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D5.1 – Guidelines for the step-by-step process

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History

Version	Description	Lead author	Date
1.1		VTT	31.8.2017

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1 Introduction

1.1 Publishable summary

The purpose of the report is to present guidelines for energy performance assessment in step-wise district-level energy refurbishment with regard to the first steps 1 and 2.

The basic approach for refurbishment at district level is a six-step procedure starting with preliminary study and resulting in the monitoring phase (Fig. 1):

1) Preliminary study: Present status of a district with refurbishment and renewal needs
2) Feasibility study: Building level energy analysis (preparation of individual building refurbishment plans)
3) Evaluation phase: Delivery strategy - district level or individual projects
4) Funding phase: Securing required financing for the project
5) Construction phase: Procurement for design and construction
6) Monitoring phase: Commissioning and key performance indicators

This report deals with the Steps 1 and 2.

As described in Deliverable 1.2, the whole process aiming at a district level energy refurbishment project can be launched by building owners, the municipality or active residents, non-governmental organisations or other active stakeholders in the district. The initiation process for a district level development is the first step in the process. The first step can be managed by the *Activator* invited by the active stakeholders.

The goal of the Preliminary study (Step 1) is to create a basis for decision making for the different stakeholders. The Preliminary study describes the starting point which will then be documented in the District Development and Use Plan. The Feasibility study (Step 2) results in the formulation of strategic targets based on the Preliminary study. These will be added to DDU. *Project Coordinator* will be responsible for the further development the strategic development targets. The Feasibility study especially focuses on building level energy analysis (preparation of individual building refurbishment plans).

This report describes

- The tasks in Steps 1 and 2
- The tools and or data bases to be used
- The role of the activator
- The purpose of the tasks
- The partners and stakeholders within the tasks
- The expected results of the tasks.

The following tasks are described:

	TASK
PRELIMINARY STUDY	Collection of information of building typology and energy systems of the district
	On-line web survey of buildings in the potential district
	Initial assessment of technology packages
	Preliminary energy performance assessment at district level
FEASIBILITY STUDY	Energy performance assessment for individual buildings
	Energy audits for business premises
	Further assessment of district level energy potentials in district level

1.2 Purpose and target group

The energy-efficient refurbishment at district level starts with assessing the energy saving potentials at building and district level.

The aim of assessment is to find out the level of wasted energy both at building and district level. This process combines energy audits to building and district level energy simulations.

The basic approach for refurbishment at district level is a six-step procedure starting with preliminary study and resulting in the monitoring phase (Fig. 1):

1 Preliminary study: Present status of a district with refurbishment and renewal needs
2 Feasibility study: Building level energy analysis (preparation of individual building refurbishment plans)
3 Evaluation phase: Delivery strategy - district level or individual projects
4 Funding phase: Securing required financing for the project
5 Construction phase: Procurement for design and construction
6 Monitoring phase: Commissioning and key performance indicators

The purpose of this deliverable is to describe guidelines for energy assessment in steps 1 – 2.

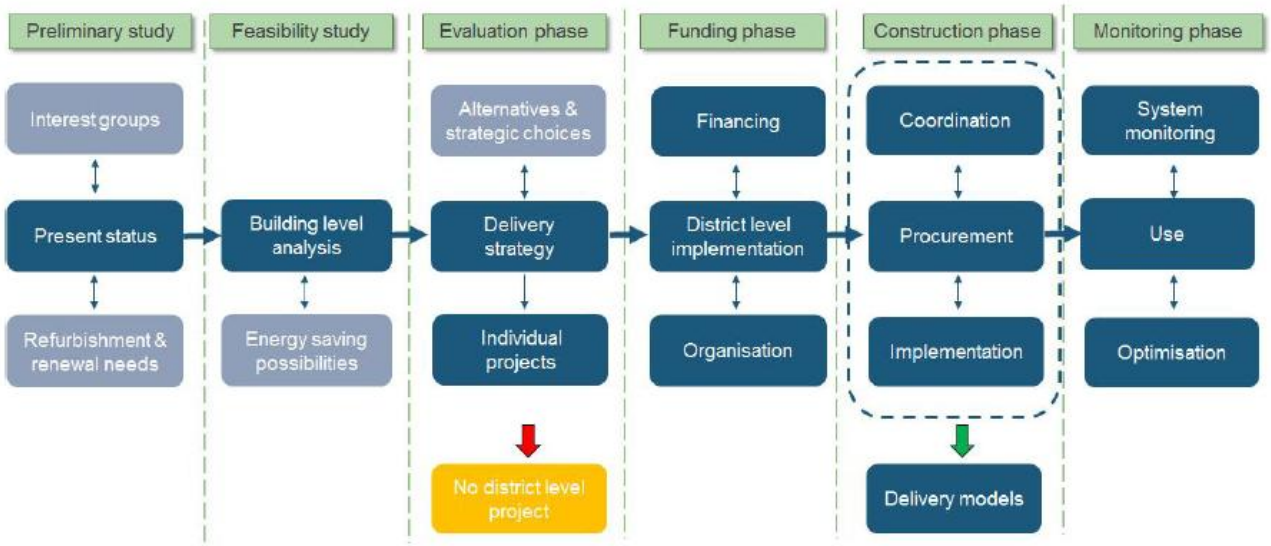


Figure 1 - Refurbishment at district level: Steps to project delivery stage

1.3 Contribution of partners

The targets and scope of the work in the Task 5.1 was discussed in project meetings, and the outcome was commented by the consortium. The deliverable was prepared by VTT. Appendix 1 was prepared by W/E.

