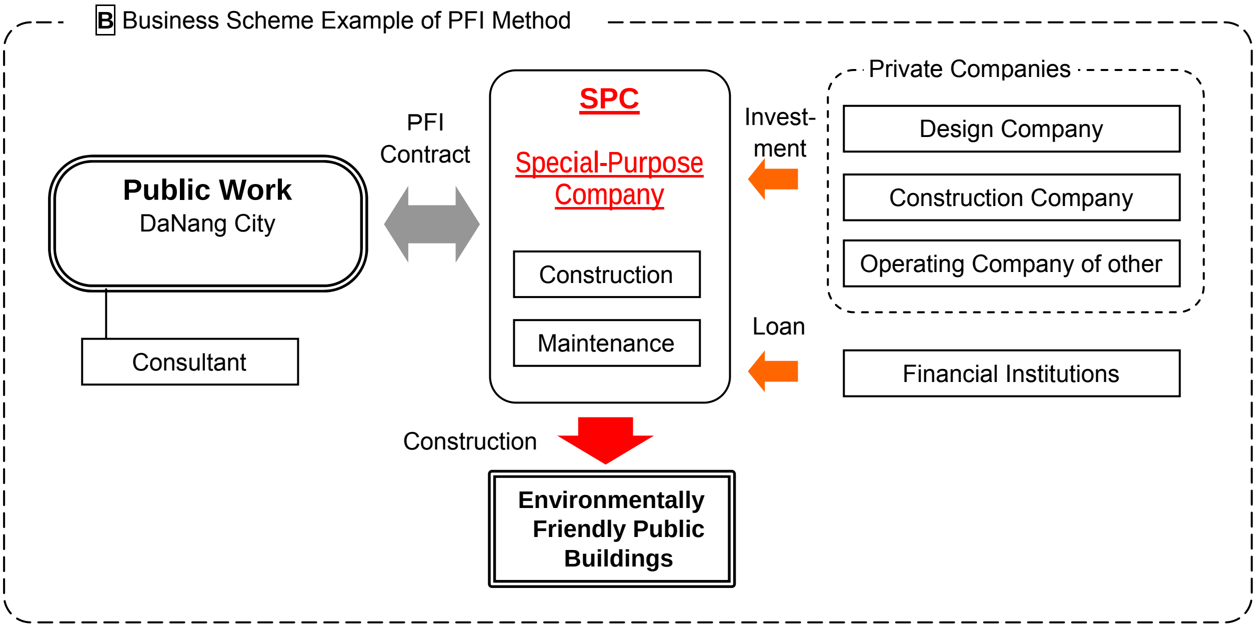


Fig 5.1.2 Business Scheme Examples

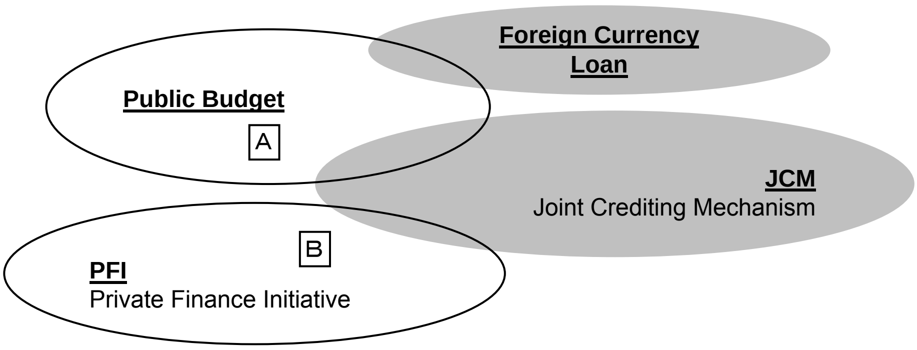


Fig 5.1.3 Public Building Construction Funding Sources and Positioning of the Examples

5.1.6 Road Map

(1) Trial Conditions

- Starting implementation measure in 2015
- The region under consideration is Ngu Hahn Son District
- The target number of buildings at 50% of new construction buildings
- Expected implementation rate at 50% of target buildings
- Expected CO2 reduction ratio with 25% reduction for common building

(2) CO2 Reduction Road Map

Expected BAU and CO2 reduction for trial 20years are shown below.

Table 5.1.1 CO2 Emissions and Reduction Ratio

NguHanhSon District BS-H

t-CO2/year	2010	2015	2020	2025	2030
BAU	6,885.7	17,661.6	51,976.8	120,303.0	197,121.7
Introduction of Environmental Evaluation System	6,885.7	17,128.1	49,304.9	113,354.7	185,357.6
reduction t-CO2/year	0.0	533.5	2,671.9	6,948.3	11,764.1
reduction %	0.0%	3.0%	5.1%	5.8%	6.0%

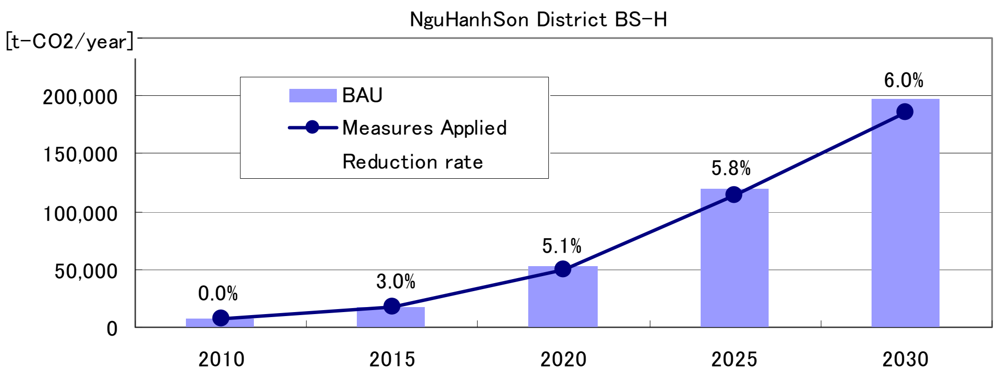


Fig 5.1.4 CO2 Emissions and Reduction Ratio

BAU; estimated on a basis of expected population growth, floor area per person, and primary energy consumption rate per floor area in future.

5.2 Facilitation of the spread of electric motorbikes and charging facilities

5.2.1 Contents of the Project

(1) Project summary

This project attempts to reduce CO_2 emission through shifting a means of everyday transportation of the citizen from gasoline to electric motorcycles.

At present, gasoline motorcycles account for approximately 96% of means of transportation in Da Nang City. Moreover, the number of gasoline motorcycles is expected to increase as the population of the city is estimated to increase about 1.7 times from 2010 to 2030.

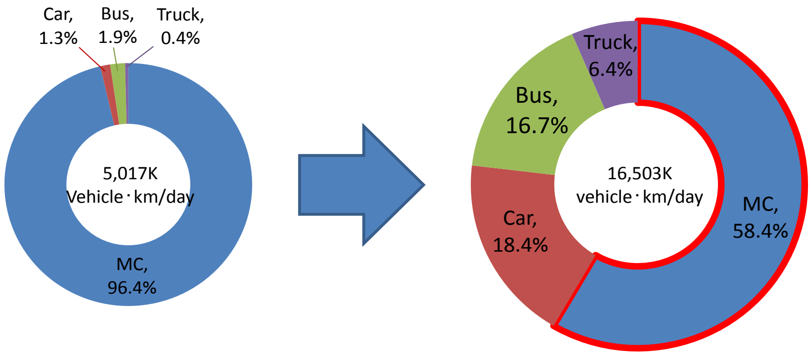
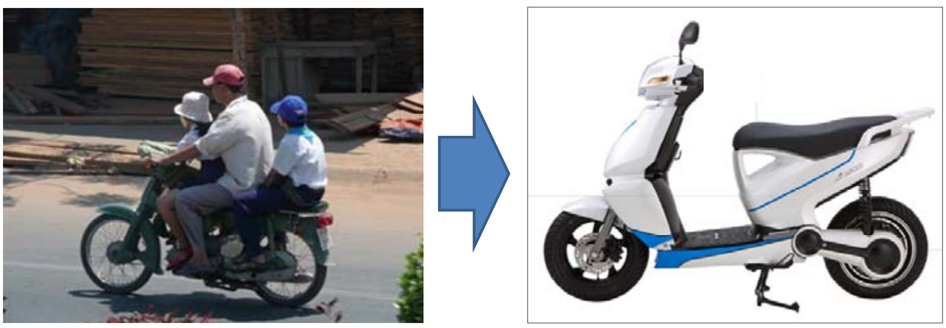


Figure 5.2.1 An Expected Change in Shares of Means of Transportation in Da Nang City

In addition, it is supposedly difficult to have a shift from gasoline motorcycles to gasoline automobile due to Vietnam's unique environment. The Vietnam's unique environment includes: automobile is expensive compared to household income, financial system for loan and installment sale is not common, a number of parking areas is inadequate, improvement of roadway infrastructure is inadequate, and it is difficult to get driver's license (long application process and high costs).

With such a background, as government policies toward a low-emission society, the project aims to promote and diffuse electric motorcycles that requires no fossil fuel, is convenient, and needs low upkeep costs.

In this report, a project plan toward the promotion and diffusion of electric motorcycles and a financing plan are drawn up.



(2) Present Conditions in Vietnam regarding gasoline motorcycles

In Da Nang City, gasoline costs account for more than 10% of income in a large proportion of households. In addition, retail price of gasoline has increased about 4.4 times from 2003 to 2013, so that travel costs account for a high proportion of household income.

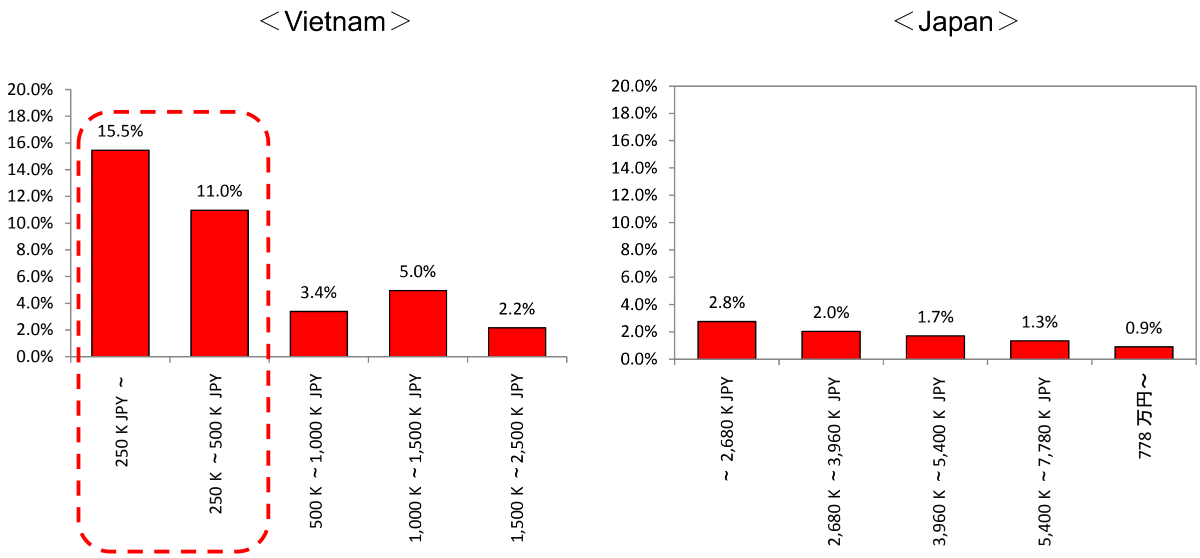


Figure 5.2.2 Comparison of Proportions of Gasoline Costs to Household Income

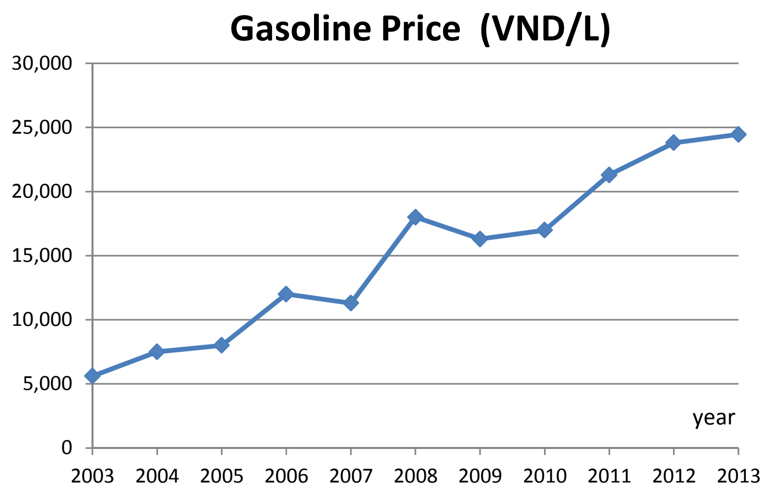


Figure 5.2.3 Changes in Gasoline Retail Price

95% of travel distances per day by gasoline motorcycles in Da Nang City are less than 10km. However, although the frequency is low, there are occasions where citizens travel more than 100km on the weekend or holidays for pleasure or other purposes.

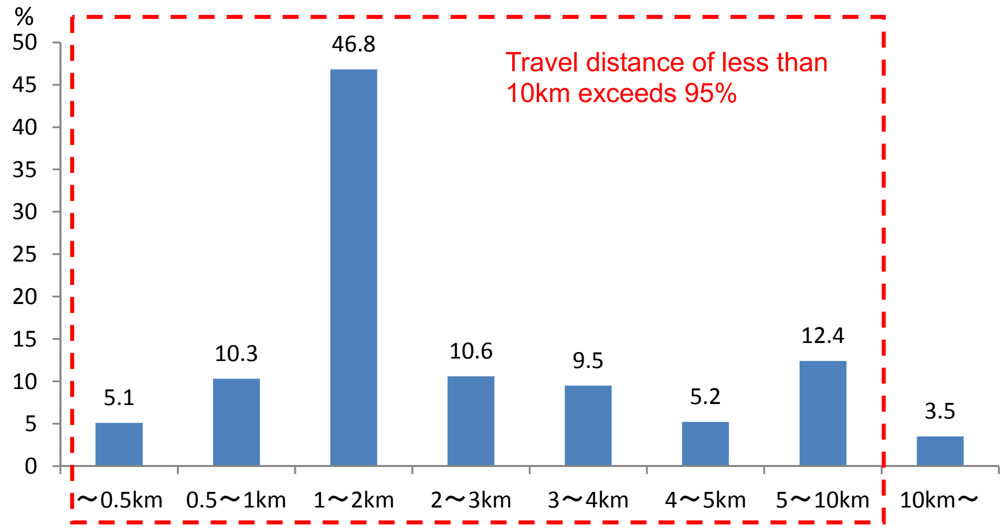


Figure 5.2.4 Number of Trips Categorized by Travel Distances by Gasoline Motorcycles

(3) Government Policies toward Low-carbon society

Vietnamese government has adopted a number of measures in transportation field regarding energy saving and emission cut in order to achieve a low-carbon society.

1) Measure for National Green Strategy
・"Make the transition of fuel structures in industry and transportation sector"
2) Energy Saving Law (50/2010/QH12)
・Promotion of development of vehicles with advanced technologies, that utilize energy-saving, clean energy, and other fuels that substitute fossil fuels
(Chapter 20: transportation means & responsibility of organizations that produce or import related products)
・Adoption of the minimum energy standard and disallowance of the use of vehicles with low energy efficiency and over the limit of expected lifetime
(Chapter 21: responsibility of the government in transportation sector)
3) Emission Control (Decision No.249/2005/QD-TTg)
・Make it obligatory to adopt EURO2 (EU's emission control) to all new and used vehicles (including motorcycles), including imported cars
4) Emission Control (Decision No.49/2011/QD-TTg)
・Adopt EURO3 to motorcycles from 2017

(4) Development Trends of Lithium Battery and Electric Motorcycles

Batteries for electric motorcycles that are currently being developed are not lead battery, but mainly lithium battery. The amount production and sales total of lithium battery are increasing year by year, and the price of lithium battery is decreasing as mass-production is achieved.

In addition, further improvement of performance and decline of price of lithium battery are expected due to technological development.

At the present moment, fuel cost of electric motorcycles with lithium battery is already lower than that of gasoline motorcycles. Retail price and maintenance cost of electric motorcycles are expected to further decline in the future.

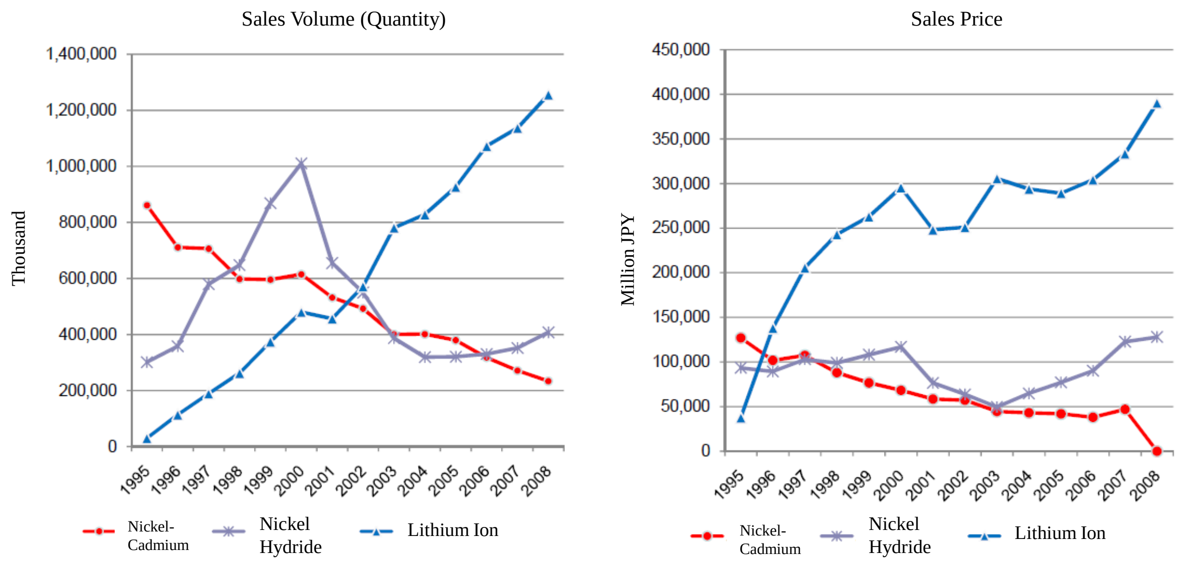


Figure 5.2.5 Changes in Sales Volume and Sales Price of Lithium Ion Battery (1995-2008)

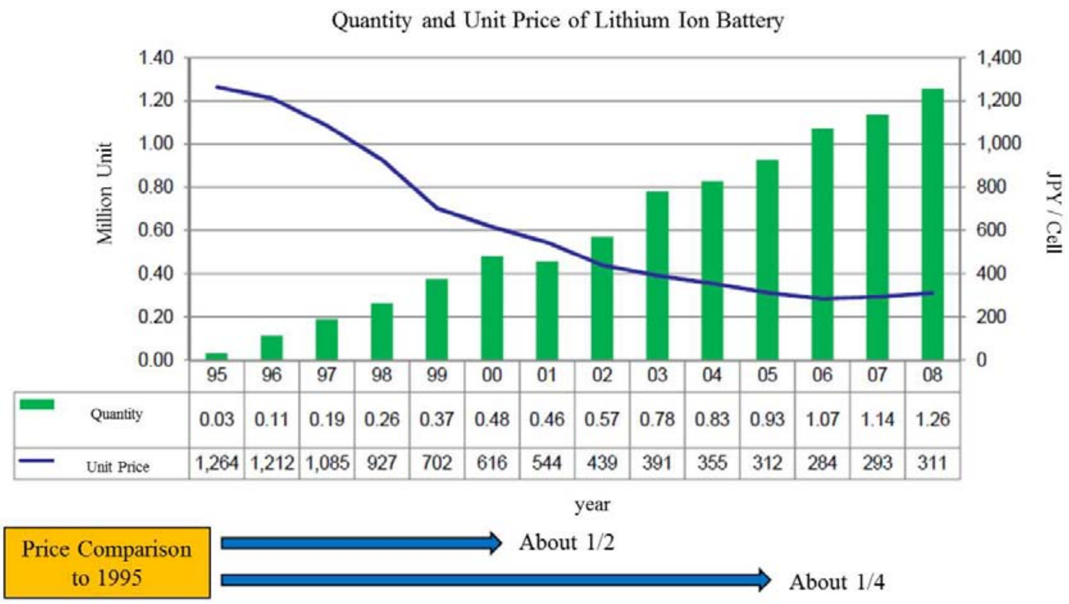


Figure 5.2.6 Changes in the Quantity and Unit Price of Lithium Ion Battery

1. Current Costs	Lead Battery	NaS Battery	Nickel Hydride Battery	Lithium Battery
Unit Price (kW)	150 Thousand JPY	240 Thousand JPY	100 Thousand JPY	200 Thousand JPY
Unit Price (kWh)	50 Thousand JPY	25 Thousand JPY	100 Thousand JPY	200 Thousand JPY

2. Targeted Costs	Present	2010	2015	2030
For next-generation automobile	200 Thousand JPY/kWh	100 Thousand JPY/kWh	30 Thousand JPY/kWh	5 Thousand JPY/kWh
For smooth interconnected system	150 Thousand JPY/kWh	40 Thousand JPY/kWh		15 Thousand JPY/kWh

Figure 5.2.7 Expected Price Decline of Lithium Ion Battery (2006-2030)

	Present	2010	2015	2030
	Compact EV for power companies	Limited commuter EV High-performance HV	Public commuter EV Fuel battery automobile Plug-in HV automobile	Well-developed EV
Performance	1	1	1.5 times	7 times
Cost	1	1 / 2 times	1 / 7 times	1 / 40 times
Developmental Regime	Private-led	Private-led	Industry-Gov.-academia	University-research institute

Figure 5.2.8 Expected Improvement of Performance of Lithium Ion Battery (2006-2030)

In 2013, travel distance to empty (full charge for one time) of electric motorcycles is approximately 60 to 70km, so that the motorcycles do not pose a problem for everyday shot-distance travel.

On the one hand, some organizations concerned has pointed out, through their interviews, that electric motorcycles are not adequate for long-distance travel on the weekend or holidays. However, the performance of electric motorcycles is expected to increase due to the improvement of performance of lithium batteries in the future.

	Concept40 (Japanese)	XR-EB16 (Chinese)
Max. Speed	65 km/h	28 km/h
Travel Distance to Empty	More than 60 km	55 km
Battery (life duration)	Lithium ion (more than 5 years)	Lead (about 2 - 3 years)
Waterproof	Yes	No
Maintenance	Yes	No

Figure 5.2.9 Comparison of Performance of Electric Motorcycles with Different Batteries

		Quantity	Unit	Value (annual)	Unit
	Average Travel Distance	27	km/day	9,705	km/yr.
Gasoline Motorcycle	Average Gasoline Consumption	41	km/L	237	L/yr.
	Average gasoline Cost	1	USD/L	237	USD/yr.
Electric Motorcycle	Average Electricity Consumption	0.04	kWh/km	356	kWh/yr.
	Average Electricity Cost	0.0765	USD/kWh	27	USD/yr.
Cost Reduction				210	USD/yr.

* results of experiment in Ho Chi Minh

Figure 5.2.10 Comparison of Fuel Costs between Gasoline and Electric Motorcycles with the Same Travel Distance

(5) Steps to Diffusion and Promotion and Necessary Measures

With a background described above, approximately 50 to 60% of gasoline motorcycles are estimated to shift to electric motorcycles even if the government leaves the matter to the private sector and the current trend of the market.

As for Da Nang City that aims for a low-carbon city, the city needs to implement measures to further increase the conversion ratio. Main measures are as follows:

1)Diffusion and Educational Activities for Electric Motorcycles（Policy 1）

- The common images of electric motorcycles held by the citizen of Da Nang are as follows: a) Electric motorcycles are a vehicle for high school students who cannot ride a gasoline motorcycle, b) Battery is lead, c) Electric motorcycles are slow and not waterproof.
- However, electric motorcycles currently being developed are: a) A quiet, stylish vehicle for adults, b) Utilizing high-performance lithium battery, c) Being able to accelerate smoothly and run in rain without any problems.
- In order to promote and diffuse the use of electric motorcycles, it is important to fill in the gap between these images and the facts.
- Therefore, it is required to do marketing for building citizen recognition and achieving the status in which citizen ride eco-friendly, high-performance electric motorcycles by installing symbolic charging equipment (e.g. at a new building of Da Nang People’s Committee and a large-scale shopping center) and exhibiting high-performance and stylish electric motorcycles, and engaging in other activities.

