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Private Investments Move Ecopower

Three Step Approach and Guide

(Work Package 3, Tool 1)

Intelligent Energy Europe

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Contents

1. Introduction - Three Steps to identify PRIME project potential

The following set of questions helps scan public buildings and open spaces (public areas) to identify potential PRIME projects.

- The **first step** is made up of the GENERAL DATA REQUEST. It will help decide whether a building or area is suitable at all for a PRIME project. This information is also helpful to the PRIME coordinator in order to compile a list of PRIME projects for the final report.
- The **second step**, the FIRST ROUGH CHECK, helps narrow down the choice of potential PRIME projects in two ways:
  - a) The QUICK & EASY CALCULATION will give a very rough estimate of the net benefits of an average of best practice energy efficiency measures in a typical public building in a specific country.
  - b) A FIRST INSPECTION of technical installations in the building can be conducted following a list of criteria to be checked. The criteria list thus acts as a first selection mechanism to separate a small number of buildings. In most cases, it will be sufficient to carry out this first inspection together with a person knowing the building very well, e.g. a caretaker. The involvement of a specific technical expert is not needed at this stage of analysis.
- In the **third step**, the DETAILED INSPECTION, the data will be further examined by a detailed analysis, i.e. an expert assessment of the public building or area. A technical expert is required to conduct this inspection.

Intended as a basis for background information, the GUIDE provides a general overview of the aspects that are of particular importance for potential PRIME projects, with focus on the technical-economic aspects of potential PRIME projects. The guide should be used as an information tool to cross-check the answers while working along the three steps, especially besides using step 1 and 2 before starting the detailed inspection.

The three steps are as follows:

1) GENERAL DATA REQUEST – First rough analysis on the base of general data

2) FIRST ROUGH CHECK

a) QUICK & EASY CALCULATION – First very rough estimate of net benefits of an average of best practice energy efficiency measures in public buildings

b) TECHNICAL CHECKLIST – First inspection of technical installations

3) DETAILED INSPECTION – Expert assessment of selected building(s) or area(s)

Step 1: General Data Request
First Criteria to Identify PRIME Project Potential

This first set of questions helps scan public buildings or areas for PRIME project potential. The requested information is related to administrative aspects as well as aspects on construction and energy data of a selected building or area. In general, the information can be obtained without a first inspection of the building or area, which becomes relevant in step 2. Nevertheless, the information is a necessary prerequisite for the selection of a potential PRIME project. Please answer the questions circling either Y for YES, N for NO or U for UNCERTAIN. In an electronic format, you can delete the answers that do not apply and possibly add a comment below the question. Positive answers (YES) indicate that there is a potential to initiate and implement a PRIME project. Every additional negative answers makes the initiation and implementation of a PRIME project more difficult but not necessarily impossible.

Step 1: General Data Request			
1.	Is the **municipality the sole owner of the building or area?**		Y / N / U
2.	Is the **municipality planning to remain owner of the building or area?**		Y / N / U
3.	Is it assured that the **current use (or non-use) of the building or area** will be **constant in the future**?		Y / N / U
4.	Does the building contain a **swimming pool**?		Y / N / U
5.	Does **data about the building** (energy consumption, etc.) or some kind of **energy analysis** already exist? For areas rather than buildings: Does **data about the area** (size, slope of roof areas, etc.) and a study of **usability** for renewable energy measures already exist?		Y / N / U
6.	What year was the building **constructed?** (Please specify as detailed as possible, e.g. in the 1960s, 1970s or early 1980s? For further information, see GUIDE)		________
6.	**In which year** (approximately) was the **technical equipment installed** in the building?	Heating System	________
		Lighting	________
		Ventilation / Air Conditioning	________

Step 2: First Rough Check

Step 2a: Quick and Easy Calculation

The QUICK & EASY CALCULATION (first part of step 2) is a first very rough estimate of net benefits of an average of best practice energy efficiency measures in public buildings.

The tool will already yield a result when choosing the type of building and the country (“**Step 1”**) as well as filling in (an estimate of) the gross surface area of the selected building (“**Step 2”**). In this very simple form, it is more a **kind of a marketing instrument** applied to convince decision makers to explore energy efficiency potentials of their buildings than being a tool for calculating the economics of a project. Please consider that by only choosing the type of building and country, the informational value will be very much reduced. **However, the more data you fill into the optional “Step 2a” of this quick & easy calculation tool, the more precise are the economic results calculated:**