1.4 Relation to other tasks and deliverables

This report refers to the report Deliverable 1.2 New processes for refurbishment projects at district Level. This report also considers the tools and assessment methods developed and described in Work packages 3 and 4 and especially Deliverable 3.2 Beta version of the extended District Energy Concept, Deliverable 3.4 Beta version of renewed Apros District visualization interface and Deliverable 4.1 Impacts of technology packages.

1.5 Terminology and definitions

CityGML	An open standardised data model and data exchange format, which enables the semantic spatial data modelling, saving, transferring and updating at district level. It defines ways to describe most of the common 3D features and objects found in cities (such as buildings, roads, rivers, bridges) and the relationships between them.
DDU	District Development and Use Plan
DECA	District energy concept advisor
GIS	Geographic Information System. A general name for systems designed to capture, store, manipulate, analyse, manage, and present spatial or geographic data
KPI	Key performance indicator
LCA	Life cycle assessment
LCC	Life cycle cost
LOD	A Level of Detail: a concept used in CityGML to describe the buildings in selected geometrical detail level (for example: shoe-box, complex shape building, building with internal spaces)

2 Description of preliminary and feasibility studies

As described in Deliverable 1.2, the whole process aiming at a district level energy refurbishment project can be launched by building owners, the municipality or active residents, non-governmental organisations or other active stakeholders in the district. The initiation process for a district level development is the first step in the process. The first step can be managed by the *Activator* invited by the active stakeholders.

The goal of the Preliminary study (Step 1) is to create a basis for decision making for the different stakeholders. The Preliminary study describes the starting point which will then be documented in the District Development and Use Plan (DDU). The *Activator* is responsible for initiating the goal setting and documenting those in the DDU during the Preliminary study. DDU includes preliminary plans for refurbishment and energy improvements, preliminary scheduling and preliminary assessment of long term impacts of the district development.

The Feasibility study (Step 2) results in the formulation of strategic targets based on the Preliminary study. These will be added to DDU. *Project Coordinator* will be responsible for the further development the strategic development targets. The Feasibility study especially focuses on building level energy analysis (preparation of individual building refurbishment plans).

The Preliminary and Feasibility studies (Steps 1 and 2) should motivate the different stakeholders to take part in the district level refurbishment project. The Feasibility study supports decision-making also regarding alternative funding models, consideration of long-term costs and assessment of future value development. The municipality can participate in the process and support the Preliminary and Feasibility studies and bring different authorities' experience and viewpoints to be considered in the DDU especially if the municipality has committed to significant emission reduction targets in the municipality.

Indicators of assessment

The most important indictors at these stages are the impacts on primary energy, total energy use, on-site renewable energy ratio, greenhouse gases and costs on district level and building level.

Preliminary Study

The preliminary study includes:

- Interviews with various stakeholders
- Definition of the refurbishment area
- Building typology
- Building ownership
- Energy performance of buildings
- Energy systems in the district and energy provider views to development
- Refurbishment and renewal needs
- District valuation and brand
- General and master plans: possibilities for additional floors and expansions
- Building permit requirements
- Strategies of local building owners and developers
- Municipality' role and requirements
- Collection of reference projects
- Preliminary DDU

Feasibility Study

The Feasibility study focuses on the development of the preliminary targets in order to explain and justify the district level project. Energy and refurbishment experts provide supporting data for decision-making. The Activator can assess the possibilities for energy saving and renewable energy utilization, e.g. using the *District Energy Concept Advisor DECA* for analysis. The aim is also to establish a platform for information, communication of the results and decision-making. Common understanding helps the stakeholders to make decisions about the process and introduce a project *Coordinator* into the process. The Coordinator is responsible for strategic targets and refurbishment plan for the evaluation phase.

The Feasibility phase includes:

- The assessment of renewable energy potentials
- Potentials for decreasing energy consumption and improving efficiency
- Energy efficiency refurbishment and / or renewable energy project
- Preparation of individual building refurbishment plans
- Potential investors
- Business potential for users and owners
- Preliminary LCC: existing stock compared to potential
- Preliminary LCA: potential emission reduction
- Potential value increase
- Potential valuation and brand improvement
- Preliminary financial plan
- Draft DDU (with preliminary juridical plan)

The *Coordinator* can start the discussions with a planning architect or a landscape architect during the Feasibility study in order to start investigating whether the planned scope fulfils set requirements by municipalities and applicable legislation. The Feasibility study results in the publication of the draft for DDU and the draft of the first juridical plan.

