



EU4Energy



# How to Implement Energy Efficiency & Renewable Energy Projects

Technical Handbook





**EU4Energy**



**Authors:**

Norbert Peherstorfer, Jan Waanders, Maksym Vereshchak

**Elaborated by:**

Kommunalkredit Public Consulting GmbH

Türkenstrasse 9, 1090 Vienna, Austria

[www.kpc-consulting.at](http://www.kpc-consulting.at)

**Elaborated for:**

European Commission

Directorate-General for Neighbourhood and Enlargement Negotiations

Head of Unit NEAR C2 (Armenia, Azerbaijan, Belarus & Eastern Partnership)

Within the project: Covenant of Mayors – Demonstration Project (CoM-DeP)

**Project partners:**

Energy Cities (France)

GOPA Infra (Germany)

GOPA Cartermill (Belgium),

Association 'Energy Efficient Cities of Ukraine' (Ukraine) and

Energy Efficiency Centre (Georgia)

**Cover photo:** a refurbished kindergarten (Zhovkva, Ukraine).

This publication has been produced with the assistance of the European Union in the framework of the EU4Energy Initiative. The content is the sole responsibility of the authors and can in no way be taken to reflect the views of the European Union.

**Vienna, Kyiv, June 2021**

# Table of Contents

|                           |  |
|---------------------------|--|
| <a href="#"><u>4</u></a>  | Definitions & Abbreviations  |
| <a href="#"><u>6</u></a>  | Introduction   |
| <a href="#"><u>13</u></a> | Project management structure and implementation steps  |
| <a href="#"><u>18</u></a> | Phase 1: Preliminary assessment  |
| <a href="#"><u>24</u></a> | Phase 2: Energy Audit  |
| <a href="#"><u>42</u></a> | Phase 3: Final (Technical) design of EE/RE measures  |
| <a href="#"><u>50</u></a> | Phase 4: Authority approvals for the technical design and BoQ  |
| <a href="#"><u>52</u></a> | Phase 5: Procurement of EE/RE measures (works)   |
| <a href="#"><u>62</u></a> | Phase 6: Procurement and Contracting of a Site Supervisor for the implementation of the EE/RE measures |
| <a href="#"><u>66</u></a> | Phase 7: Implementation of the EE/RE measures  |
| <a href="#"><u>72</u></a> | Phase 8: Final acceptance  |
| <a href="#"><u>78</u></a> | Phase 9: Project Summary / Final report  |
| <a href="#"><u>80</u></a> | Phase 10: Operation and maintenance of the EE/RE measures  |
| <a href="#"><u>83</u></a> | Phase 11: Communication and visibility   |

# Definitions & Abbreviations

**CoM** — Covenant of Mayors Initiative.

**CoM-DeP** — Covenant of Mayors – Demonstration Projects.

**CoM Signatories** — municipalities that have signed up to the EU’s Covenant of Mayors Initiative.

**Contracting Authority** — the institution which is tendering and contracting the EE/RE project (i.e. municipality, education department, municipal enterprise etc.)

**EE/RE measure** — an EE/RE project comprises usually of several individual measures (i.e. thermal insulation of exterior walls; replacement of windows; refurbishment of the heating system, etc.)

**EE/RE project** — energy efficiency/renewable energy project.

**EU** — European Union.

**Object** — building (i.e. kindergarten or school), a district heating system, street lighting system etc. where an energy efficiency or renewable energy project will be implemented.

**PRAG** — Practical Guide to Contract Procedures for EU External Actions.

**Procurement (Evaluation) Committee** — is composed of main decision-makers of Contracting Authority (mayor/deputy-mayor, heads of departments directly involved in the project, responsible person for the object to be refurbished, etc.), required persons for procurement, technical experts with knowledge of the EE measures to be implemented. The Procurement Committee is responsible for the tender dossier preparation, launch of the procurement, assessment of the offers and selection of the winning bid.



**Project team** — team of people that implement the EE/RE project on behalf of the municipality.

**SE(C)AP** — Sustainable Energy (and Climate) Action Plan.

**Support Team** — Covenant of Mayors support team that assists municipalities with implementation of demonstration projects.

**Technical design company** — a company with all required qualification and certificates to elaborate the technical design of an EE/RE measure.

**ToR** — Terms of Reference.

**Working group** — normally, a Working Group is composed of main decision-makers (mayor/deputy-mayor, owner of the buildings/facility, heads of departments directly involved in the project, responsible person for the object to be refurbished, etc.). The Working Group is responsible for general project monitoring and decision-making. Typically meets once every 2-4 weeks. The project team reports to the working group.

A refurbished gymnasium  
*Konotop, Ukraine*



# Introduction

## Background

### Covenant of Mayors

The Covenant of Mayors for Climate & Energy (CoM) brings together thousands of local governments voluntarily committed to implementing EU climate and energy objectives. The Covenant of Mayors was launched in 2008 in Europe with the ambition to gather local governments voluntarily committed to achieving and exceeding the EU climate and energy targets.

Signatories are required, within two years after signing up, to develop a Sustainable Energy and Climate Action Plan (SE(C)AP) with the aims of cutting CO<sub>2</sub> emissions by at least 30% by 2030 and increasing resilience to climate change, including a list of projects to be implemented in order to achieve these targets. Many cities in the Eastern Partnership region, however, do not have the technical or financial capacity to implement these Plans.

### Covenant of Mayors — Demonstration Projects (CoM-DeP)

The EU-financed Programme 'Covenant of Mayors – Demonstration Projects' (CoM-DeP) was developed in response to the challenges facing small municipalities of less than 200.000 residents that have signed up to the Covenant of Mayors Initiative.

Since 2015, 33 projects have been implemented by 35 cities in 5 EaP countries under the CoM-DeP programme. Those municipalities have modernized their city street lighting, district heating systems, and thermally refurbished residential and public buildings. Out of a total investment amount of more than 32 million EUR, around 25 million EUR was contributed by the European Union.

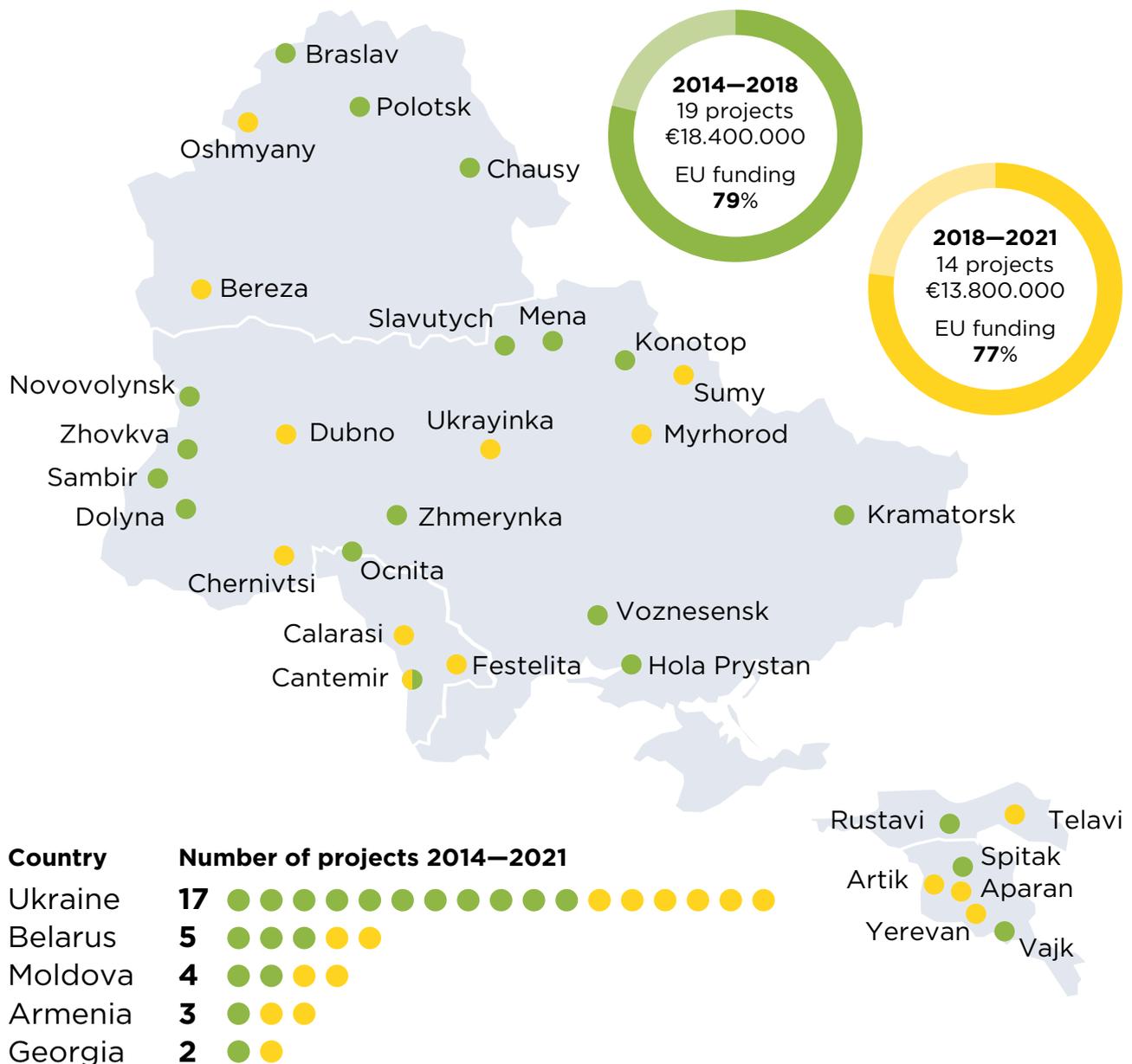
The demonstration projects show how municipalities can effectively turn their SE(C)APs into practical action.

Further project details and useful documents are available on the website of CoMDeP: <https://com-dep.eu> (general information) and <https://com-dep.eu/library> (technical publications, materials of the workshops and webinars, etc.)



The Covenant of Mayors is the world’s largest movement for local climate and energy actions, supported by the European Union. The figure below shows the demonstration projects implemented under CoM-DeP:

In the Eastern Partnership region, over 400 local authorities have voluntarily committed to reduce their CO<sub>2</sub> emissions by at least 20% by 2020 or 30% by 2030. The European Union has been supporting the Initiative in Eastern Partnership countries since 2011 with its technical, methodological and financial assistance of over 30 million Euro. This includes grants and tailor-made technical support for 34 municipalities for demonstration projects since 2015, predominantly in the area of energy efficiency.





# What was done

## & who benefited from the projects



**229**

residential buildings  
refurbished

**32.718**

citizens



**97**

renewable electricity  
systems installed

**23.212**

citizens



**23**

kindergarten buildings  
refurbished

**3.892**

children

**715**

staff



**12**

school buildings  
refurbished

**8.524**

children

**1.086**

staff



**10**

street lighting systems  
installed

**302.222**

citizens



**10**

district heating systems  
modernized

**26.078**

citizens



**9**

public buildings  
refurbished

**22.172**

visitors

**325**

staff



**1**

wastewater system  
improved

**18.600**

citizens



**1**

transport system  
upgraded

**76.000**

citizens



# Effects & Results

PER YEAR



## ENERGY SAVINGS



**31.024**  
MWh



energy consumption of  
**1.699.945**  
mobile phones



energy consumption of  
**287.259**  
TVs



## RENEWABLE ENERGY PRODUCTION



**41.770**  
MWh



energy consumption of  
**2.288.767**  
mobile phones



energy consumption of  
**86.759**  
TVs



## REDUCTION OF CO<sub>2</sub> EMISSIONS



**19.878**  
tons CO<sub>2</sub>



emissions from  
**12.742**  
new cars



**903.545** trees needed  
to be planted to absorb  
such amount of CO<sub>2</sub>

**1.846** jobs sustained

**€2.189.000** annual savings by municipalities



## Target group of the Handbook

This Handbook will serve CoM signatories (as well as non-signatory municipalities implementing energy efficiency projects) with tools and experiences that can help the responsible stakeholders in implementing sustainable and high-quality energy efficiency projects.

Furthermore, this Handbook can be used by qualified staff in municipalities responsible for implementation of the projects, Non-Governmental Organizations (NGOs) that are implementing projects for municipalities and other persons who are implementing EE/RE projects in municipalities.

## Purpose of this Handbook

This Handbook provides an overview of the experiences of CoM-DeP in implementing energy efficiency projects. It contains methodology used during implementation of the financed projects (including the basic algorithm and steps for implementation), lessons learned, best practices, templates, example documents, etc. with a view to make it easier for other CoM signatories to implement similar projects.

This Handbook provides practical support and guidance for the steps in implementation of such projects, and where appropriate pay special attention to specifics of thematic areas.

The CoM-DeP projects covered different thematic areas:

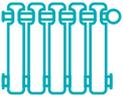
- Thermal refurbishment of public buildings / residential buildings
- Modernization of district heating systems
- Modernization of street lighting systems (using LED technology)
- Installation of PV systems
- Modernization of (electric) public transport systems and water supply / waste water system<sup>1</sup>

---

<sup>1</sup> This thematic area is **NOT** covered in detail in this Handbook



The table below provides a quick overview of the requirements and benefits of most frequently implemented project types:

| TYPE OF PROJECT  | TECHNICAL COMPLEXITY   | INVESTMENT NEEDS <sup>2</sup>  | PAYBACK PERIOD   | POTENTIAL SAVINGS IN %  |
|--|--|--|--|---|
| <br>Thermal refurbishment of public buildings       | <br><b>High</b>     | <br><b>High</b><br>100–300 EUR per m <sup>2</sup> heated floor area   | <br><b>Long</b><br>> 15 years                            | <br><b>High</b><br>30–70 %                           |
| <br>Thermal refurbishment of residential buildings | <br><b>High</b>     | <br><b>High</b><br>50–100 EUR per m <sup>2</sup> heated floor area  | <br><b>Long</b><br>> 10 years                            | <br><b>High</b><br>30–70 %                           |
| <br>Modernization of district heating systems     | <br><b>Medium</b> | <br><b>Moderate / high</b><br>150–300 EUR per kW installed capacity of boiler house, 100 EUR per m of pipe trench | <br><b>Medium</b><br>3–10 years, depending on measures | <br><b>Medium</b><br>10–30%, depending on measures |
| <br>Modernization of street lighting systems      | <br><b>Medium</b> | <br><b>Moderate</b><br>300–500 EUR per lighting point   | <br><b>Medium</b><br>3–10 years, depending on measures | <br><b>High</b><br>50–80 %                         |

<sup>2</sup> Investment costs without VAT

Modernization of multi-apartment buildings  
*Dolyna, Ukraine*





# Project management structure and implementation steps

As a general rule, the owner of the object that will undergo a refurbishment (i.e. municipality who is the owner of a kindergarten) should be overall responsible for the organizational and financial aspects of the project as well as for the quality of the project.

