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HOW INNOVATIVE BUSINESS MODELS CAN BOOST THE ENERGY EFFICIENT BUILDINGS MARKET

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ABSTRACT

Construction is the single biggest industry in the developed world, at around 13% of Gross Domestic Product, with the greatest environmental impact. There are approximately 190 million buildings in Europe and most of them were built before energy efficiency was a common issue in construction. Accelerating the market uptake of Energy Efficient Building (EEB) projects is crucial and that is where innovative business models (IBM) can play a major role. IBM can support the needed change by reorganizing firms' internal structure and offers, overcoming certain barriers to EEB uptake and aligning with the new business opportunities brought by the need for sustainable and energy efficient buildings. In the frame of the UMBRELLA project, a Europe-wide stakeholders' engagement was undertaken to analyze their understanding of the business model concept and their motivation for energy efficiency, and to determine how to overcome the issue of building value chain fragmentation. This paper relies on concepts of sustainable and energy efficient transition pathways to address how innovative business models can boost the energy efficient market. It highlights

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how the co-evolution of business models with both the wider energy system and the natural environment is responsible for the need of both innovative and sustainable business models, which are necessary for ensuring long- lasting change in the energy efficient building market. The innovative and sustainable characteristics of four business models are presented, according to criteria of functional and product-service systems thinking. The analysis of these elements will allow for further replication and adaptation of these promising models.

Key words: Innovative business models, value creation, energy efficient buildings, market uptake,

Introduction: Barriers to the Energy Efficient Building Market Reveal Building Socio-Technical System Lock-In

The energy efficient building market is faced with a plethora of barriers to widespread uptake; however, a lack of appropriate technologies does not constitute one of these. Energy efficient building technologies already exist and although their initial cost can be higher than their less efficient counterparts, most of these technologies make economic sense when analyzed on a life-cycle cost basis. Despite this proven cost-effective opportunity to reduce energy consumption, a large portion of the potential for energy efficiency in the existing residential building sector remains untapped [1]. The most common identified barriers are [1-2]:

- Market barriers and failures: low priority of energy issues for consumers and firms; information failure of available solutions; split incentives; price distortion due to non- internalization of negative externalities; fragmentation in the building supply chain.
- Information failures: overall lack of awareness; lack of skills and knowledge.
- Financial barriers: difficulty with access to capital due to high up-front investment; high transaction costs; low paybacks; uncertainties; risks; information failure of financiers; competing purchase decisions.
- Institutional, administrative and structural barriers: cumbersome regulation & planning; complex multi-stakeholders' issues.

This paper first explains why these barriers exist and then presents how innovative business models represent an adapted solution.

Buildings meet so many human needs that they represent critical interfaces with many societal functions and related technical processes, from energy delivery to energy generation, from protection against natural hazards to the need of living space, social cohesion, etc. This means that they are most likely to be concerned by change and

adaptation. Today the building industry is facing multiple environmental sustainability related challenges, which go beyond the simple need for energy efficiency. On the one hand severe economic, social and environmental issues have fostered the implementation of sustainable development and the need for a low-carbon economy. On the other, geopolitical conflicts, such as the 1973 oil crisis, have forced energy-dependent countries to rethink their energy policy for increased security and independence.

Accounting for 40% of the EU's total primary energy consumption and for about 36% of Member States' greenhouse gases emissions [2], buildings are at the heart of the EU energy policy and have a key role in limiting any further damage to the environment through the release of greenhouse gases and other pollutants.

Having acknowledged that the need for energy efficient buildings is a consequence of the need for enhanced sustainability across the economy as a whole, and in particular with regard to energy policy, the authors advocate that an appropriate framework for explaining the reasons for these barriers is the multi-level perspective on sustainable transition [3] augmented by co-evolutionary economic thinking.
In this framework, buildings and the building industry are seen as elements of a socio-technical system, which is defined as 'a seamless web of interlocking artefacts, institutions, organizations, natural resources, knowledge, etc. that combine to fulfil particular societal functions via production, distribution and consumption processes' [4].

These socio-technical systems are embedded in socio-technical regimes, i.e. 'the locus of established practices and associated rules (engineering beliefs, routines, heuristics, social expectations and visions) that stabilize existing systems' [4]. Socio-technical regimes form a deep structure that shapes the activities of the actors that reproduce the various aspects of a socio-technical system [3-4].

