

Basic Research on the Environmentally Friendly Component Technologies through Green Remodeling

Ryu, Ri¹, Janghoo Seo^{2,1}, Yongseong Kim^{2,2}

¹ The Graduate School of Techno Design, Kookmin University, Jeongneung-dong, Seongbuk-gu, Seoul, 136-702, KOREA

² The Graduate School of Techno Design, Kookmin University, Jeongneung-dong, Seongbuk-gu, Seoul, 136-702, KOREA
ri23414@hanmail.net¹, seojh@kookmin.ac.kr^{2,1}, yongkim@kookmin.ac.kr^{2,2}

Abstract. Remodeling is emerging as a new alternative for the construction market with various policy supports along with positive reactions to its effects, such as reducing costs compared to new construction as well as saving resources and protecting the environment by reusing frameworks and some finishes. Thus, the purpose of this study is to provide basic data for the reduction of energy use in buildings when planning green remodeling by analyzing environmentally friendly component technologies in examples of green modeling.

Keywords: Green Remodeling, Remodeling, Passive System, environmentally friendly construction.

1 Introduction

High-level investments in construction have continued in Korea based on advanced growth since the 1970s, which led to massive accumulation of inventories of housing and regular buildings. Recently, these buildings have become obsolete, resulting in an increased interest in remodeling. Remodeling is emerging as a new alternative for the construction market with various policy supports along with positive reactions to its effects, such as reducing costs compared to new construction as well as saving resources and protecting the environment by reusing frameworks and some finishes. Thus, the purpose of this study is to provide basic data for the reduction of energy use in buildings when planning green remodeling by analyzing environmentally friendly component technologies in examples of green modeling.

2 Concept and Method of Green Remodeling

Green remodeling is defined as “a building planned to minimize damage to the environment until its life span is over and it is demolished, after designing, constructing and maintaining it in an environmentally friendly manner by applying

energy reduction technology,” in order to build an environmentally friendly building in addition to remodeling, which is an act of major repair or partial extension of a building to control obsolescence and improve functions. Green remodeling can be classified as shown in Table 1 according to the elements of construction planning.

Table 1. Method of Green Remodeling Implementing Environmentally Friendly Construction Concept [1].

Overview	Plan
Site planning	<ul style="list-style-type: none"> - Block planning using natural energy such as solar radiation and wind - Consideration of surrounding buildings and accessibility of the building - Plan to retrieve and treat wastes generated during construction
Energy source	<ul style="list-style-type: none"> - Use of natural energy such as solar heat, wind power and subterranean heat; reduction of energy using thermal storage - Use of natural gas as energy source
Remodeling of the building's envelope and interior space	<ul style="list-style-type: none"> - Use of natural draft and lighting, improvement of quality of indoor air environment - Energy efficiency/high insulation - Harmony with surrounding environment - Use of materials that can be recycled and reused
Remodeling of machine equipment	<ul style="list-style-type: none"> - Selection of individual air conditioning instead of centralized control - Use of high-efficiency equipment and lighting devices - Planning of equipment to reduce water consumption - Sufficient ventilation and consideration of the quality of indoor air environment to ensure health and amenity of occupants - Reuse of heat recovery system and waste heat
Selection of construction materials and products	<ul style="list-style-type: none"> - Selection of OA and home appliances with high energy efficiency - Use of construction materials with low embodied energy required for production, transport and use of products - Use of construction materials with few pernicious ingredients - Use of recyclable and renewable materials - Use of products with low impact on the environment in the process of disposal
Maintenance and control method	<ul style="list-style-type: none"> - Technology to maintain and manage improved building performance - Application of system to control and monitor energy consumption - Collection of recyclables and separation processing of organic wastes

3 Environmentally Friendly Component Technologies in Green Modeling

When planning a building that saves energy and is friendly to the environment in green modeling, it is necessary to make a proper prearranged plan that includes use of energy sources, remodeling of the building's envelope and interior space, remodeling of machine equipment, selection of construction materials and products, and maintenance and control method. The component technologies of buildings for green remodeling that minimized energy load are as shown in Table 2.

Table 2. Environmentally Friendly Component Technologies in Green Modeling.

