

Socialist Republic of Viet Nam
Energy Conservation Center Hanoi

Socialist Republic of Viet Nam
Collaboration Program with the Private
Sector for Disseminating Japanese
Technology for Energy Saving Glass
Windows for Buildings

Final Report

Sept., 2017

Japan International Cooperation Agency (JICA)

Asahi Glass Co., Ltd

OS
JR
17-075

Table of contents

Map of the study area

List of abbreviations

Chapter 1 Summary	1
1.1 Summary	1
1.2 Diagrammatic illustration.....	2
Chapter 2 Background.....	3
2.1 Background of this project	3
2.1.1. Policy and Social Background.....	3
2.1.2. Development strategy	5
2.2 Disseminated technology and contribution	9
2.2.1. Disseminated technology.....	9
2.2.2. Contribution to the development strategy.....	13
Chapter3 Project Outline	14
3.1 Project Objective and target	14
3.1.1. Project Objective	14
3.1.2. Project Target and Goals (contribution to the country, region and city’s development strategy)	14
3.1.3. Project Target and Goals (business aspect)	15
3.2 Project Implementation	16
3.2.1. Schedule.....	16
3.2.2. Implementation structure	17
3.2.3. Project contents.....	18
Chapter 4 Results of this project	19
4.1 1st field activities	19
4.2 2nd field activities	19
4.3 1st activity in Japan	20
4.4 3rd field activities.....	23

4.5	4th field activities	23
4.6	Seminar in Vietnam.....	24
4.7	2nd activity in Japan.....	26
Chapter 5 Project Results		29
5.1	Accomplishment of this project (contribution to the target country, region and city)	29
5.2	Accomplishment of this project (business aspect), remaining issues and resolution policy	31
5.2.1.	Accomplishment of this project (business aspect).....	32
5.2.2	Remaining issues and future tasks.....	33
Chapter 6 Future business prospects		34
6.1	Business Target and Objectives	34
6.1.1.	Business Targets (contribution to target country, region, and cities social and economic development)	34
6.1.2.	Business Targets (business aspect).....	36
6.2	Future business development	36
6.2.1.	Outline of the business	36
6.2.2.	Business target.....	39
6.2.3.	Business Implementation.....	41
6.2.4.	Schedule of developing a business	42
6.2.5.	Investment and capital plans.....	42
6.2.6.	Competitor	47
6.2.7.	Remaining issues for future business expansion	50
6.2.8.	Future risks and tasks for business expansion	50
6.3	Possible collaboration with ODA.....	51
6.3.1.	Necessity of collaboration	51
6.3.2.	Potential collaboration scheme.....	52
6.3.3.	Potential collaboration projects	53

Attachment

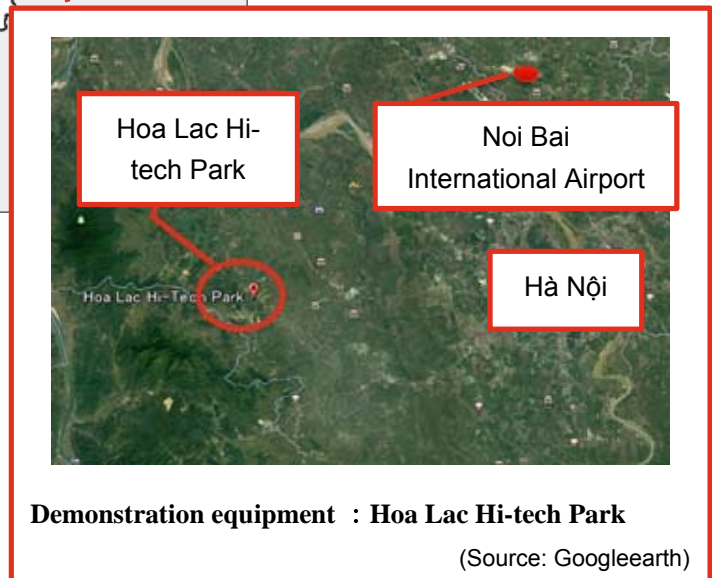
Reference

Map of the study area

Hanoi City & Ho Chi Minh City, Socialist Republic of Viet Nam



(Source : <http://www.sekaichizu.jp/>)



List of abbreviations

Abbreviation	Official name
AAP	AGC Asia Pacific Pte. Ltd.
AGC	Asahi Glass Co., Ltd.
ASEAN	ASEAN Economic Community
BAU	Business as usual
DOIT	Department of Industry and Trade
ECC	Energy Conservation Center
ECC-HCMC	Energy Conservation Center, Ho Chi Minh City
ECC-HN	Energy Conservation Center, Hanoi
EPA	Economic Partnership Agreement
FTA	Free Trade Agreement
GDP	Gross Domestic Product
GNI	Gross National Income
IMF	International Monetary Fund
JCD	JTB Communication Design, Inc.
JCM	Joint Crediting Mechanism
JETRO	Japan External Trade Organization
JICA	Japan International Cooperation Agency
METI	Ministry of Economy, Technology and Trade (Japan)
MOIT	Ministry of Industry and Trade
MONRE	Ministry of Natural Resources and Environment
NTP-RCC	The National Target Program to respond to climate change
ODA	Official Development Assistance
PDP7	National Power Development Plan VII
TPP	Trans-Pacific Strategic Economic Partnership Agreement
WTO	World Trade Organization

Chapter 1 Summary

1.1 Summary

Recently, Socialist Republic of Viet Nam (hereinafter referred to as Vietnam) has achieved rapid economic growth of about 6 to 7% per year and the energy consumption has also been tripled in this decade. It is expected that the electricity demand is expected to grow continuously by more than 10% over the previous year. According to the 7th National Power Development Plan (Power Development Master Plan 7 (PDP 7)), published in July 2011, electric power development growth is expected to be about 14% per year. Enhancing energy efficiency is crucial for continuous economic growth. Vietnam government has been developing the climate change policy since 2008. According to the Intended Nationally Determined Contributions (INDC) that was submitted to United Nations, Vietnam aims at a reduction of 8 % or 25%* of its greenhouse gas emissions (hereinafter referred to as GHG) (* =in case they accept international support) by 2030 compared to BAU (Business as usual).

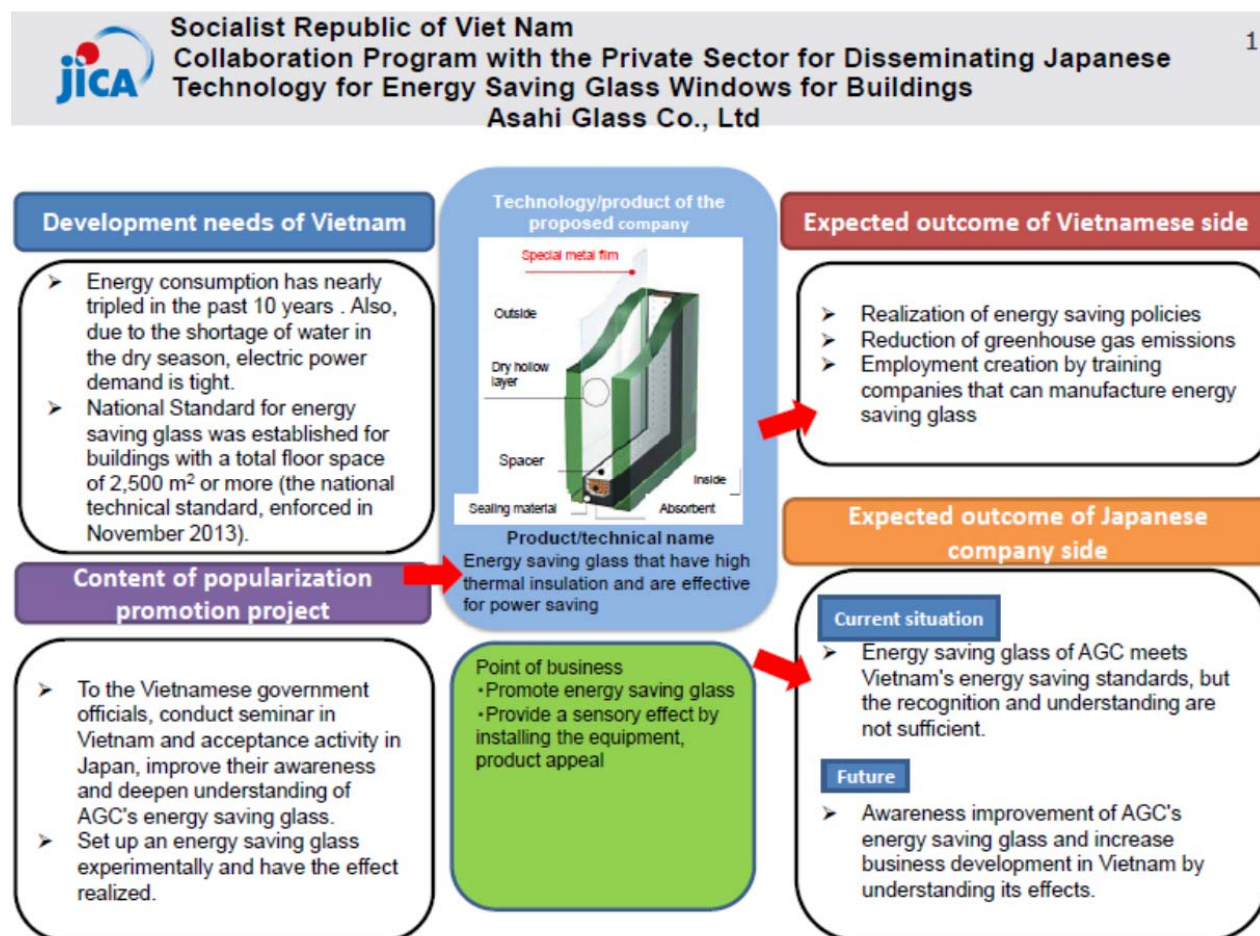
As a part of the energy saving policy, QCVN 09:2013/BXD was announced by the Ministry of Construction on November 2013 and the energy saving standard for glass was established for the building that has a total floor area of 2500 m² or more. At present, revision is being done and a revised version is scheduled to be made at the end of 2017. On the other hand, for the energy saving glass industry, only one Vietnam domestic company has the ability to manufacture energy saving glass, and had just started the production in 2016. Therefore, the energy saving glass industry in Vietnam is still in the developing phase. The installation of energy saving glass will contribute to the realization of Vietnam's energy saving policy, and the reduction of growing GHG emission from the continuous economic growth.

In this project, we aim to encourage the understanding for energy saving glass and to strengthen the capacity of the float glass industry and Vietnam government's stakeholders. Specifically, we've installed the energy saving glass demonstration equipment at the training center of the energy conservation center where the training programs will be carried out for the qualified person for energy management and the energy consultant. In aim to improve the acknowledgement and understanding for this technology to the related Vietnam government and private stakeholders, AGC Asahi Glass (hereinafter referred to as AGC) invited them for training in Japan to see AGC show room and related factory etc., and also held a seminar in Vietnam.

As a result, the acknowledgement and understanding for this technology has improved and AGC has built relations with the Vietnam government related stakeholders. It is expected that the qualified person for energy management and the energy consultant who received training at the training center where the energy saving glass demonstration equipment is installed will move to work all over the country and contribute to the improvement of understanding of energy saving glass. AGC will continue the lobbying activity by participating in the exhibition and seminars in Vietnam, and regional headquarter AGC Asia Pacific Pte. Ltd.

(AAP) (Singapore) will strategically coordinate and drive forward energy saving glass business in Vietnam. PT Asahimas Flat Glass, Tbk (Indonesia), AGC Flat Glass Thailand (Thailand) etc. will manufacture and supply the energy saving glass. As described above, AGC will drive forward energy saving glass industry in Vietnam

1.2 Diagrammatic illustration



Chapter 2 Background

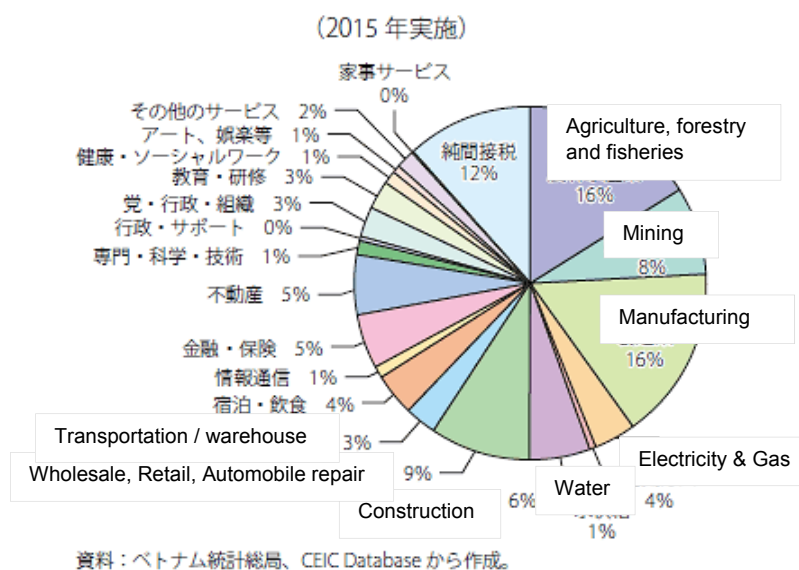
2.1 Background of this project

2.1.1. Policy and Social Background

① Policies and Social background

Viet Nam's total land area is 330,966.9km², the population of Viet Nam is 9,171 million (2015, General Statistics Office of Viet Nam) and the GDP per person is 2,173 USD (2016, IMF-World Economic Outlook databases).

Vietnam has an elongated national land in north and south and Ha Noi (population: 721.6 million), capital, is located at the north part and Ho Chi Minh City (HCMC) (population: 814.6 million), the biggest city in Vietnam, is located at the south part. Hanoi that is located at Red River Delta is a political center and HCMC that is located at southeast part is the biggest commercial city in Vietnam. In the breakdown by industry of real GDP in Vietnam (2015), the manufacturing account 16 % (Figure 2-1). Therefore, there is much room for sophistication of industrial structure.



(Source : METI (Tusyohakusyo 2016))

Figure 2-1 Breakdown by industry of real GDP in Viet Namⁱ

Vietnam is a socialist republic. Under Communist Party system, they take a collective executive by Communist Party Leader (Nguyễn Phú Trọng), chief of state (Trần Đại Quang) and Prime Minister (Nguyễn Xuân Phúc). Parliamentary elections are held every five years. At the 12th party convention of the Communist Party that ended on January 28, 2016, they decided the new leadership for 2016 to 2020. Nguyễn Phú Trọng

(Communist Party Leader) stayed in office and Nguyễn Xuân Phúc (prime minister) who promoted economic reform including TPP participation and easing deregulation of foreign capital changed.

② Economy

Continuous economic growth in Vietnam is expected, due to the population increase, active intra-regional trade by developing the ASEAN economic community, and that Vietnam has signed TPP.

The results of the introduction of the Doi Moi policy began to rise since about 1989, and from 1995 to 1996, the economic growth rate of 9% was recorded. Although the growth slowed temporary due to the impact of the Asian economic crisis, with the steady increase in foreign direct investment, the average economic growth rate in 2000 to 2010 was 7.26%. Vietnam achieved the high growth. In 2007, Vietnam joined the WTO and became a middle income country in 2010. With the efforts to stabilize the macro economy since 2011, although the growth rate has slowed slightly, it is growing steadily while suppressing inflation (Table 2-1 Major economic indicators in Viet Nam). Since then, Vietnam has been signing FTA / EPA with each country / region and has officially signed TPP in February 2016.

Although the real GDP growth rate in 2016 was 6.2%, which is 0.5 point lower than the 6.7% in the previous year, the real GDP growth rate has been around 6% in recent years and the unemployment rate (against the labor force population) is 2.30% in the first quarter of 2017 (3.24% in urban areas, 1.83% in rural areas (General Statistics Office of Vietnam, 2017)). The consumer price index (CPI) rise rate in 2016 was 2.7%, achieving the target 5.0% or less. The trade balance shifted from a deficit to a surplus in 2015.