Depending on the municipality's internal resources and capacities, the project management and implementation of the project can be done directly by the municipality or by contracting an external organization (i.e. NGO).

## Option A:

### Implementation/management of a project by the municipality

The municipality shall appoint a project coordinator and a project team that supports the project manager with additional expertise (i.e. technical, legal / procurement and communication experts) in the implementation of the project. The project manager and his team have to be provided with clear guidance of their responsibilities and duties. The project manager is responsible for the overall coordination and the day to day management of the project.

**Pros:** The municipality is in full control over the project manager and project team. Communication between the involved persons is simple and decision-making is usually efficient; no extra budget for an external organization needed.

**Cons:** risk of non-availability of experienced staff; risk that the project manager and the project team have to manage the project in addition to their usual day-to-day responsibilities (lack of time resources for proper project management).

## Option B:

### Implementation/management of a project by an external organization contracted by the municipality

The municipality contracts an external organization for the purpose of managing and implementation of the project. A core element for an efficient and successful implementation is the agreement between the municipality and the external organization.



The agreement shall address at least (among others) the following issues:

- Description of the project and detailed scope of the project
- Expected project results and project quality (results should be measurable indicators)
- Available project budget
- Project duration (concrete start and end date)
- Responsibilities, communication and decision-making procedures
- Mechanisms for coordination and cooperation between municipality and external organization
- Reporting
- Consequences in case of non-performance (culpably caused delays, quality issues or budget overspending, etc.)

The municipality has to appoint an internal project coordinator who will be the main contact person for the external organization.

**Pros:** Professional management with experienced staff by the external organization; sufficient time resources and dedicated project staff available; limited day to day project management efforts within the municipality, possibility to pay market prices for project managers and technical experts (not hindered by local government salary restrictions).

**Cons:** Risk of communication gaps and unclear responsibilities between municipality and external organization; internal project coordinator of the municipality has to monitor and coordinate the external organization; municipality is not in full control of the project implementation; risk that municipality does not take over general responsibility and ownership of the project; municipality has to bear the costs for the external organization (to be included in the project budget); municipality does not gain practical experience and knowledge itself with implementing energy efficiency projects; handover the project documentation after project completion might be difficult.

It is good practice to establish a working group which is responsible for general project monitoring and decision-making. Normally, a working group is composed of main decision-makers (mayor/deputy-mayor, owner of the building/facility, heads of departments directly involved in the project, responsible person for the object to be refurbished, etc.) and will meet frequently (depending on the relevant project phase). The project manager reports directly to the working group on progress and prepares the basis for the decisions making procedures.



In complex international donor financed projects, in addition to the working group, a so called “steering committee” might be required by the international donor. The steering committee consists of main project participants, donors and other relevant stakeholders and supports the municipality in steering the project and the strategic decision making.

For the matter of simplicity in the following sections of this document is assumed that the EE/RE projects will be implemented by the municipality **directly** (no external organization involved). Furthermore, is assumed that the municipality is owner of the objects and therefore the municipality is contracting authority as well.

### Project implementation phases:

While each of type of project has its specifics, all of them have to go through the similar phases of technical implementation (algorithm):

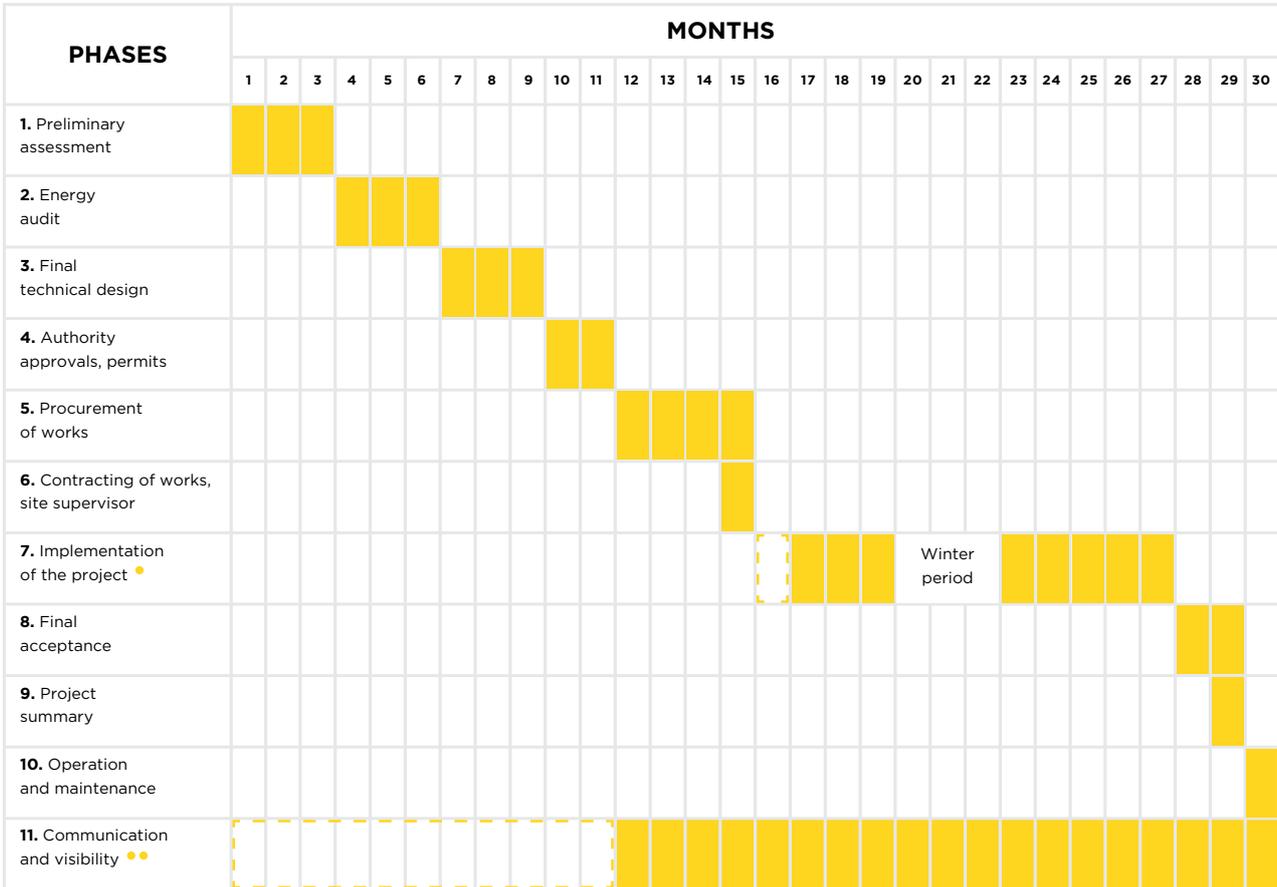
- Preliminary assessment
- Energy audit
- Final (Technical) design
- Authority approvals / state expertise
- Procurement and contracting of works
- Procurement and contracting of a site supervisor
- Implementation
- Acceptance of works
- Measurement and Verification and Project summary
- Operation and maintenance of the objects refurbished, after completion of the project

The Handbook describes for each of the above-mentioned phases the logical sequence of sub-steps and role/tasks of municipality, project team, and suppliers / service providers sub-contracted for parts of the implementation of the project. It also provides per phase template documents and concrete example documents, as well as lessons learned, best practices and do’s and don’ts which are typically described in text boxes.

The development and implementation of an EE/RE project in a municipality (for example a comprehensive thermal refurbishment of a school building with a typical implementation period of 30 to 36 months) can be structured in 11 important project phases, see figure on the next page.



## EE/RE PROJECT WORK PLAN



- Month 16: after contract signing, the company usually will need a few weeks to mobilize staff/materials/machines, etc.
- Month 1-11: preparatory communication works. Month 12-30: communication (start after the permissions have been obtained; to roll out communication before the project is officially approved might be risky)

The individual project phases are described in the following chapters.

**Lessons learned / challenges:**

1. Municipalities are often too ambitious and **do NOT** consider potential obstacles/risks during project implementation. As a result, a project may not be completed in the planned period (e.g. 12 months). Delays of the project results automatically in higher costs.



2. All project team members should be factually involved into the project implementation. "Formal" appointment of experts (without any practical role) have to be strictly avoided.
3. The Working group should be functioning in reality and provide solid governance to the project.
4. The Project manager must ensure proper documenting of the project. All documents should be collected, saved at a cloud storage and duly transferred to the municipality.
5. **Do NOT** expect great work for very little money. The costs for the Project team should be foreseen according to market rates for such positions.



Modernization of the street lighting systems  
*Cantemir, Moldova*

# Phase 1: Preliminary assessment

|                   |  |
|-------------------|--|
| <b>OBJECTIVE</b>  |  Identification and selection of EE/RE projects   |
| <b>ACTIVITIES</b> | <ul style="list-style-type: none"> <li> Developing ToR</li> <li> Selection and contracting an expert/company</li> <li> Conducting the assessment</li> <li> Analysing the assessment report</li> <li> Selection of the EE/RE projects</li> </ul> |
| <b>RESULTS</b>    | <ul style="list-style-type: none"> <li> Assessment report approved by the project team and agreed upon by working group</li> <li> List of selected and agreed EE/RE projects for further development (part of the assessment report)</li> </ul>  |
| <b>DURATION</b>   |  Approx. 2–3 months   |

The preliminary assessment of an EE/RE project is a very important part of the development of an EE/RE project as this phase determines already important cornerstones of the project (i.e. selection of buildings to be refurbished, streets to be included in a street lighting project, buildings to be connected to a renewable energy district heating project, etc.).

The starting point should be the Sustainable Energy (and Climate) Change Action Plan (SE(C)AP) or if not available, a strategic multi-year development plan for energy / energy efficiency of the municipality. It is crucial that any object/project that is to be refurbished should be a part of long-term municipal strategy. The SE(C)AP or other strategic documents usually include a broad field of project ideas with some limited project information.



The main objective of this phase is to elaborate and assess actual and reliable project information that allows the selection of potential EE/RE projects that meet the objectives of the municipality and the available budget. The selected potential EE/RE projects will be further developed in the next phases.

The preliminary assessment is typically done by an experienced inhouse expert (e.g. energy manager, engineer) but could be outsourced as well. However, a detailed scope of work and deliverables need to be defined for both options.

### **Example:**

The SE(C)AP includes the following project idea: ...*“Thermal refurbishment of municipal kindergartens and schools”*...

No in-depth information of the kindergartens and schools such as name and location, number of students, heated floor area, technical condition etc. are provided in the SE(C)AP.

In fact, the municipality operates 5 kindergartens and 3 schools. Refurbishing all kindergartens and schools is not realistic as it would exceed the available municipal budget and the management capacities of the municipality. Therefore, the municipality has to select individual EE/RE projects (buildings) that meet the priorities of the municipality but also the available budget.

In order to make an informed decision, the municipality decided to contract an experienced expert to assess all potential kindergartens and schools and prepare an assessment report to identify the most suitable buildings for the planned refurbishment project.

## **1.1 Developing of the scope of work (terms of reference)**

The scope of works for the preliminary assessment describes the work for the expert such as: which EE/RE projects it concerns, minimum activities to be carried out, time-frame and contents of the assessment report.



The scope of work should be prepared by the municipality. The municipality should formulate their priorities/criteria (if any) for the selection of potential EE/RE projects (i.e. kindergarten A, B, gymnasium C) and the available budget.

In case the municipality does not have an experienced expert, it is recommended to hire an external technical expert/consultant (approx. working days of 10–15 days) who may assist the municipality during the preparatory phase.

**The assessment should include at least the following activities/results (but not limited to):**

- Kick-off meeting (discussion of the scope of work, required information prior the site visits, provide available documents, etc.)
- Collection of basic information and data of the EE/RE projects (i.e. building passport, measurements/dimensions of the objects, existing operational problems (underheated building, mold, etc.), existing legal/administrative/structural issues, etc.)
- Review of official recommendations/instructions from state authorities (i.e. fire protection department, etc.)
- Assessment of the actual condition of the EE/RE projects on site (i.e. structural condition, serious damages, operational problems, major repair works required prior to any energy efficiency project, etc.). The EE/RE projects must be legally and technically feasible to be subject to refurbishments.
- Collection of the information on energy consumption for last 3 years (heat, electricity, natural gas, etc.)
- Identification/description of potential EE/RE measures for each EE/RE project
- Estimation of investment costs based on specific costs per measure (EUR per m<sup>2</sup> façade insulation etc.)
- Estimation of the saving potential per year in MWh, local currency and as a percentage of average energy consumed over the past 3 years
- Preparing photo documentation for each EE/RE project and schematic plan of the objects/site
- Preparing an assessment report which will be the basis for the selection of the EE/RE projects. The report should include recommendations whether an object can be addressed as originally foreseen, can be addressed with some modifications or cannot be addressed within the given situation (especially the budget and/or technical conditions of objects)



- Depending on the project type: land acquisition/permission, legal requirements, power purchase conditions, ongoing ESCO contracts, etc.
- Presentation of the results of the assessment to the working group.

Please note that the scope of the project assessment will vary depending on the type of projects to be developed i.e. a greenfield PV system of 200 kW requires different activities than a thermal refurbishment of a school building.

