

Market uptake of small modular renewable district heating and cooling grids for communities

Project No: 691679



Economic calculation tool for small modular district heating and cooling projects

WP 5 – Task 5.2 / D 5.2

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CoolHeating website: www.coolheating.eu

1 Introduction to the Economic calculation tool for small modular district heating and cooling projects

The objective of CoolHeating is to support the implementation of "small modular renewable heating and cooling grids" for communities in South-Eastern Europe. The outcome will be the initiation of new small renewable district heating and cooling grids in 5 target communities up to the investment stage. These lighthouse projects will have a long-term impact on the development of "small modular renewable heating and cooling grids" at the national levels in the target countries.

In order to prepare the implementation of small modular renewable energy district heating and cooling systems in the target countries up to the investment stage economic figures are essential for the success of the project. The Economic calculation tool was developed in order to calculate the economic performance of district heating projects that will be initiated within the CoolHeating project. The tool is open source and will be available for the public and be introduced to the target country partners, so that they are able to further adjust and modify it during the project development. The economic results will be used for developing individual business models for the target communities in Task 5.4 and for the feasibility checks in Task 6.1..

The Economic calculation tool is an Excel document which uses macros and VBA (Visual Basic for Applications) programming and is protected with a password. The tool is protected in order to avoid unwanted and accidental modifications of the tool by the users that could eventually lead to incorrect calculations and thus invalid project definition. The **password** for unlocking the file is "**tool**" in case a user needs to get detailed access to specific locked parts of the tool. In order to effectively use the tool macros and file editing has to be enabled in Excel. A full manual is included in the tool file.

The tool is mainly intended for "non-professional", "non-expert in district heating technology" target groups. Therefore special emphasis was given to develop a tool that will be easy to understand and easy to use. There are several professional tools available in the market and it would make no sense to develop another such tool. On the other hand it was determined that there is a lack of simple and easy tools which can help non-professional personnel in e.g. municipalities to prepare simple calculations of economic performance of potential district heating and cooling projects.

Nevertheless the outputs of the Economic calculation tool for small modular district heating and cooling projects consist of comprehensive calculations and simulations of projects economic performance for full project life time. These outputs can represent the full economic part of business plans and are therefore highly valuable not only for preliminary check of economic performance of projects, simulations of different heat price on economic performance, etc.... but can be used to prepare full business plans and bank cases for district heating and cooling projects.

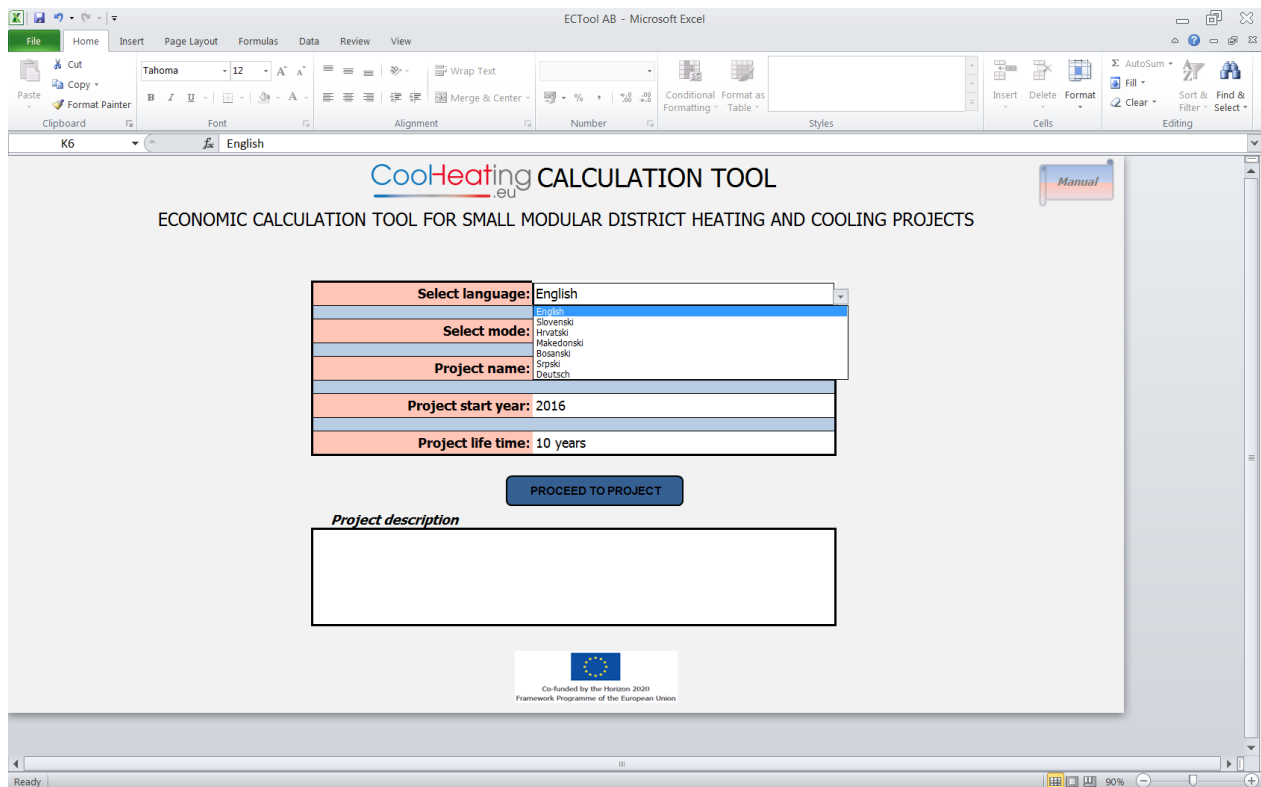
2 General overview of the calculation tool functionalities

