E-FIX

Gap Analysis
Country Report: POLAND

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1. INTRODUCTION

This report is part of the baseline analysis of the E-FIX project. The E-FIX project aims at triggering private finance for sustainable energy projects using innovative financing mechanisms. In the target countries of Central and South Eastern Europe as well as the countries of the Caucasus region there is considerable idle potential for sustainable energy products and services. Both potential energy project developers and financers face diverse financing barriers. An innovative energy financing mix is needed in order to activate new source of finance and facilitate an increased implementation of sustainable energy projects. Accordingly, the objective of the E-FIX project is to facilitate the take up and intensified usage of innovative energy financing mechanisms in the energy sector.

In order to accurately assess the idle potential of both financing sources and energy project implementation in each of the focus countries the E-FIX experts are conducting a baseline study including Gap Analysis. The present report presents one part of the baseline analysis focusing on the Gaps identified during preparation of financial sector overview for Poland.

2. POTENTIAL DEMAND FOR EE/RE FINANCE

2.1. INTRODUCTION

Significant potential for realization of both energy efficiency and renewable energy projects in Poland results from a number of factors including i.a.:

- low share of RES in Polish energy mix;
- significant share of old, energy inefficient buildings and obsolete depreciated heat generation and distribution assets;
- obligations of Poland deriving from EU energy policy;
- availability of technology enabling efficient production of power & heat and reduction of consumption by the end-users.

The main barrier related to realization of the EE&RE projects is lack of own funds by the potential beneficiaries of these projects. As a result, provision of easy-to-obtain external funding sources may be a key to enhance implementation of EE&RE projects on a wider scale.

Table 1 below presents the EE&RE project financing sources matrix for Poland. As it is shown in the table, financing EE&RE projects with equity is a common practice only for large entities.

As the vast majority of potential EE&RE projects can be defined as small and micro scale projects and tend to have long payback period, it is hard for the potential beneficiaries to attract financial investors to participate in the projects via provision of equity.

In order to enhance EE&RE projects recent years subsidies from both EU and national funds were made available via a number of dedicated programs mainly for public and large entities and private individuals.

Larger entities tend to obtain subsidies for realization of EE programs (such us thermal insulation) or construction of RES.

Construction of RES is supported by the authorities via so-called auction system. The system is based on auctions organized by the Polish Energy Regulatory Office – installations offering the lowest price per unit of energy are granted the feed-in tariffs (the tariffs are granted to the installations starting from the ones offering the lowest price, up until the sum of the total volume declared by the installations matches the volume set for the given auction).

Recently, more and more subsidy and preferred loans programs dedicated to private households for development of prosumer RES installations, mainly photovoltaic panels as well as to enhance thermal insulation initiatives appear on the market.

For example, the National Fund for Environmental Protection and Water Management (NFOŚiGW) dedicates funds via its subsidiary – the Bank for Environmental Protection (BOŚ Bank) for realization of micro prosumer installations.

BGK operates the Thermal Insulation and Renovation Fund which offers compensations in form of partial repayment of loans used for thermal insulation projects (the compensation can reach up to 20% of the loan value).

Another example of financial support for private households is introduction of new regulations since 1st January 2019 regarding personal income tax exemptions which enable tax deduction of expenses related to thermal insulation (including purchase of solar panels).

The pool of funds available via subsidies is usually limited and in most cases subsidies do not cover 100% of necessary funds, which means that potential beneficiaries are often in need to use other financial instruments in order to implement projects.

Financial instrument used to finance EE&RE projects that is the easiest to obtain and most commonly used is the debt from financial institutions. However, debt financing involves several aspects that may discourage potential EE&RE projects beneficiaries from using this kind of financing method and result in withdrawals from the projects. This aspects include i.a.:

- the necessity of provision of collateral,
- risk related to necessity of debt repayment even when the project does not generate expected results,
- the necessity of preparation of proper documentation presenting the feasibility of the potential project in order to convince financial institution to provide financing.

In some fields, such as wind energy, it may be hard for beneficiaries to finance investments through debt, or the cost of financing proves to be high due to priced-in risk resulting from the instability of the regulatory framework in Poland.