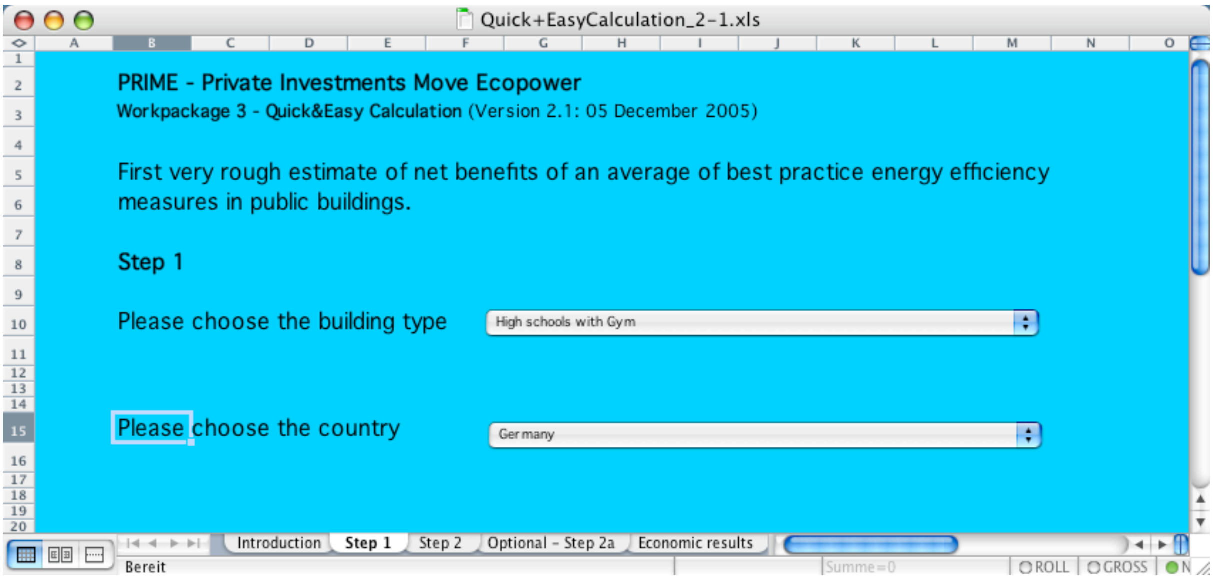
- If you do not fill in any data in the optional step 2a, default values will be used for a very rough economic calculation, with the default values being shortly explained within step 2a.
- If you, for example, fill in results of an investment grade audit or of another detailed technical and economic analysis in a later phase of your PRIME project into step 2a, the spreadsheet will give you the exact economic results in terms of benefits and costs, net present value, internal rate of return, static and dynamic and payback time.

The **calculation** table itself is hidden as well as the four tables with the **default values** (input data made use of, when no data is typed into Step 2a: EUROSTAT energy prices, 2% real interest rate, investment costs per saved kWh, specific energy consumption per m2 in typical buildings in Germany before and after refurbishment according to AGES and VDI 3807). The hidden tables (calculation and input data) can be easily made visible. Protected cells can be easily unprotected. There has not been typed in any password.

This is not a tool for calculating the net benefits of **renewable energy or CHP measures**. For renewable energy or CHP measures measures, **publicly available tools** could be used, such as the freeware offered by www.retscreen.net[1].

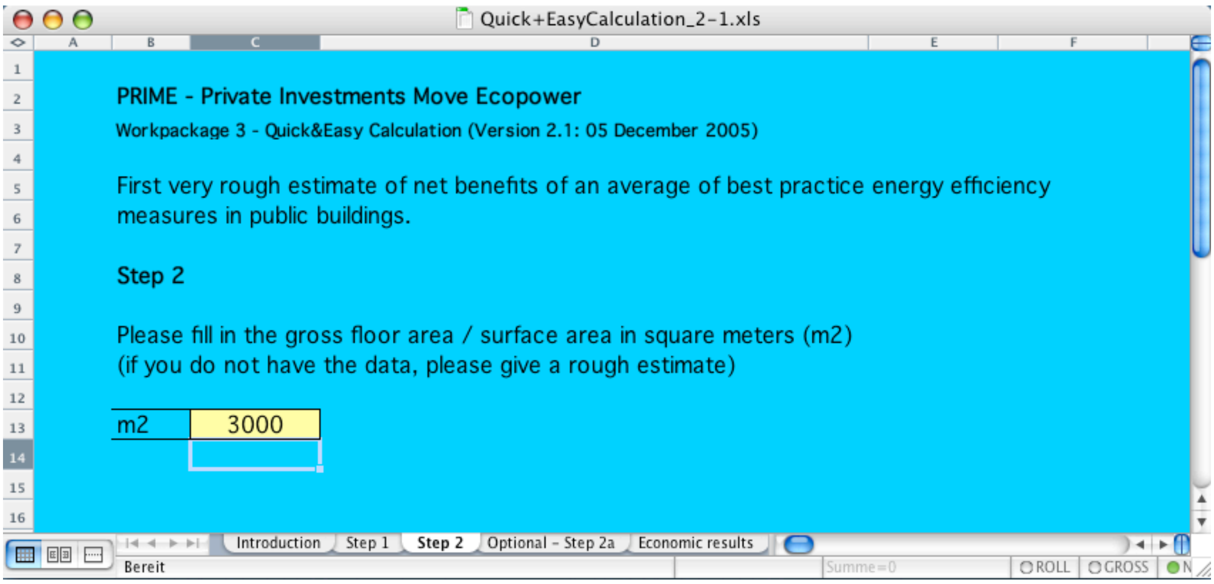
[1] However, it should be noted, that the RETScreen software is not fully developed yet for every field of application, and the calculations are not traceable in every step of analysis. Therefore, the plausibility of the results given by this software should be checked well.

