D.T2.5.7

Summary report on Pilot Action to assess Industrial sectors RE projects in the Czech Republic

WP T2: Activity 2.5 PA 2: Improving energy efficiency in Industry Sector

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Introduction

The FIRECE project aims to contribute to the achievements of targeted results of Regional Energy Plans through an increased use of (innovative) financial instruments in the Central Europe area. The particular focus is on public support to industry to invest into energy efficiency and renewable energy sources.

The activity *2.5 Improving energy efficiency in Industry Sector* includes Pilot Actions carried out in five partner countries to assess Industrial sector RE projects using the Project level tool developed in WP T1 (O.T1.4) and updated in WP T2 (O.T2.2). The goal is to assess the public investments to support Industry low carbon transition: analysis of projects/investment plans elaborated by SMEs on EE/RES to verify their quality and quantity contribute to achieve the Energy Plans' targets.

This report collects and analyses data of industry assessment in the Czech Republic, useful for the evaluation of the Pilot Action 2.

EXECUTIVE SUMMARY

Country / region / PA2 Implementation area

Czech Republic

Relevant energy saving funds:

Operational Programme Enterprise and Innovation for Competitiveness 2014 – 2020 (ERDF)

Target group – SMEs[1]

Number of SME's involved:

8 companies:

- micro: 2
- small: 2
- medium: 4

Type of projects:

Finalized and ongoing projects

- implemented: 6
- implemented and verified: 2

Energy saving measures / type of investments analysed

Energy savings projects: 4

Measures involved:

- Change of a heating source: 2
- Modernization of a heating system (distribution): 1
- Building envelop insulation: 2

[1] SMEs are the main target group of the Pilot Action 2. Under Regulation (EU) No 651/2014 of the European Commission, micro, small and medium-sized enterprises (SMEs) are enterprises with fewer than 250 persons and whose annual turnover does not exceed EUR 50 million and / or \ their annual balance sheet total does not exceed EUR 43 million.

- Replacement of doors and windows: 2
- Installation of LED lighting: 1
- Modernization of a technology: 2

Renewable energy sources projects: 4

Measures involved:

- Roof photovoltaic power plant: 4
- Battery system: 2
- Charging station for electro vehicles: 1

Involved stakeholders

Czech-Moravian Guarantee and Development Bank

Ministry of Industry and Trade

SMEs

1. Summary of the results obtained from the IT tool calculation

The analysis included eight projects funded from the ERDF Operational Programme Enterprise and Innovation for Competitiveness (OPEIC) that had already been implemented.

Half of the projects represented installation of renewable energy sources in particular roof photovoltaic power plants, in two cases combined with a storage battery system and a charging station for electric vehicles. Two projects focused on increasing the energy efficiency of a heating system (biomass boiler, modernization of a distribution system for heat and hot water), while the remaining two consisted of a wider set of energy saving measures, such as building envelop insulation, roof insulation, replacement of doors and windows, installation of LED lighting, and modernization of technology.

The main characteristics of the projects are summarized in the Annex I.

The funding was provided in a form of grants, because no financial instruments were introduced in OPEIC in the programming period 2014-2020.

Therefore, the use of grants supplemented by own resources is considered as the basic scenario and relevant results obtained from the IT tool calculations are provided in the following sub-chapter 1.1. Further, the IT tool was used to simulate how the project performance would change if financial instruments (in particular soft loans) were used. The relevant simulations are described in the chapter 2.

1.1 Basic scenario

The basic scenario consisted in the situation, when a project received a subsidy from the OPEIC (in average 49%), while the remaining part of the investment was covered by own resources of a company.

The three groups of indicators were considered and calculated:

- Energy savings, including costs of energy savings;
- GHG savings expressed in CO2eq savings, including costs of the savings;
- Economic performance (cash flow, net present value, payback period).

In general, it can be concluded that the projects on installation of renewable energy sources (RES) – here in particular, roof photovoltaic power plans – demonstrate very good results in all three categories of indicators, whereas the projects on energy

savings show more variable results depending on a concrete measure that was implemented. While the project consisting mostly of building insulation measures delivered poor results, building insulation combined with a change of a heating source was a very successful project. The worse performance in most of the indicators was achieved by the project on modernization of a distribution system (i.e. insulation of a pipework) for heat and hot water.

Energy savings

The total amount of energy savings varies from 55 to 4758 MWh per project. As it depends mostly on the amount of investment, this absolute indicator does not have adequate information value as such.