Table 2-1 Major economic indicators in Vietnam

	2010	2011	2012	2013	2014	2015
Real GDP growth rate (%)	6.423	6.240	5.247	5.422	5.984	6.679
Total nominal GDP (Billion USD)	112.8	134.6	155.5	170.4	185.8	191.3
Nominal GDP per capita (USD)	1,297	1,532	1,752	1,900	2,047	2,087
Consumer Price Index (%)	11.75	18.13	6.81	6.04	1.84	0.6
Unemployment Rate (%)	2.88	2.22	1.96	2.18	2.10	2.33

※IMF Prediction

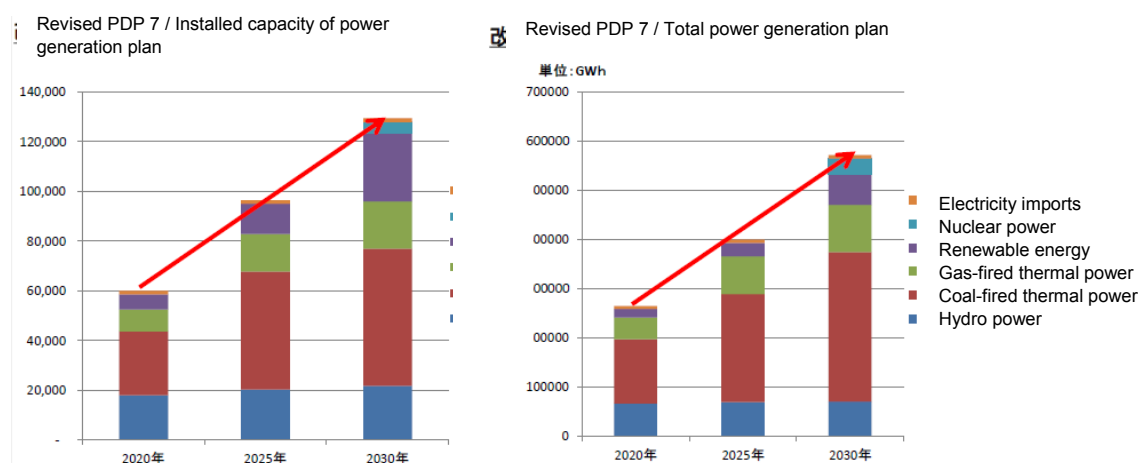
(Source : IMF2016, Investigation team prepared based on the data of General Statistics Office of Vietnam)

2.1.2. Development strategy

① Necessity of energy saving technology for the sustainable economic growth

➤ Economic growth and energy saving measures

Vietnam has achieved rapid economic growth of about 6% per year in recent years, while the energy consumption has also been tripled in this decade. In PDP 7 revised on March 18, 2016, the real GDP growth rate from 2016 to 2030 is predicted to increase by 7% per year on average, and the installed capacity of power generation and the total power generation are predicted to be 2.2 times by 2030 compared to 2020.



(Source: JETRO (Vietnam Power Survey 2016))

Figure 2-2 Capacity of power generation equipment and the plan for total power generation in Vietnam

If the power development will be implemented according to the PDP 7 revision schedule, there will be no problem of electricity supply and demand in the northern, central and southern parts. Although in the northern part, as the current energy supply depends on hydro power generation, the supply of electricity will be affected if the amount of precipitation is insufficientⁱⁱ. For this reason, in order for Vietnam to continue its steady economic growth in the future, it is necessary to switch to a socioeconomic structure that uses energy efficiently, thus the energy conservation is an urgent issue. In January 2011, the Law concerning Effective Energy Utilization and Energy Use (Energy Conservation Act) came into force, and further promotion of energy conservation is officially required in Vietnam. Also from the current climate change policies, GHG emission reduction by energy saving efforts and other measures is required (Table 2-2).

Table 2-2 Climate change policies in Vietnam

year	Title	Overview	Emission reduction target
2008	National Target Programme to Respond to Climate Change (NTP-RCC) (2009 -2015)	- MONRE is responsible for national climate change program coordination and implementation, showing the basic framework including organizational framework, budget etc., of each related ministry and agency.	8% GHG emission reduction by 2020 (compared to 2005)
2010	Approval for evaluation of priority projects in the climate change support program	- As half of the implementation budget of NTP-RCC is expected from international support, a climate change support program was established as a platform for coordination of overseas support	—
2011	National climate change strategy	- Describes long-term policies until 2050, and climate change mitigation targets have been set up in each sector such as energy saving, renewable energy, and agriculture etc... - Policy options for mitigation measures such as measures to promote energy conservation in each division, pricing system for energy conservation and renewable energy, energy conservation standards and labeling system were presented	—
2012	NTP-RCC (2012 -2015)	- Revised NTP-RCC of 2008, following the national climate change strategy and the five-year economic and social development plan of 2011-2015	—
	- National green growth strategy	- MPI and MOF are in charge - GHG emission reduction, green product development, promotion of sustainable consumption activities were presented and targets set for 17 items on mitigation policy	10% - 20% GHG emission reduction By 2020, BAU in energy sector
	- Management plan for GHG emissions and international carbon credit transactions	- Establish GHG reduction targets by 2020 for each sector of energy, agriculture, LULUCF, waste (relative to 2005)	8% GHG emission reduction in energy sector by 2020 (compared to 2005)
2014	- National Action Plan for Green Growth (2014 - 2020)	- Action plan for the National green growth strategy developed in 2012	—
2015	INDC (Intended Nationally Determined Contribution)	- Contribution plan decided by the country concerning GHG emission reduction targets after 2020, created in advance of COP 21 in December 2015.	<ul style="list-style-type: none"> • 8% GHG emission reduction by 2030 compared to BAU(emission intensity per unit of GDP will be reduced by20% compared to the 2010 levels) • Could be increased up to 25% with international support. (emission intensity per unit of GDP will be reduced by 30% compared to the 2010 levels)
2016	Plan for Implementation of the Paris Agreement	- Plan to implement the NDC for Paris Agreement on Climate Change for the period till 2020 and 2030. (1) 2016-2020; ➤ Mitigation - To review and revise the policies related to the mitigation of GHG emissions and green growth. - To operate the national GHG inventories, perform periodic GHG inventory for the base years of 2014, 2016 and 2018. - To develop national MRV system for mitigation action - To update the contribution of GHG emissions for the global assessment in 2018 - To develop and implement NAMAs that can mobilize financial resources	GHGs emission reduction compared to BAU: 8% (unconditionally) and 25% (with international support)

		<ul style="list-style-type: none"> ➤ Adaptation <ul style="list-style-type: none"> - Implement GHG inventory for national reports under the provisions of the Paris Agreement and periodic evaluation of global efforts - To develop a national adaptation plan - To develop national MRV system for adaption action - Updating the contribution to adaptation for the global assessment in 2018 (2)2021-2030; ➤ Mitigation <ul style="list-style-type: none"> - Implementation of activities for GHG emission mitigation and green growth in the energy, agricultural, transportation, construction sectors appropriate to national conditions based on the evaluation of global efforts in 2023 and 2028 - Implement GHG inventory for national reports under the provisions of the Paris Agreement and periodic evaluation of global efforts ➤ Adaptation <ul style="list-style-type: none"> - Proactively responding to natural disasters and strengthen climate monitoring - Ensuring social security - Responding to sea level rise and flood in urban area 	
--	--	--	--

(Source: Investigation team prepared based on the data of IGESⁱⁱⁱ, JICA^{iv}, METI^v, Department of Meteorology, Hydrology and Climate Change^{viii})

➤ **Construction Demand in the urban area**

The annual average urbanization rate of Vietnam is 1.9%, and by 2035 over 50% of the population is expected to move to the urban area. Also, since young people under 25 years old account for about 40% of the population, it is expected that demand for new housing will also increase due to marriage etc. of this population group. Regarding non-residential buildings, the private non-housing investment in 2010 is projected to be 11.8 trillion yen (2.2% increase from the previous year) and 13.1 trillion yen (10.7% increase from the previous year) in 2011. Both residential and non-residential buildings are expected to have large building demand. Considering the growing number of urbanization rate and the rapidly increasing number of buildings, energy consumption is expected to expand mainly in the urban areas.

Thus, in Vietnam urban areas where the population increase and the urbanization are expected, it is important to construct buildings with excellent energy saving performance before urban city development is done in order to suppress energy consumption.

② **Lack of energy saving glass manufacturing companies corresponding to Vietnamese national standards**

QCVN 09: 2013 / BXD was announced from the Ministry of Construction in November 2013 as a part of energy conservation policies in Vietnam. According to the standard, energy saving standard of glass were

established for both new construction and renovations of buildings with total floor areas of 2,500 m² or more. Although, manufacturing company is limited to only one company in Vietnam for energy-saving glass that meets the standard. Therefore, it can be said that the energy saving glass industry in Vietnam is still in the developing phase. For this reason, although the national standards have been established, lack of local manufacturers / know-how is the current issue in Vietnam glass manufacturing industry.

- The National Technical Regulation on Energy Efficient Buildings (QCVN 09:2013/BXD) enacted by the MOC in November 2013

SHGC of glazing shall be smaller or equal to the maximum allowed value, and glazing VLT shall not be lower than the VLT_{min} in under table.

Table 2-3 WWR-related SHGC for glazing

WWR, %	SHGC _{max} on 8 main orientations				VLT _{min}
	N	E or W	NE, NW or SE, SW	S	
20	0.9	0.80	0.86	0.90	0.70
30	0.64	0.58	0.63	0.70	0.70
40	0.5	0.46	0.49	0.56	0.60
50	0.4	0.38	0.40	0.45	0.55
60	0.33	0.32	0.34	0.39	0.50
70	0.27	0.27	0.29	0.33	0.45
80	0.23	0.23	0.25	0.28	0.40
90	0.20	0.20	0.21	0.25	0.35
100	0.17	0.18	0.19	0.22	0.30

Notes:
 1) If WWR does not match the values in column 1, SHGC shall be determined through linear interpolation using the nearest higher and lower WWR values.
 2) Glazing materials with SHGC values higher than the reference SHGC providing that sunshades with appropriate A coefficients are used to insure that the selected SHGC is smaller or equal to the reference SHGC multiplied by the A coefficient.

(Source: QCVN 09:2013/BXD, (2013), “National Technical Regulation on Energy Efficiency Buildings”)

2.2 Disseminated technology and contribution

2.2.1. Disseminated technology

① Details of the technology to be provided

The intended technology to be provided by this project is “energy saving glass” that decreases the electricity consumption in the buildings. In the buildings, coming and reflecting of heat mostly arise at the windows (opening windows). Thus, by the installation of energy saving glass, it can decrease the solar heat from the outside to inside and also can decrease the electricity consumption of air conditioner.

Figure 2-3 shows the energy saving glass of AGC, “Low-E double glazing glass”. A special metallic film coated on the surface of the glass selectively transmits/reflects light and heat (Low-E film). The film was developed by AGC’s original technology. In case of Low-E double glazing glass, the amount of solar radiation decrease about 50% of single glazing glass. Thus, it contributes to decrease the electricity consumption for air conditioning inside the buildings.

There are heat shield type and heat insulating type for Low-E double glazing glass. They can reduce the 30% of electricity for refrigerated air conditioning compared with single glazing glass and reduce the 60% of the amount of solar radiation (Figure 2-4).

It can be also be said that this technology is a feasible low carbon technology for installation because it just need the initial cost for introduction and does not need the additional maintenance cost and can be installed during the construction of the building.

Because the energy saving glass has a large effect on energy saving, it has become popular in developed countries such as Europe. But, it still is not common widely spread in Vietnam. In Vietnam, the consideration of the initial cost for constructing buildings are recognized efficient in equipment bids, and running cost or lifetime cost are sometimes not recognized sufficiently.

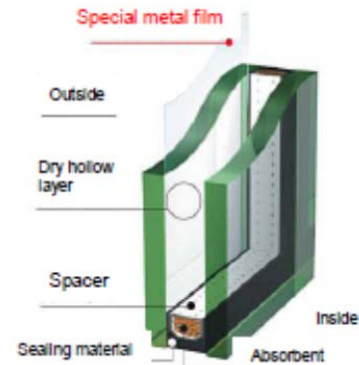


Figure 2-3 Low-E double glazing glass, Insulating type

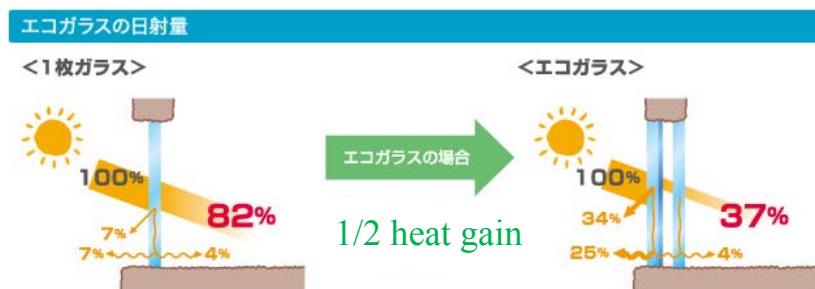


Figure 2-4 Single glazing glass (left) and Low-E double glazing glass (right)

② Performance of sales and installation in Japan and abroad

In Japan, for new construction single-family homes, the adoption rate of double glazing glass was 94.2% and that of Low-E double glazing glass was 54.5% in 2012. For new construction apartment buildings the area adoption rate of double glazing glass was 73.4% and that of Low-e double glazing glass was 21.0% in 2012. AGC dominates No. 1 share of the domestic Low-E double glazing glass market.

In Finland, the adoption rate of Low-E double glazing glass is about 60%, and in Sweden, it is about 30%. It has now become popular in Europe. Although, it still has not become general in South-East Asia including Vietnam, but, it is urgently required to promote the energy saving glass in such region, as the increase of electricity demand is expected because of the urbanization and/or increase of the population.

③ Characteristic and economic potential of Low-E double glazing glass

The characteristic of Low-E double glazing glass and competing technology are summarized in Table 2-4. Low-E double glazing glass (heat insulating type) is composed of two single glazing glasses and the Low-E film is coated on the surface of outside glass that is faced to inter-glass space. In hot season, special metal film shields the solar isolation from the outside and in cold season, it prevent the heat to escaping from inside thus it contribute to the energy saving.

➤ Competing technology (Japan)

Table 2-4 Comparison of Low-E double glazing glass with competing technology

	Low-E double glazing glass	Float glass (competing technology)
Release year	1988: Started manufacturing and selling of Low-E double glass 1992: Started manufacturing / release of "Sun Balance" with high thermal barrier performance	Unknown
Characteristic (Strength of technology)	Pair glass coated with low-E film that blocks thermal radiation on the side in contact with the hollow layer of the outdoor side glass. In the summer it prevents the inflow of solar heat, enhances the air conditioning efficiency, and in the winter it increases the heating efficiency by preventing outflow of the radiant heat to the hollow layer. Ultraviolet rays can also be drastically cut. It is effective also for interior decoration and fading of furniture, prevention of deterioration.	De facto standardization (strong point)
Price (unit price)	In the case of a combination of 3 mm transparent plate glass and 3 mm Low-E glass, the reference price is 24,150 yen / m ² (consumption tax included).	-Energy saving glass costs about 4 times the price of single glass - The price is about 1.6 to 1.7 times higher compared to general double glazed glass made up of 3 mm transparent plate glass.
Economic efficiency	Electricity charges for heating and cooling costs in the case of a general detached house in Tokyo 49,000 yen	Electricity charges for heating and cooling costs in the case of a general detached house in Tokyo • 72,000 yen (single glass) • 57,000 yen (double glazing glass)
durability	Equivalent to the durability years of buildings	Equivalent to the durability years of buildings
Safety	Equivalent to general float glass	-
Environmental considerations	Shields solar radiation heat by special metal film, reduces cooling load, contributes to energy saving. • Power consumption during peak winter season (Representative time : 7 AM) : 1.41kWh *Comparison with single glass: ~30% • Annual CO ₂ emissions from heating and cooling use in Tokyo: 768kg (Sun Balance Aqua Green E)	• Power consumption during peak winter season (Representative time : 7 AM) : 2.11kWh (single glass) 1.66kWh (double glazing glass) • Annual CO ₂ emissions from heating and cooling use in Tokyo: 1,155kg
Share in Japan	No.1 domestic share of Low-E double glazing glass in Japan	No.1 domestic share of transparent sheet glass in Japan
Reason for competitive selection	-	Selected as general glass

➤ Competing technology (abroad)

(i) Chinese glass manufacturer

In china, because of the growth of estate and automotive industry, the number of production plant/equipment and capacity of manufacturing flat glass is increasing drastically.

