Heat-Island Mitigation Technologies (Building Envelope Technologies to Reduce Air Conditioning Load and Sensible Heat Emission)

環境技術実証事業 ETV 環境省

ヒートアイランド対策技術分野 実証番号 051 - 1313

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For Heat Cut in the summer /For prevent to escape Heat in the winter
Energy Saving measures for Window glass

IRUV Cut Coat Hyper-SP Product Description

To Nature, Earth & Humans ECO Sketch

The Purpose of suggestion

The "Paris Agreement" was established at COP 21 and
it was a historical agreement for international climate change countermeasures.

COP 21 (Participating Country 196) of the United Nations Framework Convention on Climate Change concluded by delegates from each country held in Paris, France from 20 th November 2015 will be held on December 12, 2020 local time We have officially adopted the international framework for global warming countermeasures "Paris Agreement". Like the Kyoto Protocol, this Paris Agreement was agreed as a strong agreement with legally binding power. Towards "to keep the world's average temperature rise to less than 2 degrees" as the overall goal, in the second half of the century worldwide, the direction to substantially reduce greenhouse gas emissions from human activities to zero It launched. For that purpose, all countries were obliged to make emission reduction targets and submit it, and it was also obliged to take domestic measures to achieve them. This Paris Agreement means that the convention to decide the future direction of the world economy has been decided by a legally binding international agreement. We decided to aim for a low carbon society and a decarbonized society all over the world. In other words, from now on politics, business and local governments all mean that "carbon emissions are not good.

Furthermore, in 2015, the United Nations adopted the SDGs as goals for the environment, economy, and society of the entire international community, including developed countries, toward 2030.

Although adopted by the United Nations, the SDGs are already becoming the "common language" in the business world.
Efforts are being made by the Japan Business Federation, industry groups, regional banks, and even individual companies to achieve these goals.
In particular, large companies that are expanding their businesses around the world are beginning to reassess their entire value chain, which is expected to have an impact on related suppliers.
With the spread of SDGs, it is becoming necessary to respond to SDGs as the needs of the market and the needs of business partners. In fact, we are entering an era where we can see not only profits but also whether we are working on the SDGs as a condition of investment.

In this way, global warming is a serious problem that immediate measures and improvement on a global scale are urgent.
Based on this world situation,
In order to promote global warming countermeasures, at Sketch Co., Ltd., with the aim of "Energy Saving Decarbonization Society Starting with a Window - Prevention of Global Warming" as a flag, the window glass (90% of domestic existing buildings) which is not an energy saving specification, We propose thermal insulation renovation of window glass with coating solution.

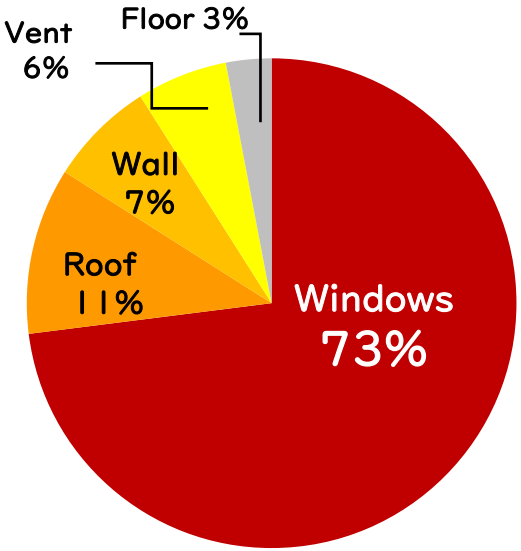
Solar heat / Heating heat movement

The window glass with the most heat transfer

It is not an exaggeration to say that summer heat and coldness in winter depend on the window.
The influence of exterior walls and roofs that are in contact with the outside air is surprisingly small, and most of the heat comes in and out of the windows.
73% of the solar heat comes into the room from the window in the summer, and 58% of the heating heat escapes from the window in the winter , assuming the whole building as 100%. In other words, in building of energy saving measures , heat shielding against window glass is the most effective.

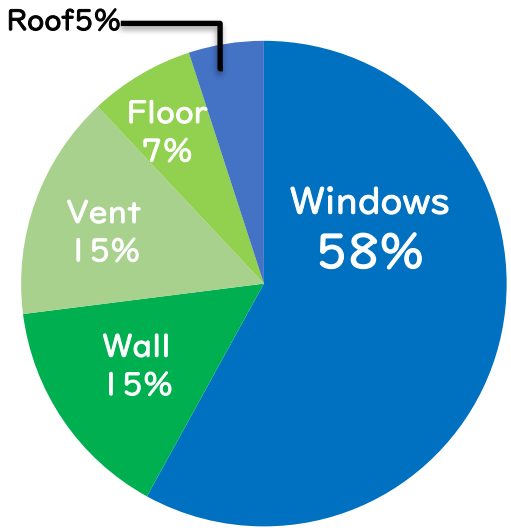
●The rate at which heat enters during cooling

Summer



●The rate at which heat escapes from the window during heating

Winter



Source: Estimate from Agency for Natural Resources and Energy

Why window glass?

The biggest point is to reduce the work of air conditioning

"Air conditioning cost reduction measures" from 10 am to 4pm in the daytime is top priority

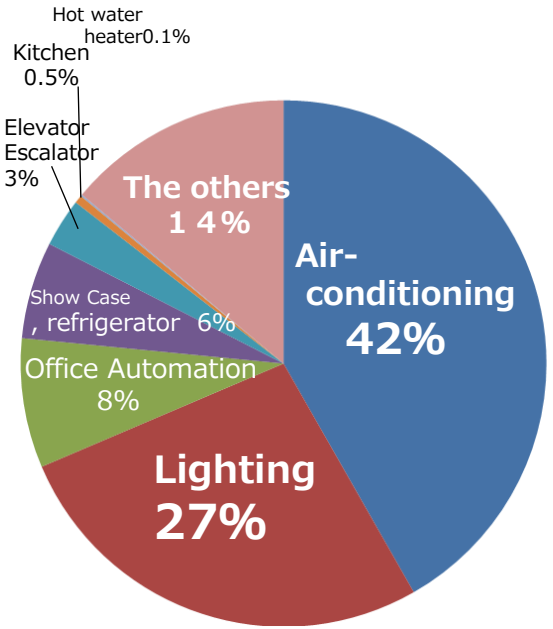
It is well-known that the proportion of air-conditioning equipment occupied in power consumption is large.

