EU Smart Cities Information System

ECONOMIC MONITORING GUIDE

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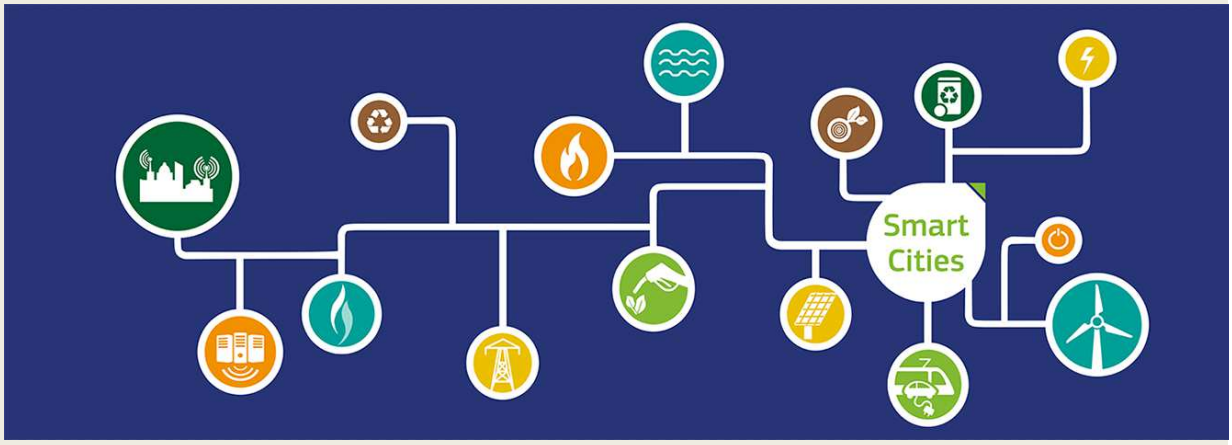

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1. INTRODUCTION

This document has been produced by SCIS on the basis of the CONCERTO Premium Economical Monitoring Guide ("This guideline is elaborated in a way that is not specifically tailored to the existing CONCERTO projects. It can also be applied in future initiatives and projects").

This current guideline is a revision and a document that has been updated based on calls of the European Union under the Horizon 2020 framework. Calls for projects up until 2017 were included. The guideline is aiming at project level, neighbourhood level and city level so with a focus on the projects that have been realized or that will be implemented in the Smart City and Communities (SCC) and Energy-efficiency Buildings (EeB) context. The previous guide focussed on the theoretical aspects of economic monitoring, hence alterations mainly focussed on removing this theoretical content, to align the guide with the SCIS self-reporting tool.

The aim of this guideline is supporting preparation and subsequent implementation of a long-term monitoring method for the collection and assessment of economic data in the building sector. For achieving this objective, an appropriate structure for collection of relevant types of costs is introduced. This is a prerequisite for the objective economic assessment of the respective measures. Furthermore, by providing a common cost structure, meaningful comparisons of assessment results of different projects are enabled.

This guideline is mainly intended for building owners, planners, operators, monitoring experts as well as persons responsible for financial project accounting and provides assistance in the systematic acquisition of data for assessing the economic benefit of measures. However, it can also be used by the respective stakeholders for supporting the development of a permanent data structure for collecting and assessing costs in the context of an already existing cost monitoring method.

2. INTRODUCTION TO THE ECONOMIC MONITORING GUIDE

2.1 Objectives

The success and the acceptance of proposed measures / policy instruments / projects intended to enhance the energy efficiency and to increase the usage of renewable energy sources on neighbourhood level strongly depend on the willingness of the stakeholders to invest in such measures. By conducting an economic assessment of possible measures, stakeholders get valuable information for supporting and justifying their decisions.