External financing of EE projects through leasing has taken place in Poland so far mainly via the PolSEFF and PolSEFF2 programs implemented by the European Bank for Reconstruction and Development in collaboration with financial institutions present on the Polish market. So far approx. 1,400 EE projects carried out by SME have been financed via leasing instrument in PolSEFF programs.

Financing activities

-> common practice	2
-> rarely used	1
-> not used	0
-> not applicable	

Projects in need of financing	**Improvement in building sector**		**Financing of energy performance improvements incl. ee equipment**				**Project preparation and development**	**R&D projects**	**Start-ups**	**Renewable energy production plants**	
Sources of funds	Public	Private	Industry	Large companies	SMEs	Public infrastructure				Large/ utility scale	Small-scale
Equity financing	0	1	2	2	0	1	2	1	0	0	1
Financing through local finance institutes	2	1	2	1	2	2	0	2	1	1	1
Financing through intern. finance institutes	1	1	2	2	0	1	0	0	1	2	0
Microfinancing											
Subsidies	2	0	0	0	1	1	0	0	1	2	1
Leasing	0	2	2	2	1	0	0	0	0	0	2
Energy Performance Contracting	1	0	2	2	0	2	1	0	0	1	1
Investment funds	0	1	2	2	0	1	0	0	1	2	0
Green bonds	1	2	2	2	1	0	0	0	0	2	0
Crowdinvesting / Energy Cooperatives	1	2	1	0	1	0	0	1	1	0	1

Energy Performance Contracting is a financial mechanism, which recently is experiencing growing popularity in Poland. Its' main advantage over debt financing is that the beneficiary is not required to provide funds for the investments prior to its completion and that the remuneration of the contractor is paid from the savings generated by the investment (in case the investment fails to generate given level of savings, the contractor is not entitled to a part of its remuneration).

This factor results in several important incentives especially for the public entities. Firstly, as already stated, no initial cash outflow is needed (in case the project is implemented fully by an external contractor) or the initial cash outflow is significantly reduced (in case the project is implemented by an SPV formed with the contractor). Secondly, EPC formula results in no (or limited) increase in debt ratios (which may allow the beneficiary to obtain debt for other issues, or to implement the project without breaching specified indebtedness criteria in case the beneficiary is obliged to meet any).

However, the problem of financing of the investment does not disappear but it is transferred to the contractor's side. As a result, only EPC contractors being the part of large capital groups are capable of realization of several EPC projects simultaneously. Smaller local contractors also often do face problems in provision of the necessary financing levels, especially when they are already engaged in other projects.

Nonetheless, EPC formula seems to have vast potential to enhance realization of EE&RE projects in Poland as it tackles major problems discouraging potential beneficiaries from implementation of the projects.

Summing up, EPC contracting may prove to be a financial mechanism with a significant impact on the level of energy efficiency experienced in Poland. However, in order to make this instrument more common on the market, a financial solution enabling obtaining of the necessary funds by contractors, which are not backed-up by large capital group is needed.

2.2. ENERGY EFFICIENCY PROJECTS

Regarding energy efficiency there are two main drivers, which result in high supply of potential projects aiming at reduction of consumption of power & heat (especially heat) and air pollution levels produced by power & heat generation. These drivers are:

a) High air pollution level in Poland and smog, which recently has suddenly become a very widely discussed issue in Poland. Peoples' awareness regarding air pollution and smog has risen sharply over the past 2 years and has also become an important social and political issue. As a result, actions are being undertaken in order to lower the emission levels (ban for the old ineffective boilers used in households combined with dotation for their replacement for newer ones or connection to district heating networks, thermal insulation of buildings);

b) High prices of CO_2 emission allowances and high coal prices which encourage interested parties to invest in energy efficiency projects aiming at reduction of generation and distribution losses (heating companies) as well as consumption (end-users).

There is a vast number of buildings in Poland, both public and households which are of significant age and suffer from poor insulation and energy efficiency parameters. As stated in the "Barometer of the healthy

houses – 2018" approx. 58% of single-family houses in Poland are over 40 years old and in poor technical condition.