How to efficiently use air conditioning equipment that accounts for this large proportion will be the most important point of energy conservation.

So, where and how can we improve it? For that, we must pay attention to windows where heat come in and out the most.

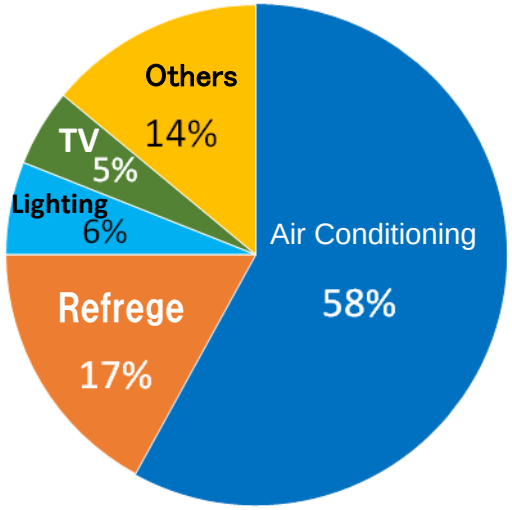
In the case of office building

Demand Structure of 2PM at office building



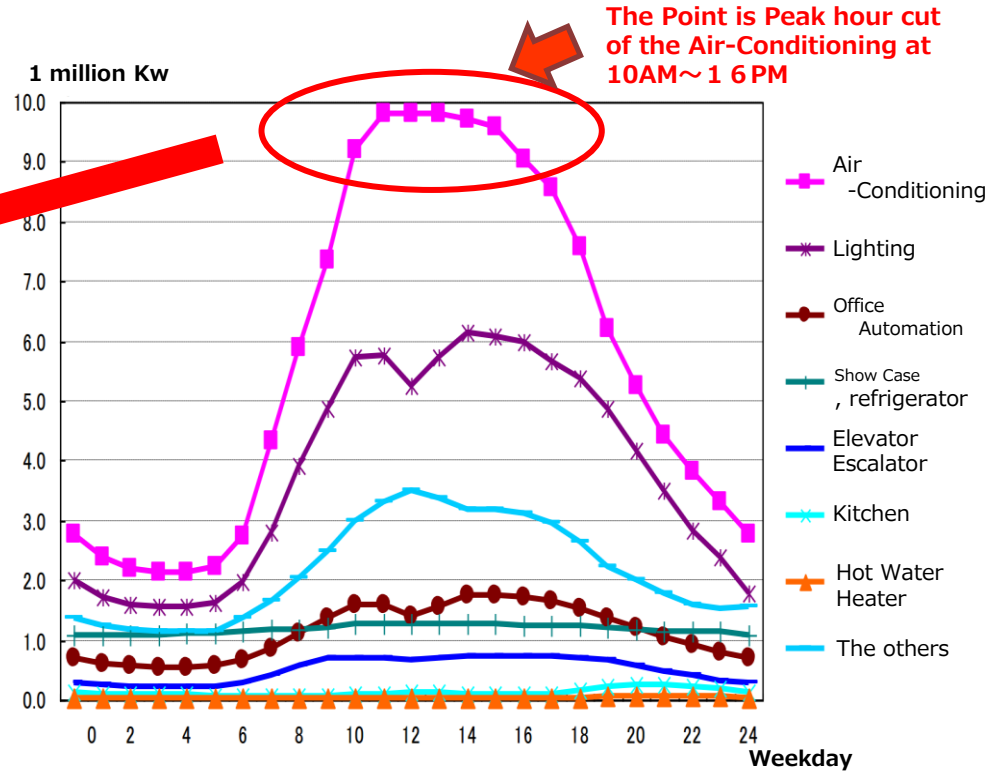
In the case of house

Average of all households in general households, power consumption ratio by usage



Assuming temperature conditions at 14:00 on July 23, recording the peak peak demand (59.99 million kW) in 2010

Demand for electric power at hourly intervals



The Information From Agency for Japanese Natural Resources and Energy on May,2011

Source: Estimate from Agency for Natural Resources and Energy

Cost and CO_2 reduction

Method of low carbon society

From the entry into force of the Kyoto Protocol to the present, various energy-saving technologies have been developed, commercialized and put into practical use in the construction and construction fields.

Among them, it has been clarified that window glass measures are the most advantageous in terms of the relationship between the introduction cost and the CO2 reduction effect.


平成 21 年度地方公共団体実行計画（区域施策）
策定マニュアルに関する都市・街区単位
における低炭素化手法の検討業務

(Report)
報 告 書

March. 2010

平成 22 年 3 月

三菱総合研究所

(Mitsubishi Research Institute, Inc.)

The Comparison report for the amount of CO2 reduction to be the energy-saving measures of the building in case of budget of ¥100 millions.

Method	Cost ¥100billion	The CO2 Reduction effect [t －CO2]	The CO2 reduction effect per ¥100million [t-CO2/100million]
High Thermal material	5920	-22771	-3.85
High Reflective Paint	3222	7007	2.17
Heat Insulation Film	2477	117270	47.35
Gardening Rooftop	7900	3756	0.48
Earth thermal heat pump	10764	46208	4.29
Ground tree planting	6100	10124	1.66
Water-retentive pavement	5424	7791	1.44

VS

Cost Comparison in the case of Japan

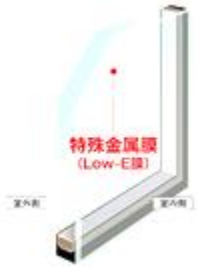
Window energy-saving products

The following are typical products related to energy-saving renovation.
Options vary depending on the customer's form (building, condominium, commercial facility, private house, etc.).

