The abstract of the Heat-Island Mitigation Technology Field (Technology for reducing air conditioning loads by using building envelop systems).

1. The background of this technology field

i) Prevention of Heat-Island phenomena

* Heat-Island phenomena are phenomena where the ambient temperature of the central area of a city becomes locally high (island-shaped temperature distribution). They are mainly caused by

A) Increase of artificial heat exhausted from human activities, and automobiles

B) Increase of artificial coverings over the ground by decrease of green areas and water surfaces and by increase of buildings and pavements

The phenomena have come to gather attention recently as an environmental problem specific to cities.

ii) Investigation of the artificial heat from human activities in Tokyo city area

The Ministry of the Environment estimates that, among heat (sensible heat to the air) having an effect on temperature rise in Tokyo's 23 wards, **heat caused by artificial exhaust heat occupies about 50%, and half of the artificial heat is generated from buildings(air conditioner, etc.)**

iii) The feasibility of measures

Among measures to reduce artificial exhaust heat, measures that can reduce the heat exhausted from existing equipment and buildings without renewal of buildings themselves, air conditioner equipment, etc., can be easily introduced compared with other heat island mitigation measures (*), because construction work is not necessary, and a problem of heavy loads to the building does not arise, which is different from the cases of greening.

* Other heat island mitigation measures

A) Technologies for reducing air conditioning loads by using building systems

B) Heat pump air conditioning systems underground, wastewater, etc

2. Outline of the Countermeasures against Heat Island Phenomena

It was laid down in March 2004. Basic policies are presented to appropriately promote efforts of the national government, local governments, enterprises, residents, etc., for heat island mitigation measures, and specific measures to be taken are summarized. Pillars of the countermeasures include: **[1] reducing artificial exhaust heat, [2] improving coverings over the ground, [3] improving urban forms, and [4] improving lifestyles**.

3. The main technologies in this technology field

Content of each technology	Numbers of verification FY2006-FY2012
1 Sunshade Adhesive films for glazings Adhesive films for glazings are the technology that reduces the amount of the heat flux to the building inside by covering films shading sunlight and decreasing the quantity of the solar radiation transmission to a window.	90
2 Sunshade Coatings materials for glazings Coatings for glazings are the technology that reduces the amount of the heat flux to the building inside by coating the special paints shading sunlight and decreasing the quantity of the solar radiation transmission.	42
3 Water Retentive Materials for roof Water Retentive Materials are the technology that uses latent heat of vaporization and decreases the temperature of the rooftop surface by laying the water-holding building materials on the rooftop.	7
4 High solar reflective paint for roof **** technologies verified in the past*** High solar reflective paint for roof is the technology that reduces the amount of the heat flux to the building inside by covering the high reflectance paint improves the solar reflectance on the painted surface and decreases the temperature of it on the rooftop	154
5 Others Sunshade Blind, High solar Reflective Roofing Sheets, High solar Reflective Kawara, … etc.	57
Total	350

These technologies are available to the existing buildings, unlike the technology like green roofs require a large scale construction. Since these technologies are not burdened to the buildings, it is easy to introduce to the existing buildings. Thus, local authorities push forward an action of introduction promotion.

4. The mechanism of these technologies

The function of these technologies is to reduce the amount of heat inside the buildings by reducing or by absorbing the quantity of sunlight to the room. Insulating multiple glasses added for the window are also to reduce the amount of heat inside the building.

5. The method of Verification Testing

The Verification Testing is conducted in a lab test (Fig.1), an outdoor exposure test (Fig.2 an endurance test) and Light-and-water exposure Test.

The lab test measured Thermal and optional performance by Spectrophotometer. In this test, the verification performance is following,

(Thermal and optional performance)

A) Solar reflectance, Solar transmittance, Solar absorption, Shading Coefficient (SC)

B) (Total hemispherical) Emissivity

C) Value (lightness): Munsell color system

Fig.1 Spectrophotometer

Fig.2 Outdoor exposure Test

Some technologies require the equipment of Fig4 to measure SC.

Based on measured Thermal and optional performance, the effect decreases the burden for the air-conditioning is calculated in the case of utilizing the applied environmental technology to residents, plants and office buildings. The way to calculate is conducted by the heat load simulation.

And considering the performance degradation during a period of service, Outdoor exposure Test and Light-and-water exposure Test are implemented.