The aim of this guideline is to support the collection and processing of data for a subsequent assessment of economic benefits of measures intended to enhance the energy efficiency and to increase the usage of renewable energy sources in municipal context. In order to reach this objective following aspects were introduced:

- an appropriate cost structure for the determination of fixed costs when a building (project) is under construction,
- the investment costs
- and costs occurred when the building (project) is in use (hereafter “operational costs”)

This cost structure enables the systematic, transparent and consistent collection of relevant costs in order to evaluate the economic impact of a measure or policy instrument. There should be a differentiation between total investment costs and energy related investment costs as far as that can be determined.

The economic assessment which is based on the data to be gathered provides answers to, inter alia, the following questions:

- What are the investment costs of energy optimised buildings in comparison to those of conventional buildings?
- Does reducing of the energy consumption result in a reduction of energy costs?
- Is it economically more reasonable to invest in thermal insulation of the building envelope or its improvement or in technical installations or its modernisation, respectively?
- Do buildings with innovative technical installations possibly have higher maintenance costs than buildings with conventional technical installations?
- How do improved energy efficiency and increased use of renewable energy sources affect life cycle costs of a building?
- To what extent are grants and subsidies needed to make investments in the energy related modernisation of a building economically beneficial from the view of selected stakeholders?
- Are the planning costs of energy optimised buildings higher than those of conventional buildings?

This guideline is mainly intended for building owners, planners, operators, monitoring experts as well as persons responsible for financial project accounting and provides assistance in the systematic acquisition of data for assessing the economic benefit of measures. However, it can also be used by the respective stakeholders for supporting the development of a permanent structure for collecting and assessing costs in the context of an already existing cost monitoring method.

It is recommended to continue the economic monitoring after the end of the actual project duration and to convert it into a long-term monitoring process for a singular buiding, a building project of

multiple buildings, a neighbourhood or a city. The effect of measures intended to enhance the energy efficiency and to increase the use of renewable energy sources on maintenance costs can be best identified only if a long-term monitoring is being performed.

Furthermore, it is recommended to adapt or extend the respective applied charts of accounts used for bookkeeping by the different stakeholders in a way that the required cost information can be entered or retrieved automatically and permanently in the desired level of detail. This entered cost information can then be used for economic analysis and assessments.

2.2 Structure and reading aide of this document

- The structure of the guide starts from the “Introduction” in Section 1.
- Section 2: “SCIS Economic Monitoring Methodology”, provides general information regarding monitoring and data requirements.
- Section 3: “Data Handling”, describes the monitoring phases; these are common to any kind of project, it also describes the reference data that have to be taken into account for a proper monitoring. In section 3, the type and structure of cost data that shall be collected is also handled.
- Section 4: “Other Relevant Issues” describes the approach in case of groups of buildings and districts, as well as behaviour aspects related to energy consumption and relevant results from interviews with stakeholders.
- In section 5: “Standards and Literature”, publications relevant for this guide are listed.

3. SCIS ECONOMIC MONITORING METHODOLOGY

3.1 Outline of monitoring

Three phases of an economic monitoring can be distinguished:

- stage I: stage of planning and realisation of the new construction project or the renovation measures
- stage II: intensive monitoring
- stage III: long-term monitoring

Formally, **stage I** is not a part of the monitoring process. However, it can be assumed that, *inter alia*, target and comparative figures for the subsequent monitoring of stage II and III are determined. During the planning process, a detailed calculation of investment costs and estimation of operational costs is carried out. The level of expected future energy costs as part of the operational costs is based on the projection of the expected energy consumption. Expected costs for servicing and maintenance must be either estimated or determined based on existing offers or similar contracts for service contracts. For the planning of maintenance costs during the period in use, inter alia, information about technical service live span of structural elements and building components is required. Especially in the case of new and innovative systems, this information should be provided by the manufacturers (for example a supplier or installer of solar PV rooftop systems).

Determined costs are intended to be used, inter alia, for comparing of variants, for considerations of economic efficiency as well as for the elaboration of target values for a subsequent energy consumption monitoring and operating cost management.