⑴To exchange Low-E Double glazing glass is mainly for service facility, but There is almost no renovation unless the glass is broken.
⑵Interior window sash is only for condo, house
⑶Window film
⑷ window glass coating corresponds to any building. but A High-performance type is expensive cost for renovation.

Heat insulated renovation of window glass for energy saving in Japan.

⑴Low-E Double Glazing Glass
￥40,000/sqm～



⑵Interior Window Sash Low-E
￥25,000/sqm～

⑶Window film
￥15,000/sqm～

⑷Other Glass Coating
￥15,000/sqm～

Type	Application cost	Type	Application cost
⑴Low-E Double Glazing Glass	¥45,000/sqm～	⑵Interior window sash Low-e	¥25,000/sqm～
⑶High heat insulating Window film	¥15,000/sqm～	⑷other glass coating	¥15,000/sqm～
		IRUV Cut Coat H－SP	¥12,000/sqm

節空電調 The feature of IRUV Cut Coat Hyper-SP

Heat shield, heat insulation, UV cut to control the heat transfer of windows

IRUV cut coat can be applied with a roller, as a heat shield in summer, UV protection, and heat escape from heating heat in winter. In addition, it is very economical because it is more than twice as durable as a thermal barrier film. It is an energy-saving product that does not require large-scale application.

Renovation of the window

Shields sunlight and ultraviolet rays in summer and suppresses direct heat from the window by about 8-15 ° C. In addition, the warmth that feels comfortable in winter and the outflow of heating energy are suppressed, and the indoor warming effect is enhanced.

・Near Infrared rays cut is 80% or more.
・UV Cut is more than 99%

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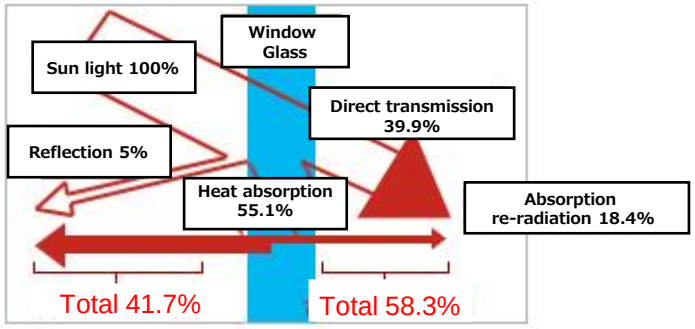


How it works

When direct solar heat hits 100% window glass, reflection is 5%.
The amount absorbed by the window glass is 55%.
36.7%, which corresponds to 2/3 of the 55% absorbed, re-radiates to the incident side of sunlight, and 18.4%, which corresponds to the remaining 1/3, re-radiates to the indoor side.
The total cut of reflection 5% and absorption re-radiation 36.7% is 41.7%.

Test pieces	Coating glass thickness 3mm	Normal glass 3mm
Thermal conductivity (K value)	4.6kcal /㎡h℃（5.3W /㎡ K）	5.1kcal /㎡h℃（6.0W /㎡ K）

The performance of IRUV Cut Coat Hyper-SP

Energy Saving	Heat Insulation	Heat escape prevention	UV Cut	Condensation	Durability
Reduces air-conditioning load by heat insulation effects	For Air-Conditioning in Summer	For Heater In Winter	Harmful UV rays 99% cut or more	50% or more of suppression	10years Or more

Heat insulation by IR Cut in Summer

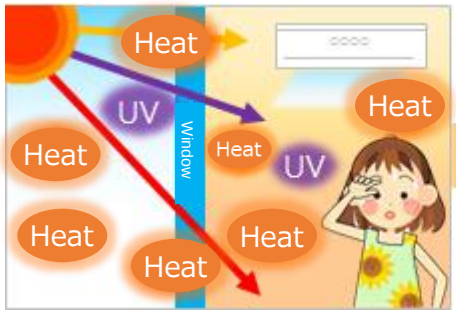
Heat cut about 8~15℃ through window glass

Shielding near-infrared rays of heat that feel uncomfortable
Reduces indoor temperature rise and improves air conditioning efficiency

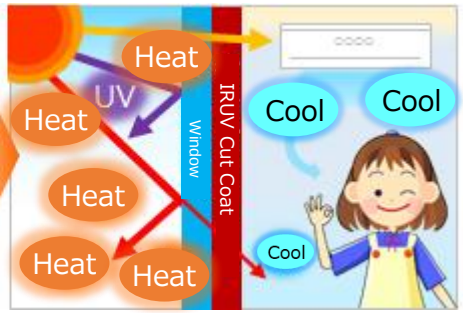
Winter of insulation far-infrared cut

Don't let the heating heat escape from the window
Light of warmth that feels comfortable "far infrared"
Suppresses the flow of heating heat energy

In Summer

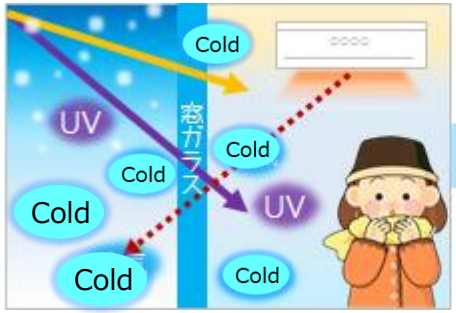


Solar heat enters, cooling is not effective, and the room is hot

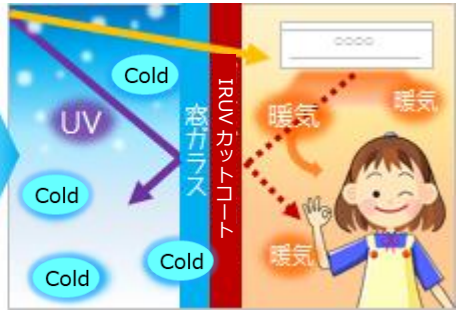


Reducing solar heat and lowers room temperature by 2-3 ° C
The cooling effect is improved.