As of 2013, the capacity of flat glass production in china shared about 60% of global market. On the other hand, the construction industry (including flat glass industry) of China is excess of production capacity and reach the plateau in market demand. Thus, Chinese government has been taking action to control the capacity of flat glass production since 2001^{viii}. The demand and supply gap in china is expanding and the export to Asia region that include Japan tends to increase.

In Vietnam, import levy of flat glass of China is higher than that of AGC (Table 2-4), thus, it is considered that it does not compete with AGC products.

Table 2-4 Import levy of flat glass in Vietnam

	Flat glass of AGC (Import from Thailand and Indonesia)	Flat glass of China
Ratio of import levy	5% (ASEAN free trade agreement)	35~40%

(Source : FedEx Trade Networks 「WorldTariff」 (June, 2017))

(ii) Domestic glass manufacturer (Vietnam)

The example of Vietnam domestic glass manufacturer includes Vignacera Float Glass Company (VIFG), Vietnam Float Glass Company (VFG) and Chu Lai Float Glass Company. VIFG is the only company that manufactures the energy saving glass. They had started manufacturing in the second half of 2016.

There is a possibility of low-priced competition in Vietnam because Vietnam domestic glass manufacturer may sell energy saving glass by lower price than AGC. On the other hand, there is the possibility that their products are lower quality in energy saving, lower durability and higher running cost for maintenance.

Low-E double glazing glass is composed of two glasses and the special metallic film is formed on the surface of one glass. Thus, Low-E double glazing glass has difficulty in production such as the defect arising from the deterioration of the metallic film during the storage or in technology such as the peeling of the film from the glass. AGC will promote the Low-E double glazing glass by appealing both the high quality and the non-energy benefit (co-benefit) such as solar radiation and heat shielding, and comfortableness.

2.2.2. Contribution to the development strategy

① Contribution to GHG emission and energy consumption reduction

The promotion of this technology in Vietnam will contribute to the realization of energy efficiency policies of Vietnam government and the reduction of increasing greenhouse gas emission because of the growing economy. In Vietnam, the main emission source of greenhouse gas of operation and residential sector is the consumption of air conditioners. The installation of the technology will contribute to the GHG emission reduction from above sector.

According to the result of JCM (Joint Crediting mechanism) feasibility study in fiscal year 2013 of Ministry of Environment, in case the energy saving glass is introduced to the five –story steel building in Hanoi city, it is expected that the reduction of electricity consumption per year of 56.2 kWh/area of windows (m²), that of 19.0 MWh/building with 2400m² in total floor area and that of 10.3 ton-CO₂ emission, respectively.

On the other hand, in case of Ho Chi Minh City, it is expected that the reduction of electricity consumption of 100.1 kWh/area of windows (m²), that of 35.0MWh/building with 2400m² in total floor area and that of 18.9 ton-CO₂ emission, respectively per year. Based on this, if the 30% of one million homes (three hundred thousand homes) is five –story steel building (there are 10 homes on each story), it means that there are 50 homes in each five –story building. In that case, three hundred thousand homes are equivalent to six thousands of five –story building, thus, it is expected that the reduction of electricity consumption is 114,000MWh ~ 210,000MWh and that of 61, 800 ~ 113,400 ton-CO₂ emission per year.

② Growth of energy saving glass industry in Vietnam

In 2013, Ministry of Construction of Vietnam set the national technical standard for energy efficient buildings, QCVN 09:2013/BXD. Although, due to the technical difficulty of manufacturing, only one domestic company manufacture energy saving glass.

It is expected that the popularization of this technology will contribute to the growth of energy saving glass industry in Vietnam.

Chapter3 Project Outline

3.1 Project Objective and target

3.1.1. Project Objective

In Vietnam, energy saving glass is still not common and does not have mass appeal in the industry. Thus, raising awareness and popularizing the AGC's energy saving glass is important to obtain the recognition and understanding of government officials that oversee the energy saving policies and glass industry stakeholders in Vietnam. Through JCM feasibility study in fiscal year 2013 of Ministry of Environment, the Vietnam side showed great interest in AGC's energy saving glass technology. On the other hand, it was also revealed that currently recognition and understanding of energy saving glass is lacking in Vietnam, and training for future contributors in in need. The Energy conservation center of Vietnam requested AGC to introduce the energy saving glass technology and Ministry of construction of Vietnam requested AGC for entering into Vietnam market and hosting a seminar in Vietnam.

In aim to apply to these requests, this project implementation was expected to overcome the issues revealed in the last study, and develop strong cooperation relationships with related stakeholders in Vietnam and speed-up the popularization of energy saving glass in Vietnam.

The purpose of this project is to develop the discussion plan for installing energy saving glass in Vietnam, by installing demonstration equipment at the training center of ECC for trainers and participants to actually feel the comfortableness and effectiveness, inviting related authorities to visit Japan for training and conduct seminar in Vietnam. From this project outputs, our future objective is to enhance the AGC's share of energy saving glass in Vietnam newly construction buildings.

3.1.2. Project Target and Goals (contribution to the country, region and city's development strategy)

The future goal of this project is to develop discussion of the introduction of energy conservation glasses in newly constructing buildings by raising awareness and understanding of Vietnamese government officials, and to promote energy saving glass that follows the Vietnamese national energy saving glass standards.

① Raising awareness of energy saving glass contribution to energy efficiency

This project aims to improve the recognition and understanding of related stakeholders in Vietnam, of the energy saving glass contribution to reduce electricity consumption of the building. Specifically, by installing the energy saving glass demonstration equipment at the training center of Hanoi energy conservation center

where the training for qualified person for energy management and energy efficiency will be held. The demonstration equipment is expected to contribute to improve the recognition and understanding.

AGC will also invite the members of Hanoi and Ho Chi Minh City energy conservation center relatives for the training in Japan and also hold the seminar for private sector in Vietnam to raise awareness.

② Popularization of energy saving glass that meets the standard of Vietnam

In 2013, Ministry of construction of Vietnam set the national energy conservation standards for glass, QCVN 09:2013/BXD. Although, due to the difficulty of technology development, energy saving glass is still not popular in Vietnam glass industry. Through this project, it is expected to improve the understanding for this technology and to contribute to the growth of the energy saving glass industry in Vietnam.

3.1.3. Project Target and Goals (business aspect)

Although AGC holds the top share of the flat glass global market, for further market development, it is important to popularize a high-value glass such as energy saving glass in South-East Asia area where the economic growth is significant and market is growing.

AGC will install the energy saving glass demonstration equipment in Vietnam for introducing experience of the heat insulation effect and will hold the seminar in Vietnam and will invite the members of energy conservation center for Japan for understanding the necessity or effect of energy saving glass. The goal of this project (business aspect) is to start the cooperative consultation for the actual introduction of energy saving glass for the building in Vietnam.

● **Energy saving glass demonstration equipment**

The image of the demonstration equipment is as below figure. By the demonstration equipment, it is possible to confirm and feel the (1) Heat shielding effect and (2) Condensation prevention effect.



3.2 Project Implementation

3.2.1. Schedule

The implementation period of this project is from Oct. 2015 to Sept. 2017. Following is the schedule of this project.

Activity	year	2015		2016			2017		
	month	10-12	1-3	4-6	7-9	10-12	1-3	4-6	7-9
1. Field study									
<ul style="list-style-type: none"> ▪ Kick-off meeting ▪ Equipment change consultation, Coordinate acceptance activities in Japan ▪ Detailed investigation of equipment installation ▪ Equipment final check, Coordinate acceptance activities in Japan 		▲	▲	▲	▲				
2. Acceptance Activities in Japan									
Training (ECC-HN)			▲						
Training (ECC- HCMC)								▲	
3. Seminar in Vietnam									
Seminar (Ho Chi Minh City)							▲		
4. Equipment installation									
Assembly								↔	
Handover									↔
5. Report writing									
									↔

3.2.2. Implementation structure

Figure 3-1 shows the Implementation organization structure of this project

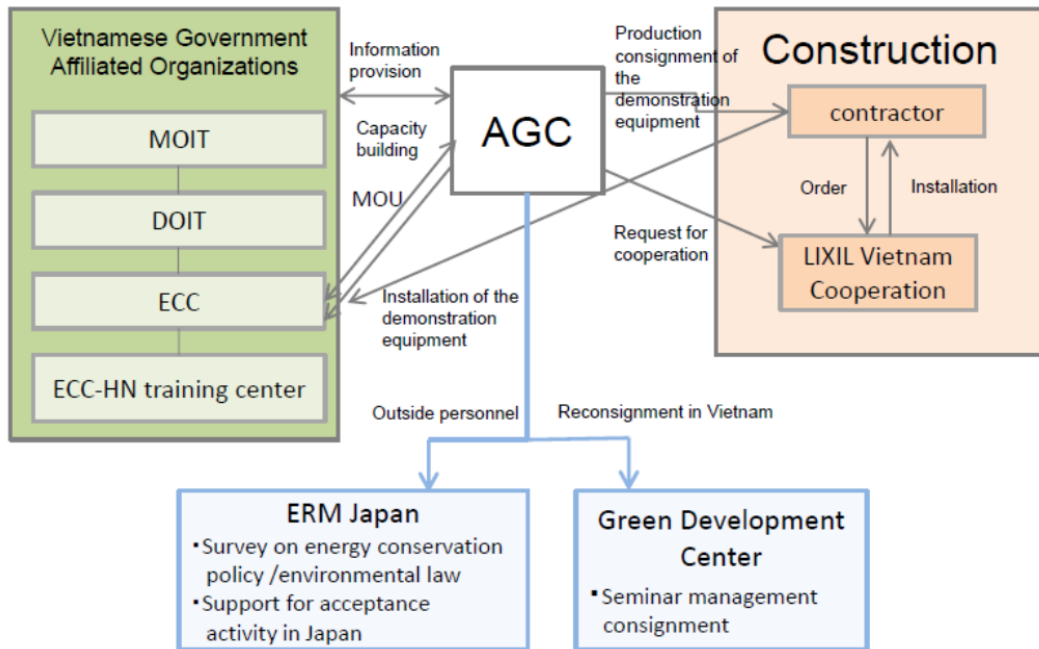


Figure 3-1 Implementation organization structure of this project

3.2.3. Project contents

The outline of Content of implementation goals and objectives of this project are summarized in Table 3-1.

Table 3-1 : Project contents (outline) and goals and objectives of this project

#	Task Items that should be done during this project for business	Activity							Content of implementation	Goals (At the end of this project)
		1st (Vietnam)	2nd (Vietnam)	3rd (Japan)	4th (Vietnam)	5th (Vietnam)	6th (Vietnam)	7th (Japan)		
1	Recognition and understanding for the energy saving glass technology for Vietnam government officials	■	■	■	■	■	■	■	<ul style="list-style-type: none"> Interview to Hanoi DOIT, ECC (Hanoi, HCMC) Improvement of understanding for this technology through the training in Japan 	<ul style="list-style-type: none"> Improvement of understanding for this technology through the training in Japan ECC (Hanoi, HCMC) staff can explain the energy saving glass
2	Recognition and understanding for the energy saving glass technology for Vietnam private sector					■	■	■	<ul style="list-style-type: none"> Seminar (Ho Chi Minh City) 	<ul style="list-style-type: none"> Understand the benefits of AGC technology by private company participating in the seminar
3	Clarification of various systems concerning local glass architecture			■	■	■			<ul style="list-style-type: none"> Confirmation of the revision of building standards concerning energy saving in Vietnam. QCVN: 2009-2013 - National technical regulation on energy efficiency buildings 	<ul style="list-style-type: none"> Understand the review trend of building standards concerning energy conservation
4	Installation of energy saving glass demonstration equipment for ECC-HN					■	■	■	<ul style="list-style-type: none"> Get quotation from trader Confirmation of the place of assembly and place of installation of the equipment Sharing of operation method of the equipment to ECC-HN 	<ul style="list-style-type: none"> Confirmation of installers and manufacturing contractors of the equipment Installation of the equipment for ECC-HN ECC-HN will be able to implement troubleshooting of the equipment without the support of AGC.
5	Consider possibility of energy saving glass production in Vietnam					■	■	■	<ul style="list-style-type: none"> Consideration of local production partner candidate Confirmation of production capacity of local manufacturers of energy saving glass and energy saving glass standard compliance. 	<ul style="list-style-type: none"> Confirmation of the status of local manufacturers of energy saving glass Examination of local partner candidates
6	Introduction and Sales plan					■	■	■	<ul style="list-style-type: none"> Interview to ECC-HN, ECC-HCMC and the Vietnamese glass association 	<ul style="list-style-type: none"> Confirmation of direction of introduction and sales plan in the future
7	Formulation of financial plan					■	■	■	<ul style="list-style-type: none"> Interview to ECC-HN, ECC-HCMC and the Vietnamese glass association Survey of local business environment (Price survey of competitors) 	<ul style="list-style-type: none"> Confirmation of direction of business development in the future Formulation of investment / financing plan
8	Energy saving effect (Recognition improvement)					■	■	■	<ul style="list-style-type: none"> Installation of the demonstration equipment Improve recognition of energy saving effect by the seminar in Vietnam 	<ul style="list-style-type: none"> Recognition of energy saving effect is improving.

Table 3-1 Equipment list

	Equipment name	number	purpose	Installation date	Installation place
1	Energy saving glass demonstration equipment	1	Experience of energy saving glass effect	2017.3.17	Training Center of ECC-HN

Chapter 4 Results of this project

4.1 1st field activities

(1) Content

The following contents were discussed during the 1st field activities carried out from Oct. 12 to Oct. 17 in 2015 with the related stakeholders.

- ① Progress confirmation of ECC-HN training center construction where the energy saving glass planned to be installed.
- ② Equipment procurement discussion (Sash supply and glass, assembly)
- ③ Request for the cooperation for seminar in Vietnam. Request for choosing candidates for the training in Japan.

(2) Results

- ① AGC visited the construction site of ECC-HN training center with ECC-HN members to check the progress verification and to confirm the construction plan about sash and glass for supervisor.
- ② Meeting with Vietnam domestic company (sash manufacturing, window and curtain wall (CW) construction) was held to confirm the drawing of energy saving glass. AGC requested ECC-HN for progress about the drawing. AGC visited the above Vietnam domestic company and confirmed the double glazing glass production was possible.
- ③ For the seminar at Hanoi /HCMC, schedule, place, lecturer of Vietnam side and so on details were discussed with ECC-HN/ HCMC. AGC visited some hotels to choose the seminar site and obtained estimate costs. Meeting with Vietnam Glass Association was held and requested for the support.

The training for ECC-HN in Japan schedule was discussed to be on April in 2016.

4.2 2nd field activities

(1) Content

The 2nd field activities was carried out from Feb. 28 to Mar. 3 in 2016 and the following contents were discussed with the related stakeholders.

- ① The schedule about the installation of energy saving glass demonstration equipment. (Based on the request from ECC-HN, the energy saving glass introduction for the windows of ECC Hanoi training

center was suspended. Instead of that, the installation of energy saving glass demonstration equipment was decided.)

- ② Training for ECC Hanoi in Japan
- ③ Seminar at HCMC

(2) Results

- ① The construction schedule of ECC-HN training center and installation schedule of energy saving glass demonstration equipment were confirmed.
- ② For the training in Japan, acceptance procedure, schedule and content were discussed with ECC-HN. ECC-HN agreed with the program of the training, the number of participants and budget.
- ③ The details of the seminar was discussed with ECC HCMC and JICA. AGC will propose the schedule and continue the discussion with related personnel.