Picture: Current Electric Motorcycles

Picture: Image for Exhibition of Electric Motorcycles

2) Preferential Treatment Concerning Taxes and Subsidy for Purchase（Policy 2）

- After an image for electric motorcycles is enhanced by the measure described in 1), it is necessary to provide supportive measures for the citizen to purchase electric motorcycles.
- Although tax rates for gasoline and electric motorcycles are currently the same in Da Nang City, the government sets a lower tax rate for electric motorcycles than for gasoline motorcycles at an early stage of diffusion. In addition, the government offers support to stimulate purchase of electric motorcycles by subsidizing.
- In Japan, the government implemented the same measure at an early stage of diffusion of electric vehicles.
- In addition, a legislation to manage electric motorcycles is currently yet to be established in Da Nang City.
- In order to clarify electric motorcycles as a means of transportation that is safe and environmentally-friendly, it is necessary to establish laws and regulations that put an obligation to register license plates and wear a helmet.

Figure 5.2.11 Example of Subsidy for Eco-Cars in Japan

3) Parking Areas for Electric Motorcycles（Policy 3）

- It would be the basic for users to charge their electric motorcycles at their homes. However, it is necessary to be able to charge outside in case of emergency or long-distance travel.
- Thus, parking areas that support electric motorcycles shall be established on street, at large-scale shopping centers, parking lots at factories, roadside stores, and other public facilities. In addition, management and operation of charging facilities in the city and battery swap and other service would be provided by gas stations.

Pictures: Parking Lot at a Shopping Center in Da Nang City (right)
Example of a Charging Equipment in a Parking Lot in Japan (left)

(6) Sustainable reduction of environmental loads through packaging related measures and solutions of urban transportation issues

Three measures described above are necessary to diffuse electric motorcycles for short and intermediate terms. However, it is also necessary to consider the following respect in order to sustainably reduce environmental loads for medium and long terms and to provide solutions to potential issues of urban transportation in the future.

4) Strategic establishment of parking lots and management

- At present, there are few off-street parking areas in Da Nang City, expect at some shopping centers, industrial complex, and governmental buildings. As a result, users park their gasoline motorcycles on the sidewalk in front of stores and facilities, so that there are many areas in the city where it is difficult to walk on the sidewalk.

Pictures: Parking Situations of Gasoline Motorcycles in Da Nang City

- In Ho Chi Minh City, there are parking areas for gasoline motorcycles, but supply is not catching up with demands for parking, so that you can occasionally come across on-the-sidewalk parking of motorcycles like in Da Nang City.


Pictures: Parking Areas for Gasoline Motorcycles in Ho Chi Minh City

- In Da Nang City whose population is expected to further increase in the future, it is extremely important to engage in the strategic establishment of parking lots and management of parking demands by setting the goals for parking policies, instead of establishing parking areas following the parking demands due to an increase in the number of motorcycles.
- This approach not only provides solutions to urban traffic issues through achieving safe, smooth road traffics, but also contributes to the vitalization and enhancement of attractiveness of Da Nang City as a tourist city. Some methods necessary for parking policies are as follows:

Table 5.2.1 Methods for Parking Policies

Perspective	Hardware Measures	Software Measures
Ensuring Parking Space	- Planned establishment of off-street parking together with future development - Establishment of multi-story parking lots for effective land use	- Establishment of laws and institutions regarding parking areas
Management & Exclusion of Unregulated Parking Vehicles	(Introduction of public transportation system, such as BRT)	- Establishment of parking prohibited areas - Enforcement of strict control
Control on Parking Demands	- Placement of parking areas (Park & Ride) in coordination with public transportation system, such as BRT - Establishment of fringe parking in resort areas and inner city	- Introduction of parking guidance system - Provision of information on parking availability - Restriction on gasoline motorcycles in resort areas and inner city - Restriction on the use of gasoline vehicles when commuting to public facilities

- As for a restriction on access by automobiles and motorcycles that emit exhaust gas, there are places with a limitation on access during fixed hours, such as Umweltzone in Koln, Germany, and ZTL (Zona Traffico Limitato) in Italy.

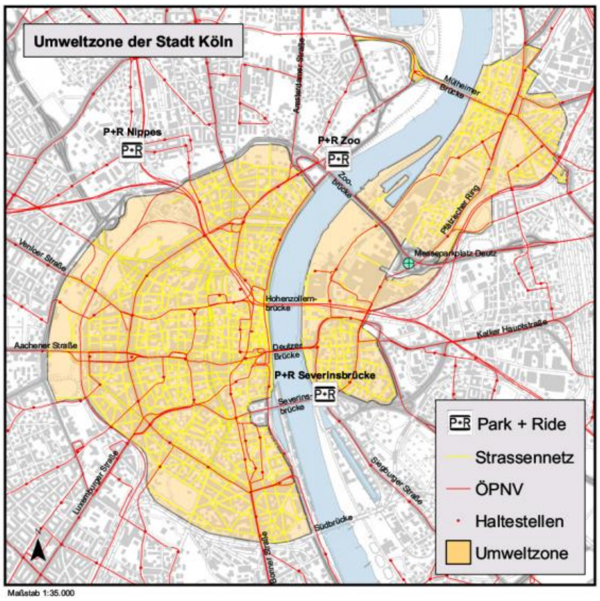
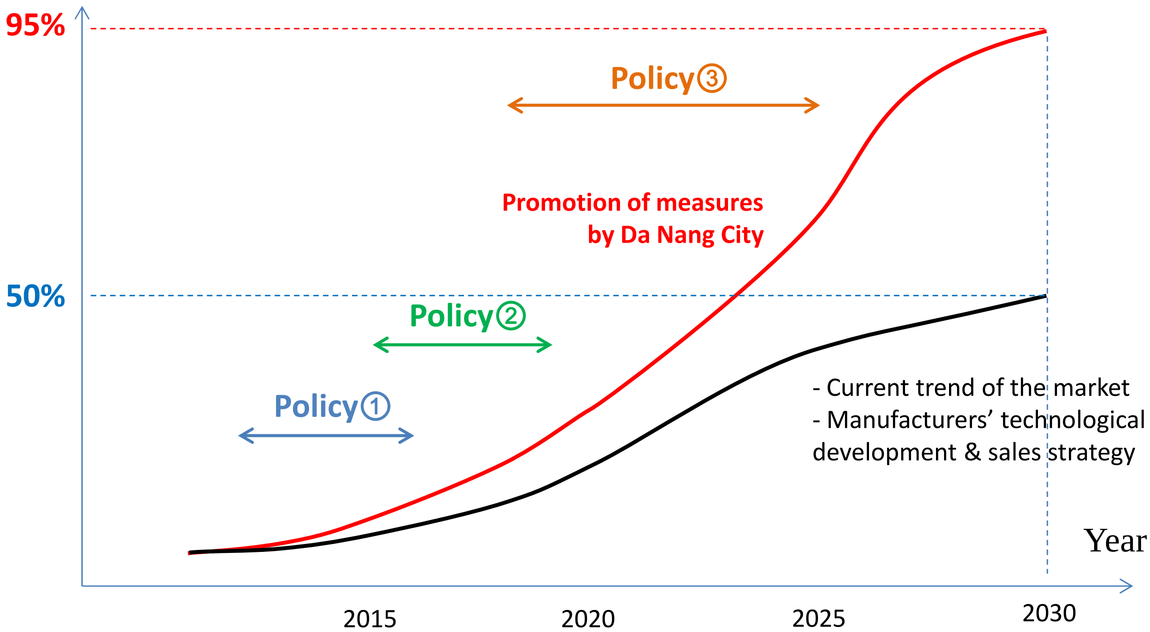


Figure 5.2.12 Umweltzone in Cologne, Germany

Picture: ZTL in Italy

(7) Project Schedule

The figure below shows an image for the relationship between measures previously described and ratio of conversion to electric motorcycles.



It is estimated that the citizen purchase electric motorcycles as the second vehicle for daily, short-distance travel (like the use of the second car) at an early stage of diffusion because the percentage of households with multiple motorcycles is high in Da Nang City.
After an early stage of diffusion, electric motorcycles are expected to become common rapidly as they become able to support any kind of travels by the citizen due to synergetic effects of measures by Da Nang City and increased performance and decreased price of electric motorcycles.

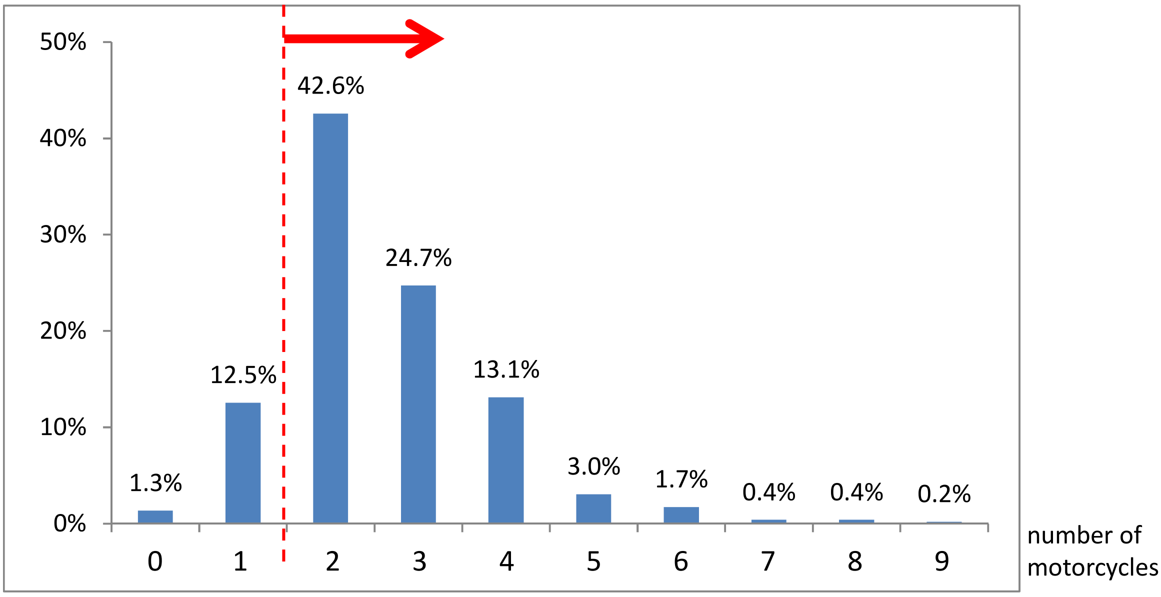


Figure 5.2.13 Ownership Ratio of Gasoline Motorcycles Per Household in Da Nang City

The table below shows a project schedule considering the measures and technological development.

Table 5.2.2 Project Schedule

	Contents	2013–2015			2016–2020					2021–2025					2026–2030					Remarks
Measures	Diffusion & educatinal activities	■	■	■	■															
	Preferential treatment concerning taxes				■	■	■	■												
	Subsidy for purchase				■	■	■	■												
	Installment of charging equipment in parking area							■	■	■	■	■	■	■						
	Restriction of gasoline vehicles in resort area														■	■	■	■	■	
	Restriction of gasoline vehicles to public facilities														■	■	■	■	■	
	＊Targe diffusion rate of electric motorcycles			10			20		30						65				95	
Tech. Development	Use of lithium battery & sales of high-performance EM	■	■	■																
	Decline in battery price (50% decrease from 2013)						■													
	Development of new-model battery by new technology										■									
	Diffusion of new-model batteries												■	■	■	■				
	performance & price of EM equals to gasoline motorcycles																■	■	■	

(8) Road Map

Based on the project schedule above, CO_2 emission reduction amount in Ngu Hanh Son District is estimated for a period between measure are implemented and 95% conversion rate is achieved. Specifically, the four steps below are assumed to follow.

Step1	2015	Shift to electric motorcycles (EM), sales of high-performance EM by manufacturers
Step2	2020	Decline in price of high-performance EM, shift to EM accelerates
Step3	2025	Performance of EM dramatically increases due to a new type of battery
Step4	2030	Depreciation of gasoline motorcycles progresses, & shift to EM is almost complete

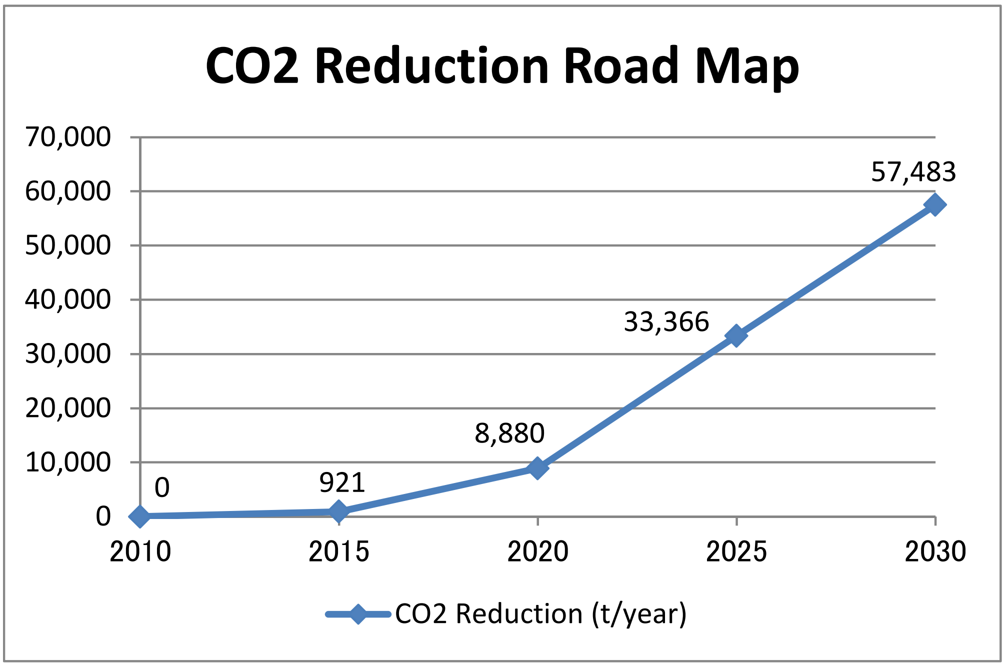
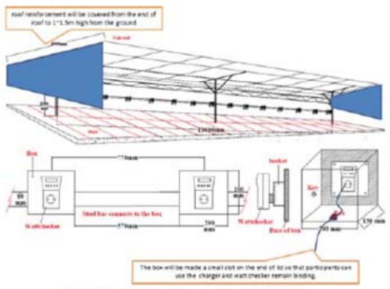


Figure 5.2.14 CO2 Reduction Road Map

5.2.2 Market environment

Currently, few cities in the world implement measures for the diffusion and promotion of electric motorcycles as governmental policies, so this project could be a pioneering approach.

However, Terra Motors Corporation in Japan has collaborated with Mitsubishi UFJ Morgan Stanley Securities CO., Ltd. to plan to expand sales of high-performance electric motorcycles in Vietnam. They worked on the project adopted in October, 2012 by NEDO in Japan.



Design of charging station

SEED48 & an examinee (EEC staff)

charging station at EEC

Survey on EM diffusion & promotion project in Ho Chi Minh City
(2012 NEDO bilateral Feasibility Study by MUFG & Terra Motors. Co. Ltd.)

5.2.3 Project scheme

(1)PPP (Public-Private Partnership) Project

It would be the basic for users to charge their electric motorcycles at their homes. When they need to charge their motorcycles while they are out, they are expected to use charging equipment at factories, shopping centers, or other public facilities provided as a service to employees and visitors. However, it is unlikely to have fee collection from users at these facilities.

However, it may be possible to establish a system to recover the investment from usage fees of parking lots for automobiles by creating parking lots for automobiles, which are currently inadequate in number in the city, and installing charging equipment for motorcycles together.

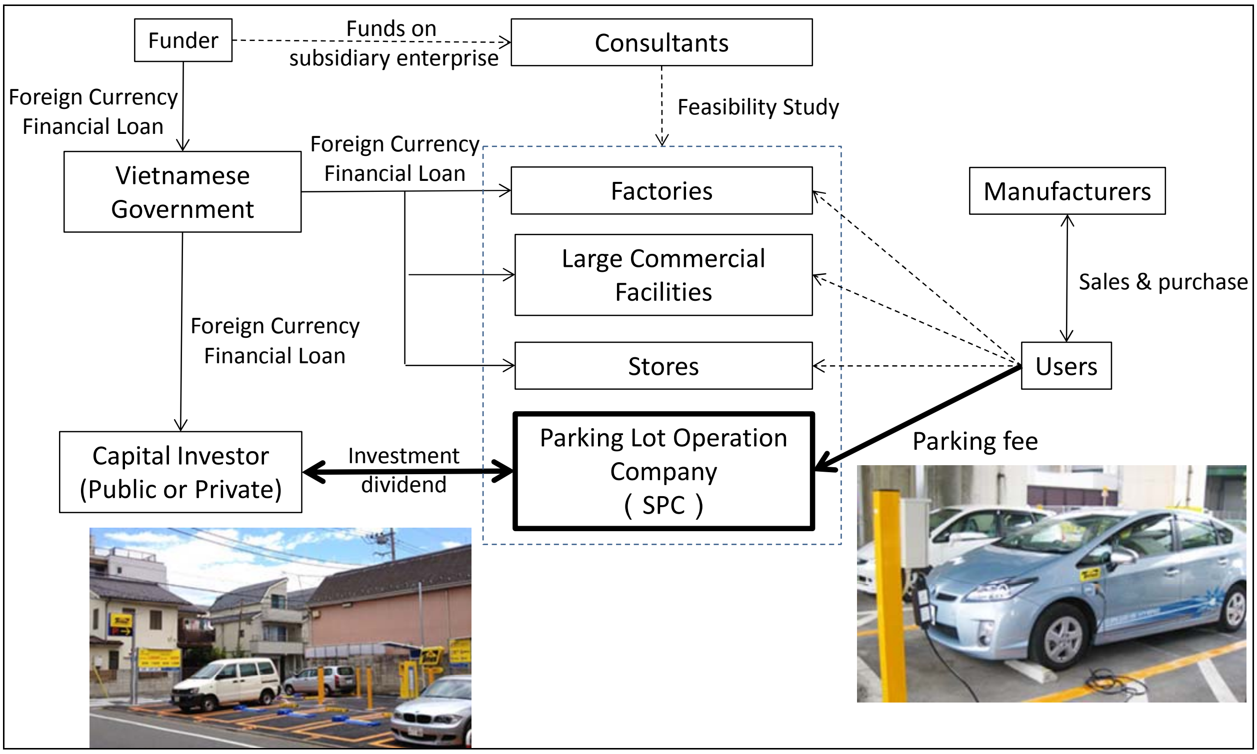


Figure 5.2.15 Image for PPP (Public-Private Partnership) Project

5.2.4 Financial Sources

Investment for installation of public charging equipment is expectedly covered by subsidy from Vietnam Central Government or within fiscal extent of Da Nang City, based on changes in the market or traffic environment through diffusion and educational activities (policy 1) and preferential treatment concerning taxes and subsidy for purchase (Policy 2).

However, it is desirable to install public charging equipment at a certain interval in broad areas to overcome weaknesses of electric motorcycles, such as the necessity for charging when travelling a long distance or in emergency.

Regarding the installation of public charging equipment, it is effective to consider it as one of a package of measures for forming an environment-friendly city, such as a smart grid and smart city, when considering the utilization of foreign funds, including ODA.

For example, NEDO (New Energy and Industrial Technology Development Organization) has conducted smart community projects in the world as a global demonstration experiment.

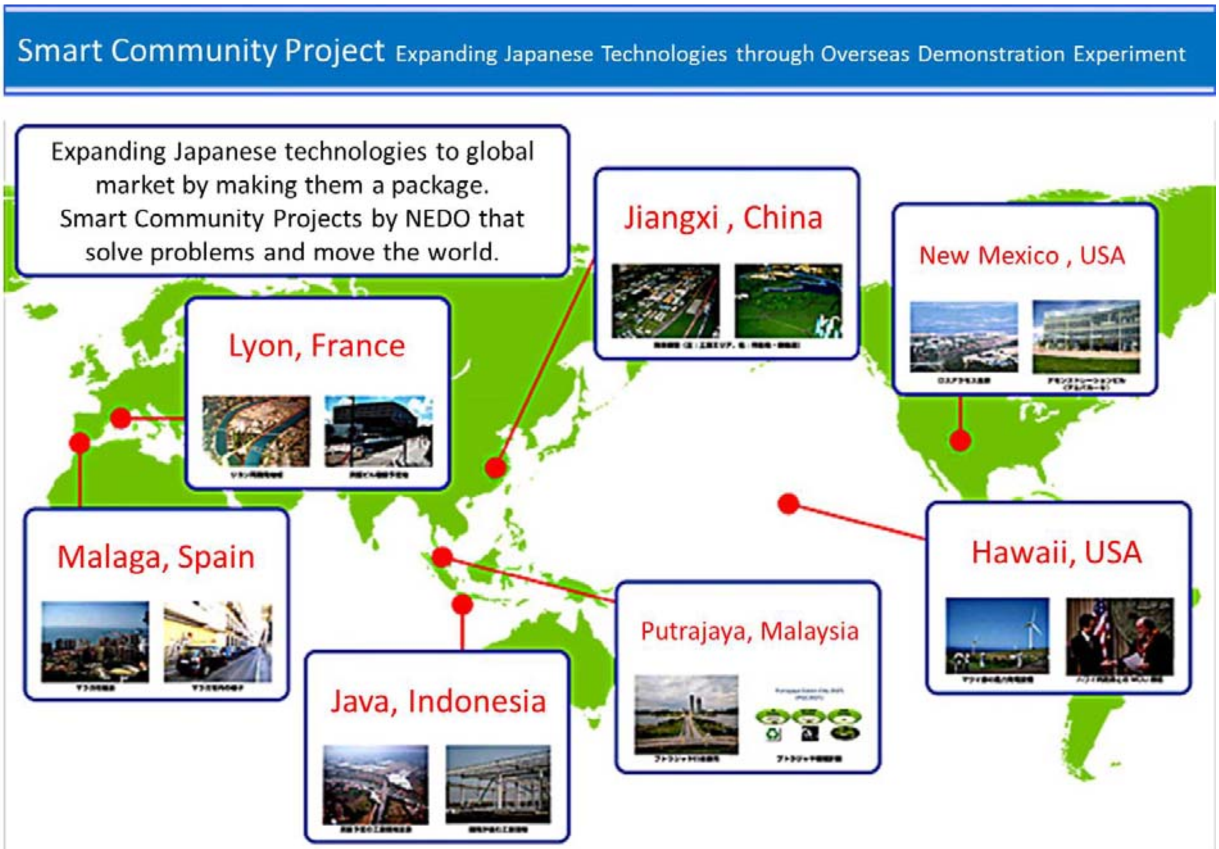


Figure 5.2.16 Example of Smart Community Project by NEDO

5.3 Introduction of a Bus Rapid Transit system

5.3.1 Contents of the Project

(1) Project Summary

This project attempts to reduce CO2 emission through shifting from gasoline motorcycles and automobiles by introducing BRT system with low-emission vehicles.

Currently, the main means of transportation in Da Nang City is gasoline motorcycle. However, it is not user-friendly in rain or when carrying a large quantity of bags. On the one hand, there are not many users for local buses due to its unpunctuality, slow speed, and unclean vehicles.

In addition to overcome these weak points, BRT contributes to form a sustainable, low-carbon city and to improve the travel convenience in the city by offering a bus service that provides high-speed, punctual operation.

Moreover, by carrying forward deliberate urban development coupled with a BRT-centered transportation system, a low-carbon compact city structure is effectively achieved.

(2) Route Plan

According to plans of Da Nang City, operation routes of BRT are consisted of a main route (BRT-1) and three branch routes (R1, R2, R3) as shown in figure below. (Route lengths are:23.8km (BRT-1), 35.4km (R1), 13.1km (R2), and 26.7km (R3))

The R1 branch route passes through Ngu Hanh Son District which is this FS study's target area.

