



# SET

## Subsidy Evaluation Tool

# USERS' MANUAL

WP3 TRANSFERRING  
ACTIVITY 3.5 USERS' MANUAL

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## 1. Introduction

Sound energy efficiency interventions on buildings especially on envelopes and glazing systems generally require long payback times and yield low IRRs (Internal Rate of Return)

The minimum IRR percentage “required by the market” is not a precise measure but rather an empirical figure based on the risk reward profile of these kind of interventions. In other words only direct contacts with ESCOs, financial institutions and other stakeholders can provide evidence of the market threshold in terms of the IRR which needs to be met to make a project bankable.

In the case that a specific project does not yield a sufficient IRR, calibrated public funding shall be needed to make it profitable. The Excel® SET - Subsidy Evaluation Tool enables PCAs – Public Contracting Authorities to calculate the exact amount of subsidy needed minimizing public spending.

The SET carries out an energy and financial evaluation of ECMs (Energy Conservation Measures) and can be used for the following four types of public buildings: schools, gyms, office buildings and health care structures (nursing homes/rest homes).

The SET is a simplified tool that does not require in-depth energy expertise for its compilation. The input data, divided into thematic blocks, includes:

1. general information;
2. general building information;
3. energy consumption measures divided in:
  - 3.A heating energy consumption and - if necessary - hot water;
  - 3.B electricity consumption, excluding the eventual part of electricity used for heating;
4. interventions and estimated investments;
5. energy prices;
6. energy calculations with 2 options (option A or B):
  - 6.A option A for a simplified energy assessment within the SET requiring some basic data on the energy measures; (surfaces affected by the new insulation, part of the building affected by the interventions, possible change of fuel if foreseen - also through the menus of box n.4. - power of the photovoltaic system when installed);
  - 6.B option B is based on a detailed and sound Energy Audit for savings calculation and reference data for energy baselining;
- 7.parameters for the financial calculation;

## 8. company financial data

Builders/ESCOs participating to the tender can fill in box n.8 of page 5 of the SET spreadsheet indicating the amount, duration, and interest rate of the loan (part of the project investment covered by the funds borrowed from the bank) whose remaining parts have been completed by the Public Contracting Authority. Once companies participating to the tender have provided their basic data, the SET model calculates the financial fundamentals related to the project (assessment) providing cash flows, DSCR-Debt Service Cover Ratio, LLCR-Loan Life Coverage Ratio.

Box n.8 of page 5 can also be filled in by PCAs (Public Contracting Authorities) with average market values for an overall financial sustainability assessment of the funding policy.

### 1.1 Identifying buildings for energy efficiency interventions

The SET can also be used by Public bodies to choose the building on which prioritize interventions/investments when carrying out an analysis on several buildings where no energy audits are available, option A (simplified energy assessment) enables, with little data, to get a first technical-financial estimation of the interventions where the building with the most convenient intervention in terms of a Subsidy/Investment ratio may be identified so that the expenditure for the energy audit shall take place only once avoiding the cost of an energy audit for each building.

### 1.2 Spreadsheet structure

SET is an Excel® file organized with spreadsheets divided into 5 groups. Normally, only the sheets with the green label are visible, numbered from 1 to 7, they contain the data entry blocks for the user. These sheets are already set in A4 vertical format ready to be printed out.

The other spreadsheets are hidden and include:

- 2 sheets with the red label where data for translation into multiple languages is collected;
- 1 sheet with the yellow label, which collects all parameters and calculation variables;
- 1 sheet with a light green label that contains the energy assessment calculations;
- 1 sheet with a brown label that contains the average prices of ECMs Energy Conservation Measures;
- 3 sheets with the blue label for the financial calculations.

### 1.3 Introductory notes to the energy and financial calculation

For a standard use of the SET it is sufficient to fill in the sheets numbered from 1 to 7. The objective of the SET is to allow a first financial assessment of the energy efficiency measures, based on data easy to retrieve and quick to fill in.