4.3 1st activity in Japan

(1) Content

The training for ECC-HN was held from April 5th to 8th in 2016 in Japan. Table 4-1 is the outline and table 4-2 is the schedule of the training.

Table 4-1 Outline of 1st activity in Japan

No.	Item	Outline
1	Purpose	1.Improvement of understanding for energy saving glass <ul style="list-style-type: none"> • basic knowledge for manufacturing float glass • basic knowledge for energy saving glass and its manufacturing process • tour for buildings installed energy saving glass 2.Improvement of understanding for Japanese climate change policy 3. Opinion exchange about above 1 and 2
2	Participants	<ul style="list-style-type: none"> • Director, Energy Conservation Center(ECC), Hanoi • Vice Director, Energy Conservation Center(ECC), Hanoi • Deputy Head, Hanoi Department of industrial and Trade, Planning
3	Schedule	April 5 th ~ April 8 th in 2016

Table 4-2 Schedule of training for ECC Hanoi

No.	Category	Place, contents	Date	Time
1	lecture	AGC Headquarter Orientation/Introduction of AGC	April 5th	10:30-11:30
2	tour	AGC Headquarter Exhibition room/energy saving glass and related products	April 5th	15:00-17:30
3	lecture	AGC Kashima Plant Introduction of AGC Kashima Plant / basic knowledge for energy saving glass	April 6th	9:30-12:00
4	tour	AGC Kashima Plant • Float glass manufacturing process • Energy saving glass manufacturing process	April 6th	13:00-15:30
5	lecture	AGC Headquarter Introduction to coated glass	April 7th	9:30-11:00
6	tour	AGC studio Buildings installed energy saving glass (near Tokyo station)	April 7th	13:00-16:30
7	lecture	AGC Headquarter Japanese climate change policy	April 8th	9:30-11:00
8	summary	General overview of this training	April 8th	13:10-14:00

(2) Results

The participants from Vietnam have understood well about the following things through the training in Japan. It is expected that this training will contribute to the popularization of energy saving glass in Vietnam.

- Basic knowledge for AGC's energy saving glass
 - Basic knowledge for AGC's manufacturing float glass and its characteristics
 - Introduction examples of AGC's energy saving glass in Japan
 - Utilization and popularization situation of energy saving glass in Japan and in the world
 - Possible application of Japanese climate change policy and greenhouse gas emission reduction project
 - Possible introduction of Japanese energy saving glass for the buildings in Vietnam.
 - Possible expansion and popularization of energy saving glass in Vietnam based on Japanese funds and scheme
- Understanding and motivation of the participants
- Understanding : We asked each participant to fill out a questionnaire for lecture and tour (No.3 ~ 7) and asked them to evaluate their understanding for each content in 5 grades of 1 to 5 (5 is the highest). As a result, out of 15 answers, 9 answers were evaluated as "5" and 6 answers were evaluated as "4" (Attachment 1). Participants' overall understanding degree was 4 or more, average was 4.6, thus overall understanding was high. In order to expand energy saving products in Vietnam,

cooperation of the energy conservation center, which is a governmental organization that promotes energy conservation measures in the country, is indispensable. Through this acceptance activity in Japan, we were able to deepen the understanding of ECC-HN Director and Deputy Director for products and technologies.

- Motivation : Participants actively touched the equipment and asked questions, therefore, we were able to see aggressive attitude and high motivation of them. Moreover, from the questionnaire results, the willingness of the technology transfer of AGC products to the stakeholders of Vietnam was shown. Specifically, they gave an opinion to consider JCM. Motivation for the future development was also high and it was expected to spread in the country through participants.

➤ Future Possibility from this activity

Based on the results of the questionnaire, the opinion that AGC energy saving glass was not well-recognized in Vietnam and it was hoped for future popularization. Since this project is planning to install an energy saving glass demonstration instrument at the training center of the ECC-HN to which this participant belongs, it is expected that active enlightenment activities utilizing the instrument will be carried out. In the presentation on the final day, there was a manifestation of intention to actively transmit AGC's technology to ECC-HN and stakeholders. It was expected that technology dissemination will be implemented effectively to Vietnamese domestic construction staff by acceptance activity in Japan and installation of the equipment.

Also, we gained an understanding that cooperation between companies, industries and government realized dissemination in Japan. Even in Vietnam, it was expected that the spread by government-private cooperation would be effective.

As a future scheme, from the results of the questionnaire and the opinions of the participants, the high degree of interest in JCM was inquired.

It was expected that the promotion of energy saving technology transfer and diffusion by JCM will be promoted.



April 7th PM: Tour, Buildings with energy saving glass. JR tower (KITTE)



April 7th PM: 「AGC Studio」
Importance of energy saving glass and introduction of AGC energy saving glass and other products, Q & A

4.4 3rd field activities

(1) Content

The 3rd field activities was carried out from June 15 to June 16 in 2016. Progress verification of ECC-HN training center construction and the installation place at the center for energy saving demonstration equipment were confirmed.

(2) Results

AGC visited construction site of training center and discussed with the supervisor for the place for installing the demonstration equipment and decided the place.

4.5 4th field activities

(1) Content

In August 2016, AGC discussed with the stakeholders about the following contents.

(August 17, 2016 - August 20, 2016, August 29, 2016 – September 1, 2016)

- ① Confirm the procurement of the demonstration equipment core member and the assembling location that entrusted the manufacturing of the equipment.
- ② Confirmation of construction progress of ECC-HN training center and meeting with contractor.
- ③ Confirmation about sashes for the equipment and on-site seminar with LIXIL Vietnam and meetings with contractor for installation.

(2) Results

- ① We confirmed with installation contractor about supplier of core areas (infrared lamp, compressor etc.) of the equipment. We also confirmed the details of borrowing period on the assembly place of the equipment.
- ② We visited the ECC-HN training center with the contractor, met with the person in charge of ECC-HN and confirmed the building progress and the installation location of the demonstration equipment. The construction work of the ECC-HN training center was progressing as planned. We decided to schedule the equipment installation and operation confirmation in March, 2017. In addition, we also confirmed that procedures such as permission and approval for installing sensible devices are unnecessary.
- ③ We confirmed the work flow (LIXIL Vietnam carries out the work of incorporating the glass into the sash frame and delivers it to contractor) with both companies.



Figure 4-1 Finished image of the equipment

4.6 Seminar in Vietnam

(1) Business content

AGC held a seminar at Ho Chi Minh City on Dec. 22 in 2016. Table 4-3 is the outline of the seminar and Table 4-4 shows the program of the seminar.

Table 4-3 Outline of the seminar in Vietnam

No.	Item	Outline
1	Purpose	1. Improvement of understanding for energy saving glass 2. Improvement of understanding for building components (Sash, ECOCARATO) 3. Improvement of understanding for windows of green buildings 4. Improvement of understanding for glasses of green buildings
2	Lecturers	<Japan> <ul style="list-style-type: none"> • Agency, AGC representative in Vietnam, chief Representative • LIXIL Vietnam Corporation, Business Sales Manager • LIXIL Vietnam Corporation, Housing Design Manager <Vietnam> <ul style="list-style-type: none"> • TTT ARCHITECTS, Design Director • GreenViet Consultancy Co. LTD., Business development director
3	Schedule	Dec. 22th, 2016 9 : 00~12 : 00
4	Place	New World Hotel Saigon (76 Le Lai, Ben Nghe ward, Dist.1, Ho Chi Minh city)

Table 4-4 Program of the seminar in Vietnam

No.	Time	Category	Title of the lecture	Presenter
1	9:00-9:10	greeting	welcome speech	JICA Vietnam Office HCMC Branch Director ECC HCMC Director
2	9:10-9:50	Lecture 1	Importance of window in houses/buildings for energy saving, and the new developed glass unit product which is suitable southeast Asian climate	Agency
3	9:50-10:30	Lecture 2	Sash/frame which is suitable for energy saving glass unit product, energy saving sanitary equipment and other green products	LIXIL Vietnam Cooperation
4	10:30-10:50	rest	-	-
5	10:50-11:15	Lecture 3	The role of windows in green buildings	TTT Architects
6	11:15-11:40	Lecture 4	The role of glass in green buildings	GreenViet Consultancy Co. Ltd
7	11:40-12:00	Q&A	-	5 lecturers

(2) Results

The number of participants were 56. 51 of them was from private company (mainly construction company) and 5 of that was from press. We distributed a questionnaire to the participants considering the seminar. Followings are the summary of the result of the questionnaire.

- ① This seminar was useful for promoting a better understanding about energy saving glass in Vietnam
 - About 70% of participants answered that the content of lecture was adequate.
- ② Better understanding for building components (Sash, ECOCARATO) was achieved through this seminar.
 - More than 90% of participants answered that the content of lecture met their expectation.
- ③ This seminar was helpful for getting a better understanding about the role of windows in green buildings
 - More than 80% of participants answered that they wanted to listen more detailed lecture.
- ④ This seminar contributed for promoting a better understanding about the role of glass in green buildings
 - More than 80% of participants answered that the content of lecture met their expectation.

Q&A session was very active and it exceeded considerably the estimated time. In addition, the results of the questionnaire showed that the participant's interest was very strong.



Exhibition space (During the break time)



Exhibition space

4.7 2nd activity in Japan

(1) Content

The training for ECC HCMC was held from April 4th to 7th in 2017 in Japan. Table 4-5 is the outline and table 4-6 is the schedule of the training.

Table 4-5 Outline of 2nd activity in Japan

No.	Item	Outline
1	Purpose	1.Improvement of understanding for energy saving glass <ul style="list-style-type: none"> •basic knowledge for manufacturing float glass •basic knowledge for energy saving glass and its manufacturing process •tour for buildings installed energy saving glass 2.Improvement of understanding for Japanese climate change policy 3. Opinion exchange about above 1 and 2
2	Participants	<ul style="list-style-type: none"> • Deputy Technical, Energy Conservation Center (ECC), Ho Chi Minh City • Head of department, Energy Conservation Center (ECC), Ho Chi Minh City • Deputy Technical, Energy Conservation Center (ECC), Ho Chi Minh City
3	Schedule	April 4 th ~ April 7 th in 2017

Table 4-6 Schedule of training for ECC HCMC

No	Category	Place, contents	Date	Time
1	lecture	AGC Headquarter Orientation/Introduction of AGC	4/4/2017	10:30-11:30
2	tour	AGC Headquarter Exhibition room/energy saving glass and related products	4/4/2017	13:00-15:00
3	lecture	AGC Kashima Plant Introduction of AGC Kashima Plant / basic knowledge for energy saving glass	4/5/2017	9:30-12:00
4	tour	AGC Kashima Plant <ul style="list-style-type: none"> • Float glass manufacturing process • Energy saving glass manufacturing process 	4/5/2017	13:00-16:00
5	lecture	AGC Headquarter Introduction to coated glass	4/6/2017	9:30-11:30
6	tour	AGC studio Buildings installed energy saving glass (near Tokyo station)	4/6/2017	13:00-16:30
7	lecture	AGC Headquarter Japanese climate change policy	4/7/2017	9:30-11:00
8	summary	General overview of this training	4/7/2017	13:30-14:00

(2) Results

The participants from Vietnam have understood well about the following things through the training in Japan. It is expected that this training will contribute to the popularization of energy saving glass in Vietnam.

- Basic knowledge for AGC's energy saving glass
- Basic knowledge for AGC's manufacturing float glass and its characteristics

- Introduction examples of AGC's energy saving glass in Japan
- Utilization and popularization situation of energy saving glass in Japan and in the world
- Possible application of Japanese climate change policy and greenhouse gas emission reduction project
- Possible introduction of Japanese energy saving glass for the buildings in Vietnam.
- Possible expansion and popularization of energy saving glass s in Vietnam based on Japanese funds and scheme

Especially, the plant tour for seeing the state-of-the-art equipment is the best way for understanding the Japanese company's excellent technology and efficient productivity. It was quite useful for enhancing the company reputation.

➤ Motivation and intelligibility of the participants

- Comprehension: We have performed the questionnaire about No.1 ~ No.7 (Table 4-6). The comprehension is evaluated by 5 steps (1 ~ 5, 5 is the best). In 12 valid response, all responses were 5 (See attached material 1).
- Motivation of the participants : Q&A were active in the lectures and in the plant tours. The participants have aggressively experienced the energy saving glass demonstration equipment and other products at AGC Studio (Show room) and Q&A were also active. It seemed that their motivation was high.

They expressed willingness to introducing AGC products (not only energy saving glass but also other products) and showed interest in the JCM as a possible scheme.

➤ Possibility of application of this activity

The participants were the specialist for energy saving glass, solar cell and furnace, respectively. Thus, the corroboration for GIPV (glass integrated photovoltaic) and energy saving furnace is also expected. The opinion exchange about these products were also held during the training.

We have explained that the cooperation of the private companies, association and the government has played the important role for popularizing energy saving glass in Japan. It is expected that the similar cooperation is proposed in Vietnam.

The participants showed interest for JCM as a further possible collaboration. It is expected for the energy saving glass technology transfer and popularization by utilizing the JCM scheme.

Chapter 5 Project Results

5.1 Accomplishment of this project (contribution to the target country, region and city)

Through this project, we have obtained the following results. We consider that the purpose of this project has been achieved.

① Realization of energy saving measures and policies in Vietnam

In Hanoi, the equipment of this technology was installed at the training center of ECC-HN, which will be a training center for qualified person for energy management and energy consultants to manage and promote energy efficiency to designated business operators. In addition, through the acceptance training activities in Japan, we gained a deeper understanding to this technology by stakeholders of ECC - HN, which is the receiving side of the equipment, and showed a willingness to actively cooperate in the future utilization and dissemination of technology. From now on, it was confirmed that cooperation can be obtained in promoting the spread by actively utilizing the demonstration equipment.

Through the above activities, it was made possible to enlighten energy conservation measures in Vietnam through the use of the equipment. In Vietnam, in the "Management plan for GHG emissions and international carbon credit transactions" (2012), it is stated to reduce the GHG emission reduction target 8% in the energy field by 2020 compared with the 2005 level. In addition, the Intended Nationally Determined Contribution (INDC) announced in 2015 (nationally determined contribution (NDC) set in 2016), targeted the GHG emission reduction ratio of 8% by 2030 compared to BAU (emission intensity per unit of GDP will be reduced by 20% from 2010) or up to 25% reduction with international support (emission intensity per unit of GDP will be reduced by 30% from 2010)^{ix}. The project activities are in line with climate change and energy conservation goals, therefore, the enlightenment activities and promotion necessary for the implementation of the measures can be realized. It is expected to contribute to realization of energy conservation measures of Vietnamese government.

② Reduction of greenhouse gas emission

In Vietnam, cooperation of Ministry of Industry and Trade and ECC, which is a public institution promoting energy conservation measures, is indispensable for expanding the spread of energy saving products. Therefore, it was meaningful that we were able to deepen the understanding of the persons in charge of the Ministry of Commerce and Industry and the people involved in the ECC-HN to energy efficient products and technologies through acceptance activities in Japan.

Participants expressed their opinion that they would like to spread the energy-saving products in Vietnamese buildings, although currently the technology is not common in Vietnam. In the future, it was expected that active technical education using the demonstration equipment will be performed.

Ho Chi Minh City, the biggest commercial city in Vietnam, AGC hosted a seminar on energy saving glass and about 50 people including private companies related to architecture participated in the seminar. Through the seminar, raising awareness for private companies in Vietnam has been realized for energy saving glass. In addition, as the ECC-HCMC is a responsible organization for promoting energy efficiency, understanding improvement of this technology was also obtained through acceptance activity in Japan. Furthermore, a positive and active attitude toward future cooperation and development including JCM scheme was shown.

