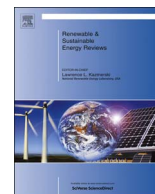




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Energy efficiency policy evaluation by moving from techno-economic towards whole society perspective on energy efficiency market

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ABSTRACT

Energy efficiency is recognised as a key strategy to tackle three energy-related challenges – climate change, energy security and economic development – at the least cost to the society. In the recent years of the economic downturn, it gained even more relevance in the developed countries as there is more than ever the need to decouple economic recovery and growth from energy consumption. However, despite this formal recognition, energy efficiency remains the least understood and the most neglected feature of overall energy policy.

Despite the substantial efforts made to develop sound energy efficiency policies, the desired effects in terms of achieved energy savings are lacking. The phenomenon is known as energy efficiency gap and its persistence was the main driver of this research. The aim of the research was to examine the causes and propose solutions for bridging the gap. Therefore, ideal policy making cycle is defined connecting design, implementation and multiple criteria evaluation of policy instruments' impacts in closed, repetitive loop. Concept of energy efficiency market was introduced as a basis for policy making, enabling better understanding of the overall environment where policy needs to be implemented.

Paper deals with the concept of energy efficiency market. It discusses the fundamental aim of energy efficiency policy – to achieve market transformation towards more efficient products and services. It presents market barriers that call for policy interventions, but upgrades the list of usually addressed barriers with behavioural and societal aspects of energy efficiency related decisions.

Established methodology for energy efficiency market assessment includes upgraded model of barriers to energy efficiency.

Focus of this paper is how to establish a model of energy efficiency market and to upgrade existing model of barriers to energy efficiencies to describe the reality better as to be a basis for policy instruments design.

1. Background and problem definition

Energy efficiency is recognised as a key strategy for energy sustainable development and main tool to tackle three energy-related challenges: climate change, energy security and economic development – at the least cost to the society. However, despite this formal recognition, energy efficiency remains the least understood and the most neglected feature of overall energy policy. This has been widely discussed in the scientific literature for more than two decades. All these studies provide the common typology of barriers causing the gap and offer generic policy solutions for their removal. These solutions, however, even when applied, are not delivering the desired level of energy efficiency improvements. There is still gap in results between policy planned measures are implemented measures [1,2].

Therefore it must be given primary consideration of energy

efficiency in national policies, and be integrated into mainstream economic planning, local government and business development processes in general. Governments have choices in how to approach energy efficiency and which policies and measures to pursue. No country can ignore the development, social and economic opportunities that are being unleashed by relevant energy efficiency policies and measures around the world [3].

There are two shortcomings of existing models of barriers to energy efficiency. Firstly, they do not take into account the maturity of energy efficiency market (in the paper, the term 'energy efficiency market' is used as a concept introduced to be a basis for policy making), generally assuming that it is developed enough but not functioning properly due to identified barriers. In general, it denotes overall environment in which energy efficiency policy is supposed to be implemented. Secondly, and as a consequence of the first, the choice of policy

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instruments applied in a certain market with the aim of removing barriers might be inappropriate, further maintaining the gap. Namely, different instruments have different purposes and effects, hence are appropriate at different market maturity levels and in different market conditions.

To tackle these problems, firstly the model of energy efficiency market needs to be established and methods for its analysis developed. Only thorough analysis and understanding of brakes and levers market participants are facing can provide policy makers quality information on potential impacts of considered policy instruments.

2. Introduction to energy efficiency market

Market assessment is a starting point in policy making. However, the concept of energy efficiency market is rather undetermined and poorly presented in the relevant energy economics literature (e.g. [4,5] or [6]). This should not be a surprise, as energy efficiency is not widely considered to be a product having its sellers and buyers. Energy efficiency may be considered purely as a feature of other products, having their markets and subject to the laws of supply and demand. This approach in policy making is sufficient if policies are aimed at stimulating specific product markets. However, in the desire to create comprehensive energy efficiency policy, aimed at creating changes and shifts towards more efficient products, services, solutions and behaviours, an effort should be made to develop a general concept of energy efficiency market and to model its functioning. This paper serves exactly this purpose – to establish a model of energy efficiency market and methods for its assessment. Recent studies show that there is limit to market forces in improving energy efficiency [7].

