Heat Exchange Paint

Tough-Coat

D－42

D－47

Summary

- Energy Saving

  ◇ Reduces temperature of non air-conditioned rooms (improving living-space quality)

  ◇ Substitution to smaller capacity air-conditioning equipment (reduced energy related capital costs)

  ◇ Air-conditioning energy reduction (reduced energy related operating costs)）

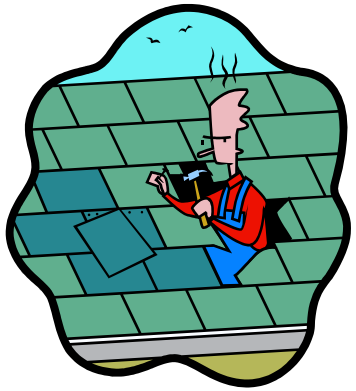
- Reduced Thermal Expansion

  ◇ Reduction of structual stress caused by thermal expansion

  ◇ Reduced calking and sealing of gaps due to reduced thermal expansion

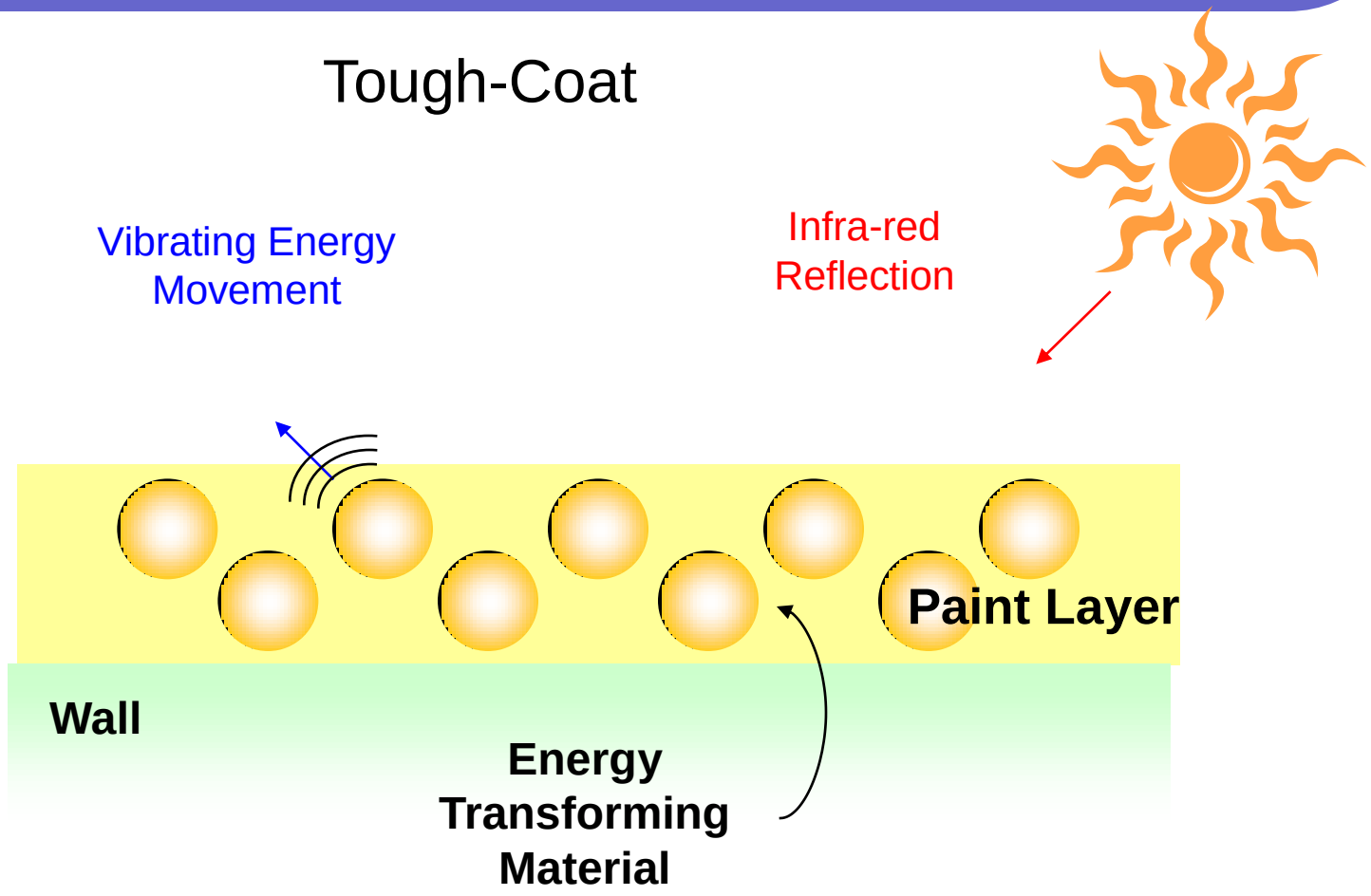
Functions & Features

- Tough coat does not have the surface blemishes and loss of gloss that characterized previous heat exchange paints