The need to reduce the number of input data for energy and financial calculation to a minimum has led to the definition of a simplified calculation algorithm that uses a set of pre-established and standardized parameters. The expert user can eventually customize the energy and financial calculation parameters based on local peculiarities by accessing the "Parameters" sheet. At the foot of the "Parameters" sheet are also two tables for a customised calculation of deductible interest expenditures (deductible debt service) and specific national or regional taxation rates for the correct compilation of the project financial assessment.

The simplified energy calculation involves 4 phases, collected in a spreadsheet called "T-Calc option A" (light green label), i.e.:

- calculation of the building geometry starting from simplified data input;
- calculation of the thermal dispersions of the building with and without energy efficiency measures;
- calculation of plant losses, possible improvements and the value in € of the thermal energy savings provided;
- calculation of electricity savings and the respective value in €.

If an energy diagnosis is available, the simplified energy calculation (option A) is replaced by the calculation of the diagnosis itself, the results of which must be reported in the "option B". The financial calculation is divided into two parts:

- the "F-Calc Subsidy" sheet (blue label) calculates the amount of the subsidy based on the inflation and expected project IRR - Internal rate of Return;
- the "F-Calc Mortgage loan" and "F-VAT bridging loan" sheets (blue labels) contain the data needed for the assessment of the cash flows of the Financial Plan of page 6 that can be used by both municipalities/public bodies and providers/ESCOs as a general check of the financial sustainability of the project. The Mortgage loan refers to the initial investment expenditures, VAT (Value Added Tax) excluded, according to the chosen ECMs (Energy Conservation Measures) while the VAT bridging loan considers the conditions in which VAT on investment expenditures is financed and recovered.

## 2. How to complete the SET

### Sheet 1: cover page

In sheet "I" it is possible to select a language. At the moment the SET can be used in the following languages: English, Italian, Slovenian and Serbian. The SISMA PLUS updated tool can also be available in French, Spanish and Greek on demand of any public body after translating some basic technical text that may be automatically uploaded on the tool.

## Sheet 2: general data and energy consumption

The data required in **Box 1** does not have an influence on the energy and financial calculations, but is useful for identifying the project and the operator responsible for project data entry.

The following data must be entered in **box 2**:

- **Location** of the building, descriptive field for general classification purposes.
- **Building type**. The SET considers four types of public buildings: schools, gyms, office buildings and health care structures (nursing homes/rest homes). Depending on the intended use of the building, the following parameters vary in the energy calculation:
  - internal temperature (18 ° C for gyms, 20 ° C for other buildings);
  - the average value of hourly air changes for ventilation;
  - internal heat gains;
  - incidence of hot water systems on thermal consumption (in the case of combined heating + HWS-Hot Water System);
  - incidence of lighting on overall electricity consumption (excluding heating);
  - self-consumption capacity of the electricity produced by a photovoltaic system for thermal consumption using a heat pump;
  - self-consumption capacity of the electricity produced by a photovoltaic system for electricity consumption (excluding heating).
- **Location**. It should be indicated if the building is a detached single-unit or in adherence with other buildings (semi-detached or part of a row in adherence on two sides). This parameter affects the definition of the building geometry and the dispersion area surfaces.
- **Latitude**. Indicate the latitude in degrees omitting decimal values, minutes and seconds. The SET updates the calculation of the requirements with the relevant solar irradiation value together with the related monthly irradiation profile.
- **Heating Degree Days (HDD)**. HDD represent the sum, for the whole heating season, of the differences between the internal temperature and the average daily outdoor temperature. Commonly, conventional heating season period definition and HDD values are used; in the "Parameters" sheet there are two fields to correct conventional HDD considering the increase of the average external temperatures, in particular:

- the "External temperature increase compared to archive data" field (table 5) corrects the historical data taking into account the increase in temperatures in recent years (preset value +0.5 K on average daily temperatures; period considered in the construction of the conventional Heating Degree days should be verified on the basis of the respective national rules);
- the field "External average temperature increase in 20 years"(table 9) corrects the value of savings to make the Financial Plan more precise (pre-set value +0.7 K over the next 20 years).
- **Construction year.** It is not necessary to indicate the exact year of construction, it is sufficient that the year reflects the construction period according to the following intervals:

1930	1950	1960	1970	1980	1990	2005	2010	> 2010
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Depending on the construction period, wall thicknesses and thermal parameters typical of the period (table 6 of the "Parameters" sheet) are assigned to the building.

- **Net internal area**, defined as the internal area of the floor (usable floor area), of all the heated floors. Gross floor area, floor area contained within the building measured to the external face of the external walls.
- **Average wall thickness.** Optional parameter that, if not indicated, is assigned using predetermined values related to the construction year of the building (table 6 of the "Parameters" sheet).
- **Heated volume.** Volume inside the building envelope of heated spaces. Unheated areas (basements, warehouses, garages, attics, etc.) are excluded.
- **Number of heated floors.** It is the number of floors intentionally heated. Small portions with different heights can be overlooked. For buildings subdivided into different portions by number of heating floors, an average value can be entered (e.g. 2.5).

On the basis of the surface, volume and number of heated floors, the SET determines the probable geometry of the building. To do this, some of the parameters in table 5 of the "Parameters" sheet are used together with envelope specifications from sheet "3".

In boxes 3.A and 3.B building consumption measures are to be indicated. Consumptions must refer to a one year period at least, but it is preferable to have consumption data of 3 years (even if non-consecutive), whose average determines the baseline for estimating savings.

**Box 3.A** is compiled with the following data:

- **fuel type**, it is possible to differentiate consumption on two types of fuel, the SET will calculate the percentage of consumption of each fuel based on the data entered (to avoid altering the calculation of the baseline, it is necessary to enter the consumption of the two fuels detected in the same years);
- **unit of measurement** of fuel consumption values; there is an important point to clarify in this case. Usually consumption data is based on energy bills that come with a certain unit of measurement, for example if bills are in €/liters the unit of measurement to choose for the consumption amount is liters; for all energy sources kWh can also be selected from the drop down list only that in this case, the system does NOT automatically convert e.g. liters in kWh, but the consumption data should be changed and entered again after calculating the equivalence, otherwise the SW will simply consider the same figure as kWh. The option of using kWh instead of the physical unit of measurement of the energy source (except in the case of electricity where the unit of measurement is already in kWh) is possible but requires a separate equivalence calculation transforming your physical unit measurements (liter, kg, STDm<sup>3</sup>etc) in kWh and then entering the new re-calculated values in the fields. The reason for this option is due to the fact that in certain uncommon circumstances (where not all bills are available, type of fuel has been changed recently etc) there is the need to have a homogenous unit of measurement which is the kWh for all;
- incidence of **hot water production** on thermal consumption (percentage incidence values in Table 7 of the "Parameters" sheet are applied);
- annual **thermal consumption** (in the previously indicated unit of measurement), the reference year of consumption and the relative **annual expenditure** from energy invoices; the **cost of thermal energy** is calculated on the most recent year.

In **box 3.B** the electric energy consumption data is inserted with the same method (if heating is also part of electricity consumption, the heating consumption component must be estimated and entered it in box 3.A).

The cost of electricity is calculated on the most recent year.

### Sheet 3: savings estimation

In **box 6** there are two options for calculating energy savings which are fundamental in the definition of the Financial Plan:

- **option A**, a simplified estimation of savings in relation to foreseen EEMs (Energy Efficiency Measures); this modality uses a simplified energy assessment carried out within the SET and is suitable for predicting the potential for savings and the ranking of buildings according to their cost / benefit ratio when resources for sound energy diagnoses are limited and cannot be carried out on all buildings;



- **option B**, estimation of savings through an energy diagnosis based on a tailored calibrated calculation; this modality therefore requires the existence of an accurate energetic diagnosis from which estimated savings and reference data on the energy baseline is derived.

