GUIDE TO COST-BENEFIT ANALYSIS OF INVESTMENT PROJECTS IN THE FIELD OF DISTRICT ENERGY

SUMMARY

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Title	Guide to cost-benefit analysis of investment projects in the field of district energy
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CONTENTS

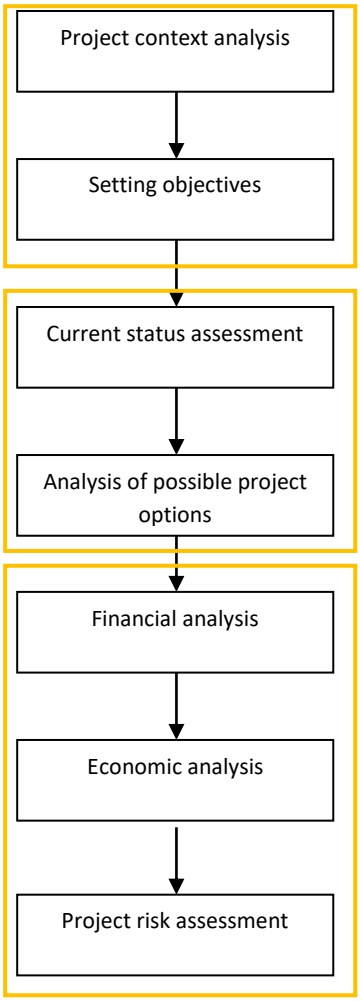
1 INTRODUCTION

Cost-benefit analysis (CBA) is an analytical tool used to compare and select the optimal project idea among several of them, through evaluation and comparison of economic benefits and costs of each project idea. The goal of CBA is to enable efficient allocation of resources through selection of the project optimal for society with respect to possible alternatives.

This guide to cost-benefit analysis of investment projects in the field of district energy provides basic steps which need to be implemented in the process of performing CBA, and it was developed within the Initiative implementing a three-year project under the title “Increasing Investments in District Heating Power Systems in Cities - SEforAll Energy Efficiency Accelerator", when 4 pilot countries: China, Chile, India and the Republic of Serbia were selected. The global objective of this Initiative is to provide sustainable, available and sufficient energy for everyone by 2030, while doubling energy efficiency and usage of renewable energy sources. The City of Belgrade was selected to implement the project of improving the district heating system in the Republic of Serbia, as a city in which a *deep-dive* analysis of the system is performed. The project of improving the district heating system is implemented as a part of a global project whose main objective is providing support to the City of Belgrade and the public utility company “Beogradske elektrane” in the process of district heating system modernization and expansion.

2 PROCESS OF PROJECT COST-BENEFIT ANALYSIS

The process of performing CBA includes three units, which are presented hereinafter:



Introductory considerations are provided and relevant objectives are set within the first unit. The second unit focuses on the analysis of the current status and possible project options in accordance with the identified situation, while the third unit focuses on financial and economic parameters together with project risk assessment. This Guide describes the implementation of each of the above mentioned steps.

Step 1: Project context analysis

The first step in performing CBA includes a description of the context in which the project should be implemented, which includes analyses of project-specific socio-economic aspects, institutional environment, existing infrastructure relevant for the project implementation and development plans, service markets resulting from the project, existing operating costs, and other information and statistical data relevant for the project implementation.

More specifically, project context analysis is crucial to assess future project benefits, number of project beneficiaries, and other key parameters for assessing project level.

Step 2: Determining project objectives

Following the analyses mentioned in the step 1, regional and/or sectoral needs which may be included into the project must be assessed. The assessment of needs further builds on the context description and provides a basis for setting objectives. A clear definition of project objectives is necessary to identify project effects which shall be further assessed in CBA and to verify project relevance.

Step 3: Project identification

The third step in the process of performing CBA involves project identification, which includes the following:

- Identification of physical elements and activities to be implemented in order to provide services
- Identification of the body responsible for project implementation
- Identification of the scope of influence, end beneficiaries and participants.

Step 4: Technical feasibility and environmental effects

Detailed information should be provided regarding the following:

- Demand analysis;
    - current demand estimate (based on statistics)
    - future demand estimate (based on reliable forecasting models)
- Option analysis;
    - defining the option “business as usual” (BAU): in order to select the best option, it is useful to describe the basic scenario;
    - defining the option “do minimum” which shall be compared with BAU;
    - defining other possible alternatives “do something”
- Environmental and climate change considerations;
- Technical design, cost estimate and implementation schedule;

- location,
- technical drawing
- production plan
- cost estimates
- implementation schedule.

Step 5: Financial analysis

In addition to the calculation of financial indicators, profitability of the project and its financial sustainability, which is one of key prerequisites for project feasibility, are also determined.

Basic steps in performing a financial analysis include the following:

1. Investment cost estimate;
   - initial investment,
   - investment maintenance,
   - residual value;
2. Estimate of operating costs and revenues;
   - fixed,
   - variable,
   - financing costs (if the project is funded from external sources of financing, e.g. credit);
3. Cash flow projection and project profitability and sustainability analysis (for the purpose of project profitability and sustainability analysis).

Step 6: Economic analysis

Economic analysis is based on costs and revenues estimated in financial analysis, which are translated into social costs and benefits through economic analysis.

Costs and revenues estimated in financial analysis are translated into social costs and benefits in two manners:

- in case of disturbed market conditions, the amounts of costs and revenues are converted into market values by their adjustment with respect to taxes, fees, customs duties, transfers and other fiscal levies;
- in case of environmental, social or health costs and benefits of the project, for which there is no established market, an assessment of their monetary values is performed by applying various methods, which are, most often, willingness to pay and willingness to accept.

Standard Conversion Factor and Shadow Wage Rate are used to convert the amount of costs and revenues estimated in the financial analysis into market values. After calculating SCF and SWR, costs estimated in the financial analysis are translated into market values. An economic cash flow projection is then provided. Economic NPV (ENPV) and economic IRR (EIRR) are calculated based on the economic cash flow. These indicators are used to analyze project profitability from the economic (social) aspect.

Step 7: Risk analysis

Risk analysis includes the analysis of different types of uncertain circumstances accompanying investment projects, and includes the following:

1. Sensitivity analysis;
2. Qualitative risk analysis;
3. Probability analysis.

Sensitivity analysis includes elasticity analysis, identification of “variable values” and scenario analysis. This analysis enables the identification of “critical” variables within the framework of project implementation.

Qualitative risk analysis involves identification of various circumstances or events which could potentially have a negative effect on generating one or more categories of assumed revenues or costs, and consequently financial and economic viability of the project.

Probability analysis involves calculation of probability or possibility of achieving assumed project results.