Zurich, June 15-17 2016
Sustainable Built Environment (SBE) Regional Conference

Expanding Boundaries:
Systems Thinking for the Built Environment

BUSINESS MODEL INNOVATION FOR LOCAL ENERGY MANAGEMENT: A SYSTEMATIC METHODOLOGY

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Abstract
The energy market and its actors are currently exposed to a triple challenge: the undergoing market liberalization, an extremely uncertain regulatory framework, and the increasing market penetration of renewable energy. This challenge is expected to provoke a deep reorganisation of the whole energy sectors. Traditional business models operated by utility companies do not guarantee any more competitiveness in the market. Energy market stakeholders are urged to identify the new business opportunities emerging with the energy transition and how to successfully exploit them. In this perspective, business model innovation has been acknowledged as of strategic importance for the successful deployment of the energy transition. This work contributes to this topic by introducing a systematic approach for the identification, development and assessment of innovative business models tailored on Local Energy Management concepts.

Keywords:
Local Energy Management; Energy Hub; Business models; Business innovation; Distributed generation; Renewable energy

1 INTRODUCTION

The first universal legally binding agreement on climate change recently signed in Paris represents a bridge between in force policies and the objective of climate neutrality by the end of the century [1]. This transition towards a more sustainable and decarbonized global energy system requires a deep reorganization of the energy sector.

The energy market and its actors are currently exposed to a triple challenge [2]: the undergoing market liberalization, an extremely uncertain regulatory framework, and the increasing market penetration of distributed generation.

As a consequence, a term, the energy supply value chain is expected to be deeply impacted [3]. Currently the main actors of the sector, utility companies, are losing market competitiveness and profitability and strive to find appropriate solutions to adapt to the undergoing transition [4] [5]. Many amongst the largest European utilities, among others the German E.ON [6], RWE [7] and EnBW [8], the French EDF [9], the Italian ENEL [10] and the Swiss REPOWER [11], in the last months announced important reorientations of their activities due to the fact that traditional business models do not allow any more to be competitive in the market. The creation of innovative business models is required to exploit the new business opportunities arising with the energy transition[3], [5].

Recently, several scientific works highlighted the emerging major role of business model innovation in supporting the radical change in value proposition and value creation logic required to promote sustainability [12], [13]. In particular, a restricted number of contributions specifically has recently focused on business model innovation within the energy sector. Loock [14] investigated through choice experiments with investment managers the business models that could favour the market penetration of renewable energy. Richter [15] compared the currently used business models for renewable energy and outlined how utilities should invest in business model innovation to increase their

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DOI 10.3218/3774-6_81, ISBN 978-3-7281-3774-6, http://vdf.ch/expanding-boundaries.html

competitiveness. The same author [16], analysing the German case, outlined as utilities tend to fail perceiving photovoltaic based distributed generation as new business opportunities and posited as business model innovation could take advantage by being addressed by newly created entities, external to the main utility company, such as spin off.

However, available research is lacking in the identification of tailored general business models potentially applicable to the energy transition. In this regard, recently the authors [17] [18] introduced a conceptual framework easing the identification of business model patterns best suited for Local Energy Management concepts (LEM) - the management of energy supply, demand and storage within a given geographical area. Building upon this conceptual framework, this work presents a systematic methodology for the identification, development and assessment of business models tailored on LEM concepts.

The paper is organized as follows. In the second section the analytical framework is delineated. Afterwards the proposed methodology is presented and discussed. Finally, in section 4 the conclusions are outlined.

2 ANALYTICAL FRAMEWORK

In this section the analytical framework supporting the methodology described in the next section is defined. In particular, the definition of Local Energy Management and business model concepts considered by the authors are outlined.

2.1 Local Energy Management

Local Energy Management, depicted in *Fig. **1***, can be concisely defined as the management of energy supply, demand and storage within a given geographical area [17]. Purely considering the energy services perspective, the Local Energy Management is an entity guaranteeing, within a limited geographical area and for multiple energy carriers, the energy supply to meet the demand through the optimized management of internal flexibilities and energy market participation. Considering the market perspective, the Local Energy Management is a business, potentially ran by utilities, aggregators, ESCOs or public bodies, connecting consumers, prosumers, and partners (i.e. neighbour Local Energy Management, industry, utilities) to each other and with the wholesale energy market [17]. The value chain of a Local Energy Management can be summarised in 5 steps: the acquisition of customers and partners; the procurement of the infrastructures required to generate and managed the energy services; the operation and control of said infrastructures; the delivery of the energy services; and finally the pricing of said services to customers and partners.