Quick & Easy Calculation – Step 1



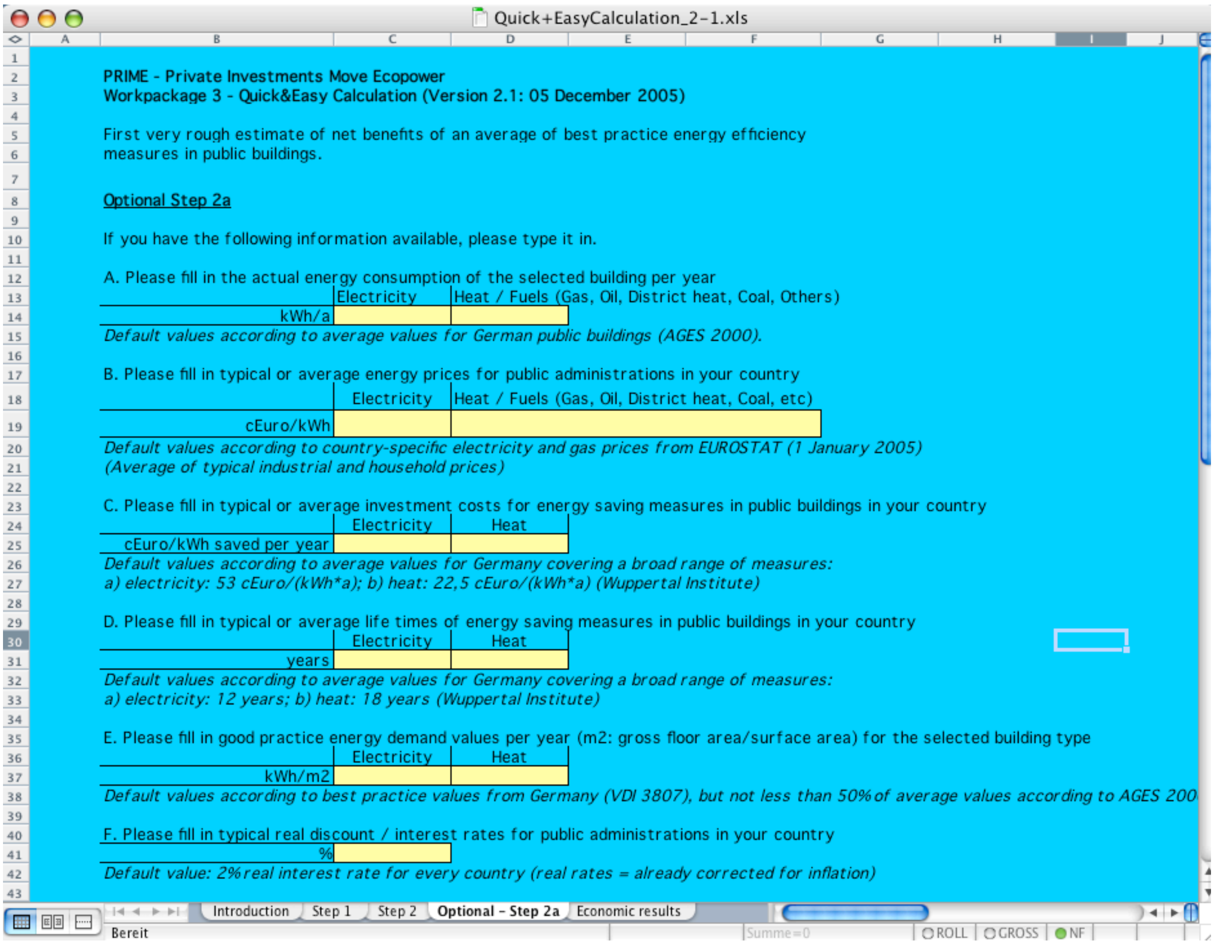
Step 1 is the first of two necessary steps. Here you can select a **type of building** (categories according to German AMEV guidelines; if you do not type in any specific data in step 2a, average and best practice energy consumption indicators from Germany will be used for the calculation of energy savings, based on your choice of a building) and a **country** (if you do not type in any specific data in step 2a, EUROSTAT energy prices will be used for the calculation of enery cost savings with respect to the country chosen).

