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Energy services: A conceptual review

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ABSTRACT

It is often stated that people do not desire energy itself but the 'energy services' it provides. Despite its importance, initial searches revealed no obviously dominant definitions of the term 'energy services', and inconsistent illustrative examples. This paper presents the results of a content analysis and literature review which aimed to answer the question: 'what are energy services?'. One hundred and eighty-five articles from the journals *Energy Policy* and *Energy Research and Social Science* containing the term "energy service*" in the title, abstract or keywords were analysed, and additional documents relevant to the concept were identified for review. In total, 27 definitions of 'energy services' were recorded, and 173 separate examples (such as 'space heating' or 'lighting'). Thematic analysis of the definitions revealed a number of recurring themes, such as 'useful energy/work' and the provision of 'benefits' to people. Previous literature suggested the importance of distinguishing between 'energy services' and the 'end services or states' which they help obtain. On the basis of the identified themes, examples and conceptual discussion, the following definition of 'energy services' is proposed: *Energy services are those functions performed using energy which are means to obtain or facilitate desired end services or states.*

1. Introduction

As Hunt & Ryan ([1]: 1) observe: 'Energy practitioners often emphasize that energy is desired not for its own sake, but for the services that it produces, such as space and water heating, cooling, lighting, cooking, etc.' Although 'energy services' are often referred to (and exemplified) in this way, it is surprisingly hard to find widely cited definitions of the term by searching online or in bibliographic databases. Furthermore, even a brief skim of the literature quickly reveals inconsistencies between examples of what constitute energy services that have the potential to muddy the conceptual waters. For example, later on in Hunt & Ryan ([1]: 5) the authors refer to 'thermal comfort or other energy services'. Is thermal comfort the energy service, or space heating and cooling as per the opening quotation? Or are they both?

The aim of this paper is to explore the ways in which the concept of 'energy services' has been interpreted and defined by researchers. This is achieved through a combination of content analysis (CA) and literature review. The final product constitutes a guide to the concept that will make it easier for researchers to communicate with clarity and precision about energy services in the context relevant to them. It also proposes a new definition of energy services based on the analysis and review.

Because the bulk of this paper is concerned with analysis and review of the concept of energy services, the conventional introductory review is replaced here by a detailed conceptual review in a later section. However, some brief contextual details are presented now to set the scene for further discussion. The first mention of the term 'energy service' according to the database Scopus[1] was in a 1955 article on 'Recent developments in the technology of ceramic materials for nuclear energy service' [2]. This immediately highlights the ambiguity of the term (a point that became increasingly evident during the research for this paper), as such a usage is quite different from more recent usage as exemplified in opening paragraph of this section. Fig. 1 shows a Scopus[2] analysis of the number of articles mentioning "energy service*"[3]; and, for comparison, the number of articles mentioning "energy". Energy services are rarely referred to until the early 1990s, when the rate of growth picks up relative to general energy articles. There is a spike of mentions in 2000, which closer inspection suggests is mainly due to an unusually high number of articles in the publication *Natural Gas Week* mentioning energy services companies. From the latter half of the 2000 s the use of the term has grown at a similar rate to

[1] For older articles Scopus can only search titles, abstracts and keywords so there may be earlier occurrences in the bodies of articles.
[2] A bibliographic database, on which more details are included in the next section.
[3] The inclusion of the * wildcard allows the search to capture both "energy service" and "energy services".

