Abstract

The notion that raw materials for building construction are plentiful and can be extracted “at will” from Earth’s geobiosphere, and that these materials do not undergo any degradation or related deterioration in performance while in use is alarming and entirely inaccurate. For these reasons, a particular building, like an organism or an ecosystem, must seek self-sustenance for that design to prevail in competition with other building designs in a time with limited availability of energy and materials. To this extent, Net Zero Energy (NZE) buildings achieve a net annual energy balance in their operations. However, approaching an NZE building goal based on current definitions is flawed for two principal reasons (1) NZE only deals with the energy required for operations and related emissions (2) it does not establish a threshold which ensures that buildings are optimized for reduced consumption before renewable systems are integrated to obtain an energy balance. This paper develops a method to maximize renewable resource use through emergy (spelled with an “m”) analysis to close the gap between current approaches to environmental building design and the over-arching goal of creating buildings that contribute to a sustainable relationship between human activities and the geobiosphere. This paper proposes using a “Renewable Emergy Balance” (REB) in environmental building design as a tool to maximize renewable resource use through disinvestment of all non-renewable resources that may be substituted with renewable resources. REB buildings attain a high standing by optimizing building construction over their entire life-span from formation-extraction-manufacturing to maintenance and operation.

Net Zero Energy; Emergy analysis; Renewable Substitutability; Renewable Emergy Balance; Environmental building design