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The role of 'indirect' greenhouse gas emissions in tourism: Assessing the hidden carbon impacts from a holiday package tour

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ABSTRACT

Tourism is a noticeable contributor to global greenhouse gas (GHG) emissions. Existing estimates of tourism's carbon footprint are however incomplete as they fail to holistically assess the additional, 'indirect' carbon requirements. These arise from the non-use phases of a tourism product or service life cycle and can be further magnified by supply chain industries. Under-development of methods for carbon impact assessment in tourism is the primary reason for the omission of 'indirect' GHG emissions. This study develops a new approach for comprehensive appraisal of GHG emissions which incorporates and advances the methodological advantages of existing assessment techniques. It tests the applicability of this approach in tourism by conducting a holistic analysis of a standard holiday package to Portugal, based on the British tourism market. The new approach demonstrates the significance of the 'indirect' GHG emissions in the total carbon footprint from the holiday package, thus emphasising the necessity for more comprehensive future assessments.

1. Introduction

The contribution of the tourism industry to the global carbon footprint is well recognised (United Nations World Tourism Organisation – UNWTO, 2007a) and the necessity to cut its greenhouse gas (GHG) emissions has been emphasised in a number of international agreements, particularly the Djerba Declaration (UNWTO, 2003) and the Davos Declaration (UNWTO, 2007b). To effectively develop and evaluate strategies to mitigate the carbon impacts from tourism requires accurate measurement of the GHG emissions attributed to its specific products and services (Becken and Patterson, 2006; Bode et al., 2003). Reliable carbon footprint assessment methods are required to fulfil this task.

The literature acknowledges the immaturity of existing techniques for environmental assessment of tourism impacts (Collins et al., 2007; Hunter and Shaw, 2007; Lundie et al., 2007; Sonak, 2004). There are relatively few appraisal methods (Schianetz et al., 2007), and the comprehensiveness of the assessments produced is limited (Warnken and Buckley, 1998). The literature underlines the necessity to refine existing and to develop new, more advanced techniques for carbon footprint assessment in tourism (Berners-Lee et al., 2011; Schianetz et al., 2007).

The most significant omission of the current methods for appraising the carbon impacts from tourism is the limited capability to estimate the 'indirect', life cycle-related GHG emissions (Gössling, 2009; Patterson and McDonald, 2004). These stem from the non-use phases of a product or service over its life cycle (Frischknecht et al., 2007) and can be further

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magnified by the breadth and diversity of the tourism supply chain (Lundie et al., 2007; Rosenblum et al., 2000). The non-tourism literature suggests that the magnitude of the 'indirect' carbon footprint can be high (Frischknecht et al., 2007) and this needs to be investigated for tourism products and services requiring the revision of current assessments to extend their scope and account for the 'indirect' carbon footprint.

The goal of this paper is to develop a new method for conducting more holistic carbon impact assessments in tourism. This new method is based on the GHG conversion factors developed by the UK's Department of Environment, Food and Rural Affairs (DEFRA), supplemented with the estimates of the 'indirect' carbon footprint produced by the Life Cycle Assessment (LCA) technique. The development of this new method demonstrates the significance of the 'indirect' GHG emissions in the total carbon footprint from tourism. It is argued that this new, hybrid method represents a more accurate and rigorous approach to carbon impact appraisal in tourism. The paper contributes to the field of transportation policy and practice research by highlighting the important role played by the 'indirect' GHG emissions from the transport element in popular tourism products. Given that transport holds the largest share in the carbon footprint from the tourism industry (Dubois et al., 2011), this has important implications for policy-makers, who are provided with a new, scientifically-grounded tool enabling better understanding of the scope and the magnitude of the GHG emissions from tourism.

2. The 'indirect' carbon footprint from tourism

The 'indirect' environmental requirements are an established topic for research in many industries, such as engineering, manufacturing and energy generation (see, for example, studies by Frischknecht et al., 2007; Lenzen, 1999; Lenzen and Dey, 2000; Lenzen et al., 2003) however these have never been consistently examined in tourism. As Hunter (1995) states, traditionally, the scope and scale of concern in research on tourism environmental impacts have been limited to the 'direct', immediate and tangible effects. However, the necessity of accounting for both the direct and 'indirect' GHG emissions from tourism products and services has been repeatedly emphasised (Gössling, 2009; Hunter, 2002; Patterson and McDonald, 2004). A wide range of non-tourism literature provides evidence of the potentially high contribution of indirect GHG emissions both from leisure transportation and from the energy use in tourist accommodation facilities (Barrett and Scott, 2003; Eriksson et al., 1996; Forsyth and Van Ho, 2008; Frischknecht et al., 2007; König et al., 2007; Lenzen, 1999; Potter, 2003 cited Chapman, 2007; Spielmann et al., 2008).

Efforts have recently been undertaken to bridge the gap in knowledge on the 'indirect' GHG emissions from tourism. The scale and scope of existing research has however been limited to studies conducted on a *macro* scale of national tourism industries (Patterson and McDonald, 2004), leisure sectors of economy (Rosenblum et al., 2000) and a large tourism company (Berners-Lee et al., 2011). Smaller scale research of separate tourism products and services is represented by a limited number of pilot case studies. These have explored the environmental impacts from a weekend break (Filimonau et al., 2011b) and budget hotels (De Camillis et al., 2008; Filimonau et al., 2011a). However, the existing research on the 'indirect' GHG emissions from tourism does not measure the contribution for many types of holiday travel with multiple variations of transportation, accommodation types and tourist activities. Therefore it is necessary to identify the magnitude of the 'indirect' carbon requirements for a broader range of tourism products and services to enable both the more holistic assessment of the total carbon footprint and allow comparative analysis between different tourism products.

2.1. Complexity of the 'indirect' GHG emissions from tourism

The 'indirect' carbon footprint arises from the non-use phases of a product or service life cycle; it is also embodied in the capital goods and infrastructure necessary to extract, transport and refine raw materials, manufacture a product or service, deliver it to a final user, regularly maintain and finally dispose of it (Frischknecht et al., 2007; Lenzen et al., 2003). Together with the carbon impacts from the use phase, these 'indirect' GHG emissions are referred to as the 'life cycle' carbon requirements. Appraising the life cycle-related carbon impacts represents the most holistic measurement of the product or service-specific GHG emissions (Frischknecht et al., 2007).

Given that the 'indirect' carbon footprint is embodied in the non-use phases of a product or service life cycle, accurate identification and appraisal of its magnitude can be difficult (Fay et al., 2000), especially for service industries where the complexity and diversity of the sector further complicates the task (Junnila, 2006a). Hence, the 'indirect' GHG emissions are often referred to as the 'grey' or 'embodied' emissions as they are not always reflected in carbon inventories and usually not addressed by carbon footprint assessment tools (Fay et al., 2000). Given that the 'indirect' carbon requirements are often outside the control of a product or service provider and may even arise in foreign countries, they are also referred to as the 'off-site' carbon impacts (Lenzen et al., 2003).

The situation is further complicated when the 'indirect' GHG emissions from complex tourism products or services, such as holiday package tours, are appraised. The holiday package consists of a number of elements, i.e. transport, accommodation and activities, and each of these elements has 'indirect' carbon emissions embodied in the non-use stages of their life cycle. In turn, some elements of the holiday package may have a number of structural sub-components which further magnifies the scope of the 'indirect' carbon footprint.

In the case of tourism transport, for example, the direct GHG emissions stem from vehicle operation, i.e. fuel combustion in the vehicle's engine (Brand et al., 2013). The 'indirect' carbon impacts arise from the non-operational phases of the fuel life