Regarding the costs of energy savings (expressed in €/MWh), the most expensive are the projects on modernization of a distribution system and building insulation, which show the costs over 2 600 €/MWh. On the contrary, the combination of a building insulation and a change of a heating source achieves the lowest costs in the amount of 570 €/MWh. Also the projects on RES demonstrate relatively good performance; their average costs are 1395 €/MWh.

The summary results are provided in following table:

Table 1 - Energy savings performance of the projects - basic scenario

Project	Cost of energy savings [EUR/MWh]	Cost of energy savings (public investment) [EUR/MWh][2]
Roof photovoltaic power plant	1 626,38	912,03
	1 369,46	838,64
	1 578,32	732,85
	1 005,44	479,01
Modernization of a distribution system	2 881,12	1 440,56
Change of a heating source	1 661,21	662,15
Building insulation	2 668,02	1 382,83

[2] The ratio does not relate to the entire investment, but only to the amount of the subsidy.

Building insulation and change of a heating source	570,36	228,14

GHG savings

The total amount of GHG (CO2eq) savings varies from 4,9 to 2 070 tons per project. As it depends on the amount of investment, this absolute indicator does not have adequate information value as such.

Regarding the CO2eq savings per MWh saved, the best ratio is delivered by the projects on RES installation and the project on change of a heating source (new biomass boiler). The electricity and heat generation in the Czech Republic still involves a lot of coal, therefore savings of these energy carries result in the best CO2eq savings (the emission factors of these energy carriers are the highest) – about 900 kg/MWh. The worst performance was delivered by the project on modernization of a distribution system (16,23 kg/MWh).

In terms of costs of CO2eq savings (expressed in €/kg), very similar performance is demonstrated by RES projects (1,59 €/kg on average), and the projects on change of a heating source and combination of building insulation and change of a heating source (1,72 €/kg and 1,31 €/kg respectively), while the project on a mere building insulation has several times higher costs (9,86 €/kg). The project on modernization of a distribution system shows extreme costs of 177,53 €/kg.

The summary results are provided in following table:

Table 2 – GHG (CO2eq) savings performance of the projects – basic scenario

Project	CO2eq savings per MWh saved [kg/MWh]	Cost of CO2eq savings [EUR/kg]	Cost of CO2eq savings (public investment) [EUR/kg]
Roof photovoltaic power plant	879,79	1,85	1,04
	879,79	1,56	0,95
	879,79	1,79	0,83
	879,79	1,14	0,54
Modernization of a distribution system	16,23	177,53	88,77

Change of a heating source	963,18	1,72	0,69
Building insulation	270,53	9,86	5,11
Building insulation and change of a heating source	435,05	1,31	0,52

Economic performance

All analysed projects show positive annual cash flow, which is equal to annual energy savings; there is no annual negative cash flow in terms of loan instalments as the financing consisted only in subsidies.

However, there is a considerable difference among projects when it comes to "cash flow breakpoint" – i.e. a year when cumulative savings exceed cumulative expenses[3] (cumulative CF = 0). The fastest repayment was achieved in the project combining a building insulation and a change of a heating source (8 years) followed by RES projects (10-11 years for most of the projects, one project – 21 years). In case of the other projects, the repayment can be achieved only several years after the lifetime of the measure, while the project on modernization of a distribution system can never reach CF = 0 when taking into account time value of money (discount rate).

Similarly, the project on combination of a building insulation and a change of a heating source and the projects on RES installation deliver positive net present value (NPV), while NPV of the other projects is negative.

The first group of projects also provides a simple payback period that is lower than the lifetime of the measure (10 years – combination project, 16-25 years – RES projects), while the payback period of the remaining projects exceeds the measure lifetime. With a subsidy, the projects are able to deliver a shorter payback period of own investment; in most of cases going below the measure lifetime. The only exemption is the project on modernization of a distribution system, which payback period is almost 104 years and the payback period of own resources almost 52 years.

[3] In case of the basic scenario, cumulative expenses = the initial own investment.

The summary results are provided in following table:

Table 3 - Economic performance of the projects - basic scenario

Sector	CF breakpoint [year]	NPV [EUR]	Simple payback [years]	Simple payback (own investment) [years]
Roof photovoltaic power plant	10	43 025,86	16,98	7,46
	10	172 392,44	20,11	7,79
	21	16 838,33	25,60	13,71
	11	38 841,42	15,97	8,36
Modernization of a distribution system	never	- 321 036,63	103,72	51,86
Change of a heating source	24	- 39 385,45	25,26	15,19
Building insulation	57	- 10 312,90	46,23	22,27
Building insulation and change of a heating source	8	2 565 497,68	10,11	6,07

Note: Among the analysed projects, the one on modernization of a distribution system shows extremely poor performance in all areas - energy, GHG emissions, economy. The costs of both energy and GHG emissions savings are the highest, while CO2eq savings per MWh saved are very low; the simple payback period exceeds 100 years, and the project can never reach the CF breakpoint.