It is this structure that encourages path dependent, incremental innovations, as opposed to disruptive radical innovations, thus lending stability to socio-technical systems and supporting the emergence of prevailing means by which particular societal functions are realized [4]. A transition from one socio-technical regime to another usually comes from external pressures offering windows of opportunities for mature innovations to challenge the existing routines. In short, socio-technical regimes, generally, only shift from one paradigm to another when there is alignment of mature innovations with external pressures.

Within the building industry, needs for energy efficiency can be considered as an external pressure and expression of the wider societal sustainable and energy transition underway. The barriers to the uptake of energy efficient buildings can be viewed in this context, as a manifestation of current locked-in regime and the need to find sufficiently mature innovations to persistently challenge the existing paradigm.

Innovative Business Models for Boosting the Energy Efficient Building Market

The relatively low uptake of energy efficient buildings solutions to date reveals the need of innovative solutions to unlock the market. However, as energy efficient technologies already exist, innovation must come from something else. Steward [5] explains that in order to successfully deliver sustainability transitions, we should focus on the development and implementation of 'system innovations' and that an important aspect of these system innovations will be the design and implementation of novel business models [5]. While a business model can be seen as a systemic method for generating revenues and profits by creating value and delivering a set of value propositions (i.e. a set of products or services [6]) business model innovation relates to the development of a novel activity for the creation and capture of value [6].

The reason why innovative business models can lead to increased penetration of energy efficiency measures in the built environment [1] is due to their performative role. Doganova & Eyquem-Renault [7] explain that business models represent active constructs or market devices that are capable of shaping the environment in which they are operating by playing a performative role that frames the way businesses and markets behave, develop and grow.

Innovative business models have therefore been identified as a means by which new markets can potentially be created [8] or by which existing ones are reshaped [9]. This explains why innovative business models can boost the energy efficient buildings market: by reorganizing firms' internal structure and offers, organizations will overcome certain barriers to EEB uptake and align with the new business opportunities brought about by the need for sustainable and energy efficient buildings.

From A Boost to A Long-Lasting Change: Insights from the Functional Economy

The authors argue however that innovation itself is not sufficient due to the very nature of business models. In addition to their capacity to change the market, BMs co-evolve with the context in which they are practiced [11]. This essentially means that the lock-in of the current non-energy efficient building market has (at least partially) been created by the incumbent business models. Innovation should not only be novel in comparison to what currently exists, but it should also solve the problems created by incumbent socio- technical building and energy regimes. This means that innovation in business models should be innovation that brings sustainability.

One of the most promising solutions to achieve sustainability is the optimization of products' life-cycle to minimize their environmental impacts. The idea behind functional thinking and the consequent functional economy concept is that to reduce material throughput and decoupling of economic growth from environmental impacts, products should not be sold to consumers, but rather the functions they deliver [12].

Producers must become function providers [13] and integrate in their business measures of performance for the function they provide. Since producers are concerned by the function they have to perform, they can retain the ownership of their performing materials and focus on increasing their efficiency. Therefore leasing, sharing and other functional arrangements between the provider and the owner may take place. They can also make available to their customers not only products, but also accompanying services, such as training, operation, maintenance, recycling, financing, development, and disposal [13].

The concept of product-service systems (PSS) may be seen as a means for achieving the functional economy [14-15]. Mont [16] defines a PSS as 'a system of products, services, networks of actors and supporting infrastructure that continuously strives to be competitive, satisfy customer needs and have a lower environmental impact than traditional business models'. Since the starting point of business development with the PSS concept is the final functionality or satisfaction of the consumers' desires, [14] firms become more responsible for fulfilling customers' needs, and therefore they undertake various processes to increase their efficiency, minimize their overheads and maximize their profit margin [14]. Development of such PSS requires that firms develop a 'greenfield' mind-set (i.e. ignoring existing structures, routines, etc.) and engage in a concerted effort with other firms and society; and lastly that customers become partners in the common task of functional delivery [13].

In order to provide long-lasting change, the authors advocate that business model innovation should embrace principles of functional thinking and product-service systems. The following section shows examples of the most promising innovative and sustainable business models studied in the UMBRELLA project.