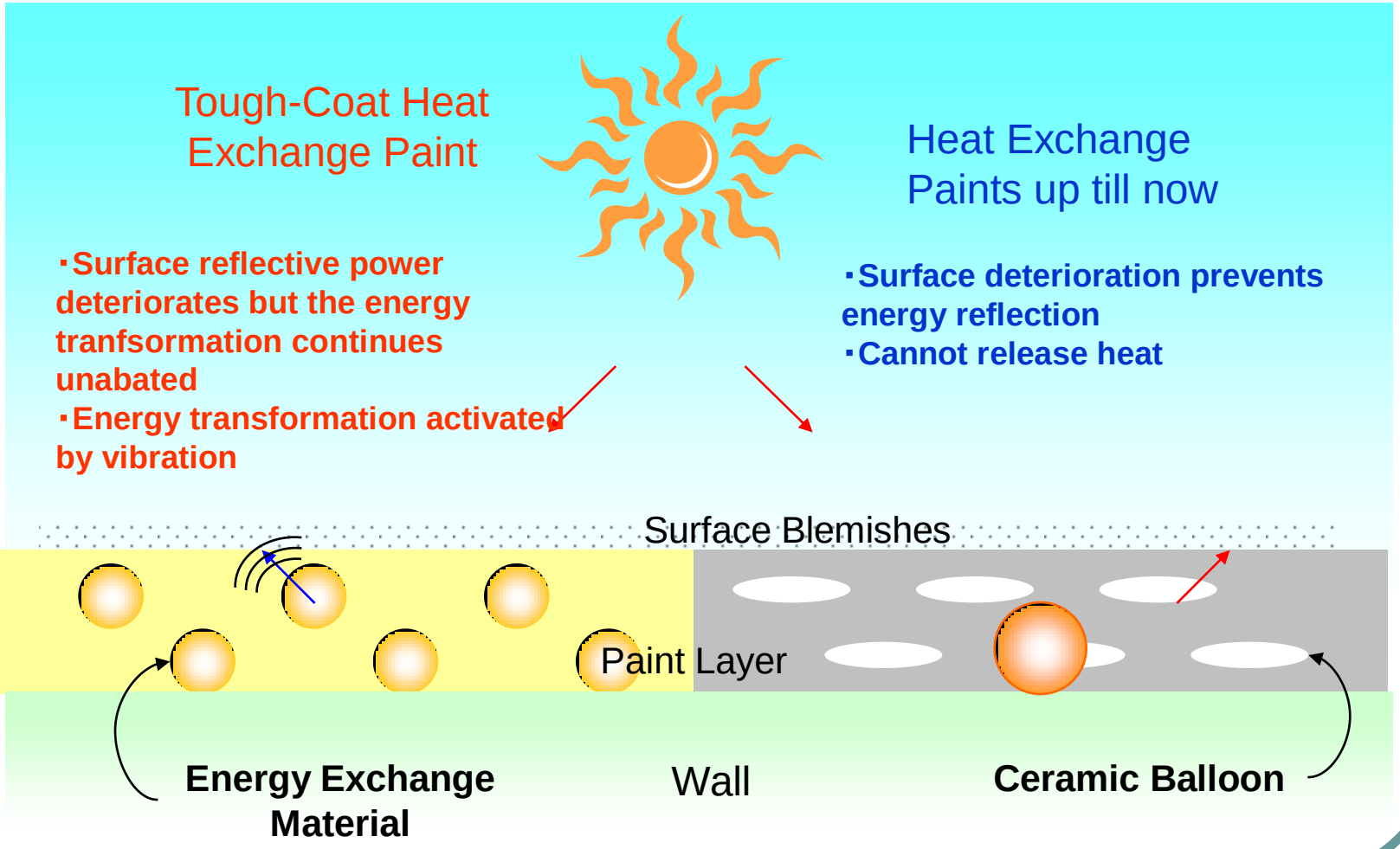


- Summertime room temperatures are reduced when Tough-coat is applied.