## 1.2 Review of the preliminary assessment report, decision on the EE/RE projects

The main outcome of this phase is the preliminary assessment report incl. a list of potential EE/RE projects that meet the priorities of the municipality and the available budget.

### **Key issues to be checked by the project team (but not limited to):**

- Was the assessment conducted according to the scope of work?
- Does the report include a list with potential EE/RE projects and do the EE/RE projects meet the priorities formulated by the municipality?
- Are the EE/RE projects legally and technically feasible?
- Do the investment costs include all cost components that are needed for the implementation (i.e. capital repair costs)?
- Does the proposed list of potential EE/RE projects meet the available budget?

Once the preliminary assessment report is approved by the project team, the project manager presents the results and recommendations to the working group.

The working group discuss the list of potential EE/RE projects and selects the projects for further development.



### ***Lessons learned / challenges:***

1. Municipalities are often too ambitious and select too many EE/RE projects (objects) that cannot be covered by the available budget. As a result, the scope of works needs to be reduced in a later stage, quality of the works suffers or expected savings cannot be achieved.
2. Objects in poor technical conditions and objects not belonging to the municipality are not the best choice for EE/RE projects.
3. Assessment of the required investment should include all project costs (incl. costs for non-EE activities such as capital repair works).
4. Municipalities should appoint only experienced experts for the management of EE/RE projects. Sufficient time resources have to be allocated for the project manager and the project team. It is recommended to involve qualified external engineers if a municipality does not have relevant expertise.
5. Clear project management structures must be set up (responsibilities, communication structure, decision making procedures, etc.)
6. EE/RE projects (objects) must meet with donor's requirements/expectations.
7. If some information is missing, **do NOT** provide unreliable data.
8. Municipality should invest in EE/RE projects (objects) preparation (e.g. order energy audits for priority objects) as this may increase chances to receive funding.
9. **Do NOT** change project priorities due to political reasons.

A modernised kindergarten  
*Oshmiany, Belarus*



# Phase 2: Energy Audit

|                   |   |
|-------------------|---|
| <b>OBJECTIVE</b>  |  Identification and selection of EE/RE measures (Action Plan)  |
| <b>ACTIVITIES</b> |  Developing terms of reference                                 |
|                   |  Selection and contracting an energy auditor                   |
|                   |  Conducting the energy audit and development of the report     |
|                   |  Develop measuring and verification procedure                 |
|                   |  Assessment of the energy audit report                       |
|                   |  Decision of the EE/RE measures                              |
| <b>RESULTS</b>    |  Energy Audit Report   |
|                   |  Energy Efficiency Action Plan approved by the working group |
| <b>DURATION</b>   |  Approx. 2–3 months  |

The energy audit is a very important part of the development of an EE/RE project. The energy audit is of crucial importance for the success of the project, and mistakes or short-cuts made during this phase might result in serious problems later on in the project development and implementation.

The main objective is to identify the final measures of EE/RE projects that will be implemented, estimate investments required and potential savings that can be reached.

The requirements and procedures for energy audits are described in the European Standard EN 16247 Part 1 to 5 (useful details on energy audits in the context of the European Energy Efficiency Directive can be found here: <https://cutt.ly/ZzjiDy1>)



## 2.1 Developing terms of reference (ToR) for the energy audit

The ToR for the energy audit describes the **scope of work** for the energy auditor such as which object(s) it concerns, minimum activities to be carried out by the energy auditor, timeframe for carrying out the energy audit, minimum number of site visits, contents of the energy audit report and requirements which the energy auditor should meet in order to be considered.

The ToR will be developed by the project team/municipality and will be the basis for the contract with the energy auditor.

The ToR should comprise at least of the following chapters:

### 1. Background and project goals

This chapter should provide a brief overview of the background of the project, the main project goals and quality criteria's.

#### Example of project goals for the thermal refurbishment of a kindergarten:

The project shall aim at reducing the operating costs and the environmental impacts (CO<sub>2</sub> emissions) associated with the utilization of conventional energy resources. At the same time the thermal comfort for the building users shall be increased.

**Energy consumption:** The final energy consumption for heating of the kindergarten building should be reduced by 50% compared to the baseline / actual consumption or limited to max. 80 kWh/m<sup>2</sup> per year.

**Quality standards:** It is expected to implement a high-quality refurbishment project that considers Western European standards and implementation practices (in particular for windows/doors and thermal insulation). Furthermore, the energy audit should consider the latest guideline of building refurbishments of CoM-DeP.



**The following technical criteria's for building components should be considered:**

- Min R-value exterior walls: 4,2
- Min R-value windows/doors: 0,77
- Min R-value roof: 5,0

**Indoor quality:** the indoor air quality shall meet the relevant national standards in order to avoid condensation and mold growth

## 2. Scope of work

In this chapter of the ToR the detailed activities and tasks for the energy auditor should be described.

**The energy audit should include at least the following activities:**

- Participation of the energy auditor in the Kick-off meeting (discussion of the scope of work, required information prior the site visits and practical arrangements of the energy audit)
- Collection of information and data of the object (i.e. building passport, occupancy patterns, energy consumption data, energy costs, operational costs, etc.)
- On-site visit incl. measurements to identify EE/RE measures
- Assessment of the relevant technical equipment and actual condition of the object (i.e. heating, ventilation, cooling, lighting, domestic hot water, fresh water / sewage other relevant systems)
- Identifications of deviations of the actual service from the appropriate (normative) service level (i.e. room temperature, ventilation, humidity, general indoor air quality, etc.).
- Analysis of the energy consumption data for at least the last 3 years, calculation of energy performance indicators, etc.
- Description of the operation, maintenance and facility management of the object
- Evaluation of the energy- and costs saving potential of each EE/RE measure and an estimation of the CO<sub>2</sub> emissions reduction potential. The savings shall be estimated by comparing the energy consumption after the proposed the EE measure with the energy consumption of the baseline scenario and the actual energy consumption.



The same assumptions (e.g. ventilation rate, roof insulation, replacement of windows, etc.) shall be applied for the baseline scenario and the measure. The calculation of the savings shall be transparent, traceable and assumptions shall be well described and stated in the energy audit report.

- Estimation of the investment costs required to implement the EE/RE measures (including a cost breakdown for main components). The estimation of the investment costs shall have an accuracy of +/- 20%. In order to avoid underestimating of costs, it is highly recommended to obtain actual market information for specific measures (including installation / labour costs).
- Estimation of the operational costs (e.g. maintenance and fuel costs for biomass boiler systems, etc.) for the baseline scenario and for each EE/RE measure
- Calculation of financial indicators of each EE/RE measure (e.g. payback period).
- Development of an Energy Efficiency Action Plan for the object
- Preparing photo documentation
- Presentation of the results of the energy audit to the working group.

### 3. Deliverables, Deadlines

The main deliverables are the energy audit report, the presentation of the results to the municipality / working group and a building certificate for audited buildings (if required by legislation).

**The energy audit report should comprise usually of the following chapters:**

- Executive summary<sup>3</sup>
- Background information (energy audit team, date of site visits, involved persons & parties, scope, objectives, method of work, etc.)
- Basic data of the object (existing situation)
  - General description of the object
  - Description of the technical characteristics of the equipment (capacity of the equipment, operation hours, heat produced, total floor area, total heated floor area, roof, walls, windows, doors, basement, thermal bridges, etc.)

---

**3** Typically energy audits prepared in the region **do NOT** contain an Executive Summary. As a result non-technical decision-makers have to go through long documents and try to find the relevant information. Therefore, an Executive Summary should be included which summarizes all relevant information for the decision-makers.



- Information on important changes in the past 3 years (e.g. energy efficiency measures, etc.).
- Comparison of deviations of the actual service level from the appropriate (normative) service level
- Operation, maintenance and facility management of the object
- Problem statement
- Energy consumption of the object, heat production (in case of district heating projects)
  - Energy consumption data, fresh water consumption, etc. for at least 3 years
  - Energy production and energy consumers, network data (in case of district heating projects)
  - Description and location of the metering system, accounting system, etc.
  - Energy tariffs, fresh water / sewage tariffs, total energy costs, total fresh water / sewage costs, energy performance indicators, typical benchmarks, heating degree days for at least 3 years, etc.
  - Applied conversion factors, etc.
- Suggested energy efficiency and renovation measures, energy and cost saving potential
  - Suggested improvements of the object
  - Needed renovation measures that are recommended according structural assessment
  - Energy efficiency related requirements of the local legislation or standards (fire protection, min performance standards, etc.)
  - Description of the baseline scenario. Assumptions applied for the baseline scenario
  - Estimation of the annual energy savings, cost savings and CO<sub>2</sub> emission reductions for each EE/RE measure. Assumptions and conversion factors, along with stated source of information, applied for the calculations<sup>4</sup>.

---

**4** The calculations should be available for review and included either in the energy audit report itself or as annex to it. Under no circumstances should the municipality approve an energy audit report where the calculations and assumptions are not transparent and cannot be checked.



- Cost effectiveness of EE measures (financial analysis)
  - Assumptions for the financial analysis (calculation period, energy tariffs and annual price increase of the energy tariff, discount rate, etc.)
  - Table with results of the financial analysis for each of the selected EE measures or set of EE measures (IRR, simple Pay Back Period, NPV)
  - Reliability of cost estimates (e.g. source of investment costs, spread of the estimated investment costs in %, etc.)
- Energy Efficiency Action Plan

Ranked list of EE/RE measures based on the agreed ranking criteria. The list shall include the EE/RE measures incl. investment costs, energy savings, costs savings, CO<sub>2</sub> savings and profitability parameters (i.e. payback period)
- Energy Certificate (if required by legislation)
- Conclusion, recommendations
- Annex(es)

### Organizational procedure for providing the deliverables:

#### **A draft energy audit report:**

The draft energy audit report shall be delivered within **20** working days after the start of the energy audit (kick off meeting). The report will be assessed and commented by the project team within **5** working days.

#### **The final report:**

The final report shall be submitted within **5** working days after receiving comments from the project team.

#### **Updated savings after TD development:**

The energy auditor has to updated potential savings after TD development within **5** working days after receiving of data from technical design company.

## 4. Requirements for energy auditors

In order to avoid offers from experts who have no/little experience in the requested fields clear and transparent requirements have to be included in the ToR.



### Typical requirements are:

- Certified energy auditor in the relevant field (if certification is available in the relevant country); Certification has to be attached to the offer
- Min. 10 energy audits carried out as a leading expert in the past 5 years of similar objects. A list of conducted energy audits (incl. role within the energy audit and contact details of a person who can confirm the energy audit) has to be attached to the offer
- Example energy audit report of a similar object; report has to be attached to the offer
- Solid skills and knowledge of relevant Western European installation standards and practices in the relevant field is an asset.

## 5. Payment conditions and organizational procedures

Description of the payment conditions, penalties and organizational procedures.

### Example payment conditions:

Advance payment: 10% of the contract price; to be paid within 10 working days after contract signing.

1<sup>st</sup> pre-payment: 40% of the contract price; to be paid within 5 working days after providing of the draft version of the EA report.

2<sup>nd</sup> pre-payment: 40% of the contract price; to be paid within 10 working days after the project team has accepted the final energy audit report in written form.

Final payment: 10% are to be paid within 5 working days after finalization of the technical design development and updating of the potential savings.

## 6. Confidentiality

It is recommended that the energy auditor agrees to keep all information under the assignment confidential.

## 7. Annexes

Documents that are important to the energy auditor can be attached such as standards & norms; guidelines; energy performance criteria that should be met, etc.

Detailed template ToRs for building refurbishments, street lighting systems and district heating systems are attached as [Annex A](#).



## 2.2 Measurement and verification (M&V)

Savings are determined by comparing the **energy use *before and after implementation of EE measures***, incl. appropriate adjustments for changes in conditions. The “before” case is called the baseline. The “after” case is referred to as the post-installation situation. Proper determination of savings includes adjusting for changes that affect the energy use, but that are not caused by the EE measure (i.e. changes in weather, occupancy, etc.).

In order to verify whether the expected energy savings have been achieved by the EE project, it is recommended to establish a simplified and practical M&V concept for each measure.

The **M&V concept** includes the required measurement equipment that should be considered already in the energy audit phase.

For example, M&V concepts for building refurbishment, street lighting projects and district heating projects see [Annex B](#).

### ***Lessons learned / challenges:***

#### **General:**

Specify in the ToR that a **comprehensive** energy audit needs to be conducted. This means an audit which views **all possible EE/RE measures** which can be implemented at the object. Clearly identify what services are expected (concrete outputs/deliverables) and within which timeframe. Penalties for delayed delivery of outputs should be included as well, as is an effective leverage to receive documents in the required quality and time.

In case of donor financed projects, it is recommended to agree on the ToR with donor / technical assistance group. It is also recommended using emission factors for CO<sub>2</sub> savings that are agreed with the donor.

#### **Investment costs of proposed EE/RE projects:**

The investment cost should consider **all** costs that are required for the implementation of an EE/RE measure. Costs that are needed for renovation works must be included as well (i.e. insulation of the attic floor requires a water tight



roof cover, in case the roof is deteriorated it has to be included in the investment cost of the measure as capital repair costs).

The investment costs should have an accuracy of at least +/- 20%, but preferably be as close as possible to market prices. For that reason, a check of market prices has to be carried out. A costs reserve for unforeseen works, risks and inflations are to be foreseen.

### **Example from a CoM-DeP project:**

Many municipalities haven't based their project decisions on a solid analysis of the investment costs; decisions have been taken based on "wishful thinking" (we want to refurbish all of our kindergartens within CoM-DeP) or poor energy audits (consideration of only national standards) or neglect required capital repair works (i.e. refurbishment of the roof). This approach led to massively underestimated investments cost and several refurbishment measures had to be removed from the project for budget reasons.

### **Profitability analysis:**

The final decision on a measure should be based on a decent economics/financial analysis: ***measures that maximize savings for the municipality should be selected.*** The project life cycle costs have to be considered: Sometimes a small additional investment (i.e. 12 cm mineral wool instead of 10 cm) can result in substantial higher cost savings over the technical lifetime of the project (i.e. for a building refurbishment >20 years). The energy auditor therefore has to look for a **cost-optimal** solution **over the technical lifetime of the project** and not only look into the minimum applicable national standards but also to apply higher standards such as European standards).

