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BUSINESS MODELS FOR ENERGY PERFORMANCE CONTRACTING

POSLOVNI MODELI ENERGETSKEGA POGODBENIŠTVA

Niko Natek[ℜ], Boštjan Krajnc

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Abstract

Energy performance contracting is a financial mechanism that can be used to jointly address the issues of increasing energy independence, as well as reducing greenhouse gas emissions and energy consumption. Moreover, energy performance contracting could substantially contribute in engaging socio-economic issues in parallel, including economic growth, job creation, social cohesion and other aspects relevant to sustainable development. This article will attempt to demonstrate the specifics of different EPC business models and how they can contribute to ambitious energy-saving targets for the year 2050.

Povzetek

Energetsko pogodbeništvo je finančni mehanizem, katerega se lahko uporabi pri skupni obravnavi relevantnih problemov kot so povečevanje energetske samozadostnosti, zniževanje emisij toplogrednih plinov ter zmanjšanje rabe energije. Še več, energetsko pogodbeništvo lahko pomembno prispeva k reševanju socialno-ekonomskih vprašanj kot so rast gospodarstva, ustvarjanje delovnih mest, družbena kohezija in ostalih faktorjev, ki so pomembni za trajnostni razvoj. V tem članku je predstavljenih nekaj posebnosti izbranih poslovnih modelov energetskega pogodbeništva, z uporabo katerih lahko pomembno prispevamo k uresničenju ambicioznih ciljev zniževanja rabe energije do leta 2050.

ℜ Corresponding author: Niko Natek, Tel.: +386 3 896 1520, Fax: +386 3 896 1522, Mailing address: KSSENA - Energy Agency of Savinjska, Šaleška and Koroška Region, Titov trg 1, 3320 Velenje, Slovenija
E-mail address: niko.natek@kssena.velenje.eu

1 INTRODUCTION

Since 2009, most economies of developed nations around the globe have struggled to generate and sustain job growth. Despite the tightening of the labour market in recent years, trailing the slow but stable economic recovery, unemployment remains at high levels, particularly among highly educated and young job seekers. Facing the growing tensions between generations and classes, fuelled by an unprecedented rise in income inequality, policymakers desire sustainable solutions to mitigate brain drain, impoverishment, and social exclusion by creating permanent employment opportunities. Energy efficiency investments can stimulate a net increase in employment in two major ways and, as such, can greatly contribute to comprehensively addressing various aspects of sustainable development, emphasizing the importance of social cohesion in our culture.

Primarily, the implementation of energy efficiency projects, either through upgrades in technical equipment, refurbishment of buildings' thermal envelopes, awareness raising/promotional/skill development or any type of comparable measures, foster the direct creation of jobs as the projects are carried out; secondly, the saved costs on energy are eligible to be retained and reinvested in the advancement of the same project or in the broader economy. Additionally, a pervasive implementation of energy efficiency projects further encourages and strengthens a wider variety of products and services (e.g. for energy management services, energy auditing, information and communication technology for personal energy accounting, energy-saving appliances and lighting systems, etc.), supplied by enterprises present in the region, nation, or anywhere in the EU.

Considering the need to mitigate limitations of strained public finances as well as several other challenges, it is sensible to pursue investment in energy efficiency on the basis of public-private partnerships on the EPC business model.

This model is especially attractive for the refurbishment of publicly owned infrastructure, as both the national and local budgets of developed countries are burdened by mandates for reduced public spending in addition to the lack of technical and operational expertise of their personnel to carry out and manage such projects. The building sector accounts for almost 40% of total final energy consumption in the EU, [1], which in itself offers tremendous potential for energy savings and investment. Furthermore, within the paradigm of reducing carbon emissions, each EU member state is required under Directive 2010/31/EU on the energy performance of buildings to renovate 3% of its total building stock surface every year, which is also transposed into Slovenian legislation under the renewed Energy Act EZ-1, [2]. This provides investment in energy efficiency with a solid legal framework and future outlook, which will partially be carried out by coupling public and private interest for achieving sustainable development through the EPC mechanism. It is perhaps the best way to address the interconnected issues of energy independence, climate change, social inequality, and job growth.