2.1. Understanding energy efficiency market

The energy efficiency market is very specific with a quite gawky quality - it is not exactly one market but a conglomeration of various industries as diverse as appliance manufacturers, energy auditors, smart meter software designers and cogeneration developers [8]. In addition, energy efficiency market's supply side includes also various institutions involved in financing and implementation of energy efficiency projects (banks, investment funds, energy service companies, service providers, design engineers, constructors, etc.) [9]. The demand side of energy efficiency market includes project sponsors with ideas for energy efficiency improvements (end-users, i.e. building owners and renters, building managers, public sector institutions and local authorities, industries). Therefore, energy efficiency market has a variety of players with different backgrounds and as such is highly influenced by behavioural, socio-economic and psychological factors that govern market players' decisions. All these influences have to be taken into account when defining policy instruments for promoting energy efficiency, i.e. the current development stage of an energy efficiency market has to be evaluated.

The performance of energy efficiency market can be evaluated according to the actual energy efficiency improvements delivered, i.e. according to number of successfully implemented energy efficiency projects. Basically, the energy efficiency market transformation depends on the success of the project development process. Policy instruments are used to stimulate demand for energy efficiency projects and to lead the project from the inception idea to the actual implementation. Development of an energy efficiency project goes through various stages, from the very initial idea, until the final and actual implementation of the project that operates and yields results in terms of reduced energy consumption and emissions. So, if all the stages in the project development from the initial idea through evaluation of project's feasibility and cost-effectiveness to actual financing and implementation of project are considered, this process can be represented as a pipeline shown in Fig. 1. Due to various barriers, only few of a variety of identified opportunities for energy

efficiency improvements reach the stage of a bankable project, becoming actually implemented; hence the narrowed pipeline presentation is chosen in Fig. 1.

For example Croatian experience shows that only few identified opportunities for energy efficiency improvements actually reach the stage of bankable project, becoming actually implemented. Thus, for every stage in this process existing barriers must be identified and support instruments designed to ensure project pipeline throughput. Experience shows that not every support instrument is relevant for every stage of the project development! And what instrument is relevant for particular stage of project development process is determined according to the barriers that are preventing the shift to the next stage. Important is to realize that the development of energy efficiency market will be achieved only when actual energy efficiency projects are "distilling" from the pipeline.

2.2. Assessing market maturity: model of barriers to energy efficiency

According to neoclassical economic thought, the dominant mainstream microeconomic theory applied today, observed deviations from perfectly competitive behaviour of markets are caused by market failures [10]. A market failure occurs when a market fails to work efficiently to produce goods in a way that optimises benefits to society [10] i.e. to increase the social welfare. Non-market failures, on the other hand, are seen as barriers that are not in collision with market behaviour viewed by economic theory, but are still impeding utilisation of existing energy efficiency improvement potentials. Both market and non-market failure can be put under the same umbrella of market barriers. In markets not delivering socially desired results, e.g. energy savings, there is a justification of policy interventions. Market assessment needs to identify existing barriers for every stage in the decision making process about investing in energy efficiency improvements, as shown in Fig. 1, removal of which is to be ensured by appropriately designed policy instruments. Some authors (e.g. [11]) argue that only market failures require policy interventions, the others believe that tackling non-market failures by policy instruments can achieve even greater results. As the intention of this research was to identify a comprehensive approach to policies for energy efficiency improvement, both types of failures will be discussed and possible solutions for their removal proposed.

2.2.1. Market failures

Competitive markets fail for four basic reasons: incomplete information, public goods, externalities and market power (detailed theoretical elaboration of these facts can be found in [12] or [10]).

2.2.1.1. Incomplete (imperfect) information. Incomplete information is the most widespread barrier preventing fulfilment of energy efficiency improvement potentials. It affects both consumers and producers, i.e. both demand and supply side of energy efficiency market. When consumers are not given enough and quality information about the effects of their energy related purchase and behaviour decisions, they will not be able to weight these effects against other factors governing their decisions. This will affect the energy efficiency market in a way that the demand for energy efficient products and services will be underdeveloped. The supply side will not be triggered to offer innovative and more energy efficient products and services; hence this will depress or at least slower further development of energy efficiency. Effects of this barrier on the supply side of energy efficiency market are the lack of financing from financial institutions for energy efficiency projects, reluctance of designers to apply energy efficiency criteria in their building projects, lack of energy services offered in the market, etc.

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