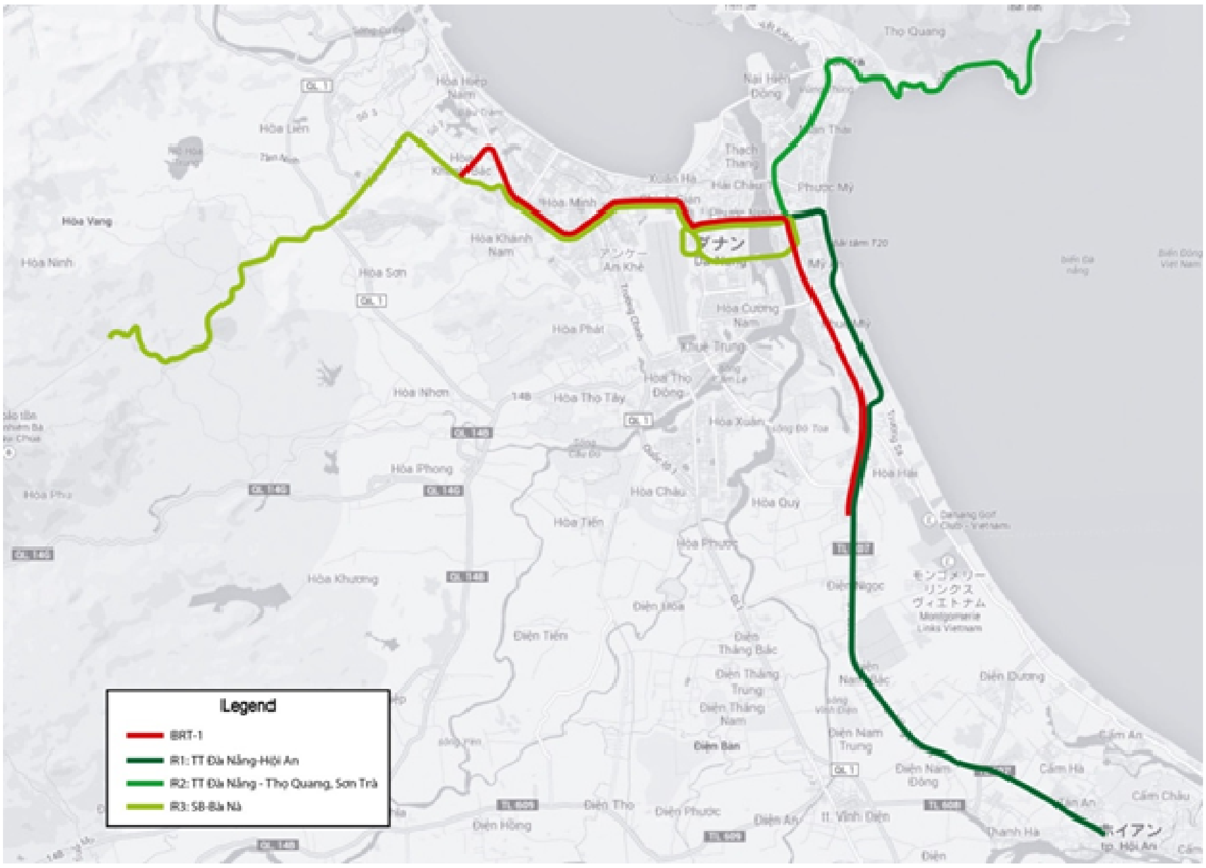


Figure 5.3.1 BRT routes

(3) Space for Introduction

As motorcycles run in outer lanes (by roadside) in Vietnam, where motorcycles are heavily used, it is desirable to establish BRT right-of-ways in the middle of the road for safety, punctuality, and rapidity. However, in order to establish BRT right-of-ways in the middle, it is necessary to ensure space for introduction and to build bus stops in the middle lanes, so that BRT can only be introduced to roads with adequate width.

Many sections of target roads of the R1 branch route that runs in Ngu Hanh Son District have a width of 48m with six lanes (three lanes for either way) and there are center dividers and road shoulders with adequate room. Thus, BRT right-of-ways shall be introduced in the middle of the road. On the other hand, BRT right-of-ways would be introduced in outer lanes (by roadside) in the sections where the width of roads is limited and bus stops have to be built by sidewalks, such as coastal roads and in the south of Ngu Hanh Son District.


Figure 5.3.2 Current conditions of space for BRT introduction
(left: Ngu Hanh Son District, right: coastal area)

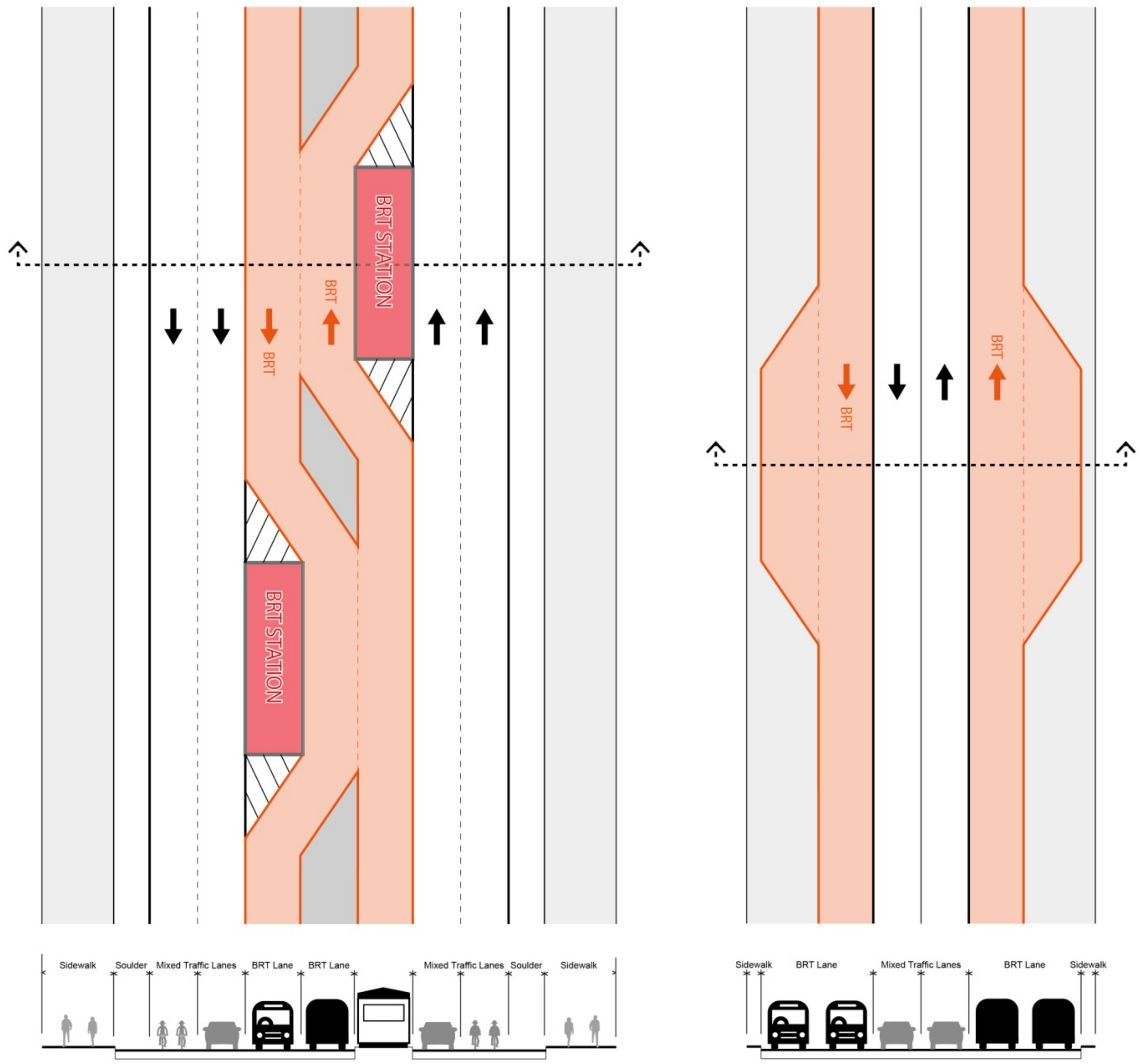


Figure 5.3.3 Space for BRT Introduction
(Left: right-of-ways in the middle – Ngu Hanh Son District,
Right: right-of-ways in outer lanes- inner city)

(4) Structure of bus stops in the middle of the road

Generally, there are two cases for building bus stops for BRT with right-of-ways in the middle of the road; island platform along the center line, and separate platform at either side of right-of-ways.

In case of island platform, the structure of platform is simple. However, introduced vehicles require doors on the left side, so that local bus vehicles with only doors on the right side cannot run on BRT right-of-ways. An advantage of BRT's functionality over that of LRT is that other local buses can run on BRT right-of-ways so that it is possible to form a seamless operation network among BRT and local buses. Like in Da Nang City, in order to form a comprehensive public transportation network centering on BRT, utilizing the current local buses, it is important to ensure the functionality of BRT right-of-ways where local buses can also run.

In addition, it is desirable to ensure the structure of bus stops that local buses can run on BRT right-of-ways for effective use of traffic lanes, as a rapid increase in demands for road traffics is expected in Da Nang City that is experiencing rapid city growth.

Moreover, as for BRT vehicles, bus stop structure that can be used for vehicles with right doors is desirable for safety, efficiency, and economic performance reasons. (see (5) for details)

Based on the points of view described above, it is desirable to establish separate platform at either side of BRT right-of-ways in the middle of the roads for BRT introduced in Da Nang City.

Figure 5.3.4 Separate Platform built at the side of BRT right-of-ways

(5) Vehicles for Introduction

Vehicles to be introduced shall not only be low-emission vehicles that is suitable for National Green Strategy, but also have functinality and design that contribute to enhancement of city images, so that the promotion of utilization of BRT could be achieved. Specifically, it is important to select vehicles by considering economic performance for operation and safety and functionality as public transportation.

Ensuring safety is the most important point of view for public transportation, so that it is necessary to provide safety for users when boarding and alighting based on characteristics of buses that operate in the road space. For the vehicle structure that avoids accidents to the extent possible, it is desirable to have vehicles with doors on one side. As for vehicles with doors on both sides, it is possible that doors open accidentally due to malfunctioning or problems on automatic control, potentially leading to major accidents.

From a perspective of functionality, it is important to create barrier-free environment for the elderly and handicapped users, and to increase the operation efficiency by ensuring as much capacity as possible. Thus, it is desirable to introduce vehicles with doors on one side that have little wasted space.

Moreover, from a perspective of economic efficiency for operation, it is important to be able to select vehicles on a flexible basis, in addition to lower vehicle costs. In order to enhance the city image, it is possible to invest in necessary functions and designs as political decisions. However, it is desirable to avoid special vehicles, such as ones with doors on both sides.

(6) Operational Management

According to operation plans by Da Nang City, operation intervals of the main line (BRT-1) are 5 to 10 minutes, wheras those of branch lines (R1, R2, R3) are 10 to 20 minutes. In order to make BRT a well-established transportation means in the city, it is important to become a reliable transportation means for users by ensuring the punctuality in the inner city where traffic congestion is heavy and by operating branch lines on schedule in which operation intervals are relatively long. Therefore, the punctuality of BRT operation and the convenience for users are maintained and improved through traffic management, such as introduction of BRT-priority signals by control center, provision of road congestion information, and dissemination of bus operation information.

Table 5.3.1 Operation Interval

Route		Operation Intervals
Main Line	BRT-1	5 min. (peak hrs.), 10 min. (off-peak hrs.) in 2016 4 min. (peak hrs.), 10 min. (off-peak hrs.) in 2020 3 min. (peak hrs.), 5 min. (off-peak hrs.) in 2030
Branch Line	R1	10 min. (peak hrs.), 20 min. (off-peak hrs.)
	R2	15 min. (peak hrs.), 20 min. (off-peak hrs.)
	R3	15 min. (peak hrs.), 20 min. (off-peak hrs.)

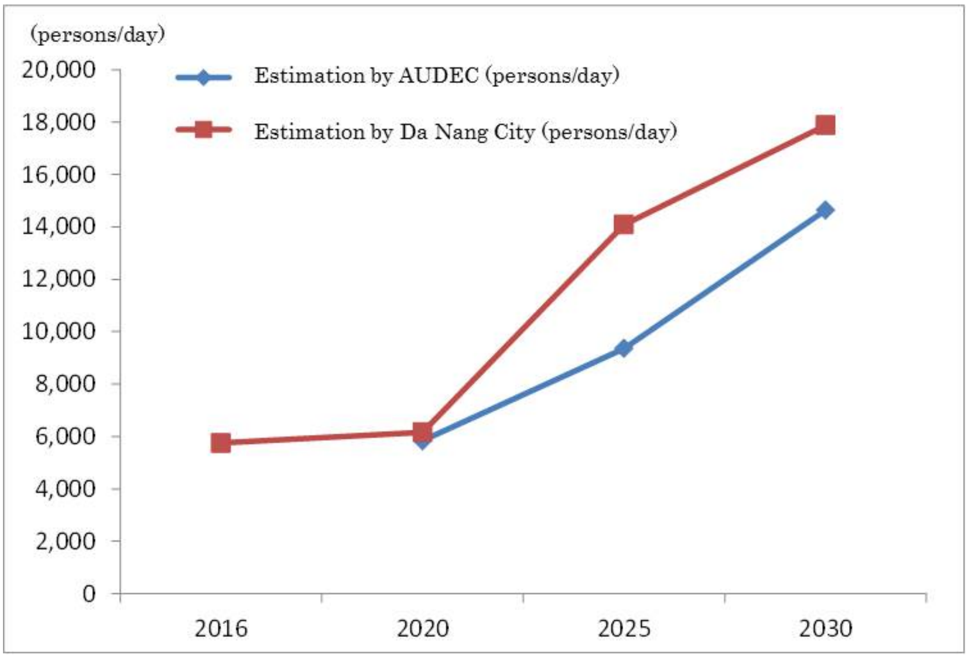
(7) Demand Forecasting

BRT plan in Da Nang City is a project that greatly changes transportation system in the city. For demand forecasting of BRT, the concept of the four-step estimation method is utilized as it is supposedly valid in the field of comprehensive urban transportation planning. Specifically, OD table of year 2010 reflecting the current population and OD tables of years 2020, 2025, and 2030 considering an increase rate of the future population and a change in shares of means of transportation were estimated, based on OD data of person trips in 2008.

As a result, an expected demand for the R1 branch line that passes through Ngu Hanh Son District was approximately the same as demand forecasting by Da Nang City for the short-term, but fell below demand forecasting by Da Nang City by 20 to 30% for the medium- to long-terms.

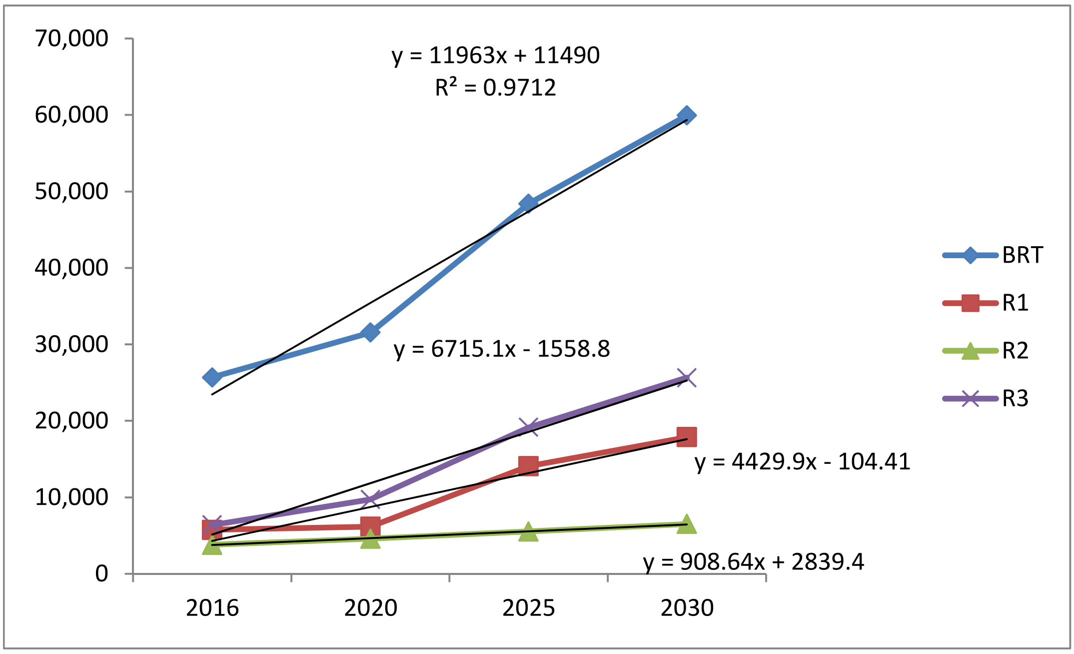
Based on the results, it is important to carry forward the developments in Ngu Hanh Son District and ensure planned population, so that the expected demand by Da Nang City could be achieved. Nevertheless, it is also important to promote the use of BRT and the shift from motorcycles and automobiles to BRT, in order to achieve the goal for CO2 emission reduction amount. In addition, it is necessary to consider risk management of plans on revenue and expenditure, as it is possible that the demand fall below the estimation by 20 to 30% in the future.

To calculate CO2 emission reduction, the expected demand estimated by Da Nang City is utilized (see (9) for details).



※an expected demand for 2030 by Da Nang City was extrapolated

Figure 5.3.5 Comparison of expected demands between Da Nang City and AUDEC (R1 branch line)



※an expected demand for 2030 by Da Nang City was extrapolated

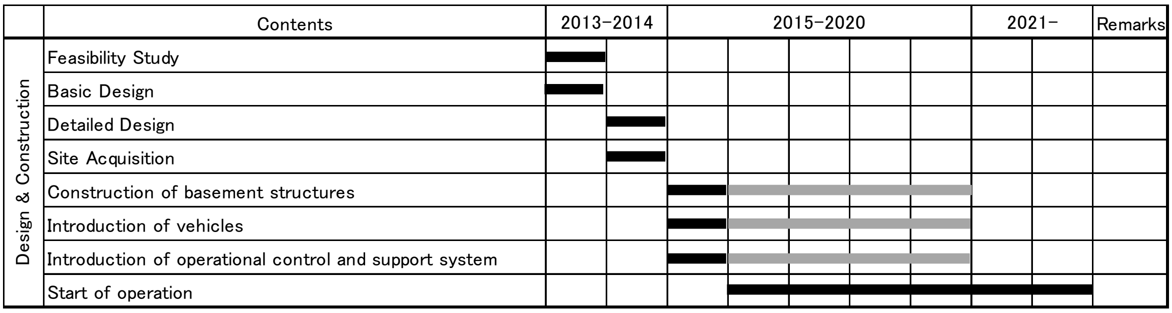
Figure 5.3.6 Expected demands of BRT by Da Nang City

(8) Project Schedule

The project schedule is shown in the table below.

After the first phase from the start of operation in 2016 to 2020, further enhancement of transportation capacity and upgrade of the service level should be promoted in the second phase (2020~).

Figure 5.3.2 Project Schedule



(9) Road Map

Based on expected demands of BRT, CO2 emission reduction amount in Ngu Hanh Son District has been calculated.

Conversion ratios from gasoline motorcycles and automobiles to BRT are: 30%, 50%, 65% in 2020, 2025, and 2030, respectively. As a result, shares of BRT in transportation means in Ngu Hanh Son District are expected to be: approximately 18%, 25%, 30% in 2020, 2025, and 2030, respectively.

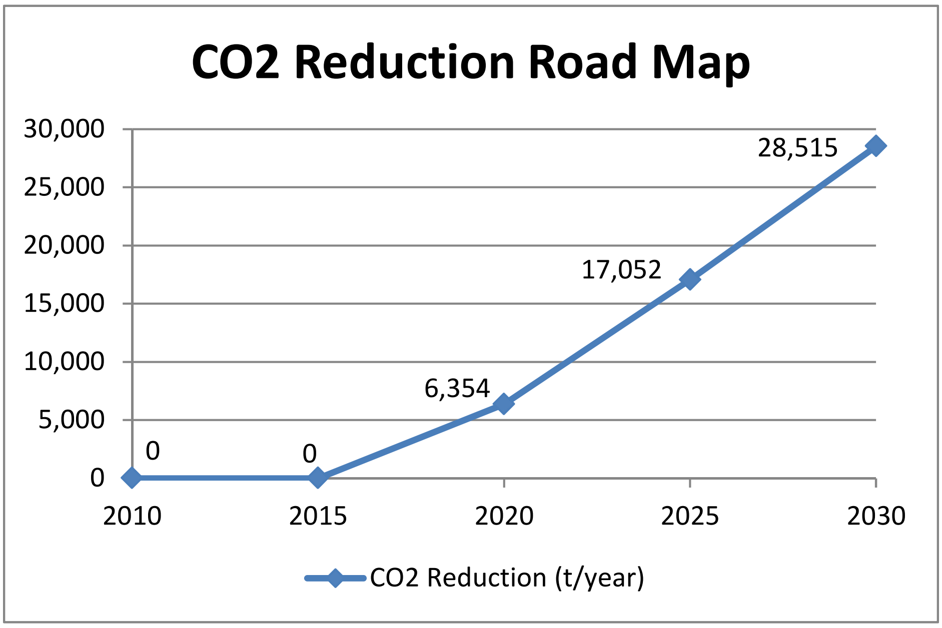


Figure 5.3.7 CO2 Reduction Road Map

5.3.2 Market environment

The first BRT in the world appeared in Curitiba, Brazil in 1973.

Currently, BRT has been spread throughout the world to countries such as USA, Canada, Great Britain, France, Netherland, Germany, Australia, Columbia, Ecuador, China, etc.

BRT running in the middle of the road (Ecuador) BRT running in the middle of the road (India)

- The City of Seoul restructured its bus network and introduced BRT due to worsening problems, such as sprawl in the commuting area, heavy congestion, a decrease in bus passengers and an increase in the automobile traffic volume.
- Introduction of BRT with right-of-ways achieves an Increase in travel speed and the number of passengers while also reducing in travel time which contributes to a convenient traffic network in combination with the railway network.
- Many of cities in Germany have succeeded in revitalizing their inner city by prohibiting vehicles in the central area.

BRT on the right-of-way (Seoul, Korea) Transit Mall in Freiburg, Germany

BRT is currently operated in five cities in Japan (Fujisawa, Atsugi, Machida, Nagoya, and Gifu). In Japan, there are examples of introducing separate platforms established at sides of BRT right-of-ways, considering safety for boarding and alighting, functionality in terms of seat layout and barrier-free environment, and economic efficiency due to introducing vehicles with high versatility. In these cases, a seamless public transportation system in combination with local buses and BRT is formed. In addition, these cases have achieved not only a convenient public transportation system, but also efficient transportation operation which is rarely seen in the world.

BRT on the exclusive lanes in Japan

5.3.3 Project scheme

Costs for introduction and construction of BRT are estimated to be 50 to 60 million USD.

Investment recovery includes fare revenues from passengers and revenues from incidental businesses (e.g. advertisement) utilizing bus stops and vehicles.

As the project is highly public, there could be two kinds of project schemes for management and operational bodies: (1) Da Nang City is responsible for both management and operation, and (2) Da Nang City is responsible for management and an operational company for operation. For either schemes, it is more important to decrease operation costs than to lower introduction and maintenance costs. Especially, in the case of the latter scheme in which an operation company is responsible for operation, it is important for sustainable BRT operation to develop infrastructures beforehand in order to reduce a load on operational costs. (see 5.3.1(3)～(5) for details)

(1) Directly-managed and operated by the public sector

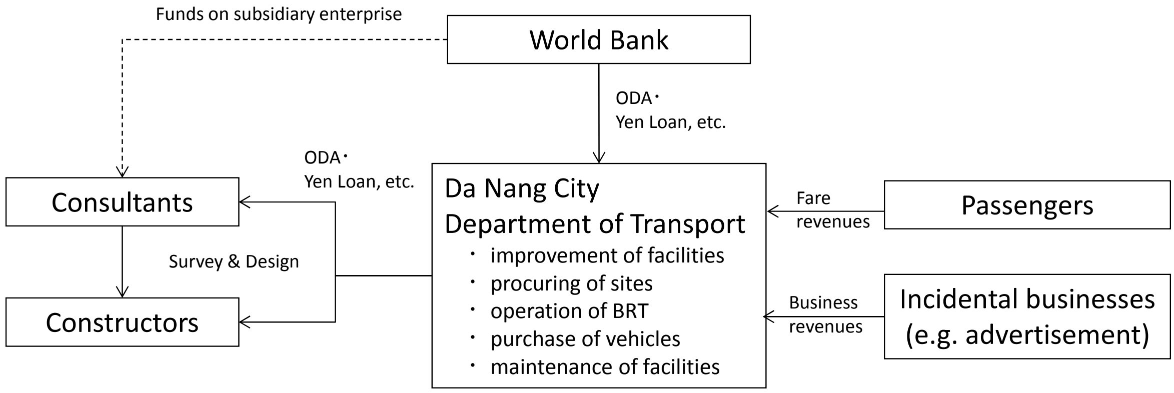


Figure 5.3.8 Project Scheme that Da Nang City is responsible for all

(2) PPP (Public-Private Partnership) Project

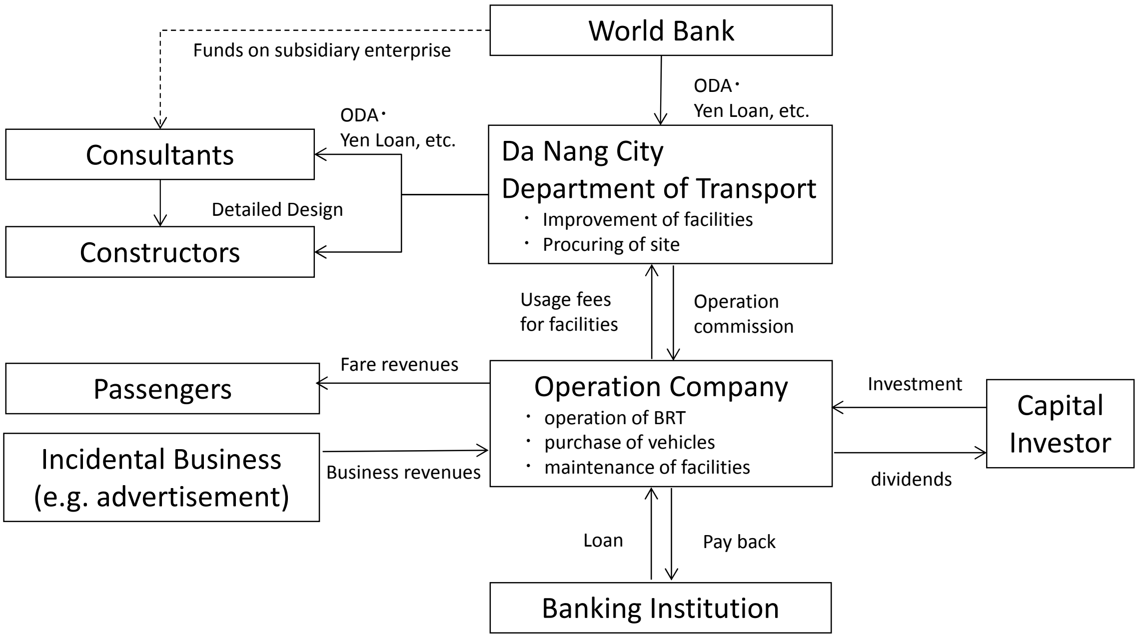


Figure 5.3.9 Project Scheme with Da Nang City for management and an operation company for operation

5.3.4 Financial Sources

Financial source for this project is expected to be ODA from World Bank or others.

