

# GUIDE

# FINANCIAL

# CALCULATIONS



# EFFECT4buildings

Investments in energy efficiency are not currently happening at the rate needed, hindered by barriers such as high upfront costs, lack of access to finance, high perceived risk, lack of trust in new technologies, competing investment priorities, lack of knowledge, awareness and personal resources, and split incentives. Many of these barriers can be overcome, at least significant part, with well-designed financial tools and instruments.

The Interreg Baltic Sea Region Program 2014-2020 project EFFECT4buildings is providing building owners and managers with a set of financial tools and instruments to support the implementation of more energy efficiency measures, developed, and improved in real cases.

The main target group is building managers in charge of public or privately owned building portfolio.

## The nine tools are:

- Convincing Decision makers
- Financial calculations
- Bundling
- Funding
- Energy Performance Contracting
- Multi Service Contracting
- Green Lease Contracting
- Prosumerism

EFFECT4buildings was implemented from 2017 to 2020 with the support from the Interreg Baltic Sea Region Programme 2014-2020. There were seven partner countries – Denmark, Estonia, Finland, Latvia, Norway, Poland, Sweden.

The project was also a part of the implementation of the EU Strategy for the Baltic Sea Region (EUSBSR), being a flagship project under policy area Energy and the horizontal action Sustainable development. Flagship projects demonstrate the progress of the EUSBSR and serve as pilot examples for desired change.

**The full toolbox can be found on project webpage: [www.effect4buildings.se](http://www.effect4buildings.se)**

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## PROJECT WEBSITE

[www.effect4buildings.se/](http://www.effect4buildings.se/)

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## LAYOUT & PICTURES

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# FINANCIAL CALCULATIONS

To predict the profitability of an investment, financial calculation methods are used. Since the traditional approach, based on pay-back time, is inefficient, the project propose tools (in web and Excel versions) that enables one to employ several methods, either independently or in combination. In particular, Net Present Value and Internal Rate of Return prove efficient and helpful for building managers, energy auditors, and other investors. To use these methods wisely, however, they need appropriate training, and so the tools are accompanied by training material that is both informative and simple to understand.

## Let's understand the problem

Interviews with building managers proved that most of them (92%) consider financial calculations critical for justifying energy efficiency measures before making decisions. At the same time, only about half of them find it easy to do—or can even understand financial calculations. Around 40 interviewed building managers – representing building stock of about 11 million square meters, with over a thousand separate buildings – stated that understandable calculation tools are key to implementing more energy efficiency measures.

The profitability of an energy efficiency investment is crucial, and investment decisions have long-term consequences in the future. Implementing energy efficiency measures requires comprehensive justification and clear calculations with easy understandable visual charts presented mainly by building managers.

Decision makers and other stakeholders need clear visual information to easily estimate the profitability of various suggested investments. Planning strongly depends on budget restrictions and the availability of convenient funding sources. All these details are key for decision makers, who have to weigh them to make final decisions.

The most common method for financial calculations of energy measures, also in energy audits, is the pay-back method. This method does not take aspects of technical lifetime and profitability demand in consideration. Therefore, complementary calculation methods are needed and building managers need knowledge in how to use them.

## Solution

Building managers need financial calculation tools that are both useful and understandable. If both these requirements are satisfied, a building manager can use them to study the profitability of energy efficiency investments. EFFECT4buildings have developed two financial calculation tools to evaluate diverse options in a decision-making process in energy efficiency investments. It has also developed relevant training material exists for educational purposes.

### Calculation methods

Planning a new energy efficiency investment benefits from estimating its life cycle costs. It can be done using cash flow analysis, by predicting all costs and benefits during the investment's life cycle. For the investments with long life cycle, it is beneficial to use discounted cash flows, which called Net present value (NPV).

Alternative economic method is Internal rate of return (IRR). Internal rate of return is the discount rate, which makes investments net present value to 0. IRR is the very useful method for decision makers to estimate profitability of investment.

These methods are particularly suitable for choosing different kind of technical solutions for energy efficiency in buildings that may have different initial investment costs, different operating, maintenance and repair costs, and possibly different technical lifetime. Complementary calculation methods should also be implemented as a standard for energy serving companies, for example, in energy audits.