Principles of Heat Exchange Paint



Comparing Fundamental Principles with Other Heat Exchange Paints



A Case Study

The case of :Hattori Kogyo K.K.

Kamizaki Government Office: Meeting Room Annex
Heat Exchange Paint: Applicaton Report

- Carried out between:
  2004-8-21 ～ 2004-9-15

- Measurement Locations:
  Roof Surface
  Roof Underside
  Meeting Room Interior and Exterior

- Measurement Instruments:
  Thermo Recorder TR-57C
  Made by T&D Corp.

Before

After

Summary of Temperature Data

Date	Roof Top	Roof Under-side	Ambient Temp	Room	Date	Roof Top	Roof Under-side	Ambient	Room
	55.0	39.4	32.8	36.8	08月31日	28.4	35.0	35.2	35.6
08月22日	53.2	36.2	32.1	34.8	09月01日	25.5	27.6	27.9	28.6
08月23日	70.0	40.6	35.4	38.5	09月02日	31.6	32.2	30.7	32.5
08月24日	71.7	37.9	34.3	24.3	09月03日	36.4	33.3	33.9	33.5
08月25日	60.6	39.1	35.0	35.3	09月04日	35.4	31.7	31.8	32.4
08月26日	66.2	41.6	37.6	36.8	09月05日	39.0	33.7	33.8	34.5
08月27日	35.2	35.6	35.6	34.7	09月06日	28.8	28.9	30.4	29.9
08月28日	34.1	34.8	34.8	34.3	09月07日	23.8	26.2	28.4	25.8
08月29日	39.1	32.5	32.8	32.7	09月08日	36.4	30.4	32.7	29.5
08月30日	29.1	29.0	30.2	28.8	09月09日	39.2	31.5	32.0	32.1
					09月10日	23.5	23.5	23.4	24.0
					09月11日	38.0	33.1	35.2	34.3
					09月12日	41.6	36.9	35.9	36.8
					09月13日	44.4	37.2	36.0	36.4
					09月14日	40.0	37.7	36.6	37.5
					09月15日	48.2	38.3	37.3	38.0