World Bank's programs targeted at Vietnam go along with SEDP (Socio-Economic Development Plan 2006 - 2010) by Vietnamese government and emphasize the improvement of business environment, enhancement of social cohesion, better management of natural resources and environment, and improvement of governance.

5.4 Purification and Power Generation Utilizing of Biogas (Digestive Gas)

5.4.1 Content of business

(1) Project summary

This power generation is conducted by accumulating sewage sludge and methane gas produced from sewage sludge.

At the moment, the amount of the sewage, including rainwater, accounts for about 15% of the whole.

The BOD water quality at Ngu Hanh Son sewage plant is really low because the sewage is overflowed water from septic tanks. Even though the capacity at Ngu Hanh Son plant is already full, constructing a new plant costs a lot of money and time. Thus, collecting sewage sludge from each house's septic tank directly should be prioritized. In this chapter, we will plan a business plan a funding such a system.

- Reduction of CO2 emissions when generate electricity using the methane recovery
- CO2 reduction due to be recovery methane

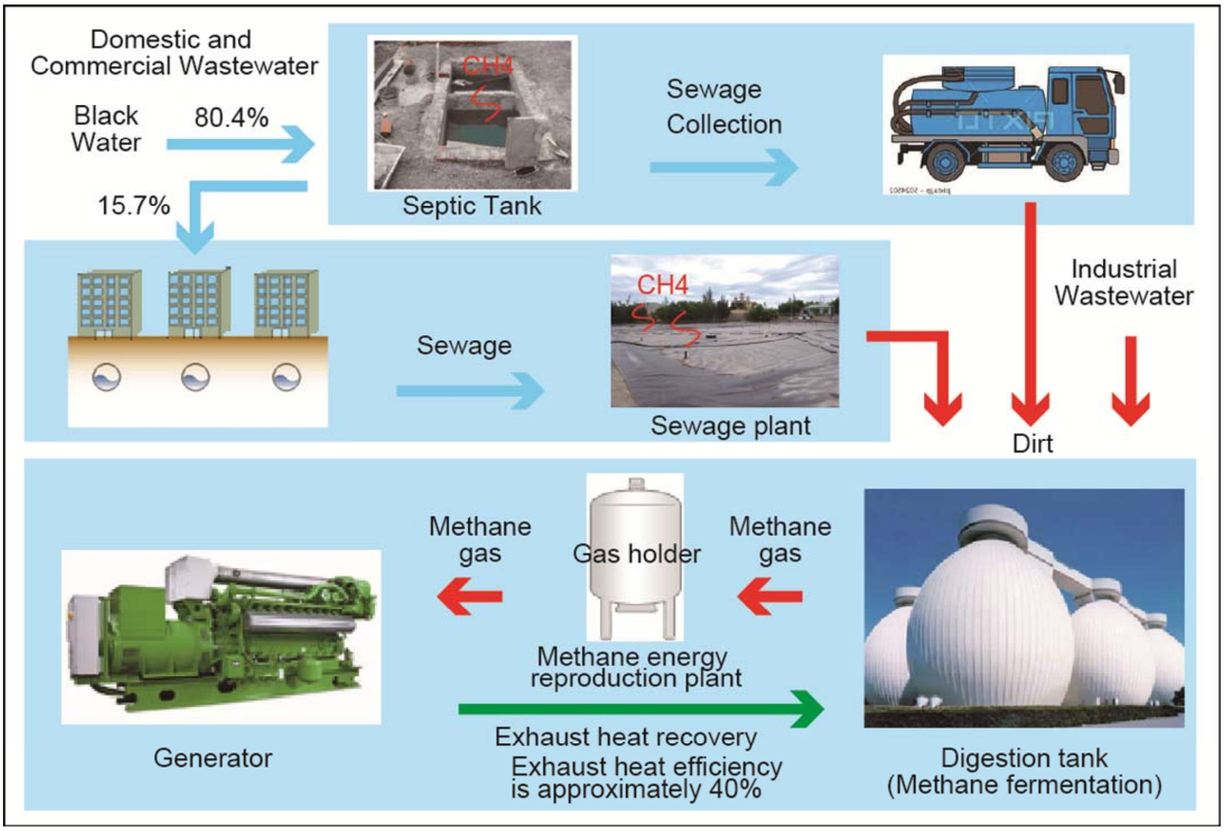


Fig.5.4.1 Project summary

(2) Action Plan

- Formulation of programs for the recovery of sludge of in septic tanks

Current drainage system in Da Nang city is the common drainage system. It means wastewater, usually from septic tank, service facilities (with or without treatment system), and rainwater are collected and flows in the same drain system. Almost households have septic tank or similar sanitation treatments. The rate of households that have septic tanks (ST) connected to drainage system is 80.4% in average. Actually, only 15.7% of septic tanks are connected to the sewage system.

Therefore, the septic tanks collection, I carried out in vacuum car.

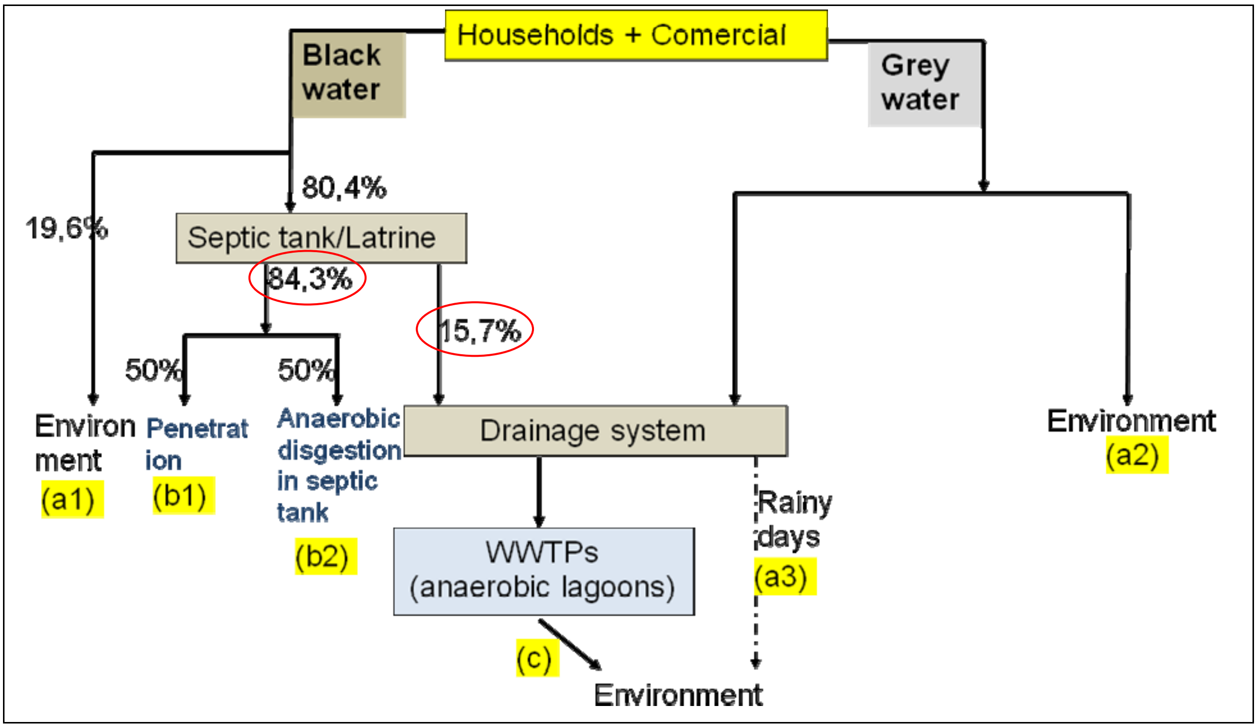


Fig.5.4.2 Drainage system in Da Nang City

- Development of new sewage treatment plant

Currently, there is a sewage treatment plant of the four places in Da Nang city, but the capacity is low, it can not only support domestic wastewater. So, by the master plan of Da Nang city (World Bank), land of 4.2 ha for processing sludge of corruption aquarium Da Nang whole is planned.

(3) Project Schedule

The project schedule is outlined below.

Table.5.4.1 Project Schedule

	Contents	2010-2015	2016-2020	2021-	NB
Initiatives	new sewage treatment plant				
	Sludge recovery				
design review	business structure making				12 months
	Feasibility Study				24 months
	operation test				24 months
	baseline design				12 months
	detailed design				12 months
execution of works	engineering works				4 months
	permanent works				10 months
	equipment works				6 months
	electric works				6 months
	test working				3 months
	startup operation				2020-

(4) Roadmap

The target population of Ngu Hanh Son District, will converted to using the CO2 methane gas generated. It is expected that by 2020 CO2 emissions will starts to decrease.

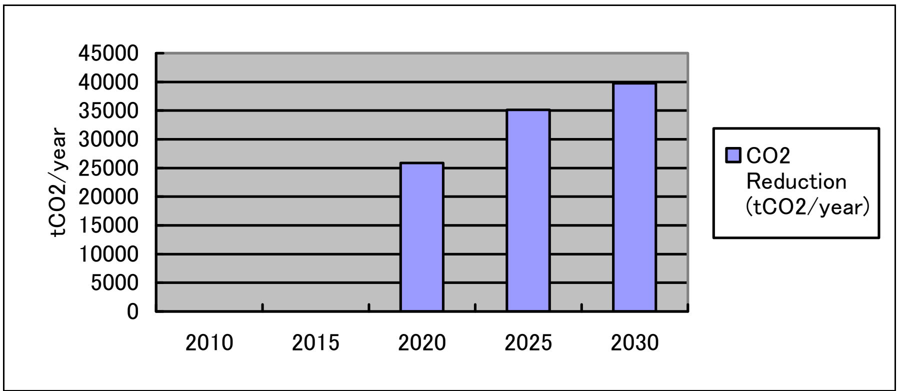
To perform plant maintenance and collection by vacuum car to the goal in 2020.

Table.5.4.2 Total CO2 emission volume

Contents	Unit	2020	2025	2030	N B
popluration	person	178,571	287,589	370,142	Ngu Hanh Son District
methane-gas volume	tCH4/year	1,153.09	1,564.99	1,770.00	
CO2 weight conversion	tCO2/year	24,214.98	32,864.86	37,170.06	greenhouse effect factor 21
volume conversion of methane weight	m3／year	1,747,112.84	2,371,202.09	2,681,822.20	Density 0.66kg/m3
methane-gas volume	m3／day	4,786.6	6,496.4	7,347.5	
power generator utility factor	kWh/m3	2.42	2.42	2.42	Results data 800/330
generation volume	kWh/year	3,104,404.1	4,213,333.8	4,765,267.4	80%
emission factor	tCO2/kWh	0.000541	0.000541	0.000541	Viet Nam
CO2 conversion	tCO2/year	1,679.5	2,279.4	2,578.0	
total CO2 emission volume	t/year	**25,894.5**	**35,144.3**	**39,748.1**	Methane recovery activities＋Grid power alternative activities

Contents	Unit	2020	2025	2030	N B
population	person	1,338,230	1,876,936	2,632,501	EPRC
Total volume of CH4	t/year	9,126.1	10,859.6	13,136.8	EPRC
Industrial wastewater	t/year	1,348.9	1,348.9	1,348.9	
Landfull leachate treatment	t/year	383.3	383.3	383.3	
Sewage treatment plant	t/year	0.0	0.0	0.0	
Domestic sewage treatment plant	t/year	7,113.1	8,748.4	10,892.8	
Human-waste treatment plant	t/year	280.9	379.2	511.9	

1 Industrial Wastewater	t-CO2/year	2,722.1	2,722.1	2,722.1	Ngu Hanh Son District
2 Domestic and Commercial Wastewater	t-CO2/year	20,719.5	29,369.4	33,674.6	
3 Other (Landfil leachate treatment)	t-CO2/year	773.4	773.4	773.4	
Total	t-CO2/year	24,215	32,865	37,170	



<u>2010-2019 year</u>
0.0tCO2/year
<u>2020 year</u>
25,894.5tCO2/year
<u>2025 year</u>
35,144.3tCO2/year
<u>2030 year</u>
39,748.1tCO2/year

5.4.2 Environment of the market

- Sewage plant project in the industrial parks in Da Nang, implemented by Viet Nam/ Kajima Corporation, Hitachi Plant Technology
- Remedial investigation for a hygienic environment in Da Nang, Viet Nam/ JETRO
- Remedial investigation for hygienic environment in Da Nang, Viet Nam/ METI
- Feasibility study for water and sewerage services in Hoa Lien, in Da Nang (PPP Infrastructure Project)/ JICA
- Da Nang priority infrastructure investment project – Component B – environment infrastructure improvement: Drainage, Wastewater collection and treatment / World Bank

5.4.3 Project Scheme

(1) Public- Private Partnerships

Consulting companies, plant makers, the government of Japan, the government of Viet Nam, the administrator of the facility (organization), power producers, investing organizations, financing corporations.

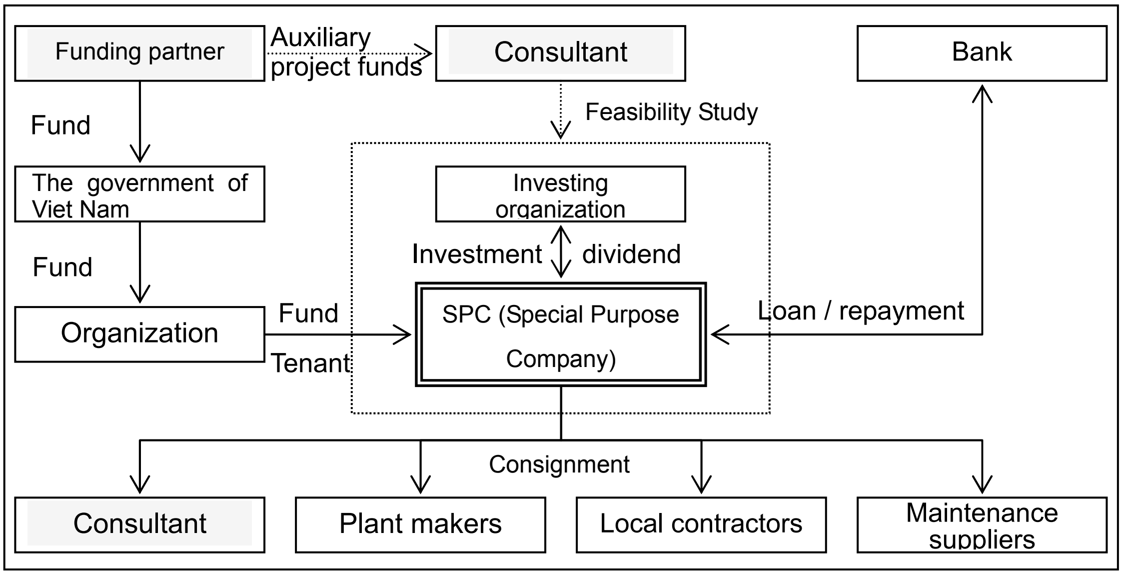


Fig.5.4.3 PPP scheme

(2) Direct-managed business by public sector

Consulting companies, plant makers, the government of Viet Nam, administrator of facility (organization)

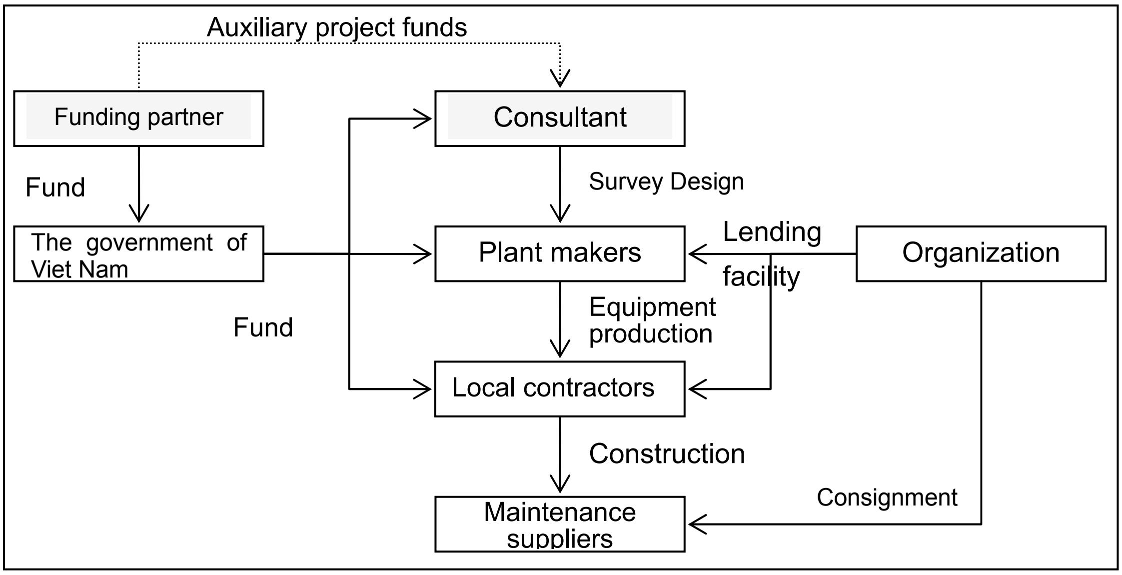


Fig.5.4.4 Direct-managed business by public sector scheme

5.4.4 Fundraising plan and practical achievement process (Appendix 5.4)

(1) PPP related supplemental business / ODA project

Need, feasibility, role-sharing of public and private, possibility of funding by overseas loans and investment are important factors for evaluation in order to be chosen as a PPP project.

(2) JCM related project

Some other county and Viet Nam have already signed a bilateral agreement, and the budget for other supplemental project have been made.

5.5 Biomass Generations from Kitchen Garbage

5.5.1 Content of business operation

(1) Project summary

Biomass generation is carried out by accumulating kitchen garbage and storing the methane produced from the garbage.

At the present time, rubbish separation is not carried out in Da Nang city. However, the amount of garbage has been increasing every year. Because of this, it will only be possible to run the Kanson disposal plant for six years more. Decreasing the amount of garbage is the urgent tasks.

Accordingly, a biomass power system which involves separating rubbish and utilizing the garbage in Ngu Hanh Son District is a solution for decreasing the amount of garbage. In this chapter, we have created plans for biomass generation and funding.

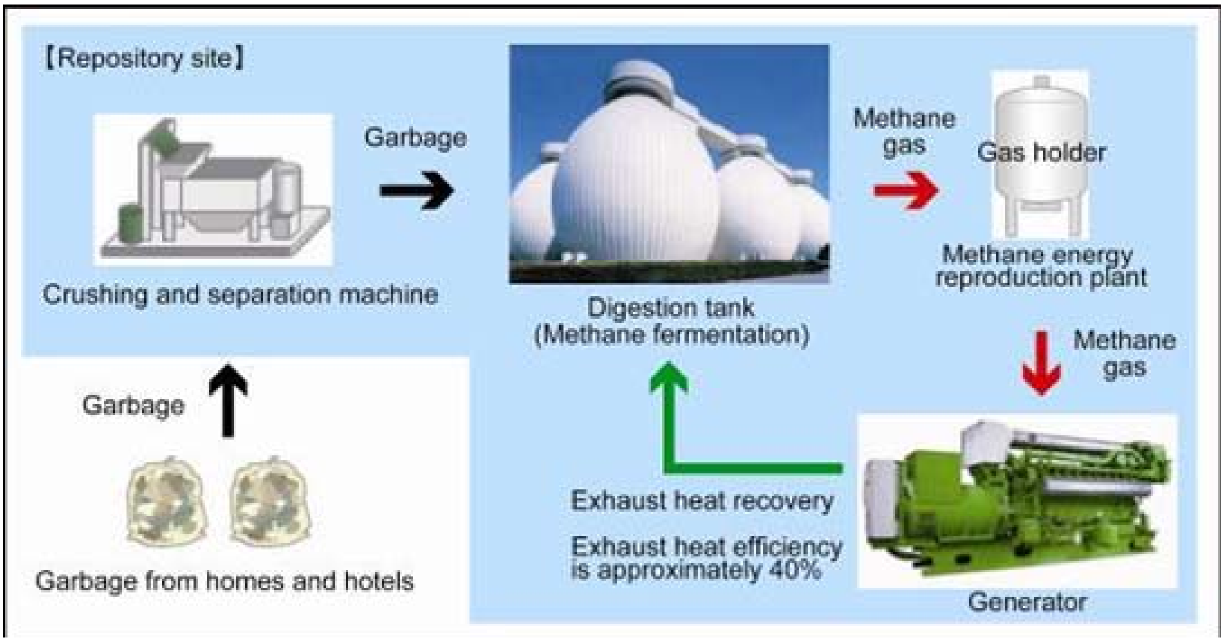


Fig 5.5.1 Project description

(2) Action Plan to be effective for recovery of methane

- Distribute of separation garbage bag
- Installation of separation trash

Garbage generation amount in the Ngu Hanh Son District is about 55 tons / day currently. In addition, the organic component accounts for about 60-70%.

To increase the effect of the recovery of methane gas, it is indispensable garbage separation. In addition, It is believed that as for Five Elements Mountain District, to implement waste sorting, and publicity activities for residents, and is easily spread to the entire Da Nang city. However, only Ngu Hanh Son District, if a waste sorting, it is necessary to invest in treatment facilities of garbage after fractionation.

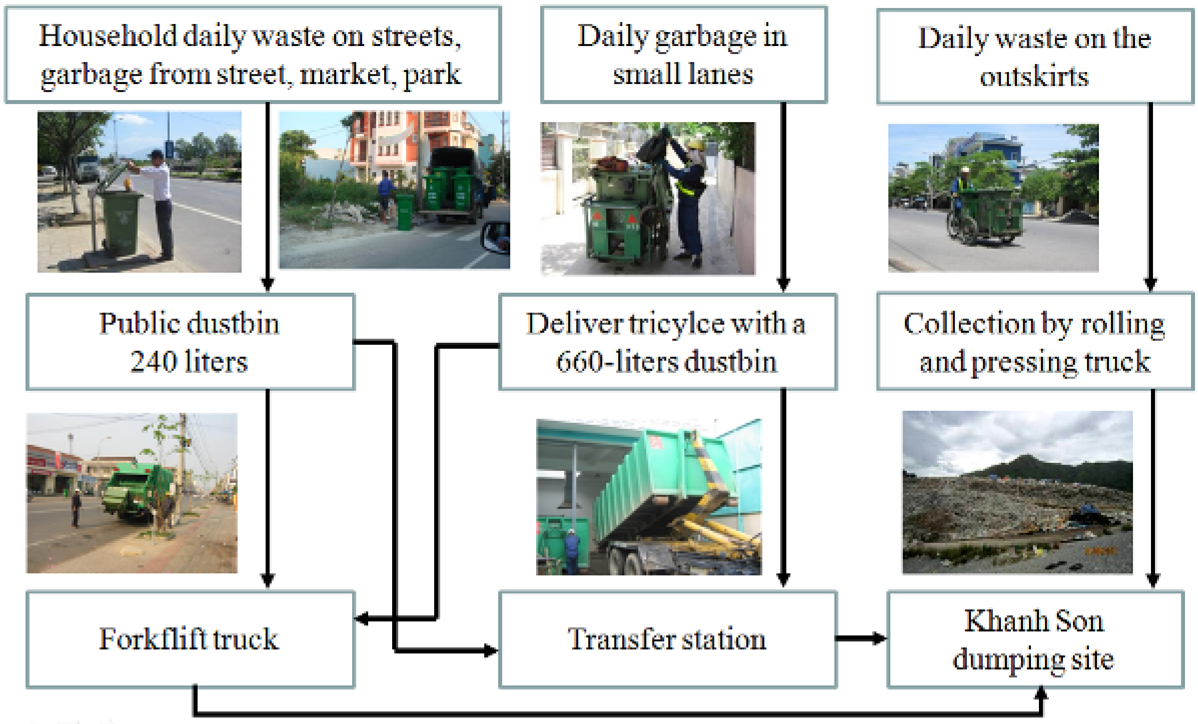


Fig 5.5.2 Garbage collection Flow of the current

Fig 5.5.3 Case Study to facilitate separate collection

(3) Construction site of the plant

The Khanh Son Sanitary Landfill is located 1 km southeast from the present landfill and 8 km from Da Nang.