2.1 Calculation tool – Home

The Economic calculation tool for small modular district heating and cooling projects is an MS Excel file with included macros and VBA Visual basic programming. It is embedded in Excel and can use all of Excel functionalities. It is important that users enable editing and enable use of macros while opening the tool.

The economic calculation tool is locked for users with password protection. Meaning only cells where parameters are inserted are open for editing. These cells are marked white. All descriptive cells and cells that contain calculations are locked and coloured. The economic calculation tool is locked in order to avoid accidental change of formulas or accidental deletion of contents in the tool that are important for performed calculations and simulations in the tool.

In case the users need to adapt the calculations or would like to check the formulas the password for unprotecting the calculation tool is: tool



The Home section of the tool is where basic data such as Project name, start date and Project life time is inserted. A dropdown menu enables to use English, German, Slovenian, Croatian, Bosnian, Serbian or Macedonian language.

2.2 Calculation tool – Input parameters

In this module all key project input parameters are included and calculated. From the financing of the project to the fuel demand and fuel costs, to the basic parameters in a market such as the discount rate and the taxation.

The input parameters module consists of four sections:

- Investment and financing. Consist of the breakdown of investment costs in € and financing sources (Equity, Subsidies, Loans and Connection fees).
- Costs. Costs are inserted and simulated for the life time of the project (the tool includes a linear “year2year” cost change simulation). Costs are segmented to Operating costs (fuel costs), Service costs (Management, insurance and lease, Promotional activities, Other) and Cost of labour.
- Revenues. Revenues from different sources are inserted for the project life time (the tool includes a linear "year2year" revenue change simulation). Revenues are segmented into Revenues from sold electricity, Sold heat (includes 3 possible heat sales models) and Other revenues (financial and other revenues).

The revenues generated by the sold heat include 3 ready to use price models:

- **Direct input of the heat price.** The most basic model where only overall sold heat amount and heat price is inserted on annual basis.
- **Calculation from basic price, metering price and consumption.** In this model users can define Average connection power in kW, Basic price (fixed) in €/kW, Metering price in €/year and Consumption price (variable) in €/MWh for five different heat consumer categories (e.g. Households, Large public buildings, Large industry, Small industry,...). Based on that data the "Average heat price in €/MWh" is calculated for each of the categories. The data on Average consumption per consumer in MWh/year and Total demand in MWh/year for each of the five heat consumer categories is also inserted. Based on this data the heat demand structure in % and total sold heat amount is calculated.
- **Calculation on the basis of price discount for larger consumption.** In this basic model the calculation tool enables the use of up to 5 classes of consumers based on the heat demand. Classes are defined by the Lower and Upper limit of annual heat consumption in MWh/year. For each of the classes the heat price in €/MWh and the total annual demand of all heat consumers in a class can be inserted. The heat price is inserted for the first class and for other classes discount rate in % is inserted.

All models include the optional linear simulation of the year2year change of the heat price and heat volume sold can (e.g. 2% annual price increase and 1% annual volume increase).