It is expected to lead to the expansion of business opportunities of AGC in Vietnam and the introduction of energy saving glass in buildings will lead to the development of energy saving effect and the reduction of greenhouse gas emissions

③ **Industry development - energy saving glass manufacturing**

In 2013, the Ministry of Construction issued "National Technical Regulation on Energy Efficiency Buildings" (QCVN 09: 2013 / BXD), but as of 2015 at the start of this survey, there were no manufacturers that meet the national standards for energy-saving glass (mainly, Low-E double glazing). As of June 2017, although one local company has been confirmed to manufacture energy saving glass, although its energy-saving performance is uncertain and it is necessary to confirm. For this reason, the energy saving glass industry in Vietnam is still in the development stage.

On the other hand, in this project, the introduction of the demonstration equipment was realized in cooperation with production contractor of the equipment and sash manufacturing company. Technical guidance such as installation of energy saving glass and operation after installation was given to production contractor of the equipment, before the installation of the equipment. In addition, AGC have provided operation manual to ECC-HN which is the receiving side of the equipment, the staff of the ECC-HN has become possible to explain the effect of energy saving glass and handle the trouble without the support of AGC. It is expected that this achievement will be utilized when introducing it to buildings in Vietnam. In addition, at the seminar on energy conservation glass held in Ho Chi Minh City, AGC has promoted recognition and understanding of energy saving glass to several private companies interested in this technology. As a result, it can be said that contribution to realizing energy saving glass industry in Vietnam which was almost not present at the start of this project was enabled through the project.

5.2 Accomplishment of this project (business aspect), remaining issues and resolution policy

Table 5.1 shows the accomplishments of this project on the business side, the remaining problems and its solution policy.

Table 5-1 Accomplishment of this project on business side, remaining problems and its solution policy

#	Task Items that should be done during this project for business	Activity and Results							Progress and Evaluation	Remaining issues	
		1st (Vietnam)	2nd (Vietnam)	3rd (Japan)	4th (Vietnam)	5th (Vietnam)	6th (Vietnam)	7th (Japan)			
1	Recognition and understanding for the energy saving glass technology for Vietnam government officials	■	■	■					F	Recognition and understanding of this technology has deepened through acceptance activities in Japan against Hanoi Department of Industrial and Trade, ECC-HN and ECC-HCMC.	-
2	Recognition and understanding for the energy saving glass technology for Vietnam private sector					■	■		F	Due to the seminar held in Ho Chi Minh City, recognition and understanding of this technology has deepened for participants in the private sector.	-
3	Clarification of various systems concerning local glass architecture			■	■	■	■	■	F	Building standards on energy conservation in Vietnam were obtained. Review status of building standards concerning energy conservation in Vietnam was confirmed and future revision plan was grasped.	-
4	Installation of energy saving glass demonstration equipment for ECC-HN				■	■	■	■	F	The supplier of the main component for installing the equipment was secured, and the sash construction company and the equipment manufacturer were selected. The equipment was installed at the ECC-HN training center and explanation about it was performed using the operation manual. They can handle the trouble without the support of AGC.	-
5	Consider possibility of energy saving glass production in Vietnam					■	■	■	F	One local company has been confirmed to manufacture energy saving glass but the energy-saving performance is uncertain. AGC to set up solar control coating facility in Indonesia for its architectural glass production (It is planned to start production in the 2Q of 2018). AGC to enhance architectural glass production in Indonesia (It is scheduled to commence in the 1Q of 2019).	-
6	Introduction and Sales plan					■	■	■	R	Total floor area 2500 m ² or more, renovation and new construction of middle-to-high-rise building (middle and high class), especially Ho Chi Minh City properties are the main target.	By the end of 2018, AAP and Vietnam agent of AAP will appeal the performance of AGC's energy saving glass through seminars etc. for the customers in Vietnam (architectural designers and developers).
7	Formulation of financial plan					■	■	■	F	According to above 5.	-
8	Energy saving effect (Recognition improvement)					■	■	■	F	The equipment was installed. From the results of the questionnaire at the seminar, it was confirmed that recognition was improved.	-

F: Finished, R: Remaining

5.2.1. Accomplishment of this project (business aspect)

There were three major achievements for realizing business development through this project activity.

- 1) Improvement of recognition and understanding on energy saving glass from the Vietnam government officials (mainly ECC)
- 2) Start to discuss concrete projects
- 3) Relationship establishment with stakeholders for future business development

Details of these results are shown below.

1) Improvement of recognition and understanding on energy saving glass from Vietnam government officials (ECC)

In Hanoi, energy saving glass demonstration equipment was installed at the training center for training of qualified person for energy management who manage and promote energy consumption efficiency and energy consultant. The training center is located in Hoa Lac Hi-tech Park (about 60 minutes by car from the center of Hanoi). After training, qualified person for energy management and energy consultant, will promote energy conservation dissemination and awareness activities throughout Vietnam. Also, AGC plans to cooperate by providing teaching materials for the training.

Through acceptance training activities in Japan, understanding by ECC-HN stakeholders for this technology was obtained. The attitude to cooperate the utilization and dissemination of technology is confirmed and it is expected to promote the spread utilizing the equipment. In addition, through the acceptance activities in Japan and seminar in Vietnam, the promotion of recognition and understanding for ECC-HCMC stakeholders was realized.

The Basis on which this technology can be developed utilizing the ECC network was formed.

2) Start to discuss concrete matters

Through ECC-HCMC stakeholders' acceptance activities in Japan and seminar in Vietnam, they showed positive attitudes towards future cooperation. Especially, ECC-HCMC showed interest in deploying using JCM scheme by combining energy saving glass with other technologies of AGC such as photovoltaic power generation, which led to consultation on concrete implementation projects to the building.

3) Relationship establishment with stakeholders for future business development

Through the installation of the equipment in Hanoi, relationship with local sash dealers was established. In addition, through seminar in Ho Chi Minh City, we were able to promote recognition and understanding of this technology for private companies involved in the construction industry, and the opportunity to introduce it into concrete buildings has been realized.

5.2.2 Remaining issues and future tasks

As a result of consultation with Vietnamese government officials through the project, the current challenges to the realization of business development are the following two.

- 1) Technical confirmation of competitors
- 2) Continuous effort on lobbying activity in Vietnam, sales/marketing promotion

The correspondence to these tasks is shown in the table below (Table 5-2).

Table 5-2 Remaining issues resolution policy of this project

No.	Remaining issues	Content	Future measures	Planned implementation date
1	Technical confirmation of competitors	Although factory operation of energy saving glass in Vietnam was confirmed, detailed confirmation of technical performance, price etc..has not been confirmed. It is also needed to keep an eye on the development of overseas manufacturers.	<ul style="list-style-type: none"> • Confirm technical performance and price of energy saving glass which production started in Vietnam. • Confirm entry trends of competitors (overseas manufacturers). 	Continue to do as appropriate
2	Continuous effort on lobbying activity in Vietnam, and sales/marketing promotion	<ul style="list-style-type: none"> - Installation of demonstration equipment was realized. - Installation to concrete building is necessary. 	Promotion of sales and marketing will be conducted through lobbying activities through ECC-HCMC, which showed active cooperation attitude.	Continue to do as appropriate

Chapter 6 Future business prospects

6.1 Business Target and Objectives

6.1.1. Business Targets (contribution to target country, region, and cities social and economic development)

① Implementation of energy saving policies, GHG emission reduction

➤ Implementation of energy saving policies

In Vietnam, in the national green growth strategy (2012), the energy sector has set a greenhouse gas emission reduction target of 10% - 20% by 2020 compared to BAU level. Also, the draft national commitment (INDC) announced in 2015 sets forth climate change measures of greenhouse gas emissions reduction of 8% by 2030 compared to BAU level (reduction of up to 25% with international support). Introduction and diffusion of energy saving glass can realize reduction of greenhouse gas emissions in buildings and dwellings, and contribute to the realization of Vietnam's climate change and energy conservation policy.

The "National Technical Regulation on Energy Efficiency Buildings" standard on energy efficient glass (hereinafter referred to as "Standard ") (QCVN 09: 2013 / BXD) was set by the Ministry of Construction of Vietnam in 2013, thus new construction and renovation of buildings (offices, hotels, hospitals, schools, commercial / service facilities, condominiums, etc.) with a total floor area of 2,500 square meters or more, the thermal insulation performance of the window glass was stipulated. Although the glass standard is possible to be considered and examined in urban areas, the requirements are too severe in rural areas and expansion of diffusion is an issue.

For this reason, the Ministry of Construction is considering the revise the standard, and ECC is responsible organization for the energy efficient glass promotion, and AGC was asked advice. AGC will advise ECC and VIETNAM GLASS ASSOCIATION for standard revision, which will be consistent with the situation of the country so that energy saving glass will be more installed and standardization progresses will be promoted in Vietnam. Therefore, through the business of AGC, it is expected to promote domestic penetration of national technical standard of the Vietnamese government.

➤ GHG emission reduction

Through the spread of energy saving glass, it is expected that the cooling and heating air conditioning efficiency will be improved (annual energy consumption will decrease) and the greenhouse gas emission will be reduced in buildings and dwellings. Furthermore, in Vietnam, it was found that not only energy saving by energy saving glass but also interest in energy creation by solar power generation was high for large commercial facilities with large energy consumption.

Because AGC has technology of GIPV (Glass Integrated Photovoltaic) system that combines energy saving glass (energy saving) and solar battery (energy creation) (Figure 6-1), the possibility of installation/development of this technology to Vietnam will also be examined in the future.

By introducing GIPV to the buildings in Vietnam, it is expected to realize energy saving and energy creation by renewable energy and contribute to further reduction of greenhouse gas emission.



Figure6-1 Glass Integrated Photovoltaic (GIPV)

② Improvement of comfortable building environment

AGC's energy saving glass realize not only energy saving effects but also realizes non-energy benefits (co-benefits) such as comfort (dew condensation prevention, ultraviolet ray cutting), sound insulation (neighboring buildings, noise of automobiles, motorcycles). By the heat shielding effect, the temperature near the window zone of the glass is suppressed and realize a comfortable environment where the sensible temperature of the window and the back of the building does not change almost. The construction market in Vietnam is expanding year by year, and it is expected that the demand for flat glass for building will continue to expand in the future. It is important to introduce glass with a service life equivalent to that of buildings at the time of new construction or renovation of buildings.

By introducing AGC technology to Vietnam where new construction projects are increasing, a comfortable building environment in the building of the country will be realized.

6.1.2. Business Targets (business aspect)

Through this project, relations with ECC-HN and ECC-HCMC were established and future information on training and seminar schedule related to this technology in Vietnam was informed. In the future, through ECC, AGC will participate actively in future training and seminars in Vietnam and conduct sales promotion activities. In addition, at the ECC - HN training center where demonstration equipment were introduced, training for qualified person for energy management and energy consultant will be carried out, and it is expected that the equipment will be utilized as well. Along with this, the awareness of AGC and AGC technology (energy saving glass) has improved, and it is expected that sales will increase in Vietnam where the construction market is expected to expand in the future.

AGC is a glass manufacturer with the world's top share in the field of window glass, but in order to expand the market share for high value added products, it is important to disseminate the high quality value added glass in Southeast Asia where growth is remarkable. Specifically, AGC expects to raise the market sales ratio in Southeast Asia, including Vietnam. The target ratio of related sales of new product sales was set to be 30% in 2020. Expansion of energy saving glass in Vietnam is expected to contribute to achieving this goal.

6.2 Future business development

6.2.1. Outline of the business

AGC considers the business model in Southeast Asia including Vietnam from three points (Figure 6-2).

For sales, in addition to the Vietnam Agency that existed before this project, aiming to expand business in Southeast Asia including Vietnam, AGC established regional headquarters in Singapore (AAP) (News release: May 9, 2013). AAP plans and promotes sales strategies of AGC group products. In Vietnam, AAP will continue to promote AGC products and work as a trading company and will promote sales in Vietnam and further strive for market development.

For production, looking at the movement of construction rush in Southeast Asia including Vietnam, AGC has decided to enhance energy saving glass production capacity in Thailand (Production expected to start from first quarter in 2016) (News release: April 7, 2015) (Attached document 2), which has already expanded, the establishment of a coating facility that enhances the heat shielding performance of construction glass in Indonesia was expanded (Production scheduled for production from third quarter in 2018) (News release: November 9, 2016) (Attached document 3) and increase in production of construction glass (Production scheduled for production from first quarter in 2019) (News release: May 12, 2017) (Attached document 4). For this reason, there is no new investment in Vietnam at present, but AAP will work as a

trading company and will sell AGC group products of Indonesia (PT Asahimas Flat Glass, Tbk), Thailand (AGC Flat Glass Thailand Public co., Ltd.) etc. in Vietnam.

For lobbying activities, AGC introduced the energy saving glass at the Hanoi Energy Conservation Exhibition (ENTECH) sponsored by the Hanoi Ministry of Industry and Trade in May 2015 and AGC's Low-E pair glass won the 2nd prize at the energy-saving product contest (The picture below is the opening ceremony).

AGC will continue to improve recognition by participating in seminar and exhibition (Table 6-1 Seminars and exhibitions scheduled).

Also, in March 2017, AGC installed the energy saving glass demonstration equipment at the ECC-HN training center. Since there are expected training scheduled at the training center, the enhancement of awareness of energy saving glass by utilizing sensible equipment at training will be effective.

Furthermore, it is also expected that a good relationship with Vietnamese government officials was established. As a result, it is expected that AGC will be involved in the formulation and revision of standards in Vietnam, and it will be expected that Vietnamese standards and systems will not be a barrier to energy saving glasses and AGC's glasses installation into buildings in the future. According to circumstances, standardization activities (for example, a combination of other building materials and equipment and energy saving glass) are also conducted and AGC aims to expand the energy saving glass sales. Since it is expected that the political aspect will be strong for the standardization, it is very important to build good relationship with Vietnamese government officials through improvement of awareness.

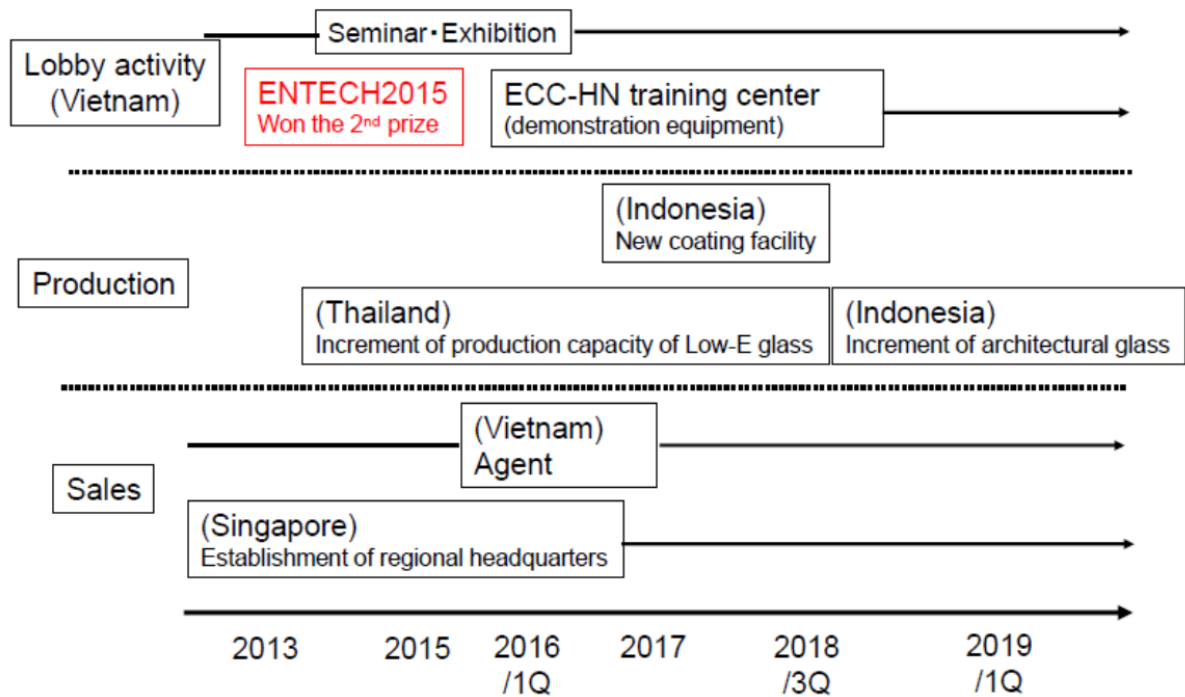


Figure 6-2 Business model in Southeast Asia including Vietnam



Opening ceremony of ENTECH sponsored by the Hanoi Ministry of Industry and Trade (AGC's Low-E pair glass won the 2nd prize at the energy-saving product contest)

Table 6-1 Schedule of seminar and exhibition

Name	Schedule	Place	Main sponsor
ENTECH VIETNAM 2017	2017/5/11-5/13	Ho Chi Ming City	Hanoi Industry and Trade Department
ENTECH VIETNAM 2018	2018/5(Details undetermined)	Ho Chi Ming City	Hanoi Industry and Trade Department

6.2.2. Business target

In the future, among the construction industry in Vietnam, new buildings that use air conditioning such as housing and commercial and official buildings will be targeted. The current market situation is shown below.