The project consists in replacement of old central heating pipework with new pipes. Although it does not deliver high energy savings and is investment-intensive at the same time, the modernization was necessary to be carried out due to the age of the old pipework.

The implementation of the measure was not motivated primarily by energy and financial savings, but by technological needs.

2. Conclusion of the Industrial sector energy efficiency projects assessment analysis

In order to assess an impact of the different types of instruments and different shares of financial support on the economic and environmental parameters of the projects, two alternative scenarios were developed and analysed:

- **Scenario 2** simulates the situation when the project receives a subsidy (same amount as in the basic scenario) and the rest of the investment is financed through a soft loan. The repay of the loan is 10 years, while two levels of the interest rate are considered – 1% and 2%.

  Note: This combination of financial instruments was piloted in some operational programmes in recent years; however, not for energy-related projects.

- **Scenario 3** excludes subsidies and consists in financing through a soft loan with the repay of 10 years and 0% interest rate. The loan is provided up to 70% / 90% (two alternatives) of the investment, while the rest is covered from the company's own resources.

  Note: This type of financing is already piloted by the Czech-Moravian Guarantee and Development Bank for specific energy savings projects, and is considered to be more widely used in the next programming period, in particular for small-scale projects.

In terms of results, energy and GHG emissions savings – both absolute and relative indicators – remain the same in the described scenarios as in the basic scenario. Concerning economic indicators, the cash flow and the simple payback period also do not change, while the cash flow breakpoint and the net present value differ.

For more detailed evaluation of the results, which are presented in the following sub-chapters, the projects were divided into two groups based on the NPV indicator (positive or negative) reached in the basic scenario – see table 4.

Table 4 – Groups of the project based on their economic performance

Group 1	Projects with NPV > 0 • Roof photovoltaic power plant (4 projects) • Building insulation and change of a heating source
Group 2	Projects with NPV < 0 • Modernization of a distribution system • Change of a heating source

- Building insulation

Compared to the basic scenario, some other indicators were introduced into the scenarios 2 and 3 to evaluate economic performance of the projects, including:

- Alternative subsidy share – Taking into account the NPV achieved in this scenario, the indicator shows hypothetical subsidy that would be needed to reach the same NPV without applying a loan.
- Alternative own investment – Following the previous indicator, this indicator calculates what would be necessary amount of own investment.
- Interest rate to reach the basic scenario NPV – This indicator calculates what could be the highest interest rate acceptable for the project, if the company would like to achieve (at least) the same NPV as in the basic scenario.
- Interest rate to reach NPV=0 – For the projects with negative NPV, the indicator calculates the highest interest rate acceptable, if the company would like to achieve (at least) NPV=0.

2.1 Scenario 2 – subsidy + loan

The use of financial instrument (soft loan) instead of own resources for co-funding of the project has the ability to increase its NPV and decrease the CF breakpoint – which is valid for both interest rates analysed. However, none of the projects with negative NPV in the basic scenario was able to turn into positive numbers in the scenario 2.

The analysis of the group 1 projects reveals that the better is the economic performance of the project the lower is the relative increase of the NPV. While the best performing project's increase of NPV achieves 9,12%, the worst performing projects shows 103,14% increase, while the other projects vary between 13% and 17% (data for the variant with 1% interest rate).

The projects with higher annual financial savings than the annual loan instalment generate positive cash flow since the beginning; therefore their CF breakpoint is 1 year.

The hypothetical increase of the subsidy share ranges between 5,5% and 8,7% (for 1% interest rate), and does not show any differences between group 1 and group 2 nor among the project types.

The interest rate, which results into the same NPV as the one achieved in the basic scenario, is the same for all the projects. It reaches 4% and indicates the interest

rate up to which it is still more beneficial for a company to apply for a loan rather than invest its own resources.

None of the projects from the group 2 was able to achieve NPV=0 even with an interest-free loan. It indicates that annual loan instalment is always higher than annual energy savings.