3 Guidelines for energy performance assessment in Preliminary study (Step 1)

The preliminary study assesses the overall building stock and typology of the buildings in the district, describes the current energy systems in the district and assesses preliminary potentials for energy saving and the use of local renewable energy.

3.1 Building stock and building typology and energy systems of the district

The building typology, the current energy systems and the principal potential for local renewable energy of the district must be investigated by the Activator to find initial information for the use of the district level energy assessment tool.

Hereby the Activator collaborates with the urban planners, building permission authorities and energy companies. Information may be available for instance in the following sources:

1 On-site investigation of the district and Google Street view
2 Registered information maintained by the municipality[1]

[1] For example in Finland the Population Information System contains data on buildings and residences. Building information is maintained and checked in close cooperation with municipal building supervision authorities and local register offices. In international practice, building information is commonly referred to as the Building and Dwelling Register (BDR) (http://vrk.fi/en/building-information).
Information about construction projects is obtained from municipal building supervision authorities. Their duty to issue notification of construction projects is based on the Population Information Act (661/2009) and Population Information Decree (128/2010). Local register offices maintain residence details related to persons and their respective residences. Cooperating with municipal authorities, local register offices are also responsible for various changes and corrections to building information and maintaining of address and voting district information.
Land register authorities, district survey offices and municipal authorities are responsible for matching buildings to the correct property by maintaining the building codes of the Population Information System.
Statistics Finland maintains municipal sub-area codes and business identity codes, which are submitted to the Population Information System at regular intervals.
The addresses, building codes and centre point coordinates of buildings form the basis of the Population Information System's nationwide address information system. Using building and apartment codes, persons registered in the Population Information System can be linked with the centre coordinates of buildings and, using identifiers, buildings can be linked with other national base registers used in Finland. This enables the utilisation of the Population Information System in various geographical data applications. Information can be searched for example on the basis of postal codes.
For example the following information about buildings and construction projects is registered in the Population Information System:

- Real estate and building code
- Addresses of the building
- Location coordinates
- Municipal sub-area
- Name and address of the owner
- Type of owner (for example person, housing corporation, municipality or the state)
- Planning situation when building permit was granted (for example master plan, building plan or no plan)
- Site ownership status (owner-occupied or rented)
- Size (for example gross floor area and number of storeys)
- Facilities (for example lift, sauna or swimming pool)
- Year of construction
- Purpose of use (for example detached house, terraced house, block of flats, summer cottage or school)

3 District heating and electricity utilities
4 House managers of big building owners
5 On-line market-places to evaluate the price tags of properties in the district

3.2 On-line web survey of buildings in the potential district

On-line web survey is a practical way to collect the preliminary information about the renovation needs of the building and expectations and hopes of the residents. The survey can be put into practice using free of commercial tools like Google Forms, Webropol or Digium.

The survey should include questions, which indicate the potential of the building to be part of the district refurbishment project. Question can be for example like:
"What kind of renovation has been made in the building you live?"
"What kind of renovation has been made in your department?"
"What kinds of refurbishment measures have been planned for near future?"
"What kinds of refurbishment measures you would like to be done in your building?"
"Are you interested about the refurbishment made at district level, if that will lead to cost savings, improvement of indoor air and/or appearance of the building?"

The survey should be also explain what is the district-level refurbishment and what would be the benefits of it compared to refurbishment made individually for different buildings.

The major challenge of the survey is to reach the residents of the area. A good way to deliver the information of the survey (and its web address) is to deliver leaflets to the letterboxes. The leaflet should give preliminary information of the district-level refurbishment and information about the possibility to get a paper version of the survey. Leaflets and information of the survey can be shared through local residents' associations and in a local public places..

It can be supposed that 10…20% of the residents will answer to the survey. Thus it is important to know the types of buildings wherefrom the answers were given. This should be taken into account when planning the survey. The survey can be completed with some interviews and thus get a better overall impression.

- Network connections (incl. sewerage, water and electricity)
- Building permits granted
- Contact details of those granted building permits
- Construction and facade material (for example wood, concrete or glass)
- Method of heating (for example oil, electric or wood heating)
- Fuel (for example oil, electricity, wood or geothermal energy)
- Number of apartments
- Residents in the building

For example the following information about residences is registered in the Population Information System:

- Apartment code
- Floor area
- Tenure status (owner-occupied or rented)
- Occupancy status (for example inhabited or uninhabited)
- Number of rooms and type of kitchen
- Facilities (for example sauna or balcony)
- Habitants of the apartment.