### The Pay back time method

This method works out how long it takes to recover the amount invested (reimbursement period). The advantage of this method is that it is easy to use and understand.

The disadvantage is that it encourages short-term investments because it does not take technical lifetime and interest into account. The method is not suitable to use for long lifetime investments in the building sector with long life time, for example thermal insulation, window replacements etc.

### The net present value method

The method converts all costs and savings to their present value. If the present value of all future savings is greater than the investment, it is considered to be cost-effective.

The net present value method can also be used in comparisons of different options when there are no actual savings to be made. The present value of the total costs of the different options then shows which is the most cost-effective over a period of time.

### The internal rate of return method

The internal rate of return method determines that the present value of the annual savings should be equal to the investment, i.e. the net present value is zero, and calculates what interest rate fulfils that condition. This interest rate is called the internal rate of return.

The internal rate of return method produces a calculated internal rate of return that is equivalent to the annual return on the capital invested. Whether this return is acceptable can be seen immediately by comparing it with the investor's required rate of return, the cost of capital.



### Excel calculation tool

The comprehensive Excel calculation tool proposed in the project is handy, simple and straightforward to use for building managers to study the profitability and other aspects of energy investments.

The tool is accompanied by a comprehensive training material; it describes, among others, all optional methods behind calculations. The training material can be used as an additional supporting material for studying and sharing information about calculation methods for stakeholders, or as educational material for all possible interested parties.

The financial calculation tool mainly aims to facilitate decision making when implementing energy efficiency investments. Its charts are easy to use and understand, and so can be employed when presenting financial data to decision makers and other stakeholders.