Regarding option A, in **box 6.A** all foreseen measures are selectable, for some further data may be needed to better define the extent of the intervention:

- surfaces affected by insulation measures on the building envelope;
- portion of the building affected by interventions on lighting systems;
- installed photovoltaic power to support electricity and eventual heat consumption (for heat pumps);
- further savings on thermal and electrical consumption due to interventions other than those indicated in the list.

In **box 6.B** the following main parameters of the energy diagnosis must be inserted:

- annual reference consumption (baseline of thermal and electrical consumption);
- Heating Degree Days HDD of the thermal baseline;
- annual savings value on thermal and electric consumption, expressed both in percentage and in Euros.

## Sheet 4: costs and investments

**Box 4** shows a list of the most common energy requalification measures.

Only the measures selected in sheet "3", and whose costs have been inserted in the "Price list" sheet (not to be used and also hidden to final users) will indicate the cost in euros; measures that have not been selected will have a blank "estimated cost"; this is interesting because, principally for the entire envelope (or a mix of measures) it is possible to easily confront different types of interventions for the same building or consider the same mix of interventions on different buildings.

The drop-down menus associated with interventions on the envelope (rows from 1 to 6) indicate whether the intervention affects the entire dispersion area or only a part of it. The information provided through these menus, in association with the number of square meters of the specific type of energy efficiency measure carried out on the envelope indicated in sheet "3", improve the geometry preciseness of the building modelled by the SET; when square meters inserted are 20% higher than the standard

SET building geometry number, a popup reminds to double check the figure in order to prevent factual errors (like adding a zero, copying the wrong number ect)

In the drop-down menu referring to the replacement of the heat generator (line 7) it is possible to specify if the replaced generator will use the same fuel or switch to a new fuel type. In the case of an initial starting situation with 2 boilers running on different fuels, if a new fuel switch is foreseen then then same fuel will apply to both boilers. This approach covers most of the practical cases<sup>1</sup>, namely:

- replacement of all existing generators with one or more generators powered by the new fuel;
- replacement of generators powered by the less favorable fuel, with a centralized heating plant powered by only one more convenient type of fuel.

In the case of a photovoltaic installation (lines 13. and 14.), it must be specified if the PV plant covers electricity and heat consumption (in the case of heating systems powered by heat pumps). If the same PV plant serves both systems (heat pump and general electricity production) an estimation of costs and installed power distributed between the two systems is necessary.

Finally, other further energy efficiency measures may be specified (lines 15. and 16.), an estimation of energy savings in % stemming from these extra measures needs to be indicated in sheet "3".

Total expenditure of energy efficiency measures should be completed by adding professional expenses (design and construction fees), building site security and VAT (Value Added Tax) in the last three fields of Box 4; and that is why security costs should NOT be included in all the estimations of the measures foreseen in the "Price list" sheet in order to avoid double costing for security.

If a financial plan without any of the above mentioned items is needed, simply fill in zero in the fields that are to be excluded.

Box 5 summarises the energy carrier costs used by the SET. The predefined values, which are national average values of the unit cost of the various carriers, are reported in the "Parameters" sheet (table 1); these values can be updated periodically and, in any case, adapted according to national prices.

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<sup>1</sup> Simultaneous replacement of 2 generators powered by different fuels with 2 new generators powered still by two different fuels is not foreseen in this tool.

Unit costs related to energy carriers actually used in the building - calculated in boxes 3.A and 3.B of sheet 2 prevail over predefined values.

If more updated or accurate energy costs are available, this data may be inserted in Box 5 in the column "entered by the user". The value entered by the user prevails over predefined or pre-calculated values.