In Winter



Heating heat escapes from the window
The room is cold with poor heating



Reduces heat escape from heating heat
Heating effect is improved

Visible Light → UV rays

Near Infrared rays → Far Infrared Rays

What is the difference from Window film?

Comparison of the heat insulating film
「Pasting」film　「Coating」IRUV Cut Coat


Glass Film


Glass Coating

-Film-
Due to the deterioration of glue, peeling or bubbles may occur in about 5 to 7 years.
-IRUV Cut Coat H-SP-
15years durability

-Film-
Because the standard dimensions are fixed, the joint line between the films remains in a large window glass.

-IRUV Cut Coat H-SP-
Even large glass is seamless and finished as one surface.

-Film-
The thickness is as thick as 80 microns, and it can not handle the expansion and contraction of glass, so it is easy to break.

-IRUV Cut Coat H-SP-
Because it is as thin as 8 microns, it has elasticity that follows that of glass, and it is harder to crack than a film.

-Film-
Since the surface hardness (pencil hardness) is H-2H, it is easily damaged.

-IRUV Cut Coat H-SP-
Pencil hardness is 4H and is hard to be scratched (After complete curing)

What is the difference from other coatings ?

Comparison with other coatings

(1) Workability

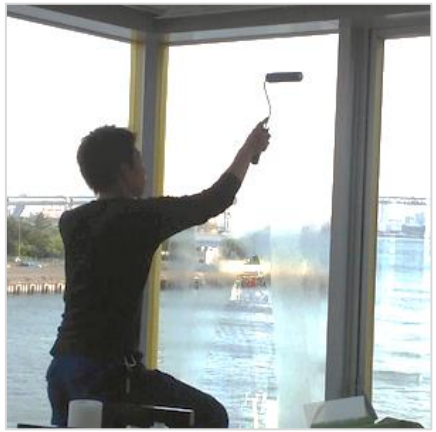
【Other Coatings】

Sponge bar

Spray

- ☆Difficult application
- ☆Cannot be fixed.
- ☆Hard to peel off
- ☆Hard to coat for big size (Sponge bar)
- ☆Easy to occur dripping and unevenness
- ☆Unable to adjust film thickness
- ☆It takes time to master Application technique

【IRUV Cut Coat H-SP】



Roller application

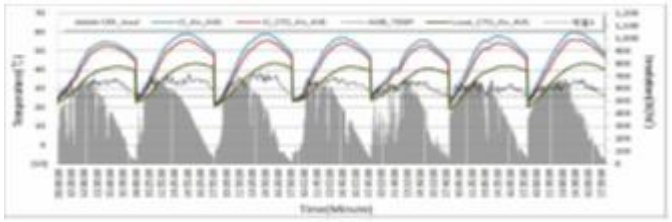
- **☆Easy application**
- **☆can be fixed**
- **☆Easy to peel off**
- **☆can apply for big size**
- **☆No dripping, unevenness**
- **☆Uniform film thickness**
- **☆Easy to master application technique**

Energy-saving simulated case in Korea in Summer

Data collection / test booth

Korean Construction Company measured the temperature at 4 rooms under the same conditions. As a result, the room temperature was at most 3.6 ℃ lower than the non-coated room. Air conditioning cost reduction rate of the year was 14% (28%).（※As a condition, the temperature setting of air conditioning change 1 ℃ effects 5% of the energy-saving .Calculated at 10% in Japan）Calculate the application cost by electricity charges and labor costs in South Korea, it has proved to be recovered in 4.9 years. South Koreas is the cheapest electricity rates in the developed countries, it will be recovered within five years even there is winter time.

- The indoor temperature comparison by the changes in the outside air temperature-

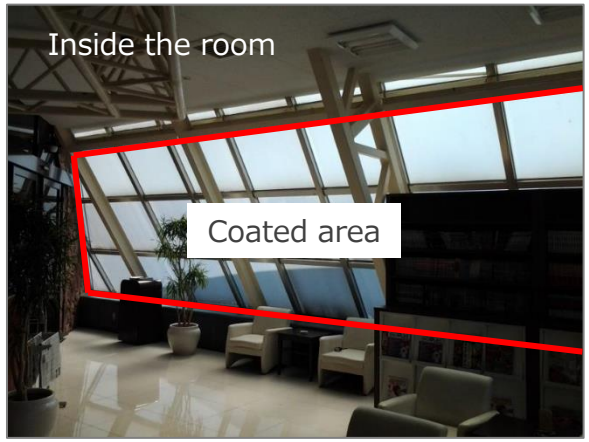


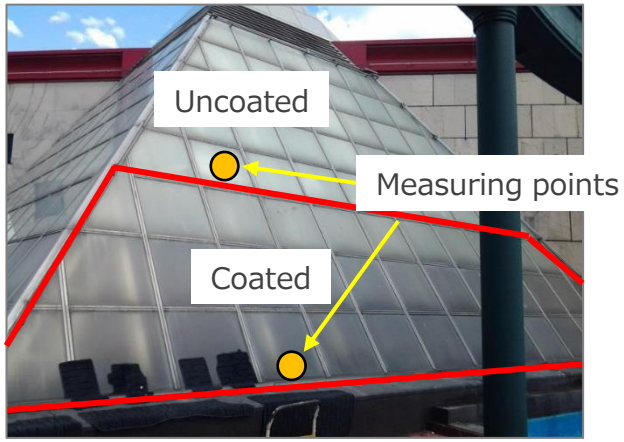
1	26℃～28℃	20.0	3.7	4.1	1.7	8.5	0.4	3.7
2	26℃～30℃	163	30.1	33.4	2.1	10.5	3.5	29.9
3	31℃～35℃	313	58.1	64.8	3.0	15.0	9.7	54.8
4	36℃～	44	8.1	9.1	3.5	17.5	1.6	7.5
		540(h)	100	111.1			15.2**	95.9

