COMPARISONS OF BUILDING ENERGY AND COST EQUIVALENCE: AN ANALYSIS OF THIRTY MELBOURNE CASE STUDIES

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Abstract
This study investigates the energy and cost performance of 30 recent buildings in Melbourne, Australia. Commonly, building design decisions are based on issues pertaining to construction cost, and consideration of energy performance is made only within the context of the initial project budget. Even where energy is elevated to more importance, operating energy is seen as the focus and embodied energy is nearly always ignored. For the first time, a large sample of buildings has been assembled and analyzed to improve the understanding of both energy and cost performance over their full life cycle. The data was obtained from capital costs provided by Davis Langdon Australia and the application of modelling tools for embodied energy, operating energy and operating costs over a 100-year time horizon. The aim of this paper is to determine typical equivalence periods for embodied energy vs. operating energy, and capital cost vs. operating cost across a range of building functional types. Discounting is advocated as an appropriate mechanism for comparative energy studies but for different reasons than commonly employed in comparative cost studies. The conclusion is that, when discounting of energy flows at 5% per annum is introduced, the energy equivalence period increases from 14 to 28 years, placing more emphasis on initial embodied energy. Mean cost equivalence is shown to be 2.26 more than mean energy equivalence, although at a 5% discount rate nearly half of the projects never reach cost equivalence (operating cost exceeding capital cost), even when measured over a 100-year time horizon.

Keywords
energy equivalence, cost equivalence, discounting, Melbourne buildings

INTRODUCTION

Energy has become a significant issue worldwide. Greenhouse gas emissions (GGE) and the perceived threat of climate change (caused by phenomena such as global warming and ozone depletion) is identified by Beggs (2002; p.10) as driving, “more than any other issue”, change in energy consumption attitudes. Since the energy crisis of the mid-1970s, attention has been directed towards strategies that lower operating energy demand (Robertson, 1991) yet it has been only recently that the impact of energy embodied in building materials themselves has come under scrutiny.

Australia has the highest per capita GGE in the world (NAEEEC, 1999; Department of Natural Resources and Environment, 2000; ASEC, 2001). Without targeted and effective action, these emissions are projected to grow by 28% from 1990-2010 (NAEEEC, 1999). Bell and Fawcett (2000) indicate that GGE from the Australian construction industry are substantial and rapidly rising, particularly in the commercial sector. Buildings consume 40%-50% of the energy and 16% of the water used annually worldwide (Lippiatt, 1999; Hoglund, 1992; Lam et al., 1992).