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BUSINESS INSTRUMENTS FOR SUSTAINABLE BUILDING RENOVATION

Boris Kupchik, Prof. Dr. of Sc. Tatiana Guseva, Assoc. Prof. Dr. Yana Molchanova,
Prof. Dr. of Sc. Alexander Khachaturov,
D. Mendeleyev University of Chemical Technology of Russia, **Russia**

Introduction

Residential buildings are one of the main sources of greenhouse gases emissions. This paper aims to investigate how could the involvement of energy service companies (ESCOs) help to improve energy efficiency (EE) of residential buildings.

Methodology

Findings of the current research are based mostly on literature analysis and semi-structured interviews. The literature review of existing business models provided an understanding of what business models theoretically could be applicable to residential energy efficiency renovation (EER) and environmental projects. The next stage of the research was conducting the qualitative research of the ESCO EER market. A PEST (Political, Economic, Social and Technological) analysis was chosen as the main instrument.

Research

Several business models were chosen as the basis for research and analysis, including Energy Performance Contracting (EPC) with shared and guaranteed savings, Chauffage, and Preferential loans.

EPC is a special type of business model (see Figure 1), when EE measures are implemented, which allows to decrease energy costs for the building owner and generate profits for ESCO. According to the EPC model, customer pays for the implementation of the EPC project. Moreover, ESCO's profit is also included in the customer's payment. Therefore customer takes the financial risk, while ESCO takes the performance risk. Thus, ESCO is responsible for the results of the EEN project and energy savings. EPC contract usually includes a guaranteed level of energy savings, which have to be reached as a result of the EPC project implementation (see Figure 2).

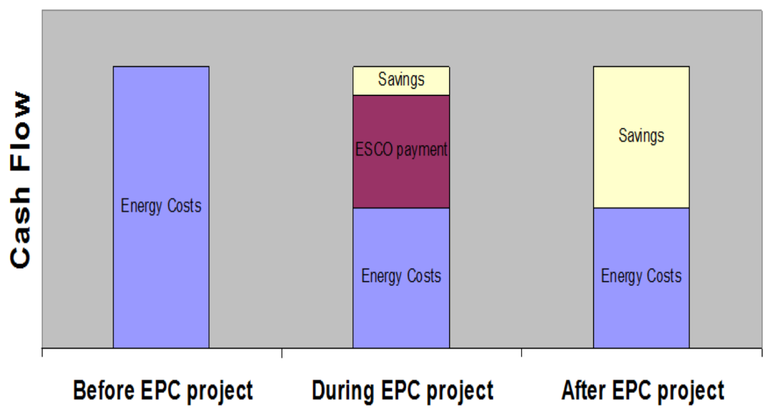

Figure 1. Energy Performance Contracting Model

Chauffage is a business model, which core concept is that ESCO is fully responsible for providing an energy function. According to Chauffage model (see Figure 3), ESCO is responsible for providing an energy function on a lower price than it was before contracting. ESCOs are very often responsible for the whole cycle of energy management. During the research process, 21 real life cases of residential ESCO energy efficiency renovation projects in Sweden were analyzed. These projects were conducted by Siemens and E.ON.

The average energy savings in Siemens strictly residential energy efficiency renovation projects is about 22%. The energy savings in E.ON energy efficiency renovation projects are around 45%, as E.ON renovated not only the residential buildings, but also the energy supply side.

Russian approach is similar to E.ON's. In order to improve EE by 40 %, Russian government developed a special "Energy savings and energy efficiency improvement up to 2020" programme. A number of practical measures must be implemented in all sectors of Russian economy, which also includes measures related with EER in residential buildings. Main indicators of the programme are presented in Table 1. These measures are to be financed by the government through the preferential loans model.