## Sheet 5: financial calculation parameters

**Box 7** contains the main parameters for the financial calculation. The first part summarises savings and the investment expenditure which are determined by the SET. In the second part of the box the following information must be compiled:

- financial plan duration (20 years maximum);
- general inflation rate;
- inflation rate of electricity prices;
- inflation rate of heating energy source;
- IRR\* (Internal Rate of Return ) the minimum project return required by the market for projects with a similar risk reward profile.

On the basis of the values entered above, the SET determines the subsidy amount (figure in Euros) that is needed to make the project yield an internal return equal to IRR\*.

**Box 8** is dedicated to ESCOs/service providers where information on their debt structure such as own capital and loan<sup>2</sup> details (amount, duration, annual interest rate) shall be compiled in specific fields. Basic data on the VAT Value Added Tax bridging loan is also to be entered.

Box 8 can also be filled by PCAs (Public Contracting Authorities)/Municipalities for a general overall check on the financial sustainability of the project according to market benchmarks in terms of senior debt coverage of investments (% of the investment covered averagely by loan).

## Sheet 6: the financial plan

The financial plan (sheet 6 FIN) provides a general insight to the financial sustainability of the project. While the SET calculates a subsidy/grant amount that is the same for all ESCOs, builders or other bidders each one of them obviously has its own specific debt structure and debt service conditions which is represented in the financial plan that is structured in two parts:

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<sup>2</sup> Loan duration cannot exceed the duration of the Financial Plan included in box 7 of sheet 5.

- the first part – cash flow statement - presents the following cash flows related to the initial investment:
  - operating cash flows (concession fee = total savings + incentives) in our scheme ESCOs/builders realise the interventions and get, in return, a subsidy + concession fees for all the project period, there are no other operating costs related to maintenance and other general expenses, these would be part of another , separate contract;
  - investing cash flows in our case consider only VAT recovery on the investment since it has a significant financial impact and can take place within 5 years maximum in our scheme;
  - financing cash flows regard the annual loan payments on the long period mortgage for the investment (debt service: Current Portion Of Long-Term Debt [CPLTD] + interest). Tax-deductible interests are not considered here because they vary for each bidder according to their fiscal situation and management; the same applies for income tax.
  - VAT bridging loan payments refer specifically the VAT bridging loan whose duration is 5 years maximum in our scheme
  - net cash flows = operating cash flows + investing cash flows - financing cash flows - VAT bridging payments. Net cash flow is calculated before tax.
- the second part highlights two financial indicators that assess the financial stability of the project:
  - **DSCR-Debt Service Cover Ratio** (EBITDA / Debt service. Debt service = Loan payment (Current Portion Of Long-Term Debt [CPLTD] + interest). DSCR is an indicator of the project capacity to cover debt service with earnings before interest, tax, depreciation and amortization and is calculated on a yearly basis;
  - **LLCR-Loan Life Coverage Ratio** (NPV - Net Present Value of the cash flow available for loan /total loan ) indicates an overall repayment capacity of the project.

## Sheet 7: credits

The SET was developed within the SISMA project, co-financed by the European Regional Development Fund within the Interreg MED Interreg programme, with the collaboration of the following Partners:

- AFE - Florence Energy Agency (Italy)
- APE FVG - Energy Management Agency of Friuli Venezia Giulia (Italy)
- CEA - Alternative Energies and Atomic Energy Commission (France)
- RIBERA Consortium (Spain)
- CRES - Centre for Renewable Energy Sources and Saving (Greece)
- GOLEA - Goriška local energy agency (Slovenia)

- INFORMEST (Italy)
- PREDA-PD - Agency for Economic Development of City of Prijedor (Bosnia and Herzegovina)

The SET has been upgraded for its use within the SET PLUS project.

The simplified calculation method presented provides a preliminary assessment of the energy and financial aspects related to energy efficiency investments in public buildings.