① Construction industry in Vietnam

Past trend

Along with economic development, the scale of the construction market in Vietnam is expanding year by year.

According to the 2015 statistical annual report of the Vietnam National Statistical Office (GSO), the gross domestic product (GDP) in 2015 increased by 6.68% compared to 2014, but the industrial and construction industry GDP in 2015 increased by 9.64% compared to 2014 and it increased by 3.2% compared to 6.42% in 2014.

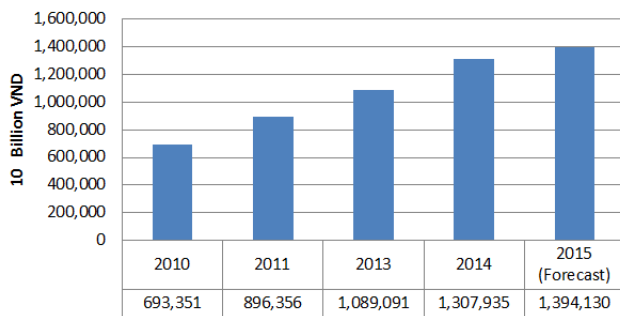


Figure 6-3 Industrial and construction industry GDP in Vietnam (Ref: Vietnam National Statistical Office (GSO),2015)

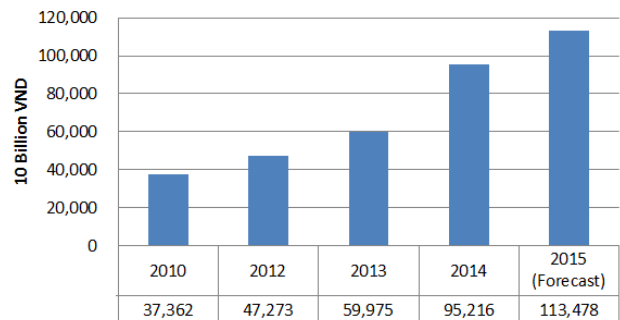


Figure 6-4 Investment amount of construction sector in Vietnam (* Price for 2015) (Ref: Vietnam National Statistical Office (GSO),2015)

Forecast

World Bank forecasts on the growth rate (%) of GDP, labor force and labor productivity of the construction industry sector in Vietnam are shown in the Table 6-3.

The GDP growth rate from 2013 to 2035 is estimated to be 6.8%. Continued growth is expected even in 2035.

Table 6-2 Growth rate (%) of GDP, labor force and labor productivity of the construction industry sector in Vietnam^x

	1990-2000	2000-2013	2013-2035 (forecast)
GDP growth rate (%)	8.9	8.1	6.8
Labor force growth rate (%)	3.4	10.4	3.0
Labor productivity growth rate (%)	6.3	Δ2.1	3.7

(Ref: World Bank (2016), “Vietnam 2035: Toward Prosperity, Creativity, Equity, and Democracy”)

② New residential housing market in Vietnam

Past trend

According to the General Statistics of the State of Vietnam (GSO) 2015 statistical annual report, the number of newly built houses tends to increase particularly in single-family homes. In Vietnam, the real estate business law and housing law were revised and constructed in 2014, the direction of deregulation was indicated and the housing industry led to the revitalization of the real estate market. By region, it can be seen that many new houses are built in the Red River delta region including Hanoi, the granaries in the Mekong Delta region and the coastal regions in the northern and southern central regions which are agricultural production area (Figure 6-6).

The total floor space of newly built houses in 2014 were 89.8 million square meters, which shows a 3.7% increase from the previous year. In 2014, 18,300 houses / group dwellings construction was completed and housing floor space increased by 954,500 m² in 2020 (GSO, 2015).

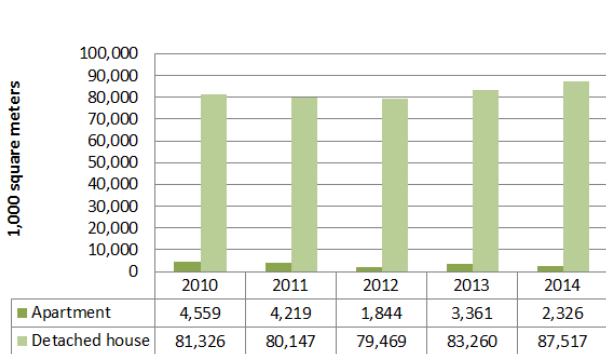


Figure 6-5 Shifts in the floor area by type of new housing
(Source: GSO, 2016)

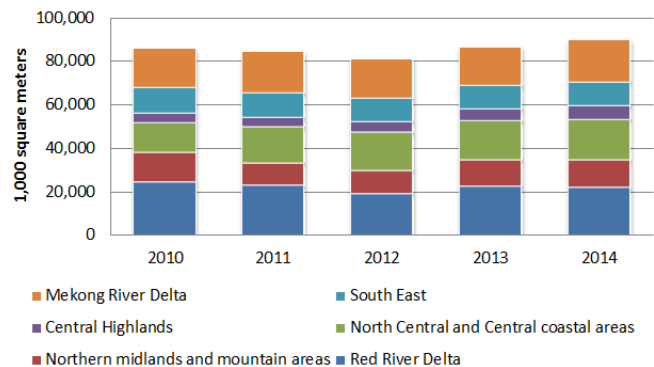


Figure 6-6 Shifts in the floor area of newly built houses by region
(Source: GSO, 2016)

Forecast

According to the Ministry of Construction 'National Program on Urban Development 2012 - 2020', the average residential area was 23.1 m²/person (2013), but it is predicted that it will reach 29 m²/person (Table 6-3).

Table 6-3 Urbanization rate and shifts in settlement in Vietnam

(Ref: Ministry of Construction in Vietnam)

	2013	2015	2020
Urbanization rate (%)	33.5	38	45
Average residential floor area (m ² /person)	23.1	26	29
Permanent housing rate (%)	60	65	75

6.2.3. Business Implementation

The following figure (Figure 6-7) shows the implementation structure of business to promote and expand energy saving glass in Vietnam. In addition to AAP's information on energy conservation seminar and exhibition in Vietnam, AGC will obtain information on seminar and exhibition to be held in Vietnam through the ECC-HN and ECC-HCMC where the relationship was established through this project. AGC plans to carry out lobbying activities to further improve recognition and understanding through participation in these seminar and exhibition.

Concrete projects will be advanced through lobbying. As for sales, AAP that is a regional headquarters, is responsible for the trading company function and also plans to develop sales and market development in Vietnam through AAP's agency in Vietnam.

For production, one of the AGC group's company in Indonesia (PT Asahimas Flat Glass, Tbk) and Thailand (AGC Flat Glass Thailand Public co., Ltd.) will manufacture the energy saving glass.

AGC plans to develop future business in Vietnam by playing each function (sales, production and lobby activities) mainly in the Southeast Asia base of AGC Group (Singapore, Thailand, and Indonesia).

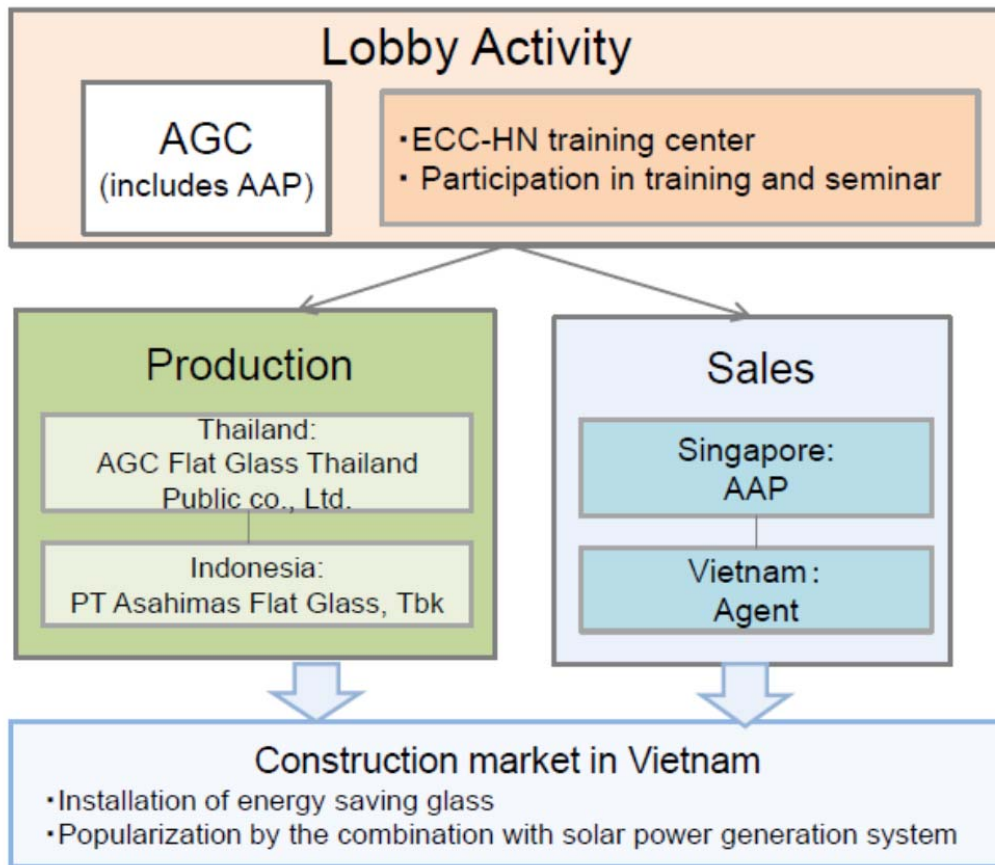


Figure 6-7 Implementation structure of business to promote and expand energy saving glass in Vietnam

6.2.4. Schedule of developing a business

The business development schedule is shown in Figure 6-2.

6.2.5. Investment and capital plans

1) Schedule of developing a business in Vietnam

Based on the demand of the flat glass market in Vietnam and the demand forecast of the sheet glass for building, the development plan of the energy saving glass business in Vietnam is summarized below.

(i) Demands of flat glass (market trend)

Market share of flat glass in Vietnam occupies 1% share of the Asia-Pacific market (2013). The future demand forecast for flat glass in Vietnam is shown below (Table 6-4).

Table 6-4 Demands forecast of flat glass in Vietnam (Unit: one million m²)

year	2013	2018	2023
flat glass	55	76	94

(Ref.: METI (2015) (Survey report on market structure of flat glass industry (Survey report based on Article 50 of the Industrial Competitiveness Enhancement Act)))

(ii) Demands of flat glass for construction

Demand forecast for flat glass in Vietnamese building market is shown below (Table 6-5).

Table 6-5 Demands forecast of flat glass for construction in Vietnam (Unit: one million m²)

year	2013	2018	2023
flat glass for construction	44	60.8	75.2

* Calculation method: From the proportion of the use of the flat glass in the world (buildings: 83%, automotive: 7%, special application areas: 10% (Ref.: NSG^{xi})), the use for buildings was set at about 80% and 80% of the demand forecast in Table 6-5 was calculated

Based on the demand forecast of the above market, we predicted the penetration rate and quantity of energy saving glass (Low-E double glazing glass) in Vietnam from the demand forecast from 2017 to 2021 and the ratio of penetration rate in Japan.

(iii) Penetration plan of Low-E double grazing glass in Vietnam

Table 6-6 Penetration prediction of Low-E double glazing glass in Vietnam

year	2017	2018	2019	2020	2021
Flat glass for construction* (Unit: one million m ²)	57	60.8	63.4	66.2	69.1
Penetration of Low-E double glazing glass** (%)	≒0	1.4	4.5	9.3	8.9
Low-E double glazing glass (Unit: one million m ²)	≒0	0.85	2.85	6.16	6.15

*2019~2021 - Calculated from annual average growth rate (CAGR) of market demand forecast (Ref.: METI, 2015).

2017 - Estimated from market demand forecast (Table 6-5) in 2013 and 2018. (Ref.: METI, 2015).

**The penetration rate for newly built apartment in Japan is used. Also in Japan, since penetration was around 2006 (since the production itself was around 1993), 1.4% at that time was set to 2018 in Vietnam. (Ref.: flat glass association “double glazing glass penetration rate transition (residential use)”).

Because of the domestic circumstances of Vietnam, it is expected to spread initially only to newly-built high-rise buildings etc. (> 2500 m²), so it contains the possibility of slight differences in penetration rate change from Japan.

Among competing glass manufacturers to be described later, four companies (VIFG, Guardian, Saint Gobain, VFG) are currently considered competitive in Vietnam for Low-E glass. AGC was able to enter the Vietnamese market by improving awareness through this project and considered that there are five players in the Vietnamese market.

As a result, energy saving glass share in Vietnam was targeted at 20%.

(iv) Capital investment amount by AGC

AGC decided to establish a glazing facility in Indonesia that enhances the insulation performance of energy saving glass in order to respond to the growing demand prediction of Low-E double glazing glass and the energy saving needs of the buildings increasing in the whole Southeast Asia region. AGC will expand the

production of Low-E double glazing for Southeast Asia region including Vietnam and make a major contribution to energy consumption reduction in the region. The outline of the capital investment content is summarized in the table below (Table 6-7).

Table 6-7 Penetration prediction of Low-E double glazing glass in Vietnam

Capital investment	Production capacity of coating plant	Production plan
40 Billion JPY	Approx. 6 million m ² per year	Expected to start from second quarter of FY 2018

2) Sales strategy for energy saving glass

Energy saving glass sales strategy by AGC in Vietnam will not promoting cheap price competition of initial cost but promoting sales by appealing non-energy benefit (co-benefit) effect.

(i) Investment recovery period

When comparing Low-E double glazing (heat shield type) with single glass, air conditioning cost can be reduced by about 40% (Ref.: AGC). Reduction of air conditioning costs in buildings realizes investment recovery throughout the life cycle cost. Specifically, if we calculate the investment recovery period when introduced in the ECC-HN training center, it will be 11.5 years, just in consideration of electricity benefit by energy saving^{xii}.

(ii) Price comparison of energy saving glass and single glass

Depending on the owner of the building, not only the cost of the glass, but also the cost of the sash and the construction expenses etc. are required for introducing the energy saving glass into the building. Specific cost differences are shown below.

- Glass cost: Energy saving glass cost is about 4 times higher from single glass
- Material cost: If the aluminum sash is 1, the aluminum / resin composite sash is 1.5 and the resin sash is 2

Energy conservation sashes are expected to spread along with popularization of energy saving glass. In Japan, the penetration rate of energy saving sashes in northern and eastern Japan are over 90% and in western Japan as well, it is 80 to 90%. It shows that the spread has advanced considerably. In this situation, among the energy saving sashes, the spread of resin one is mainly in cold areas^{xiii}. From this, it is assumed that energy savings sashes other than resin one are mainly used in Vietnam.

As a result, there is a high possibility that the sash cost increase when changing single glass into energy saving glass is 50% at maximum.

- Construction cost: Energy saving glass and single glass are the same (time and effort are the same as they are introduced to new construction).