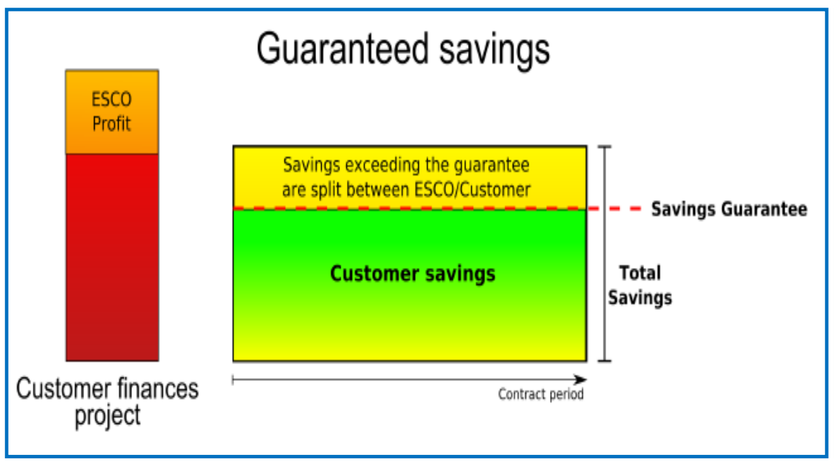

Figure 2. Guaranteed Savings

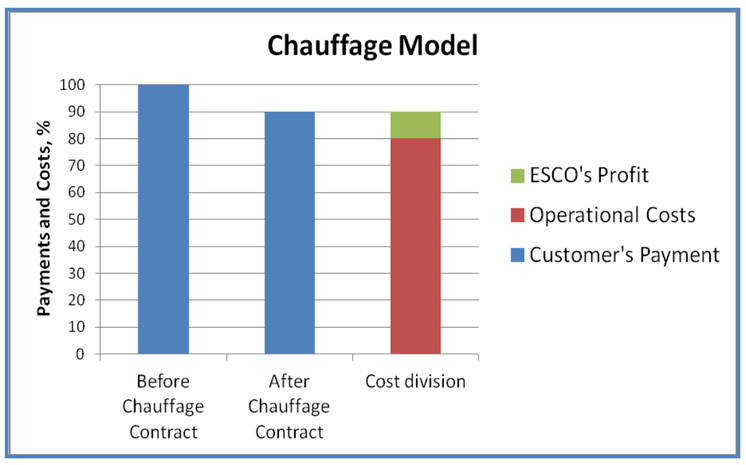

Figure 3. Chauffage Model

Table 1. Main Indicators of Russian Energy Efficiency Improving Programme

Indicators	Units	2012	2013	2014	2015	2020
Losses in the heat distribution system	%	13,5	13,3	13	12,7	10,7
Energy consumption of the community facilities per citizen in comparison with 2007	%	99	98	98	97	95
Average energy consumption in residential buildings	kg e.f./m²/ /year	41,4	39,3	37,1	35,9	31,2
Buildings where energy efficiency renovation project was conducted	%	0,45	0,5	1	1,4	2
Buildings equipped with meters of heat received from central heating system	%	53	65	80	89	98

Conclusion and recommendations

The following **political conclusions** were drawn:

Sweden and Russia have a broad and well developed regulation regarding EE improvement. However, there are no legislative acts that would stimulate usage of private funds of the financial institutions and publication of the results of the residential ESCO EER projects. This leads to a low number of implemented EER projects in the Swedish residential sector and absence of private EER projects in Russia. Implemented PEST analysis indicates that the average payback period of an ESCO residential EER project is 10 years. An energy audit every 7-9 years would determine whether the building's energy system is performing as planned. The audit would help to plan future steps for even deeper EER. Therefore, development of legislation to require a building's energy audit is recommended.

The following **economic conclusions** were drawn:

EER projects do not reach the best possible results in energy savings because of the lack of financial resources and implementation of only the EPC business model. Therefore, the use of additional business models (EPC with shared savings or Chauffage) is recommended. These models are able to divide a project's risks between different stakeholders and attract new investors. The direct relation between the amount of invested financial resources and a project's energy savings was identified during a PEST analysis. The following strategy needs to be emphasised to customers: further investment will lead to more energy savings; use long-term investments instead of short-term.

The following **social conclusions** were drawn:

Residents of EER buildings are not fully aware of the benefits of such renovation projects. Awareness-raising campaigns and environmental education in connection with implemented projects could stimulate further development of the energy service market and increase results of EER projects.

The following **technological conclusions** were drawn:

Case studies demonstrate that projects where both the supply side and demand side were renovated show more energy savings than ESCO EER projects where only the demand side (residential buildings) was renovated. It is recommended to renovate the supply side in addition to the demand side.

In addition, analysis showed that outside climate conditions are very important factors in achieving energy savings. It is recommended to install not only energy monitoring systems in buildings, but also weather monitoring systems. Together, both systems would allow the current state of the energy system to be controlled in real-time with faster adjustments to weather changes. The availability of data about energy consumption in relation to weather conditions would improve the quality of energy consumption predictions for future projects.