The facility is owned by URENCO, who is responsible for the safe and legal operation of the landfill in accordance with current rules and legislation of the province. The owner is responsible for following the permits and licenses issued for the operation of the facility. The site is approximately 45 hectares in size and contains the following tow main facilities:

Fig.5.5.2 The map of Khanh Son Landfill Area

(4) Progress of the project

The progress of the project is shown in the table blow.

Table.5.5.1 Progress of the project

Contents		2010-2015	2016-2020	2021-	NB
Initiatives	Educational activities to the public				
	Educational activities to the public				
design review	business structure making				12 months
	Feasibility Study				24 months
	operation test				24 months
	baseline design				12 months
	detailed design				12 months
execution of works	engineering works				4 months
	permanent works				10 months
	equipment works				6 months
	electric works				6 months
	test working				3 months
	startup operation				2020-

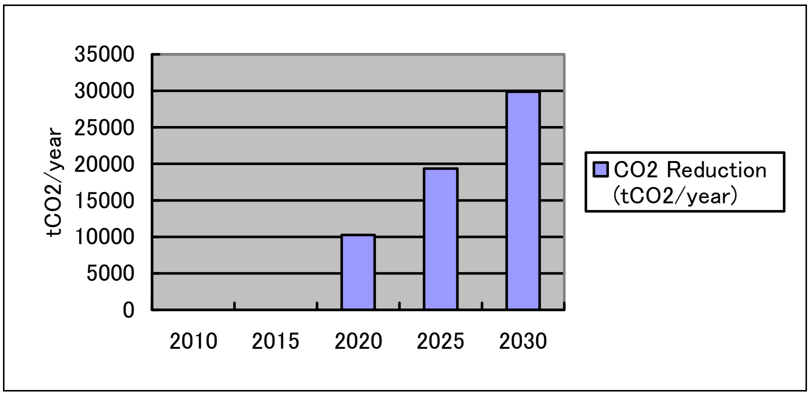
Methane fermentation goes through stages of water operation, addition of seed sludge, incremental garbage addition, acclimation, trial operation of generation, and extradition performance tests. It takes approximately 2 to 6 months depending on the accuracy of rubbish separation. The trial operation period will be 120 days although it depends on the situation of the area.

(5) Roadmap

To target kitchen garbage of Ngu Hanh Son District, is converted to CO2 methane gas. It is expected that by 2020 CO2 emissions will start to decrease.

Table.5.5.2 CO2 emission volume

contents	unit	2020	2025	2030	NB
population	person	178,571	287,589	370,142	Ngu Hanh Son District
Total volume of waste	t/day	152.7	287.6	444.2	Analysis from EPRC report
(organic material)	t/day	114.0	214.7	331.6	74.7%
basic unit of CO2 emission from landfill	t/year/person	0.11679	0.12503	0.14696	Analysis from EPRC report
Decomposition rate	%	15.67	15.67	15.67	Ministry of the Environment (Japan)
Amount of decomposition	t/day	7.27	13.70	21.16	
Methane gas incidence output level	tCH4/t	0.13	0.13	0.13	Ministry of the Environment (Japan)
Methane gas emissions	t/day	0.945	1.781	2.751	
	t/year	345.1	650.1	1,004.0	
CO2 emission from landfill (A)	t/year	7,246.4	13,652.2	21,084.6	
generation incidence	kWh/t	182.7			Average performance in Japan (Ministry of the Environment)
generation volume	kWh/day	20,819.7	39,224.3	60,578.4	
emission factor	tCO2/kWh	0.000541			Viet Nam
CO2 emission volume (B)	t/day	11.3	21.2	32.8	100%
	t/year	3,018.6	5,687.1	8,783.1	80% Electricity volume to national grid
CO2 emission Volume (A)+(B)	t/year	10,265.0	19,339.3	29,867.8	



2010-2019 year
0.0tCO2/year
2020 year
10,265.0tCO2/year
2025 year
19,339.3tCO2/year
2030 year
29,867.8tCO2/year

5.5.2 Environment of the market

- PPP infrastructure project F/S for Da Nang city environmental infrastructure development business feasibility study/JICA
- JCM major project feasibility study/Ministry of Environment

5.5.3 Project Scheme

(1) Public- Private Partnerships

Consulting companies, plant makers, the government of Japan, the government of Viet Nam, administrator of the facility (organization), power producers, investing organizations, financing corporations.

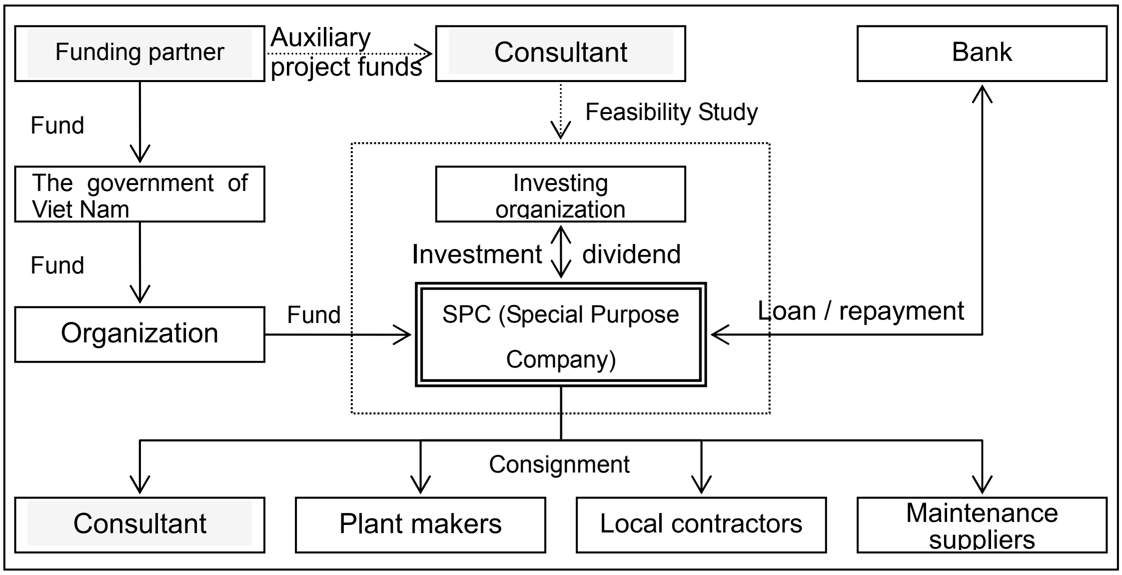


Fig.5.5.3 PPP scheme

(2) Direct-managed business by public sector

Consulting companies, plant makers, the government of Viet Nam, administrator of the facility (organization)

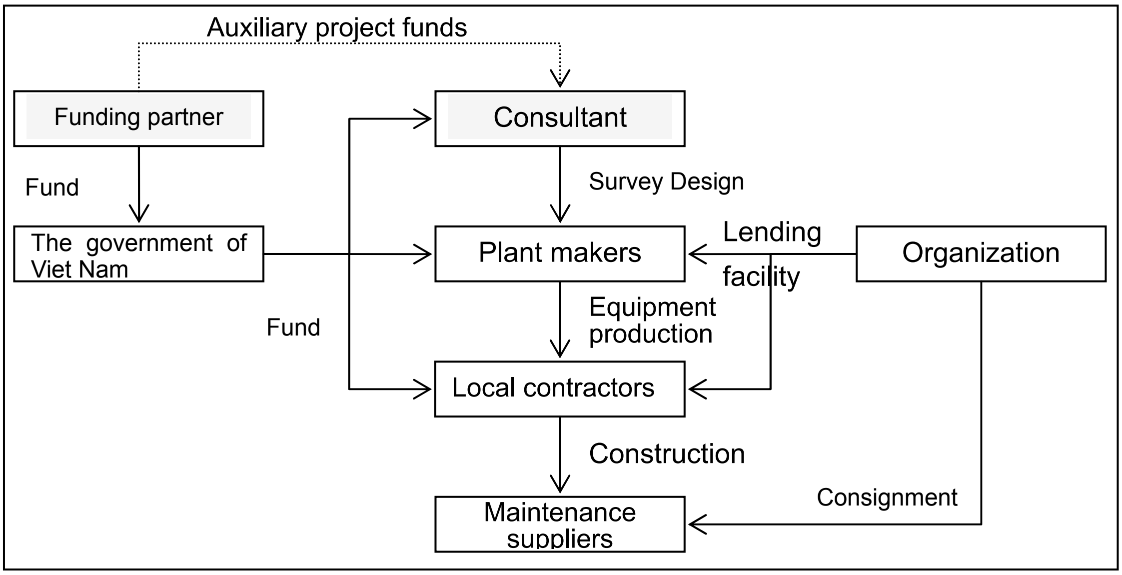


Fig.5.5.4 Direct-managed business by public sector scheme

5.5.4 Fundraising plan and practical achievement process (Appendix 5.4)

(1) PPP related supplemental business / ODA project

Need, feasibility, role-sharing of public and private, possibility of funding by overseas loans and investment are important factors for evaluation in order to be chosen as a PPP project.

(2) JCM related project

Some other county and Viet Nam have already signed a bilateral agreement, and the budget for other supplemental project have been made.

5.6 Optimum management and energy conservation of the street lights through LED lighting

5.6.1 Contents of the Project

(1) Project Summary

- This measure reduces the power consumption of street lights and upgrades street light management by replacing the existing street lights with LEDs and by introducing optimal control through ITC.
- Some light sources for street lights include mercury lamps, high-pressure sodium lamps, and LED lamps. In recent years replacement of the existing lamps with LEDs has been taking place.
- These light sources for street lights are also being placed in Da Nang City, including Ngu Hanh Son District. This measure intends to reduce CO_2 through reducing the energy consumption of street lights in the area through the following initiatives.

a) Modulate high-efficient lights, such as high-pressure sodium lamps that have been recently placed mainly along major roads, by using a remote automated control system, .

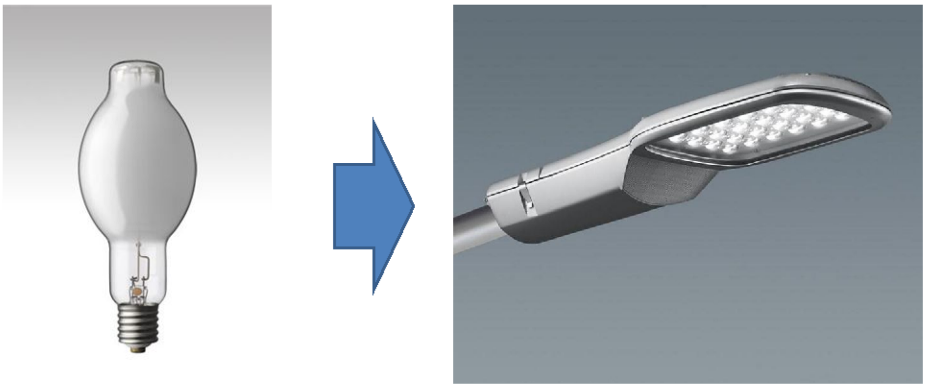


Fig.5.6.1 Displacement of mercury lamp with LED lamp

Distance for introduction: 2 routes totaling 20.3km (the red routes as shown in Figure 5.6.3)

Replace those that are relatively easy to be replaced with LED lamps, such as lights on sidewalks, and effectively modulate them with a remote automated control system..

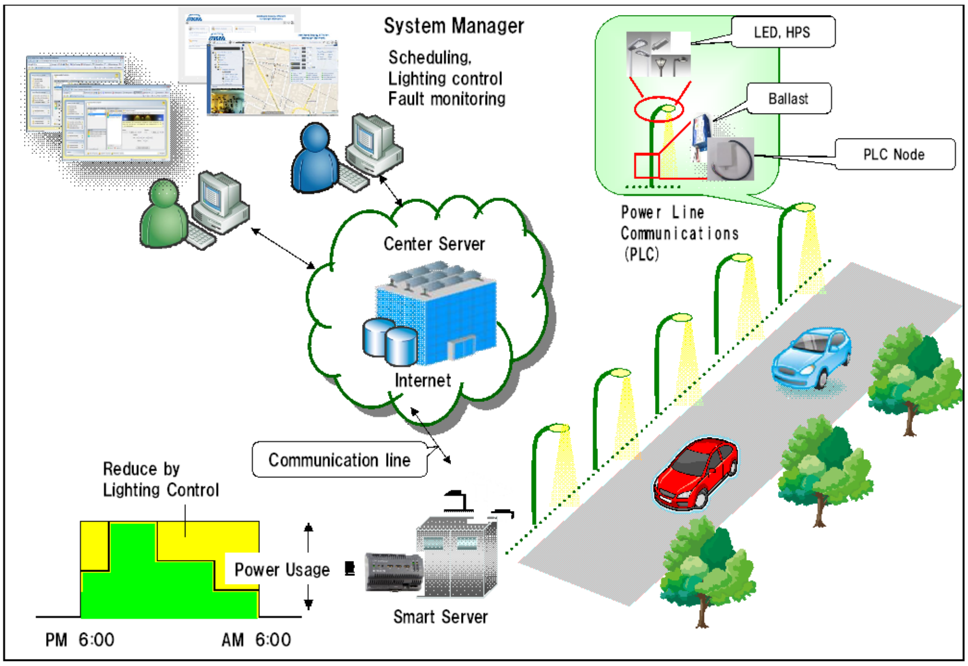


Fig.5.6.2 Outline of smart street light control system

Distance for introduction: 5 routes totaling 4.3km (blue routes as shown in Figure 5.6.3)

- A smart street light system is a system that streamlines and optimizes operation using IT, through methods such as remote control of source, modulation, and fault detection.- The system not only reduces electricity costs, but also has great effects of cost reduction on street light maintenance. Over 300 cities around the world, especially those in Europe, have adopted the system, and ITOCHU Corporation owns the system in Japan.
- In Europe, costs for system adoption are paid off within a few years due to the cost reduction effects on electricity usage and maintenance.

(2) Routes for introduction

- The proposed system can be applied to almost all street lights. In addition to replacing street lights with LED lamps in Ngu Hanh Son District, introducing this system along arterial roads with high intensity lamps is planned.
- Based on roadside environments, the smart street light control system is intended to be introduced in the routes colored by red and blue as shown in Figure 5.6.3.
- The distance of the two red routes totals 20.3km whereas the two blue routes total 4.3km.

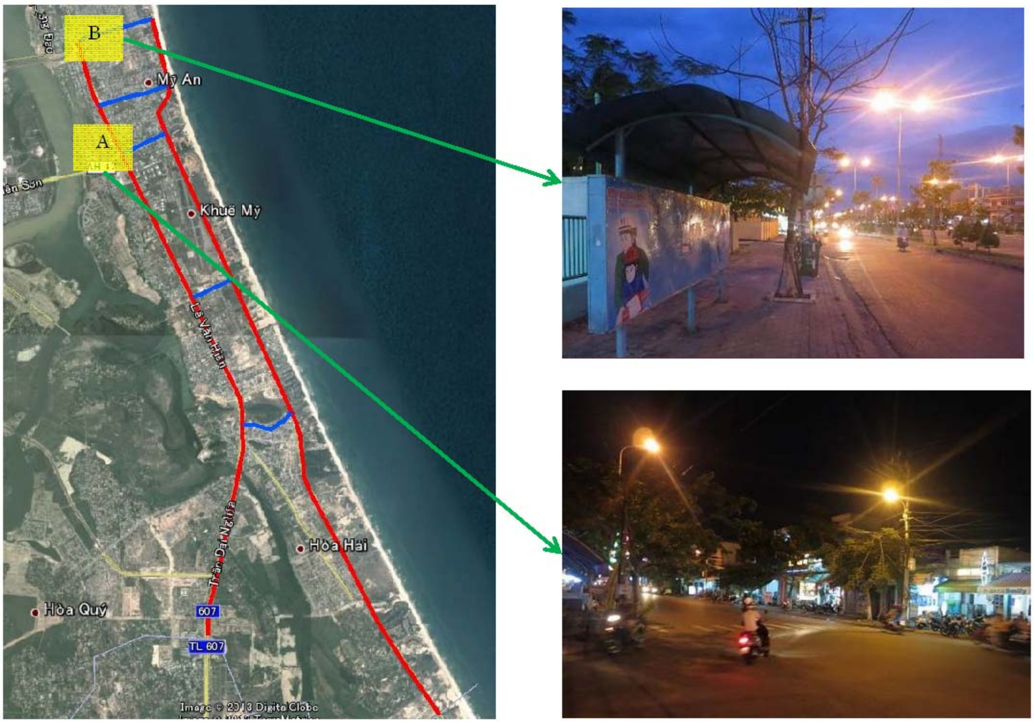


Fig. 5.6.3 Target routes for the project

(3) CO2 Emission Reduction Amount

- 2 street lights are placed at 35m-intervals along arterial road A (20.3km). The power consumption averages 200W/light, totaling 232kw/h (1,160 lights), and these are controlled by smart street light control.
- 2 street lights are placed at 35m-interval along arterial road B (4.3km). The power consumption averages 200W/light, totaling 49kw/h (245 lights), and these lights are replaced with LEDs while concurrently applying smart street light control.
- As in Paris, we set a modulated light rate of 30% and a power consumption rate of 30% by smart street light control. In addition, replacement with LED reduces power consumption by 25%.
- Reduction amounts of street light power consumption through this measure totals approximately 327.5 tons/yr.
- This project is assumed to introduce LED lamps and a smart street light control system to arterial roads shown in Figure 5.6.3. However, it could be possible to introduce them to all large-size street lights with large electricity consumption.
- In addition to Ngu Hanh Son District, it is easy to expand the system to the entire area of Da Nang City. Through introducing the system to a large number of street lights in a short period of time in broad areas, it is possible to reduce more CO2 emissions.

(4) Road Map

- The road map is to be made according to the schedule described below.

STEP1 Survey on routes for introducing smart street lights and a project feasibility simulation: 2015
STEP2 Execution design, fixing project budget & project partner: 2016
STEP3 Introduction of the street lights to arterial road B: 2020
STEP4 Introduction of the street lights to arterial road A: 2025

- When the smart street light system is introduced in the following four steps above, the CO2 emissions reduction amount will be as follows.

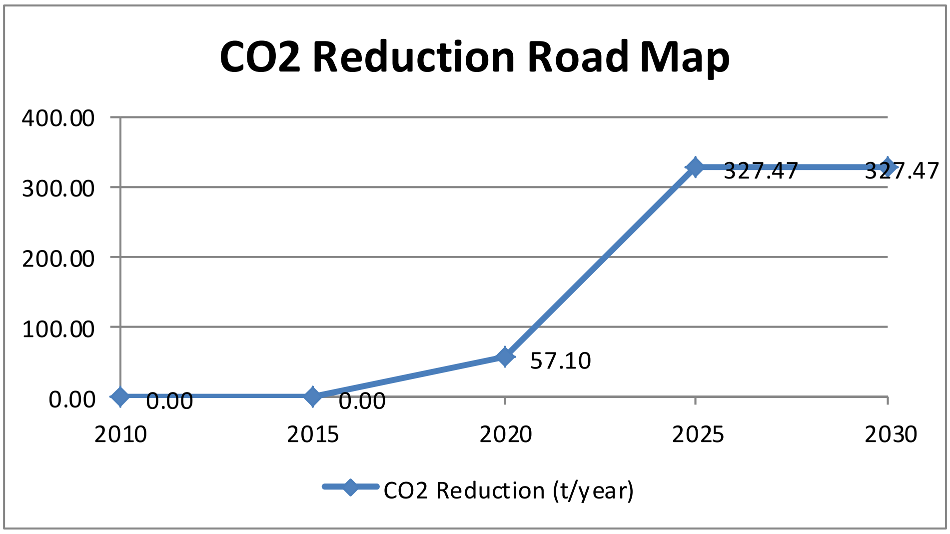


Fig. 5.6.4 CO2 Reduction Road Map

- The CO2 reduction road map is estimated with an assumption of implementing the project from 2020 to 2025. However, it is possible to introduce the system within two to three years from decision-making if introduction effects by the prompt test experiment could be recognized. Therefore, it is easy to change the road map shown in Figure 5.6.4 to a shorter-term plan.

5.6.2 Market Environment

(1) Case examples of smart street lights in the world

- Over 300 cities around the world (e.g. Europe, USA and China) have adopted smart street lights.
- Cities in Europe that have adopted these lights are shown in the Figure below. Paris has adopted about 18,000 smart street lights with an average electricity reduction rate of 30%, and the investment is estimated to be paid off in about four years.

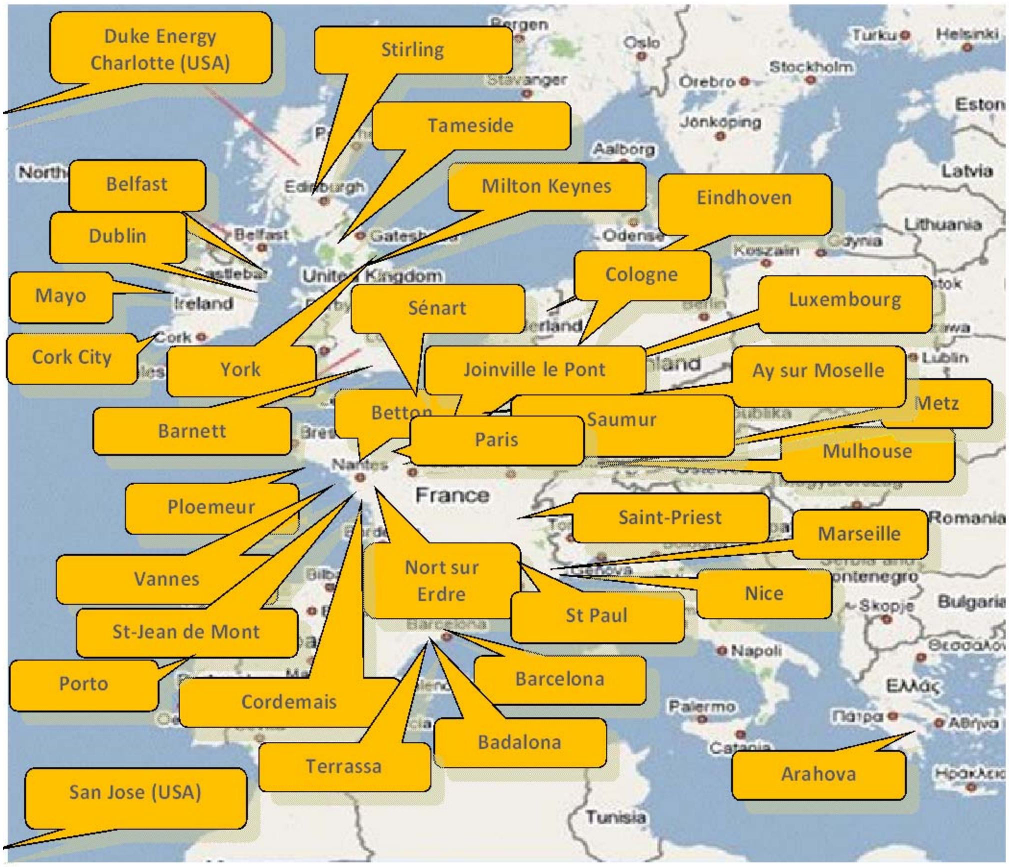


Fig. 5.6.5 Examples of introduction of smart street lights in Europe

(2) Case examples in Viet Nam

- In Viet Nam, smart street lights are planned to be introduced in Ha Noi.
- Echelon Corporation is partnering with Elcom Technologies Corporation (ElcomTek) to deploy an energy control networking system.
- The country's first smart street lighting system will use Echelon's segment controllers to run its Control Operating System (COS) and ElcomTek's energy management software to control 28,000 streetlights and help reduce energy consumption.
- The project is expected to be finished by April of 2012, and covers approximately 25 percent of all street lights in Ha Noi.