### **Quality standards:**

The expected quality standards of the EE/RE project should be clearly noted in the ToR. As national standards often **do NOT** stimulate energy efficiency it is recommended to refer to Western European standards that usually consider, beside higher energy efficiency requirements, proven implementation procedures to ensure a technical lifetime of the measure of >20 years.

Important indicators such as R-values for building components, efficiency of boilers, control functionalities for street lighting systems, etc. should be clearly mentioned in the ToR.



Energy audits in buildings should **consider ventilation systems** as sufficient ventilation is crucial to ensure the sustainability of energy efficiency measures and to meet the national norms for indoor conditions.

Proper measurements of object dimensions have to be carried out.

Municipality / project team should be able to check all steps of calculation. For this purpose, all needed data/information must be provided in a transparent and understandable manner by an energy auditor.

### **Measurement & Verification:**

It is important to elaborate a Measurement and Verification plan to be able monitor, verify and improve the savings after the implementation. The required measurement devices (heat meters, electricity meters, etc.) have to be included into the investment costs (in case these have to be purchased). **Do NOT** select “experts” without any/much practical experience with energy audits to carry out the energy audit. **Energy audits require an experienced and professional expert!**

**Do NOT** expect great work for very little money. **Do NOT** select the cheapest offer, go for the best value for money. Often the cheapest offer will be selected without questioning whether the scope of work correlates with the offered budget. Doing a comprehensive energy audit requires sufficient time resources to identify the best solution for the object. An experienced expert develops individual solutions instead of providing just a standardized report derived from an energy audit software tool.

**Do NOT** expect that energy auditor will do all work himself. The project team / municipality should be involved in the activities related to energy audit development, support auditor with needed information, revise the draft of document and provide comments. It is best practice for the project team to include a short-term/part-time technical expert to review the energy audit report.

## **2.3 Procurement of a company/expert for conducting energy audits**

Once the ToR for the energy audit has been finalized, the contracting authority (usually the municipality) will launch the procurement for the energy audit.



The procurement procedure should be selected in accordance with the national legislation or conditions of your contract with donor.

The procurement documents can be sent to pre-selected energy auditors or be published on a public procurement platform. The tender period should be between 2 and 3 weeks. It is strongly recommended to solicit bids from at least 3 companies/experts.

The received offers will be analysed whether all the requirements as defined in the ToR are fulfilled and ranked according to predefined selection criteria, which is usually the price.

The offer that meets all requirements of the ToR and offering the lowest price will be contracted by the contracting authority. The ToR shall be an essential and obligatory part of the contract.

### ***Lessons learned / challenges:***

1. In order to identify experienced energy auditors, you may contact the energy auditor associations (if available in the relevant country) for a list of recommended energy auditors.
2. International organisations (EU, EBRD, etc.) usually apply high quality criteria for energy auditors. Auditors who worked already in such international projects are likely to be more experienced with international energy efficiency standards and practices.
3. Make sure that the energy auditor is independent from any of the companies and manufacturer that will later bid on the works to be carried, in order to avoid any conflict of interest.
4. **Do NOT** select an “expert” without any/much proven practical experience with energy audits of similar objects. Energy audits require an experienced and professional expert!
5. **Do NOT** select the cheapest offer, go for the best value for money. Often the very cheapest offer will be selected, and the scope of work doesn’t correlate with the offered budget. Doing a decent energy audit requires enough time resources to find the best solution for the object. An experienced expert develops individual solutions instead of just entering data into a software and provide generic solutions.



## 2.4 Conducting the energy audit

During the energy audit, the project team / municipality should support the energy auditor as needed and described in the ToR. **Usually main activities for the project team are:**

- **Organizing the kick-off meeting**

During the kick-off meeting the project team / municipality and the energy auditor will discuss the scope of work, time schedule, quality requirements, relevant documents for the energy audit, available budget for the investment measures, measurement and verification equipment to be considered, etc.

- **Providing available documents of the object**

Relevant documents for the energy audit (as discussed during the kick-off meeting) such as building passports, guidelines, previous conducted assessments, energy consumption data, information about the available budget for investment measures, etc. will be provided to the energy auditor prior to the start of the energy audit.

- **Providing access to the object for site visits**

- **Supervising the energy auditor during the energy audit** (in particular also during site visits)

### ***Lessons learned / challenges:***

1. Agree in advance on a concrete schedule for site visits and participate in the site visits to ensure that activities (i.e. measurements) listed in the ToR are being conducted.

#### **Example from a CoM-DeP municipality:**

The energy auditor did not check building dimensions properly during the site visit, as a result the energy auditor was using incorrect surfaces for the cost calculations (30% of roof area was missed). Only during the technical design phase this error was revealed which caused an unexpected increase of the required budget of 40% and severe problems for the municipality.

2. The progress of the energy audit should be monitored by the project team / municipality to recognize delays as early as possible. The energy auditor should be reminded of the agreed penalties in case of a delay (and as described in the contract with the energy auditor).



3. The energy audit (site visits) for buildings or district heating system should be conducted as much as possible during cold weather conditions (this is in particular important when using a thermal camera) and when all systems (heating, ventilation, etc.) are under operation.
4. The energy auditor, but also the project team / municipality should collect photos of important elements and systems that may be used at a later stage (i.e. technical design stage) for clarification of technical details and as documentation of the situation/condition before the project implementation. Moreover, photos can be used to show later on the before-and after situation of the buildings for communication and visibility purposes.

## 2.5 Review of the deliverables

The main outcome of the energy audit is the energy audit report, which should provide a solid basis for the selection of the EE/RE measures by the working group. Example energy audit reports are available in [Annex C](#).

As outlined in the ToR, the energy auditor has to submit a draft final report to the project team for checking and commenting.

### Key issued to be checked:

- Was the energy audit conducted according to the ToR?
- Does the energy audit report include all the chapters and information according to the ToR?
- Are the proposed EE/RE measures properly described and meet the agreed quality criteria?
- Are the calculation steps and assumptions properly described and understandable?
- Do the investment costs include all costs that are needed for the implementation (i.e. also capital repair costs)<sup>5</sup>?

---

<sup>5</sup> In case that it is likely that external experts will have to be recruited in order to implement (part of) the project, also these costs should be included in the final project budget (technical design company, site supervisor, etc.)



- Do the operational costs include all costs that are needed for the operation (i.e. maintenance costs)? Does the energy auditor provide the accuracy of the cost estimation (i.e. +/- 20%)?
- Are the investment costs reliable and the sources properly described (i.e. through commercial offers)?
- Is the Energy Efficiency Action Plan understandable and properly prepared?
- Does the proposed Action Plan meet the available budget?

In cases when the budget is not sufficient for all proposed EE/RE measures, the project team / municipality and energy auditor have to find solutions to meet the available budget, or the municipality has to seek for additional finances to carry out all originally foreseen measures.

- Does the report include measurement and verification equipment needed?

The result of the review of the draft final report should be documented and provided to the energy auditor in order to improve/change the energy audit report.

The task is for the energy auditor and project team to find the mix of measures which lead to the maximum energy savings possible within the available budget (while also keeping in mind costs of operation of the object in the future). The decision on which measures to implement should be well-justified, in line with national construction standards and norms, preferably in line with EU construction standards and norms, and be based on economic/financial criteria, such as Net Present Value (NPV), Internal rate of Return (IRR) and simple payback time.

Once the energy audit report has been improved by the energy auditor, the updated report will be reviewed again. In case of no additional comments from the project team the energy auditor can issue the final report. The project team reviews again and approves the report.

Please note that donor funded projects might require a check of the energy audit by delegated experts. Projects implemented under CoM-DeP shall be checked by the Support Team.



### ***Lessons learned / challenges:***

1. The energy audit report should be provided in digital and paper format.
2. Most energy auditors are using dedicated energy audit software for the calculation of savings and profitability. However, the energy auditor has to develop ***tailor made EE/RE measures*** for your object. Standardised and simple energy audit reports derived from energy audit software that **do NOT** provide you with tailor made solutions for your object ***should not be accepted***. Calculation steps and assumptions must be comprehensible and able to be verified.
3. Often, persons in project teams **do NOT** have the experience to review energy audit reports and provide useful comments. In such cases the project team should contract an experienced external expert to supervise the energy audit and to review the energy audit report on behalf of the project team.
4. When assessing the draft final report, clear and concrete comments should be formulated by the project team / municipality. The energy auditor has to provide well-justified answers for all questions/comments that were raised, before the final report can be accepted.
5. **Do NOT** underestimate the costs of the EE/RE measures. The estimation of the investment costs is a crucial element of the energy audit and very often investment costs are underestimated during the energy audit (European standards not considered, not all works considered such as capital repair works, etc.). Materials often account for just a small part of the EE/RE measures, while labour costs (installation) account for a far higher percentage of the total costs. It is strongly recommended to ensure that all cost main components are included and to get commercial offers from vendors/producers for main equipment and materials.
6. **Do NOT** pay the energy auditor the final tranche until all comments have been considered and all improvements of the energy audit report are done.
7. **Do NOT** forget about measurement and verification



## 2.6 Decision on EE/RE measures to be implemented

Based on the results of the energy audit, **the project team should propose a set of EE/RE measures** (Energy Efficiency Action Plan) which meet the overall project objectives (energy savings and/or cost savings committed to) to the greatest extent possible. Furthermore, the investment costs (as identified in the energy audit report) of the proposed EE/RE measures should match the available budget.

The Energy Efficiency Action Plan specifying the measures selected, costs per measure, expected energy savings per measure, total required budget, implementation table and other relevant information shall be presented to and discussed within the **working group**. The action plan shall be formally approved by the working group.

### Example Action Plan

Action Plan for the kindergarten #3 (technical specification, investment costs, energy savings, cost savings, CO<sub>2</sub> savings, financial indicators).

| Measure  | Investment costs in EUR | Cost savings in EUR (compared to baseline) | Energy savings in MWh/a (%) | CO <sub>2</sub> savings in tCO <sub>2</sub> /a | Simple back pack period in years |
|--|-------------------------|--|-----------------------------|--|----------------------------------|
| Thermal insulation of walls (14 cm mineral wool; R-value 4,2; 530 m <sup>2</sup> )             | 50.000                  | 3.840                                      | 64 (22%)                    | 13   | 13,0                             |
| Replacement of windows, window sills, doors (R-value 0,77; 150 m <sup>2</sup> )                | 20.000                  | 1.600                                      | 27 (9%)                     | 5  | 12,5                             |
| Thermal insulation of top floor / attic (15 cm mineral wool; R-value 5,0; 600 m <sup>2</sup> ) | 10.000                  | 3.600                                      | 60 (20%)                    | 12   | 2,8                              |
| Centralised ventilation system (incl. heat recovery)   | 20.000                  | 4.900                                      | 83 (58%)                    | 17   | 4,1                              |
| Capital repairs (new roof cladding)  | 10.000                  | None (no EE measure)                       | None (no EE measure)        | None (no EE measure)                           | None (no EE measure)             |
| <b>Total</b>   | <b>110.000</b>          | <b>13.940</b>                              | <b>234</b>                  | <b>47</b>                                      | <b>7,9</b>                       |



| Project goals   | EE/RE project   | Goal achieved |
|---|---|---------------|
| Energy consumption reduced by 50%   | 62%   | YES           |
| Specific final energy consumption<br>85 kWh/m <sup>2</sup> per year (heating)   | 70 kWh/m <sup>2</sup> per year  | YES           |
| Exterior walls: 4,2 (K.m <sup>2</sup> )/W<br>Windows / doors: 0,77 (K.m <sup>2</sup> )/W<br>Roof: 5,0 (K.m <sup>2</sup> )/W | Exterior walls: 4,2 (K.m <sup>2</sup> )/W<br>Windows / doors: 0,77 (K.m <sup>2</sup> )/W<br>Roof: 5,0 (K.m <sup>2</sup> )/W | YES           |
| Indoor quality: CO <sub>2</sub> concentration < 1.000 ppm,<br>rel. humidity between 30 and 60%                              | Centralised ventilation system planned<br>to meet the requirements  | YES           |

## 2.7 Relevant annexes

[Annex A.1. ToR for energy audit of Buildings](#)

[Annex A.2. ToR for energy audit of Street Lighting](#)

[Annex A.3. ToR for energy audit of District Heating](#)

[Annex B.1. Measurement and Verification template for Buildings](#)

[Annex B.2. Measurement and Verification template for Street lighting](#)

[Annex B.3. Measurement and Verification template for District Heating](#)

[Annex C.1. Example energy audit report Buildings \(available in Ukrainian only\)](#)

[Annex C.2. Example energy audit Street Lighting \(available in Russian only\)](#)

[Annex C.3. Example energy audit District Heating \(available in Ukrainian only\)](#)



Modernization of multi-apartment buildings  
*Dolyna, Ukraine*

# Phase 3: Final (Technical) design of EE/RE measures

|                   |  |
|-------------------|--|
| <b>OBJECTIVE</b>  |  Elaboration of the technical final design documents (drawings, technical specifications, BoQ, etc.) for the selected EE/RE measures  |
| <b>ACTIVITIES</b> | <ul style="list-style-type: none"> <li> Developing ToR</li> <li> Selection and contracting a technical design company</li> <li> Elaboration of the technical design documentation</li> <li> Updating the financial analysis</li> <li> Selection of the EE/RE measures for procurement</li> </ul> |
| <b>RESULTS</b>    | <ul style="list-style-type: none"> <li> Final design documents for each EE/RE measure</li> <li> Total investments costs / operational costs, energy savings for each EE/RE measure</li> <li> Updated financial analysis</li> <li> List of selected and agreed EE/RE projects for procurement (updated Action Plan)</li> </ul>  |
| <b>DURATION</b>   |  Approx. 3–4 months   |

The main objective of this phase is to elaborate the technical design incl. technical specifications and Bill of Quantities (BoQ) for the EE/RE measures which were selected



during the energy audit phase (Energy Efficiency Action Plan). Furthermore, the financial analysis which was elaborated during the energy audit will be updated with the latest investment cost information and market prices. Based on the updated financial analysis, the Municipality will agree on the final Energy Efficiency Action Plan.

