Relationships Between CO₂ Emissions and Embodied Energy in Building Construction: A Historical Analysis of Taipei

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ABSTRACT

Urban form is one of the key strategies the IPCC AR5 emphasized in attempting to mitigate greenhouse gases in urban areas. Although there is an abundance of research exploring the relationship linking the elements of urban form, energy consumption, and CO₂ emissions on an urban level, little is known in regards to their relationships at the sub-city level. In addition, the energy consumed and the associated CO₂ emissions during the construction of buildings in urban areas have seldom been assessed. To address these two research areas, this paper uses emergy synthesis to evaluate embodied energy storage of different building types according to construction methods and development intensity and assesses the resources consumed and CO₂ emissions during construction processes across urban space. With the city of Taipei as a case study, five building types were classified according to building materials and stories. The spatial distribution of emergy storage embodied in the urban form of Taipei indicates that neighborhoods with higher emergy storage and building CO₂ emission are dominated by six to twelve stories reinforced concrete (RC) buildings. In contrast, the neighborhoods of low urban development dominated by brick buildings and one to five stories reinforced concrete buildings have lower emergy storage in buildings and building CO₂ emission. The results of the spatial distribution of emergy storage and building CO₂ emission are used to discuss the relationship of the intensity distribution ratio, the building types, the daily consumption of CO₂, and the effects of urban spatial planning.

Citation