Innovative and Sustainable Business Models Examples

The EEB market is very complex due to the large number of stakeholders engaged in a wide range of activities at all stages of the building value chain. While the different players and their actions are interlocked around the lifecycle of a project, the building value chain is very fragmented; for any given project, many configurations of actors are possible. In the UMBRELLA project, a Europe-wide stakeholder engagement process, comprising a series of face-to-face interviews with stakeholders all along the construction supply chain, generated rich data on EEB value chains, with a particular focus on business model aspects. These data were analyzed to develop the insights presented in this paper, suggesting innovative business models configurations and highlighting potential solutions to the challenge of building value chain fragmentation. The interests, motivations and market expectations collected through the interviews coupled with the functional and product-service system thinking were considered as the criteria to select the most promising business models. Four business models are

presented in this paper as a part of the business model analysis carried out in UMBRELLA.

One-Stop-Shop Business Model

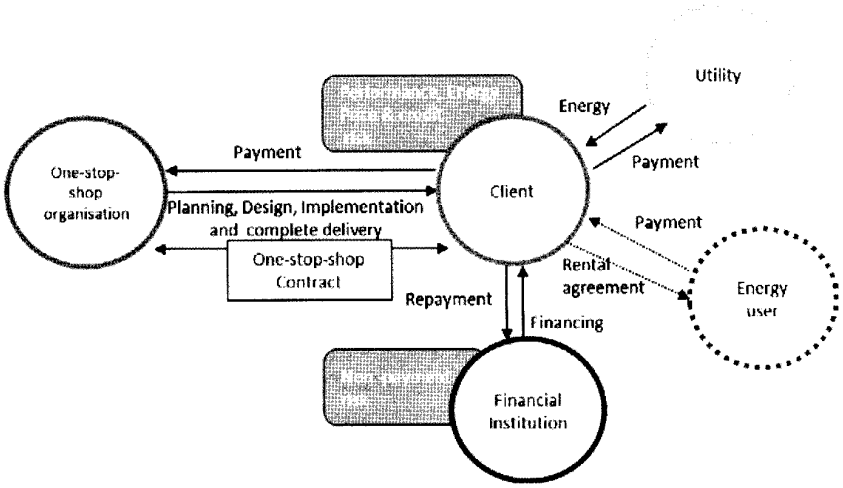

Figure 1 : One-stop-shop business model

- Value proposition: To offer a unique contact point for all the services involving an energy efficient project, from planning, execution and follow up. One-stop-shop organizations provide a holistic approach, simplifying the planning process and advising on the most adapted financing schemes and technical solutions.
- Revenue model: One-stop-shop organizations, including ESCOs, engineering firms or general contractors, carry out their services and they receive a pre-agreed price depending on the scope of the contract.
- Customers and market segment: Homeowners who have the capacity to open or increase their mortgage loan. This business model has been widely replicated in the last years to support owners in their decision making process.
- Risks: No performance or financing risk is borne by the organization; these are assumed by the owner.

Metered Energy Efficiency Transaction Structure (Meets) Business Model

Energy Service Companies (ESCOs) have focused their work on projects with short to medium payback times. However, deep retrofitting, where the substantive investments and measures are made, is often put aside. This model was born in the USA to answer the owners' lack of motivation and to ensure the utility that the model will not have adverse effects on its financial position. It represents a win-win situation for the owner, the utility and the ESCO.