Quick & Easy Calculation – Step 2



Step 2 is the second of two necessary steps. Here you have to type in the number of square meteres of the building selected. This number is used for the calculation of energy consumption and savings.

Quick & Easy Calculation – Step 2a



Quick+EasyCalculation_2-1.xls

PRIME - Private Investments Move Ecopower
Workpackage 3 - Quick&Easy Calculation (Version 2.1: 05 December 2005)

First very rough estimate of net benefits of an average of best practice energy efficiency measures in public buildings.

Optional Step 2a

If you have the following information available, please type it in.

A. Please fill in the actual energy consumption of the selected building per year

	Electricity	Heat / Fuels (Gas, Oil, District heat, Coal, Others)
kWh/a		

Default values according to average values for German public buildings (AGES 2000).

B. Please fill in typical or average energy prices for public administrations in your country

	Electricity	Heat / Fuels (Gas, Oil, District heat, Coal, etc)
cEuro/kWh		

Default values according to country-specific electricity and gas prices from EUROSTAT (1 January 2005)
(Average of typical industrial and household prices)

C. Please fill in typical or average investment costs for energy saving measures in public buildings in your country

	Electricity	Heat
cEuro/kWh saved per year		

Default values according to average values for Germany covering a broad range of measures:
*a) electricity: 53 cEuro/(kWh*a); b) heat: 22,5 cEuro/(kWh*a) (Wuppertal Institute)*

D. Please fill in typical or average life times of energy saving measures in public buildings in your country

	Electricity	Heat
years		

Default values according to average values for Germany covering a broad range of measures:
a) electricity: 12 years; b) heat: 18 years (Wuppertal Institute)

E. Please fill in good practice energy demand values per year (m2: gross floor area/surface area) for the selected building type

	Electricity	Heat
kWh/m2		

Default values according to best practice values from Germany (VDI 3807), but not less than 50% of average values according to AGES 200

F. Please fill in typical real discount / interest rates for public administrations in your country

%	

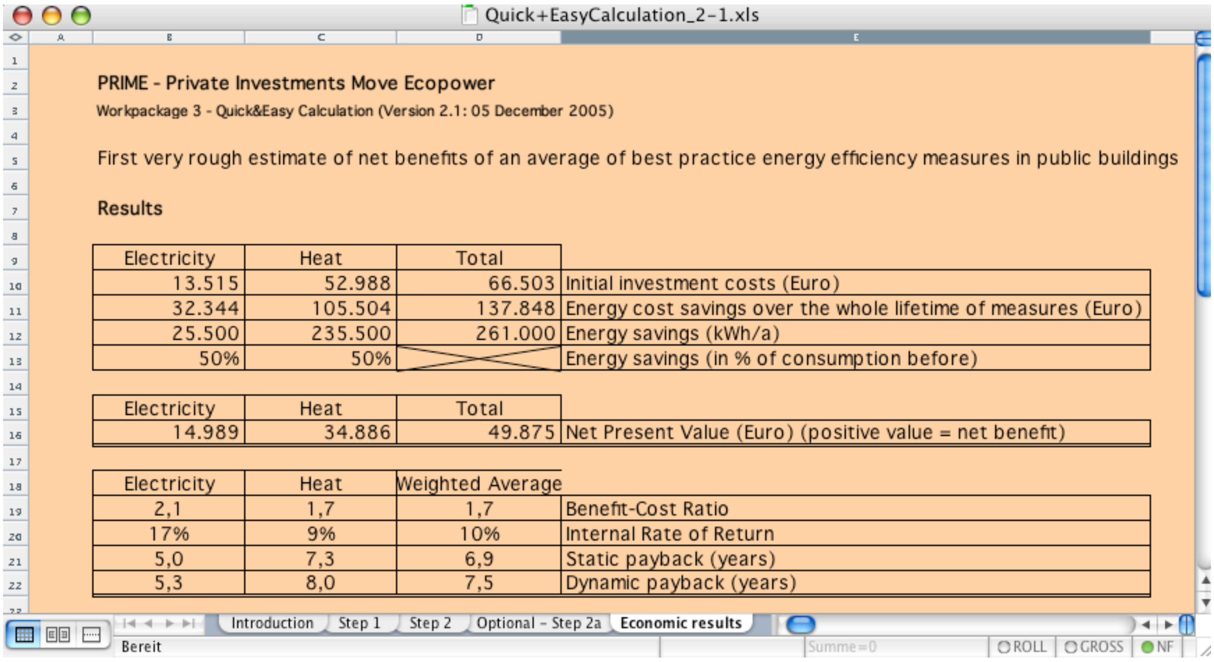
Default value: 2% real interest rate for every country (real rates = already corrected for inflation)

Introduction | Step 1 | Step 2 | Optional - Step 2a | Economic results

Bereit | Summe=0 | ROLL | GROSS | NF

The Step 2a is an optional step. However, the more data you type in here, the more viable are the economic results calculated. You can even insert here the results of an investment grade audit or detailed energy analysis to calculate economic values in the end. If you do not insert data here, the calculations are just very rough ones, based only on the default values mentioned above.