The tool does not replace the detailed technical-financial analysis that must always be carried out by professionals and experts in the sector.

The authors may not be held responsible for an improper use of the SET, nor for any calculation errors that may arise with respect to other evaluations carried out with different methods.

### 3. Calculation parameters

Energy assessment implemented in the SET with option A, implies two simplification levels:

- simplification of the building geometry, so as to define dispersion areas starting from a minimum input data, in order to allow a general energy assessment even in the absence of a project or detailed geometric details that the public authority or the ESCO may not have;
- simplification of the building energy calculation through the use of a series of predetermined coefficients defining the climatic context and building utilization.

The parameters for the simplification of the calculation and, in general, all the variables that influence the energy and financial calculations are defined in the "Parameters" sheet. They can eventually be modified in order to provide users with a tool adapted to national or local requirements.

Parameters include:

- **Tab. 1, Energy carrier data.** To facilitate consumption data entry, carriers are listed with their units of measurement, lower calorific values and average unit costs. Each fuel type is associated to an existing or new heat generator defined by an average thermal efficiency value of generation  $\eta_H$ .

- **Tab. 2, data on the climatic context.** This table contains data on conventional heating days and daily heating hours. On the basis of the Heating Degree Days (HDD), 8 climatic zones are defined and for each one of them a monthly distribution of heating days together with a percentage distribution profile of Heating Degree Days (HDD) is specified (the user usually only knows the annual HDD value hence through the settings of Tab.2 all the needed profiles will be calculated automatically).
- **Tab. 3, irradiation on the horizontal plane.** For each degree of latitude, the annual solar irradiation value and the monthly percentage distribution profile of the radiation is indicated. The annual production value of a photovoltaic system (PV), for 1 kWp of installed power is also defined.
- **Tab. 4, irradiation on the vertical plane.** The table shows, for the main orientations (north, east-west, south), the monthly profile of the percentage variations of the solar irradiation values compared to the horizontal plane.
- **Tab. 5, characteristics of the building and interventions.** The following parameters are defined:
  - average internal height of floor and average gross inter-floor height (for gyms the values are doubled by the SET);
  - data for modeling the building geometry by the SET, such as the maximum size to be assigned to the short side of the building and the minimum ratio between sides; these predefined values enable to determine the surface area to volume (S/V) ratio of the building with a good approximation in most cases;
  - increase in external temperatures compared to historical data (for Italy, a value of +0.5 K has been set on average daily outdoor temperatures, considering the conventional HDD available in the current legislation);
  - incidence factors of thermal bridges in the calculation of heat losses, before and after envelope retrofitting;
  - the average shading factor applied to the glazing areas due to obstructions and fixed systems, as the sum of the shielding effects produced by overhangs, adjacent buildings, vegetation, etc;
  - the value of average internal heat capacity of the building differentiated by "medium structure" and "light structure" (the latter applies to interventions for the internal insulation of the perimeter walls), using the values of the UNI EN ISO 13790: 2008 standard tab. 12;
  - the efficiency value of the heat recovery unit in case of its installation on an existing ventilation or air treatment plant;
  - the estimated value of savings due to the replacement of the lamps with LED systems;
  - the estimated saving value due to the installation of presence and brightness sensors to improve the management of the lighting system.

