



Analysis of Net-Zero Village Planning Factors to Respond to Climate Change

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Abstract

Recently, abnormal temperatures, floods, and droughts due to climate change have occurred frequently, and the amount of damage is increasing. To respond to this, the world has set a Net Zero goal for 2050 based on the Paris agreement. however, specific implementation plans for this are still insufficient, and most policies are focused on reducing greenhouse gas emissions and installing renewable energy facilities. As scientific evidence suggests that human activities dominate the impact of climate change, we need to focus on villages, the basic spatial unit where human activities take place. To this end, 20 planning factors applicable to Net-Zero villages were derived and can be used to improve the villages living environment and change lifestyles. In addition, if follow-up research is conducted, such as the development of a model that combines planning factors and basic units for each planning factor, a quantitative analysis of Net-Zero village will be possible.

Keywords: Climate change; Net-zero; Mitigation and adaptation; Greenhouse gas

Introduction

Currently, humanity is faced with two paths: Entering the realm of a hot house Earth, where temperatures rise 4 - 5 °C compared to before the industrial era through continuous emissions of greenhouse gases and stabilizing the climate through controlling greenhouse gas emissions [1]. To prevent hot houses from entering the district, it is necessary to significantly reduce greenhouse gas emissions or secure additional sinks that can absorb them, and efforts to balance energy must also be made [2,3]. Response measures to climate change are largely divided into mitigation and adaptation. Mitigation means quantitatively reducing greenhouse gas emissions. This includes reducing greenhouse gas sources or expanding greenhouse gas sinks. Adaptation refers to reducing damage by controlling various risk factors that are currently occurring or expected to occur in the future due to climate change using natural and artificial systems, and further transforming them to be beneficial to our lives. These include raising the river planning flood level, creating buffer green areas along riversides, and diversifying crops in preparation for climate change. The village is a space where these countermeasures occur in complex ways. A village is the basic unit of human life and the smallest unit of a regional group, meaning a place where several houses live together. As it has been scientifically verified that human activities affect climate change, control and change of human activities are necessary to respond to climate change, it is necessary to build a wide range of basic data by conducting various studies that can lead to Net-Zero at the village level. Consequently, a set of applicable planning factors was systematically developed for the creation of a Net-Zero village, as documented within this paper.

Net-Zero Village Planning Factors

Applicable planning factors for creating and improving a Net-Zero village were analyzed as shown in Table 1. It was largely divided into a research section and a case study section and was then investigated in parallel with not only domestic but also overseas studies and cases so that it could be utilized for general purposes. As a result, a total of 28 planning factors were

ISSN: 2578-031X



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Submission: H March 25, 2024 Published: H April 03, 2024

Volume 6 - Issue 5

How to cite this article: Dong Kyu Lee*. Analysis of Net-Zero Village Planning Factors to Respond to Climate Change. Examines Mar Biol Oceanogr. 6(5). EIMBO. 000646. 2024. DOI: 10.31031/EIMBO.2024.06.000646

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derived, and 20 of them were presented as usable when creating a Net-Zero village. When selecting factors, feasibility, quantification, relevance to policy, and measurability were comprehensively considered. In addition, factors that could be included in any one element were excluded. These planning factors can be broadly divided into improving the infrastructure aspects of the village and changing the behavioral patterns of village residents. The creation of carbon forests, green spaces, and solar power facilities can be categorized as factors that improve the living environment while strengthening resident competency education and practicing Net-Zero living can be categorized as factors that can change lifestyles. Meanwhile, suppose carbon absorption and reduction intensity data for each element is established. In that case, it will be possible to predict whether carbon neutrality is possible when applying planning factors at the village spatial level.

Table 1: Planning factors applicable to the Net Zero Villages.