Stage II – the proper monitoring begins with the determination of the actually incurred costs.

Especially in parallel to the monitoring of energy use, in the context of the economic monitoring, the energy costs (and possible energy cost savings) have to be determined. Furthermore, the costs for inspection and servicing have to be collected. It is proposed that stage II should cover a period of at least three years. The self-reporting tool focusses on this stage.

With **stage III,** the transition to a long-term monitoring takes place. Continuously, costs for energy, inspection and servicing have to be determined. It may be necessary to refer the cost values to a common reference year. As an alternative, the present value of the cash outflows can be calculated.

Moreover, the determination of maintenance costs including costs for replacement of building components and systems takes place in stage III. Stage III should cover a period of at least five years. A transition to a permanent energy consumption monitoring and operating cost management is strongly recommended.

Figure 3-1 gives an overview on stages I to III and the embedded starting points for planning and monitoring.

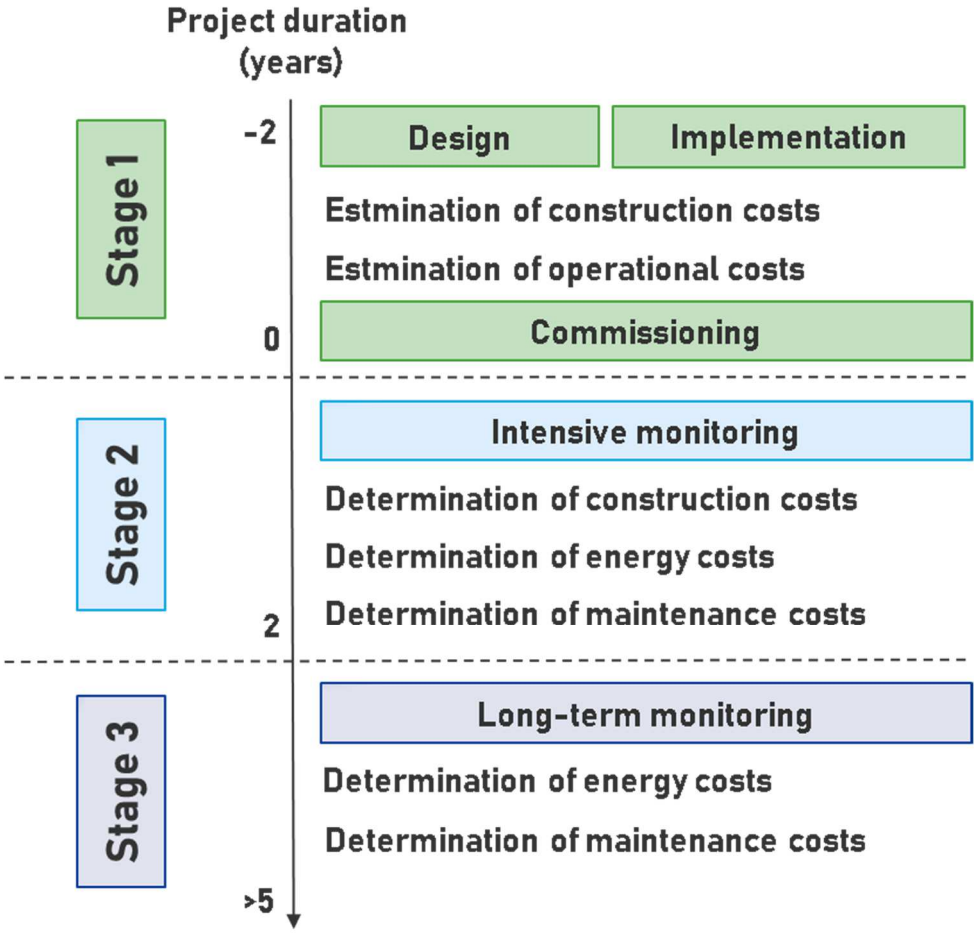

Figure 3-1: Stages of monitoring (Based on illustration from Concerto Premium)

4. DATA HANDLING

4.1 Fundamentals

4.1.1 Handling of cost key values

Assuring transparency and comparability is an essential requirement for the determination and interpretation of key cost values. Therefore, at least the following information for cost data should be available:

- Handling of VAT (not included, included with x %);
- Reference year for the invoiced costs (price level) – e.g. II/2010;
- Type, extent, level of difficulty or quality standard of measures which cause the costs.

