B-14.2.2 Technology Assessment for Eco-Community Planning

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Abstract

For the reduction of environment impact caused by domestic buildings, the technological innovations are required in planning housing communities for the coming sustainable society. These Eco-energy technologies, however, depend on the natural- and social conditions of each specific communities, such as location, size, climate, lifestyle and so on.

In this research, applicabilities of the innovative eco-energy technologies are discussed and the effect of introduction of them are evaluated. The research consisit of;

1) Survey and categorizing of innovative eco-energy technologies.
2) Studies on necessary social conditions for eco-communities.
3) Simulation of the energy consumption and the urban climate change through the case studies.

Case studies were carried out in redeveloping old high-dense communities in Tokyo. A redeveloping district plan and architectural plans were proposed and innovative eco-energy technologies in several scales were introduced. Finally, the energy consumption in this area were simulated and the effects of reducing environmental impacts were discussed.The simulation showed that 42% of energy saving and 43% reduction of CO2 emission were achieved. Also, simulations of the improvement effect on the micro-urban climate were carried out. The "cool down effects" in the summer time were shown after the redevelopment.

1.A case study of Eco-community in Tokyo

As a proposal for Sustainable Community Regeneration in an urbanized area, it is critically required that an ecological life style should be consistent with a high quality urban life. An ecological life style is supported by environmental conscious structures in both a social and physical sense and in various scales such as building, district and city planning.

Various sizes of mixed use districts are scattered through out the central area of Tokyo. They are mainly occupied with highly dense but low-rise wooden buildings that were originally built as small industrial factories adjacent to houses. The familiar atmosphere and closeness of the communities still exist. On the other hand, these districts have been growing without any planning as a part of the rapid expansion of Greater Tokyo that they have concerns with in case of disasters and environmental problems.There is an urgent need to improve and revitalize these areas taking into considerations regional characteristics, especially the ecological balance of the area.

2. Sustainable renewal and Eco-energy techniques

A sustainable renewal should contribute to form the compact urban structure controlling the unorderly expansion of this urban area. Each renovation is also expected to be a the stimulus to heal the city and to recover its eco-system. The incremental modernization taking into account regional context will promote the recover of an organic ecological balance with the whole city.
The strategies for ecological planning are shown at Table.1.

Table.1. strategies for eco-energy technologies

		scale of application		
target	strategy	site	block	district
(1)increase ecological potentials	site-greening	x		
	roof greening	x		
	wall-greening	x		
	green path		x	x
	water stream		x	x
	biotope		x	x
	klein garten		x	x
	natural park			x
	rain penetration	x	x	x
	composting	x	x	x
(2)improve micro-climate	solar & wind access	x	x	
	wind path		x	x
	land-use control	x	x	x
(3)reduce traffic load	central car parking	x	x	x
	common elec. car	x	x	
	public transport			x
	access to mass tra.		x	x
	bicycle road		x	x
	pedestrian path	x	x	
(4)discover local resource	retrofit buildings	x	x	x
	historical resource	x	x	x
	builders net work	x	x	x
	use local material	x	x	x
	geo-topology	x	x	x
	use rain water	x	x	
	landscape/town scape	x	x	x
(5)reconstruct community	community network	x	x	
	peoples participation	x	x	
	life style	x		
(6)safety from disasters	refuge route	x	x	x
	land use control	x	x	x

Innovate eco-energy technologies are full of variety for scale and purpose. However, the appropriate integration of these technologies depends on the condition of area to be developed and depends on the quality of environment that people want to live in. The appropriate integration for eco-housing on mother earth may be completely different from that for a moon base or for a space ship. The process to find the appropriate integration according to a regional context is essentially important.

3.Simulation and result

A block of the redeveloped area was selected for the simulation analysis . In this block, there are 102 units of dwelling, light-industry factories(floor area:9086 m2) and commercial facilities (1279 m2). Eco-energy systems are planned to be introduced at three stages of redevelopment and the energy consumption at each stage are simulated. The calculated results are compared with the predicted energy consumption of the present condition before redeveloped, then the ratio of energy saving and reduction of CO_2 emission are calculated. The results are shown through Fig.1, Fig.2 and Table.2.

Fig.1 shows the ratio of energy saving at the three stages. 9.2% at the first stage, 21.0% at the second stage and finally at the third stage, 42.2% of energy consumption are reduced. Fig.2 shows the ratio of emitted CO_2 reduction. 9.2% at the first stage, 22.2% at the second stage and finally at the third stage, 43.4% of energy consumption are reduced.

Table.2 shows the contribution of each eco-energy technique individually. This table also shows the techniques which are introduced at each of the three redevelopment stage.