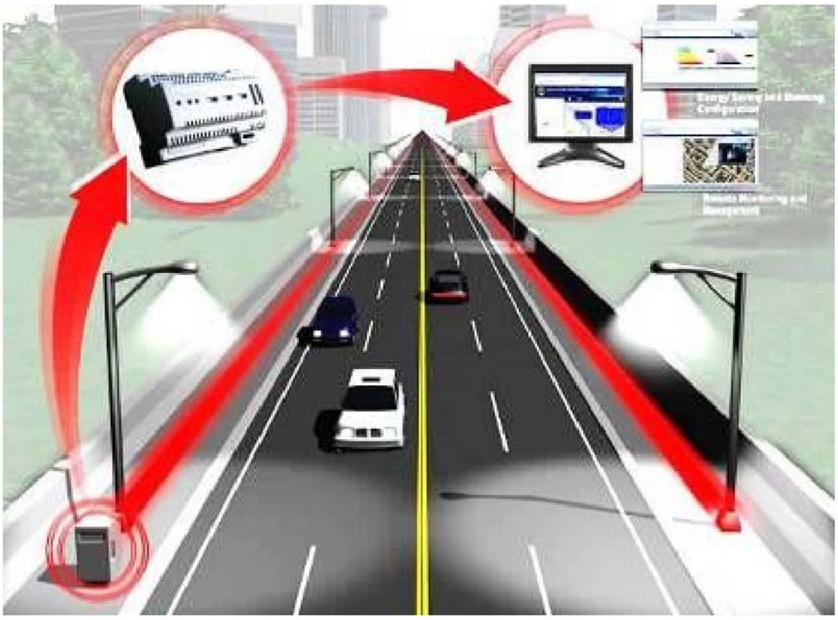


Fig. 5.6.6 Image for the smart street lighting system planned in Ha Noi

5.6.3 Project Scheme

- Replacement with energy efficient LED lamps and reduction of power consumption through a smart street lighting system would reduce electricity costs.
- As smart a street lighting system retains cumulative data on lighting times as calculated values, it is possible to predict the replacement time and automatically detect faulty spots.
- It is possible to reduce the maintenance costs of street lights through these functions.
- It is common to get loans for the initial investment from financial institutions when introducing the system, having reduced electricity and maintenance costs as pay-back resources.

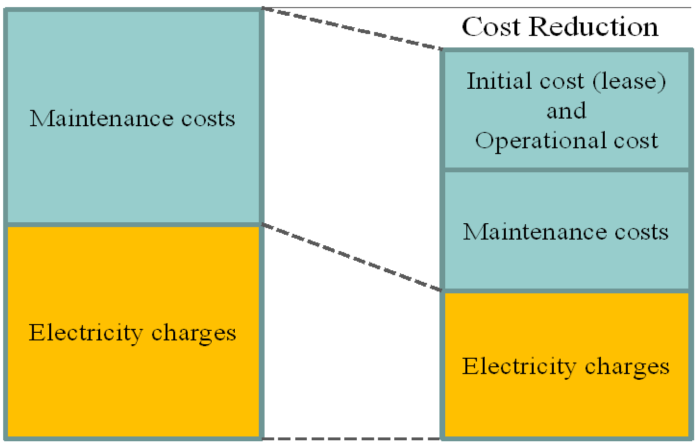


Fig. 5.6.7 Project Scheme

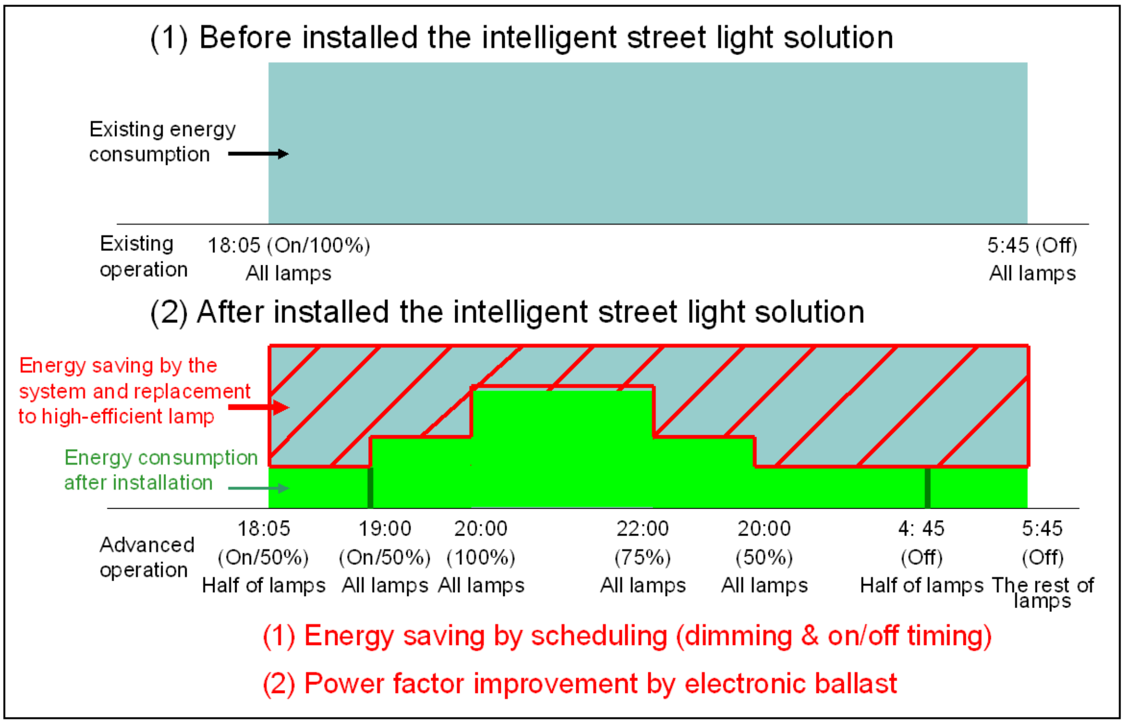


Fig.5.6.8 Reduction of electricity costs through system introduction

5.6.4 Financial Sources

- Financial sources for this project come from private financial institutions.
- Business operators get loans by having electricity and maintenance costs reduced in the project as a pay-back resources.
- It may become impossible to implement the project if the amount of reduced costs is small, as this would make it difficult to get funds.
- Either an Operation and Management Company for public electricity and lighting in Da Nang or a company that manages and operates street lights would be responsible for financing the Project’s implementation.

5.6.5 Decision on Project Feasibility & Implementation Process

- Decision on financial arrangement will be made according to the flow in Figure 5.6.9.
- Public street lights in Da Nang City are managed by the public lighting management company. Thus, the system shall be first introduced to street with high electricity price and maintenance costs after discussion with the company.
- By estimating reduction effects of electricity and maintenance costs after system introduction design, it would be checked to see if an expected reduction of introduction and maintenance costs can cover the payback of the initial investment and system operation costs.

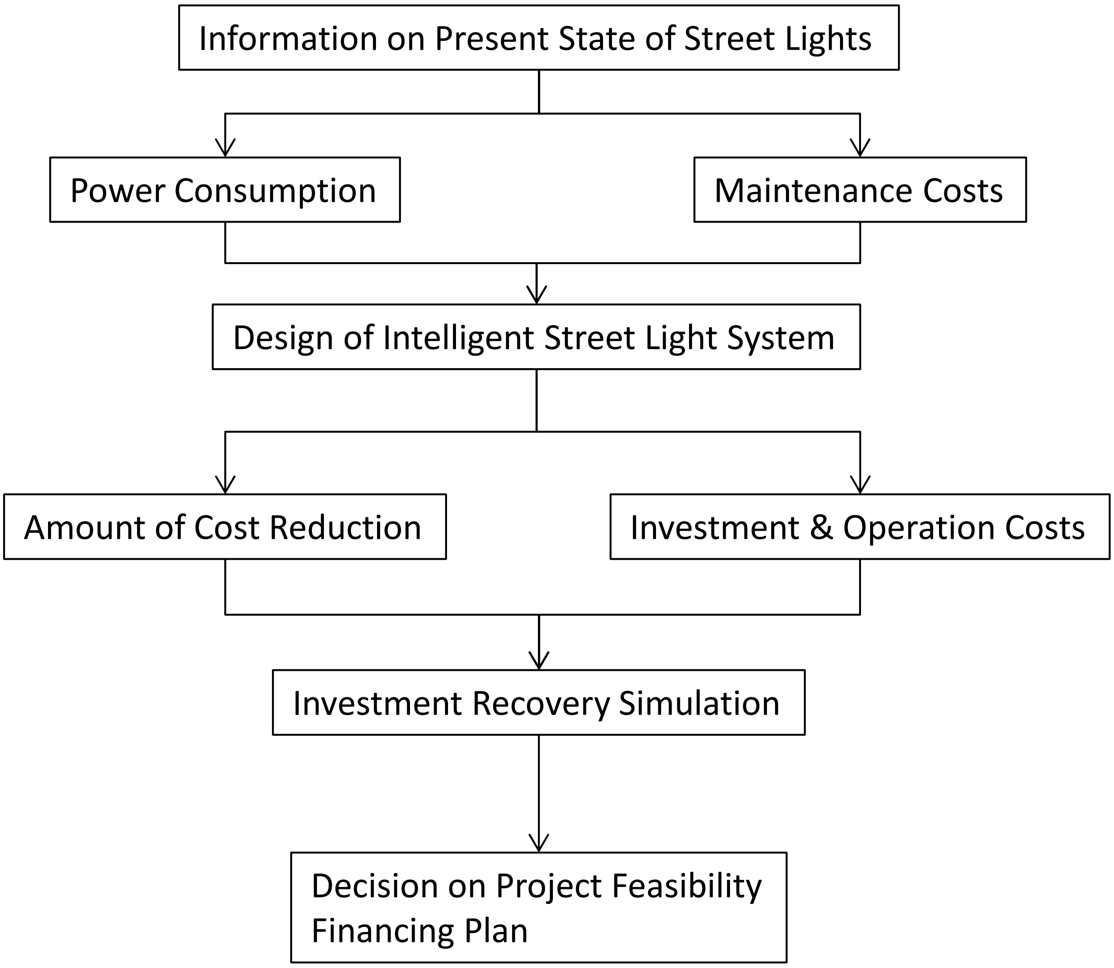
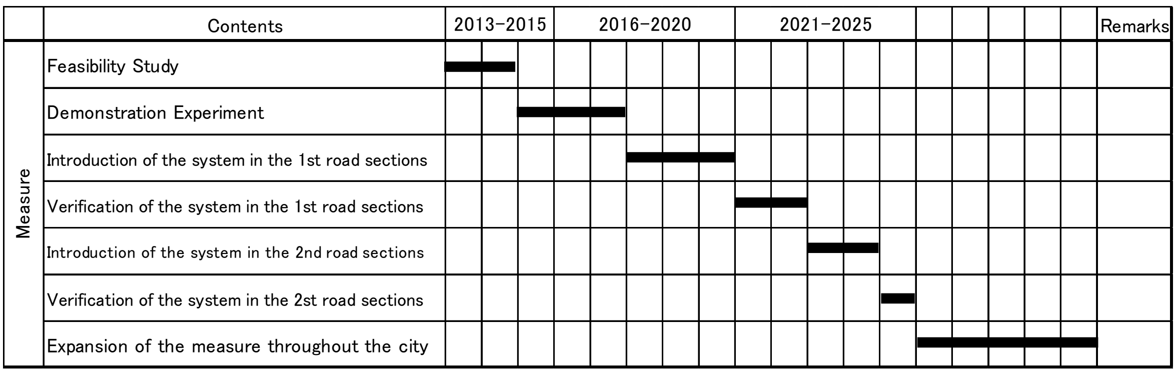


Fig. 5.6.9 Decision on Project Feasibility and Implementation Process



- As shown in Figure 5.6.10, electricity price continues to increase with an increase in crude oil price. The early-on implementation of the project to reduce electricity consumption is effective because it is highly possible that an increasing trend of energy costs continue in the future.

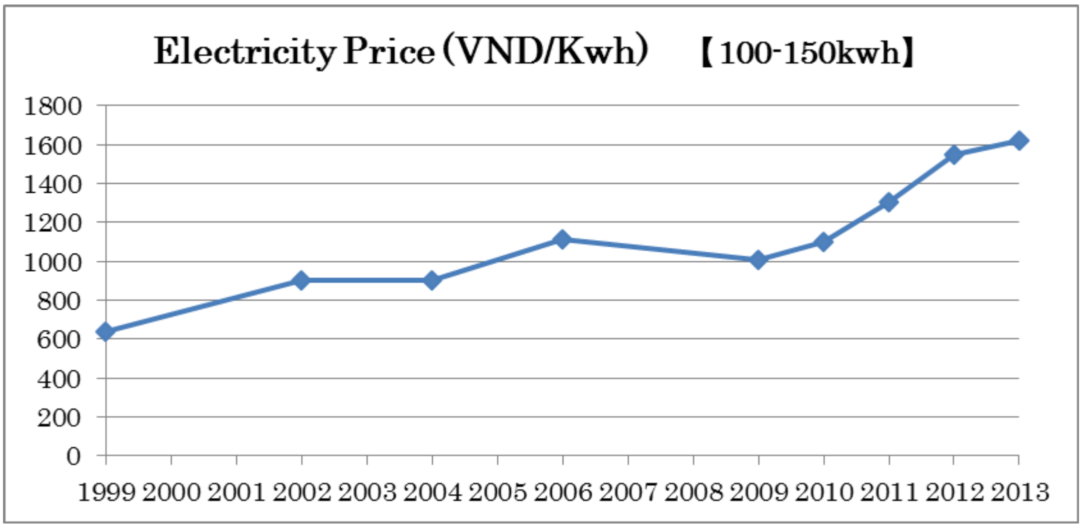


Fig. 5.6.10 Changes in Electricity Price in Da Nang City

5.7 Action plan of the six measures

The action plan of the six measures is shown in the table blow.

Table 5.7.1 Action plan (1/2)

Measures	Buildings	Motorbike	BRT
Action as a Da Nang PC	・Organize a committe to develop environmental assesment tool/system ・Administrate the system ・Construct a model of eco-friendly building	・Setting policy goals ・Promotion of electric motorcycles in cooperation with motorcycle manufacturers (ads, TV commercials, test-ride events, etc.) ・Survey on citizen intentions to shift to electric motorcycles ・Incorporation with parking development plan and parking policies ・Incorporation into a package of measures for creating a smart grid and smart city	・Making a detailed design ・Procuing of site ・Deciding operation scheme and lowering operation costs ・Study on new routes for introduction (western area - inner city, etc.) ・Integrated promotion with other transportation policies, such as electric motorcycles
Action for the public	・Campaign environmental (eco-friendly) building and the assesment system ・Enhance public environmental conciousness	・Diffusion and Educational Activities for Electric Motorcycles	・Promotion and transportation eduction on the use of public transportation (BRT)
Action for the Business person	・Campaign environmental building and the assesment system ・Incentive measures; tax and subsidy, etc ・Raise a fund for public building construction	・Establishment of charging facilities at large-scale commericial facilities ・Establishment of charging facilities at parking lots of factories for employees ・Selection of model factories for diffusion of electric motorcycles (experimentally introducing electric motorcycles and charging facilities for employees)	・Promotion and transportation eduction on the use of public transportation (BRT) ・Promotion of utilization of BRT for commuting
Legal system and action for theNational level	・Request enactment of the assesment system ・Subsidy application for eco-frindly building	・Establishment of a law to manage electric motorcycles ・Relaxation of tax rates on electric motorcycles and subsidy for purchasing ・Unifying the standard of charging facilities and international standardization	・Decision on introduction methods of BRT right-of-ways (exclusive lanes or traffic control) based on compliance with existing laws
Action for the other country	・joint cooperation on environmental building promotion ・Investment for environmental building	・Assistance with installation costs by CDM	・Assistance with installation costs by CDM
Other	・Refer to LOTUS upon the assesment system development ・LOTUS: developed by VGBC in Vietnam	・Introduction of prohibited areas for gasoline vehicles (automobile & motorcycle)	・Dispatch of information on BRT operation ・Introduction of BRT priority signaling system ・Introduction of fare card system ・Creating barrier-free vehicles and bus stops ・Establishment of Park (automobile & motorcycle) and Ride parking lots at terminals

Table 5.7.2 Action plan (2/2)

Measures	Waste water	Garbage	Street Light
Action as a Da Nang PC	･Securing site ･Planning of sewer construction plan ･Set of costs and sewer unit price ･Appropriate pricing ･Measurement of the effect	･Securing site ･Development of Fractionation rules (installation of trash, setting the date of collection, setting fractional items) ･Monitoring of illegal dumping ･Set of costs and refuse collection unit price ･Measurement of the effect	･ Relpacement to energy efficient LED Lamps ･ Introduction of smart street litghting system
Action for the public	･Guidance of septic tanks connected to the public sewage ･The education about the role of sewer	･Fractionation guidance of garbage Environmental education	･Call for understanding of off street lights late-night
Action for the Business person	･Guidance of septic tanks connected to the public sewage ･The education about the role of sewer	･Fractionation guidance of garbage Environmental education	･Call for understanding of off street lights late-night
Legal system and action for theNational level	･Penalties and obligations of the septic tanks connected to the public sewage ･Bounty system	･Penalties for illegal dumping ･Entry rules of the private sector ･Bounty system	･ Establishment of technical standards for Smart Street Light System
Action for the other country	･Attracting state-of-the-art technology	･Attracting state-of-the-art technology	･ Assistance with installation costs due to CDM
Other	･Education and training of facility management workers	･Education and training of facility management workers	･ Cost reduction through introduction into many areas in Viet Nam

6 Roadmap for reducing CO2 by implementing the six countermeasures to NHSD

In Chapter 5 the feasibility of each of the six countermeasures was studied, and the roadmap for reducing CO2 by each of the countermeasures over the period of 2015 to 2030 was proposed.

Table 6.1 summarizes the estimated CO2 reductions by the six countermeasures when implemented to Ngu Hanh Son District over the period of 2015 to 2030. The total amount of reductions by implementing these countermeasures to the district was 54,097t-CO2 (19% reductions from the BS-H emissions level) and 167,680t-CO2 (22% reductions from the BS-H emissions level) by 2020 and 2030, respectively.

The countermeasure of electric motorcycles provides the largest reductions (57,483t-CO2 in 2030) among the six countermeasures, whereas the countermeasure of LED introduction provides the least (327t-CO2 in 2030).

In comparison with the CO2 emission reduction targets proposed in Chapter 3, the total amount of reductions by the six countermeasures exceeds the target (10% reductions) for 2020 and the target (20% reductions) for 2030. This implicates that the CO2 reduction targets may be achieved by implementing these countermeasures to Ngu Hanh Son District along the roadmap proposed in Chapter 5 and that further implementation of other countermeasures in addition to the six countermeasures may result in a challenging achievement of 20% reductions by 2020 and 25% reductions by 2030 towards a low-carbon town.

Table 6.1 Estimated CO2 reductions by the six countermeasures when implemented to Ngu Hanh Son District over the period of 2015 to 2030.

Unit: t-CO2

Year	BS-H emissions	Reductions target	CO2 reductions by 6 countermeasures							
			EES of buildings	Electric motorcycle	BRT	CH4 (wastewater)	CH4 (solid waste)	LED	Total	% of BS-H level
2010	95,722	0	0	0	0	0	0	0	0	0.00
2015	157,759	14,140	534	921	0	0	0	0	1,455	0.92
2020	282,795	28,280	2,672	8,880	6,354	25,869	10,265	57	54,097	19.13
2025	507,575	90,144	6,948	33,366	17,052	35,118	19,339	327	112,151	22.10
2030	760,044	152,009	11,764	57,483	28,515	39,722	29,868	327	167,680	22.06

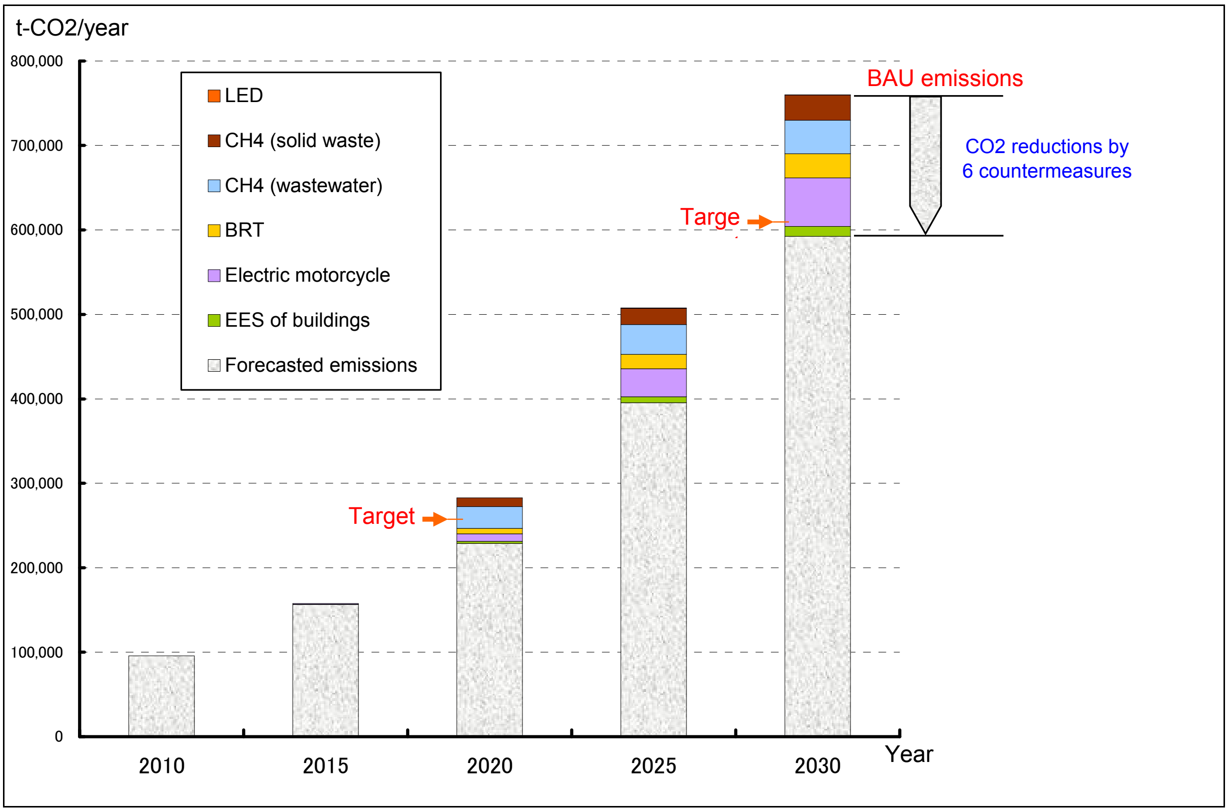


Figure 6.1 Roadmap for reducing CO2 by implementing the six countermeasures to Ngu Hanh Son District towards 2030.

EWG 20/2012A

APEC Low Carbon Model Town (LCMT)

Project Phase 3

Finalization of Feasibility Study Report with Executive Summary [Appendix]

November, 2013

NEWJEC Inc.

