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The citizen funding: an alternative to finance renewable energy projects

Benjamin Tyl[a]*, Iban Lizarralde[b]

[a]APESA, Pôle Territorial de coopération économique social et environnemental, 40 220 Tarnos, France
[b]ESTIA, Technopole Izarbel, 64210 Bidart, France

* Corresponding author. *E-mail address:* benjamin.tyl@apesa.fr

Abstract

Nowadays, energy transition is a crucial issue to achieve sustainability. Emergent works emphasize the need to shift from a centralized energy production, based on large-scale production unit, to a more distributed one, based on small-scale and flexible production units. Therefore, energy projects cannot be longer dissociated from territories in order to better fit with local specificities. Moreover, such projects do not only focus on energy supply but also provide a variety of services, being closer to the end-user / citizen than traditional energy companies.
The implementation of these territorial energy projects addresses a triple technical, legal and financial challenge, in order to create sustainable value on territories. Indeed, as Product/Service-Systems (PSS), these projects require high investments and the involvement of the future end-user as much as possible. An efficient way to involve the end-user is to allow its participation as a finance provider. This paper focuses on financial challenges and on alternative models to finance renewable energy projects through citizen funding. To do so, we analysed five alternative funding models both on an economic and "end-user/citizen" points of view. Our study underlines the heterogeneity of models in terms of value proposal, citizen involvement, governance or implantation on the territories, and proposes a new classification of these models.

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Keywords: citizen funding; renewable energy; Energy Product Service Systems

1. Introduction

The current objectives of sustainable development require profound changes in our current modes of production and consumption. In the present context of sustainable transition and circular economy, territories (which can be "administrative" territories managed by political entities, or "geographical" territories involving a stakeholder network using, shaping and managing a geographical space [1]) must encourage the emergence of projects with strong environmental and social ambitions while creating value for the end-user and more generally for all associated stakeholders [2].

The PSS concepts is one solution to support such sustainable solutions. It consists on a set of products, services, network and infrastructures closely linked with the end-user and all the value chain [3]. These solutions need a radical change, and all actors involved in the transition toward sustainability must develop technical, methodological, and organizational innovations (economic model, relationship between actors, etc.). [4]

This paper focuses on the transition to sustainable energy systems. While many technological solutions exist in the field of energy: electricity generation (renewable and decentralized technologies, etc.), mobility (electric vehicles, etc.), or distribution (short loop economy), it is clear that these solutions are often complex to be implemented on the territory [5].Two main barriers can be mentioned:

(1) A great difficulty of the current modern economy to take into account environmental and social problems. This difficulty comes from a short-term and profitability thinking, but also from a "centralized value"-oriented logic, that is to say calculation of a project's value in function of a stakeholder, and not in function of the region as a whole. Yildiz [6] underlines that it is complex to finance decentralized renewable energy infrastructures in Germany because public authorities lack

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capital and private investors are “generally averse to restraints such as high transaction costs and risk-return-concerns”.
(2) The lack of cooperation between the different territorial stakeholders, leading to a lack of appropriation of the energy transition. Poize and Rüdinger [7] point out that "citizen and local ownership of projects is an essential factor in the success of the energy transition", whether these projects are initiated by citizens or co-constructed with private stakeholders.

Therefore, even if many sustainable PSS solutions emerged in the energy domain, they must be developed by involving the future end-user as much as possible [3]. Besides, this domain is also characterised by high up-front investments to be made before being launched [8]. One way to finance such projects, involving end-users, is crowdfunding and citizen funding. This approach enables the financing of projects by calling on a large number of people (social networks, friends, etc.) to make the investments. Consequently, this solution is an answer to the barrier previously mentioned as it can be considered as long-term and decentralized investments, supported by a strong collaboration between territorial actors (citizens and project holders).

The energy sector proposes a lot of alternative to develop projects and can be seen as a relevant case study for the PSS research community. Indeed, many observers stress the growing role of citizens founding in the development of renewable and distributed energy systems.

Therefore, in the context of the renewable energy sector, the major objective of this study is to better understand the different models to finance alternative energy solutions involving the citizens, and with a great impact in the territory.

To do so, through the analysis of five French case studies, this paper compares different citizen funding models. Section 2 presents a state of the art about the energy sector and the citizen involvement, section 3 explains the methodology and describes the case studies; section 4 shows the main results of the analysis; and section 5 presents some conclusions.

2. State of the art

In this section, we first analyze some literature concerning Energy related PSS and then we focus on the means to finance energy projects and on the incorporation of citizens in such models.

2.1. Distributed energy systems and Energy related PSS

Energy transition involves the development of innovative approaches to encourage the deployment of local initiatives that, over the long term, will have greater impact on global changes [9]. The energy sector has been widely studied in literature using different terms. Distributed Generation (DG), is defined as “electric power generation within distribution networks or on the customer’s side of the network” [10]. The combination of distributed generation with renewable energy sources (such as the sun, wind, water, biomass and geothermal energy) can be labelled Distributed Renewable Energy (DRE).

Several authors agree that DRE can support decentralised markets and contribute to local economic development by creating employment, introducing new capital and innovation and developing new revenue sources for local communities [11]. Moreover, Sioshansi [12] argued that consumers are concerned by the DRE approach as they have the opportunity to empower themselves by obtaining cheap clean sources of energy and become prosumer (producer and consumer).

Energy Service Companies (ESCos) have also developed PSSs that aim to reduce customer’s consumption by either supplying energy from micro-generation or by providing efficiency measures that cut energy consumption [13,14].

Beyond the renewable energy production systems, Demand Side Management (DSM) has been introduced as a way to modify the curve of consumption. This modification is done by reducing the global consumption or by modifying the load curve. The former appeals to energy efficiency measures and the latter deals with the Demand Response activities [15].

Several PSSs have also emerged aiming at energy efficiency. Companies often propose products that can help the customer reduce its energy cost, complemented by services as energy audit or real time data delivery. Demande Response activities are also closely related to innovative PSSs. In this case, associated services aim to modifying consumers’ consumption curve in order to avoid global consumption peaks or in order to match with the renewable energy production curve [16].

DSM activities are being implemented with the support of new technologies such as metering systems and smart grids. The latter has been described as a disruptive technology as it offers the possibility to develop new PSSs by allowing flow of energy and information in two-directions and by providing a real-time access to usage data. Moreover, it encourages people to move towards distributed generation, promotes energy saving, enables the implementation of new energy services and induce consumers’ demand response [17]. Consequently, the distinction between the role of the supplier and the consumer might be blurred. Smart grids offer more tailored energy services that match with the consumer’s need and extend the relationship with them [18].

2.2. Financing sustainable projects

Banks are particularly cautious about the financing of collective projects in the start-up phase, projects whose governance is collective and not centralized [7]. In the energy sector, fa major impediment to the major penetration of renewable energy is the difficulty of financing the high initial cost of the equipment [6] even though the lifetime cost of the installation usually is highly competitive. Therefore, new models for funding these investments are rapidly growing in the renewable energy market [19].

Emergent literature underlined new sources to finance sustainable projects. Bocken [20] analysed how venture capital can support the development of sustainable projects in order to create positive environmental and social impacts. She underlined the emergence of specific investors, called “pragmatic idealists”, who are looking to help the business development, which are successful in an environmental, social and economical way.

Alternative forms of financing have emerged, based on the participation of the greatest number (crowdfunding), but also bringing citizens into the governance of new companies. This