The summary results are provided in following tables:

Table 5 - Economic performance of the projects - scenario 2 (1% interest rate)

Project	CF breakpoint [year]	NPV [EUR]	Alternative subsidy share [%]	Alternative own investment [EUR]
Roof photovoltaic power plant	1	48 668,82	62,39%	33 643,92
	1	197 048,94	66,81%	147 004,56
	17	34 204,85	54,12%	103 540,97
	1	45 268,85	55,16%	38 321,00
Modernization of a distribution system	never	- 258 548,39	57,18%	372 561,26
Change of a heating source	19	- 18 291,15	48,50%	125 766,38
Building insulation	37	- 5 349,08	58,75%	29 594,79
Building insulation and change of a heating source	1	2 799 372,65	48,62%	1 394 386,43

Table 6 - Economic performance of the projects - scenario 2 (2% interest rate)

Project	CF breakpoint [year]	NPV [EUR]	Alternative subsidy share [%]	Alternative own investment [EUR]
	1	46 838,34	60,34%	35 474,40
	1	189 050,80	65,00%	155 002,71

Roof photovoltaic power plant	18	28 571,45	51,63%	109 174,37
	1	43 183,90	52,72%	40 405,94
Modernization of a distribution system	never	- 278 818,49	54,85%	392 831,37
Change of a heating source	21	- 25 133,78	45,70%	132 609,00
Building insulation	42	- 6 959,26	56,50%	31 204,96
Building insulation and change of a heating source	1	2 723 507,64	45,82%	1 470 251,44

2.2 Scenario 3 – loan + own investment

The use of financial instrument (interest-free loan) and own resources without any subsidy very significantly decreases the projects NPV and increases the CF breakpoint compared to both basic scenario and scenario 2– which is valid for both amounts of a loan analysed.

While two projects from the group 1 turn into red numbers (NPV decreases below 0), three projects experience decrease ranging between 28% and 89% (data for the variant with 70% loan). Negative NPV of the projects from the group 2 doubles or triples. Positive NPV remains only in case of two RES projects and the project on building insulation and change of a heating source.

None project is able to generate higher financial savings than the annual loan instalment; therefore, the annual cash flow gradually decreases in the period of the loan repayment (10 years). Only three projects are able to achieve lower CF breakpoint that the measure lifetime (11 years – combination project, 20-23 years – two RES projects).

For all the projects, the hypothetical subsidy share is 13,22% in case of the variant with 70% loan and 17% in case of the variant with 90% loan.

As the scenario 3 calculate with the interest rate = 0%, the indicators 'Interest rate to reach the basic scenario NPV' and 'Interest rate to reach NPV=0' were not analysed.

The summary results are provided in following tables:

Table 7 - Economic performance of the projects - scenario 3 (loan 70%)

Project	CF breakpoint [year]	NPV [EUR]	Alternative subsidy share [%]	Alternative own investment [EUR]
Roof photovoltaic power plant	23,00	4 687,70	13,22%	77 625,04
	31,00	- 40 276,81		384 330,31
	56,00	- 58 115,28		195 861,09
	21,00	9 425,57		74 164,27
Modernization of a distribution system	never	- 641 053,76		755 066,63
Change of a heating source	54,00	- 104 438,32		211 913,54
Building insulation	never	- 38 012,44		62 258,14
Building insulation and change of a heating source	12,00	1 838 766,81		2 354 992,27

Table 8 - Economic performance of the projects - scenario 3 (loan 90%)

Project	CF breakpoint [year]	NPV [EUR]	Alternative subsidy share [%]	Alternative own investment [EUR]
Roof photovoltaic power plant	22,00	8 066,55	17,00%	74 246,19
	29,00	- 23 547,76		367 601,26
	49,00	- 49 589,87		187 335,69
	20,00	12 653,78		70 936,07

Modernization of a distribution system	never	- 608 187,37		722 200,24
Change of a heating source	47,00	- 95 214,19		202 689,41
Building insulation	never	- 35 302,48		59 548,18
Building insulation and change of a heating source	11,00	1 941 274,44		2 252 484,63

2.3 Conclusions

Comparison of the analysed scenarios represents, at the same time, comparison of the three different financing models:

- subsidy + own resources (prevailing model in ERDF funding in the Czech Republic);
- subsidy + soft loan;
- soft loan + own resources.

While the substitution of own resources with a soft loan delivers better economic results in terms of slightly higher NPV and lower CF breakpoint, the substitution of a subsidy with a soft loan leads to considerable decrease of NPV and increase of CF breakpoint (see table 9). The settings of a financial instrument (e.g. interest rate, ratio of a loan) have only a less significant impact on this overall trend.

Table 8 - Economic performance of the projects - scenario 3 (loan 90%)

Indicator	Basic scenario Subsidy + own resources	Scenario 2 Subsidy + soft loan	Scenario 3 Soft loan + own resources
Net present value (NPV)	o	+	- -
Cash flow (CF) breakpoint	o	+ +	- -

When combining a subsidy with a soft loan (scenario 2), several projects generate positive cash flow since the beginning. Their annual financial savings are higher than

the annual loan instalment and at the same time, the company does not need to provide its own initial investment.