Quick & Easy Calculation – Economic Results



Quick+EasyCalculation_2-1.xls

PRIME - Private Investments Move Ecopower

Workpackage 3 - Quick&Easy Calculation (Version 2.1: 05 December 2005)

First very rough estimate of net benefits of an average of best practice energy efficiency measures in public buildings

Results

Electricity	Heat	Total	
13.515	52.988	66.503	Initial investment costs (Euro)
32.344	105.504	137.848	Energy cost savings over the whole lifetime of measures (Euro)
25.500	235.500	261.000	Energy savings (kWh/a)
50%	50%		Energy savings (in % of consumption before)

Electricity	Heat	Total	
14.989	34.886	49.875	Net Present Value (Euro) (positive value = net benefit)

Electricity	Heat	Weighted Average	
2,1	1,7	1,7	Benefit-Cost Ratio
17%	9%	10%	Internal Rate of Return
5,0	7,3	6,9	Static payback (years)
5,3	8,0	7,5	Dynamic payback (years)

Introduction | Step 1 | Step 2 | Optional - Step 2a | Economic results

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The spreadsheet calculates the benefits (energy savings, energy cost savings) and costs (investment costs) of an average of best practice energy efficiency measures for the selected type and size of building in the selected country. It can further take account of specific input data filled in Step 2a.

The economic indicators presented are benefit-cost ratio (from the perspective of the investor), internal rate of return, static and dynamic payback times.

Step 2b: Technical Checklist (First inspection)

This TECHNICAL CHECKLIST serves within step 2 (FIRST ROUGH CHECK) to identify potential PRIME projects in public buildings. The questions are related to technical details of a building that has been scanned using the questionnaire in step 1 (GENERAL DATA REQUEST) and identified for further examination. With regard to the technical specificity of the information requested in this questionnaire, it is necessary to combine this checklist with a first technical inspection of the selected building. However, this technical check can be done without involving a specific technical expert. In most cases, it will be sufficient to carry out this first inspection together with a person knowing the building very well, e.g. a caretaker. After the screening process in step 1 this rough technical inspection will provide relevant information to select a building that qualifies as a potential PRIME project.

As highlighted in the GUIDE, the following technical areas are of special interest for the evaluation process:

- Electricity in general
- Photovoltaic / Solar thermal systems
- Indoor Lighting
- Ventilation and Air Conditioning (A/C)
- Heating, including pumps
- Insulation / Building envelope
- Water

Please answer the questions circling either Y for YES, N for NO or U for UNCERTAIN. In an electronic format, you can delete the answers that do not apply and possibly add a comment below the question. Every additional positive answer increases the economic and ecological potential for RES and RUE measures. The realisation of these measures in a third party approach, e.g. by following the PRIME concept, will only makes sense if a specific minimum size of the building (and automatically energy costs; cf. the Guide) is reached in order to be economically feasible. Therefore, every additional positive answer, in this way, also increases the potential for realising these measures in the course of a PRIME project.

Step 2b: Technical Checklist		
1.	**Electricity in general**	
1.1	Are there **high annual maintenance costs** for electricity installations? (If yes, the building might have additional possibilities for savings through efficiency measures. New technologies can lower costs of maintenance.)	Y / N / U
1.2	Does the building contain a **kitchen**?	Y / N / U
1.3	Does the building contain a **EDP (Electronic Data Processing) Server Room**?	Y / N / U
2.	**Photovoltaic / Solar Thermal Systems**	
2.1	**If the use of solar energy (PV or solar thermal) is planned / is an option,** does the building have an adequate roofage for the installation of a photovoltaics system? a) 400 to 600 m^2 area of flat roof	Y / N / U
	b) southward saddleback roof	Y / N / U
3.1	Is there an (outdoor) swimming pool without any existing or planned solar thermal system yet?	Y / N / U
3.	**Indoor Lighting**	
3.1	Is the **lighting system more than 20 years old?**	Y / N / U
3.2	Are **incandescent bulbs** in use?	Y / N / U
3.3	Are **double-flame luminaires** in use? (two fluorescent tubes per lamp) (If yes, they might be replaced with single-flame luminaires.)	Y / N / U
3.4	Is **lighting controlled manually**?	Y / N / U
3.5	Can you use **daylight** more effectively?	Y / N / U
3.7	Are **conventional ballasts** in use? (If yes, energy might be saved by replacing them with electronic ballasts.)	Y / N / U
4.	**Ventilation and Air Conditioning**	
4.1	Does a **ventilation and/or air conditioning system exist covering more than a few rooms?**	Y / N / U
4.2	Is the **ventilation and/or air conditioning system more than 15 years old?**	Y / N / U