Furthermore, it is preferable to specify in case of single measures

- The technical service life of components or systems.

4.1.2 Types of costs to be determined

There are a wide variety of costs which need to be monitored over the respective phases of a project. The determination of the investment costs can be a difficult process. For further information and guidance on this subject, please refer to Annex II. It is important to differentiate between construction and renovation projects. In the case of new construction investment costs are related to entire buildings. In the SCIS self-reporting tool, this investment costs for the entire building are the total investment costs. In the case of renovation, the investment costs are related to a package of measures.

- Investment costs: focus on investment costs relating to energy (because of the nature of the guide)
- Annual costs
  - > Fuel
  - > (other) operational costs (maintenance etc.)

For a more comprehensive costs analysis, like the life cycle assessment see Annex I. Annex II and III provide more insights in the differentiation between costs associated with new build projects and renovation projects. Please refer to these documents in case more detail on this topic is needed.

4.2 Determination of investment costs

4.2.1 Foundations and aims

The determination of investment costs should preferably be based on already invoiced projects or based on actual quotations of suppliers. In case those sources are not available, cost estimations as, based on available estimating methods can be used as well.

The objective of the determination of investment costs in case of new constructions and renovation projects to enable dynamic payback and return on investment calculations.

The costs in the business as usual case (baseline scenario) is used for determination of payback time. Payback time is defined as: additional investment in energy measures and the related reduction of energy costs.

4.3 Determination of operational costs

4.3.1 Determination of energy costs

There are two methods for determining the energy costs:

- the consumption-based determination and calculation (method A) or
- determination based on bills (method B).

For the **consumption-based determination and calculation of energy costs (method A),** it must be possible to use the results of an adequate energy consumption monitoring (based on a metering concept). The energy consumption should thereby be determined separately both for each metering point and energy service and especially summarised for each energy carrier (e.g. natural gas or electricity).

Depending on the metering concept in the building, energy meters for properties, single buildings and parts of buildings or sub-meters for individual energy services (e.g. heating, water heating, cooling) must be read off and evaluated.

For the subsequent calculation of energy costs, tariffs of energy suppliers must be available for the considered periods. Usually, tariffs consist of a base price (e.g. annually charged for each installation) and a demand charge (e.g. price per kWh). Since for the application of method A consumption data need to be available anyway, an adjustment for climatic and location-related conditions is possible.

Method A offers the possibility of generating further energy carrier-specific information, like e.g. direct or indirect CO_2-emissions or CO_2-emission equivalents. For determination of direct or indirect CO_2-emissions or CO_2-emission equivalents, energy-carrier-specific emission factors are needed.

The bills of energy suppliers are the basis for **the determination of energy costs based on bills** (method B). Usually, when using method B, no information from internal energy consumption monitoring is available. That is why an adjustment for climatic and location-related conditions is only possible if the consumption data is stated in the bills of the energy supplier. Figure 4-1 shows the interrelations.

Energy suppliers or utilities treat energy bills often as confidential and can refuse to provide these to other persons or organisations than the owner or user of the building. The confidentiality due to privacy reasons can also be embedded in the legislative. Often, it is possible to acquire aggregated data for several buildings, streets or a residential quarter. These data can be used with a certain level of approximation.