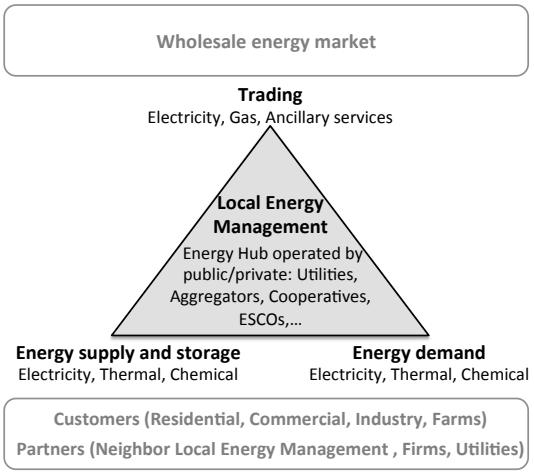

Fig. 1: Local Energy Management concept [17].

2.2 Business models

Business models are attracting more and more interest from the scientific literature. No univocal accepted definition exists. Instead many authors provided general and compatible definitions. Two common coherent definitions widely used in the literature and in particular applied to the energy sector [15], [17], [19] are the one proposed by Gassmann et al. [20], who define the business model as ‘’a unit of analysis to describe how the business of a firm works’’; and Osterwalder et al. [21], who define it as “the rationale of how an organization creates, delivers, and captures value”. Many of the existing definitions, and in particular the ones proposed above, rely on four key elements to fully characterise a business model. Following the naming proposed by Osterwalder et al. [21] these elements are: the value proposition, describing what is offered to the customers; the customer interface, including the characterisation of the target customers; the infrastructures, including all means needed to deliver the value proposition; and finally the revenue streams, explaining how profit is generated.

The flourishing literature on business models feeds the research on business model innovation. Business model innovation is framed in the literature as a discipline supporting the change of value proposition to a customer [13], generally involving the change of the way a business is ran [22], and considering a large number of stakeholders and a broad value-network going well beyond the existing firm perspective [22], [23]. In particular, several works targeted business model innovation for sustainability, which focus on maximising not only economic profit but also societal and environment gains [12], [13], [24]. Recently a comprehensive literature review on this topic has been performed by Bocken et al. [13] to derive a number of business model archetypes promoting sustainability.

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The authors contributed to the topic of business model innovation for sustainability with the development of a conceptual framework supporting business model innovation for Local Energy Management concepts [17], [18].

3 RESULTS AND DISCUSSION

Based on previous scientific works [17] [18] and as a result of the experience acquired in business innovation related collaborations with industrial partners (i.e. mainly including utility companies), a systematic methodology addressing the business model innovation for Local Energy Management has been developed and it is presented hereafter.

The objective of the methodology is to systematically guide potential Local Energy Management stakeholders through the business model innovation process. In particular, the methodology aims on the one hand to enable the assessment of new business opportunities with respect to their market penetration potential; and on the other hand to support the creation of tailored business model concepts considering in an holistic perspective technology, economic and social aspects. The methodology is depicted in its six steps in Figure 2.

I. Identify the intended concept

At first, the intended Local Energy Management concept must be identified. In particular, the intended business idea must be generally delineated with respect to the four key features characterising a business model presented above [21]: the value proposition, the customer interface, the infrastructures, and the revenue streams. Within this step, Stakeholders Analysis and Customer's Pains and Gains Analysis (Osterwalder and Pigneur, Y., 2010) are performed to highlight opportunities and barriers related to the intended concept.

II. Intended concept characterisation

Within the second step the intended concept is systematically characterized with respect to general main determinants defined in a previous work [18] including technical aspects related to the intended Local Energy Management typology, customer socio-demographic aspects, macro-economy and regulatory frameworks related aspects.

The characterisation through general predefined determinants enables to associate the indented concept with the most appropriate portion of the conceptual business model solution space for Local Energy Management defined in a previous work [17].