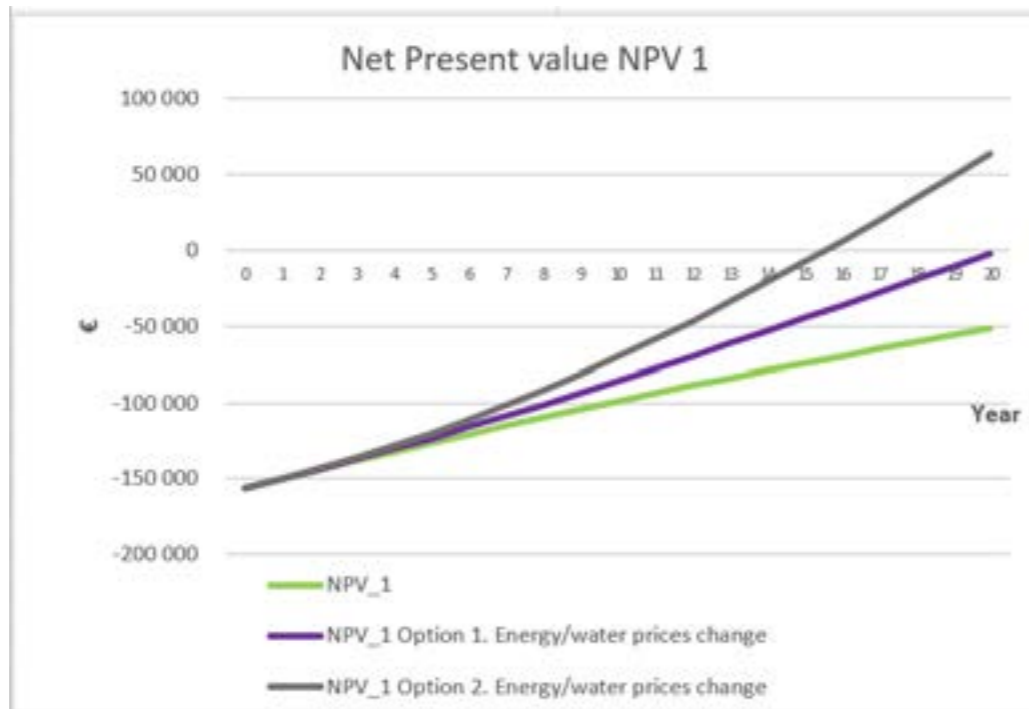


FIGURE 2. GRAPHS FROM EXCEL CALCULATION TOOL

REDUCTION OF CO <sub>2</sub> EMISSIONS	Ventilation system with heat recovery	Geothermal heat pump system
Reduction of CO <sub>2</sub> -emissions (kgCO <sub>2</sub> /year)	20.400	46.000
Reduction of CO <sub>2</sub> -emissions/CO <sub>2</sub> -emissions before measures (%)	16 %	35 %
Reduction of CO <sub>2</sub> -emissions during the life cycle (kgCO <sub>2</sub> )	408.000	920.000
NON-ENERGY BENEFITS	Ventilation system with heat recovery	Geothermal heat pump system
Decrease cost due the non-energy benefit (euro/year)	8.200	0
Pay back time 2 (year), includes the efforts of non-energy benefit (for example decrease health cost)	7,96	8,64
FINANCIAL RESULTS	Ventilation system with heat recovery	Geothermal heat pump system
Pay back time (year)	13,65	8,64
Internal rate of return, IRR (%)	2,06 %	8,28 %
Internal rate of return, IRR (%), option 1. Energy/water prices change	5,24 %	11,39 %
Internal rate of return, IRR (%), option 2. Energy/water prices change	8,29 %	14,43 %

TABLE 1. TWO MEASURES CAN BE COMPARED WITH THE TOOL

To help estimate and understand the profitability of an energy efficiency investment, the tool uses the following methods to compare alternative energy efficiency measures:

- Cash flow
- Net present value
- Internal rate of return
- Pay-back time
- Carbon dioxide emissions

The tool also includes sensitivity analysis, with options to estimate energy and water price changes. In doing so, the tool helps analyse and compare possible future development paths. The calculations can also take into account non-energy benefits.

### Simplified web calculation tool

The EFFECT4buildings website presents a web tool for the financial calculations of profitability. Straight-forward and simple to use. It helps estimate the rough profitability of individual investments using different calculation methods. The tool also visualizes the different calculation methods it includes in pedagogic graphs. Simplified financial calculation tool can be found here: <https://energi.jahopp.com/energy.html>

## Results from testing and recommendations

Based on testing of the tool among planned end users, the tool was further adjustments and improved. Conclusions from recalculations of proposed energy efficiency measures showing the need to use complementary financial calculation methods than simple pay-back-time.

The table below simplifies results of the analysis, showing that pay-back-time disregards the technical lifetime of the investment. Investments with longer lifetime will benefit from using the net present value method. In many cases using internal rate of return will make more measures profitable than using only pay-back-time would make.

The proposed tool should create a new standard for presenting measures in energy audit reports, requiring to present alternative financial calculations for each measure. All countries should implement at least net present value and internal rate of return.

Investment	Cost	Pay-back time		Technical lifetime	Net present value		Internal rate of return	
Solution A	10,000	5 years	Most profitable!	10 years	7,000		7 %	Profitable!
Solution B	10,000	8 years		20 years	8,600	Most profitable!	8 %	Profitable!

TABLE 2. COMPARISON OF SOLUTIONS A AND B

## Combination with other tools

Financial calculation tools can be combined smoothly with other tools provided in the project toolbox. By utilizing diverse combination of tools, it is possible to get more comprehensive and clearer picture of profitability of the planned investment, thus these tools complement each other in a holistic way. To get positive implementation decisions, different calculation methods for comparing alternative energy efficiency measures should be used and presented. The output of financial calculation tools can be used with every other tool as careful calculations help to achieve the main goal.



## Conclusions

By using different financial calculation methods, results will be different on what solution is most profitable. Without efficient training, building managers, energy auditors, and other investors will have problems with using these methods, translating to the insufficient implementation of new energy efficiency measures.

Calculations with net present value and internal rate of return gives more fair answers on what investments to choose, than pay-back-time. To get a full and correct comparison between different solutions, more parameters that are included in the excel calculation tool should be used.



# TOOLS

- 1a Guideline for excel based financial calculation tool.
- 1b Financial calculation tool in excel format
- 1c Financial calculation tool in excel format. Example.
- 2 Guideline for Financial calculation methods
- 3 Presentation of measures in energy audits. Example.
- 4 Financial calculations training material (PP)
- 5 Financial calculation tool in web format, online  
<https://energi.jahopp.com/energy.html>

## FIND ALL TOOLS HERE

[www.effect4buildings.se/toolbox/financial-calculations/](http://www.effect4buildings.se/toolbox/financial-calculations/)



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