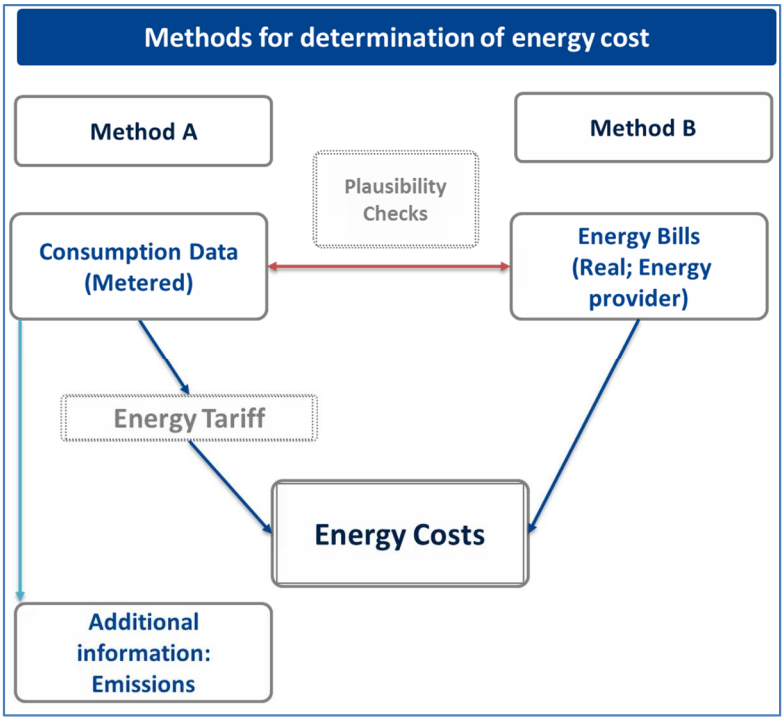

Figure 4-1: Methods for the determination and calculation of energy costs

A plausibility check of the bills is possible through internal metering and monitoring.

Energy costs are categorised under the cost group Q (Operation) according to the CEEC Code of Measurement for Cost Planning edited by the European Committee of Construction Economists (European Committee of Construction Economists, 2008). For more information on this topic please refer to Annex IV. This cost group is assigned to the operational costs. For different energy carriers there should be, *inter alia*, the following sub-cost groups provided: costs for oil, gas, solid fuels, district or local heat and electricity.

When determining energy consumptions and/or energy costs, it is necessary to ensure that energy use is specified in detail. For example:

- Heat consumption including energy for domestic hot water supply;
- Heat consumption for space heating only;
- Electricity consumption for common-area only (e.g. staircase in case of buildings with multiple dwelling or flats);
- Total electricity consumption including household appliances.

The self-reporting tool assists with the selection of energy consumption in relation to its use (see the examples above).

In case of renovation measures, it is desirable that energy consumption and energy costs are determined and stated before and after the energy-related modernisation. If possible, there should also be information about energy consumption so that the costs can be adjusted to a common price level.

4.3.2 Determination of inspection and servicing

When analysing operating costs (excluding fuel costs), the costs for inspection are included here as well. Inspection and servicing are intended for the control and up-keeping of the required or planned status of technical installations.

According to CEEC, inspection, servicing and operation of technical installations are assigned to operational costs (cost group Q). Those costs are incurred regularly on an annual basis.

The costs for inspection and servicing can be determined as a sum of the costs which arose during the whole year. In this case, it has to be documented which building components and systems are included in the inspection and servicing. If possible the costs for inspection, servicing and operation should be directly assigned to the individual building components and systems.

4.3.3 Determination of costs for maintenance and replacement investments

Maintenance is intended for ensuring or re-establishment of functionality and can include repairs. Usually, at the end of the planned service life, replacement investments are necessary, which are also assigned to maintenance.

Maintenance costs are grouped under the cost group operational costs according to CEEC. They form the separate cost group P (Maintenance).