*A: Lee (2003) [4], B: ME (2004) [5], C: Kim (2004) [6], D: Na and Cheon (2007) [7], E: Ban et al. (2008) [8], F: Lee et al. (2009) [9], G: Kim and Lee (2013) [10], H: Kim and Nam (2013) [11], I: Hwang (2011) [12], J: Lee and Kim (2011) [13], K: Park et al. (2019) [14], L: Luo et al.(2015) [15], M: Newton & Rogers (2020) [16], N: Mathur and Awasthi (2016) [17], O: Janssens et al. (2017) [18], P: Voytenko et al. (2015) [19], Q: Davis et al. (2018). R: Dzebo et al. (2018) [21]. S: Damsø et al. (2017) [20], T: Lynso T. (2021) [22], U: Carpino et al. (2020) [23], V: Gils and Simon (2017) [24], W: Noguchi and Kim (2015) [25], X: Jindo-ri, Muju-gun, Y: Janghwa-ri, Ganghwa-gun, Z: Donggoji, Yeoju-si, a: Hongcheon Eco-friendly Energy Town, b: Suncheon Bay Energy Self-Reliance Village, c: Australian Crystal Waters, d: kilhasse, Germany, e: Feltheim, Germany, f: BedZED, England, g: Kapuni, Hawaii, USA, h: Dutch Shunship, i: Author's suggestion, Germany, j: Applicable planning elements, k: Applicable planning factors.

Planning		Previous Research in Korea													Previous Research in Overseas													in	Similar Cases in Overseas								k
A	B	C	D	E	F	G	Н	I	J	К	L	М	N	0	Р	Q	R	S	Т	U	v	W	X	Y	Z	а	b	с	d	e	f	g	h	i			
Maximize use of existing terrain	0	0		0	0			0	0															0		0			0	0							0
Natural river conservation and restoration	0	0	0	0	0			0				0																									0
Restoration and improvement of surrounding forests									0																				0								0
Minimize damage to green areas and topsoil	0	0	0	0	0																			0		0				0							
Creating a carbon forest						0		0	0	0				0													0										0
Wetland creation																																				0	0
Greening (walls, rooftops, idle land, etc.,)							0	0	0	0				0																			0				0
Use of waste composting toilets	0	0	0	0	0																			0	0				0	0				0	0		
Rainwater reuse								0	0	0			0	0						0									0			0		0			0
Biogasification of livestock manure						0			0																		0				0			0	0		
Utilization of renewable energy	0	0	0	0	0			0	0	0	0	0		0			0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Bio-char																																				0	0
Plant-MFC																																				0	0
RE100 Smart farm																																		0		0	0

Sources: Rewritten by the author referring to Lee (2022) [26].

Use of environmentally friendly building materials	0	0	0	0	0		0		0											0	0				0	0		0	0			
Use of energy- saving building materials			0	0	0		0		0				0							0				0		0		0	0			
Use of building insulation materials		0	0	0	0				0				0							0	0			0					0			
Installation of high-efficiency heating facilities		0	0		0				0				0													0			0			
Zero energy house remodeling (passive)																	0					0										0
Village public electric vehicle							0		0									0										0				0
Bike path network									0							0												0				0
Eco-friendly farming	0	0			0							0			0					0	0	0			0			0		0		0
Ecotourism and Rural Experience		0			0			0												0	0	0	0	0	0		0				0	0
Village joint profit project										0										0	0	0	0				0			0		0
Village council operation	0	0			0			0		0				0	0						0	0			0	0	0	0		0		0
Resident capacity building training		0			0	0								0						0	0	0				0						0
Practice the Net- Zero lifestyle					0							0			0		0		0													0
Practicing electrical energy conservation		0	0		0						0									0					0	0						0

Conclusion

Climate change is continuously worsening due to various human activities, and as it is recognized as a climate crisis beyond climate change, it is a task of the times that requires a global response. To this end, Net-Zero village planning factors were presented to be used as a climate change response plan. This can be used as a way to reduce and alleviate climate change, and above all, it is significant in that it can implement Net-Zero based on the village, which is the living unit of residents. It is necessary to prepare detailed plans to implement Net-Zero by conducting follow-up research, such as deriving the basic unit of the 20 planning factors presented in this paper and developing a Net-Zero village model incorporating planning factors.

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