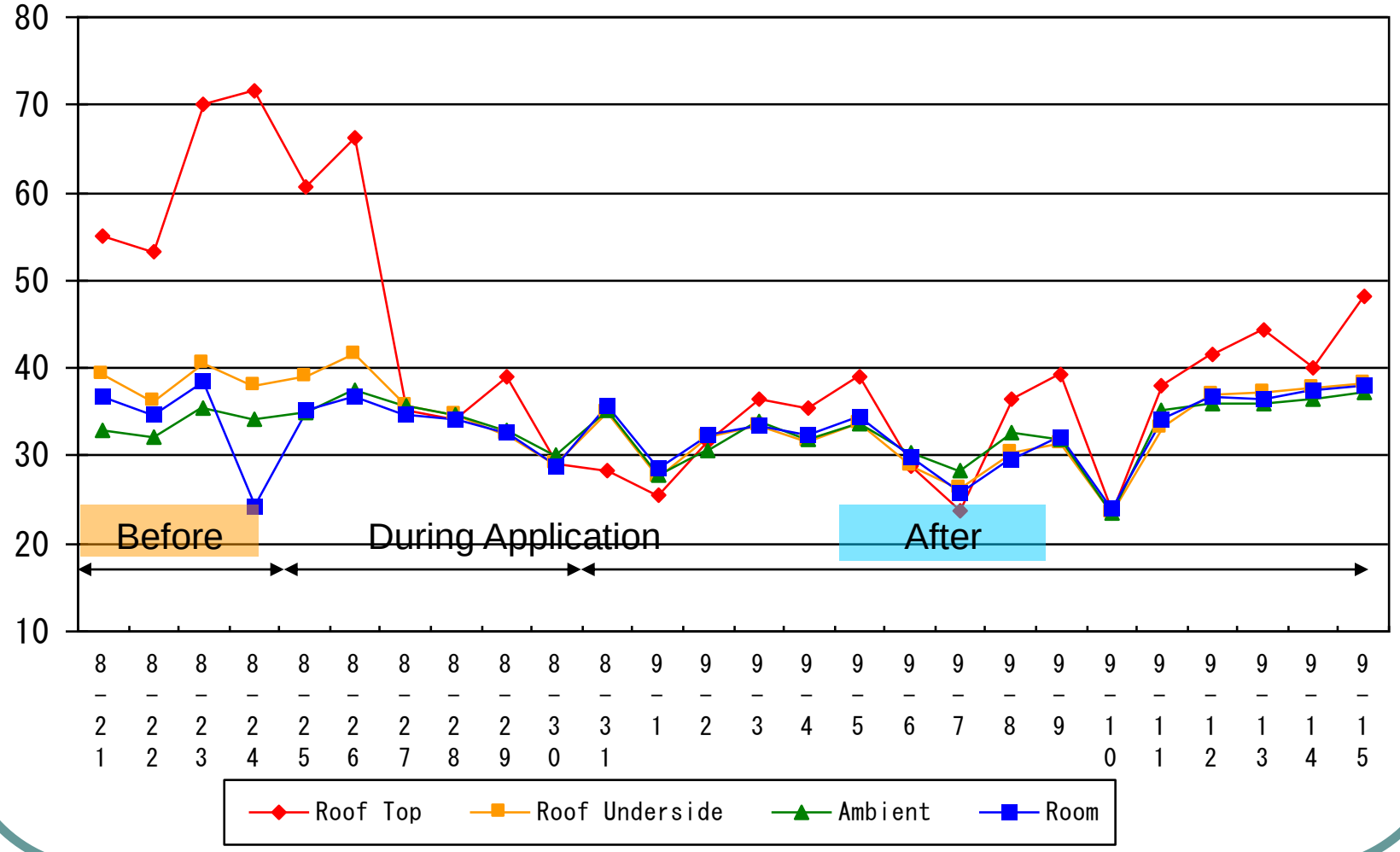
8月21日 ～ 8月26日 Before Application

8月27日 ～ 8月30日 During Application

8月31日 ～ 9月15日 After Application

※ 8月24日の8:00～17:00with Air-conditioning。

Temperature Graph



Summary of Results

Adjusted for: before and after termperatures being identical

Case－１　　８月２１日　Ambient（ｍａｘ）３２．８℃　and
９月　８日　Ambient　３２．７℃　comparison

	Ambient	Rooftop	Roof Underside	Room
８月２１日	３２．８	５５．０	３９．４	３６．８
９月　８日	３２．７	３６．４	３０．４	２９．５
Variance	－	△１８．６	△９．０	△７．３

Case－２　　８月２３日　Ambient（ｍａｘ）３５．４℃　and
９月１１日　Ambient（ｍａｘ）３５．２℃　comparison

	Ambient	Rooftop	Roof Underside	Room
８月２３日	３５．４	７０．０	４０．６	３８．５
９月１１日	３５．２	３８．０	３３．１	３４．３
Variance	－	△３２．０	△　７．５	△　４．２

Conclusion: Rooftop Change at least 18^{o} C, Roof Underside 7^{o} C and Room Temperature 4^{o} C of reduction is observed.

Efficacy Calculations

①Roof Area **118 m^2 Assumed**

②Roof Insulation **No Insulation, (Assuming U.S. standard constant)**
U＝8kcal/m^2・h・℃ assumed。

③Cooling Cost **1kw/USRt.**
USRt=3023kc High Voltage Power 11Yen/kw

④Heat Exchange Paint **Tough-Coat D-42 (Grey)**
0.15kg/m^2 x 2 coats

⑤Calculating Heat Energy **Using 2 hours of data**
Room temperature assumed to be 26° C

Energy-in: kcal/ 2 hours＝
U (insulation constant)×(under-roof temp. – room temp. (26° C)) x 2 hours x roof top temp.

Efficacy Calculation

Comparing Days with similar temperatures before and after application

8/25 compared to 8/31

	Time of measure-ment	Ambient (°C)	Room Temp. Assumed (°C)	Pre-existing Roof Tmp (℃)	Heat Exchange Paint Temp. (℃)	①Energy Absorption by Pre-existing Roof kcal/2h	②Heat Exchange Paint Energy Absorption kcal/2h	Variance ①－②
1	8:00	30.3	26.0	39.7	24.6	25865.6	▲2643.2	28508.8
2	10:00	31.8	26.0	60.3	24.4	64758.4	▲3020.8	67779.2
3	12:00	34.4	26.0	72.7	26.1	88169.6	188.8	87980.8
4	14:00	32.0	26.0	59.1	27.2	62492.8	2265.6	60227.2
5	16:00	32.5	26.0	48.7	27.2	42857.6	2265.6	40592.0
6	18:00	30.0	26.0	34.9	32.6	16803.2	12460.8	4342.4
7	20:00	27.6	26.0	27.5	30.1	2832.0	7740.8	▲4908.8
8	22:00	25.7	26.0	24.0	26.5	▲3776.0	944.0	▲4720.0
9	0:00	25.0	26.0	22.5	25.1	▲6608.0	▲1699.2	▲4908.8
10	2:00	24.8	26.0	22.2	22.8	▲7174.4	▲6041.6	▲1132.8
11	4:00	24.2	26.0	21.6	21.2	▲8307.2	▲9062.4	755.2
12	6:00	23.4	26.0	21.4	20.3	▲8684.8	▲10761.6	2076.8
					Total Heat	269228.8	▲7363.2	276592.0
					KWConversion	89.1	▲2.4	91.5
					Cost Yen/Day	979.7	▲26.8	1006.5

Efficacy Calculation cont.