3.3 Initial assessment of technology packages

In order to make the first initial ideas of the possible technology packages at district level, the Activator can consider alternatives and their assessed impacts with the help of the rough guidelines given in Deliverable 4.1 Impacts of technology packages. D4.1lists 18 technology packages (on the basis of Deliverable 2.3) and gives a rough estimation of the impacts of these packages in terms of of the impact on greenhouse gas (GHG) emissions and impact on energy matching. These aspects were chosen as the most important aspects in accordance with the district level indicators presented in Deliverable 2.2.

3.4 Preliminary energy performance assessment at district level

The D-ECA tool (the extensions of which have been developed by MODER) or other similar tools are the main types of tools that support the preliminary energy assessment in the Preliminary study (Step 1).

As described in Deliverable 3.2 D-ECA tool enables the target audience (urban decision makers and planners of energy efficient districts) to assess the energy performance of a city quarter already in the first planning stages when not many detailed information is available. It works with archetype buildings that are combined to a city quarter, and that can be quickly adapted to the real situation. Various energy planning variants regarding the building quality and the energy supply system can be compared to the current situation in the city quarter.

The geometry and user profiles of the archetype buildings are fixed, while the energy quality of the building envelope and the included building services systems technologies can be chosen by the user. The user chooses the suitable archetype buildings from the archetype library. The selected types can also be further adapted to the real and planned situation.

The calculation core of D-ECA is the German standard DIN V 18599 which is compatible with the CEN EPBD standards. The detailed calculation has been simplified for the user with the help of pre-configurations. The user only has to choose for example the heating system and the ventilation system. The building envelope can be pre-configured based on the building age in accordance with national databases. Pre-configured definitions can also be overwritten when more specific information is available. In total there are the following steps to further adapt the archetype building:

(1) Building information: year of construction/insulation level, total net floor area
(2) All these changes can be done in "Building parameter" window
(2) Heating + hot water systems
(3) Solar water heating
(4) Ventilation
(5) Cooling system
(6) Electricity consumer: lamps, equipment
(7) Renewable electricity generation

Based on the chosen heating and cooling system the archetype building is either automatically directly connected to an energy source (gas, oil, electricity, biomass, district heating, district cooling, etc.) or to a local district heating or local district heating and cooling unit. The local district heating (and cooling) unit can then further be defined regarding the energy generation technology, contributions from solar thermal or waste heat, and losses in the district heating and cooling network. The so-called “electricity node” that is used to balance the electricity used in the district with possible RES electricity feed-in by the buildings can also take centrally generated RES electricity into account.

The tool calculates the energy use, renewable energy use, the CO_2 emissions and costs with the help of different key performance indicators (KPIs).

The Activator uses the D-ECA or similar tools in the Preliminary study (Step 1) in collaboration with the municipality, energy companies and building owners of the district in order to search and present benefits and attractive alternatives for energy-efficient district level refurbishment. The results formulate the initial and preliminary information for the following issues:

1 Potential technological alternatives for building refurbishment
2 Energy saving potential in the district
3 GHG saving potential in the district
4 Potential use of local renewable energy in the district
5 Refurbishment cost on district level.

4 Guidelines for energy performance assessment in Feasibility study (Step 2)

Feasibility study makes building level energy analysis and prepares individual building refurbishment plans and makes further studies about the energy potentials on district level.

The activator works together with owners and supports owners to assess energy refurbishment potentials and make refurbishment plans. The activator together with the owners makes preliminary energy assessments and/or energy audits for individual buildings by assessing the current energy performance and assessing the building level improvement potentials. Instead of working separately with different owners and housing associations, the activator can also – if possible – work together with a group of owners. This kind of collaboration may be possible if for example the municipality supports the assessments and refurbishment plan preparation with the help of incentives.

4.1 Energy performance assessment for individual buildings

Simple building level assessment tools can be used to motivate building owners and to clarify the current energy performance level and the improvement potentials.

Available tools are E-PASS developed by VTT and other similar tools that help owners and consultants to make preliminary assessment about the potentials of energy-efficient refurbishment. E-PASS tool can be in used in the Preliminary study in collaboration by the Activator and the building owners or by building owners when encourages / supported by the Activator.

The important features of E-PASS tool and other suitable tools with regard to the needs of the Preliminary study are as follows:

The tool

1) focuses on refurbishment projects,
2) is easy to use,
3) is transparent,
4) has adequate and accurate calculation basis and
5) gives simultaneously information on energy, costs and greenhouse gas emissions.

Also D-ECA tool described in Section 3 can be used on building level assessment. However, its user interface is not planned for these kinds of use cases where the activator studies the building level refurbishment options together with the building owner. D-ECA's user interface makes it especially suitable for that kinds of use cases where the district level options and impacts are assessed together with municipalities and/or energy companies. In addition, the calculation engine of E-PASS works with higher resolution than that of D-ECA. Thus D-ECA is more suitable to be used in Step 1.