(iii) Sales Target

Vietnam newly constructing and renovating middle-high-rise buildings with total floor area of over 2,500 square meters are set as sales target. AGC will enhance its promotion and lobbying activity by appealing the non-energy co-benefits, such as comfortableness and heat reduction effects.

(iv) Penetration plan

As stated above, sales promotion will be focused from AAP and Vietnam Agency. AGC aims for penetration by presenting cost estimate including energy conservation effect and investment collection period, preventing price competition and appealing non-energy benefits (co-benefits) effect. Energy saving glass will be manufactured at Thailand's base that has increased production capacity and at Indonesia's base where the thermal barrier coating equipment has introduced and the production is scheduled to be increased. AGC will sell and penetrate energy saving glass in Vietnam centering on AGC Group's Southeast Asia base.

● Non- energy co-benefits

AGC's high quality energy saving glass will promote its lobbying activity by stating the non-energy co-benefits of its energy saving glass, such as high quality (transparent and beautiful appearance), Comfortableness (Reduce the sunlight around the windows, prevent condensation, ultraviolet cutting), and Sound insulation (nearby buildings, cars and bikes) etc.,

(v) Concrete installation discussion

From this study, concrete discussion on installing energy saving glass to actual building was realized with the active motivation from the ECC side. Specifically, AGC's technology combining solar PV and energy saving glass was recognized as high potential technology for future installation considering the high interest from the ECC and other relevant stakeholders. AGC will continuously promote lobbying activities for actual installation in Vietnam, and futurely contribute to Vietnam's climate change actions and comfortable building environment.

6.2.6. Competitor

Vietnam domestic glass manufacturers

When selling energy saving glass in Vietnam, competitor is the Vietnam domestic glass manufacturers. Vietnam domestic glass makers include VIFG, VFG, Chu Lai Float Glass Company, etc. Among them, VIFG, which announced its start on manufacturing energy saving glass in the second half of 2016, and is the only manufacturer in Vietnam. Manufacturers in Vietnam are expected to be more cost effective than AGC for initial price due to local production. As a result, there is a possibility of low price competition. With regard to quality, there is a possibility that energy saving performance is inferior to AGC's energy saving glass and durability is low. On the other hand, although the initial cost is cheaper than the energy saving glass of AGC, life time cost consideration will be effective considering the energy efficiency effective quality. Therefore, AGC will keep confirming the local market on future trends.

● Vietnam domestic glass manufacturers

No.	Company's name
1	Công Ty TNHH Kiến Việt
2	Cong ty Co phan San xuất Thương mại Dịch vụ Phú Phong
3	Cong ty TNHH Thương mại Sản xuất Dịch vụ Hồng quý
4	Cong ty TNHH Sản xuất Dịch vụ thương mại An Đại Hưng
5	Cong ty TNHH Kinh Việt Hưng
6	Cong ty TNHH Kỳ Anh
7	Cong th TNHH thông mại Dịch vụ Ngọc Anh 1

Overseas glass manufacturers

Overseas glass manufacturers are listed in the table below.

Some of them are also listed in the table below, Guardian, Saint Gobain, VFG etc. are the main competitors.

● Overseas glass manufacturers

No.	country	Company's name
1	Malaysia	Malaysian Sheet Glass Berhard
2	Philippine	AGC Flat Glass Philippines Inc.
3	Thailand	AGC Flat Glass (Thailand) Public Co., Ltd.
4	Thailand	Guardian Industries Corp Ltd.
5	Indonesia	PT. Asahimas Flat Glass Co., Ltd.
6	China	China Luoyang Float Glass Group Co., Ltd.
7	Indonesia	PT Muliaglass

Measures to contribute with competitors

In this project, energy saving glass was not installed in the actual building but the demonstration equipment was installed at the ECC-HN training center (The figure 6-8 shows the equipment).

Therefore, the effect of heat shielding and convention prevention will be possible to feel and try at the demonstration equipment.

The heat shielding effect could be possible to feel when people puts their hands near the equipment. If you raise your hand about 10cm near to the equipment, you can feel the (1) reference equipment (flat single glass type) to be very hot, but in case of (2) Low-E double grazed glass equipment, you will hardly feel the heat.

The convention prevention effect could be confirmed in the Figure 6-9. The convention could be recognized at the left hand side equipment of the photo (especially upper part of the equipment) (1) reference equipment (flat single glass type), but at the same time (2) Low-E double grazing glass equipment has hardly no convention.

In this way, AGC will appeal not only energy saving performance of energy saving glass but also appeal non-energy benefits (co-benefits) such as comfort (dew condensation prevention, ultraviolet ray cutting) and sound insulation (neighboring buildings, automobile / motorbikes noise) etc.,



Figure 6-8 Demonstration Equipment (Installed at ECC-HN training center)

(a) Heat prevention effect, (b) Convection prevention effect (Both (1) reference (flat single glass), (2) Low-E double glazed glass)



Figure 6-9 Energy saving glass demonstration equipment
((1) ref. (one sheet glass), (2) Low-E double glazing glass)

6.2.7. Remaining issues for future business expansion

The challenge for future business development in the future is low price competition with the domestic competitors in Vietnam. AGC will expand its promotion by appealing its quality. Therefore, instead of price competition, AGC is also planning to appeal to customers for non-energy benefits (co-benefits) such as high quality, comfort (dew condensation prevention, ultraviolet ray cutting) and sound insulation (neighboring buildings, noise of cars and motorbikes) etc.,.

6.2.8. Future risks and tasks for business expansion

Below are the considerable risks assumed for further business development.

- Risk for low-price competition

Manufacturers in Vietnam's glasses are expected to be cheaper than AGC in terms of price, taking advantage of local production. In aim to overcome and prevent from low price competition, AGC will appeal its high quality of the products in energy saving performance and may have low durability.

Additionally, AGC will present total lifetime cost including energy saving effect, and also appeal the non-energy benefit (co-benefit) effect such as comfort and heat shielding.

- Risk for currency exchange and interest rate

The tariff price based on the ASEAN Free Trade Agreement between the two countries is applied for deliveries from AGC Indonesia manufacturing base to Vietnam. However, if the situation of free trade agreements between Vietnam and neighboring countries fluctuates, there is a possibility that the tariff rate will be affected. Also, overseas business development may be affected by fluctuations in foreign exchange rates. AGC is taking measures to minimize the impact of these currency risks through hedging etc.

- Risk for natural disasters and accidents

In the event of natural disasters such as earthquakes, typhoons, etc., and/or accidents such as fires, the manufacturing and supply chain system of energy saving glass can be affected by the damage to the factories or shortage of electricity, gas and water etc. In addition, there is a possibility that repair expenses may occur when equipment damage or other operation changes occurs. In the AGC Group, the AGC Group Crisis Management Guidelines are established to minimize the impact of such risk with serious effect on business activities. In particular, AGC developed business continuity plans (BCP) in 2008 to deal with large-scale accidents and disasters risk. AGC is also working continuously to improve the level of response by updating the BCP.

6.3 Possible collaboration with ODA

6.3.1. Necessity of collaboration

In Vietnam, promotion of energy conservation measures to reduce GHG emission is crucial to tackle the current increase in GHG emissions related to the remarkable increase of electricity demand.

In response to this issue, JICA started its support to Vietnam in 2008 with the development of energy conservation promotion roadmap as Japan's ODA project. From this point of support, comprehensive energy conservation support for policy improvement, national plan formulation, capacity development and infrastructure improvements were continuously developed as a support to Vietnam (Table 6-8). By Japan's ODA continuous support, energy conservation law and energy saving labeling system development, related policy and plan development have been progressed in Vietnam. However, diffusion of specific private energy efficient technology to realize actual energy conservation is still in development. Energy saving technology is a field that Japanese companies have advanced technology and experience, thus Vietnamese government officials have raised request to AGC for investment in energy saving glass. Vietnam is an important area for

developing glass business for AGC and the spread of energy saving glass is beneficial for both Vietnam and AGC.

Therefore, further promotion of AGC's energy saving glass support linked with Vietnamese policy by the Cooperation with the ODA project will be effective.

In addition, in JICA 'Nationally Appropriate Mitigation Behavior (NAMA) Planning and Development Support Project', a technical evaluation study is conducted to identify priority energy efficient technologies to promote INDC mitigation measures. Among the project, identification of energy saving technology is required and energy saving glass can be one technology candidate for promotion within the project.

Table 6-8 ODA project on energy conservation in Japan in recent years in Vietnam

No.	Project name	Period	Scheme	Contents
1	Master plan for energy conservation and effective use	2008~2009	Technical Cooperation for Development Planning (and Development Study)	Establishment of a road map to promote energy conservation
2	Establishment of Energy Management Training Center (Stage 1, 2)	2011~2015	T/A Pro. related to ODA Loan	Support for introducing human resource development / qualification system with practical training of energy conservation law
3	Energy Efficiency and Renewable Energy Promoting Project	2009~2014	Yen loan (46.8 billion yen)	-Mid- to long-term financial intermediary loans (Two-Step Loans) for energy conservation (capital investment / activity) through Vietnam Development Bank - Energy conservation consultation promotion
4	Project on Strengthening the System and Operation on Standards and Conformance for Energy Efficiency and Labeling	2013/11~2016/11	Technical cooperation project	Support for construction of energy saving labeling system. Support for introducing energy saving products (air conditioners / refrigerators)
5	Support Program to Respond to Climate Change	2009~present	ODA Loans (100 billion yen/year)	Promotion of energy conservation law, improvement of organization structure, improvement of Financial Mechanism (Formulation of notifications pertaining on implementing the roadmaps for promoting energy conservation)
6	Project to Support the Planning and Implementation of NAMAs (SPI-NAMA)	2015/2~2018/1	Technical cooperation project	Capacity enhancement of the Vietnamese government for planning and implementation of NAMA, promote implementation of mitigation measures of INDC (Technical evaluation to identify priority technologies for promoting each measure)

6.3.2. Potential collaboration scheme

As mentioned above, in Vietnam, the development of energy conservation society is required in aim to implement the energy conservation law requirements, thus the introduction and promotion of energy efficient technology to Vietnam is expected. Potential collaboration scheme could be ODA loan assistance to support the national climate change strategy, and formulate infrastructure project for energy saving equipment and

technology. Another potential scheme could be technical cooperation projects that contribute to energy efficient policy improvement, national plan formulation, and capacity development, which could promote recognition and understanding of energy saving glass technology by leading Japanese companies and spread energy saving glass technology as one of them. Additionally, Country-focused Training in Japan or dispatch of experts on energy saving glass technology can be considered. Furthermore, promotion to the Southeast Asia can be considered by implementing regional training in Japan and third country training in Vietnam to spread the technology in the whole area.

6.3.3. Potential collaboration projects

Specific collaboration candidate projects could be "Support Program to Respond to Climate Change (SPRCC)" and "Project to Support the Planning and Implementation of NAMAs" currently in implementation phase. Introduction of energy saving glass is expected to be effectively disseminated and promoted through the collaboration.

(1) Support Programme to Respond to Climate Change (SPRCC)

The SPRCC loans will support policy and institutional improvements with financial assistance and policy dialogue to both strengthen international competitiveness and address climate change. Loan was developed with collaboration and participation of several donors (World Bank, French Development Agency, etc.). 10 billion yen is committed from JICA every year, and has already provided ODA loans totaling 70 billion yen from 2010 to 2015. Furthermore, in January 2017, an ODA loan agreement with a total amount of 21 billion yen (2 projects) was signed. The program supports the Vietnamese government's climate change measures through financial support and policy dialogue etc. and evaluates the achievement status of policy actions by the Vietnamese government, confirms the good achievement status and financially support through ODA loan. As for energy conservation, "Formulating a roadmap for promotion of energy saving implementation measures in industrial sector" is one of the policy action committed. Specifically " Formulation of regulations on energy conservation for the industry sector ", "Establishment of qualifications for qualified person for energy management and energy consultant ", " Introduction of voluntary internal agreement for energy management in energy-intensive companies ", " Development of energy conservation database for energy-intensive companies ", and " Enhance the capacity of the Energy Conservation authorities under the jurisdiction of the General Energy Department " were implemented. It is expected to strengthen the ability of energy conservation authorities to understand energy saving glass technology and promotion of energy conservation measures utilizing private sector technologies. Additionally, as the counterpart of the program is Ministry of Industry and Trade, possible collaboration with SPRCC is expected to be effective for promotion of energy saving glass.

(2) Project to Support the Planning and Implementation of NAMAs (SPI-NAMA)

This project is conducting a technical evaluation study to identify priority technologies for promoting INDC mitigation measures. The research team will propose candidate technologies through consultation with related ministries and agencies in Vietnam, business entities, and other donors. The survey team has already proposed to add "Energy Efficiency of Building" as one measure of energy saving technologies. Therefore, energy saving glass is also expected to be one of the technologies, and it is expected to expand and spread by becoming a popular technology in the future.

(3) New technology cooperation project development

The AGC group has the leading global market share in the flat glass industry. AGC has the world's top share on glass products for windows, decorative glass, special function glass and other flat glass products, and provide glasses with various functions such as heat insulation, energy saving, security prevention, disaster prevention, and sound insulation, etc. around the world. In the Southeast Asian region including Vietnam, construction and renovation of buildings are growing in various countries along with the economic growth. As the sheet glass has the same useful life time with the buildings, installation of energy saving glass is important to be conducted at such renovation and new construction period. However, energy saving glass that also has co-benefits of comfortableness and safety is generally still not recognized widely in the Southeast Asia region, and also the possible manufacturers with relevant technology are limited. Utilizing AGC's world - class energy saving glass technology and the rich experience of introducing it to buildings, technical cooperation projects could be considered as one collaboration scheme, by providing training from AGC to Southeast Asia countries and support establishing and revising the country's energy conservation glass standards. As AGC provided technical support to ECC in reviewing the energy saving glass standards through acceptance activities in Japan for ECC-NH and ECC-HCMC members, this technical support / policy recommendation project could be developed through ODA collaboration. Therefore, with the aim of supporting countries' energy conservation policy realization, it is conceivable to provide technical support / policy recommendations to local governments and private construction companies of each country, by training in Japan and/or third countries.

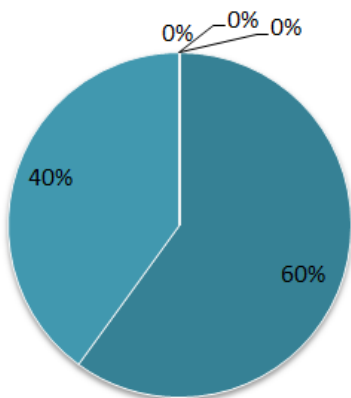
Attachment

1. Questionnaires results of the acceptance activity in Japan
2. AGC News release (AGC to Increase Production Capacity of Solar control Low-E Glass in Thailand)
3. AGC News release (AGC to Set Up Solar Control Coating Facility in Indonesia for its Architectural Glass Production)
4. AGC News release (AGC to Enhance Architectural Glass Production in Indonesia)

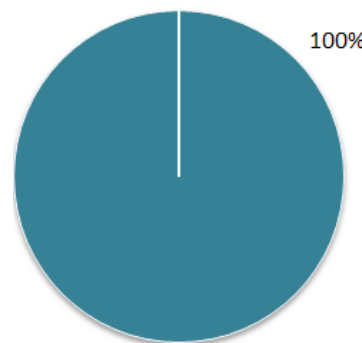
Attachment 1. Questionnaires results of the acceptance activity in Japan

The acceptance activity in Japan was held two times for ECC-HN and ECC-HCMC. We asked the participants to take a questionnaire for 5 lectures and 5 tours and the degree of comprehension was evaluated by 5 grades of 1 to 5 (5 was the highest). The results are shown below.