2 GENERAL COST AND SAVING DISTRIBUTION IN EPC PROJECTS

Energy performance contracting is an innovative financing model used to fund investment in energy efficiency and renewable energy sources (RES), which are in turn financed through reductions in overall costs. The services related to implementation measures are realized through an agreement with an external party, a so-called Energy Saving Company (ESCO) that assumes the investment, technical, operational and other associated risks and utilizes the income generated either by energy efficiency or by implementation of renewable energy production to repay the initial capital investment plus profit. The ESCO guarantees the projected level of energy savings (or energy production) and bases its profit margin on the effectiveness of implemented measures.

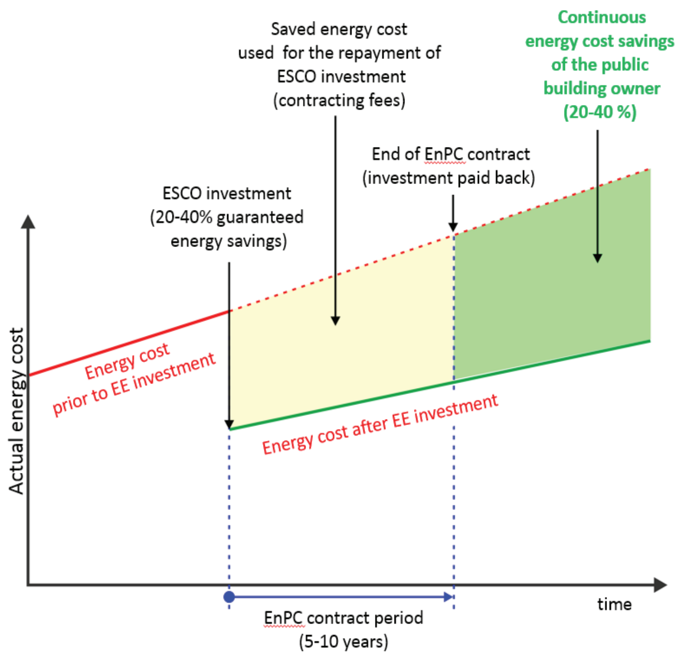

Figure 1: *A schematic presentation of energy cost projection (recapitalization and profit of the ESCO) before and after carried out refurbishment measures (Source: Chart provided by GIZ - Deutsche Gesellschaft für Internationale Zusammenarbeit)*

As described, the chart illustrates the reduced energy costs due to investment in energy efficiency measures. The chart features a linear growth trend for the cost (price) of energy, which has not yet materialized, mainly due to the slowdown in economic activity in China as well as production increases in the USA (fracking sources), as well as additional oil supplied by Russia. Even in a static energy price environment, the concept remains valid, although the payback period is slightly longer, and the future profit margin for the ESCO is somewhat reduced.

3 EPC MODELS PERTINENT TO VARIED LEVELS OF RE-FURBISHMENT

There are many methods for structuring a contract; therefore, it is difficult to extensively define all possible variations of EPC business models. However, the contracts broadly fall into certain groups that share many aspects.

Several types of EPC business models, which use different approaches to implementing energy efficiency (or renewable energy) projects, are available on the service market today. They differ in many aspects, the most relevant of which are investment requirements, risk distribution and duration of the contract. Among the many known models, the most frequently applied ones typically fall into one of the following categories, [3]:

- Shared savings contract: The customer shares an agreed portion of savings with the ESCO.
- Guaranteed Savings Contract: The ESCO assumes performance risks by guaranteeing energy savings.
- Variable Contract: The ESCO receives a defined amount of savings every year until the ESCO has been paid its original costs.
- Integrated EPC contract: Combination of Energy Performance and Energy Supply Contracting
- Comfort contract (Chauffage): ESCO takes over complete responsibility for the provision to the client of an agreed set of energy services
- EPC Plus contract: Deeper renovations/ comprehensive refurbishments are included; the payback time is longer than the contract; co-financing by the owner, by public funds or others
- EPC light contract: Savings are achieved through organisational measures with low or no investments in technical equipment, energy saving is guaranteed by the ESCO.