The E-PASS tool[2] proceeds through four steps as follows. All these are necessary to preliminary assess the potential benefits of energy-efficient refurbishment on building level:

[2] Available http://cic.vtt.fi/epass/vtt/

1 Definition of the basic data for the building
2 Assessment of results before measures
3 Optionally refining the given default values for the building characteristics
4 Application of measures
5 Assessment of results before and after energy refurbishment measures

Initial data is needed in the calculation of the present (before retrofitting) energy performance of the building. When using E-PASS, the initial data is given by writing the information in accordance with the given guideline or with the help of a drop-down list which provides the user the different options for each parameter. The required building data is presented in Table 1. To support the easy definition of the building, the tool includes information about the typology of buildings, giving the default values of building's characteristics.

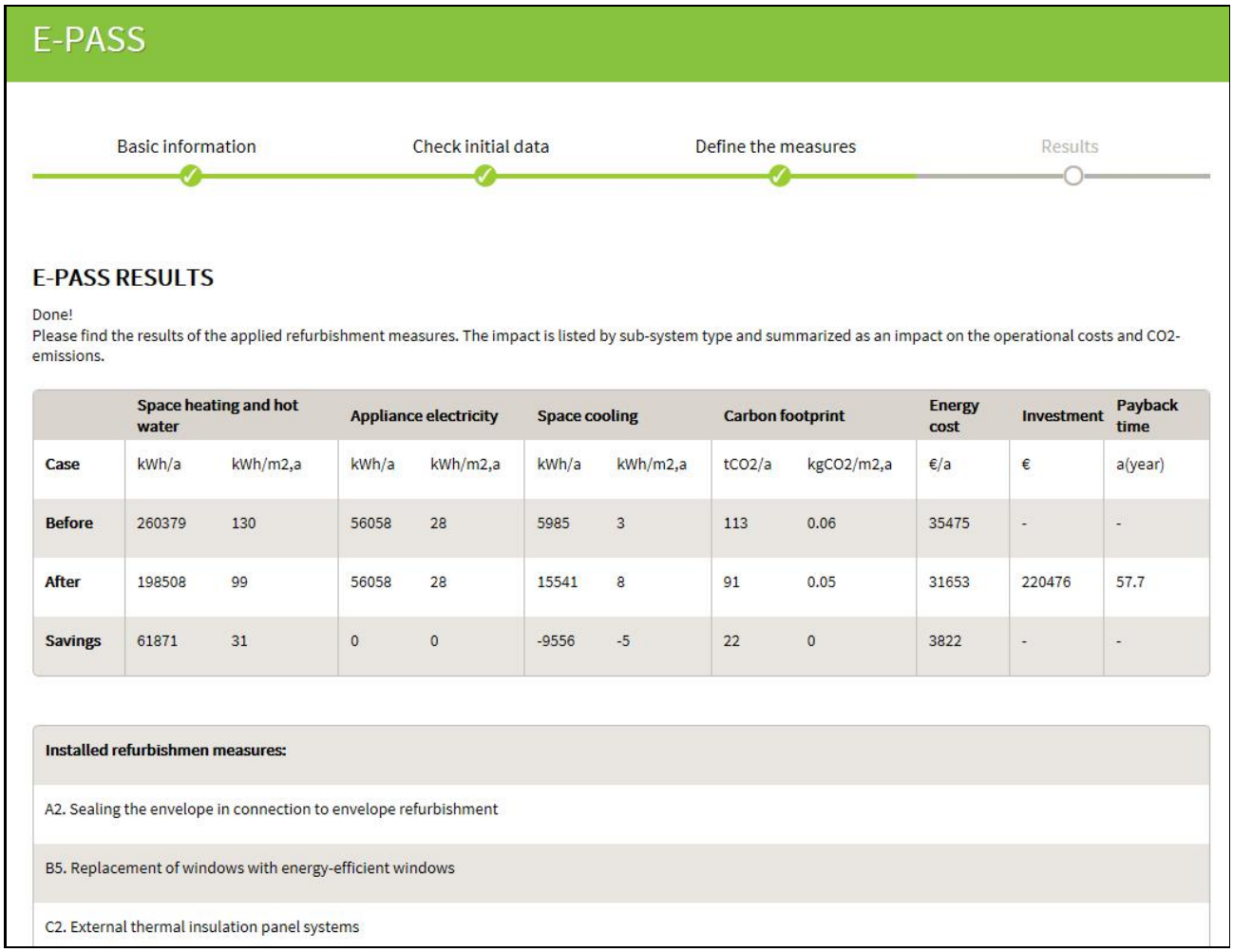
Table 1 Basic building data in E-PASS

Data description	**Input type**
Name of the building	written by user
Country	drop-down list
Building type (drop-down list)	drop-down list
Weather data (drop-down list);	drop-down list
Cooling point	default value / inserted by user
Heating point	default value / inserted by user
Space heating type	drop-down list
Space cooling type	drop-down list
Conditioned floor area	default value / inserted by user
Number of floors	default value / inserted by user
Number of residents	default value/ inserted by user

The purpose of the second step of E-PASS tool is to assess the initial energy performance values for the building with the help of the given basic data. The tool calculates and presents energy consumption, peak load, and CO2 emissions for heating, cooling and electricity and the amount of water consumption.