According to the estimates presented by the Polish Institute of Environmental Economics the total value of potential renovation and modernization needs of single-family houses reached in 2017 the level of PLN 78 bn. The authors of the same report estimate the number of the dingle-family houses in Poland at 5.4m, out of which 69.8% could be a subject of potential renovation and modernization works.

Table 2 Estimates of potential renovation needs in the Polish single-family houses

Type of renovation works	Estimated value (PLN bn)
Insulation of exterior walls	20.6
Roof renovation including thermal insulation	29.8
Replacement of exterior doors	0.9
Replacement of windows	2.4
Kitchen/bathroom renovation	8.5
Heating system modernization including boiler replacement	16.0
TOTAL	**78.1**

Source: Energy efficiency in Poland – 2017 review – Institute of Environmental Economics

When it comes to multiple dwellings, according to the Ministry of Investments & Development, there are about 60k multiple dwellings in Poland, out of which 50k are large panel prefabricated buildings (housing approx. 12 m people) with potential for thermal insulation works.

Investments in improvement of power & heat consumption parameters for these buildings could result in significant reduction of demand for these commodities nationwide.

As both public utilities and housing cooperatives in Poland usually suffer from lack of funds to perform such investments, but, on the other hand, would be willing to reduce their power & heat consumption, there seems to be a significant potential for financial mechanisms, which would allow implementation of such investments.

As stated above, smog has become a very important social issue in Poland. The problem is of a major concern during the winter period (for example as of December 2018 according to WHO data 36 out of 50 most polluted cities in the EU were in Poland). As the people's awareness has risen sharply over the past couple of years, this issue has also become an important topic of the political discussions, which can encourage authorities to take strong actions to solve the problem in the coming years including provision of funds for replacement of boilers or connection to district heating systems.

Another pool of potential EE projects that could result in significant reduction in air pollution is modernization of heat pipes. As of 2017 there were over 21,000 km of heat pipes in Poland, out of which many were not insulated, which resulted in significant losses in the heat distribution process – the heat distribution efficiency in Poland has fallen down from 88.2% in 2002 to 86.7% in 2017. It is worth stressing out that

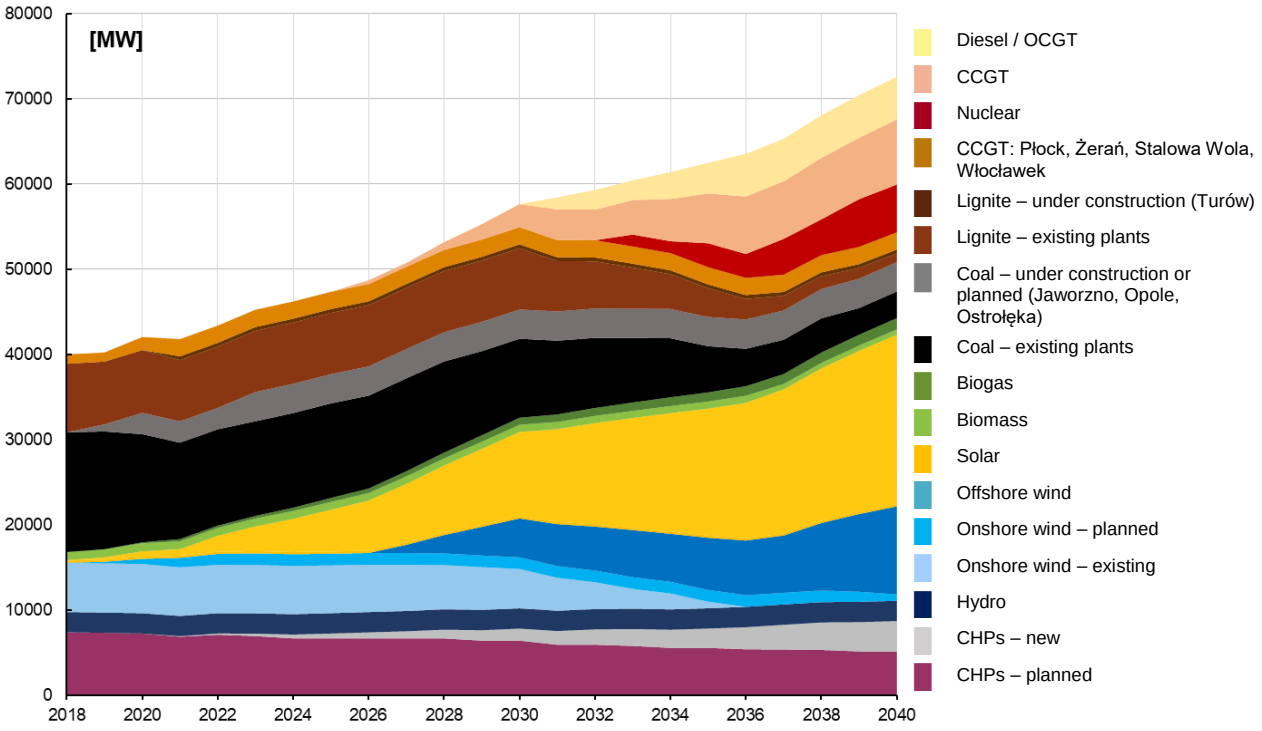
thermal insulation of buildings causes a conflict of interest for the heating companies as it results in reduction of heat sales. On the other hand, modernization of the heating pipes do not cause reduction of heat consumption but lowers the production needs, which has a positive effect on financial results of the heating companies.