A comprehensive review of implemented energ-saving projects utilizing the EPC model within the preliminary analysis carried out in nine countries (Germany, Greece, Croatia, Slovenia, Slovakia, Serbia, Romania, Latvia, and the Ukraine) was implemented under a coordination and support project funded under Horizon 2020 - EnPC INTRANS (Capacity Building on Energy Performance Contracting in European Markets in Transition). The analysis showed the particular favourability for three distinct types of EPC business models that proved to be successful in different socio-economic environments, facilitating energy efficiency investment from basic to intensive renovation initiatives.

The three identified models in question are essentially variations of the standard EPC model, which is also one of the models represented in this group.

3.1 Energy performance contracting light

3.1.1 Main model feature

EPC light is a zero-investment business approach: energy-saving measures with zero-investment costs are implemented by the ESCO, which includes an energy-saving guarantee within a contract duration of two to three years. The ESCO recommends further low or high investment measures to be paid by the building owner. It is up to the client to decide if the measures are to be implemented. If so, a share of the achieved savings of these measures can be attributed to the ESCO's savings guarantee. All technical devices still belong to the building owner.

3.1.2 Main Energy-Saving Measures

The most applied measures are the operational optimization of lighting systems, heating systems, ventilation systems, and the use of the warm water generation. Training sessions of the technical staff are included, and user motivation training can be provided. Mostly, the ESCO is responsible for the maintenance of the technical equipment.

3.1.3 Financing

The ESCO only has to calculate staff costs for the periodic inspection of the buildings including the technical devices. It receives bi-monthly or quarterly payments from a public entity and the remaining payment after the final invoice of the achieved energy savings.

3.1.4 Measurement and Verification

Energy savings are calculated based on energy invoices and a defined baseline of energy costs or (if not yet available) meter readings. An annual climate correction is taken into account, if necessary, and correction for changes in use or high-level savings by measures implemented by the building owner are applied.

3.1.5 Risks and de-risking strategies

The ESCO bears several risks concerning the energy cost baseline, the energy-saving guarantee, and operating errors. Additionally, the adjustments regarding user behaviour and other energy-saving measures made by the building owner can be risky as well as the controlling of the energy savings. Risk reduction strategies in this context are a sound saving calculation by the ESCO and experiences with the operation and optimization of technical equipment. In addition, the involvement of experienced project facilitators in the preparatory phase of the project is important as well as in the tendering procedure and evaluation of the savings. Furthermore, clear contract rules are necessary to avoid conflicts regarding adjustment mechanisms.

The bankruptcy of the ESCO is a possible risk for the public entity, but because all technical devices belong to the building owner, and there are no payments to a financial institution, this risk is very low. If savings are low performing, and the paid instalments are higher than the savings, there could a risk for the public entity as to whether the ESCO will pay back the difference between real achieved savings and paid instalments. To avoid these risks, the public entity has to involve an in-depth due-diligence process within tender evaluation process.

Main Advantages:

- Saving Guarantee and risk transfer to the ESCO (the risk level is low and always borne by the private partner),
- Detailed controlling of the annual energy consumption of every building,
- The real savings are measured and documented,
- No investment for technical measures,
- Profound proposals regarding low or high investment measures in the buildings,
- Cooperation between public entity and experienced ESCO,
- Entry for new ESCOs and PPP-unexperienced municipalities,
- Short contract duration.

3.2 Basic energy performance contracting

3.2.1 Main model feature

In common EPC basic-projects, the ESCO is accountable for the complete services: planning and installation of the technical measures, financing of the technical equipment, maintenance and energy management during the contract period. They guarantee the refunding of the complete costs through energy and maintenance costs savings during a fixed period. The public entity pays the cost savings that were actually achieved to the ESCO.