The purpose of the third step is to select refurbishment methods for the building, regarding improvement of the different elements, like air tightness of building envelope, mechanical ventilation, thermal performance of windows, thermal insulation level of walls or floors, water system or change of the heating or cooling system. For each of these types, the tool lists alternative measures.

The purpose of the fourth step is to recalculate the energy performance of the building after the chosen refurbishment measures have been taken. The tool presents the values for BEFORE stage, AFTER stage, and Savings (Figure 2).



E-PASS

Basic information ✓ Check initial data ✓ Define the measures ✓ Results

E-PASS RESULTS

Done!
Please find the results of the applied refurbishment measures. The impact is listed by sub-system type and summarized as an impact on the operational costs and CO2-emissions.

	Space heating and hot water		Appliance electricity		Space cooling		Carbon footprint		Energy cost	Investment	Payback time
Case	kWh/a	kWh/m2,a	kWh/a	kWh/m2,a	kWh/a	kWh/m2,a	tCO2/a	kgCO2/m2,a	€/a	€	a(year)
Before	260379	130	56058	28	5985	3	113	0.06	35475	-	-
After	198508	99	56058	28	15541	8	91	0.05	31653	220476	57.7
Savings	61871	31	0	0	-9556	-5	22	0	3822	-	-

Installed refurbishmen measures:
A2. Sealing the envelope in connection to envelope refurbishment
B5. Replacement of windows with energy-efficient windows
C2. External thermal insulation panel systems

Figure 2 Assessment of results before and after measures with E-PASS

Other similar tools can also be used in the Preliminary study to motivate owners. However, an important requirement is that the tool fulfils the 5 requirements listed in the beginning of this Sector. With regard to E-PASS tool the adequate and accurate calculation basis is described in the following:

> The calculation basis of the calculation engine follows the principles of ISO 13709 (2008). The method is a dynamic hourly based heating and cooling simulation method. The simulation model used is based on a resistance — capacitance (R-C) model. It uses an hourly time step. All building and system input data can be modified for each hour enabling the modelling of the various user profiles. The thermal inertia of structures and dynamic impact of solar on the heating and cooling of the building is also taken account.

4.2 Energy audits for business premises and retail buildings

Energy audits aim to analyze the gross energy consumption and the energy intensity of the audited company, investigate the potential for energy-saving and present the proposed saving measures, including the relevant profitability calculations. The audit report contains also the occupancy comfort issues to evaluate the possible low performance of the indoor climate, which can be an important trigger for larger refurbishment measures.

Preliminary study may also make use of existing energy audit results for business premises and retail buildings or encourage owners for energy audits.

Energy audits aim to analyze the gross energy consumption of the audited company, investigate the potential for energy-saving and present the proposed saving measures, including the relevant profitability calculations.

Customized energy auditing models have been developed to assess energy performance and potential improvements in business and other premises for the use in different life-cycle stages. An energy audit is always a comprehensive study that assesses the saving opportunities with regard to heat and water. Both voluntary and legal processes exist. Guidelines are available from national energy agents or expert organisations such as Motiva (www.motiva.fi).

Auditing models are not developed by MODER project but the Activator can encourage the owners of business premises to call for energy audits and the results can be made use of during the Preliminary study in collaboration with the owners and the Activator.

4.3 Further assessment of district level energy potentials in district level

The purpose of the Feasibility study is to create more information about alternatives and potentials. More convincing information is important in order to enable the preliminary commitment of the owners, the municipality, energy companies and to describe business potential for owners and users and to raise the interest of potential investors.

The preliminary interest must be raised and the preliminary decisions must be done on the basis of abundant of information on complicated issues. Thus visualisation of assessment results is an important feature of the energy performance assessment methods in Step 2. The visualization will ease the understanding of the complex energy system behaviour for the non-technical stakeholder.

In Step 2 the Activator may start to use the semantic 3D spatial visualisation tool developed by MODER providing that a CityGML model for the district is available for use.

The main modelling steps are as follows:

- the baseline survey of the district where the actors check together the “as is” -status of the district to be refurbished to get the common understanding of the potential and constraints; and
- the scenario alternatives of the district where the actors get the common understanding of the available design alternatives and their pros and cons relative to each other. The alternative is a set of refurbishment actions on the district to reach a certain selected target (energy, costs, emissions, profitability) measured by spatial KPI’s

The main actors are the consultant – the Activator – together with the municipality and the local energy companies.

As explained in Deliverable 3.5, the principle to get the simulation data for the visualisation purposes is as follows:

- Build up the CityGML model of the district to be refurbished from the open data sources, if not existing. Use at least LOD3 -level modelling

- Read the CityGML model into energy simulation program, fine tune the model and run the simulation. Tag the simulation outputs by the city object type (e.g. buildings)
- Compile the KPI's from the simulator data
- Build up the 3D model on the selected visualization platform, import CityGML data, fine tune the 3D model and link the KPI's tagged by the city object to the 3D model.