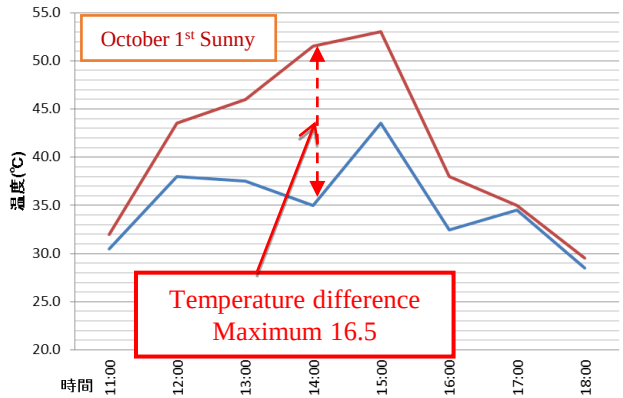
The examples of Heat insulating performance in Summer

Temperature measurement at application site/　Amusement facility/Smoking room in Oita-ken Japan

Summer is hot and no one wants to enter the smoking room. Even if the air conditioner is set to 19 ° C every year, it becomes hot air. Although a film was pasted, it was installed 10 years before and no effect.
After application of IRUV Cut Coat , temperature measurement was performed.







[Temperature measurement period]
11:00 on October 1, 2013 to 17:00 on October 22, 2013

～Customer comments after application～

Until now, even if the air conditioner setting was 19 ° C, it was too hot to enter the room. However, after application, even if the air conditioner setting was raised to 24 ° C, it became cool, and I felt a strong heat shielding effect.

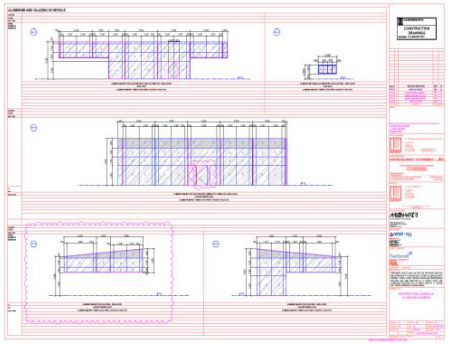
＊ The air conditioning load is reduced by 5 ° C (energy saving about 30-50%) because it is comfortable even at the air conditioning set temperature of 19 ° C ➡ 24 ° C.

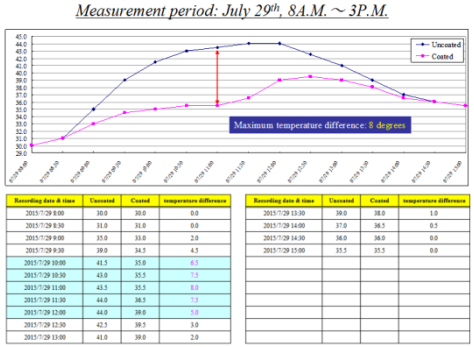
Energy Saving performance in Summer

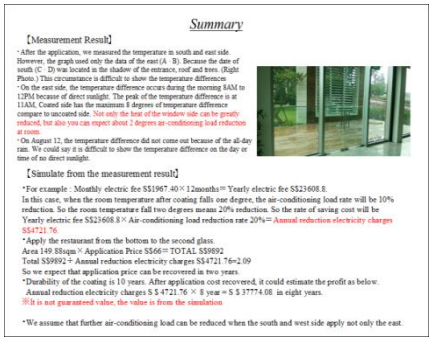
Golf Course / Clubhouse in Singapore

Active in hot Southeast Asia

Result of the temperature measurement, the temperature difference of the direct heat at the window was 8 ℃ (maximum) in comparison with the uncoated glass (Low-E glass) Reduction rate of the air conditioning costs was 20 percent, so recovery of the initial investment simulated in 2.03 years. Because there was high electricity prices and low applicator cost. For 10 years coating guarantees, we can expect significant cost savings of 20% to 30% more than eight years is. ⇒ 2years payback period and more than eight years profit