Fixed prices (payment) during the contract period (6–15 y.) related to the fulfilment of basic project requirements defined in procurement requirements mostly targeting maintenance measures. Sometimes the public entity receives a defined share of the savings; therefore, the municipality has to pay only the remaining share to the ESCO. Bonus-malus payments are also included if guaranteed energy and maintenance savings are over- or underachieved during the contract period. The technical equipment property is transferred from the ESCO to the municipality after the acceptance of the installation works by the municipality.

3.2.2 Main energy-saving measures

Depending on the detailed situation in the building and the economic calculation of the savings and costs, the following measures are possible in principle:

- Lighting, air conditioning, ventilation, pumps, control;
- Heating (heat pumps, biomass boiler, CHP, fossil fuel boiler), heating distribution, heat recovery systems, cooling systems, warm water generation, technical equipment for swimming pools, control;
- Showers, toilets;
- Thermal collector, solar cell, biomass boiler.

Sometimes, a few measures regarding fire protection, heritage protection, pollutant disposal and authorizations are included.

3.2.3 Financing

Financing by the ESCO is applied as a common financing model in EPC basic models. The ESCO frequently cooperates with a financial institution. The costs of the ESCO will be refunded by the energy cost savings and the maintenance cost savings. The public entity pays a monthly or quarterly instalment to the ESCO up to nearly 80% of the savings guarantee; the remaining amount is paid after the annual saving invoice.

Furthermore, there are few more options regarding financing of EPC basic projects:

An additional allowance by the public entity reduces the investment and financing costs of the ESCO. If many construction measures are included in the project, or the energy costs are very low and the refurbishment demand is high, the municipality has to finance a larger allowance.

Sometimes, the funding of the projects is supported by Energy Efficiency Funds to improve the access to available capital.

In few cases, public entities finance all planning and investment costs from their own communal budget or via interest subsidy loans for public entities. In this case, the municipalities pay back the annuity to the financial institution themselves.

Sometimes the municipality receives a share of the savings during the contract period; therefore, ESCOs can refund their costs only by the remaining amount of savings.

The financing conditions can be improved by the application of forfeiting. Thus, the ESCO receive a better interest rate, and the municipality confirms that annuities will be paid to the financial institution in every case.

3.2.4 Measurement and verification

Energy savings are validated with an energy price fixed during the contract period related to the measured and verified energy savings during the contract period. Energy savings are deducted from the energy and water bills or meter readings. Sometimes, fixed savings are defined, e.g. regarding saving through new lighting systems or pumps to avoid huge adjustments during the operation period. Because the ESCO has guaranteed the savings, it cares for the periodic controlling of the energy and water consumption, often supported by remote access to a building's energy management information system. All energy consumption-related data are collected and documented in the annual energy report and, together with adjustments, in the annual invoice of savings. Additionally, the ESCO is responsible for the quality assurance and maintenance of all installed technical devices.

3.2.5 Risks and de-risking strategies

Because of the greater extent of EPC basic measures and investments, the risks are higher comparable to the EPC light model. Risks exist related to the ESCO and related to the public entity. However, in every case, EPC basic includes a shifting of risks from the municipality to the ESCO. De-risking elements for both the ESCO and the public entity are integrated into the EPC basic business model.

3.2.6 Risks for ESCOs

ESCOs are commercial stakeholders, and they have to bear entrepreneurial risks. In the following, we describe the main significant risks and the most common de-risking strategies in current EPC basic-projects.

a) Economic risks:

- The level of annual energy savings. If the real savings are frequently below the guarantee and/or on a high level, then the ESCO cannot refund the complete costs by the savings.
- The right baseline: if the baseline is wrong, the energy-saving calculation is also incorrect.
- Planning errors lead to massive impairments of users or of the building.
- The level of investment is higher than calculated.
- Many energy-related measures of the principal within the contract period and/or the closure of buildings within the contract period.