### 3.1 Developing of the ToR for the technical design, contracting a design company

The Terms of Reference (ToR) for the technical design describe the scope of work for a technical design company for the elaboration of the final design of each EE/RE measure. The ToR should be developed by the project team preferable with involvement of the energy auditor. Beside the scope of work, the ToR should include also clear project goals, as outlined in the energy audit phase (see energy audit phase). Relevant information/documents of the object such as the energy audit report, structural reports, M&V concept, guidelines to be considered etc. should be attached to the ToR.

For building refurbishment projects, it is strongly recommended to additionally obtain a **structural report** with involvement of an external certified engineer who may confirm that a building condition is suitable for a thermal refurbishment. It is recommended to have the structural report available **before** starting the tender for the technical design.

Usually more than one engineering discipline is required for a comprehensive EE/RE project e.g. building construction, heating/ventilation, electric systems, etc. In such a case it is recommended to contract a single technical design company that is able to cover all relevant disciplines or subcontract the engineering disciplines that cannot be cover with their own resources. This approach will significantly reduce the coordination efforts for the project team.

The bidder that meets all requirements of the ToR and offers the lowest price will be contracted by the contracting authority (municipality). The ToR shall be an integral part of the contract.

An example ToR is attached as [Annex D](#).



## 3.2 Procurement of a company/expert for developing of the Technical Design

The procurement follows the same principles as for energy audits, please see [chapter 2.3](#).

## 3.3 Developing of the technical design for each EE/RE measure foreseen to be implemented at an object

The contracted technical design company will elaborate the final design **of each EE/RE measure** according to the ToR and in close cooperation with the project team. Furthermore, a detailed project implementation schedule for each EE/RE measure shall be elaborated. The M&V concept (developed in the energy audit phase) shall be considered during the development of the technical design.

The technical design company should contact the relevant authorities in advance to introduce the intended projects and to receive preliminary comments.

It is recommended to provide the technical designer with the relevant publications, guidelines, etc. Please see Covenant of Mayors – Demonstration project library: <https://com-dep.eu/library/>

In the event that additional measures (e.g. ventilation system, refurbishment of the roof, etc.) will be implemented by third parties or in the framework of another project at the same construction site, the project team and the technical design company should coordinate the EE/RE measures with those in order to ensure a smooth and efficient implementation.

The project team has to review the progress and the quality of the technical documents, in particular technical drawings, technical specifications and BoQ. This task requires specific knowledge and experiences, therefore the municipality is advised to contract a short-term/part-time technical expert to review the technical design and provide comments.



Each component of the EE/RE measures must be properly described **incl. their technical specifications and installation practices**. The BoQ uses predefined text modules for describing the works/materials which is usually not a sufficient way to describe all the specifications and requirements properly. It is crucial to ensure that the design documents (technical drawings, technical specification and BoQ) are coherent and not in contradiction to each other.

It is recommended to elaborate the technical drawings and BoQ in parallel in order to identify budget issues at an early stage in the development of the technical design.

The technical design company should also provide an energy performance certificate (for buildings refurbishment projects) if it is required by the national legislation.

### 3.4 Elaboration of investment costs, operational costs, energy savings

The technical design company should estimate the total investment costs and the operational costs (e.g. in case of a biomass boiler house) for each of the EE/RE measures based on the final technical design. Furthermore, the technical design company should provide the basic data for the calculation of the expected annual energy and cost savings.

In case the technical design company is not able to fully provide all required cost information (investment costs, operational costs, savings, etc.), the project team (or a delegated expert — an energy auditor, as usually) has to support and provide additional data as required.

The reliability of the cost estimation should be at least +/- 15% (but the closer to market prices the better).

### 3.5 Update of the financial analysis

Based on the financial information provided under the previous step, the project team will update the financial analysis for each EE/RE measure or a functional set of EE/RE measures.



The investment cost should consider **all** costs that are required for the implementation of an EE/RE measure (preliminary assessment, energy audit, technical design, construction, site supervision, etc.). Costs that are needed for capital repair works must be included as well (i.e. improving the support structure of the roof, renewal of the roof cladding, rain gutter system, repair of structural damages, indoor works, etc.), as well as costs of project team / external experts needed for implementation of the project.

### 3.6 Decision on the EE/RE measures to be implemented

For the final decision of the measures to be implemented, the project team or a delegated expert such as the energy auditor needs to prepare an **update of the Action Plan** which was developed under the energy audit phase.

Based on the actual results of the technical design, the project team should propose a set of EE/RE measures (updated Energy Efficiency Action Plan) which meet the overall project objectives (energy savings and/or cost savings, etc.) to the greatest extent possible. Furthermore, the actual total investment costs of the proposed EE/RE measures have to match the available budget.

The Energy Efficiency Action Plan specifying the measures selected, total investment costs, expected energy savings per measure, key financial performance indicators, implementation period and other relevant information shall be presented to the Municipality. The updated Action Plan shall be formally approved by the Municipality.

#### Example Action Plan

The Action Plan for the kindergarten #3 was updated with latest information from the technical design phase (technical specification, investment costs, energy savings, cost savings, CO<sub>2</sub> savings, financial indicators).

In the event of budget limitations, it is recommended to split EE/RE measures in few stages/waves (e.g. stage 1: kindergarten #1, #2 and #3; stage 2: kindergarten #4 and #5 (implementation of stage 2 only when the required budget is secured)).

| Measure  | Investment costs in EUR  | Cost savings in EUR (compared to baseline) | Energy savings in MWh/a (%) | CO <sub>2</sub> savings in tCO <sub>2</sub> /a | Simple back pack period in years |
|--|--|--|-----------------------------|--|----------------------------------|
| Thermal insulation of walls (14 cm mineral wool; R-value 4,2; 530 m <sup>2</sup> )           | 55.000   | 3.940                                      | 66 (22,5%)                  | 13   | 14,0                             |
| Replacement of windows, window sills, doors (R-value 0,77; 150 m <sup>2</sup> )              | 20.000   | 1.600                                      | 27 (9%)                     | 5  | 12,5                             |
| Thermal insulation of top floor/attic (15 cm mineral wool; R-value 5,0; 600 m <sup>2</sup> ) | 15.000   | 3.600                                      | 60 (20%)                    | 12   | 4,2                              |
| Centralised ventilation system (incl. heat recovery)   | <b>Excluded.</b> The ventilation system is a crucial element of the refurbishment, however it will be excluded from the current project in order to stay within the available budget. A follow up project implemented in 2021 will consider the ventilation project. The technical design documents of the current project considers already all preparatory works (ventilation in/outlets, etc.). |  |                             |  |                                  |
| Capital repairs (new roof cladding)  | 15.000   | None (no EE measure)                       | None (no EE measure)        | None (no EE measure)                           | None (no EE measure)             |
| <b>Total</b>   | <b>105.000</b>   | <b>9.140</b>                               | <b>153</b>                  | <b>30</b>                                      | <b>11,5</b>                      |

| Project goals   | EE/RE project   | Goal achieved                                 |
|---|---|---|
| Energy consumption reduced by 50%   | 51%   | YES   |
| Specific final energy consumption 85 kWh/m <sup>2</sup> per year (heating)  | 66 kWh/m <sup>2</sup> per year  | YES   |
| Exterior walls: 4,2 (K.m <sup>2</sup> )/W<br>Windows/doors: 0,77 (K.m <sup>2</sup> )/W<br>Roof: 5,0 (K.m <sup>2</sup> )/W | Exterior walls: 4,3 (K.m <sup>2</sup> )/W<br>Windows/doors: 0,77 (K.m <sup>2</sup> )/W<br>Roof: 5,0 (K.m <sup>2</sup> )/W | YES   |
| Indoor quality: CO <sub>2</sub> concentration < 1 000 ppm, rel. humidity between 30 and 60%                               | To measures foreseen to be covered by a separate future project   | NO to be covered by a separate future project |

Please note that Donor-funded projects might require a check of the technical design documents by delegated experts.



### ***Lessons learned / challenges:***

1. Project team / municipality should assist the technical design company in collection of needed data and information (for instance, provide existing technical documentation, help with obtaining technical conditions from energy supply companies, etc.)
2. The ToR for the technical design company is often too vague and does not include concrete project goals (such as energy efficiency performance criteria). As a result, the technical design company comes with a “standard” technical design that might not meet your or International Donor’s expectations.
3. It is strongly recommended to organize an on-site visit prior to the submission of the offer for the bidding engineering companies. It is important that the technical design company is familiar with the technical condition of the object (e.g. structural damages, etc.).
4. For building refurbishment projects, it is strongly recommended to develop a structural report with involvement of an external certified engineer who may confirm that a building condition is suitable for thermal refurbishment. Ideally this should be contracted and finalized before the procurement of technical design services is started (as there might be a need to drop certain objects, measures, review the financials).
5. The technical design documents are the basis for the contract with a construction company. Services/components/materials/installation practices, etc. which are not properly described or specified or missing will not be implemented by the construction company.

An in-depth check of the technical design documents (technical drawings, technical specifications, BoQ) is required by the project team in order to ensure that the technical design documents are complete and form a coherent set of documents. Inconsistent technical documents could lead to complaints of bidders and a cancellation of the tender.

6. In case of refurbishment of several buildings (e.g. 5 kindergartens) it is recommended to elaborate the technical design and procurement documents separately for each object (e.g. LOT 1 to LOT 5).

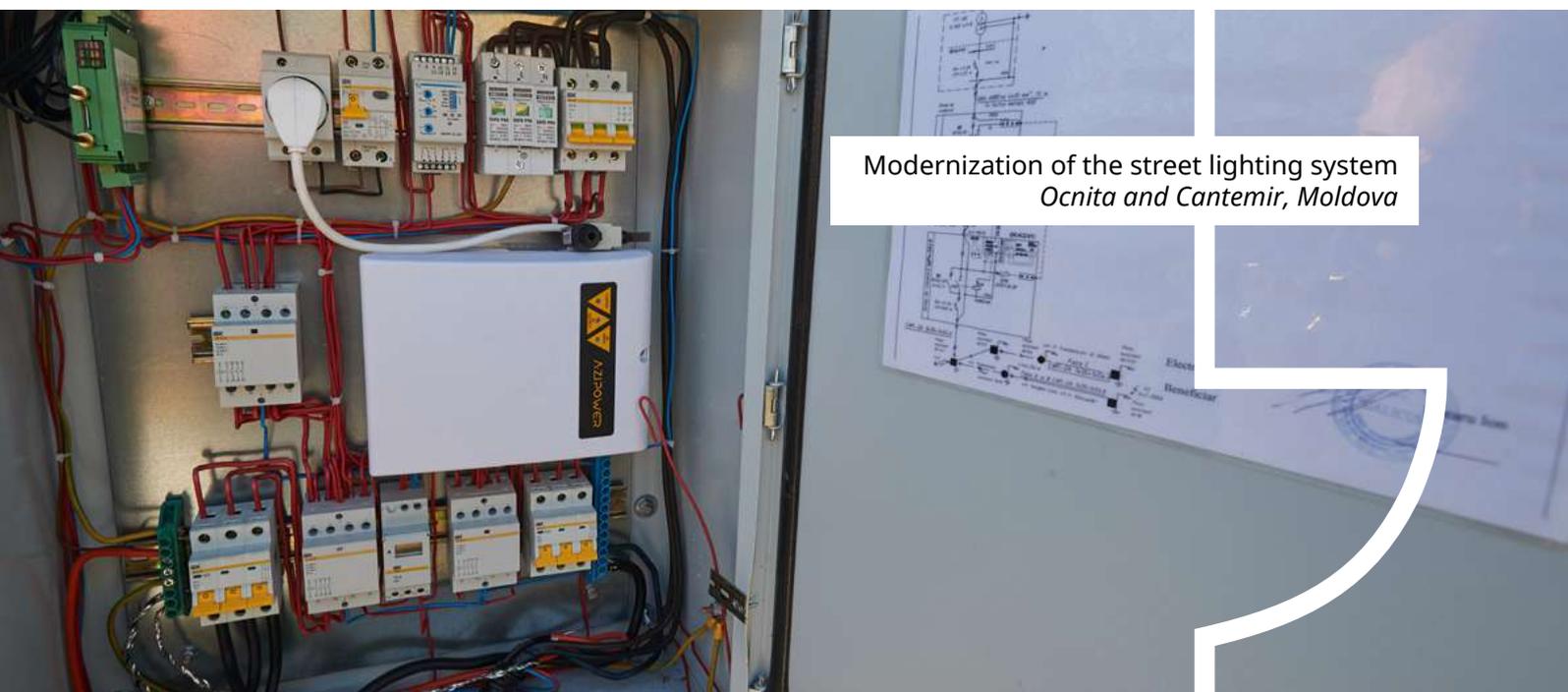


7. Timing in the development of the technical design is very important. It is recommended to request a detailed work plan from technical designer and monitor its implementation. A penalty condition included in the contract with the technical design company would also support a timely delivery of the technical design.
8. Technical Design companies must be independent from manufacturers/ producers to avoid any conflict of interest. Technical Design companies must be product neutral as much as possible, preferences for any product/ manufacturer in the technical documents are not allowed.
9. The technical designer should provide also assistance during the construction phase (technical designer supervision).
10. **Do NOT** use technical drawings from a specific manufacturer (e.g. a particular boiler manufacturer), the technical drawings should be product neutral.

## 3.7 Relevant annexes

[Annex D.1. ToR Technical Design — General](#)

[Annex D.2. ToR Technical Design — Buildings](#)



# Phase 4: Authority approvals for the technical design and BoQ

|                   |   |
|-------------------|---|
| <b>OBJECTIVE</b>  |  Receiving approvals for the technical design and BoQ  |
| <b>ACTIVITIES</b> |  Elaboration of documents for authority approvals<br> Submission to the authorities |
| <b>RESULTS</b>    |  Authority approvals and permits for each EE/RE measure  |
| <b>DURATION</b>   |  Approx. 2 months  |

The main objective of this phase is to receive the relevant permits for construction and operation of the selected EE/RE measures from the authorized authorities.