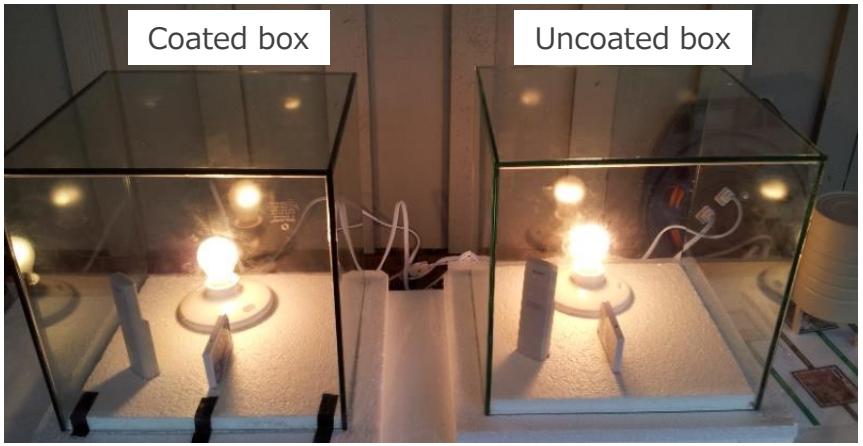


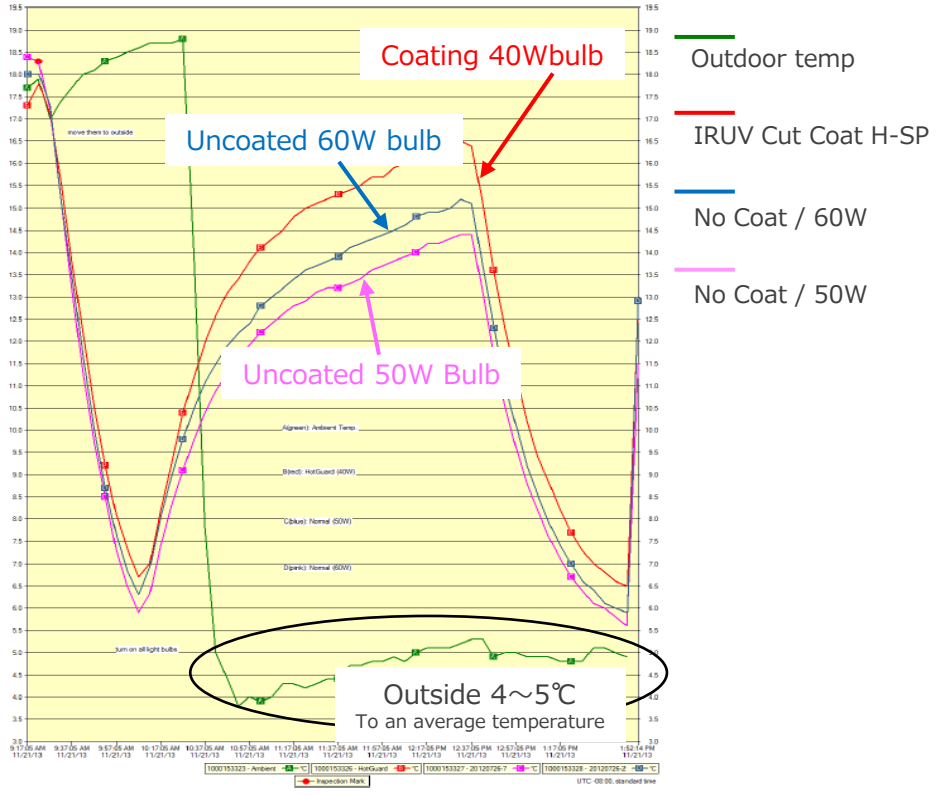
Energy Saving Performance in Winter

Heating heat energy

Heat escape prevention test in Canada

Glass box with a heat source (light bulb) and thermometer. As a result of measuring the transition of the temperature inside the BOX, Uncoated box and coated box installed outdoors, The temperature inside the coated BOX (40W) is the highest and suppresses heat escape compared to the uncoated BOX (50W, 60W). The coating warms the room with a small amount of heat, improving heating efficiency and showing a high energy-saving effect.





■ Exam contents:
Prepare three 30cm square glass boxes and install it outdoors with a light bulb inside. Measure internal and external temperatures. One glass BOX is covered with a glass coat and 40W bulbs are used. The remaining two glass boxes were left uncoated, and 50W and 60W bulbs were installed.

■ Period: 9 am~1pm on Nov 21th ,2013

■ Test location: Vancouver, Canada

■ Outside temperature: 4 ℃ ~ 5 ℃, cloudy weather

Energy Saving Performance in Winter

Energy Saving for School

As a result of application at an elementary school in Vancouver, Canada and comparison with the air conditioning costs from 2009 to 2011, an average 16% reduction in air conditioning costs were demonstrated. Converting 16% into monetary amounts will reduce air conditioning costs by 5,472 Canadian dollars (approximately 474,200 yen) annually, so application costs can be amortized and recovered within 1.97 = 2 years. (8 years will be profitable due to durability over 10 years)




	2011			2010			2009		
	Gas Consumption	HDD Monthly Total	GJ/HDM	Gas Consumption	HDD Monthly Total	GJ/HDM	Gas Consumption	HDD Monthly Total	GJ/HDM
Jan.	459 GJ	427.5 HDM	1.074	358 GJ	334.2 HDM	1.071	549 GJ	491.5 HDM	1.117
Feb.	406 GJ	407.6 HDM	0.996	370 GJ	304.3 HDM	1.216	414 GJ	391.3 HDM	1.058
Mar.	**292** GJ	345.1 HDM	0.846	399 GJ	317.8 HDM	1.256	436 GJ	406 HDM	1.074
Apr.	288 GJ	320.2 HDM	0.899	253 GJ	253.2 HDM	0.999	233 GJ	266.4 HDM	0.875
May	201 GJ	211 HDM	0.953	150 GJ	185.3 HDM	0.809	121 GJ	166.4 HDM	0.727
June	76 GJ	82.4 HDM	0.922	86 GJ	91.6 HDM	0.939	44 GJ	28.4 HDM	1.549
July	29	HDM		51	HDM		179	HDM	
Aug.	30	HDM		21	HDM		167	HDM	
Sep.	51 GJ	56.8 HDM	0.898	54	81.4 HDM	0.663	64 GJ	73.5 HDM	0.871
Oct.	205 GJ	251.1 HDM	0.816	211	206.5 HDM	1.022	141 GJ	246.6 HDM	0.572
Nov.	382 GJ	385.6 HDM	0.991	441	386.8 HDM	1.140	602 GJ	326.1 HDM	1.846
Dec.	434 GJ	440 HDM	0.986	457	405.4 HDM	1.127	541 GJ	491.6 HDM	1.100
Total(4mo)	1072 GJ	1133.50 HDM	0.946	1163 GJ	1080.10 HDM	1.077	1348 GJ	1137.80 HDM	1.185

4) Magee Secondary

Date Job completed:	August, 2011	
Method:	IRUV cut Liquid Film	
Cost of Materials:		$10,800
Coated Area:	15% of glazing area	
Average Gas Consumption:		$38,000 /year
Heating Gas Consumption:		$34,200 (90% of Total Gas Consumption)
Energy Savings:		16.00% (Saving Target was 5% on heating, 10% on cooling)
Savings per year:		**$5,472.00 /year**
Payback (years):		**1.97 years**