Fig.1 Energy saving at the three stages

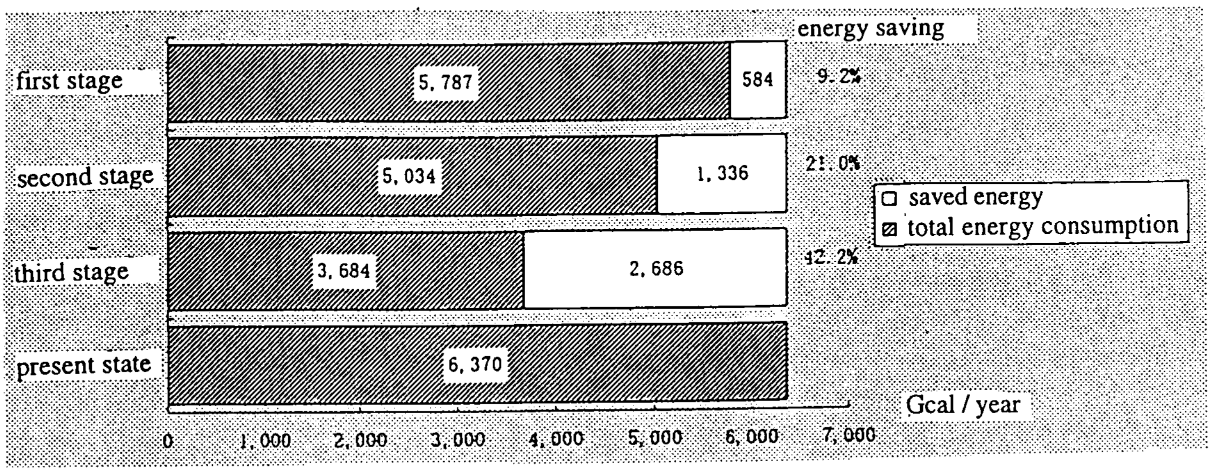

Fig.2 Energy saving at the three stages

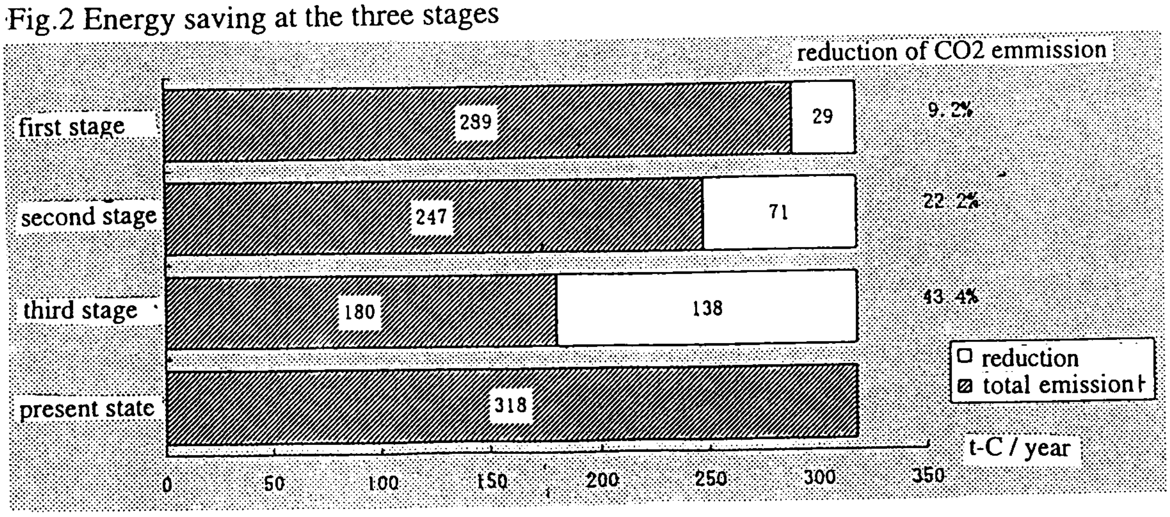

Table.2 contribution of individual eco-energy technique

			energy saving				CO2 reduction	
			electricity	gas	total			
Stage	technique application item		Mwh/Y	KNm3/Y	Gcal/Y	%	t-C/Y	%
Stage 1	housing	passive solar	3.2	10.3	121.0	21	6.3	21
		elec.appliance	55.5	0.0	134.3	23	6.5	22
	commercial	insulation	1.9	13.9	157.5	27	8.2	28
		lighting	70.7	0.0	171.1	29	8.3	28
	total				583.9	100	29.3	100
Stage 2	housing	passive solar	3.2	10.3	121.0	9	6.3	9
		air con.	-12.8	10.3	82.3	6	4.4	6
		condense boiler	0.0	10.3	113.3	8	5.9	8
		elec.appliance	55.5	0.0	134.3	10	6.5	9
		PV	43.2	0.0	104.5	8	5.1	7
	commercial	insulation	1.9	13.9	157.5	12	8.2	12
		massHP	-385.5	112.8	307.9	23	19.0	27
		lighting	70.7	0.0	171.1	13	8.3	12
		PV	59.4	0.0	143.7	11	7.0	10
	total				1335.8	100	70.7	100
Stage 3	housing	passive solar+	10.5	12.3	160.7	6	8.3	6
		air con.+	0.2	8.2	90.7	3	4.7	3
		GWdhwHP	-112.5	46.5	239.3	9	13.3	10
		elec.appliance	74.8	0.0	181.0	7	8.8	6
		PV	130.5	0.0	315.8	12	15.4	11
	commercial	super insulation	3.2	23.8	269.5	10	14.0	10
		GWmassHP	-182.0	102.9	691.5	26	37.4	27
		GWdhwHP	-10.0	4.2	22.0	1	1.2	1
		lighting	176.7	0.0	427.6	16	20.9	15
		PV	118.8	0.0	287.5	11	14.0	10
	total				2685.6	100	138.0	100

some items shows the introduction of the more efficient techniques.
massHP: heat strage type heat pump dhw : domestic hot water GW : gray water PV : photo voltaic