Fig3. Light-and-water-exposure apparatus (Open-flame carbon-arc type)

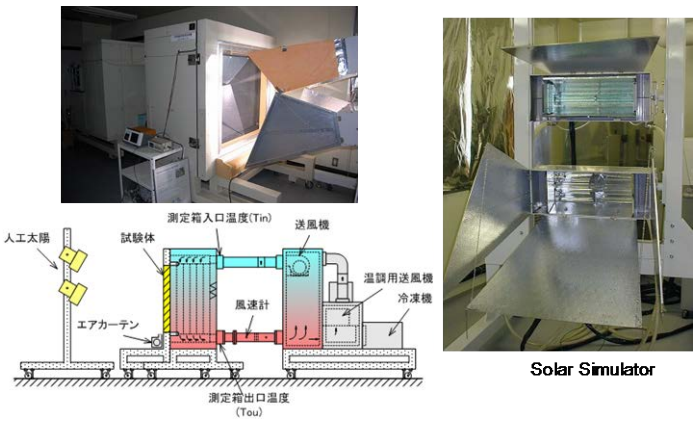

Fig.4 shading coefficient measuring apparatus[1]

6. The verification performance

The verification performance in this technology field is divided in two types; the performance of decreasing the burden for the air-conditioning and the performance of influence to the environment and maintenance.

i) Thermal and optional performance

D) Solar reflectance, Solar transmittance, Solar absorption, Shading Coefficient (SC)

E) (Total hemispherical) Emissivity

F) Value (lightness): Munsell color system

ii) The performance of decreasing the burden for the air-conditioning

G) Solar reflectance, Solar transmittance, Solar absorption , Shading Coefficient

H) (Total hemispherical) Emissivity

I) Value (lightness): Munsell color system

The following performance are calculated from the data

J) Decrease in the amount of roof surface temperature (in summer season)

K) Cooling load reduction (1 Month from June to September)

L) Inhibitory effect at room temperature rise

M) Effect of reducing the amount of heat convection (1 Month from June to September)

The following reference performance are calculated from the data

N) Cooling load reduction (per year)

O) Heating load reduction (1 Month from November to April next year)

P) Cooling load reduction (per season)

iii) The performance of influence to the environment and maintenance

We conduct the endurance test for four Months from September to January next year and grasp the degree of the following performance.

Q) Decrease in the amount of roof surface temperature (in summer season)

R) Cooling load reduction (1 Month from June to September)

S) Inhibitory effect at room temperature rise

T) Effect of reducing the amount of heat convection (1 Month from June to September)

7. The fee and the cost of implementing verification testing

The fee: ¥ 100,000 - 300,000 (Approx. $1,250 - 3,750)

(Including the conducting testing cost)

*1 Transportation cost to the testing center is covered by the Verification Applicants

*2 Examining cost in the Verification Technical Panel is covered by the government.

8. Required interval of conducting verification testing

i) Conducting the testing: 6 Months

ii) Preparation of the Test Result Report and Test Statement : 2 - 3 Months

(Including the examination in the Verification Technical Panel)

9. Main user

i) Local authorities

ii) Building contractors, construction companies and custom home builders

iii) Facility manager of plants and buildings (Films, paints)

iv) Residents (Films)

10. Verification applicants

i) Technology developers

ii) Distributors

11. Good Practice

i) Utilization to public projects

The Water Retentive Material is applied to the parking area for bicycles in the public transportation station is near to Tokyo Sky Tree (Famous sightseeing sight).

Fig4. Water Retention Ceramics

ii) Development of JIS

JIS (Japanese Industrial Standard) has been developed through the use of Verification Result Reports (2011. July) Thus, since developers and distributors need to certify JIS and clarify the performance above the standard, the numbers of verification has increased dramatically. As a result, the market has enlarged by developing JIS.

iii) Connection to the subsidies of local authorities

Some local authorities encourage the users to use these verified technologies by granting and in the government procurement. We think it also leads the increase of the number of verification.

12.Others

The point that this technology field has spread is to connect the verification testing method and the Japanese industrial standard (JIS).

We think that one of factors of this technology field's spread is the low cost implementing a Verification Testing. Typically, Endurance Test costs about ¥ 800,000 - 1,000,000 (approx. $10,000 - 125,000) each product. However, by testing some products together at the same time, we come to be able to save the cost.

Also, easy introduction of technologies contributes to the spread of this technology field. Specifically, technologies in this technology field can be applied to the existing constructions and we can choose the part to the construction (only the openings and roofs), not to be limited to all the part.

And we think that the development of products, CRRC (http://www.coolroofs.org/) has initiated the study of the cool roofs in 1997, has contributed to this technology field's spread.