For the determination of maintenance costs there are two possibilities:

- Long-term analysis of maintenance costs according to bills (at least in the context of a long-term monitoring of stage III) or
- analysis of full maintenance contracts.

The costs for maintenance and replacement investments can be determined as a sum of the costs which arose during the year. In this case, it has to be documented which building components and systems are included in maintenance and replacement investments. If possible, costs for maintenance and replacement investments should be directly assigned to the individual building components and systems. At least, the technical service life of relevant building components and systems should be specified.

In practice, it is rather difficult to achieve a long-term analysis of maintenance costs. Experience shows that for new constructions maintenance costs incur only after five years at the earliest or that those costs are covered by guarantee and warranty obligations within this five-year period, respectively.

As an alternative strategy, it is recommended to analyse full maintenance contracts or to obtain offers from manufactures if no full maintenance contracts have been concluded yet.

Full maintenance contracts usually include maintenance services and enable a transition of irregular maintenance costs into regular (annual) payments. The exact scope of services of the analysed full maintenance contracts should be examined. Contracts which are called full maintenance contracts can also include services like small spare parts up to the point of replacement of complete components or plant components.

4.4 Determination of payments, costs and revenues

4.4.1 Data collection process: self reporting

One of the goals of the SCIS is that this data collection work involves as much as possible the relevant parties involved in the assessed projects. To facilitate and stream-line the dataset collection, self-reporting and auto-analysis functionalities will be implemented.

The self-reporting allows direct access for the project coordinator and the different experts taking part in the DEMO projects in order to deliver detailed project or monitoring data into the database. This improves the data quality and plausibility of the data since the responsible persons of the demo site are directly involved in the data provision.

In order to make the process of entering the dataset as much user-friendly and timesaving as possible, default auto-completion values are used. Depending on predefined choices (i.e. building types such as office building, hotel, etc.), the crucial inputs are filled with a set of default values. The defaults can be changed if the actual value is known and the changes can be visualised in order to track them easily. This guarantees a complete dataset that allows for further analysis with a minimum effort for the user.

4.4.2 Determination of one-time payments

Investments are the main category of one-time payments of energy transformation units. An investment is defined as cumulated set of payments up to the initial operation of the energy supply unit. The components included in the investment are of major importance. It has to be considered that all components included have to be known to allow for comparability. In addition, the investment-related grants as well as the other investment-related grants are part of the data provision.

4.4.3 Determination of annual payments

The second part of the economic data collection comprises of the collection of data on annual payments (or the corresponding costs/revenues).

The annual costs encompass energy carrier costs and further costs. The annual revenues are net energy sales revenues / grant revenues for

1. Electricity fed into the grid and/or
2. Delivered heating/cooling energy and/or
3. Other additional revenues, e.g. revenues from the sale of residual materials.

4.5 Concluding remark

Economic data are needed to properly assess the benefits and drawbacks of demonstrated technologies. The technologies with best future perspectives combine their technical advantages with a reduction of overall cost.

Experiences from different research projects show that a systematic and significant analysis of investment costs and operating costs operational costs is only possible if the advice given in this guide is followed consequently. Because of the increased future need for reliable data for planning and budgeting reasons in the facility management and for external reporting, it is recommended to align the existing chart of accounts with the cost groups needed for the economic monitoring as described in this guide.

5. OTHER RELEVANT ISSUES

5.1 Approach in case of groups of buildings and districts

The authors would like to point out that this guide describes the approach in case of the determination of investment costs and operational costs for individual buildings and energy systems, mobility projects and ICT related pilot projects. Analogously, the approach can also be applied in case of groups of buildings or it can be up-scaled to a district level. For this, an appropriate typology of buildings and district energy systems should be established and for each representative of a type, the determination of investment costs and operational costs must be accomplished.

5.2 Behaviour aspects related to energy consumption

In the analysis of energy consumption there are a number of behavioural aspects that are relevant to consider. Some of them are typical for residential buildings and other are related to public or commercial buildings, but they can overlap.