These risks can be reduced by the integration of an experienced facilitator during project preparation (baseline check, plausibility check of saving guarantee and calculated costs, and planning check), detailed planning and calculation of savings and investments, possibly in cooperation with a professional engineer and a detailed measurement & verification system, including data from applied technical devices, error protocols, and other sources. Additionally, clear contract rules concerning baseline adaptation, climate and user-related adjustments, closure of buildings and energy-related measures of the public entity are necessary to minimize the risks for the ESCO.

b) Technical risks:

- Failure of the technical equipment or assembly mistakes,
- Operation risks, e.g. the technical staff of the principal adjust the technical set-points.

Again, clear contract rules regarding the responsibilities of the contract partners are crucial. The ESCO should have experiences with the used technical equipment considering the instructions from the manufacturers, and deploy qualified personnel or cooperate with professional partners.

c) Administrative risks:

- Delayed application for feed-in-tariff, subsidies or others by the municipality,
- Delayed acceptance of installation work.

All defined risks can be reduced by clear contract rules, especially the responsibilities should be exactly regulated.

3.2.7 Risks for public entities

Because the most important risks are shifted to the ESCO, the remaining risks for public entities are quite manageable:

- If the level of annual savings underachieves, the share of annuity for the financial institution, then the public entity cannot cover the instalment to the financial institution only through the savings. Thus, the municipality has to pay the difference from their own sources, mostly from the municipal budget;
- The bankruptcy of the ESCO.

Public entities can require an agreement fulfilment guarantee from the ESCO covered by an agreement between the ESCO and a financing institution for the implementation of the measures during the implementation period and after that. The municipality has the technical equipment property after the implementation period; therefore, the devices are operated by the technical staff of the municipality. This will also produce some savings, but definitely less than by the ESCO.

Main Advantages:

- Detailed controlling of the annual energy consumption of every building,
- The real savings are measured and documented,
- End energy savings of 20 to 50% (depending on the bundles of measures) and, therefore, reduced energy and water demand (heating, electricity),
- Higher market value of the building,
- Many measures are carried out in a relatively short time,
- Additional supplements to the calculated investment costs are not possible,
- The investment costs for the technical equipment are less in comparison to procurement without ESCO,
- Improved operational comfort (new control systems),
- The technical staff receive training and better qualifications,
- Comprehensive measurement bundles also including necessary non-energy-related measures.

3.3 Energy performance contracting plus

3.3.1 Main model feature

The EPC plus model is based on EPC basic. The mechanisms used are very similar: the energy-saving guarantee and the refunding of the complete costs through energy and maintenance costs savings during a fixed period; fixed prices (payment) during the contract period related to the fulfilment of basic project requirements; bonus-malus-payments regarding over- or under-achieved saving guarantee and the property transfer from the ESCO to the municipality.

However, the extent of measures is much broader: in addition to the installation of technical equipment, the ESCO is also accountable for the planning, installation and financing of the thermal insulation on the building envelope and of construction measures. Because of far higher investment costs and longer payback periods, this model is more sophisticated, particularly regarding financing.

3.3.2 Main Energy-Saving Measures

Depending on the detailed situation in the building and the calculation of the savings and costs, the following measures are possible in principle:

- Facade insulation; plinth insulation; basement ceiling insulation; roof ceiling insulation and replacement; replacement of windows, stairways, door replacement;
- Construction measures on walls, ceilings, floors, swimming pools;
- Lighting, air conditioning, ventilation, pumps, control;
- Heating (heat pumps, biomass boiler, CHP, fossil fuel boiler), heating distribution, heat recovery systems, cooling systems, warm water generation, technical equipment for swimming pools, control;

- Showers, toilets;
- Thermal collector, solar cell, biomass boiler.

