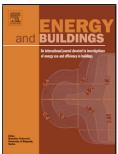
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### ACCEPTED MANUSCRIPT

# Sustainability Evaluation of Buildings in Pre-Use Phase Using Figure of Merit as a New Tool

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#### 12 Abstract

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Built Environment has significant impact on natural environment and construction industry 14 plays a vital role. Assessing the overall energy impact during pre-use phases of a building 15 has been largely neglected. The complex interaction phenomena between the Construction 16 Materials, Embodied Energy footprint and Global warming (CO<sub>2</sub>e) are simplified as 17 interaction between: I1-Construction Materials and Embodied Energy; I2- Embodied 18 Energy and Global Warming; I3- Global warming and Construction materials. These three 19 20 interactions result in the net outcome of a Sustainability Development Index (SDI). A new 'Sustainability Development Index (SDI)' is presented here using the concept of Figure of 21 Merit (FoM), an exclusive non dimensional parameter, accounting for two engineering 22 properties namely modulus of elasticity and density, and two construction industry cost 23 24 stimulants. The proposed SDI is a comprehensive energy assessment model that integrates FoM with other energy indicators and by applying which, sustainability level of a building 25 26 is expressed in terms of sustainability percentage during pre-use phases of a building. The proposed Sustainability Development Index Model (SDIM) is a preventive approach rather 27 than curative approach and can be applied to buildings, infrastructure projects or renovation 28 projects. Case study building included possesses a sustainability level of 57% as compared 29 to a benchmark project with low energy and is 10% less sustainable as compared to 30 sustainability level computed using embodied energy values. It is also found that, concrete, 31 32 steel and formwork contribute significantly to global warming within a building system. This prior knowledge about building's sustainability remarkably helps in mitigating global 33 warming. 34

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