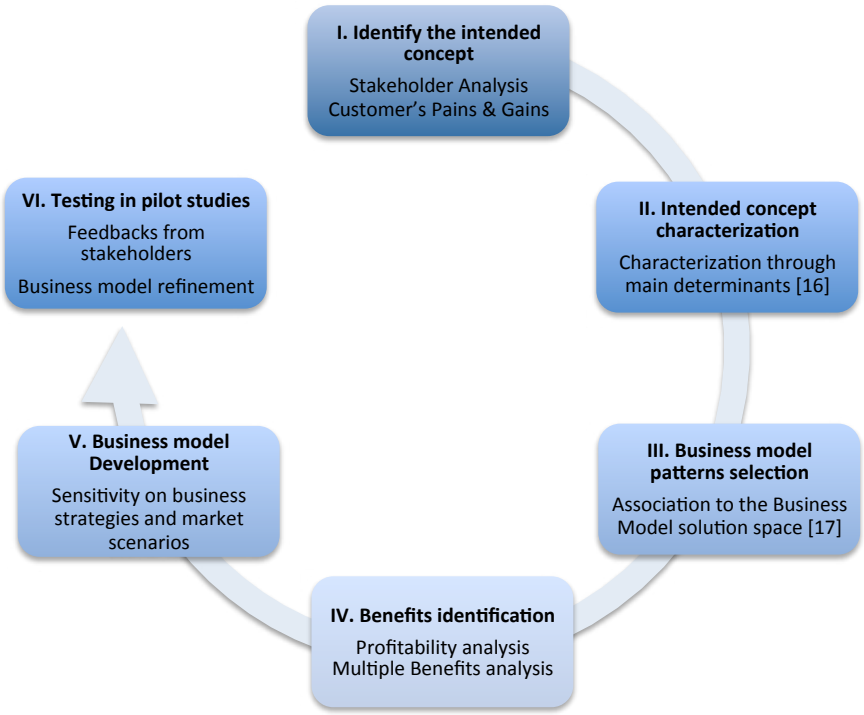

Fig. 2: The systematic methodology for Local Energy Management Business Model Innovation.

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III. Business model pattern selection

The conceptual framework defining the business model solution space [17], comprehensively organises in a structured way the general business model patterns potentially applicable to Local Energy Management. Associating the main determinants characterised in the previous step to the business model solution space, the general business model patterns that are most appropriate to the intended concept can be identified. Each pattern refers to a certain region of the solution space and includes a number of basic business model ideas organised with respect to the Local Energy Management value chain step. The combination of the identified business model ideas is used in step V to create specific business models.

IV. Benefits identification

Within this step, the benefits obtainable from the intended concept are assessed. The benefits are distinguished in two different main categories: the ones directly and the ones indirectly associated to economic profitability.

The benefits belonging to the first category are assessed through the combination of:

- thermo-economic analyses, investigating the trade-off between energy efficiency performance and investment/operating costs of the energy conversion, storage and grid infrastructures required by the intended concept;
- and profitability analyses estimating the value that the intended concept can potentially create within the retail (i.e. the market value of the services provided to the customers) and wholesale energy markets (i.e. the market value obtainable from the valorisation of the internal flexibilities).

The full added value potential of an intended concept must also include all benefits not directly associable to economic profitability. In the scientific literature these benefits are often refer to as multiple benefits or co-benefits [25]. In the Local Energy Management perspectives, multiple benefits analysis aims to capture and assess all additional benefits facilitating the achievement of the objectives of the different involved stakeholders [25], including for instance: emission reduction, improved energy security, improved local air pollution, creation of local employments, avoidance high voltage electricity transmission lines, etc.

The comprehensive assessment of all potential benefits enables to spot all the value creation opportunities associated to the intended concept.

V. Business model development

Combining the information on the business model strategies most suitable to the intended concept (outcome of step III) with the understanding on where and how value is created (outcome of step IV), within step V a range of specific business models tailored on the intended Local Energy Management concept can be designed.

The range of developed business models should address different strategies (i.e. considering several business model archetypes based on the selection performed in step III) and multiple future market scenarios. The direct involvement of a variety of stakeholders is crucial at this stage to capture their preferences through behavioural/preference surveys. This step should lead to the selection of a restricted number of promising business models to be tested in pilot experiments.

VI. Business model development

The final step of the methodology focuses on the implementation in pilot experiments of the newly developed business models. The testing in pilot experiments prior the market implementation is considered essential to validate new business models and refine them based on the feedbacks collected directly in the field from the involved stakeholders [20] [21]. Furthermore, from the pilot experiments useful insights can be derived to define the most appropriate market implementation strategy.

The presented methodology is kept in continuous refinement and evolution through the integration of new analysis approaches as well as the knowledge continuously acquired from stakeholder's preferences investigations.

4 CONCLUSIONS

Business model innovation emerges as a key driver towards the reorganisation of the energy market required to achieve the ambitious goals of the undergoing energy transition. The present work contributes to this topic proposing a systematic methodology for the business model innovation of Local Energy Management - the management of energy supply, demand and storage within a given geographical area. The presented methodology hase been developed based on the outcomes of previous scientific works in this topic and on the experience acquired through business innovation projects carried out in collaboration with industry partners. The six steps methodology aims to support potential stakeholders in a systematic way through the business model innovation process: from the identification and the assessment to the business model development and testing of Local Energy Management related business opportunities.

5 ACKNOWLEDGMENTS

This work has been accomplished in the frame of the Swiss Competence Center for Energy

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DOI 10.3218/3774-6_81, ISBN 978-3-7281-3774-6, http://vdf.ch/expanding-boundaries.html

Research on Future Energy Efficient Buildings & Districts SCCER FEEB&D, funded by The Commission for Technology and Innovation of the Swiss Confederation.

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