3.3.3 Financing

Financing by the ESCO (in cooperation with a financing institution) or financing by the ESCO in combination with the capital of Energy Efficiency Funds are the most common financing models in existing EPC plus projects. The first model is based on comparable approach as EPC basic financing, but the contract duration ranges between 20-25 years.
In addition to these described options, there are other approaches:

- Sometimes the public authority gives an additional allowance reducing the higher investment costs. This allowance can be paid once after the implementation of the measures, or as instalment payments during the contract period.
- In addition, public subsidies can be involved in the project to decrease the investment costs.
- Additionally, a combination of further financing instruments is applied, e.g. internal financing, loans of financial institutions and funds' capital.
- Measurement and Verification: Construction and insulation measures do not have to be optimized during the contract period. Therefore, all energy savings (building and technical measures) are deducted from energy and water bills or meter readings validated with a fixed energy price.
- Furthermore, in EPC plus models, the ESCO is responsible for periodic controlling of energy consumption, the periodic adjustment of technical parameters, annual energy reports and annual invoices of savings.

3.3.4 Risks for ESCOs:

In addition to the risks described for the EPC basic model, there are few additional risks for EPC plus models:

a) Economic risks:

- The ESCOs have a technical background and often no experience with the calculation of thermal insulation measures. They have to cooperate with external architects, engineers or other companies and balance all complete savings.
- The calculation of savings through insulation measures depends on many user-related facts and should be carried out very thoroughly.
- Because the contract duration is much longer comparable to EPC basic, there are also more risks regarding the failure of the technical equipment and higher costs for the replacement of technical components.
- Because of the long contract times, the fixed interest period for the loan is also limited and ESCOs have to calculate with a possibly higher interest rate.

All these risks belong to the entrepreneurial risks and can be minimized by a cooperation with very experienced planners, by the deployment of proven calculation software and established products.

b) Technical and administrative risks:

- To consider changes in HVAC system for reduced heating and cooling loads is necessary. Poor planning based on few experience has to be avoided.
- Architectural quality is becoming more important in the context of measures on the building envelope. Therefore, heritage protection restrictions, higher costs and a higher need for coordination have to be taken into account.

In addition, experienced personnel for the planning should be deployed, and all eligible questions regarding measures on the building envelope should be harmonized before the dateline of the tendering procedure.

3.3.5 Main Advantages

- Reduced thermal and cooling loads in the buildings,
- Improved indoor climate quality (e.g. by new sun blinds),
- Better indoor space quality and, therefore, reduced illness of the users,
- Increased architectural quality via a modern façade,
- Wall insulation and highly efficient windows will reduce cold or hot indoor surfaces, which enables putting good quality working places much closer to the wall than before the retrofit,
- Better reputation of the building because of environmental friendly construction.

4 RENOVATION SCENARIOS

The revised energy efficiency directive (EED) stipulates the preparation of national strategic plans by member states that aim to reduce the energy consumption of the existing building stock by 80% compared to 2010.

According to a study published by Ecofys in June 2012 "Renovation Tracks for Europe up to 2050: Building renovation in Europe – what are the choices?", building stock renovation is the most cost-effective way to reduce greenhouse-gas emissions, reduce energy dependency and simultaneously revitalize European economies. Specifically, three potential scenarios of future renovations were examined developed on the Ecofys Built Environment Analysis Model (BEAM), indicative of the renovation speed, the quantity (ambition) of energy efficiency improvement and use of renewable energy.

These three business models offer a transition from basic/shallow renovation attempts to widespread deep renovation initiatives as well as the best value in terms of created jobs, reduced emissions and improved living standards of the general population and should, therefore, represent the final goal of the international movements towards sustainable development. The three EPC models presented above are able to facilitate different levels of energy refurbishment according to these so-called renovation "tracks", defined as follows.

4.1 Track 1: Shallow renovation

The first scenario features a fast renovation rate (3% a year) with a demand-side-driven retrofit standard (average level of refurbishment ambition, inclusive of market failures representative of potential measures that are not carried out because of anticipated obstructions such as high up-front investment, lack of information, cultural heritage and aesthetics, technical limitations, etc.). The scenario assumes low contributions from renewable energy sources with the majority of heating systems to be utilized operate on fossil fuels (gas and oil condensing boilers – 90%) while only 10% would use RES (air/water and ground/water heat pumps and biomass boilers). No solar thermal systems are included in this calculation. The track foresees that all existing building are to be retrofitted by 2045;no further retrofits are to be implemented for the last five years.