## 4.1 Elaboration of the required documents

The technical design company is hired for the final design and the project team should elaborate the documents which will be required by the relevant authorities beside the final design documents of the EE/RE measures. As the list of required documentation differs per country, and often changes, it is recommended to check on the necessary permits and approvals carefully in advance. Normally, the technical design company that worked out the final design can support with the list of required permits/authorities.



## 4.2 Submission of the EE/RE measures to the relevant authorities

After thorough checks by the municipality's legal department, and other relevant personnel (construction department etc.), the municipality/contracting authority will officially submit the documents to the various authorities for approvals and permits.

Comments from authorized institutions have to be addressed by the technical design company, either to provide clarifications or improve technical design documents.



Installed photovoltaic system  
*Vayk, Armenia*

# Phase 5: Procurement of EE/RE measures (works)

|                   |  |
|-------------------|--|
| <b>OBJECTIVE</b>  |  Selection of the most competitive offer that meets all tender criteria   |
| <b>ACTIVITIES</b> | <ul style="list-style-type: none"> <li> Elaboration of the technical and general part of the tender documents</li> <li> Launch of the tender</li> <li> Evaluation of the offers (evaluation report)</li> <li> Selection of the winning offer</li> </ul> |
| <b>RESULTS</b>    |  Procurement evaluation report  |
| <b>DURATION</b>   |  Approx. 3–5 months   |

The main objective of this phase is to elaborate the tender documents, procure the construction works and contract a construction company for implementing the selected EE/RE measures.

## 5.1 Elaboration of the procurement documents (technical part)

The technical design company for the final design normally should also elaborate the technical part of the tender documents (specifications and technical requirements), according to the final design of the EE/RE measures. Properly prepared tender documents are crucial for the implementation of a successful project. The “technical specification document” beside technical drawings and the BoQ is a key element of the tender documents.



EE/RE measures in similar technological fields at the same object (e.g. construction measures such as windows, roof, etc.) should be included into one tender / lot.

In the event of measures in similar fields but on different construction sites, these can be included in one tender, but it is recommended using separate lots.

EE/RE measures in different fields (e.g. EE measure 1: refurbishment of a building, EE measure 2: refurbishment of the street lighting system) should be tendered separately.

### ***Lessons learned / challenges:***

1. A BoQ in most cases is **NOT** sufficient to describe the services and materials properly. Detailed technical specifications are needed, as well as clear instructions on the installation.
2. Make sure that key documents (technical drawings / technical specification and BoQ) are coherent.
3. **Do NOT** separate procurement of supplies/materials from installation of the materials, as otherwise in case of a defect there is no clear responsibility between supplier and installer. It is strongly recommended to have materials/supplies and works in one tender, so there is one clear party responsible for handing over a fully functioning system.

## **5.2 Elaboration of the procurement documents (general part), procurement procedures**

The Project team will elaborate the general part of the tender documents (general terms and conditions) and the tender procedures (type of tender, selection criteria etc.).

The general part of the procurement documents comprises usually of the following documents/chapters:

- **Advertisement/announcement** (summary of tender dossier that is to be published in media or at specialized procurement portals)



- **Information on Contracting Authority / Client** — legal form, address, requisites, etc.
- **General information on the subject of procurement** — general description of the object, its address, procurement procedure, implementation period, etc.
- **Selection criteria** — in order to be eligible for the award of the contract, tenderers must provide evidence that they meet the selection criteria. The selection criteria should be clear and non-discriminatory and may not go beyond the scope of the contract. Usually i) the economic and financial capacity of the bidder and ii) the technical and professional capacity of the bidder are selection criteria's.
- **Instruction for tenders** — this chapter consists of information on language of tender, how the bid can be submitted, main milestones in procurement and their deadlines, currency, guarantees, procedure of clarifications, information on contact person, list of documents are to be submitted, evaluation procedures, etc.
- **Draft Contract and General terms and conditions** — this document describes general obligations and activities for the construction company. An example can be found in [Annex E](#).

Procurement procedures: the procurement regulations vary from country to country and need to be assessed by the project team and the municipality / contracting authority in order to arrive at the proper procedure. It is assumed in this Handbook that works exceed the value of 20 000 EUR, and therefore only procurement procedures for over this amount are being described below.

### The following basic principles always apply for procurements:

- It should be very clearly described in the tender dossier what exactly is being procured, i.e. there **always** should be a clear Terms of Reference specifying outputs expected (for services) or clear technical specifications of materials / equipment sought (for works and supplies), as well as timeline for delivery/installation/construction.
- Competition is of utmost importance to get the best value for your money. You should therefore try to get as many bids as possible. **The best way to do so is to always use the open tender procedure.** The open tender procedure normally has a slightly longer duration (up 15–30 days extra) than a negotiated tender procedure (at least 3 bids), but given that a typical energy efficiency project lasts 3 years, 15 or 30 extra days should not be used as an argument to forego an open tender procedure.



- The whole tender process should be transparent (everything should be documented and on file), fair (all bidders should receive the same conditions and chances) and avoid any conflict of interest. Persons/companies that have been involved in developing documents that form (the basis) of the tender dossier, are not to be allowed to bid on the tender. In this regard, the company / expert that prepared the Technical Design documentation is also not to be allowed to bid.
- Tenders should be **widely** announced/published and preferably on the national **public** procurement platform (or in its absence on a nation-wide procurement platform). It is the task of municipality to ensure that competition will be guaranteed. Tenders announced only on the municipal website / Facebook page or in local media are **NOT** considered to be meeting the criteria of transparency and equal treatment of bidders.
- The time-limits for applications and/or tenders must be long enough to give interested parties a reasonable period to prepare and submit their tenders. For the typical works in an EE project a period of at least 30 days should be given.
- Potential bidders should be given the possibility to ask questions for clarifications to the tender dossier. These questions, and the answers to them, should be publicly made available, so each potential bidder has this information.
- It is **very highly recommended** to organize a site visit for potential bidders to the object to be refurbished (date, time, place and contact details to be included in the tender dossier)
- **Exclusion, selection and award criteria should be published by the municipalities in advance in the tender documents**
- A tender evaluation committee must be set up to evaluate received bids, consisting of an odd number of members. It should be ensured that the members have the right background, education, capacities and expertise to be able to evaluate the bids
- The contract must be awarded to the most cost-effective tender (i.e., the tender offering the best price-quality ratio), or, in case of works or supply contracts not involving after-sales service, the sole award criterion should be the price. In case of best price-quality ratio being used, the criteria for evaluating the quality should be clearly defined so an auditor can later on verify that the quality has been properly evaluated.



The table below describes the most common procurement procedures for construction works:

| Procurement   | Description  | Pros/Cons  |
|---|--|--|
| <b>Open tenders (national public procurement rules)</b>   | Recommended for obtaining the largest possible number of bids<br><b>Tender period</b> (varying per country): between 30 and 60 days  | <b>PROS:</b><br>Larger number of bids can be expected when published on common procurement platforms (greater competition)<br>Well-known procedure for Contracting Authorities and bidders<br><b>CONS:</b><br>if not published on a common procurement platform, bidders might not be aware of the tender and only limited bids will be received<br>Procurement can be delayed/suspended due to complaints from other bidders<br>Procedures vary between countries and transparency might be lacking |
| <b>Simplified procedure / competitive negotiated procedure</b> (at least 3 bids)  | Recommended for obtaining bids from a number of preselected companies (5–7)<br><b>Tender period:</b> 30 days   | <b>PROS:</b><br>Preselected companies that will bid will realistically be able to carry out the work<br>Well-known procedure for Contracting Authorities and bidders<br>Only 30 days tender period<br><b>CONS:</b><br>Restricted number of participants (limited competition)  |
| <b>EU PRAG</b> (Practical Guide to Contract Procedures for EU External Actions).<br>Can be applied for projects that are financed by the European Union | Recommended for construction works<br><b>Tender period:</b><br>from 30 days for competitive negotiated procedures and 60 days for open tenders<br>Recommended procurement procedure from European Union for construction works when the national procurement system is not fully transparent/developed | <b>PROS:</b><br>Transparent and well documented procedure.<br>Well-standardized templates of documents<br>Limited complaint possibilities for non-winning bidders (recommended in markets with many complaints of bidders)<br><b>CONS:</b><br>Standard tender documents are available only in English (translation is required)<br>Lack of experience of municipalities / bidders in preparing such tender dossiers / bids   |
| <b>International open tenders</b>   | Recommended if you want to bring in foreign bidders<br><b>Tender period:</b> typically, 60–90 days   | <b>PROS:</b><br>Competition from foreign bidders (especially useful for larger projects and in distorted markets and monopolies)<br><b>CONS:</b><br>Long duration of tendering<br>International open tenders often result in no bids being received  |



## Frequently Asked Questions:

### 1. What to do in case only one offer is submitted?

If only one bid is submitted it is recommended to relaunch procurement and get more bids (at least 3). Project team / municipality should widely promote the tender in order to involve more companies. If the 2nd attempt is unsuccessful again (only 1 bid was submitted) you can move ahead with contracting the bidder in case the offer meet all requirements.

### 2. What to do in case the price of the potential winner is significantly above/below the expectations?

If the offer is lower than the typical market price, it is unlikely that the contractor will be able to deliver work of sufficient quality. It is recommended to reject such a bid or cancel the tender (if allowed by legislation) and relaunch it with additional requirements (e.g. you may ask for a performance / tender guarantee).

If the offer is higher than the project budget, you may i) find additional resources or ii) try negotiate with the company for some discount (if it is allowed according national legislation) or iii) launch new procurement and specify the maximum amount that you may pay (or reduce the scope of work).

### 3. Can the Contracting Authority (e.g. municipality) enter in price negotiations with individual bidders?

If it is allowed by national legislation, the municipality may negotiate with the bidders in order to cut the price. For instance, it is a common practice in Ukraine when services/works are being procured via electronic auction (**after the initial bids have been received**).

In some countries national legislation also allows to enter into negotiations with individual bidders if the bids exceed the maximum available budget. In those cases, each of the bidders should be treated in the same way, same criteria should be used for all bidders and all communications with the bidders should be on file.



#### **4. Can the scope of work be separated in several small lots (e.g. < 20.000 EUR) to avoid a competitive tender procedure?**

This is absolutely not allowed, as the main objective of such dividing of tenders (called “artificial slicing”) is to reduce competition. Financers or control bodies likely will investigate such tenders, resulting in the tender not being considered eligible, or even take legal action.

#### **5. How to deal with bidder’s complaints after selection of the winner of the tender?**

You have to deal with complaints in the way as described in the tender documents and relevant procurement legislation and regulation. You should argue your decision by providing reasonable clarifications. In different countries there are different complaint mechanisms within public procurement rules, and you should follow these. You should be prepared for situations where certain bidders (in open tenders) keep on complaining and will send complaints to various control bodies, courts etc. This can result in serious delays of your project: in the case of CoM-DeP in one of the projects the procurement had to be repeated 6 times because of filed complaints at state control bodies and more than a year was lost. In general, the complaints mechanism in the EU PRAG procurement procedures give less space for endless complaints by bidders and if procurements have failed two times because of complaints by bidders it is recommended to carry out the 3rd procurement under PRAG procedures (this only applies to projects funded by the EU).

#### **6. What to do if a company offered other equipment/materials that were foreseen in the TD?**

The technical specifications in the tender dossier describe the characteristics for the different materials/equipment to be procured. If the materials/equipment offered meets these technical specifications you have to accept them. In some cases bidders will offer ‘alternative’ materials/equipment that in their opinion is better suited for the works. This makes it difficult to compare bids (and moreover is not in line what you asked for) and it is a best practice in tenders to include a line clearly saying that variant solutions (meaning solutions that do meet the technical specification) are not accepted. Please note that in your tender dossier you cannot ask for specific brands, you have to specify the characteristics (technical specifications) of materials/equipment.



## 7. What to do if none of the bidders meets with selection criteria? Can we reduce them?

Changing of selection criteria after bids submission is not possible. You have to cancel the procurement and then amend the tender dossier and requirements for bidders.

## 8. What to do if a company refuses to sign the contract?

It is recommended to use a tender guarantee for reducing such risks. You may charge guarantee costs if the company does not want to cooperate with you. Normally if a company refuses to sign a contract within a stipulated deadline you can move to the 2<sup>nd</sup> best scoring company and see if you can agree on a contract with this company.

Please note that donor funded projects might require a check of the procurement documents by delegated experts.

## 5.3 Launch of the procurement

In general, receiving four to six valid offers is an optimal situation in order to ensure competition, three bids should be the minimum. In case of open tenders, the more publicity and portals used to announce the tender the better.

### ***Lessons learned / challenges:***

1. In terms of the reaction time to be given to bidders (time between the announcement of the procurement and the deadline for submitting bids), it is crucial that sufficient time is given to bidders. It is recommended to use the reaction times as prescribed by the EU in the PRAG, namely 30 days for competitive negotiated procedures and 60 days for open tenders. Insufficient reaction time, might result in the procurement being considered as ineligible.
2. It is highly advised to give potential bidders the possibility to visit the objects prior to the submission of their offer. This is normally included in the tender documentation, specifying date, time and place where potential bidders can inspect the objects (pre-tender meeting).



3. The number of employed staff and their skills relevant for the implementation of the EE/RE measure (e.g. number of certified welders for a district heating project; number of trained construction workers, etc.) can be considered as additional qualification criteria. Proper evidence must be requested from the bidder.
4. Procurement dossier must be prepared by a qualified procurement expert. Municipality / contracting authority may involve such expert for a short-term period.

## 5.4 Evaluation of the received offers

The contracting authority's procurement/evaluation committee will assess the received bids and evaluate the bids according to the selection criteria that were mentioned in the tender documentation.

Technical expert(s) should be involved into the procurement / evaluation committee who may check technical offers from bidders. If it is allowed by the national legislation independent external expert(s) should be involved.

A procurement evaluation report and the proposed selection of the construction company should be prepared by the procurement / evaluation committee.