- Other parameters. Additional parameters are inserted which are important for economic calculations and simulations, such as Cash conversion cycle parameters, Annual depreciation rates, Profitability calculation (Discount rate) and Taxation (Corporate income tax)

INVESTMENT COST	
TOTAL EURO	EURO/M
Equipment/Machinery	0,00%
Buildings and construction works	0,00%
PC	0,00%
Project and investment documentation	0,00%
Intangible assets (patents, licenses, software)	0,00%
Total working capital 0,00 €	% of investment (%)

FINANCING SOURCES	
TOTAL EURO	EURO/M
Private equity 0,00 €	0,00%
Bank loan	0,00%
Bank loan 2	0,00%
Bank loan 3	0,00%
Connection fees	0,00%
Investment outside	0,00%

2.3 Calculation tool Project performance calculations and simulations

In this section extensive economic calculations and simulations are presented based on the input parameters. There are no editable cells in this section, only calculations produced by the economic calculation tool. All sections of this module are print ready. The Project performance module was developed in the way to produce all necessary calculations for a full economic part of a business plan. All calculations can be transferred to a business plan or to a bank case and shown to relevant target groups.

The sections of the Project performance module:

- Investment and financing. Investment and financing includes an overview of the project investment costs and the sources of financing the respective investment costs.
- Revenues. Structure of total planned incomes that will be generated in the project life-time
- Costs. Structure of total estimated costs incurred in the project life-time
- Assets. Development of the project properties and resources
- Liabilities and Equity. An overview of the obligations connected to financing the project assets and development of the value (capital) of the project for its owners.
- Income statement. An overview of the projects revenues and expenses during the projected period.
- Balance sheet. A summary of project assets, liabilities and capital, reflecting what the project will own and owe and the amounts invested by owners.
- Cash-flow statement. A record that shows the actual flows of cash in and out of the business.
- Profitability. A forecast of the projects financial performance and its ability to generate earnings compared to the invested capital and costs incurred in the project life time.
- Project summary. A summary of key aspects comprised in all previous sections of the project performance module.

Projected investment cost in €		
	Value	Share %
1. Buildings and construction works	0	0,0%
2. Plot	0	0,0%
3. Equipment/Machinery	0	0,0%
A. PROPERTY, PLANT AND EQUIPMENT	0	0,0%
B. PROJECT AND INVESTMENT DOCUMENTATION	0	0,0%
C. INTANGIBLE ASSETS	0	0,0%
D. INVESTMENT COST (A+B+C)	0	0,0%
E. INITIAL WORKING CAPITAL	0	0,0%
F. TOTAL INVESTMENT COST (D+E)	0	0,0%

Sources of investment cost financing in €		
	Value	Share %
A. PRIVATE EQUITY	0	0,0%
B. BANK LOANS	0	0,0%
C. CONNECTION FEES	0	0,0%
D. INVESTMENT SUBSIDIES	0	0,0%
E. TOTAL FINANCING (A+B+C+D)	0	0,0%