The Apros® software is used as the data source. Apros® is commercially available multifunctional software for the modelling of the dynamic simulation of industrial processes, power plants and district energy systems (http://www.apros.fi/en/). Apros® has users in several countries.

The Apros® kind of tool is needed as a data source for the visualisation because of the foreseen complexity of the urban energy models in the future containing various interconnections and interactions between systems especially in case of the large share of renewable energy supply on the district causing dynamic hourly fluctuations and potentially causing imbalance between demand and supply during the day. The resulting hourly data sets of the urban energy simulations will be exhaustive due to nature of the complex high-resolution simulation. This impairs the communication of the urban energy system simulation results to non-technical people of the municipality and other. The use of the visualisation of the result with KPIs by the tool developed by MODER will help the situation.

An example of the scenario alternative results in MODER 3D viewer is presented in Figure 3.

Figure 3 An example of the Step 2 scenario alternative on the solar electricity energy potential on the roofs of the selected buildings in the city of Suonenjoki centre in Finland. The KPI's and their relative change compared to the baseline are summarized in the left hand corner of the viewer.

5 Energy performance assessment and energy design in next steps

During the next steps the actual energy design starts. During energy design sophisticated tools are used on building and district level.

The energy design procedure is described in MODER deliverable 4.2.

6 Summary

The following Table 2 summarises the use of different methods and tools in Steps 1 and 2 for energy assessment.

Table 2 Guidelines for energy performance assessment for Steps 1 and 2

	Task	Tool / data source	The role the Activator	Purpose	Partners and stakeholders	Targeted result
PRELIMINARY STUDY	Collection of information of building typology and energy systems of the district	On-site investigation of the district Use of Google street view Registered information maintained by the municipality Information from district heating and electricity utilities Information from house managers of big building owners On-line market-places of properties in the district	The collector of information	To create a good starting point for assessments and analyses	Municipalities and big owners as providers of information	Initial information about the current buildings and energy systems in the district to be used with the D-ECA tool
	On-line web survey of the building in the potential district	Open / commercially available web-survey tools	The organiser of the web-survey	To collect initial information about the needs of refurbishment of buildings in the district	Intended respondents are building owners, housing managers, representatives of housing companies and housing associations	Initial understanding about the condition and refurbishment needs in the district
	Initial assessment of technology packages	List of 18 technology packages and comparative rough impact assessment in terms of energy matching and GHG (D4.1 Appendix 1)	Inspector of first preliminary options	To figure the picture and develop initial understanding about the options	-	Rough picture of possible alternative technology packages to be studied with the D-ECA tool
	Preliminary energy performance assessment at district level	D-ECA tool	The user of the tool and assessment of district level alternatives with the help of the tool	To assess and compare the district level energy refurbishment alternatives	Municipalities, big building owners in the district	Initial understanding about the potentials, benefits and the most promising options

	Task	Tool / data source	The role the Activator	Purpose	Partners and stakeholders	Targeted result
FEASIBILITY STUDY	Energy performance assessment for individual buildings	E-PASS tool	The initiator for the doing of assessments and refurbishment plans, the user of the tool or the advisor and supporter	Assessment of building level refurbishment alternatives with the help of the tool and development of refurbishment plans	Building owners, housing companies and housing associations, house managers	Understanding about the refurbishment needs, alternatives and benefits. Preliminary scheduled plans for refurbishment
	Energy audits	Energy auditing schemas and methods	Utilization of existing results based on energy audits Activator for implementation	To provide good quality information about the needs, potentials, alternatives and benefits of refurbishment	Owners of business and other premises	Scheduled plans for refurbishment
	Further assessment of district level energy potentials in district level	The semantic 3D spatial visualisation tool developed by MODER providing that a CityGML model for the district is available for use	The use of the tool possibly together with an energy consultant	To develop further information about the alternatives and benefits of district level building and energy system refurbishment and potentials of local renewable energy	Municipalities and energy companies	God quality basic information about the alternatives and benefits to set up a basis for district level energy design