Please note that donor funded projects might require participation of the donor or/and delegated experts as observers.

## 5.5 Contracting of the Construction company

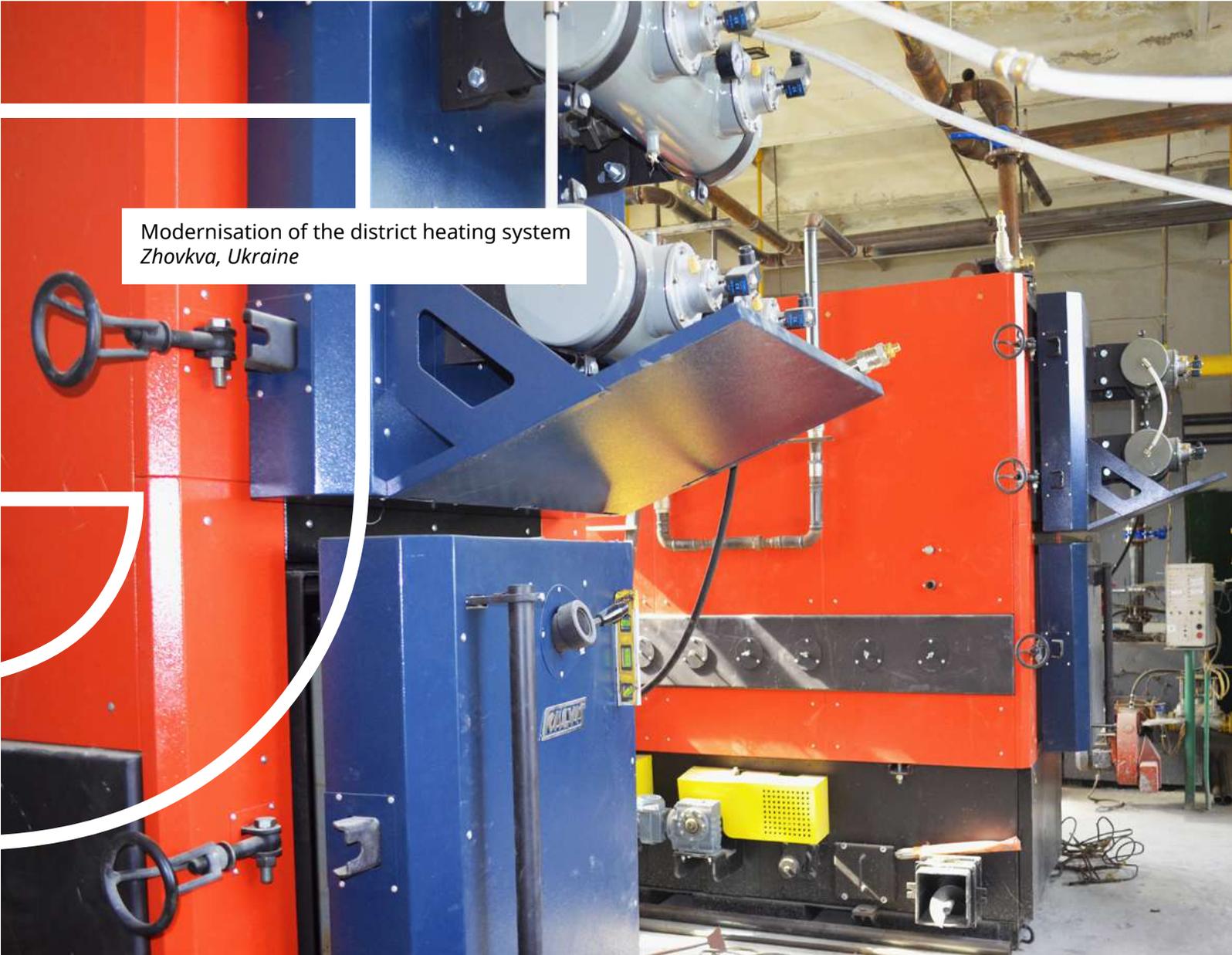
The municipality / contracting authority will contract the selected company for implementation of the EE/RE measures, within the period as described in the tender documentation. Also, the unsuccessful bidders will have to be informed formally about the outcomes of the procurement. Before signing the contract, the construction com-



pany is obliged to prove (**prove obligation**) the provided documents before the implementation. In case he identifies an issue (e.g. the technical design doesn't foresee strengthening of the roof support construction but from his point of view it is necessary) or any other issue that is relevant for the project to avoid any damage he has to inform (**warning obligation**) the contracting authority in writing. Furthermore he has to advise on a solution (**advisory obligation**).

## 5.6 Relevant annexes

[Annex E. General terms and Conditions for construction works](#)



Modernisation of the district heating system  
*Zhovkva, Ukraine*

# Phase 6: Procurement and Contracting of a Site Supervisor for the implementation of the EE/RE measures

|                   |   |
|-------------------|---|
| <b>OBJECTIVE</b>  |  Procurement and contracting of site supervision                 |
| <b>ACTIVITIES</b> |  Preparation of ToR for site supervision, launch of the tender |
|                   |  Evaluation of the offers (evaluation report)                  |
|                   |  Selection of the site supervisor                              |
|                   |  Contracting the site supervisor                               |
| <b>RESULTS</b>    |  Contract with site supervisor                                 |
| <b>DURATION</b>   |  Approx. 1 month   |

## 6.1 Preparation of a ToR and Contracting of a Site Supervisor

The project team will develop the ToR for tendering for an **experienced** and **independent** site supervision expert for the implementation of the EE/RE measures. Clear and transparent minimum requirements should be developed by the project team i.e. site supervision of at least 3 similar projects during the last 5 years, fulfillment of all legal requirements and certificates for the relevant project type, at least 10 years of work experience with the relevant project type, etc.).



The main duty of the site supervisor is to ensure that the contracted works and services will be implemented in accordance with the technical design / authority approvals and the ToR for the construction works. The Site Supervisor has to act solely in the interest of the Contracting Authority (e.g. municipality).

In order to avoid any conflict of interest the site supervisor has to be contracted and paid by the municipality / contracting authority and **must not** be contracted and paid by the construction company.

The site supervisor has to have in depth knowledge and practical experiences of the works to be implemented. In case of very different EE/RE measures e.g. a street lighting system and a building refurbishment, 2 Site Supervision experts might be needed as a single expert will not cover both fields.

**Key activities / responsibilities of the site supervisor are the following:**

- Introduction of the construction company prior to the start of the construction works
- Elaboration of a detailed implementation plan with the construction company, project team, municipality and the relevant institution (kindergarten, school, hospital, etc.)
- Monitoring of the construction works (progress, quality or materials and installation, construction defects, deviations from the technical design, etc.)
- Documenting of the construction works (photo-, video-shooting)
- Participation in regular meetings at the construction site (frequency depend on the construction phase, in average once a week); preparation of monitoring reports of his site visits
- Assessment of the construction works after completion
- Elaboration of a completion report including a detailed list of construction defects
- Supporting the municipality / project team in the final acceptance procedure

Details of the main activities are included in the example ToR ([see Annex F.1](#)).

The municipality / contracting authority will launch the procurement for site supervision, select and contract an experienced company/expert, according to the tender selection criteria. Often it possible to carry out a single tender, however it is strongly



recommended to solicit bids from at least 3 companies/experts. Recommended general conditions for the contract with a site supervisor are available as [Annex F.2](#).

### ***Lessons learned / challenges:***

1. In order to identify experienced site supervisors, relevant associations (if available in the relevant country) or other municipalities should be contacted for a list of recommended experts.
2. Make sure that the site supervisor is independent from the construction company in order to avoid any conflict of interest.
3. It is recommended to introduce sanctions in the contract with the site supervisor in case of wilful neglect of his duties (reporting, regular meetings, etc.)
4. Make sure that a site supervisor visits a site at least once per week and participate in all weekly meeting organised by the project team.
5. **Do NOT** expect great work for little money: the site supervisor has a key role to ensure that the project meet the expected quality and outcome and therefore, the site supervisor's work requires sufficient resources in order to fulfil his duties.

A simple estimation of the required budget can be done based on the expected working days and a typical daily rate for such services or using a fixed percentage of the total investment costs of a project, as specified in national legislation/regulation.

#### **Example estimation for the refurbishment of a kindergarten:**

- Preparation: 5 days
- Implementation (8 months): 1 day per week throughout the construction period
- Final acceptance: 5 days
- Unforeseen tasks (e.g. change orders): 5 days

Total estimated working days: 47 days x 100 EUR per day = 4.700 EUR



## 6.2 Relevant annexes

[Annex F.1. General terms and conditions for site supervision](#)

[Annex F.2. ToR for site supervision](#)



Architectural lighting for municipal objects  
*Polotsk, Belarus*

# Phase 7: Implementation of the EE/RE measures

|                   |   |
|-------------------|---|
| <b>OBJECTIVE</b>  |  Implementation of the EE/RE measure in accordance with the technical design / authority approvals and construction contract   |
| <b>ACTIVITIES</b> |  Obtain construction permission, establish a project implementation structure<br> Management of the implementation (time, costs, quality)<br> Permanent quality control on site |
| <b>RESULTS</b>    |  Implemented EE/RE measure   |
| <b>DURATION</b>   |  Approx. 6 to 12 months (excl. non-working periods i.e. winter period)   |

## 7.1 Obtain the construction permission

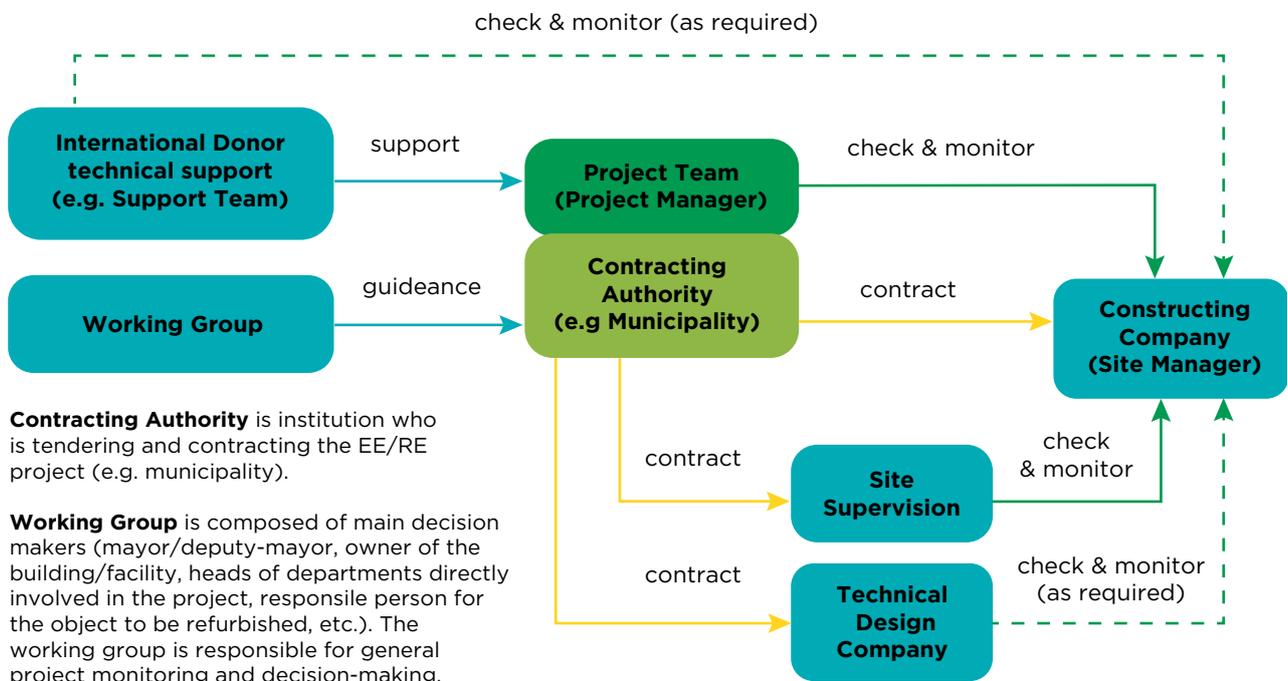
In most of countries in the EaP region, a special permission for the construction works is needed. Usually, it is issued by the specialized local/state authority that checks all relevant documents for the construction (special legal permissions, approval of the technical design, licenses and certificates of engineers/workers that are involved into the project, land plot property documents, etc.). Duration of construction permission receiving is app. 1 month.



## 7.2 Establish the implementation structure for the EE/RE measures

After selection of the construction company the project team should start establishing the implementation structure for the implementation of the projects.

Usually the following stakeholders are involved:



It is of utmost importance to establish an effective implementation structure to ensure a smooth and correct implementation of the contracted services and works. The project team organizes all stakeholders who are relevant for the successful implementation of the project. The stakeholders should meet regularly (e.g. weekly) at the construction site to **discuss and decide** on the actual construction issues. **It is recommended to include the following stakeholders in the regular meetings:**

- Construction company: Site manager who is responsible for the object
- Site supervisor
- Municipality / contracting authority: representative person of department that signed the contract with the construction company; other relevant persons from the municipality



- Working group: representative person of the working group (if different from the representative of the municipality / contracting authority)
- Project team: Project manager and technical expert of the project team
- Technical design company: representative from the technical design company (as required demand)
- Representative of the building users / facility operators — on demand (e.g. director of the school)
- Others: Representatives from donors — as required

Beside the selection of the participants, the project team has to clarify the decision-making powers at the construction site. Each member shall have the mandate, on behalf of the organization he/she represents, to make decisions at the construction site regarding actual and urgent issues. Decisions will be recorded in the minutes of the meetings.

Usually the project team (project manager) is organizing the meetings and prepares the minutes of the meetings.

## Frequently Asked Questions:

### 1. What to do in case of unforeseen works (change orders)?

In case of unforeseen activities during the construction works (e.g. a porch roof is structural not sound and must be replaced, which was not included in the technical design and BoQ), the construction company has to submit a change proposal prior to the implementation of the works and services. The construction company shall provide detailed information about the required works and costs (breakdowns of labor and materials for all trades involved, updated implementation schedule, proposed technical solution incl. drawings, etc.). The cost calculation must be based on the same cost structure as used in the main offer (e.g. same labor costs, etc.).