- **Tab. 6, thermal parameters:**
  - descriptive parameters of buildings (before retrofitting) differentiated by construction period: wall thickness, average glazing area of the building and frame area percentage of windows, typical U transmittance values for walls, floors, roofs and windows, solar transmission factors of glazing;
  - the thermal transmittance values to be adopted in the case of building retrofitting according to the climatic zone (values may change according to each countries legislation).
- **Tab. 7, building usage parameters differentiated by building type:**
  - the internal reference temperature for the heating period;
  - the average value of hourly air changes for ventilation;
  - the average value of internal thermal energy gains;
  - the incidence of hot water on total thermal consumption (hot water is included in the consumption of thermal fuel);
  - the incidence of lighting consumptions on overall electricity consumption (excluding heating if produced with electricity, e.g. heat pumps);
  - the percentage of self-consumption of energy produced by the photovoltaic system, for electrical and thermal uses (if the photovoltaic system is combined with a heat pump).
- **Tab. 8, efficiency of plant subsystems.** Typical efficiency values referring to system emission, distribution and regulation, before and after any intervention. For the emission sub-systems of gyms the reduction value indicated is to be subtracted from the typical efficiency value
- **Tab. 9, financial calculation parameters:**
  - a corrective value that takes into account the expected increase in the average external temperature over the next 20 years;
  - consumption corrector factor, a value for a precautionary calculation method of savings when using the simplified method (option A), determined through a test run on a group of sample buildings where SET consumption values are compared to the ones obtained with an energy diagnosis;
  - the starting date of the loan, set automatically on January 1 of the year following today's date.

If necessary, only parameter values should be modified, not formulas nor links between cells.

## 4. Energy calculations

The SET performs simplified energy calculations through “option A”, according to the 4 phases described below.

### Phase 1. Building geometry calculations

Starting from the simplified input data inserted in sheet "2" box 2, the geometry of the building is modelled, determining the floor area and the perimeter. The latter takes into account the maximum size of the short side and the minimum ratio between the sides in the "Parameters" sheet (table 5). The windowed surface is determined as a percentage of the façade areas, depending on the construction period of the building (Table 6). All dispersion surface areas are confirmed or adjusted according to the values inserted in sheet "3" box 6.A, in the cases where the intervention affects the entire dispersion surface area (specify in the drop-down menus of sheet "4" box 4) .

### Phase 2. Building thermal dispersions

In step 1 the heat transfer coefficient of the building  $H_{tr}$  [W / K] before and after the intervention is applied to the building geometry. Then the respective net energy demand values for heating  $Q_{H,nd}$ , is defined by means of a simplified calculation (with a monthly resolution) according to the UNI EN ISO 13790 and UNI TS 11300-1 standards.

### Phase 3. Plant losses and savings on the thermal energy supplied

Heat losses due to the heating subsystems are added to the net heating energy needs, calculated before and after the planned interventions, applying the system efficiency coefficients indicated in the "Parameters" sheet (tables 1 and 8). Heating energy needs can be subdivided into two fuel types - if indicated in sheet "2" box 3.A - in proportion to the consumption entered as baseline.

On the energy supplied to the building - before the intervention - the share of thermal energy for hot water is determined and added (when the production is combined with heating).

The unit energy cost is applied to the savings of each fuel type and, in the case of heating with a heat pump, the self-consumption contribution of the photovoltaic system, if any, is deducted.

On the savings for each type of fuel an energy unit cost is applied and, in the case of heating with a heat pump, the self-consumption contribution of the photovoltaic system is deducted.



Finally, savings are precautionarily reduced, before being used in the financial plan. The corrective factor of the savings, indicated in the tab. 9 of the "Parameters" sheet, was determined through a test run on a group of sample buildings where SET consumption values are compared to the ones obtained with an energy diagnosis.

## Phase 4. electricity savings calculation

Electric energy savings due to improvements of the lighting system are calculated by applying the savings percentages ("Parameters" sheet table 5) to the share of electrical consumption attributed to lighting ("Parameters" sheet, table 7) and to the building portion affected by the plant indicated in sheet "4". The final result also takes into account the installation of a photovoltaic system and the related self-consumption.

## 5. Financial calculations

The parameters for financial calculations are inserted in Sheet "5", boxes 7 and 8. Project outline data such as duration of the project, general inflation rates of the energy carriers and the IRR\* (that is the minimum project return required by the market for projects with a similar risk reward profile) is defined in box n. 7. The subsidy displayed in Sheet "5" is automatically calculated and also depends on the abovementioned data.