8月26日　対比　9月15日

	Time of measure-ment	Ambient (°C)	Room Temp. Assumed (°C)	Pre-existing Roof Tmp (°C)	Heat Exchange Paint Temp. (°C)	①Energy Absorption by Pre-existing Roof kcal/2h	②Heat Exchange Paint Energy Absorption kcal/2h	Variance ①－②
13	8:00	27.6	26.0	40.8	32.6	27942.4	12460.8	15481.6
14	10:00	32.4	26.0	60.8	40.9	65702.4	28131.2	37571.2
15	12:00	34.0	26.0	68.9	47.5	80995.2	40592.0	40403.2
16	14:00	37.5	26.0	64.8	46.5	73254.4	38704.0	34550.4
17	16:00	33.2	26.0	49.8	36.9	44934.4	20579.2	24355.2
18	18:00	30.6	26.0	25.5	29.4	▲944.0	6419.2	▲7363.2
19	20:00	28.5	26.0	24.8	25.2	▲2265.6	▲1510.4	▲755.2
20	22:00	26.0	26.0	29.4	24.0	6419.2	▲3776.0	10195.2
21	0:00	25.7	26.0	29.0	24.0	5664.0	▲3776.0	9440.0
22	2:00	25.1	26.0	27.7	23.5	3209.6	▲4720.0	7929.6
23	4:00	23.7	26.0	26.3	23.2	566.4	▲5286.4	5852.8
24	6:00	23.6	26.0	25.1	22.8	▲1699.2	▲6041.6	4342.4
					Total Heat	303779.2	121776.0	182003.2
					KWConversion	100.5	40.3	60.2
					Cost Yen/Day	1105.4	443.1	662.3

Average Cons Cost Yen/Day	834.4
Average Cost Yen/Month	25030.8

Summary of Efficacy Calculations

The preceding data calculated heat absorbed from roofs. Below is a simuluation based on the actual experience of Company M operating a 5100 sq. meter Plasma factory. The values below correspond to the savings Company M realized.

Calculation Summary

Period covered corresponds to the summer season (May to September)

5 months × 30 days ×0.6(daylight proportion)＝90 days

Average consumption cost (Yen/Year) 834 × 90 ≒ 75,060Yen

〈 Roof Area assumed to be 1180㎡(10times) above calculations 〉

Electric bill savings	Yen 750,600
CO_2 Conversion	27 t based on Japan EPA formula: 1 KWH = 0.378 Kg CO_2 Equivalent

Supplement

There is more to feeling “hot” than just room temperature

When you feel hot its not just the temperature but, humidity and radiation energy also affect our perceptions of heat. As the graph below shows, actual room temperature only accounts for 20.7% of our bodily sensation of heat. Humidity accounts for 30.9% and radiation accounts for 43.7%. Other factors constitute the remaining 4.7%

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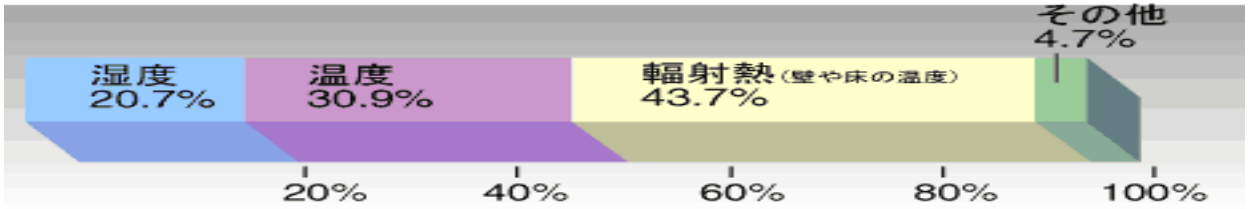

What is radiation?

It is the transfer of heat from object to object arising as a result of the temperature differences between the two bodies. As a result of radiation walls, furniture and objects in our living environment warm up and cool down.
As a result bodily sensation of heat and room temperature can vary.