



# Alternative energy technologies in buildings: Stakeholder perceptions

R. Cooke<sup>a,b</sup>, A. Cripps<sup>b</sup>, A. Irwin<sup>c</sup>, M. Kolokotroni<sup>a,\*</sup>

<sup>a</sup>*Mechanical Engineering, School of Engineering and Design, Brunel University, Uxbridge, Middlesex UB8 3PH, UK*

<sup>b</sup>*Buro Happold Consulting Engineers, 17 Newman Street, London W1T 1PD, UK*

<sup>c</sup>*The University of Liverpool, Abercrombie Square, Liverpool L69 7ZG, UK*

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## Abstract

This paper explores the factors affecting the use of alternative energy technologies (AETs) in buildings through the eyes of building project stakeholders. While there are many published lists of incentives and restrictions to using these technologies there are few reports of their impact in practical contexts. The paper reports on the results of a qualitative study of building project stakeholders in the UK—their experience of AETs, the factors that influence assessments and their views on how to improve the chances of using AETs in future projects. The large amount of variation in the importance of drivers and barriers to using AETs between projects is revealed. Despite this variation the emphasis for assessment methods is on financial concerns, largely ignoring more qualitative concerns. This lack of suitable assessment methodologies along with a lack of education, motivation and case-study information in the building industry are restricting the use of AETs in UK building projects.

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## 1. Introduction

Buildings have a large impact on the global environment and building designers and owners play a significant role in shaping present and future environmental impacts [1]. The UK government has targets for reducing environmental impacts, including carbon

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\*Corresponding author. Tel.: +44 0 1895 266 688; fax: +44 0 1895 256 392.

E-mail address: [maria.kolokotroni@brunel.ac.uk](mailto:maria.kolokotroni@brunel.ac.uk) (M. Kolokotroni).

emissions from the generation and use of energy, through the Energy White Paper [2]. They have also applied a climate-change levy on carbon-emitting fuels and support the use of renewable energy through the renewables obligation. However, despite this and other schemes carbon emissions in the UK rose by 1.5% in 2004, with energy consumption rising by 1% [3].

It has been estimated that 45.2% of the total UK energy consumption is from use within buildings [4] generating around 46% of the UK's CO<sub>2</sub> emissions [5]. At present, renewable sources only provide around 1.7% of the UK's total primary energy requirements, with the remainder from fossil fuel or nuclear sources [3]. To meet the UK government's aspiration for a 60% reduction in CO<sub>2</sub> emissions by 2050 [3] buildings need to reduce their reliance on non-renewable energy. One possible method for doing this is to integrate alternative energy technologies (AETs), defined as renewable energy and CHP technologies, into building designs.

There are a number of significant actors in the building process, and each has a role that can influence the chances of using AETs. The present paper investigates the experiences of a range of stakeholders and their perceptions of what factors influence the chances of using AETs most often, what methods are used for assessment and what the building industry can do to help AETs become more commonplace.

## 2. Defining the problem

The increased use of embedded AETs is important because, amongst other drivers [6], they meet UK policies [2], and provide societal, economic, engineering and environmental benefits [7,8]. However, in the UK this need is not being met and this paper looks at why AETs are not being used in building projects and how the building industry can help to rectify this.

The subject of installing AETs in buildings crosses a number of topic boundaries. These technologies and their application are discussed in publications covering the subjects of green buildings, sustainable communities, sustainable construction, sustainable energy, renewable energy, energy efficiency, eco-design, local embedded generation, planning policy and energy policy. Hence, there is a broad range of literature covering the subject of AETs and their role in providing more environmentally friendly buildings.

International research reflects the large and diverse number of barriers to AETs in different contexts:

- Lovins et al. [7] discuss 207 barriers to distributed energy generation.
- In his framework for identifying and addressing barriers to using renewables in developing countries Painuly [9] suggests 40 barrier elements within 7 categories.
- Maldonado and Marquez [10] offer 4 main barrier categories related to use of renewables in Latin America: Market, Technological or R&D, Institutional and Socio-economic.
- Using their framework for analysing innovation, Foxon et al. [11] consider the factors affecting renewable energy in the UK from the evidence of gaps in the innovation chain, listing 4 risk factors and 6 other barriers.

These barriers vary throughout the world, are site and situation specific [12]. They also vary with each technology, and studies have been performed for bioenergy [13], CHP [14]

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