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Sustainable Housing

Short communication

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Author Details

*Joseph Laquatra PhD**

Cornell University, USA

*Corresponding author

Joseph Laquatra PhD, Cornell University, USA

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Short Communication

Sustainability is a term that refers to the use of resources by the current generation that does not reduce their availability for future generations and does not contribute to climate change. Thus, a community or society that practices sustainability can continue to do what it has been doing forever. However, current practices in many countries, including the U.S., are not sustainable. Given the increasing global population, the currently expanding global economy, and thus the increasing global demand for resources, ways to imitate natural systems are optimally implemented when all resources are used in a process, there is no waste material, and the carbon footprint is minimized. In such a system, materials are constantly recycled, and they serve as inputs to the human economy or nourishment to the ecosystem, thus ending the linear process currently used for material acquisition and use. This article covers various aspects of sustainable housing, including waste management at the construction site, energy efficiency, the use of renewable energy, and green building.

Waste Management

Building a single family home in the United States typically produces between three to five pounds of waste per square foot. Costs of disposing this waste are mounting throughout the country, and environmental aspects of this issue are receiving heightened scrutiny. Although research on this topic has shown that 80 percent of waste generated during the construction of a home can be recycled [1], less than 30 percent actually is [2]. This is likely to change as state and local government regulations of construction waste increase, with some mandating waste recycling. In addition, builders who participate in green building programs are learning that reducing the amount of waste generated during construction, and recycling waste that is produced, earns points toward certification.

As green building practices become more commonplace, construction site waste management practices will become routine. Builders can distinguish themselves from their competitors by becoming familiar with waste minimization now. As they continue in such efforts, their knowledge and skills in the area will increase and their profit margins will most likely improve. Construction site waste recycling is now mandated in some municipalities in the U.S. and Europe, which is a likely indicator of a long-term trend.

Energy Efficiency

Home energy consumption is a key component of one's overall housing expenditure. Partially owing to its volatile nature, home energy usage comprises a significant portion of one's household budget, especially for low-income families [3]. Meanwhile, recent data trends seem to show energy costs rising relative to general inflation in the long term [4]. As a result, retrofitting one's home or installing energy-efficient features seem to make logical sense for the consumer acting as a rational economic decision maker. Factors that influence space conditioning of a home include the preferences and behavior of its occupants, within the constraints imposed by characteristics of the structure itself [5]. In U.S. housing markets, before the advent of artificially low-priced fossil fuels, space heating and cooling considerations comprised a starting point in the design process [6]. Distortions induced by policies of regulation and control in the energy supply industries kept fossil-fuel prices below their replacement costs, and created little incentive for energy conservation [7]. However, the economic shocks that resulted from the rapid escalation of energy prices during the 1970s highlighted the low levels of thermal integrity designed into most of America's housing stock. The savings potential from conservation retrofits in existing units and better design of new units was recognized, and spurred policy makers at federal and state levels to create incentives for such actions. In spite of these incentives, actual conservation of energy has lagged behind its potential [8]. Although the technology exists to improve dramatically the efficiency with which energy resources are consumed in the residential sector, its adoption faces barriers in local housing markets.

Sorrell, O'Malley, Schleich, and Scott [9] described barriers to energy efficiency in new construction. These include imperfect information, which affects both builders and buyers because of specialized building techniques that are still unfamiliar in spite of the massive amounts of research and demonstration related to energy-efficient construction. Laquatra [10] discussed this particular barrier as a result of the lack of building-science instruction in curricula related to construction management, architecture, engineering, and other fields. Sorrell, et al. (2004) also cite other barriers to energy efficiency in new construction as agency problems, specifically the moral hazard that arises when actions of one party in a contractual relationship cannot be observed by another party. They give as examples "equivalent to" clauses in a contract that allow for cheaper building materials and the lack of building commissioning after construction. These authors also mention the problem of the split incentive that occurs when designers, builders, and others involved in the construction of a building have no long-term interests in the operations of a building. This has long been a problem in the rental housing sector [11]. Sorrell, et al. (2004) also cite barriers to energy-efficient housing as bounded rationality. This refers to the time and resources that are required to obtain information and limits that occur to fully using that information, which results in substituting heuristics for more complete information. An example of this problem is incorrectly sized heating and cooling systems (Sherman & Walker, 2011). Jaffe and Stavins [12] also cite transaction costs and buyer uncertainty as hurdles that prevent energy-efficient measures from occurring.

Another barrier to residential energy efficiency is the rebound effect, which is described as an increase in consumption that occurs after energy-efficiency improvements are made because of the reduced cost of energy services [13]. Galvin (2015) describes rebound effects in residential home heating as "…elasticities, energy performance gaps, or fuel savings shortfalls." (p. 28). Herring and Roy [14] recommend increased regulation and taxation to counter the rebound effect. Another solution may be increasing consumer education for a better understanding of environmental benefits of energy efficiency, including a reduction in carbon dioxide emissions [15,16].

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