Once all the data has been inserted, the Financial Plan of the project is automatically available in "6 FIN" with the following information:

1. **CASH FLOWS** (on a yearly basis over the entire project period);
2. **FINANCIAL INDICATORS** addressing loan coverage capacity:
  - **DSCR-Debt Service Cover Ratio** ((revenues+incentives) / Debt service. Debt service = Loan payment (Current Portion of Long-Term Debt [CPLTD] + interest). DSCR is calculated on a yearly basis);
  - **LLCR-Loan Life Coverage Ratio** (NPV - Net Present Value of the cash flows available for loan repayment/total loan ).

Sales revenues are the savings of the municipality/public body that stem from the energy conservation measures of the project in the form of a concession fee without VAT to be paid to the ESCO/provider who carries out the interventions.

The analysis is only based on simplified financial calculations (cash flows and financial indicators), with no income statement or other economic indicators of the project for

ESCOs and builders, furthermore this information would not be useful for our purpose that is to determine the minimum subsidy/grant that makes the project financially sustainable according to average market benchmarks.

All input data for the financial plan calculations are pre-defined and entered directly by the Public Contracting Authority (PCA) except for the information on the debt structure of the ESCO/provider which is provided directly (PCAs ask all proposers to fill in box 8 of sheet n.5 themselves). Debt structures may fluctuate between 100% **self-financing** (all investments covered by own resources) and 100% **debt-financing** (all resources are provided by third parties, in our case a bank loan). It is evident that different debt structures involve different debt service expenditures and a different effects on cash flows. Each ESCO / company therefore has its own specific financing structure (specific mix of own resources, loan and subsidy in order to realize the investment.

The definition of the financial data, in addition to the direct processing in Sheet "6 FIN" of the data included in the previous pages, is also based on parameters calculated in the following three sheets of the SET Excel tool:

1. **Sheet "F-Calc Mortgage loan"** (loan calculation sheet) that according to the amount, duration and interest rate of the loan, provides details on: number of loan payments, debt service (interest) and capitol composition of each payment;
2. **Sheet "F-VAT bridging loan"** (VAT bridging loan calculation sheet) VAT Value Added Tax is an import tax paid on the initial investment, since VAT is recoverable in a relatively short period of time compared to the duration of the loan by the ESCO/builder it is subject to a specific bridging loan which differs from the senior debt for the initial investment, it is always a loan though so general conditions are to be inserted in the sheet as for the Mortgage loan;
3. **Sheet "F-Calc Subsidy"** (subsidy calculation sheet) instead, provides the amount - in Euros - of the grant that guarantees a minimum return on the project equal to the one required by the market for projects with a similar risk reward profile (IRR\*) considering the achievable savings, the investment amount and the above mentioned IRR\*.

The "**Price list**" sheet for all the foreseen interventions (energy conservation measures) must be filled in carefully. The Public Contracting Authorities (PCAs) shall be provided with an Excel version containing the standard costs regarding the envelope, glazing, installation of thermostatic valves, lamp replacements and photovoltaic installation costs. Other type of costs are more complex and difficult to define as average costs since specific interventions require specific estimations like boiler replacements, heating system efficiency improvements, lighting system energy efficiency improvements or thermal recovering systems on existing AHUs or MCVs.

A pragmatic approach is to carry out an initial evaluation considering measures where standard costs are available because these are the interventions of a correct starting point for a sound energy requalification for all buildings, the golden rule is start from improvements of the envelope (external walls, roof and glazing system) and then pass to other standard measures such as thermostatic valves, lamp replacements and photovoltaic plant installations (as RES Renewable Energy Source).

This approach also enables an easy comparison between different buildings or an analysis of a mix of standard measures (when not all are possible because too expensive) on the same building.

Only once the building/s has/have been identified the other measures regarding plants (boiler replacements, thermal recovering systems etc.) should be addressed.