4.2 Track 2: Shallow renovation with renewable energy

This target scenario forecasts a slightly lower but still rapid renovation rate (2.3% per year) with a demand-side-driven retrofit standard similar to Track 1. The main difference is in the focus on the utilization of RES that forecasts high contribution from heating, ventilation and heat recovery systems. This assumes a more or less 100% rate for retrofits that utilize some form of RES (specified as 80% for air/water and ground/water heat pumps, 15% biomass boilers and five district heating systems with a growing share of RES). It also stipulates that 80% of all retrofits be equipped with solar thermal systems for domestic hot water and 100% have ventilation and heat recovery systems installed.

4.3 Track 3: Deep renovation

The deep renovation track is the most ambitious of all target scenarios. It features the same renovation rate as Track 2 (2.3% a year) and a demand-side-driven retrofit standard that is highly ambitious (representative of the level of passive housing) in terms of achieved energy savings. It is also projects a high level of utilized RES (70% for air/water and ground/water heat pumps, 15 % biomass boilers and 15 district heating systems with a growing share of RES) with all retrofits with ventilation and heat recovery systems in addition to 33% equipped with solar thermal systems for domestic hot water preparation.

It was concluded that the implementation of the deep renovation scenario (moderate yearly retrofit rate of 2.3% with high-energy efficiency ambition), would foster the largest energy consumption reduction, GHG savings and economic output (compared to shallow renovation with low and high use of renewable energy sources). While the cost of implementing all three scenarios were estimated to be roughly equal (from €8.2 to €8.8 trillion), the deep renovation was identified as offering the most promising outcome.

4.4 Results of the model projections

All three target scenarios assumed a maximum renovation rate of 3% taking into account average renovation cycles that last from 30 to 40 years. The renovation rates in Tracks 2 and 3, which are approximately 100% greater than the present rate, still ensure that the entire building stock would be renovated prior to 2050.

It was concluded that adopting the first target scenario (deep renovation) model could bring about a 80% reduction of energy required for space heating and hot water preparation, meet the CO_2 emission target (a 93% reduction) and perhaps even more importantly, create an additional 1.4 million jobs for highly educated and skilled workers until 2050 (almost twice as much compared to shallow renovation), building on the assumption that each million euros of investments creates one year of full employment for 17 workers.

Table 1: *Overview of target scenarios modelling results for the period 2012–2050. (Source: "Renovation Tracks for Europe up to 2050: Building renovation in Europe – what are the choices", Ecofys, June 2012)*

Scenario	Retrofit rate	C02-Emissions for space heating and domestic hot water EU27 by 2050 [Mt]	Final Energy use for space heating EU27 [TWh] by 2050 (without new buildings)	related reduction in final energy use by 2050 compared to 2010	Total Costs (investment costs **and** energy costs for space heating and domestic hot water, discounted costs for 2012–2050) [trillion euros]
Track 1	3.0%	498	1,987	32%	8.2
Track 2	2.3%	103	1,228	58%	8.8
Track 3	2.3%	93	613	80%	8.5

5 CONCLUSIONS

Although investment in energy efficiency is often shrugged off as not offering an attractive investment value in terms of risk-to-reward quotas, numerous real-life studies have refuted these false notions. Such was the case of the study carried out by the Jüllich Research Centre for the German KfW Development Bank, which showed that employing people on building refurbishment could result in immediate benefits for the greater economy. The study concluded that every euro invested in building refurbishment programmes returned a four- to five-fold capital return in terms of life-cycle impact. The reviewed investment created a total of 340,000 newly created local jobs. Additionally, according to the EU's energy efficiency review estimations, meeting a 40% energy efficiency target in 2030, mentioned in the European Commission consultation document, would stimulate annual economic growth of 4%, provide roughly a 3.15% increase of jobs and reduce fossil fuel imports by up to €505 billion every year, [6].