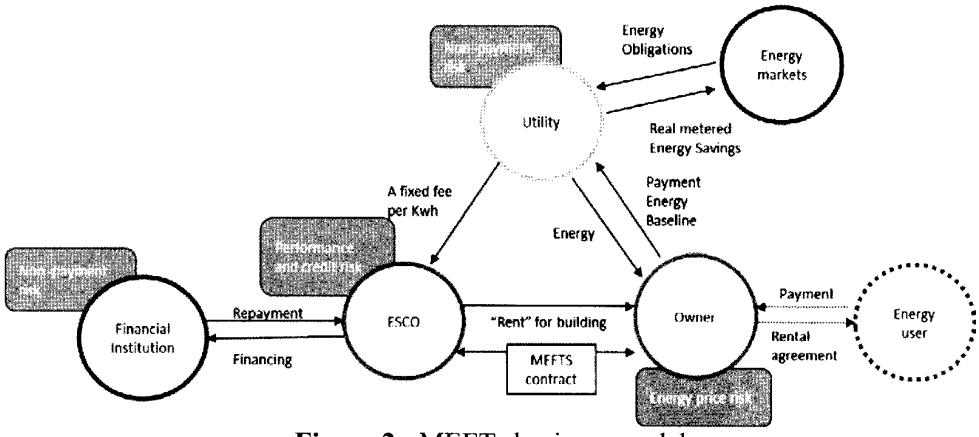

Figure 2 : MEETs business model

- Value proposition: The concept is built upon a trialogue between the ESCO, the utility and the owner. An ESCO partners with a utility to provide incentives -a rent- to the owner to undertake deep energy retrofitting projects. It could be considered as a power purchase agreement between the owner and utility by leasing the property's energy efficiency to the ESCO.
- Revenue model: The ESCO "rents" the building for installation of energy efficient equipment and compensates the owner with a monthly payment (motivating the owner). The utility charges the owner upon the baseline energy data (20-year power purchase agreement) and pays a premium to the ESCO for each kWh of metered energy (remuneration of the ESCO). The utility can sell the real metered energy savings to the energy markets (motivating the utility).
- Customers and market segment: It is a very recent model born in the USA. It can be applied to housing, offices and public buildings. It is attractive to owners as they receive a rent for a more efficient building.
- Risks: The performance and financing risks are borne by the ESCO; the utility assumes the non-payment risk from the owner and the owner borne the energy price risk.

Energy Supply Contract Business Model

- Value proposition: ESCOs provide an "off-balance-sheet" arrangement for the client to supply energy and are paid with an agreed fixed fee based on the real kWh generated.
- Revenue model: The ESCO designs, provides financing based on its own balance sheet, purchases the equipment, installs and executes the operation and maintenance (O&M) of the equipment. Costs of all equipment upgrade renewals and repairs are borne to the ESCO. The ESCO's remuneration is performance-based and depends on the useful energy output delivered

- Customers and market segment: This type of BM is suitable for clients with a relatively constant heat load and willing to outsource the energy supply management and the technical and economic risks related to the supply. Potentially suitable buildings include public buildings, offices, or housing.
- Risks: The ESCO assumes all responsibility for the design, financing, installation, operation and maintenance (including fuel delivery). The performance risk is transferred from the customer to the ESCO. The credit risk is also absorbed by the ESCO, as it assumes the financing of the project. The customer engages to buy energy for long-term contracts, 10-15 years, so the fuel fluctuations are retained by the customer.

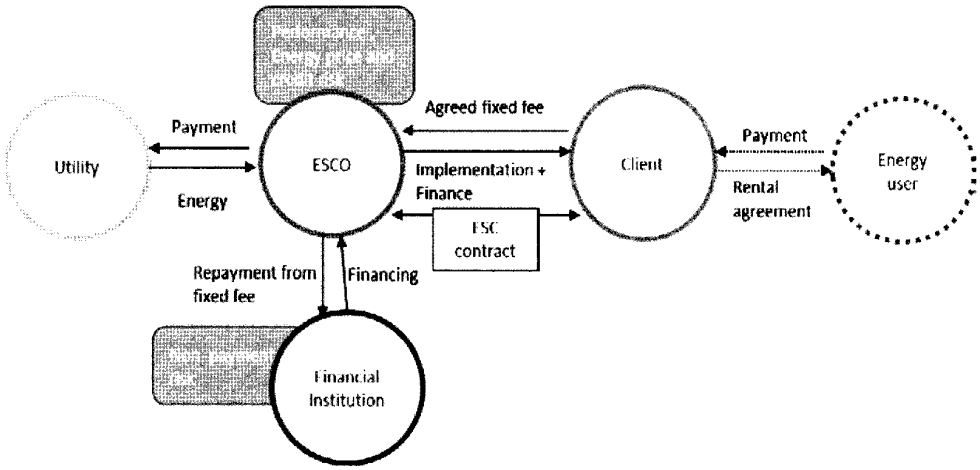

Figure 3 : ESC business model

Integrated Energy Contracting Business Model (IEC)

IEC provides an integrated approach between energy conservation and energy supply.

- Value proposition: The ESCO reduces the energy demand through energy conservation measures plus ensures an efficient supply, preferably from renewable energy sources.
- Revenue model: Remuneration of the ESCO comes from the useful energy delivered, depending on the actual consumption, as well as flat rate service remuneration for O&M, including quality assurance.
- Customers and market segment: It is built on the widely spread ESC energy contract, but includes the demand side measures. It has only been implemented in few projects for now.
- Risks: The performance risk is transfer to the ESCO. The credit risk depends on the financing of the model.