5.	**Heating**	
5.1	**Is the heating system more than 15 years old?**	Y / N / U
5.2	Are there **high annual maintenance costs** for space and water heating installations? (If yes, the building might have additional possibilities for cost-savings through an efficient heating system)	Y / N / U
5.3	Are "speed controlled" pumps missing in the heating system?	Y / N / U
5.4	Does the **pump/** Do the **pumps** require an exceptionally large amount of **power**? (If yes, hydraulic equilibration between the different rooms/heating panels is an important tool to reduce the power required to warm up every room.)	Y / N / U
6.	**Insulation / Building envelope**	
6.1	Is the building envelope in such a bad condition that a refurbishment is needed anyway and is a renovation of the building envelope already planned anyway?	Y / N / U
7.	**Water**	
7.1	Are **low-flow aerators/ taps** missing throughout the building?	Y / N / U
7.2	Are **automatic shutters for toilet flushes** absent from the facilities?	Y / N / U
7.3	Are **waterless urinals** absent from the men's toilets?	Y / N / U

Step 3: Detailed Inspection (Expert assessment)

Based on the first two analyses of step 1 and step 2 to assess the potential of a PRIME project, a detailed inspection is required in a third step. This expert assessment of the building or area selected will finally lead to a decision, which energy efficiency, cogeneration (CHP) or renewable energy measures will be implemented that are economically feasible. An **INTERNAL EXPERT** from the municipality **OR A CONTRACTED EXTERNAL EXPERT** needs to assess the energy consumption in the building and the technical specificities of the energy-using equipment in more detail as well as the measures taken into consideration.

The economic results of this detailed analysis will be fed into a template for the documentation of the PRIME projects analysed and implemented, which will be provided within Tool 2 of Work Package 3. A first draft of this documentation is due at the time of writing the interim report of the project in summer 2006 describing the state of the PRIME project at this time. The final draft of this documentation is due at the end of the project. In case the internal or external expert does not possess sufficient spreadsheets for the detailed analysis of possible measures in this step 3, or if he or she wants to look at other spreadsheets, Tool 2 will provide a list of publicly available software and spreadsheets for different fields of application or technologies.

2. Guide

This GUIDE for Tool 1 shall be used for essential background information relating to the specific questions in Step 1 (GENERAL DATA REQUEST) and Step 2 (FIRST ROUGH CHECK) as well as serve as an information source for contracting projects in general

2.1. What is a PRIME project?

Definition from the contract:

„PRIME projects will be local RUE and / or RES projects for which private capital from citizens and local stakeholders will be mobilised for the investments via such a participatory approach. The focus will be on integrated RUE and RES investments in public buildings.“

Definition for ideal PRIME projects:

- At least 50% private capital from many citizens and local stakeholders (minutes of Frankfurt meeting; minutes of Wuppertal meeting say 20%)
- Investments in public buildings
- Integrated RUE and RES investments (energy efficiency, CHP, renewables)
- Substantial size of project
- Implementation of measures by kind of energy performance contracting (EPC)
- More than financial participation: participatory approach includes further measures

2.2. Size of the Building

Setting up energy efficiency measures by way of energy performance contracting requires a specific minimum size of the building (and automatically energy costs) in order to be economically feasible. Pooling several buildings could be a way to achieve the required minimum of energy costs.

2.3. Energy and Water Costs

Any kind of energy analysis, such as an analysis of current energy and water consumption, which has already been conducted for the selected building, can be helpful for analysing the potential of a PRIME project. When calculating energy and water costs, the following elements should be considered: Current prices and expected price developments of

- Electricity
- (District) Heat
- Fuels (Gas, Oil, Coal, Biofuels), and
- Water

Furthermore, the current and expected future feed-in tariffs for renewable energy and energy from CHP sources have to be taken into account (see below).
A larger building will have higher energy and water costs and thus have greater potential for energy and water savings. In general, there is no regular indicator for the minimum size of the building. However, a minimum of annual *saving* in energy costs should be approximately 15,000 Euro. This corresponds to a minimum of annual energy *costs* of about 30,000 Euro.