Appendix

Appendix3.1.1 Summary of the legal framework for development of renewable energy in Viet Nam

No	Legal document	Contents related to promoting development of RE/ biomass energy
1	Electricity Law - 2005 (amended 2012)	- Promote the exploitation and use of new and renewable energy sources to generate electricity. - Invest in power plants using new and renewable energy sources - Encourage organizations and individuals to invest in grids or the building of power stations using on-site energy, new and renewable energy to provide electricity to rural, mountainous and island areas. - Investment in power development in rural, mountainous and island areas - State policy support includes: + Support on investment; + Support for investment loan interest rates;
2	Investment Law - 2005	**Article 27**. Field of investment incentives: new and renewable energy. **Article 28.** Preferential investment areas: areas with socio-economic difficulties
		Article 32. Objects and conditions for investment incentives: investors who have investment projects in the fields and areas for investment incentives provided in Article 27 and Article 28 of this Law shall enjoy preferential treatment under the provisions of this Law and other provisions of the relevant law. **Article 33.** Tax incentives
3	Domestic Investment Promotion Law - 2003	**Article 16.** Investment projects in the following areas will get incentives: 1. Geographical areas with socio-economic difficulties; 2. Geographical areas with extreme socio-economic conditions
4	Environment Protection Law – 2005	Article 6. Environmental protection activities are promoted 4. Development and use of clean energy, renewable energy; reductions in greenhouse gas emissions, prevention of destruction of the ozone layer. Article 33. Development of clean energy, renewable energy and environmentally friendly products 2. Increase investment from organizations and individuals in renewable energy development and the manufacture of environmentally friendly products through state tax incentives, financial support and providing land. 3. Government develops and implements a renewable energy development strategy to achieve the following objectives: a) Strengthening national capacity in research and the application of exploitation technology and the use of renewable energy; b) Expand international cooperation and mobilization of resources for the exploitation and use of renewable energy;

No	Legal document	Contents related to promoting development of RE/ biomass energy
		c) Increase the proportion of renewable energy in the total national energy production; achieve the objectives of energy security, saving natural resources and reducing greenhouse gas emissions; d) Integration of a renewable energy development program into poverty alleviation programs, rural development, mountainous regions, coastal areas and islands.
5	Technology Transfer Law Nr. 80/2006/QH11, dated 29/11/2006	Article 9: Technology is transferred. Use of the new and renewable energy
Government's Decree		
1	Decree incentives, support environmental protection activities Nr. 04/2009 / ND-CP dated 14/01/2009	+ This Decree stipulates incentives and support for land and capital; exemptions or reductions of taxes; charges for environmental protection activities; subsidies and support for product consumption and environmental protection activities and other support for activities and products for environmental protection. A. A list of environmental protection activities are granted special incentives and support I. Construction activities 3. Construction of waste treatment facilities. II. Research, production and trading 10. Import of machinery, equipment, vehicles, tools and materials which are used directly in the collection, recycling, and treatment of waste; renewable energy. B. A list of environmental protection activities that are granted special support II. Scientific research, production and trading 6. Renewable energy production. C. Preference list of products and support 4. Energy from waste disposal.
2	The Government's Decree No. 151/2006/ND-CP dated 20/12/2006 on the investment credit and export credit of the State	List the project investments granted credit loans 4. Investors own projects, develop production plans, business, assure debt pay back; Viet Nam Development Bank evaluates the financial plan, repayment plans and approves loans. Loan term *Loan term is defined according to the project's capability for investment return and the solvency of investors in accordance with the production and business type of the project. It will not exceed more than 12 years*
3	Decree No. 108/2006/NDD-CP dated 22/9/2006 of the Government stipulates in details and guides application of some articles in the Investment Law	List of areas for investment incentives A. List of special areas of investment incentives I. New energy 3. Investment in buildings applying solar energy, wind energy, biogas, geothermal, tidal. B. List of preferential investment fields I. new energy

No	Legal document	Contents related to promoting development of RE/ biomass energy
		List of areas granted investment incentives: remote and difficult areas
4	Decree Nr 133/2008/NĐ-CP	Stipulates in detail and guides the implementation of some articles of the Technology Transfer Law on technology transfer contracts, technology assessment services and other incentives to promote technology transfer. Dated 31/12/2008
Decision of Prime Minister		
1	National energy development strategy of Viet Nam by 2020, with a vision to 2050; Number: 1855/QD-TTg on 27/12/2007	d) To develop comprehensively and reasonable energy system: Consists of electricity, petroleum, coal, and new and renewable energy. The development of clean, new and renewable energy is prioritized. A reasonable distribution energy system by region and territory; harmonizing through exploration exploitation and then processing; develop a comprehensive system of services and recycling. + Strive to increase the proportion of new and renewable energy sources to about 3% of the total commercial primary energy by 2010; to approximately 5% in 2020, and about 11% in 2050.
1	National energy development strategy of Viet Nam by 2020, with a vision to 2050; Number: 1855/QD-TTg on 27/12/2007	+ Complete a program for rural, mountainous energy. Increase the number of rural households using commercial energy for cooking to 50% in 2010 and 80% in 2020. By 2010, 95% of rural households have electricity and by 2020 most rural households have access to electricity. + Consider an energy development fund to support investments in new and renewable energy. d) The development orientation of new and renewable energy - Surveyed planning: the types of renewable energy has not been fully evaluated, thus planning and the appropriate investments for the additional data required for planning and energy source allocation is highly needed for investment planning and rational exploitation. - Enhance PR for the application of new and renewable energy resources for remote, border areas and islands. Develop suitable management mechanisms to maintain and develop power sources in these regions. - Integrate the use of new and renewable energy into energy efficiency programs and other national target programs such as rural electrification, afforestation, poverty alleviation, clean water, VAC etc.. - Support investment in surveys, research, experiments and pilot projects which apply new and renewable energy; import tax incentives, new technology, production tax, conservation devices; copyright protection for inventions, valuable technical improvements etc. - Allow individuals, national and international organizations to cooperate to exploit new and renewable energy sources on the basis of mutual benefit.

No	Legal document	Contents related to promoting development of RE/ biomass energy
2	Master Plan for Power Development in the period 2011 to 2020 with vision to 2030; Number: 1208/2011/QD-TTg, on 21/7/2011	+ Prioritize the development of renewable energy for electricity production: 4.5% of total electricity production by 2030, and 6% by 2030 **- The planning stage: newly install about 13.000 MW from RE** + Electrification – by 2020 most households have electricity: 600 thousand households are powered with renewable energy + The solution to electricity prices (ensure the recovery of costs + attain reasonable profit)
3	Decision Number 130/2007/QĐ-TTg of Prime Minister's on mechanisms and policies, finance for investment projects under the clean development mechanism on 02/8/2007	**Article 6**. Rights and obligations of investors who build and implement CDM projects a) Preferences: tax; charges for the use of land, land rent; depreciation of fixed assets; investment credit of state regulations. b) To be considered for the subsidies for products of CDM projects in priority areas. c) To be considered for financial support in the preparation and construction of the project in accordance with the current legislation. **Article 12**. Corporate income tax on CDM projects 1. The tax rate of corporate income tax and tax exemption for corporate income CDM projects are carried out for projects in the field of special investment incentives stipulated in paragraph III, Section A, Appendix I lists sectors for investment incentives which are attached to Decree No. 108/2006/ND-CP September 22, 2006 detailing and guiding the implementation of some articles of the Law on investment and the Law on income Tax business as well as legal documents guiding the implementation of the Law on corporate Income tax. **Article 13**. Import duty CDM projects are exempt from import duties for goods imported for creating fixed assets of the project, raw materials, materials, or semi-finished products which can not be produced serve as imported products of the project under the provisions of Clause 6 and Clause 16, Article 16 of Decree No. 149/2005/ND-CP of December 8, 2005 of the Government which details the implementation of the Law on export Tax, and the import Tax provisions of the current law on export taxand import tax. **Article 14**. Land use fees, land rent CDM projects are exempt or have reduced land use fees and land rents as prescribed by the current law applied to projects in the field of special investment incentives. **Article 16**. Subsidies on products of CDM projects 1. Products of CDM projects are subsidized from the Environmental Protection Fund Viet Nam if they meet the following conditions: a) Part of the product portfolio of CDM projects in priority areas. b) The actual cost to produce the product is greater than the actual sale contract signed. 2. Time subsidies for products of CDM projects are determined based

No	Legal document	Contents related to promoting development of RE/ biomass energy
		on the time of the project's products and subsidize the ability to offset the production costs. 3. The Environmental Protection Fund of Viet Nam will implement subsidies for products of CDM projects under the provisions of this decision and the guidance of the Ministry of Finance. 4. The Ministry of Finance, in collaboration with the Ministry of Natural Resources and the Environment, give specific guidance on conditions, subsidies, price support and subsidies the eligible product support price for the duration of the product portfolio of CDM projects
4	Decision of the Prime Minister of Viet Nam on Power Sector Development Strategy for the period 2004 - 2010, with the vision to 2020; Number: 176/2004/QD-TTG, on 05/10/2004	- Promote R&D of new and renewable energy to meet the demand for electricity, especially in islands and remote areas. - Accelerate the "electricity to rural and mountainous areas" program, so that by 2010, 90% and by 2020, 100% of rural households have electricity - Development of new and renewable power plants. Take advantage of on-site renewable energy sources to generate off-grid electricity for areas outside of the national grid especially islands and remote areas.
Circulars of Ministries		
1	Circular "Guidelines for the implementation of some articles of Decision No.130/2007/QD-TTg; No. 58/2008TTLT-BTC-BTN & MT, 04/7/2008	Regulations on subsidies for the products of CDM projects, including: + Electricity produced from wind, solar, geothermal and tidal sources. + Electricity is produced from methane recovered from landfill waste, and coal mining
2	Circular No. 97/2008/TT-BTC 29 10, 2008 of the Ministry of Finance	Guide the implementation of state policies to support investment in power development for rural, mountainous and island areas
Decisions of Ministries		
1	Decision issued Regulations on the avoided cost and power purchase contract form; Number 18/2008/QD-BCT, on 18/7/2008	+ Regulation on conditions, process and procedures for development, modification, addition and cancellation of the electricity tariff applicable to small power plants using renewable energy connected to the national grid + Applicable to organizations and individuals who purchase and sell electricity from small renewable energy power plants

Appendix 3.2.1 Spreadsheet of CO2 emissions in the Energy sector and CH4 emissions in the Waste sector for Viet Nam, Da Nang City and Ngu Hanh Son District (BS-H scenario).

Category (sector, subsector…)	Viet Nam						Da Nang City				Ngu Hanh Son District	
	2000*1		2005*2		2010*3		2010 (APEC)*4		2010 (WB)*5		2010 (APEC)*6	
	CO2	CH4	CO2	CH4	CO2	CH4	CO2	CH4	CO2	CH4	CO2	CH4
Total Energy	45,900.00	240.21	82,204.00	890.21	133,805.26		1,352.19	0.00	1,339.75	0.00	77.34	0.00
A Fuel Combustion Activities (Sectoral Approach)	45,900.00		80,747.20		133,805.26		1,352.19		1,339.75		77.34	
1 Energy Industries	11,174.15		23,960.10		41,528.58		0.00		0.00		0.00	
a Public Electricity and Heat Production					23,633.07		0.00					
b Petroleum Refining					17,895.51		0.00					
c Manufacture of Solid Fuels and Other Energy Industries							0.00					
2 Manufacturing Industries and Construction	15,020.36		23,985.10		47,002.19		349.06		351.13		30.22	
a Iron and Steel					1,807.13		0.00				0.00	
b Non-Ferrous Metals							0.00				0.00	
c Chemicals					1,615.60							
d Pulp, Paper and Print					1,481.88		0.00				0.00	
e Food Processing, Beverages and Tobacco					3,982.63							
f Other (please specify)					38,114.96							
3 Transport	11,886.00		20,780.60		32,835.88		594.53		711.68		16.99	
a Civil Aviation					1,776.60							
b Road Transportation					23,200.97		594.53		711.68		16.99	
c Railways					6,573.74							
d Navigation					1,284.57							
e Other (please specify)												
Pipeline Transport							0.00				0.00	
4 Other Sectors	6,644.86		11,350.50		12,438.60		408.60		276.94		30.12	
a Commercial/Institutional	2,957.56		3,997.40		3,491.16		93.40		52.60		6.89	
b Residential	2,314.27		5,727.30		7,304.46		315.20		224.33		23.24	
c Agriculture/Forestry/Fishing	1,373.03		1,625.80		1,642.98							
5 Other (please specify)	1,174.63		670.90									
B Fugitive Emissions from Fuels	0.00	240.21	1,456.80	890.21			0.00	0.00	0.00	0.00	0.00	0.00
1 Solid Fuels	0.00	89.26		169.31			0.00	0.00	0.00	0.00	0.00	0.00
a Coal Mining		89.26					0.00	0.00	0.00	0.00	0.00	0.00
b Solid Fuel Transformation							0.00	0.00	0.00	0.00	0.00	0.00
c Other (please specify)							0.00	0.00	0.00	0.00	0.00	0.00
2 Oil and Natural Gas	0.00	150.95	1,456.80	720.90			0.00	0.00	0.00	0.00	0.00	0.00
a Oil		150.95	1,456.80	720.90			0.00	0.00	0.00	0.00	0.00	0.00
b Natural Gas							0.00	0.00	0.00	0.00	0.00	0.00
c Venting and Flaring							0.00	0.00	0.00	0.00	0.00	0.00
Total Waste	0.00	331.48	3.55	342.15			0.00	11.88	0.00	9.88	0.00	0.88
A Solid Waste Disposal on Land		266.52		129.52				4.40		4.93		0.32
1 Managed Waste Disposal on Land								3.82				0.28
2 Unmanaged Waste Disposal Sites								0.58				0.04
3 Other (please specify)												
B Wastewater Handling		64.96		212.63				7.48		4.94		0.55
1 Industrial Wastewater		63.61		53.00				0.73				0.05
2 Domestic and Commercial Wastewater		1.35		159.62				6.49				0.48
3 Other (please specify)								0.26				0.02
C Waste Incineration			3.55				0.00	0.00				0.00
D Other (please specify)							0.00	0.00				0.00
TOTAL (in 1000 t-GHG)	45,900.00	571.69	82,207.55	1,232.37	133,805.26		1,352.19	11.88	1,339.75	9.88	77.34	0.88
TOTAL (in 1000 t-CO2e)	57,905.49		108,087.25		133,805.26		1,601.58		1,547.13		95.72	

*1 Viet Nam's Second Communication to UNFCCC (Hanoi, 2010)
*2 Data from Institue of Energy
*3 Data from Institue of Energy (only provisional)
*4 This study
*5 WB report
*6 This study

	Da Nang City 2010 (APEC)	Ngu Hanh Son District 2010 (APEC)
Emission intensity [tCO2e/year/person]	1.73	1.40

Category (sector, subsector…)	Da Nang City							
	2015 (APEC)		2020 (APEC)		2025 (APEC)		2030 (APEC)	
	CO2	CH4	CO2	CH4	CO2	CH4	CO2	CH4
Total Energy	2,384.11	0.00	4,038.09	0.00	6,473.23	0.00	9,534.57	0.00
A Fuel Combustion Activities (Sectoral Approach)	2,384.11		4,038.09		6,473.23		9,534.57	
1 Energy Industries	0.00		0.00		0.00		0.00	
a Public Electricity and Heat Production								
b Petroleum Refining								
c Manufacture of Solid Fuels and Other Energy Industries								
2 Manufacturing Industries and Construction	637.45		1,164.11		2,125.89		3,882.29	
a Iron and Steel								
b Non-Ferrous Metals								
c Chemicals								
d Pulp, Paper and Print								
e Food Processing, Beverages and Tobacco								
f Other (please specify)								
3 Transport	1,068.92		1,484.27		1,976.12		2,383.01	
a Civil Aviation								
b Road Transportation	1,068.92		1,484.27		1,976.12		2,383.01	
c Railways								
d Navigation								
e Other (please specify)								
Pipeline Transport								
4 Other Sectors	677.74		1,389.71		2,371.22		3,269.27	
a Commercial/Institutional	172.69		439.99		848.61		1,294.88	
b Residential	505.06		949.72		1,522.61		1,974.39	
c Agriculture/Forestry/Fishing								
5 Other (please specify)								
B Fugitive Emissions from Fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 Solid Fuels								
a Coal Mining								
b Solid Fuel Transformation								
c Other (please specify)								
2 Oil and Natural Gas								
a Oil								
b Natural Gas								
c Venting and Flaring								
Total Waste	0.00	15.79	0.00	20.75	0.00	28.59	0.00	39.03
A Solid Waste Disposal on Land		6.37		9.09		13.45		19.66
1 Managed Waste Disposal on Land		5.70		8.53		13.28		19.59
2 Unmanaged Waste Disposal Sites		0.67		0.56		0.17		0.07
3 Other (please specify)								
B Wastewater Handling		9.42		11.67		15.15		19.37
1 Industrial Wastewater		1.34		2.44		4.46		8.14
2 Domestic and Commercial Wastewater		7.70		8.84		10.30		10.84
3 Other (please specify)		0.38		0.38		0.38		0.38
C Waste Incineration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D Other (please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL (in 1000 t-GHG)	2,384.11	15.79	4,038.09	20.75	6,473.23	28.59	9,534.57	39.03
TOTAL (in 1000 t-CO2e)	2,715.70		4,473.93		7,073.71		10,354.16	
	170		279		442		646	
% of 2010 base year emissions (Da Nang City)								
	2.35		2.80		3.34		4.14	
Intensity of CO2e emissions [tCO2e/year/person] (Da Nang City)								

Category (sector, subsector…)	Ngu Hanh Son District							
	2015 (APEC)		2020 (APEC)		2025 (APEC)		2030 (APEC)	
	CO2	CH4	CO2	CH4	CO2	CH4	CO2	CH4
Total Energy	125.89	0.00	237.31	0.00	436.40	0.00	661.83	0.00
A Fuel Combustion Activities (Sectoral Approach)	125.89		237.31		436.40		661.83	
1 Energy Industries	0.00		0.00		0.00		0.00	
a Public Electricity and Heat Production								
b Petroleum Refining								
c Manufacture of Solid Fuels and Other Energy Industries								
2 Manufacturing Industries and Construction	31.43		32.37		33.34		34.34	
a Iron and Steel								
b Non-Ferrous Metals								
c Chemicals								
d Pulp, Paper and Print								
e Food Processing, Beverages and Tobacco								
f Other (please specify)								
3 Transport	26.63		42.70		68.73		130.59	
a Civil Aviation								
b Road Transportation	26.63		42.70		68.73		130.59	
c Railways								
d Navigation								
e Other (please specify)								
Pipeline Transport								
4 Other Sectors	67.84		162.24		334.33		496.90	
a Commercial/Institutional	17.66		51.98		120.30		197.12	
b Residential	50.18		110.26		214.03		299.78	
c Agriculture/Forestry/Fishing								
5 Other (please specify)								
B Fugitive Emissions from Fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 Solid Fuels								
a Coal Mining								
b Solid Fuel Transformation								
c Other (please specify)								
2 Oil and Natural Gas								
a Oil								
b Natural Gas								
c Venting and Flaring								
Total Waste	0.00	1.52	0.00	2.17	0.00	3.39	0.00	4.68
A Solid Waste Disposal on Land		0.61		1.01		1.83		2.91
1 Managed Waste Disposal on Land		0.55		0.95		1.80		2.90
2 Unmanaged Waste Disposal Sites		0.06		0.06		0.02		0.01
3 Other (please specify)								
B Wastewater Handling		0.91		1.15		1.56		1.77
1 Industrial Wastewater		0.13		0.13		0.13		0.13
2 Domestic and Commercial Wastewater		0.74		0.99		1.40		1.60
3 Other (please specify)		0.04		0.04		0.04		0.04
C Waste Incineration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D Other (please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL (in 1000 t-GHG)	125.89	1.52	237.31	2.17	436.40	3.39	661.83	4.68
TOTAL (in 1000 t-CO2e)	157.76		282.80		507.58		760.04	
	165		295		530		794	
% of 2010 base year emissions (Ngu Hanh Son District)								
	1.42		1.58		1.76		2.05	
Intensity of CO2e emissions [tCO2e/year/person] (Ngu Hanh Son District)								

Appendix 4.1.1 Policy for selecting measures in this project

Category		Model Measures	Viewpoint 1					Viewpoint 2				Viewpoint3					Viewpoint4					Result	Implementation Board	Selecting Measures
			tCO2 /year	Project Period	tCO2 /total	Score ①		Initial Cost (USD)	tCO2total /1,000USD	Score ②		Re-develop ment	Sprawl	Landscape	Energy	③	LCT	Resort	Tourism	Sustainable	④	①×② +③ +④		
Buildings	(1)-1	Introduction of a system of comprehensive environmental benchmarks that target buildings	11,764.1	15 years	176,461.5	◎	3	975,000 (37,601,000)	181.0 (4.7)	◎ 3		◎ 2	△ 0	◎ 2	○ 1	5	◎ 2	○ 1	○ 1	◎ 2	6	**20**	○	○
	(1)-2	Deciding on an energy-saving architectural plan that considers reducing the thermal load.	2,575.2	15 years	38,628.0	○	2	375,000 (3,522,000)	103.0 (11.0)	○ 2		○ 1	△ 0	○ 1	◎ 2	6	◎ 2	△ 0	△ 0	◎ 2	4	**14**		
Transportation	(2)-1	Facilitation of the spread of electric motor-bikes and charging facilities.	57,483.1	10 years	574,831.0	◎	3	480,000	1,197.5	◎ 3		◎ 2	△ 0	○ 1	- 0	3	◎ 2	△ 0	◎ 2	◎ 2	6	**18**	○	○
	(2)-2	Introduction of a Bus Rapid Transit system	21,934.7	30 years	658,041.0	◎	3	42,450,000	15.5	○ 2		◎ 2	◎ 2	○ 1	- 0	5	◎ 2	○ 1	◎ 2	◎ 2	7	**18**	○	○
	(2)-3	Introduction of a subway system	7,137.0	30 years	658,041.0	◎	3	1,971,990,000	0.3	△ 1		○ 1	◎ 2	△ 0	○ 1	4	△ 0	△ 0	○ 1	△ 0	1	**8**		
Energy Management System	(3)-1	Stabilization of the electric power supply through a high capacity electrical storage facility	4,737.0	10 years	47,370.0	○	2	2,000,000	23.7	○ 2		△ 0	△ 0	△ 0	◎ 2	2	○ 1	△ 0	△ 0	○ 1	2	**8**		
	(3)-2	Optimization of power generating facilities by peak power limitation	-	15 years	-	-	0	4,700	-	- 0		◎ 2	◎ 2	○ 1	△ 0	5	△ 0	○ 1	○ 1	△ 0	2	**7**		
Area Energy Network	(4)-1	A heat pump style cooling system that uses river water and ocean water	995.1	15 years	14,926.5	○	2	12,883,000	1.2	△ 1		○ 1	△ 0	○ 1	◎ 2	4	◎ 2	△ 0	△ 0	◎ 2	4	**10**		
	(4)-2	Utilization of waste heat	261.0	15 years	3,916.5	△	1	2,400,000	1.6	△ 1		○ 1	△ 0	△ 0	◎ 2	3	◎ 2	△ 0	△ 0	◎ 2	4	**8**		
Untapped Energy	(5)-1	Purification and power generation utilizing of biogas (digestive gas)	39,748.1	15 years	596,221.5	◎	3	9,120,000	65.4	○ 2		○ 1	○ 1	○ 1	◎ 2	5	◎ 2	◎ 2	○ 1	◎ 2	7	**18**	○	○
	(5)-2	Biomass generation from kitchen garbage	29,868.0	15 years	448,020.0	◎	3	461,365,691	1.0	△ 1		○ 1	◎ 2	○ 1	◎ 2	6	◎ 2	○ 1	○ 1	◎ 2	6	**15**	○	○
	(5)-3	Utilizing BDF by purification of Jatropha plant oil	66.9	30 years	2,007.0	△	1	89,517.5	0.8	△ 1		△ 0	△ 0	△ 0	◎ 2	2	◎ 2	○ 1	○ 1	◎ 2	6	**9**		
Renewable Energy	(6)-1	Power supplied by renewable energy such as wind power and solar power.	450.0	15 years	6,750.0	△	1	9,120,000	0.7	△ 1		○ 1	△ 0	○ 1	◎ 2	4	◎ 2	△ 0	○ 1	◎ 2	5	**10**		
	(6)-2	Introduction of an ocean water pumped storage power station that guarantees the stability of the power supply	-	40 years	-	-	0	256,000,000	-	- 0		○ 1	○ 1	◎ 2	○ 1	5	△ 0	○ 1	○ 1	◎ 2	4	**9**		
ICT Control	(7)-1	Optimum management and energy conservation of the street lights through LED lighting	327.5	10 years	3,275.0	△	1	192,000	1.7	○ 2		○ 1	○ 1	◎ 2	◎ 2	6	◎ 2	◎ 2	○ 1	◎ 2	7	**15**	○	○
	(7)-2	Integrated management of multiple building groups	90.9	15 years	1,363.5	△	1	1,800,000	0.8	△ 1		○ 1	○ 1	△ 0	◎ 2	4	○ 1	△ 0	△ 0	○ 1	2	**7**		
	(7)-3	Optimized control of traffic flow due to an ITS (Intelligent transportation system)	6,958.8	30 years	208,764.0	◎	3	27,030,000	7.7	◎ 3		△ 0	△ 0	△ 0	△ 0	1	◎ 2	○ 1	◎ 2	◎ 2	7	**14**		
	(7)-4	Integrated management by a Smart Meter	24.9	15 years	373.5	△	1	750,000	0.5	△ 1		○ 1	○ 1	△ 0	◎ 2	4	○ 1	△ 0	△ 0	○ 1	2	**7**		
Environment	(8)-1	Making environmental initiatives visible	-	-	-	-	0	-	-	- 0		○ 1	○ 1	○ 1	○ 1	4	○ 1	○ 1	○ 1	◎ 2	5	**9**		
	(8)-2	Environmental educations for citizens	-	-	-	-	0	-	-	- 0		○ 1	○ 1	○ 1	○ 1	4	◎ 2	◎ 2	◎ 2	◎ 2	8	**12**		
	(8)-3	Preservation of the natural environment and planting trees	614.9	30 years	18,447.0	○	2	1,294	480.0	◎ 3		◎ 2	◎ 2	◎ 2	△ 0	6	○ 1	○ 1	○ 1	○ 1	4	**16**		
Water Supply and Sewage	(9)-1	Efficient management of waterworks and the water supply as well as urine power generation	577.0	1 year	557.0	△	1	-	-	- 0		○ 1	△ 0	○ 1	◎ 2	4	◎ 2	△ 0	○ 1	◎ 2	5	**9**		
	(9)-2	Bio generation through utilizing of water treatment sludge	22,252.0	15 years	333,780.0	◎	3	25,840,000	12.9	○ 2		△ 0	○ 1	△ 0	◎ 2	3	◎ 2	△ 0	△ 0	◎ 2	4	**13**		

Appendix 5.1 - Introduction of a system of comprehensive environmental benchmarks that target buildings

This appendix consists of chapters described herein under.