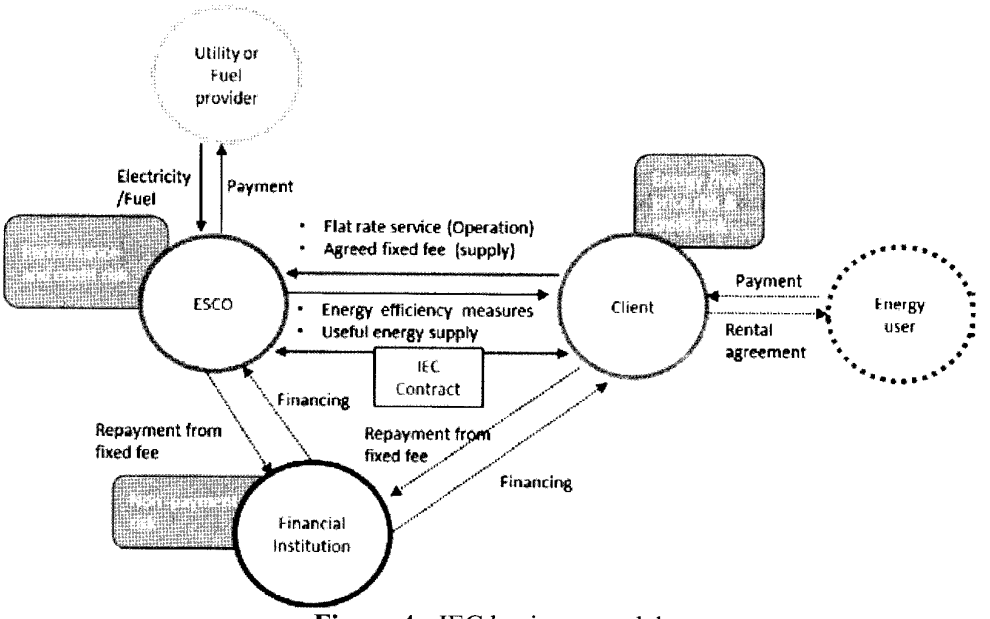

Figure 4 : IEC business model

Conclusion

By using the multi-level perspective theory on sustainable transition with a co-evolutionary point of view between business models and their wider environment, it appears that business models have the capacity to overcome the current lock-in of the building socio-technical system from which a number of recognized barriers arise. In order to turn this potential of BMs into a long-lasting and sustainable change, innovation should take into account the characteristics advocated by the functional economy and the product-service system literature. Four business models, which offer the required characteristics for boosting and changing the energy efficient building market in a sustainable way, are presented. Table 1 summarizes the essential characteristics of these business models.

Highlighting the features that make up innovative and sustainable business models should allow for a better understanding of business models and the characteristics they should have to unlock markets. In the medium term, this can serve to launch adaptation and replication measures of these models. The functional and product-service system thinking allows for many win-win situations emerging from new and innovative opportunities that could not have been harvested before due to the lock-in effects of the existing building socio-technical regime. This 'sustainable' thinking also provides ways for reorganizing the building value chain, which emerged as a very crucial issue in the UMBRELLA project.

Table 1 : Functions provided by each stakeholder ("~" means that it is partially done or sometimes included in the business model)

Business model	ESC	IEC	One-stop shop	MEETS
Innovation to overcome barriers				
Support in the decision making process (subsidies, other) (addresses information	~	~	✓	
Remove up-front investment barrier (addresses financial	✓	✓		✓
Receive strong incentives to undertake project (addresses financial barrier)				✓
Having a unique contact point with integrated approach (addresses information	✓	✓	✓	
Reduce uncertainties of low payback (addresses financial	✓	✓		✓
Sustainable function-based/PSS characteristics				
Provide a function rather than a service (addresses environmental degradation)	~			
Ownership arrangement (increase efficiency)	~	~		
Performance risk is borne by the contractor (addresses financial barrier and				
Offer associated/integrated services (addresses information failure, maximise				
Based upon cooperation with other firms (addresses building chain fragmentation)				
Engage with customers (maximise function provision)				

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