Component	Feature
Heat gain and heat cutout	- This technology reduces heating load by inducing solar radiation inside the building in winter, and directly gains radiation by absorbing it through the window and reducing heating and illumination load. - It maintains natural lighting and ventilation while reducing heat gain of the building through solar control as well as cooling load in summer.
Insulation	- Air tightness is required to reduce consumption of cooling/heating energy and control infiltration and noise by securing air tightness in the gaps of the building.
Air tightness of windows	- It saves energy by blocking cold air current around the window through the application of system window that secured high-performance glass and air tightness, and prevents thermal displeasure that may be felt on the envelope such as condensation generated by the temperature gap between indoors and outdoors.
Prevention of heat bridge	- Thermal environment is improved by preventing the heat bridge in the building, and unnecessary use of cooling/heating energy and generation of condensation are minimized.
Ventilation	- The ventilation method using natural air buoyancy and wind power improves indoor air quality of the building and reduce cooling load in summer, and maximizes indoor ventilation effect in summer by inducing cross ventilation in the form of facing an opening of the building.
Natural lighting	- Direction and size of the window are adjusted suitably, and colors with high reflectivity are applied on the walls and ceilings to bring external sunlight indoors and reduce indoor uniformity factor and lighting energy.
Interior finishing materials	- Environmentally friendly indoor finishing materials are used to reduce harmful chemicals discharged from materials into the air.
Building greening	- Building greening refers to creating a greening system to sustain the growth of plants on the roof or the walls, and it may produce various effects such as reduction of heat island phenomenon, purification of river water quality, and reduction of noise.
Maintenance	- Energy simulation and actual energy use are compared to determine the problems of the building, and mock tests are conducted through various repair and maintenance simulations to seek ways to save time and cost and control adequately.
Energy production (use of renewable energy)	- Dependence on primary energy can be reduced by reusing electric energy that had been used in the previous building without having to use fossil fuels.
Resource recycling	- This method reduces energy used in treatment and transfer of water by recycling water resources, while also seeking environmental improvement through purification and establishing infrastructures for rainwater catchment. It also recycles rainwater collected in rainwater storage tank into cleaning and landscaping water, or creates a pond to use as a biotic habitat.
High-efficiency equipment	- This method contributes to energy saving and environmental preservation by replacing obsolete equipment of the previous building with high-efficiency energy-saving equipment.
Reuse of waste	- It is possible to minimize environmental destruction and waste of resources and reduce construction costs by fundamentally classifying the waste materials through the preparation of a floor plan for demolition.

As a result of analyzing Table 2, green remodeling methods can be categorized into methods to save energy, use natural and waste energy, save water resources, improve indoor amenity, preserve natural ecology and be friendly to the natural environment, and use environmentally friendly construction materials.

4 Conclusion

Through literature review, this study determined definition of remodeling as well as the concept and application of green remodeling. Green remodeling is improving the performance of existing buildings that require improvement of energy performance and efficiency to build environmentally friendly buildings. By enhancing the structural, functional, aesthetic and environmental performance of the previous building as well as environmental or energy performance, green remodeling contributes to the improvement of productivity, amenity and health of the occupants while also reducing indoor energy use. Energy-saving remodeling is considered an important element in excessive energy consuming buildings. Based on the case analysis of current green remodeling buildings, it is necessary to prove the applicability and validity of indoor energy saving based on environmentally friendly component technologies that are applied in planning.

References

1. Jong-Hwan Kim, A study on a green remodeling system activation plan for the business building, Master's thesis, Hanyang university Graduation school, p7-10(2004)
2. On-Gu Lee, International Green Remodeling Practices and skill levels, Journal of the Korea Green Building Council Fall Conference lecture, Korea Green Building Council, p20-27(2001)
3. Republic of Korea Competition Green Building (<http://www.green2014.or.kr>)
4. Yeong-Sik Park, A Study on the Propriety analysis of Office building as Remodeling Business: Focused on the large sized office building in Seoul area, Master's thesis, Graduation school of Konkuk university of Real Estate studies, p5-24 (2001)
5. Yo-Seon Yun, A study on the development of the building design indicator for green-remodeling, Master's thesis, Graduation School of KongJu University (2014)
6. Ki - Tae Kim, Study on Examples of Reducing Energy Consumption through Green Remodeling of Public Offices, The Korean Solar Energy Society, (2013)