2.4. Year of Construction

The year of construction of a building is highly relevant for selecting a PRIME project. In Germany, for example, we have found that buildings from the 60s, 70s or early 80s are most suitable for a contracting project because they require high energy use and are build in a technically complex way – before the first oil price crisis. High energy costs mean that energy efficiency measures can be lucrative. In contrast, very old buildings and newer buildings in Germany are less appropriate for a PRIME project because they either require too much renovation or already possess updated equipment.

2.5. Legal and administrative information

Specific legal and administrative information is needed to guarantee an efficient PRIME project for the future. For example, knowing whether the municipality is and will most likely continue to be the sole owner of the building is important, because the project is intended to pay for itself in the long run. Another example is analyzing the current and future use of the building. Changes in usage may result in changes in consumption, which will make it difficult to accurately calculate future project savings.

2.6. Renewable Energy and Cogeneration Incentives

A precondition for renewable energy measures within PRIME projects is the existence of a Renewable Energy Law (REL). Without the **incentive of feed-in tariffs** (a guaranteed remuneration for feeding electricity into the grid) or **subsidisation of investment**, renewable energy measures are financially unattractive. This applies to the installation of a photovoltaic system on the roof of a building as well as the installation of a wind park or a small hydro power station. However, it might not apply to the usage of some kinds of **biomass** and **solar thermal systems**.

A law supporting the implementation of cogeneration (combined heat and power (CHP)) plants by a **feed-in tariff or a subsidy** can ease the implementation of cogeneration units in the selected PRIME buildings. The more evenly the use of heat is distributed over time (for example, in an indoor swimming pool, a high amount of heat is steadily used during opening hours), the more economical is the cogeneration unit. However, in how far a cogeneration plant is profitable, depends also on other factors like the feed-in tariff for electricity produced by the plant and the opportunity costs of heat production (costs of producing heat from other sources/systems).

2.7. Occupancy

Public buildings vary not only in the way they are used but also when they are used during the day. Some buildings, such as schools, may only be occupied for part of the day. Others, like police stations, are used 8,760 hours a year, at least partly. The higher the occupancy during the day (and year in sum), the higher the potential to save energy. The question of occupancy can also be extended to single rooms, floors and specific sections of a building. Nevertheless, buildings with low occupancy can be found to be potential PRIME projects if their heating or air conditioning systems are not set up to correspond to the limited time that the building is being used. The systems that are being operated during the times of non-occupancy can become potential energy cost savers.

2.8. Specific Indicators

There are certain indicators, which help to select a potential PRIME project. Variables such as heating fuel per m^2 or electricity consumption per m^2 can support an energy cost savings calculation. PRIME partners may have access to average measurements for their country or city.

2.9. Surface Area

To ensure consistency across PRIME project reporting, the surface area should be measured in square meters (m^2).

2.10. Indoor Lighting

It is important to know how old the lighting-system in the building is. For reasons of energy efficiency and of achieving high potential the system should be more than 15-20 years old. Another important aspect to improve energy efficiency is to know whether there are incandescent lamps, single-flame or double-flame luminaires installed. In general, the retrofitting is easier when there are incandescent or double-flame luminaires installed.

Another relevant aspect relates to the question of the illumination level of the lighting system. Is the lighting level high enough to fulfil the requirements of the new EU norm EN 12464-1 or is it an old lighting system that has to be upgraded towards a higher illumination level?

If the lighting system is controlled manually, energy might be saved by installing lighting controls (sensors, timers) that turn the lights on only when needed in areas that are used by many people without any clear personal assignment (e.g. in hallways, toilets, meeting rooms).

In addition, it is helpful to know how long the lights are in use: less than 5 hours a day, 5-10 hours a day, or more than 10 hours a day? (Also relating to the question of occupancy). Against this background, finally the question of using daylight more effectively should also be examined in detail before planning any technical improvements.

2.11. Heating (including pumps), Ventilation, Air Conditioning

As well as the indoor lighting system, the potential for energy efficiency in the heating system, ventilation and Air Conditioning (A/C) will be greater if those systems are more than 15 years old.

However, the profitability of heating measures also depend on the kind of heating system and the energy carriers used. When designing heating (or cooling) measures, possibilities to integrate renewable energies should be checked.

2.12. Insulation / Windows

In how far the insulation of roofs/lofts, ceilings of cellars, walls and better insulated windows or just the replacement of window glass are economical, strongly depends on the energy prices and their development, the kind and time of use of the building and on the need for refurbishing the building envelope anyway.

In Germany, it had turned out, that insulation measures often have long payback times as long as there is no renovation of the building envelope anyway. This would lead to a very long duration of the PRIME contract, which will usually not be accepted by the stakeholders. However, a loft/roof insulation might be feasible to combine with the installation of solar thermal or PV systems on the roof, an insulation of parts of the ceiling of the cellar with the installation of the heating system and the insulation of tubes.