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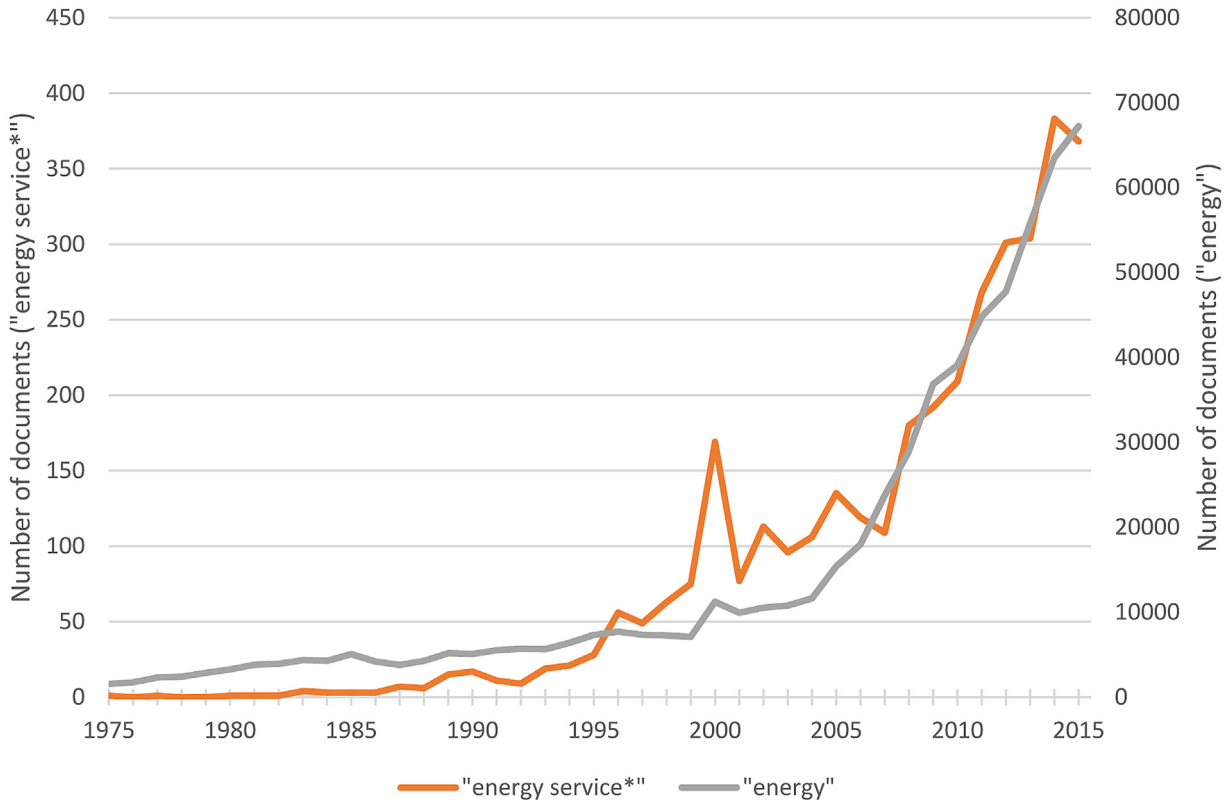

Fig. 1. Scopus analysis of documents mentioning "energy" or "energy service*", limited to sources categorized within the subject 'energy'.

general energy outputs, but as the chart shows, only approximately half a per cent of articles mentioning 'energy' each year explicitly mention energy service(s).

Given the concept of energy services has been around for so long, why is it useful to revisit it now? As well as the inconsistencies in its usage which have become apparent (and are further revealed by the CA presented here), there continues to be increasing recognition of the importance of the demand-side of energy (e.g. see [3]). This is prompted by considerations such as the growing need for demand-side management to make efficient use of existing infrastructure while minimizing costs and carbon emissions. In this case, conceptual clarity around what exactly needs to be managed is important in actually formulating action and research in this area. A brief example of this potential is given in the final section of this paper. Other important issues to which the energy services concept is central include energy poverty, justice and democratization, all of which feature in the subsequent discussion.

As stated previously, a combination of content analysis and literature review is used as the basis for this work. The next section gives an overview of the processes which were followed. Subsequent sections focus on definitions and examples of energy services, a more detailed dive into the literature considering the concept, and a final discussion drawing the strands together and attempting to answer the question: 'what are energy services?'. A concluding section sums up and considers the implications of this work.

2. Content analysis and literature review methods

Content analysis (CA) has be described as 'any technique for making inferences by objectively and systematically identifying specified characteristics of messages' [4]. It involves elements of systematic coding and extraction of content from source material and aims to be objective, transparent and replicable. [5] provides an example of the approach as deployed in the context of energy research. This sub-section describes how the source material sample for this study was arrived at, while the next sub-section outlines the process of coding, extraction and analysis. The final sub-section describes the process by which a wider review of the 'energy services' concept was conducted.

2.1. Search strategy for content analysis

Searches for the content analysis (CA) were performed on Scopus, which describes itself as 'the largest abstract and citation database of peer-reviewed literature: scientific journals, books and conference proceedings'.[4] Employing relevance sampling [6], an initial full-text search was undertaken for any document containing the words "energy service*" (to accommodate the term 'energy services'), yielding 8217 documents. Since this was considered an unnecessarily (and unfeasibly) large pool from which to draw, it was necessary to focus the search to achieve 'a manageable number of relevant texts' ([6]: 119). This could have been done in a variety of ways – by publication date, publication source, or by restricting the search to specific fields such as the title, abstract and keywords.

Restricting by publication date was undesirable since researchers draw on literature of all ages in informing their work, so capturing usage of the term over a long time period is important. The journal with the most articles mentioning the term, according to Scopus, was *Energy Policy* with 445. As well as being the most common destination for outputs mentioning energy services, this journal also has a broad coverage within the field of energy research, with a global scope and taking in all supply and demand sectors, with the latter including social, building, transport and commercial dimensions. It was considered likely

[4] https://www.elsevier.com/solutions/scopus.