

Dynamic Modeling of the Green Building Movement in the U.S.: Strategies to Reduce Carbon Footprint of Residential Building Stock

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Abstract : The U.S. buildings consume significant amount of energy and natural resources and they are responsible for approximately 40 % of the greenhouse gases emitted in the United States. Awareness of these environmental impacts paved the way for the adoption of green building movement. The green building movement is a rapidly increasing trend. Green Construction market has generated \$173 billion dollars in GDP, supported over 2.4 million jobs, and provided \$123 billion dollars in labor earnings. The number of LEED certified buildings is projected to be almost half of the all new, nonresidential buildings by 2015. National Science and Technology Council (NSTC) aims to increase number of net-zero energy buildings (NZB). The ultimate goal is to have all commercial NZB by 2050 in the US (NSTC 2008). Green Building Initiative (GBI) became the first green building organization that is accredited by American National Standards Institute (ANSI), which will also boost number of green buildings certified by Green Globes. However, there is much less focus on greening the residential buildings, although the environmental impacts of existing residential buildings are more than that of commercial buildings. In this regard, current research aims to model the residential green building movement with a dynamic model approach and assess the possible strategies to stabilize the carbon footprint of the U.S. residential building stock. Three aspects of sustainable development are considered in policy making, namely: high performance green building (HPGB) construction, NZB construction and building retrofitting. 19 different policy options are proposed and analyzed. Results of this study explored that increasing the construction rate of HPGBs or NZBs is not a sufficient policy to stabilize the carbon footprint of the residential buildings. Energy efficient building retrofitting options are found to be more effective strategies than increasing HPGBs and NZBs construction. Also, significance of shifting to renewable energy sources for electricity generation is stressed.

Keywords : green building movement, residential buildings, carbon footprint, system dynamics

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