The proposal must be approved by the municipality / contracting authority after consultation with site supervisor and technical design company prior to the implementation.

Works and services implemented without written approval by the municipality / contracting authority cannot be paid.



Furthermore, the municipality / contracting authority is entitled to change the contracted services and works by a Change Order (e.g. increase the number of windows to be replaced).

Please note that Donor funded projects might require a check of the change proposal by delegated experts.

## 2. What to do in case of severe irregularities (e.g. construction company does not follow the technical design or implements not approved materials)?

**In the event that the site supervisor has identified severe irregularities at the construction site the following procedure shall be followed:**

1. The site supervisor shall immediately inform the site manager of the construction company, the project team and the municipality / contracting authority.
2. The site supervisor must prepare a brief minute (incl. the description of the problem, photos and recommendations how to solve the problem) within 1 working day after the site visit. The report shall be sent by email to the construction company, project team and municipality / contracting authority.
3. Site supervisor must suspend any construction works if the construction company does not follow the technical design, norms and standards and/or does not improve identified defects during agreed timeframes.

### ***Lessons learned / challenges:***

1. It is recommended for a project manager to organise a kick-off meeting with presence of all stakeholders and discuss all procedures, work plan, crucial elements of the technical design, installation practices etc. before start of the construction works. The meeting should be organised within 2 weeks after contract signing.
2. A detailed work plan must be elaborated by the Construction company for timely delivery of the results within 2 weeks after the kick-off meeting.
3. Any changes in the technical design and contract (materials, technical solutions, etc.) must be agreed by the municipality / contracting authority prior to implementation.



4. Permanent quality control is a key element for a successfully implemented project. Weekly meetings (and reporting) on site are a practical tool to ensure a correct implementation.

## 7.3 Project management and coordination of the implementation

The project team should manage the implementation of the EE/RE measures with regards to the agreed **implementation schedule, the project budget and the general quality** of the project implementation. In the event that other projects (e.g. ventilation systems, capital repair works, etc.) are implemented at the same object, the project team and the site supervision should coordinate the EE/RE measures with those projects.

**The project team is responsible for the overall quality of the works.** For this reason, the project team (project manager or technical expert) should participate in the weekly meetings with site supervisor and the construction company, etc. see above.

Please note that Donor funded projects might require a participation of the Donor or/and delegated experts during implementation.

## 7.4 Relevant annexes

[Annex G.1. Template for weekly report by construction company](#)

[Annex G.2. Template for weekly report by site supervisor \(buildings\)](#)

A refurbished kindergarten  
*Cantemir, Moldova*



# Phase 8: Final acceptance

|                   |   |
|-------------------|---|
| <b>OBJECTIVE</b>  |  Taking over a fully functioning and completed project   |
| <b>ACTIVITIES</b> |  Organisation of the final acceptance procedure, inspection of the finalised works and services, preparation and signing the final acceptance report |
| <b>RESULTS</b>    |  Final acceptance report  |
| <b>DURATION</b>   |  Approx. 1 to 2 months (depending on the number of identified defects and test operation)  |

The final acceptance is an important legal and financial step for the municipality / contracting authority and the construction company. By accepting the works and services the municipality / contracting authority officially takes over the ownership of the services and is henceforth fully responsible and liable for it. In addition, payment conditions are usually also linked to the official acceptance of the services and works.

Main objective of this phase is to ensure a structured acceptance procedure that guarantees that only a finalized and fully functioning project will be accepted by the municipality / contracting authority.

## 8.1 Organizing the acceptance of the EE/RE measures

The project team will organize the final acceptance procedure of the services and works with the relevant parties (site supervision, construction company, municipality / contracting authority, technical design company if needed).



This also includes verification of performance of the EE/RE measures (test operation, test protocols etc.).

The final acceptance procedure can also be applied on sub-projects or individual EE/RE measures, if they can be seen as an independent functional unit.

Measurement and verification must be performed in accordance with appropriate plan which was developed at the energy audit stage.

### The sequence of the acceptance procedures should be as follows:

#### 1. Announcement of the completion by the construction company

The finalization of the contracted services and works shall be announced in written form by the construction company to the site supervision, the project team and the municipality / contracting authority.

#### 2. Inspection of the services and works

The site supervision, supported by the project team and the municipality / contracting authority and if needed by the technical design company, will verify the finalization of the services and works at the construction site. Any construction deficits and deviations from the contracted and agreed works and services should be recorded (pictures etc.) and listed in the final acceptance report. The site supervision will prepare a final acceptance report incl. a list of construction defects and other deviations incl. deadlines for their correction.

Please note that a proper technical documentation of the services and works (as built plans, maintenance plan, instruction manuals of installed equipment, training of staff and documents requested by the authorities such as an emission test) have to be delivered already at this stage.

#### 3. List of construction defects

The acceptance report incl. a list of construction defects (incl. reference to technical drawings / ToR, pictures, or other evidence) will be handed over to the construction company with the request to correct the defects until a feasible deadline.

#### 4. Correction of construction defects

Correction of the construction defects by the construction company; announcement in written form of the finalization of the correction works.

#### 5. Inspection of corrections works

The site supervision, supported by the project team and the municipality / contracting authority and if needed by the technical design company will again verify the finalization of the services and works at the construction site.



## 6. Final Acceptance (signing of act)

Once all construction defects are corrected the site supervision, construction company and the municipality / contracting authority shall sign the final acceptance report.

Final acceptance procedure in case of measures that require a **test operation** (i.e. street lighting systems, ventilation systems, boiler systems, district heating systems, etc.) should be accepted **only after successful completion of an agreed test operation** period. During this period the system has to be tested under real conditions and identified problems must be corrected by the construction company.

In this respect is important to outline the detailed conditions for the test operation in the contract with the construction company, in particular: type of tests to be applied, what parameter to be tested, how to measure the results, minimum performance criteria to be met, test period, etc.

### Example:

**biomass boiler system**  
**(1 biomass boiler 500 kW, 1 gas boiler 1.000 kW)**

#### Requirements of the system as outlined in the ToR:

##### **Biomass boiler:**

Capacity 500 kW, boiler efficiency > 85%, fuel specification according to ISO 17225-4: Wood chips Typ A (virgin wood), Water content < 35%, Particle class P31; max emission values: fine dust 150 mg/Nm<sup>3</sup>

##### **Gas boiler:**

Capacity 1.000 kW, boiler efficiency > 90%, fuel: natural gas

##### **Control system:**

The overall control system shall ensure that the biomass boiler covers the base load and gas boiler peak loads

##### **Test operation:**

The test operation will last for 4 weeks during heating period.



During the test period, the construction company must test the following:

- Capacity and efficiency of the biomass boiler and the gas boiler by using the fuel as specified in the ToR. The capacity must be measured over a period of 2 hours. The results have to be documented by the installed heat meter of the boiler and by measuring the fuel input and fuel quality (in case of the biomass boiler).
- The load management of the system in particular the start/stop routine of the gas boiler. The results have to be documented.
- Performing an emission test for the biomass boiler by an accredited test institute according to the requirements of the authority.
- During the test operation the construction company has to test the overall system, identified problems have to be corrected.
- During the test operation the construction company has to provide a full documentation of the system and to deliver the training of staff as outlined in the ToR.

The results of the tests have to be recorded and provided to the municipality / contracting Authority incl. all evidence (test protocols, etc.).

Key test (such as capacity test, emission test, etc.) have to be announced to the site supervisor and the project manager in advance and shall be invited to participate in the testing.

Based on the project type, the final acceptance of different EE/RE measures might be managed separately (depending on the contractual agreement). For example: EE measure 1: solar system; EE measure 2: building refurbishment. Both measures are relatively independent from each other and the final acceptance can be done separately. However, measures that are strongly connected to each other such as thermal insulation of walls and replacing of windows should be accepted in one procedure.

Please note that donor funded projects might require a participation of the donor or/ and delegated experts in the final acceptance procedure.



## 8.2 Project financial management

The project team (supported by the site supervision) will verify invoices and the supporting documents attached to invoices (dimensions, schemes, drawings, etc.) and confirm the correctness of the invoices and documents.

### *Lessons learned / challenges:*

1. It is highly recommended to outline the detailed acceptance procedure in the construction contract in order to avoid any conflict during the acceptance stage.
2. It is recommended that the site supervisor and the project team are inspecting the works and services prior to the official meeting with the construction company to be fully prepared with all relevant evidence.
3. It is in the interest of the construction company to hand over the works and services as soon as possible to the municipality / contracting authority. Often, construction companies neglect the technical documentation and trainings and are forcing municipalities to accept the works without delivering these activities/services. It is strongly recommended to accept works and services only if all agreed documents and trainings have been delivered.
4. It is highly recommended to perform a test operation before signing the final acceptance. The test operation incl. test to be applied must be included in the contract with the construction company.
5. **Do NOT** pay the full amount before the acceptance procedure is properly finalised. Once the construction company has received the full payment, they are very reluctant to deliver outstanding services and works e.g. technical documentation or correction of remaining minor defects.



Modernization of multi-apartment buildings  
*Dolyna, Ukraine*

# Phase 9: Project Summary / Final report

|                   |   |
|-------------------|---|
| <b>OBJECTIVE</b>  |  Summary of the key data of the project implementation and lessons learned |
| <b>ACTIVITIES</b> |  Elaboration of the final report   |
| <b>RESULTS</b>    |  Final report of the project development and implementation                |
| <b>DURATION</b>   |  0,5 months   |

The project team will elaborate the final report of the project development and implementation. The final report will be a handy document that summarizes key information of the implemented projects to provide concise information to stakeholders and to use this information for future projects. It should be also used to compare the expected performance (as estimated before the implementation) with the actual performance and to help improving project implementation in general.

### The report should summarize the following information:

- Short description of the purpose of the project, available budget, expected savings, etc.
- Short description of the implemented measures and key technical data (e.g. replacement of 50 windows, R-Value 0,77 (K.m<sup>2</sup>)/W, total window surface 75 m<sup>2</sup>)
- Total investment costs per measure incl. specific costs as applicable (e.g. investment costs windows: 7.100 EUR; 94,7 EUR/m<sup>2</sup>). If possible, the project preparation costs for the measure should be also evaluated (costs for energy audit, technical design, site supervision, etc.)
- Summary of involved experts and companies (incl. internal rating of the experts and companies)



- Expected savings per installed measure and/or per building/facility (e.g. expected final energy consumption of the kindergarten: 160 MWh natural gas; specific energy consumption 80 kWh/m<sup>2</sup> per year)
- Lessons learned during project development and project implementation (e.g. investment costs of kindergarten #3 were underestimated during the energy audit phase by 30% => Lesson learned: cost estimation should be prepared as accurate as possible also during the project assessment / energy audit phase and must include all cost (capital repair costs, unexpected cost, etc.)
- Other relevant information



Modernisation of the district heating system  
*Zhovkva, Ukraine*

# Phase 10: Operation and maintenance of the EE/RE measures

|                   |  |
|-------------------|--|
| <b>OBJECTIVE</b>  |  Ensuring the delivery of the expected outcome throughout the technical lifetime of the project   |
| <b>ACTIVITIES</b> |  Organisation of the operation and maintenance<br> Ongoing monitoring<br> Implementing the M&V concept |
| <b>RESULTS</b>    |  Operation and maintenance structure  |
| <b>DURATION</b>   |  Continuous   |

Main objective is to establish an organized and structured operation and maintenance of the project that ensures the delivery of the expected outcome of the project and the sustainability of the project. Furthermore, a well-organized operation and maintenance (incl. monitoring of outcomes) should support the ongoing improvement of the performance of the project (e.g. optimization of a district heating network or the energy consumption of a kindergarten).

## 10.1 Establish the maintenance and operation structure

The project team in close cooperation with the municipality will elaborate a maintenance and operation structure that secures the sustainability of the EE/RE measures.



**The following issues should be considered (among others):**

- Decide on clear responsibilities for the operation and maintenance of the project (e.g. which institution is responsible for the operation and maintenance, who is paying for the costs for operation and maintenance, etc.)
- Securing the resources for operation and maintenance in accordance with the maintenance requirements of the manufacturer (i.e. biomass boiler manufacturer). This includes ensuring that the funds required are allocated within the annual budget of municipality or municipal company responsible for operation and maintenance
- Securing the fuel supply (amount and **quality**) for fuel-based facilities (i.e. biomass boilers, etc.)
- Coordination/train staff in the operation and maintenance
- Implementation of the M&V concept (monitoring and verification concept) developed under chapter 4.1.
- Coordination with the construction company in the event of defects during the warranty period

## **10.2 Ongoing operation and maintenance of the project**

The implemented projects will be operated and maintained by the institution which was defined in the previous step. It is recommended, to monitor the performance of the EE/RE measures in order to verify the actual savings and to identify performance improvements (see also M&V concept).

Smart Street Lighting System  
*Cantemir, Moldova*



# Phase 11:

## Communication and visibility

It is important for all donors (as well as your own citizens) to ensure proper project visibility and inform on all developments within the project. A communication plan must be prepared, according to the requirements and guidelines provided by the donor or you can develop your own plan using the expertise of the PR and communication unit of your municipality. **The communication plan includes among others:**

- Short description of the project
- Target groups
- Messages to be communicated
- Activities (incl. number of description of targets to be reached (like X Facebook post, Y visitors to website etc.))
- Budget (with a breakdown per activity)

Typical communication and visibility activities mentioned in a communication plan include: presence in local and regional media, press tours for journalists, banners and publications, video and social media promotion etc..

Please note that nowadays people are used to read only very condensed information, they will not read long texts like newsletters. Also, try to use infographics to make things clear and provide condensed information instead of using too much text.

## Relevant annexes

[Annex H. Example Communication Plan](#)



**EU4Energy**



This publication has been produced with the assistance of the European Union in the framework of the EU4Energy Initiative. The content is the sole responsibility of the authors and can in no way be taken to reflect the views of the European Union.

**Vienna, Kyiv, June 2021**