2.3. RENEWABLE ENERGY

The share of energy from RES in Polish gross final energy consumption reached in 2017 the level of 11.0% The level is relatively low compared to other EU countries – the RES share for the whole EU reached 17%. In 2016 Poland was on the 21st place in EU in regards to the share of RES in gross final energy consumption.

Provisions of the European Union's energy and climate policy oblige Poland to reach 15%-share of energy from RES in Polish energy consumption by end-users by 2020, which means that Poland should increase this share by 4% till 2020 (compared to 2017). Many experts in Poland believe that fulfilling this obligation would be very challenging, if not impossible.

Graph 1 Polish energy mix (by installed capacity) according to the project pf the Polish Energy Policy 2040



Source: Polish Energy Policy 2040 (project as of November 2018)

As the EU policy regulations oblige countries not meeting the RES criteria to buy lacking level of power from RES from countries surpassing these criteria, Poland may have to spend PLN 8 bn to cover the gap

between obligations and achieved RES share. This may encourage regulators to enhance realization of RES projects in the coming years.

Experts suggest that the Polish energy policy should concentrate on the sources that are fast do develop in order to cover the gap as quickly as possible (Polish government assumes it may take up to 2 years since 2020 to meet the RES criteria). The main source offering quick and significant rise in the installed capacity is solar power, which may receive now more attention and support from the governing bodies than in the previous years.

The authorities have already taken action aiming at promoting prosumer photovoltaic installations, including subsidies, preferred loans and tax deductions of expenses related to this kind of installations.