2.13. Particular Conditions

PRIME projects will differ greatly according to the following circumstances:

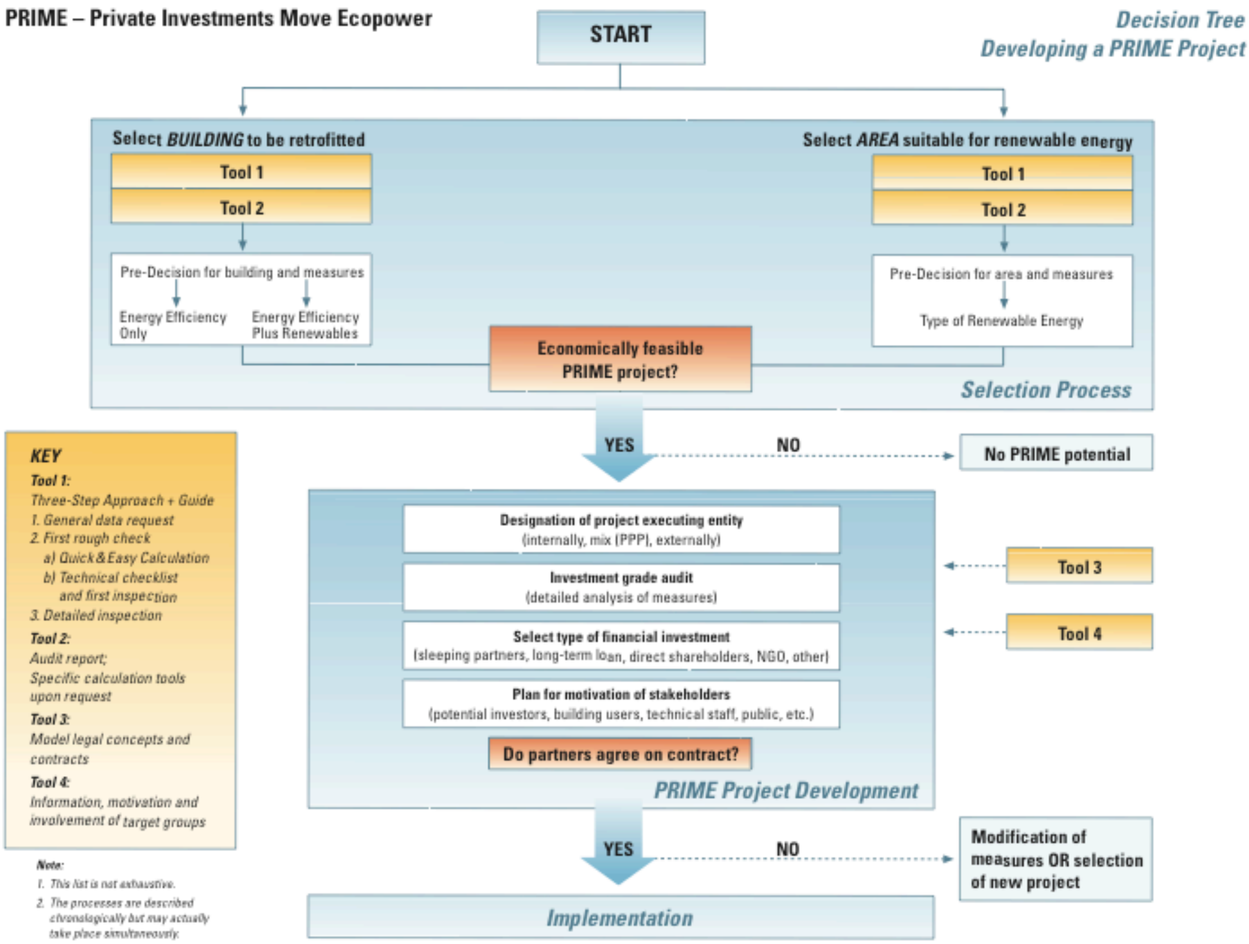
- National legal conditions
- Costs of energy sources
- National financial support for renewable energy sources
- Individual technical standards in the building
- Usage of the buildings

3. Decision Tree

The decision tree explains the flow of analyses, decisions and planning from the start of the considerations to initiate a PRIME project to its implementation. The main PRIME project phases are:

- Selection process: selection of building to be retrofitted and/or of open space/area suitable for renewable energy measures.
- PRIME project development
- Implementation.

The decision tree further shows, in which phase of the project which PRIME tool could be used.



Please notice that "Tool 2 Audit report" is the documentation of PRIME projects requested for the intermediate report (draft due in summer 2006) and for the final report (final version).

Please further notice that not only energy efficiency and renewable energy measures, but also cogeneration units could be implemented in the course of a PRIME project. The final optimised portfolio of measures will be defined after the investment grade audit.