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Comparing drivers, barriers, and opportunities of business models for renewable energies: A review

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ABSTRACT

This article systematically reviews the emerging field of research on business models for renewable energies, differentiating between developing and industrialized countries. The key findings on developing countries are as follows: first, there is a lack of quantitative data; second, opportunities are driven primarily by unfulfilled basic needs and micro-finance, whereas corruption and weak electricity grids are the main barriers; and third, business models should be replicable. The key findings on industrialized countries are as follows: first, opportunities are driven primarily by climate change mitigation and energy efficiency improvements; second, stuck thought patterns and high costs of energy storage are important barriers; and third, cooperation is a key in future business models to handle increasing complexity. This review reveals implications for researchers and policy-makers. Promising avenues for future research are the analysis of intermodal business models and opportunities concerning energy self-supply and renewable district heating. Policy-makers are advised to design legal frameworks that account for the global nature of the renewable energy challenge and are simultaneously adapted to regional disparities.

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1. Introduction

Due to globally shrinking public support for renewables and related government subsidies [1], stakeholders in the energy sector can rely to a lesser extent on governmental financial support for renewable energies. As a result, the industry needs to identify new and self-sustaining business models for renewable energies to ensure their ongoing growth [2].

Hence, a new field of research is emerging as scholars increasingly combine the two buzzing areas of renewable energies and business models (see Fig. 1). They apply the business model concept to the energy sector to study business cases and factors fostering or hindering their success. First, some scholars focus on the perspective of certain stakeholders (e.g., [2–6]). For instance, Andersen et al. [3] identified strong governmental support in the form of tax incentives as a key driver for business models for electric vehicles powered by renewable energy. Second, others study business models for single renewable technologies (e.g., [7–10]). Jolly et al. [8] present that photovoltaics provide a strong business opportunity for social entrepreneurs by addressing the worldwide 1.3 billion people without access to electricity. Third, most researchers analyze business models for renewable energies in specific regions ([11–14]). For example, Harish et al. [13] identified low power quality due to voltage fluctuations in rural areas as a critical barrier to business models for renewable energies in India. Analyzing the literature of this emerging field of research shows that the business model concept is a helpful framework to create in-depth insights on the level of single firms, technologies or countries.

However, on a global level, the current research provides a fragmented picture of the topic. Studies often pick single cases or regions to analyze specific situations. A global and structured overview of drivers, barriers and opportunities is missing. Such an overview is important for researchers and policy-makers for designing the right legal and policy frameworks to nourish viable business models for renewable energies. It should account for the global nature of climate change without neglecting regional disparities. Thus, this review focuses on answering the following questions. (1) How do researchers apply the business model concept to the area of renewable energies? (2) Which methodologies and theoretical concepts are applied in connection with research on business models for renewable energies? (3) What are the drivers and barriers for business models for renewable energies, and what are promising opportunities in different regions of the world?

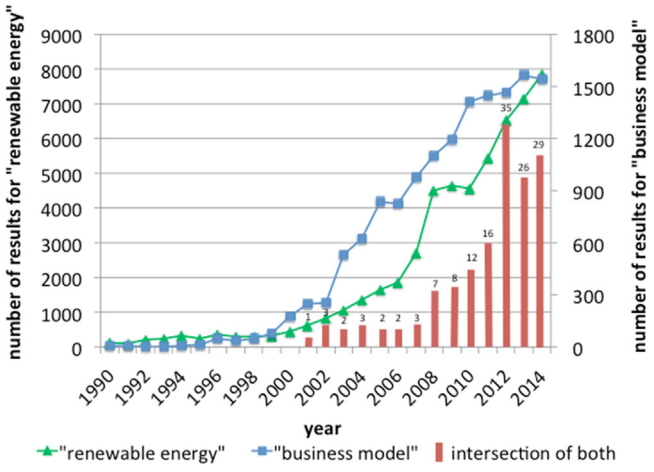

Fig. 1. Results for the search terms “renewable energy”, “business model” and the intersection of both on the database Scopus from 1990-2013.

These goals are accomplished by developing a conceptual framework at the intersection of business models and renewable energies. To build the framework, the authors identified all papers that fit the following criteria: central keywords that describe renewable energies and business models in the title, abstract or keywords of peer-reviewed articles within the scientific database Scopus (see Section 3). The research framework is built by examining and structuring the methodologies, theories and findings of the selected literature according to the following two-level structure: First, the distinction between industrialized and developing countries is identified as the most helpful separator and thus builds the main structuring unit for the entire analysis. It allows for a better understanding of local disparities and global commonalities. Second, the three categories energy, methodology and business model – each comprise of several units of analysis – are identified and complement the developed framework. Finally, this study provides an agenda for future research and highlights important implications for actors in the energy sector, particularly for policy-makers on how to support the emergence of viable business models for renewable energies.

The remainder of this study is organized as follows: Section 2 explicates the exact scope of this review by defining the terms renewable energy and business model. Section 3 explains the applied methodology. Section 4 presents the findings of the systematic literature review and a synthesis of identified drivers, opportunities and barriers for business models for renewable energies. Section 5 summarizes the findings and a future research agenda, in which the authors also formulate their implications for industry players and policy-makers. Section 6 briefly concludes this review.

2. A classification of renewable energies and business models

For a precise understanding of the key research terms of this review, this section provides a short definition and classification of the terms renewable energies and business models.

Renewable energies are well described and defined in several publications. To define renewable energies, the authors refer to the generally accepted definition of the International Energy Agency (IEA): “Renewable energy is derived from natural processes that are replenished constantly. In its various forms, it derives directly or indirectly from the sun, or from heat generated deep within the earth. Included in the definition is energy generated from solar, wind, biofuels, geothermal, hydropower and ocean resources, and biofuels and hydrogen derived from renewable resources” [15, p.11]. To elaborate upon this description, renewable energies are comprised of solar photovoltaic, solar thermal, wind, tide, wave, ocean, solid and liquid biofuel, biogas, geothermal, renewable municipal waste and hydroelectricity. This definition does not include industrial waste and non-renewable municipal waste.

A business model is a widely accepted concept among researchers for analyzing how an organization, be it a multinational company or a new venture, works and what it does to generate and capture value. However, there are many views of how to actually describe and define the business model concept; both academics and practitioners have heavily discussed, developed, and applied it in recent years [see 16,17–22]. In this review of business models for renewable energies, the authors follow the definition of Osterwalder [20], which combines many common definitions. A business model consists of four basic elements: the product, the customer interface, the infrastructure management and the financial aspects. The product describes the area of business and the value proposition the company offers to the market. The customer interface explains which customers are targeted, how the company delivers the product or services and how the customer relationship is maintained. The infrastructure