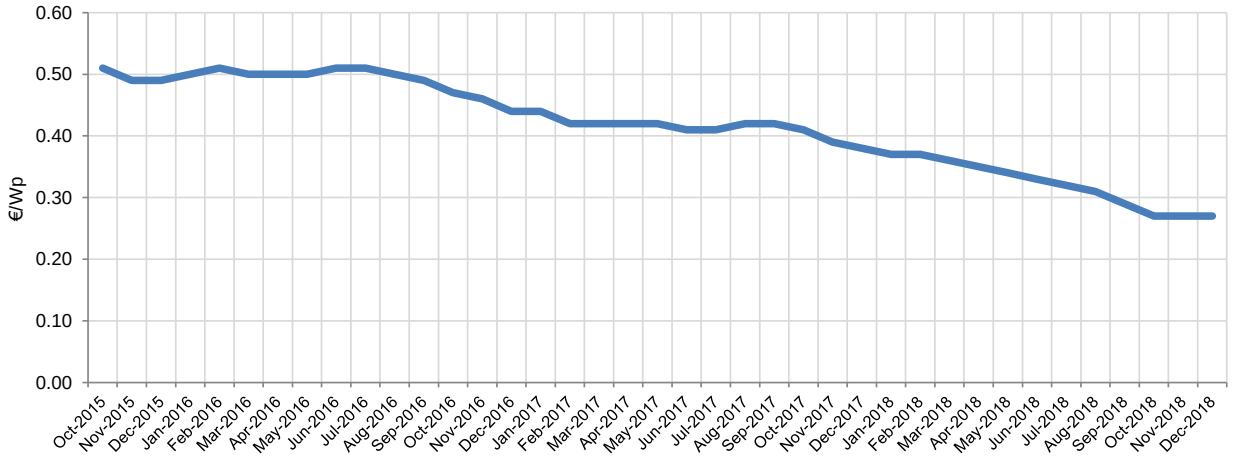
The project of the Polish Energy Policy 2040 envisages developing of over 20,000 MW of new photovoltaic installations till 2040 (as of end 2018 there was 147 MW of installed capacity of photovoltaic sources in Poland). On the other hand the authors of the document assume decrease in the volume of installed capacity of onshore wind, which is to reach the level of 800 MW in 2040 compared to 5,864 MW in 2018.

Calculation of the payback period of the photovoltaic panels is difficult due to dynamic changes on the electricity market but it is believed that currently it may reach approx. 10 years, which still may be considered as too long for many private individuals in Poland.

Fortunately, the costs of the technology used in solar power decrease rapidly so the payback period of many types of EE investments is expected to decrease significantly in the coming years.

According to pvXchange the price of “mainstream” solar modules has dropped by 27.0% in 2018 to €/Wp 0.27 in December 2018. Since end-2015 the prices have fallen down by almost a half (in December 2015 “mainstream” solar modules cost €/Wp 0.50).

Graph 2 Mainstream* solar modules prices (EU spot market prices)



** modules with usually 60 cells, standard aluminium frames, white backing and 260 Wp to 280 Wp – majority of the modules on the market*

Source: pvXchange, PV Magazine

Summing up, there seems to be a significant potential for development of RES as the share these sources in the energy mix has to rise in order to enable Poland to meet its obligations vs. EU energy policy (even with a small delay) and to prevent the country from the costly obligation of purchasing green energy abroad. However, not all types of RES seem to have good perspectives – solar power is to become the main driver of the growth of RES, while onshore wind energy seems not be considered as an attractive energy source by the authorities (at least at the moment).

3. BARRIERS TO EE INVESTMENTS

3.1. INTRODUCTION

As stated in the previous chapter, there is a significant supply of potential EE&RE projects in Poland. However, there are several important barriers that hamper implementation of these projects on the wider scale.

3.2. BARRIERS REGARDING EE PROJECTS

The landscape for EE projects differs from the RES projects as the dynamics of the regulatory environment is much slower leading to lower instability of the sector. However there are still significant barriers, which obstruct realization of these projects in Poland and efficient usage of the financial instruments by the potential project beneficiaries.

The key aspect here is the lack of ability to present adequate level of collateral by the potential beneficiaries in order to gain access to external financing sources. Debt financing also usually requires participation of the beneficiary's own funds in the financing of the project.

Public entities usually suffer from high level of indebtedness (total debt of Polish municipalities reached in 2017 the level of PLN 57.2 bn, compared to PLN 56.7 bn in 2016) and lack the assets that could provide for collateral for the financing. This also is often combined with risk assertiveness of the local authorities (as in case the investment fails to achieve its goals there is always a risk that after the elections the new authorities will accuse the former ones of mismanagement).

Lack of own funds and adequate collateral is also a common problem for potential private beneficiaries. The buildings providing the largest potential for thermal insulation are the old and in poor technical condition – these buildings are usually occupied by people with low disposable income, with a high rate of people living from social transfers. As a result these people usually lack both funds and assets that could be used in order to attract external funding sources.