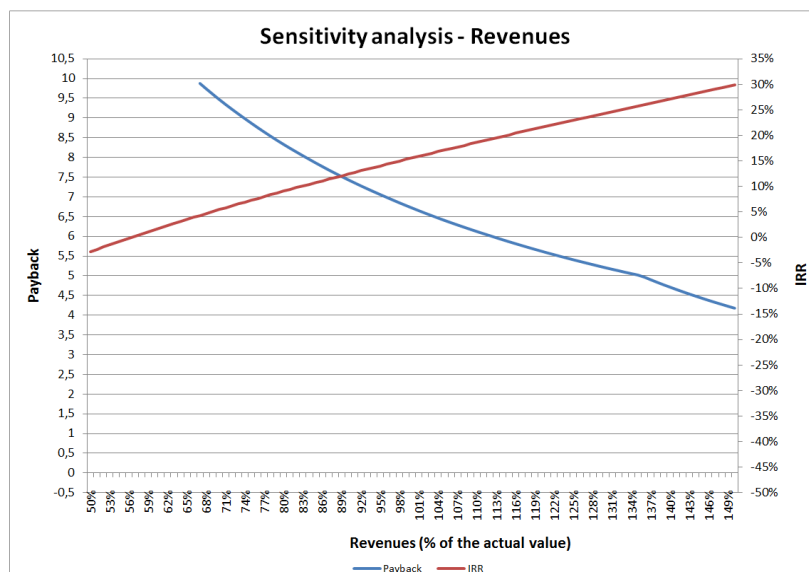
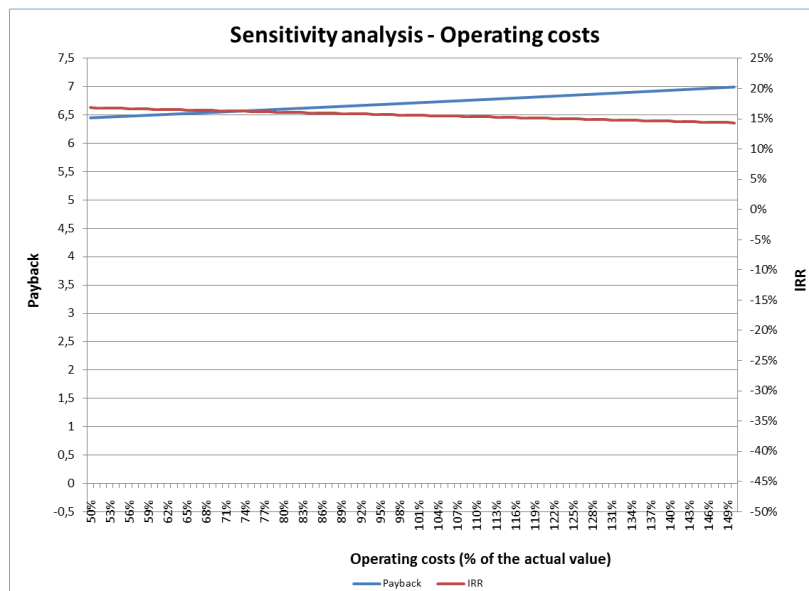
Projected investment cost in €		
	Value	Share %
1. Buildings and construction works	0	0,0%
2. Plot	0	0,0%
3. Equipment/Machinery	0	0,0%
A. PROPERTY, PLANT AND EQUIPMENT	0	0,0%
B. PROJECT AND INVESTMENT DOCUMENTATION	0	0,0%
C. INTANGIBLE ASSETS	0	0,0%
D. INVESTMENT COST (A+B+C)	0	0,0%
E. INITIAL WORKING CAPITAL	0	0,0%
F. TOTAL INVESTMENT COST (D+E)	0	0,0%

Sources of investment cost financing in €		
	Value	Share %
A. PRIVATE EQUITY	0	0,0%
B. BANK LOANS	0	0,0%
C. CONNECTION FEES	0	0,0%
D. INVESTMENT SUBSIDIES	0	0,0%
E. TOTAL FINANCING (A+B+C+D)	0	0,0%

2.4 Project performance module – Sensitivity analysis

One of the key segments of the Project performance module is the Profitability segment. In addition to the forecast of the projects financial performance and its ability to generate earnings compared to the invested capital and costs incurred in the project life time a Sensitivity analysis is also included. The economic calculation tool generates two sensitivity analysis graphs:

1. Operating costs sensitivity analysis. This graph shows the influence of change of the operating costs on the Payback time and IRR (Internal rate of return). Operating costs consist of goods and services necessary to perform business operation (fuel, maintenance, insurance etc.).
2. Revenues sensitivity analysis. This graph shows the influence of changes in revenues generated within the project on the Payback time and IRR (Internal rate of return). The revenues change can be mainly connected to the change in sold heat (price and amount). Possible revenues generated by electricity sales are usually based on long-term contracts with fixed prices thus this type of sensitivity analysis can be used to assess change in customer heat price on the overall economic project performance.



3 Dissemination and adaptation of the Economic calculation tool for small modular district heating and cooling projects

The tool will be freely and publically available on the CoolHeating project website www.coolheating.eu. It will be presented to audiences on the D5.5 training course for local actors on financing, business models, and training course for financing bodies and investors on technologies organised in 2017 and on the second iteration of D4.3 Technical capacity building training courses for involved actors and other project events.

The tool was developed in close cooperation of all CoolHeating project partners. As partners closely collaborated in the development phase, no specific activities were needed for adaptation of the tool of partners from all target countries in the first phase. All partners reviewed and provided feedback in development of the tool. They also tested the tool prior to publishing the delivery. It was established that all partners are able to use the tool effectively.

The tool will also be used to prepare calculations of economic performance of the initiated projects in target communities in the CoolHeating projects. These calculations will represent the basis for developing individual business models for the target communities in Task 5.4 and for the feasibility checks in Task 6.1.. In this development the tool will be further adapted in CoolHeating partners and local communities.