1. Survey of building environmental assessment system
2. Operational case study of building environmental assessment system
3. Survey of building environmentally design methodology

1. Survey of building environmental assessment system

(1) Comparison of building environmental assessment system of existing development

In order to promote a low carbon society, many countries have been developed and improved the evaluating methods of environmental performance in the construction field including buildings. BREEAM (UK), LEED (US), and international GBT have been lead, and attracted interest around the world. In this chapter, those evaluation methods currently used or promoted are comparatively studied with LOTUS (Vietnam) in their evaluation categories.

1) Classification of evaluation categories

Classification of evaluation categories is 11 fields/ sectors that plus GHG to 10 basic items of LOTUS (Vietnam).

2) Study of the weighting of the evaluation categories

Evaluation categories are classified and weighted by percentage of the highest score on each assessment system. Study results are shown in the comparison table herein below.

Table 5.1.1 Evaluation Categories of International Assessment System

		LOTUS(Vietnam)		CASBEE(Japan)		LEED(USA)		BREEAM(UK)		GreenStar(Australia)		GreenMark(Singapore)	
	Categories	MaxPoints	Weight(%)	MaxPoints	Weight(%)	MaxPoints	Weight(%)	MaxPoints	Weight(%)	MaxPoints	Weight(%)	MaxPoints	Weight(%)
1	energy	34	23.0	41%	20.6	35	33.7	19	19.0	29	20.7	116	65.9
2	GHG			10%	5.0		0.0		0.0		0.0		0.0
3	water	15	10.0	5%	2.3	10	9.6	6	6.0	12	8.6	17	9.7
4	material/dur ability&reliabi	20	13.0	23%	11.3	14	13.5	12.5	12.5	22	15.7	8	4.5
5	sustainable/ site	13	9.0	9%	4.5	26	25.0	18	18.0	19	13.6	15	8.5
6	waste and pollution	13	9.0	25%	12.4		0.0	17.5	17.5	19	13.6	2	1.1
7	indoor environment	20	13.0	47%	23.5	15	14.4	15	15.0	27	19.3	8	4.5
8	adaptation and	13	8.0	10%	5.1		0.0		0.0		0.0	3	1.7
9	regional	10	7.0	23%	11.6	4	3.8		0.0		0.0		0.0
10	management	12	8.0	8%	3.8		0.0	12	12.0	12	8.6	7	4.0
11	innovation	8				6		10		5		17	
	Total	158	100	200%	100	110	100	110	100	145	100	193	100

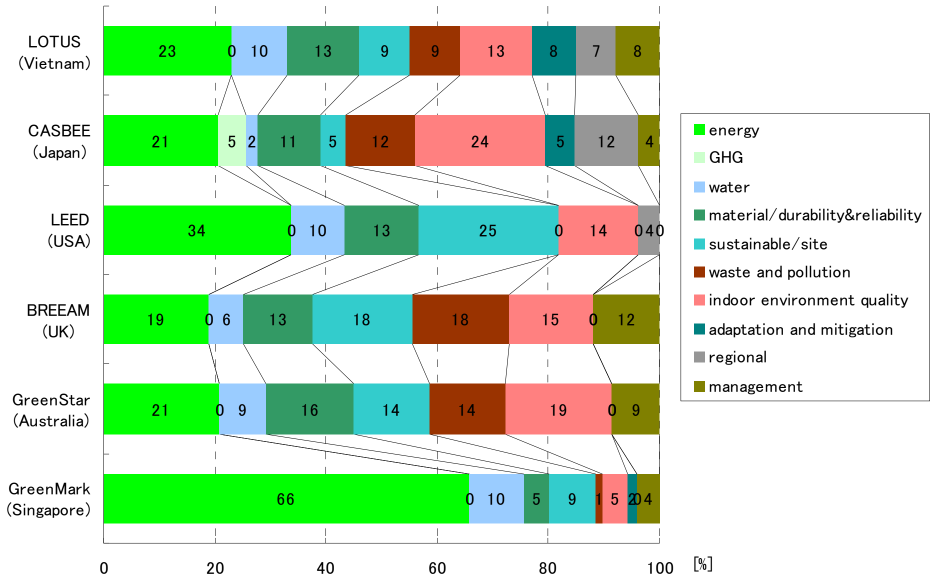


Figure 5.1.1 Comparison Table of Evaluation Categories and Weighting

3) Comparison of assessment system

Features extracted from a comparison table of assessment system are as follows;

-Weighting of evaluation categories is similar to LOTUS, CASBEE, BREEAM, and GreenStar. A feature of LEED is that weighting of evaluation categories about waste is small. A feature of GreenMark is that weighting of evaluation categories about energy is large.

-Weighting of evaluation categories related to natural disasters and water resources is large in LOTUS compare with other systems.

-A feature of CASBEE is that simplified calculation of LCCO2 is included in the GHG assessment.

(2) Comparison of LOTUS and CASBEE

LOTUS is an environmental assessment system that has been recently developed in Vietnam. The evaluation categories are considered for building environmental performance that required in Vietnam. Meanwhile, CASBEE is effective for the evaluation of GHG reduction performance because it includes estimation of LCCO2. These features of evaluation categories in LOTUS and CASBEE are compared herein below.

1) Configuration comparison of evaluation categories

Configuration of evaluation categories of each evaluation system are shown in the following pie chart.

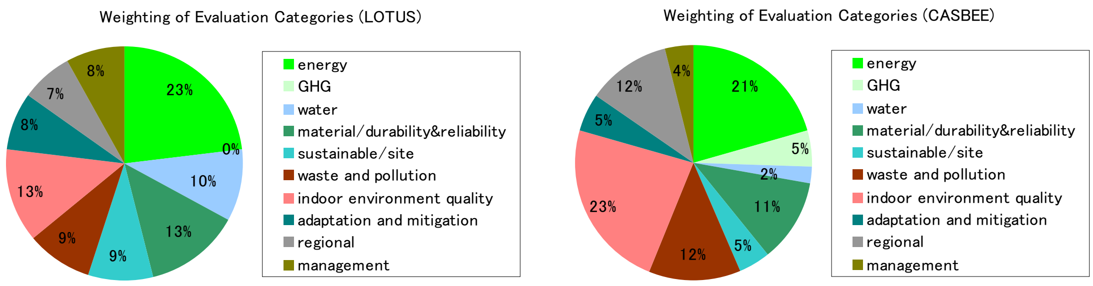


Figure 5.1.2 Comparison pie chart of LOTUS and CASBEE

2) Features of the evaluation items of LOTUS

-"Rapidly Renewable Materials", "Non-baked Materials" are included as evaluation criteria of Material

-"Site Selection - Previously polluted site and treat contaminations" is included as evaluation criteria of Sustainable

-"Flooding Resistance" and "Collective Transport" are included as evaluation criteria of Adaptation and Mitigation

-"Community Connectivity", "Local Jobs" are included as evaluation criteria of Regional

-"Produce a safety policy and safety plan" is included as evaluation criteria of Management

3) Features of the evaluation items of CASBEE

-"Noise", "Vibration", "Glare", "Air Quality", "Service Ability" are included as evaluation criteria of Indoor Environment. Evaluation items are subdivided.

-"Service Life of Components" is included as evaluation criteria of Material

-"Townscape & Landscape", "Restriction of Daylight Obstruction" are included as evaluation criteria of Regional

-Simplified calculation of LCCO2 is included

(3) Criteria of environmental assessment system in DaNang

The items that should be considered for constructing environmental assessment system in DaNang are shown in the following.

-Assessment system shall be rearranged/improved in a basis of LOTUS that developed to suit local conditions.

-Assessment methods shall be of simple for easy use.

-Assessment of LCCO2 shall be taken into account as evaluated in CASBEE.

2. Practical case study of building environmental assessment system

(1) Selection of survey target

Building environmental assessment systems have been developed as an environmental labeling tool for the purpose of use of real estate ratings of buildings in so many countries. CASBEE can serve widely as an assessment tool of environmental performance of buildings for the building designers and provide their clients with objective information on environmental consideration. It can also be used as a tool of administrative application by local government. Herewith, the case in Osaka City, Japan is introduced as a tool of construction administration.

(2) The building environmental assessment system Case Study in Osaka City, Japan

1) Development of environmental assessment system in Osaka City, Japan

In Osaka City, specialized environmental assessment system named "CASBEE Osaka Mirai" was developed based on "CASBEE for New Construction (Brief Version)" that is one of the standard tools of CASBEE. Important evaluation categories for Osaka City are added to the assessment system.

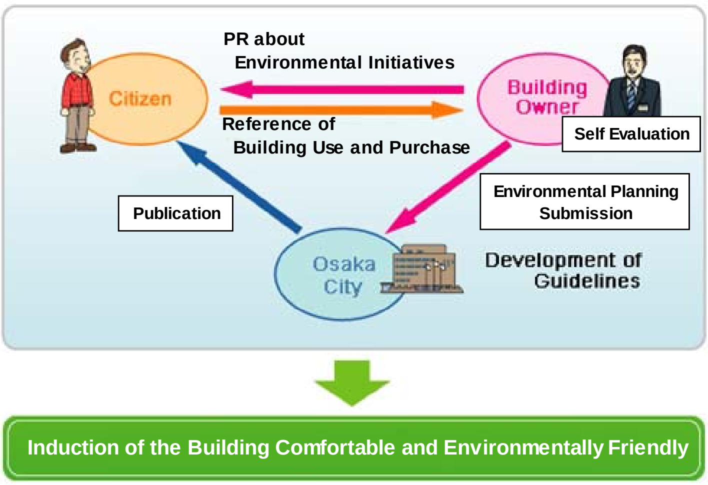
-Reduction of CO2

-Energy Conservation

-Measures of Heat Island

2) The enactment of the ordinance

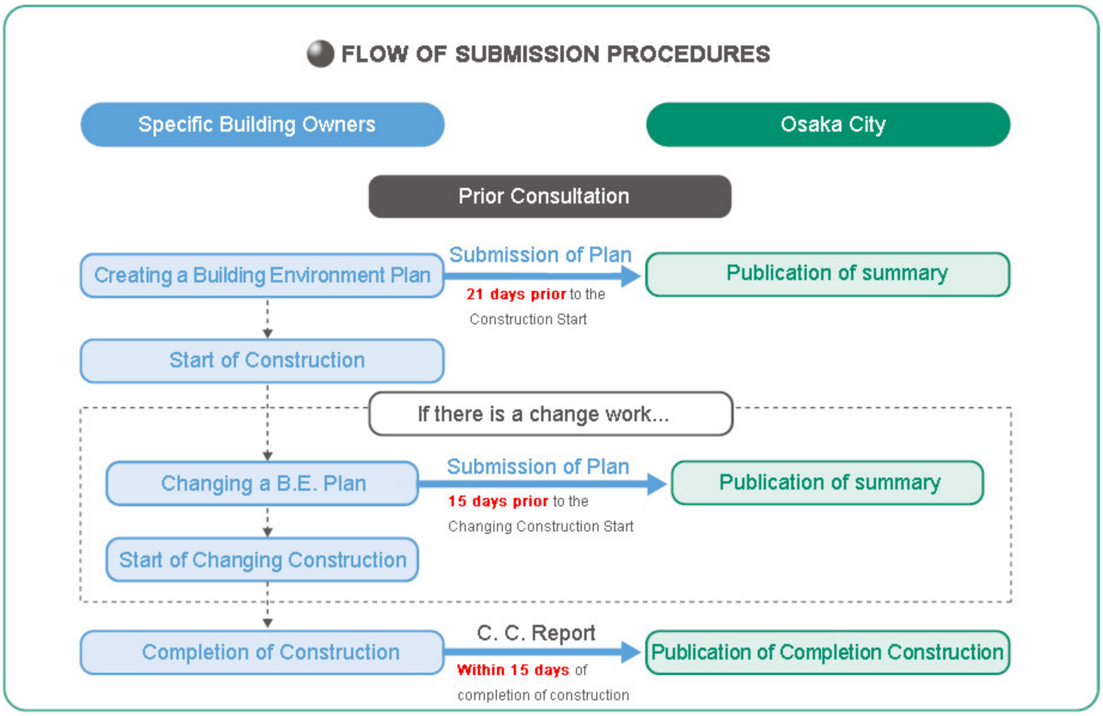
"The Ordinance on environmental considerations of building in Osaka" was enacted to incorporate the environment assessment system to construction administration. Framework of administrative operations is shown in the following. In addition, only submission of building environment plans are specified in the ordinance, because this ordinance is intended to increase environmental awareness and voluntary environmental efforts of building owners. The target of environmental levels is not defined.



(Source: Osaka City Web Site http://www.city.osaka.lg.jp/toshikeikaku/page/0000114438.html)

Figure 5.1.3 Framework of Environmental Construction Administration

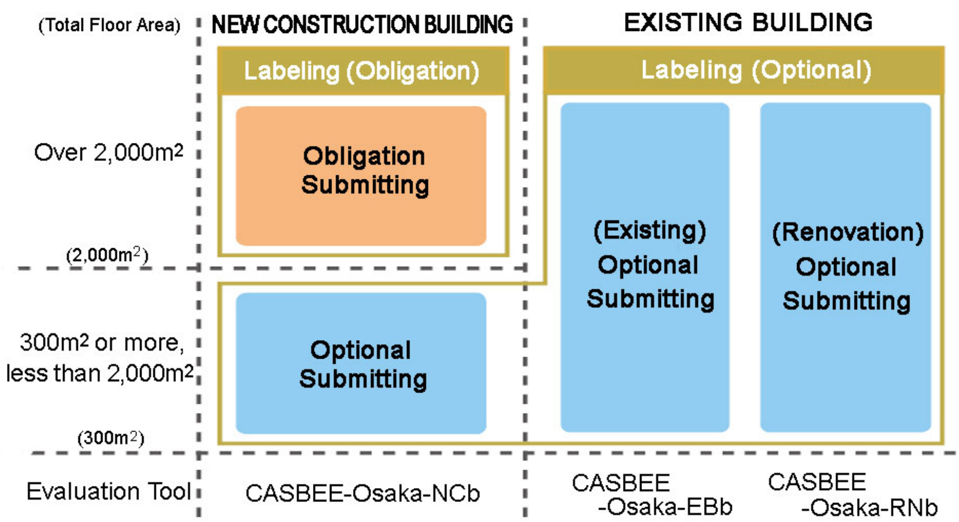
The administrative procedure of environmental assessment system is shown in the figure below. It is requesting notification of the plan of up to 21 days before the start of building construction.



(Source: Osaka City Web Site http://www.city.osaka.lg.jp/toshikeikaku/page/0000114438.html)

Figure 5.1.4 Flow of Submission Procedures for Environmental Building

Obligation target buildings are new building of 2,000m^2 or more, and submission of existing building and other new building is optional.

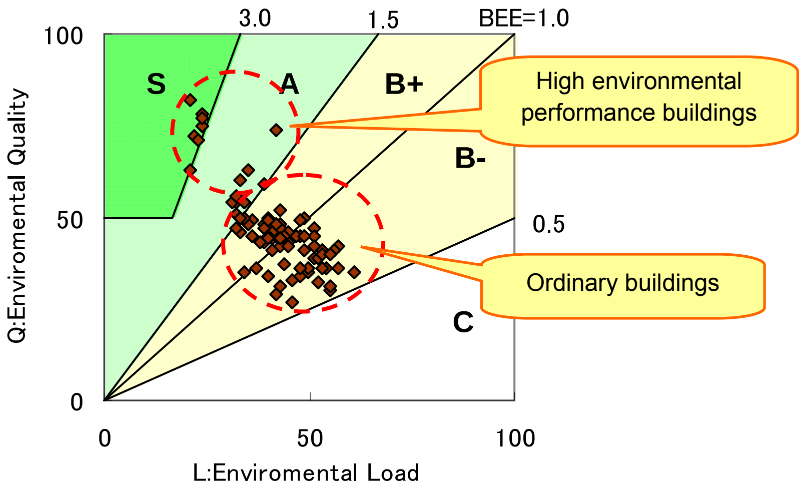


(Source: Osaka City Web Site http://www.city.osaka.lg.jp/toshikeikaku/page/0000114438.html)

Figure 5.1.5 Target of Submitting of Building Environment Plan

3) Present status

Ordinance is to start operation in 2008, and building environment plan has been submitted about 600 cases up to now. Situation of 2013 is shown in the figure below. Rank "A" or more of the building is 22% of the total, under the effect of increase environmental awareness and voluntary environmental efforts of building owners.



Built Environment Efficiency (BEE) = $\frac{\text{Q (Built Environment Quality)}}{\text{L (Built Environment Load)}}$

Ranks	Assessment	BEE value, etc.
S	Excellent	BEE = 3.0 or more and Q = 50 or more
A	Very Good	BEE = 1.5-3.0 BEE = 3.0 or more and Q is less than 50
B^+	Good	BEE = 1.0-1.5
B^-	Fairy Poor	BEE = 0.5-1.0
C	Poor	BEE = less than 0.5

(Reference: Osaka City Web Site http://www.city.osaka.lg.jp/toshikeikaku/page/0000212441.html)

Figure 5.1.6 Present status of CASBEE Osaka on 2013

3. Survey of building environmentally design methodology

Environmental design methodology that applies to the new construction building can be classified into five categories. Environment considerations in the classification of each are shown in the table and figure below.

Table 5.1.2 Environmental Considerations

Classification	Sub-Classification	Environmental Considerations
Surrounding Environment Friendly	Regional Ecosystem Conservation	Building placement along natural terrain Green Network Biotope
	Urban Climate Mitigation	Planting to roof, wall, and surroundings Permeable pavement
	Pollution Prevention	Control of water, soil contamination Control of air pollution, stink, noise, vibration
Energy Conservation in the Operational	Load Reduction	
	Heat Insulation to Roof and Exterior Wall	High airtightness, High thermal insulation Outside insulation Showering to the roof
	Insulated Windows	Using high SC glass, Low-e grass, Insulateing glass Heat insulating frame
	Partial Air-Conditioning and Ventilation	Spot cooling Floor-mounted air diffuser system
	Avoid Waste of Energy	Avoidance of distribution loss Improvement of power factor
	Using of Natural Energy	
	Natural Lighting	Design of window, considering natural lighting Light shelf and light tube
	Natural Ventilation	Building design that considering the prevailing wind direction Night Purge System
	Using of Renewable Energy	Solar power and wind power generation Solar hot water Using of untapped energy such as river water for heat pump system
	Efficient Use of Resources	
	Efficient Use of Energy	Combined heat and power system Using high efficient air- conditioning system Exhaust heat recovery such as total heat exchangers
	Electric Load Leveling	Thermal storage air conditioning system
	Minimization of Transport Energy	Variable air volume and variable water volume system Using energy-efficient fan
	Minimization of Lighting Energy	Using high efficiency fluorescent lamp and LED Variable lighting system Task-ambient lighting system
	Efficient Use of Water	Utilization of rainwater Using water saving faucet
	Management	Introduction of building energy management system Promoting energy saving awareness
Long Service Life	Ensure a Flexibility	Flexibility of floor height, floor area, floor load limit
	Durability of Building Material	Material with excellent durability Method of easy updating
	Durability of Building Facilities	Prepare the update space
Eco-Friendly Material	Low Environmental Impact Material	Using sustainable material such as timber and stone
	Using of Recycled Materials	Using blast-furnace slag cement Using recycled concrete aggregate
	Degradable Materials and Construction Methods	Modular design that considering a unit length
Appropriate Processing	Reduction of Waste	Separating rubbish for recycling Composting of food waste
	Suppression of Material Waste	Onsite processing of waste soil Recycling of temporary material
	CFC-free	Using natural refrigerant system Using CFC-free insulation

(Reference: Standard and Explanation for Assessment of Environmental Preservation Performance of Government Building Facilities; BMMC Japan 2006)

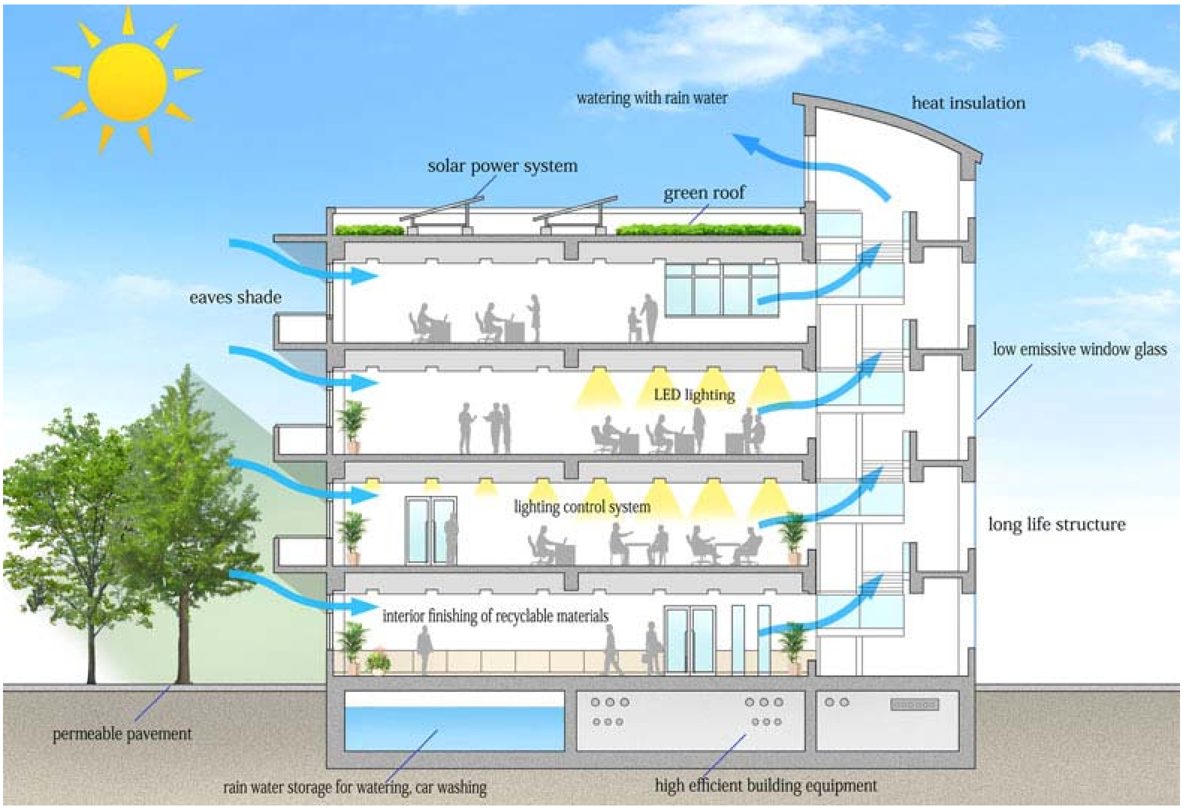


Figure 5.1.7 Environmental Considerations

(Reference: Standard and Explanation for Assessment of Environmental Preservation Performance of Government Building Facilities; BMMC Japan 2006)

Appendix 5.4 Pickup of funding sources

(1) PPP project and ODA project/ e.g. JICA

JICA (Japan International Cooperation Agency) has started a program called "Public- Private Partnership" which JICA carries out based on propositions from private companies. The range of initiatives include many projects such as airports, harbors, electrical facilities, city transportation, industrial parks, processing of forest products, and so on. Moreover, these propositions seek to promote overseas investment for infrastructure development in developing countries, and bring about overseas expansion of small and medium enterprise. To put it concretely, infrastructure development achieved through cooperation between public and private organizations is indispensable. This development requires a great deal of private involvement from the construction stage to administration.

JICA defrays up to one hundred million and fifty thousand yen of the survey costs. JICA advertises for propositions from the private sector corporations which plan to invest in PPP infrastructure projects. The corporation will then proceed to conduct a survey when their proposition is chosen by JICA as a PPP infrastructure project. The survey intends to plan commercialization of propositions which target the whole of PPP infrastructure operations.

The biggest problems are profitability and funding from organizations. It is difficult to get the host country's commitment, even though some burden on the public is indispensable. Consequently, the government of Japan's involvement is essential. Also at present, issues related to the project development of infrastructure PPP projects include: insufficient study and preparation at the master plan stage of infrastructure development; insufficient know-how and software studies which emphasize the specifications of construction; and efforts from Japan t not sufficient.

(2) JCM related supplemental venture/ e.g. NEDO, METI, Ministry of Environment

- Each ministry of Japan manages to organize a budget for joint crediting.
- Joint Crediting Mechanism and Infrastructure development feasibility study/ METI
- Global warming countermeasures and technology promotion activities/ NEDO

Since JCM business is a new system which was evolved this year but the degree of recognition is low and there is no precedent.

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