Another example of this barrier is the so-called energy poverty, which can be observed in relation to modernization of local heating boilers in private households. Many households are equipped with obsolete boilers fired with low-quality fuel with high level of produced emissions. There is also a common practice to use household waste as fuel, which involves severe air pollution. There are programs, which offer subsidies for replacement of the low quality boilers. However, after the boiler replacement, the poorest may have not enough funds to buy fuel of better quality. As a result, they may be reluctant to take advantage of these subsidies.

The next barriers making it difficult for potential beneficiaries to attract external capital for realization of EE projects are: small or micro scale of most of the projects and long payback period (the smaller the project the longer the payback period).

The scale of the thermal insulation projects makes them unattractive combined with the payback period for financial institutions (they are either below the minimum investment threshold for the financial institutions or they do not meet the economic feasibility criteria).

Municipalities owning heating companies also face a conflict of interest when engaging in building thermal insulation projects as these projects result in reduced heat consumption which lowers the sales of the heating companies.

The next barrier that is worth mentioning in regards to the EE projects is the low knowledge level regarding the possibilities, technology, available financial instruments and formal requirements for obtaining financing. The latter results in entities not being able to prepare proper documentation regarding implementation of the EE projects without the help of the external auditing companies. As a result, the costs of realization of the projects are driven up by the remuneration of such companies.

3.3. BARRIERS REGARDING RES PROJECTS

One of the largest barriers impacting the development of the RES projects in Poland is regulatory environment and its instability.

Over the past 3 years significant changes have been introduced to laws regulating RES operation and RES support system. The major changes affecting RES were as follows:

- replacement of the green certificates market with auction system based on feed-in-tariff (RES that have become operational before 1st January 2017 had the option to remain in the green certificates system);
- perturbations connected with introduction of the auction system resulting in first successful RES auctions held in November 2018, almost 3 years after introduction of the system;
- destabilization of the green certificates market leading to significant oversupply on the market which lead to collapse of the prices of the certificates and heavy deterioration of the financial results of RES;
- modification of the calculation method of the so-called substitution fee in the green certificates system without introducing a minimum level (only the maximum level was introduced), which led to a negative stability change in the economic conditions for the continuation of long-term renewable energy projects;
- introduction of new laws regarding of construction and operation standards for wind turbines in 2016 – the major changes were related to wind farms' location against living areas (the distance between the wind turbine and the closest occupied building cannot be lower than 10-times the length of the turbine – so called "distance law") and the taxation regulation (property tax was imposed on the wind turbine, while earlier it was not treated as a property – this regulation has already been withdrawn).

Introduction of the “distance law” has a heavy impact on the possibilities of future development of new wind projects as the area meeting all the criteria regrading location of wind turbines amounts to approx. 1% of the area of the entire country.

In June 2018 new changes were adopted in the RES Law in order to animate the onshore wind market. These changes include cancelation of imposing of property tax on wind turbines and granting a 3-year period for wind farms with building permit in locations failing to meet the location criteria to start the operations.

Second legal factor affecting the RES investment climate is the dynamics of the changes in the regulative landscape of the whole power system in Poland.

On 28th December 2018 a new law was passed in order to curb electricity prices, which have risen rapidly in 2018 (the market electricity prices rose by approx. 40% in 2018) due to higher coal and CO_2 emission allowances prices. New law envisages cut in the level of the excise tax and (what is more important for the companies on the electricity market) sets the maximum limit of the prices for electricity sale (which cannot exceed the level from 30th June 2018) and the distribution fee (which cannot exceed the level from 31st December 2018). Trading and distribution companies are to be reimbursed by a special public fund with funds generated from disposal of the excess CO_2 emission allowances from the pool for 2013-2017 eligible for Poland via derogation mechanism, which were not allocated to the power generators. Total volume of unused allowances reached 113m and Polish authorities plan to dispose 55.8m allowances from this pool in 2019.