4 mo(Sep.-Dec.) comparison

Savings 2011 vs.2010	12%
Savings 2011 vs.2009	20%
Ave.	16%

Condensation Suppression in Winter

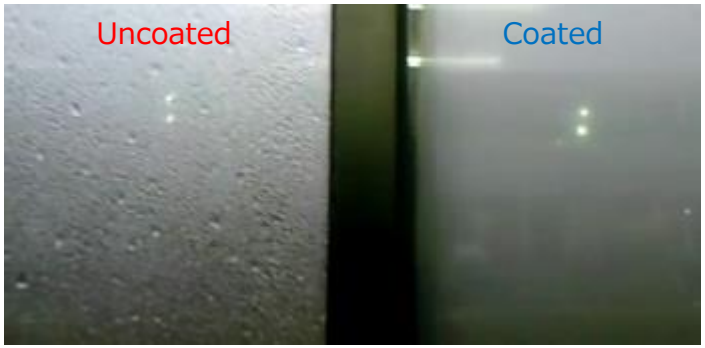
50% suppression of Dew Condensation in Winter

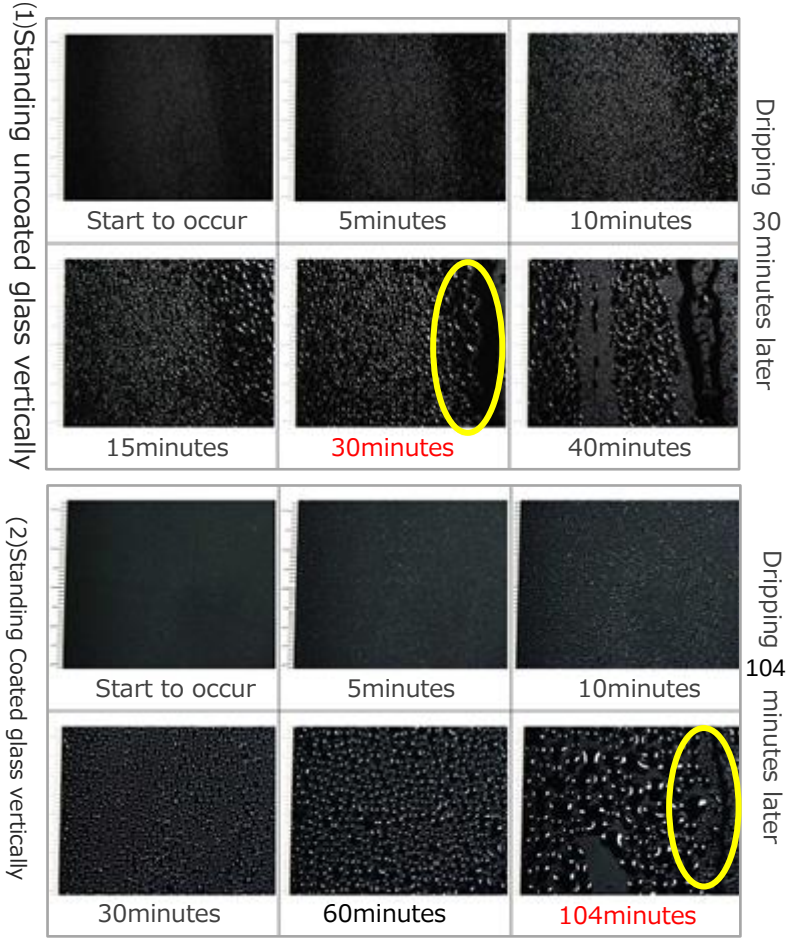
Condensation means that in the winter, moisture-containing air is cooled on the window glass and becomes water droplets. When coated, the glass surface absorbs heat, warming the glass surface and slowing down condensation. In addition, since the water retention of the coating surface itself is high, the time it takes for the water to drip is as follows: uncoated glass = 30 minutes, coated glass = 104 minutes.

High Environmental Engineering Co., Ltd.
"Experimental report on condensation" in July 2005

Test category	Time to start dripping
(1)Uncoated glass	30minutes later
(2)Coated glass	104minutes later

Difference in condensation state between coated and uncoated





Introduction by publicity in Japan

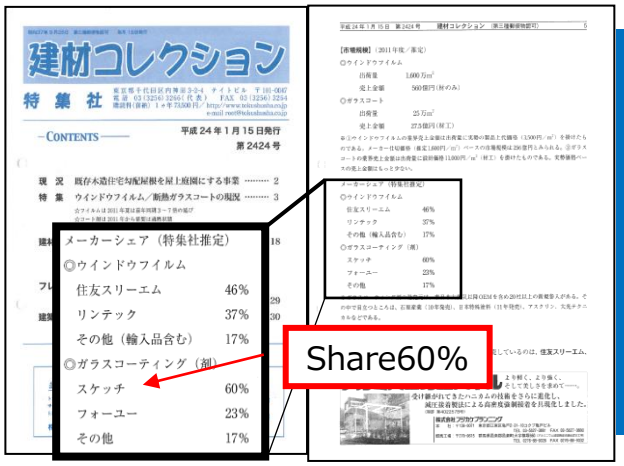
TV, newspaper, magazine, etc.

No. 1 in the thermal barrier glass coating industry (70% market share).
It was also introduced on TV and industry newspapers.