However, when increasing the share of a loan (scenario 3), the annual instalment is too high to be recovered by annual financial savings, and so the annual cash flow turns into positive trend only after the repayment of the loan.

All the projects have the ability to generate energy and GHG savings, and so to contribute to the goals of national/region energy plans. Nevertheless, to make the projects also economically viable, a certain level of a subsidy component seems to be necessary to be involved into the financing schemes.

3. Conclusion of the performance of the Project level tool (O.T1.4) to assess public investments for industry's low carbon transition

ENVIROS was a responsible partner for the development of the Tool including the graphical design as well as for local specifications finalized based on other partners' data.

Technical aspects

The Tool is developed in MS Excel and includes macros. In the process of local specifications elaboration, some partners faced a problem that the Tool (macros) did not work properly in their MS Excel version; however, there issues were flexibly solved by ENVIROS.

Besides the inputs inserted by the user in the main screen, the data on emission factors has to be incorporated into the Tool in advance. As the energy mix in partner countries is different, the emission factors had to be identified for each country/region. For some partners, it was a little bit difficult to identify the national/regional factors, and so the development of local specifications took more time.

User friendliness

Inserting of the input data is easy; the input tables are highlighted in lighter colour and the specific fields are described. The Tools includes internal control mechanisms that prevent data to be inserted in a wrong format (e.g. text instead of numbers, share of financial resources higher than 100%, etc.).

For data on energy savings and energy prices, several units can be used (kWh, MWh, GWh, MJ, GJ, TJ), and they are automatically recalculated to the common unit selected by the user.

The table with outputs is also highlighted in lighter colour, and the outputs are displayed in charts, too. When the user changes some of the inputs, the results are immediately visible in the charts.

However some issues regarding the inputs and the charts were identified:

- table Inputs: The field 'Lifetime/expected payback period' relates to the lifetime of the measure. The text 'expected payback period' can be misleading for users.
- chart Energy cost: The bars of specific energy carries does not match the items in the legend.
- chart Cash Flow: The negative cash flow in the year '0' (initial own investment) is not displayed.

Recommendations and suggestions

The Tool was developed with the aim to provide a calculation of energy, environmental and economic performance of the energy-related projects, and to allow the user to simulate and compare different possibilities of financing.

The Tool and the presented outputs are built on basic calculations that definitely could be extended to make the Tool more robust and the results more precise – which, however, would require more data to be inserted as inputs and would pose more requirements on the users.

The more sophisticated version of the Tool could include for instance the following aspects:

- Consider different lifetimes of measures in case of projects that consist of several measures;
- Consider additional annual savings not relevant to energy savings (e.g. lower maintenance costs);
- Consider depreciation (amortization) of new equipment;
- Calculate with expected inflation;
- Consider the time delay between the beginning of the project (i.e. year '0') and the time when the company receives a subsidy;
- Besides the simple payback period, calculate also discounted payback period;

- Introduce some additional indicators (e.g. Relative costs of energy savings, Relative costs of CO2eq savings, Interest rate to reach expected NPV, Interest rate to reach NPV=0);[4]
- etc.

[4] These indicators were used in the calculations of the scenario 2; however, they were calculated additionally as they are not included in the Tool.

Annex I: Main characteristics of analysed projects

Company	Sector	Size	Project	Investment	Status
1.	Manufacturing of machinery for quarrying	Medium (73 employees)	Roof photovoltaic power plant and battery system	89 451 EUR	implemented
2.	Processing of plastics (injection moulding)	Small 45 (employees)	Roof photovoltaic power plant, battery system and charging station for electro vehicle	442 882 EUR	implemented
3.	Manufacturing of housing and office furniture	Medium 58 (employees)	Change of heating source – installation of a new biomass boiler	244 198 EUR	implemented
4.	Heating plant	Micro 5 (employees)	Modernization of a distribution system for heat and hot water	870 099 EUR	implemented and verified
5.	Construction and buildings	Medium 233 (employees)	Roof photovoltaic power plant	225 700 EUR	implemented
6.	Logistics and storage of frozen and chilled foodstuffs	Small 14 (employees)	Roof photovoltaic power plant	85 463 EUR	implemented

7.	Manufacturing of ceramic products	Micro 5 (employees)	Set of measures: - building envelop insulation - replacement of doors/windows - modernization of technology (electric resistance furnace)	71 743 EUR	implemented
8.	Manufacturing of machinery for rubber and plastics industry	Medium 198 (employees)	Set of measures - building envelop insulation - change of heating source (gas heaters) - installation of LED lighting - modernization of technology (furnace, welding aggregates)	2 713 769 EUR	implemented and verified