However, there are still no ordinances regulating functioning of the reimbursement mechanism and many experts believe that there is a high risk of trading and distribution companies bearing part of the cost resulting from the price freeze. Moreover, the experts mention that the cost of reimbursement, which was estimated by the authorities at the level of PLN 9bn, may be insufficient to cover all the loses by these companies (these costs are estimated to reach PLN 13 even to 16bn).

Another factor generating potential risks is uncertainty, if these regulations are in line with EU law and how potential changes in this respect could affect the situation of the companies on the electricity market. The price freeze law does not affect electricity generators directly but it may have a critical impact on the entities purchasing the power from generators, so it may affect generators as well.

The next factor discouraging investors from the RES sector is insecurity regarding the actions and business relations with the largest clients. In 2017 the largest Polish energy utilities controlled by the State Treasury decided to withdraw from the execution of a number of the long-term CPA and PPA agreements that were the basis for financing the RES projects in the project finance formula, which led to significant deterioration of the financial situation of wind farms being parties of the contracts.

As a result investors and financial institutions are reluctant to provide financing for RES or the cost of financing is unattractive due to the priced-in risk of these investments.

The next barrier is long payback period of particular RES types – e.g. for photovoltaic installations payback period in Poland, as already stated earlier in this document, is currently estimated at the level of approx. 10 years (however this ratio is decreasing significantly due to changes in technology).

3.4. BARRIERS RELATED TO EPC CONTRACTS

EPC mechanism has been developed as the solution for the problem of lacking money and collateral of the potential project beneficiaries. However, this mechanism still suffers from several barriers on the Polish market making it difficult for the companies not backed by large capital groups to perform successfully on a wider scale. Lack of the supply of potential contractors curbs the number of EPC formula projects realized in Poland.

The main players on the Polish market are i.a.:

- CEZ ESCO Polska
- Enea Oświetlenie
- Energa Oświetlenie
- Engie Services
- Siemens
- Veolia

Another advantage of the ESCO companies being part of the large capital groups is that the EPC projects often involve the usage of the equipment produced by these groups and as a result they increase the future demand for the products and services of the specified producer (e.g. EPC projects regarding street lighting performed by groups offering adequate lighting solutions). This advantage also may result in those entities being able to offer their services for a lower price than their smaller competitors.

In the EPC formula the contractor is the party responsible for providing financing for the realization of the project (the contractor is later repaid in part of the saving generated by the project to the beneficiary). Smaller contractors can only take on a very limited number of projects as they often have to seek external forms of financing. Moreover small contractors with high debt levels are usually assumed as entities with higher risk levels by financial institutions, which results in higher cost of debt.

One of the solutions that can be used to tackle this issue is forming of a JV company dedicated to realization of the project by both the beneficiary and the contractor. This solution however results in participation of the beneficiary in the financing of the project, so, to some extent, it consumes the main advantages of the EPC formula.

As a result the size of the ESCO market in Poland is relatively small – according to DB Energy estimates, the market in Poland in 2018 was € 30 m compared to € 27 bn of the global market, which implies the share of the Polish market at the level of 0.1%.

4. PROPOSED E-FIX COMBINED EPC/ESCO FINANCING MECHANISM

Subject of financing

The subject under consideration is how to finance innovative EE/RES projects exploiting low waterfalls, weirs and barrage levels after watermills in river channels to generate electricity for local small estates or villages as well as some production activities. The project consists in the construction of small size hydroelectric power stations on the rivers of Mazovia.

The project consists in the effective use of an innovative water wheel in the riverbed with a water threshold to generate electricity. The project restores to original conditions to devastated hydro-technical constructions. The solution is patented, it ensures the use of potential and kinetic energy along the entire height of the water column damming, preventing the deposition of mules in the river bed against weirs.

The research and development phases have been financed by the National Centre for Research and Development (NCBR). As a result a prototype has been developed, which will be tested at the turn of January and February 2019. Financing for the construction of the production line and further on the production of the prototype rig will be provided by Polish Agency for Industrial Development (PARP) and the National Fund for Environmental Protection (NFOŚiGW).