1. Results of questionnaires for all acceptance activities in Japan (Understanding)

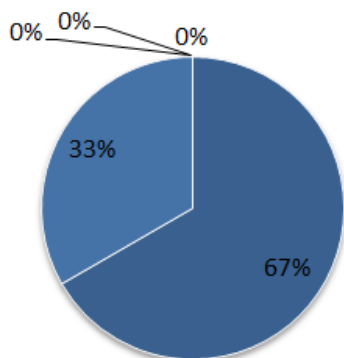


1st acceptance activity in Japan (2016/4/6~4/8)
Participants: DOIT (one person), ECC-HN (two persons)

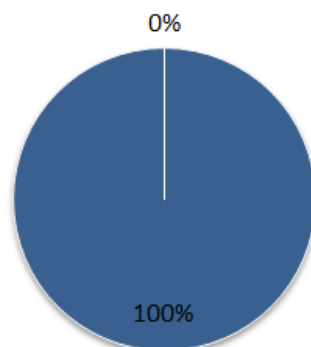


2nd acceptance activity in Japan (2017/4/5~4/7)
Participants: ECC-HCMC (three persons)

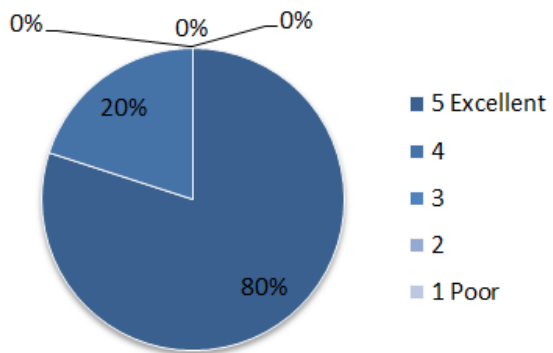
2. Questionnaire result for each activity (Understanding) (Total of 1st and 2nd acceptance activities in Japan)



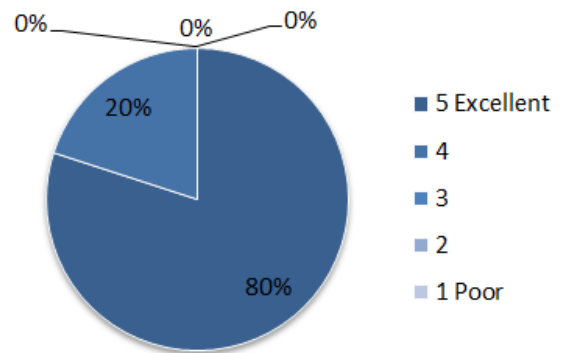
Lecture: AGC Kashima Plant “Basic knowledge for energy saving glass”



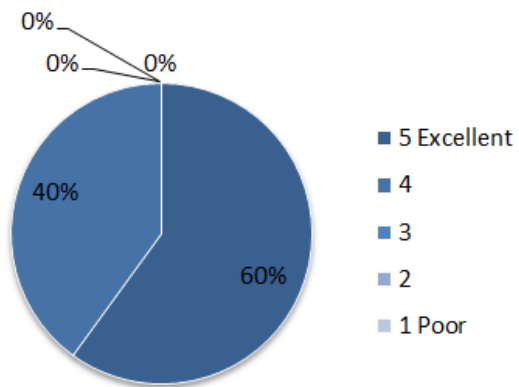
Tour: AGC Kashima “Plant Float glass manufacturing process/Energy saving glass manufacturing process”



Lecture: Introduction to coated glass



Tour: AGC studio/ Tokyo station “building with energy saving glass”



Lecture: Japanese climate change policy



FOR IMMEDIATE RELEASE

AGC to Increase Production Capacity of Solar Control Low-E Glass in Thailand

—Aiming to respond to the expanding need for energy efficient commercial buildings in Southeast Asia—

Tokyo, April 7, 2015—AGC (Asahi Glass Co., Ltd.; Head Office: Tokyo; President & CEO: Takuya Shimamura) announces that it will increase its production capacity of solar control Low-E glass in Thailand by 50%. The investment will not only enhance the production efficiency of the facility, but also allow the production of higher-performance glass products. The production will begin at the Samut Prakan Plant of AGC Flat Glass Thailand Public Co., Ltd. (AFT) in the first quarter of 2016.

As the construction boom continues in Southeast Asia, improvement of energy efficiency has become one of key issues for large buildings against the backdrop of increasing fuel imports and power shortages in recent years while air conditioning is used to cool buildings throughout the year. As a solution, there is a rapidly growing demand for solar control Low-E glass which increases cooling efficiency and contributes to reducing energy use.

Under these circumstances, AGC has decided to increase the production capacity of solar control Low-E glass at AFT by 50% to ensure a sufficient supply of the products to meet the demand in the Southeast Asian region. Furthermore, the investment will enable AFT to manufacture double-silver-coated Low-E glass in addition to single-silver-coated Low-E glass. The double silver coating improves solar control performance while maintaining the level of visible light transmission, thereby enabling "bright windows with good heat shielding performance."

With the production capacity enhancement, AFT will become the first manufacturer in Southeast Asia that has an integrated manufacturing process, handling from manufacturing of float glass up to the double silver coating process. AFT will respond to the future demand increase and the need for Low-E glass with improved solar control performance, and contribute to the energy efficiency of buildings in the Southeast Asian region.

This investment will:

- increase the production capacity of Low-E glass at AFT by 50% to respond to the product demand in the Southeast Asian region;
- improve the production efficiency of the facility;
- enable production of glass products with superior solar control performance; and
- enable an integrated manufacturing. This will be the first plant in Southeast Asia that can manufacture float glass and complete double silver coating process within the same premises.

AGC will continue to capture the expanding demand in the emerging countries and aim for increase in sales under the management policy *AGC plus*.

Media Contact

Junichi Kobayashi, General Manager, Corporate Communications & Investor Relations

AGC Asahi Glass Co., Ltd.

(Contact: Aoi Takahashi; Tel: +81-3-3218-5603; E-mail: info-pr@agc.com)





<Reference>

AGC Flat Glass Thailand

Representative: Hideki Shioi

Established: 1963

Production items: Architectural glass, automotive raw glass, industrial glass and mirror

Plant: Samut Prakan Plant, Chon buri Plant and Rayong Plant



**AGC to Set Up Solar Control Coating Facility in Indonesia
for its Architectural Glass Production**
—Responding to growing needs for energy-saving buildings in Southeast Asia—

Tokyo, November 9, 2016—AGC Asahi Glass (AGC), a world-leading manufacturer of glass, chemicals and high-tech materials, announces that it will build a new solar-control coating facility for architectural glass at the Cikampok Factory of PT Asahimas Flat Glass Tbk (AMG), one of AGC's consolidated subsidiaries in Indonesia. Through this project, AGC aims to meet the needs for energy-saving buildings, which are growing in Indonesia and other Southeast Asian countries. Capital investment for the construction of the new coating facility is estimated at about 4.0 billion yen, and the production capacity is expected to be about 6.0 million m² a year. The new facility is planned to start production in the second quarter of 2018.

Demand for glass in Southeast Asia is expected to increase 5% or more annually. In Indonesia, among other countries, demand for architectural glass and automotive glass is rising due to steady domestic economic growth. At its Jakarta Factory, AMG stopped operating a float glass furnace with an annual production of 150,000 tons in October 2016, and, in December 2016, it will restart mass production of float glass at the Cikampok Factory using its state-of-the-art facility that produces 210,000 tons of float glass annually.

In Southeast Asia, where a construction boom is continuing, the issue has emerged of how to improve energy-saving efficiency on the back of increasing fuel imports and power supply shortages. In response, the Indonesian government is promoting saving-energy policies for large-sized buildings, including those air-conditioned throughout the year. Against this backdrop, demand is surging for Low-emissivity (Low-e) coated glass, which features excellent solar control performance, as one solution for improving air-conditioning efficiency and reducing energy consumption.

Under such circumstances, in addition to the increase in its float glass production in the region, AGC has decided to establish an offline Low-e coating facility that uses the state-of-the-art sputtering method. It will expand the lineup of energy-saving products that feature improved solar control and insulation performance, while maintaining high transmissivity of visible light. With the new facility, AGC will provide customers in the Southeast Asia region with products that meet their diverse needs for the performance and design of buildings, thereby making a significant contribution toward reducing energy consumption.

Under its management policy, *AGC plus*, the AGC Group will continue responding steadily to growing demand in emerging markets and supplying high value-added products that meet market needs, aiming to strengthen and solidify its foundations for growth.

<Media inquiries>

Junichi Kobayashi, General Manager, Corporate Communications & Investor Relations Office

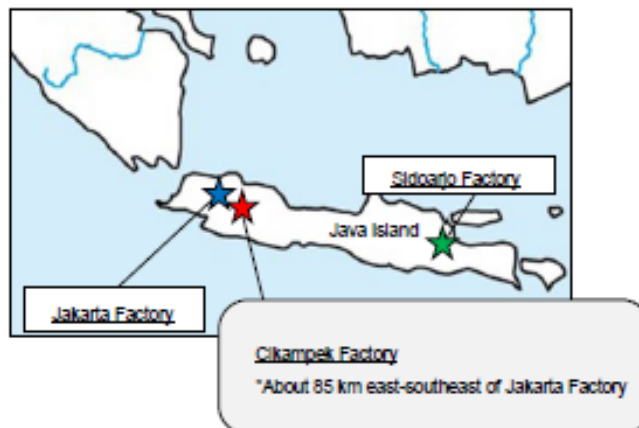
AGC Asahi Glass

(Contact: Takuya Miyagawa; Tel: +81-3-3218-5603; E-mail: info-pr@agc.com)

<Reference>

PT Asahimas Flat Glass Tbk

1. Name: PT Asahimas Flat Glass Tbk
2. Representative: Takao Takai
3. Location of Head office: Jakarta, Indonesia
4. Capital: 217.0 billion rupiah
5. Shareholding ratio: AGC: 43.9% (AGC's consolidated subsidiary);
Redans*: 40.8%;
Others: 15.3%
*Local partner
6. Established: 1971
7. Products: Architectural glass, fabricated architectural glass (planned for the second quarter of 2018), automotive glass, fabricated automotive glass, industrial glass, and mirrors
8. Production capacity: Float glass: 630,000 tons a year;
Coating facility: 6.0 million m² a year (planned for the second quarter of 2018)
9. Production sites:



<Media inquiries>

Junichi Kobayashi, General Manager, Corporate Communications & Investor Relations Office
AGC Asahi Glass
(Contact: Takuya Miyagawa; Tel: +81-3-3218-5603; E-mail: info-pr@agc.com)



AGC to Enhance Architectural Glass Production in Indonesia

Tokyo, May 12, 2017—AGC Asahi Glass (AGC), a world-leading manufacturer of glass, chemicals and high-tech materials, announces that it will invest approximately 19 billion yen to relocate a float furnace and mirror manufacturing facility from the Jakarta Plant to the Cikampok Plant of PT Asahimas Flat Glass, Tbk (AMG). The float furnace is for manufacturing of architectural glass and mass production is scheduled to commence in the first quarter of 2019. The new float furnace and mirror manufacturing facility will have increased production capacity by 40% and 30% respectively, which will significantly enhance AMG's architectural glass production.

AMG's Jakarta Plant has been manufacturing flat glass since 1973. Under the Jakarta City Master Plan, the plant is facing relocation as the land category of the plant premises will be changed from industrial to commercial use. One of the two float furnaces at the plant has already been transferred to the Cikampok Plant and started operation in December 2016.

In anticipation of continued growth in Indonesia and Southeast Asia, the new furnace will be relocated with increased production capacity as well as excellent productivity for high-quality glass. Furthermore, AMG will enhance the production capacity for mirrors and other glass products for interior use to meet diversifying high value-added glass needs. Following the relocation, AMG's Jakarta Plant will cease all production activities, and property will be sold.

Overview of the new furnace

1. Location: Cikampok, West Java, Indonesia
2. Production capacity: Approx. 210,000 tons of float glass per year
3. Special features:
 - a) 40% production capacity increase over the existing furnace
 - b) Environmentally friendly, fuel efficient furnace
 - c) Produces high-quality glass for various size and architectural usage
 - d) Enables efficient integrated production in conjunction with the adjacent mirror manufacturing facility and glass offline coating facility

Under its management policy, *AGC plus*, the AGC Group will continue to capture growing demand in Indonesia and Southeast Asia through the production enhancement in the region. Furthermore, the Group aims to strengthen and solidify its growth foundations by responding to growing energy-saving needs in the area, which will be achieved by utilizing the offline sputtering coating facility that will start operation at the Cikampok Plant in the second quarter of 2018.

<Media inquiries>

Kazumi Tazaki, General Manager, Corporate Communications & Investor Relations Office

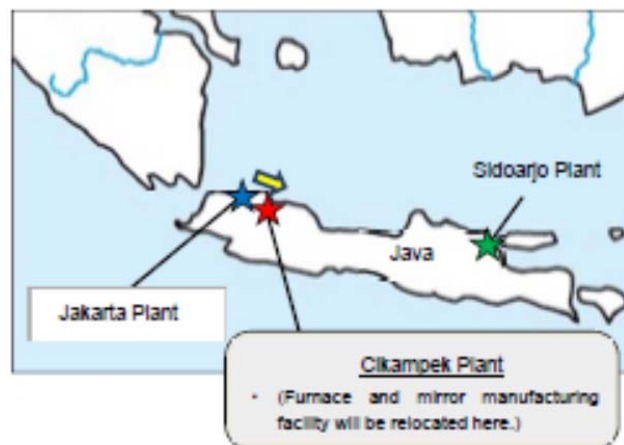
AGC Asahi Glass

(Contact: Takuya Miyagawa; Tel: +81-3-3218-5603; E-mail: info-pr@agc.com)

<Reference>

Overview of AMG

1. Company name: PT Asahimas Flat Glass, Tbk
2. Representative: Takao Takei
3. Location: Jakarta, Indonesia
4. Capital: 217 billion rupiah
5. Investment ratio: AGC 43.86% (AMG is a consolidated subsidiary of AGC),
Rodmas* 40.96%, Others 15.18%
* AGC's local partner
6. Establishment: 1971
7. Products: Architectural glass, raw and fabricated glass for automotive use, industrial glass, mirrors
8. Production capacity: Float glass: 720,000 tons/year (scheduled from the first quarter of 2019)
Mirror facility: 6.8million m²/year (scheduled from the first quarter of 2019)
Offline coating facility: 6.0 million m²/year (scheduled from the first quarter of 2019) (
9. Production bases:



<Media inquiries>

Kazumi Tamaki, General Manager, Corporate Communications & Investor Relations Office
AGC Asahi Glass
(Contact: Takuya Miyagawa; Tel: +81-3-3218-5603; E-mail: info-pr@agc.com)

Reference

ⁱ METI (2016) "Tsushohakusyo2016"

ⁱⁱ JETRO (2017.03) "Vietnam energy survey2016"

ⁱⁱⁱ IGES "Climate Policy and Market Mechanism Status Report" (Vietnam)

^{iv} JICA (2013) "Project for the Establishment of Energy Management Training Center"

^v METI (2017.03) "Feasibility Study Project for the JCM (2015FY) Energy Saving for Factories with Introduction of EMS and Highly Energy Efficient Equipment"

^{vi} The Socialist Republic of Vietnam, (2016), "Plan for Implementation of the Paris Agreement"

^{vii} Department of Meteorology, Hydrology and Climate Change, Ministry of Natural Resources and Environment of Vietnam, (2016), "VIETNAM'S NDC IMPLEMENTATION PLAN"

^{viii} Ministry of Economy, Trade and Industry (2015) 「The survey report on the market structure of the flat glass industry (pursuant to Article 50 of the Industrial Competitiveness Enhancement Act)」

The survey report on the market structure of the flat glass industry

^{ix} The Socialist Republic of Vietnam (2016), Intended Nationally Determined Contribution of Viet Nam

^x World Bank (2016), "Vietnam 2035 : Toward Prosperity, Creativity, Equity, and Democracy"

^{xi} Nippon Sheet Glass Co. Ltd Website (as of June 2017)

<http://www.nsg.com/en/about-nsg/whatwedo>

^{xii} GEC (2013) "MOEJ/GEC JCM Feasibility Study (FS) 2013 Final Report"

^{xiii} ALIA NEWS 148[2015.9] (MARKET NEWS Recent Status of Energy Saving Sashes)

-Diffusion status of energy saving sash for each areas(Japan Sash Manufacturers Association)