The first model that was recognized as effective was the EPC light business model, which is characterized by a low volume of investment and focuses on achieving energy savings exclusively through organizational measures, avoiding an intensive capital requirement in technical equipment and labour. The involved ESCO can guarantee savings in energy and thus maintenance costs in a similar fashion as in the EPC standard model, but with significantly less risk and capital requirement, making it a viable solution to underdeveloped markets in general, as well as SMEs that are interested in participating in the ESCO market, but lack the start-up capital, technical know-how and experience in the market.

The second one, as stated above, is the EPC basic/standard model that is also most commonly defined as a guaranteed savings contract between the ESCO and the client outlining different scenarios in terms of obligations, responsibilities as well as division of profits in the case of outperformance. The majority of risks are therefore taken over by the ESCO; nevertheless, the client can be severely exposed in the case of ESCO bankruptcy.

Finally, the conducted research of implemented ESCO projects also favoured the EPC Plus business model that is represented by the application of comprehensive refurbishment measures, including adaptation measures, which generally lowers the effective ROI and lengthens the effective payback period of the investment as a whole. This is, in general, a characteristic of deep renovation, for which it is not unusual for the payback period to exceed 20–25 years or even longer. Considering the deviations of energy price projections and the present volatility in the energy markets, it is unreasonable for investors to consider the outstanding risks associated with such a prolonged period in correlation with relatively small upside/reward potential. Therefore, the implementation of such business models is dependent on co-financing, either by building owners, public funds or less likely, private actors, which effectively channels risk and reduces the payback period, making it a viable opportunity when structured appropriately

The three EPC models outlined in the article are applicable to support the different target scenarios for building renovation and are quintessential tools to step-up the current actions and ambitions. The current level of activity in the field would roughly result in the fulfilment of the Track 1 target scenario, meaning we would severely underperform with regards to the energy saving, emission reduction and energy independence targets by 2050. Furthermore, even though deep renovation is currently viewed as economically unfeasible (or marginal), due to extensively long payback periods, we can conclude from the results that each target scenario requires about the same absolute amount of investment, from 8.2 to 8.8 billion euros. This points to the fact that there is a need to adapt financing and business mechanisms in the form of public-private partnership, which will maximize investment value and returns while outperforming the energy saving and emission reduction targets.

References

[1] **Jens. Laustsen; Paul. Ruyssevelt; Dan. Staniaszek; David. Strong:** *Europe's buildings under the microscope - A country-by-country review of the energy performance of buildings,* Buildings Performance Institute Europe (BPIE), 2011

[2] **Ministrstvo za infrastrukturo:** *Dolgoročna strategija za spodbujanje naložb energetske prenove stavb,* Portal Energetika, 2015

[3] **Konstanze. Stein:** *Description of identified EPC business models, provided within EnPC INTRANS EU project.*

[4] **Thomas. Boermans, Kjell. Bettgenhäuser, Markus. Offermann, Sven. Schimschar:** *Renovation Tracks for Europe up to 2050: Building renovation in Europe – what are the choices, Ecofys,* 2012

[5] **Forschungszentrum Jülich:** *Impact on public budgets of kfw promotional programmes in the field of energy-efficient building and rehabilitation,* KfW Bankengruppe, 2011

[6] **Arthur. Neslen:** *EU's energy efficiency review puts high target on agenda,* EurActiv website, 2014

[7] **Maria. van der Hoeven**: *Energy efficiency market report 2013 - Market Trends and Medium Term Prospects,* International Energy agency, 2013

Nomenclature

(Symbols)	(Symbol meaning)
t	time
EPC	Energy Performance Contracting
ESCO	Energy Service Company
EE	Energy efficiency
GHG	Greenhouse gases
BEAM	Built Environment Analysis Model
HVAC	Heating, Ventilation, and Air Conditioning
TWh	Terawatt hours
Mt	Megatons
CHP	Cogeneration of heat and power