Electricity saving to survive the heat in TV

NHK Devise spend a warm winter

Base design document



Building material collection

Example ① 100 yen shop Daiso store whole in Japan

Example ② Drug Store Chain shop in Japan


2020年4月24日 福岡南里店 106.01㎡


2020年4月26日 福岡久留米高良内店121.35㎡


2020年5月21日 福岡須玖北店174.72㎡


2020年12月26日 鹿児島春山店108㎡


2021年2月28日 大分三重町店137.04㎡


2021年3月6日 熊本大津町店110.53㎡

2021年3月6日 福岡水巻店107.86㎡


2022年6月5日 佐賀大和店 124.59㎡


2021年7月13日 宮城七北田店 112.72㎡


2021年7月31日 徳島阿波市場店113.84㎡


店 109.5㎡


2021年10月15日 鹿児島国分広瀬店 113.76㎡


2021年11月4日 鹿児島草牟田店115.31㎡


2021年11月16日 徳島石井店92.21㎡


2022年1月7日 宮城角田店 110.65㎡


2022年1月25日 福岡和白丘店 115㎡


2022年1月30日 大分明野店 119.74㎡


2022年2月19日 山口柳井店 86.92㎡


2022年2月23日 熊本田迎店 105.93㎡


2022年2月24日 愛媛東大洲店 121.86㎡


2022年2月24日 諫早高来店 115.57㎡


2022年2月28日 大分鶴居店 107.28㎡


2022年3月2日 長崎広田店109.29㎡


2022年4月14日 宮城古川若葉店105.36㎡


2022年4月29日 宮城・名取愛島店91.42㎡


2022年5月11日 愛媛中ノ庄店 78.35㎡


2022年5月13日 愛媛久万ノ台店103.3㎡

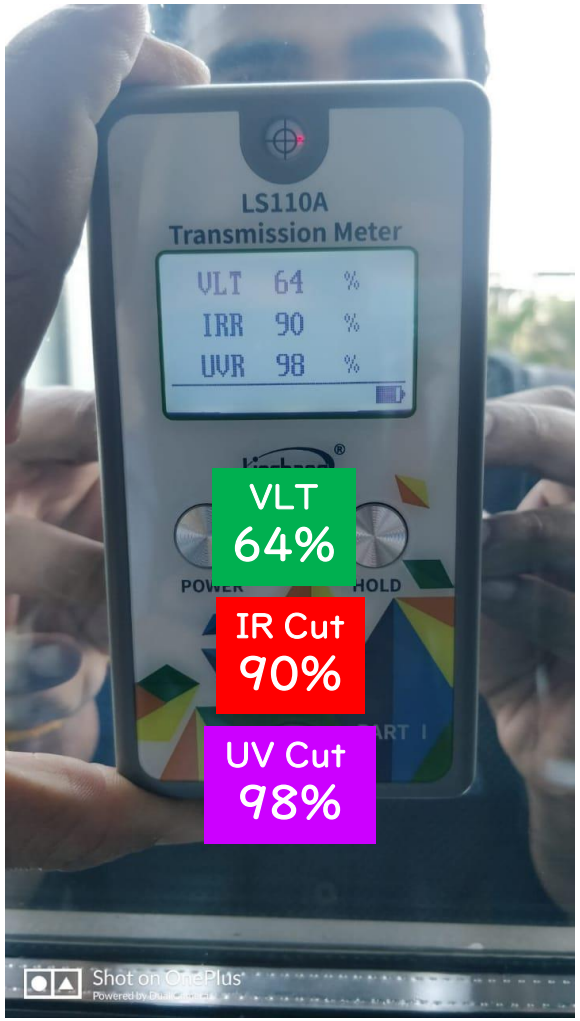

2022年5月22日 福岡筑後野店129.05㎡


2022年6月8日 佐賀、鳥栖村田町店 108.6㎡


2022年9月5日 福岡浦志店 31.86㎡

Example③ Application of the Ritz-Carlton Hotel by a local distributor in India

About 2000 sqm at the Ritz-Carlton Hotel in India,
implemented in May 2022



Application Record in Japan(1)

Sample application records


【Amazon Odawara warehouse】


【HOTEL in Hokkaidou】


【KEWPIE Mayonnaise headquarters 】


【 Kawasaki Heavy Industries Technical Development Division 】


【Tokyu hospital】


【 Kagoshima District Legal Affairs Bureau Kirishima Branch 】

Application Record in Japan(2)

Sample application records


【 Ministry of Internal Affairs and Communications 】


【 Hotel Japan Shimoda 】


【 Sapporo Beer Chiba Factory 】


【 Tokyo Gakukan Niigata High School 】


【 Edogawa City Hall 】


【 Japan Atomic Energy Agency 】

Recommendation for the person like these

「10% energy saving by the difference of temperature setting of 1 ℃」

considering energy-saving measures

- Requirement for power-saving heating and cooling.
- In the summer, to save the air Conditioning fee.
- In the winter, to keep warm Without the air conditioning.

Afternoon sun is hot

- I can not stand near a window is hot.
- air conditioning does not work in the afternoon sun.
- Can not sleep in the summer.
- Can not concentrate on work because of the heat.
- Care about heat stroke
- Cooling bill is high.

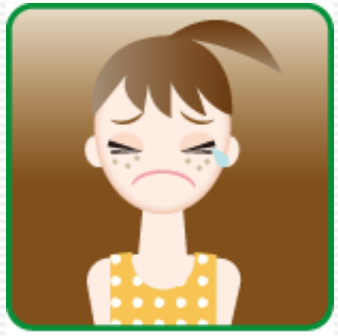
For keeping the heat from inside the room.

- Window area is cold.
- Effectiveness of heating is low.
- Heating bill is high.
- Can not sleep because of cold.
- Avoid to get the cold.

The terrible condensation of window

- A terrible condensation of the window.
- The trouble with water dew.
- I have to wipe the window every morning.
- Unsanitary mold grows
- Child asthma.

「Price is Less than half of other insulated glass product」



Care about freckles and spots because of UV.

- Furniture and sofa have faded.
- summer, Insects gathered to window.
- Avoid to get the dark spots by UV.

Save the money, a good product Been looking for!

- Reduce the heat and strong sun light from the window.
- Demand for the highest performance.