7 Appendix 1 - Process guidelines for stakeholder involvement and ambition setting

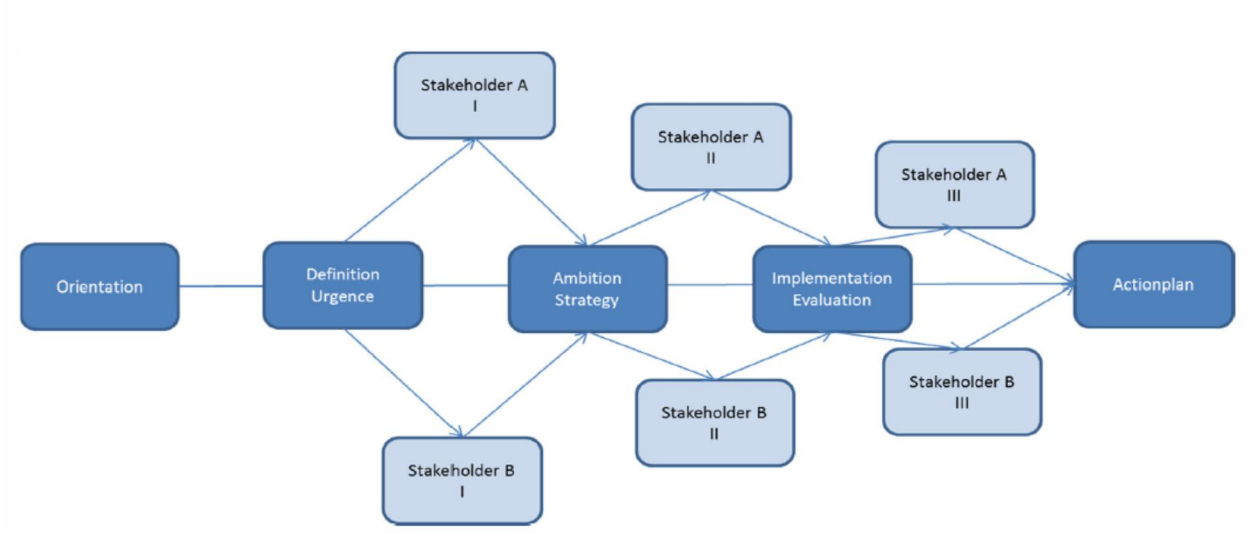
7.1 Introduction

This section presents an example how an action plan for district renovation may be developed including the formulation of the “ambition” for the renovation project. The ambition in this case details the level of energy savings and other quality improvements.
at parties want to as result of the renovation. The process is based on an inclusive stakeholder approach with building owners (e.g. social housing associations), building users and city planners.
The process description is based on practical experiences with such processes, as executed in the Netherlands in a number of renovation project with social housing associations.

7.2 Guideline as a ‘saw-tooth’-process

Below we show a schematic guideline which structures the phases (and ingredients) for creating an action plan:

1. Orientation
2. Definition and urgency
3. Ambition and strategy
4. Implementation and evaluation
5. Action plan



Essential for this guideline is the cooperation between the stakeholders in the ‘making of’ the action plan. (Dark blue = phase, Light blue = meeting/discussion).

7.3 Purpose of this guideline

- to provide a road map with framework for actions;
- It can help and stimulate municipalities to set up an action plan;
- It can provide in guidelines for energy cooperation, housing companies or sustainable networks to start projects
- (convincing politicians has to be done at forehand already, otherwise there’s is no mandate for making an action plan?!)

7.4 Process steps

We structured the ingredients from the guidelines-draft into the saw-tooth model and complemented it with some ingredients and/or comments:

7.4.1 Orientation

Ingredients for discussion in this phase:

- Background of society, general awareness
- Policy of municipality and mandate
- Policy of housing companies
- Which role do you want to play as a municipality?
- Stakeholder analysis
- Why an action plan?
- What is the subject?
- How do we want to make a plan?
- Who will be involved?
- Collecting inspiring examples
- Defining the process of creating an action plan
- …

7.4.2 Definition and urgency

Actions in this phase:

Set definition of the context and purpose of the action plan and focus on the urgency by analysing:

- Stakeholders (what's in it for them?)
    - Real estate owners' motivation = increase of value (not decrease of energy)?
    - Tenants: not the value of the apartment, but the comfort and energy costs are important?
    - Municipalities: keeping grip on living costs?
- Ownership, users
    - You don't have to choose one type of sector, prefer an action plan for every type?
    - The combination of – high saving potential and - high influence/activity gives most impact?!
- Inventory (housing stock and types, energy labels)
- Energy consumption
- Other qualities of the building(s)
- Scope: city, region, neighbourhoods
- Playing field, market
- Legislations
- Financial issues (who pays the bill?)
- Juridical issues
- …

7.4.3 Ambition and strategy

Ingredients for actions in this phase:

Within the definition and urgency:

- Formulate an ambition/goal;
    - The most important action for the municipality! Setting the goals, also if you have little influence in a certain sector. The signal of ambition (from the government) is in that case very important.
- Define strategies (for example a competition);

- Calculations of feasibility;
- Using examples
- Choose strategy
- …

7.4.4 Implementation and evaluation

Ingredients for actions in this phase:
Within the definition, urgency, ambition and chosen strategy:

- Create a project team;
- Define tasks and rolls;
    - Implementation as much as possible by stakeholders themselves (and not the municipality)?
- Communication plan
- Monitoring system
- Frequency of measurements
- Responsibilities
    - How to make it easy for stakeholders? Facilitate with examples, financial constructions
- …

7.4.5 Delivery of the action plan

Products of the phase definition, urgency, ambition, strategy, implementation and evaluation together form the action plan!