Implementation of the pilot rig and operational tests

The owner of the solution is “Hydroenergy”, which in cooperation with “Investor” has started an inventory of locations in Mazovia, where it could be possible to install a prototype of hydroelectric power plant connected to a nearby grid to carry out a year-round exploitation of the hydro generation rig observing seasonal changes and total yearly performance. It is been agreed that an “Investor” into these hydroelectric plants will be a regional self-government company which is responsible for promotion, implementation as well as of financing for the EPC and RES projects. “Hydroenergy” will act as a developer and post-warranty services provider for the hydroelectric power plants in Mazovia at locations selected by both parties.

Project financing mode

The project will be executed according to the EPCC mode (Engineering, Procurement & Construction Contracting) by “Hydroenergy”. “Investor” is obliged to arrange project execution financing. Since innovative projects usually incorporate some risks, it has been decided to apply EPC/ESCO (Energy Performance Contracting / Energy Service Company) financing methodology into the project execution. “Hydroenergy” will be obliged to achieve some fixed energy performance over a period of time to refinance the arranged by “Investor” loans, leaving some guaranteed margin to “Investor”.

It is been assumed that financing of investment will consist out of two phases:

- Engineering loan for 5 years – for financing inventory works at selected locations consisting out of potential energy efficiency auditing and complete set of engineering works and commissioning as well as operational supervision over unpaid warranty period – refinanced over 3 year warranty period exploitation;
- Construction and exploitation supervision loan – for over 3 year unpaid warranty and 12 year paid (2%) exploitation period – refinanced from energy sales.

Refinancing of the investment after its implementation will take place from energy sales, therefore it is important as part of project engineering duty to conduct carefully energy efficiency audit of the location lasting at least for ½ year, however annual period is recommended.

As it can be seen from the above, the investment contractor should have a data acquisition system that allows for seasonal characteristics collection of a given location as well as exploitation supervision.

Potential locations of the power plant

So far, there have been 10 places identified in Warsaw nearby locations, in which it would be possible to install hydroelectric power plants with capacities from ca. 50 kW to ca. 400 kW. Actions have been taken to obtain the necessary approvals for hydropower project implementation projects (realized power plants are portable devices) - they can be installed in a series system or parallel depending on local conditions. 4 of the acceptable locations can be implemented in a serial configuration, and 2 in parallel. In the initial stage, individual units are planned.

Illustration of the cost of an example project

Construction of a hydroelectric power plant with a rated power of 160 kW, max. 180 kW, dia. 110 kW, min. 68 kW, working time in 11 months. Initially, devices with a design amounting to PLN 1,450 thousand were priced. Up to this amount should be added about PLN 200,000 for construction works, strengthening of the banks and clearing the river bed on the 200 m section. Total cost of the whole is PLN 1,650 million net. At a price of 1 kWh at the level of PLN 0.495, the revenue from energy production will amount to PLN 39,420 per month, and PLN 470 448 per year.

The contractor will take a profitability ratio for an external investor at the level of 20% return. The device must be returned to the investor within a maximum of 5 years. At First the device will be subject to a discount in the sale price and the return on this investment will take about 3.5 years.

The Contractor gives a guarantee for 3 years, it is possible to extend it for 12 years at a price of 2% per annum, which extends the return on investment period to approx. 8.5 years, respectively,

Attention!
The above analysis does not take into account financing costs and assumes a 15-year lifetime of the installation.

5. ANNEXES

5.1. ANNEX A: BIBLIOGRAPHY

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5.2. ANNEX B: ABBREVIATIONS

- BGK – Polish national development bank
- BOŚ Bank – the Bank for Environmental Protection
- CPA – Certificate Purchase Agreement
- EE – energy efficiency
- EPC – energy performance contracting
- ESCO – energy saving company
- EU – European Union
- NCBR – National Centre for Research and Development
- NFOŚiGW – the National Fund for Environmental Protection and Water Management
- PARP – Polish Agency for Industrial Development
- PLN – Polish zloty

- PPA – Power Purchase Agreement
- RE – renewable energy
- RES – renewable energy sources
- WFOŚiGW – the Fund for Environmental Protection and Water Management of the Voivodeship
- Wp – watt peak capacity

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