An example of behavioural aspects and actions that can influence the behaviour:

- Income of the inhabitants (residential)
- Awarenes level regarding the environment (both)
- Attitude and motivation (both)
- Social and cultural context (residential)
- Age of the inhabitants (residential)
- Acceptance of innovative technologies (both)
- Influenece of the rebound effect (the offset of the beneficial effects of the new technology or other measures taken) (both)
- Dedicated energy management staff (public and commercial)
- Publicly displayed monitoring energy consumption and renewable energy generation (both)
- CSR (Corporate Social Responsibility) made a vital part of the everyday functioning of the whole company (public and commercial)
- Enthusiastic management leading by example (public and commercial)
- Easy access to information (both)
- Involved employees
- Customer engagement (both)

5.3 Alignment with self-reporting tool

Detailed description of the data to be collected and entered in the self-reporting tool can be found in the self-reporting tool guide.

5.4 Non-quantifiable indicators

Several new indicators have been included in the economic monitoring assessment. However, not all these indicators can be quantified in terms of a payback period or monetary values, meaning that there is freedom in the interpretation of these indicators (e.g. customer engagement).

6. STANDARDS AND LITERATURE

DIN 18960:2008-02. (2008). Code DIN 18960:2008-02 User Costs of buildings.

DIN 276-1:2008-12. (2008). Code DIN 276-1:2008-12 Building Costs - Part 1 Building Construction.

European Committee of Construction Economists. (2008). CEEC Code of Measurement for Cost Planning.

ISO 15686-5:2017. (2017). ISO 15686-5:2017 Buildings and constructed assets - Service-life planning - Part 5: Life-cycle costing.

Wöhe, Günter; Döring, Ulrich. (2010). Einführung in die allgemeine Betriebswirtschaftslehre. 24. Aufl. München: Vahlen.

VDI (2000): Economic efficiency of building installations - Fundamentals and economic calculation. No. 2067

7. ANNEX I: LIFE CYCLE COSTS

Annex I provides background information on the determination, structure, and analysis of life cycle costs.

Determining and interpreting life cycle costs is an approach for the assessment of the economic benefit of a building or renovation-modernisation project. These costs can be analysed both as a unity as well as partially and discussed from the perspective of different issues and stakeholders. For a subsequent assessment and interpretation of the economic benefit of energy-efficiency-related measures especially their financial effort (in this context the non-recurring and current effort) as well as their financial benefit (e.g. reduction of energy costs) have to be determined. Thus, with regard to SCIS, a special interest is to determine costs that are linked with energy-efficiency-related measures, for both new and existing buildings. The costs can be linked to the building process stages like planning, construction, use, renovation and possibly demolition and recycling. See examples below:

- Planning costs as part of ancillary investment costs;
- Investment costs (e.g. material costs for structures, labour costs and costs for technical equipment);
- Energy costs,
- Other operating costs – excluding fuel costs (energy)
- Costs for dismantling, demolition and disposal are determined and assessed in the context of renovation measures as well as replacement investments (when necessary).

Investment costs, planning costs and operational costs as well as costs for dismantling, demolition and disposal are part of the life cycle costs. With life cycle costs in the narrow sense (Life-Cycle-Costs) all *cash outflows* that occur during the whole life cycle of a building are classified in different categories. If also *cash inflows* are considered the term life cycle costs in the broader sense (or Whole-Life-Cycle-Costs) is used. For further information about life cycle costing in the narrow and broader sense please refer to ISO 15686-5:2017.

Figure 7-1 gives an overview over the costs in the life cycle of buildings. For the assessments conducted in SCIS, the costs for the construction or the renovation of a building as well as the operational costs (inter alia energy, servicing and maintenance costs including replacement investments and termination (deconstruction, disposal) are relevant. All types of costs that are relevant in the context of SCIS are highlighted in red in Figure 7-1.

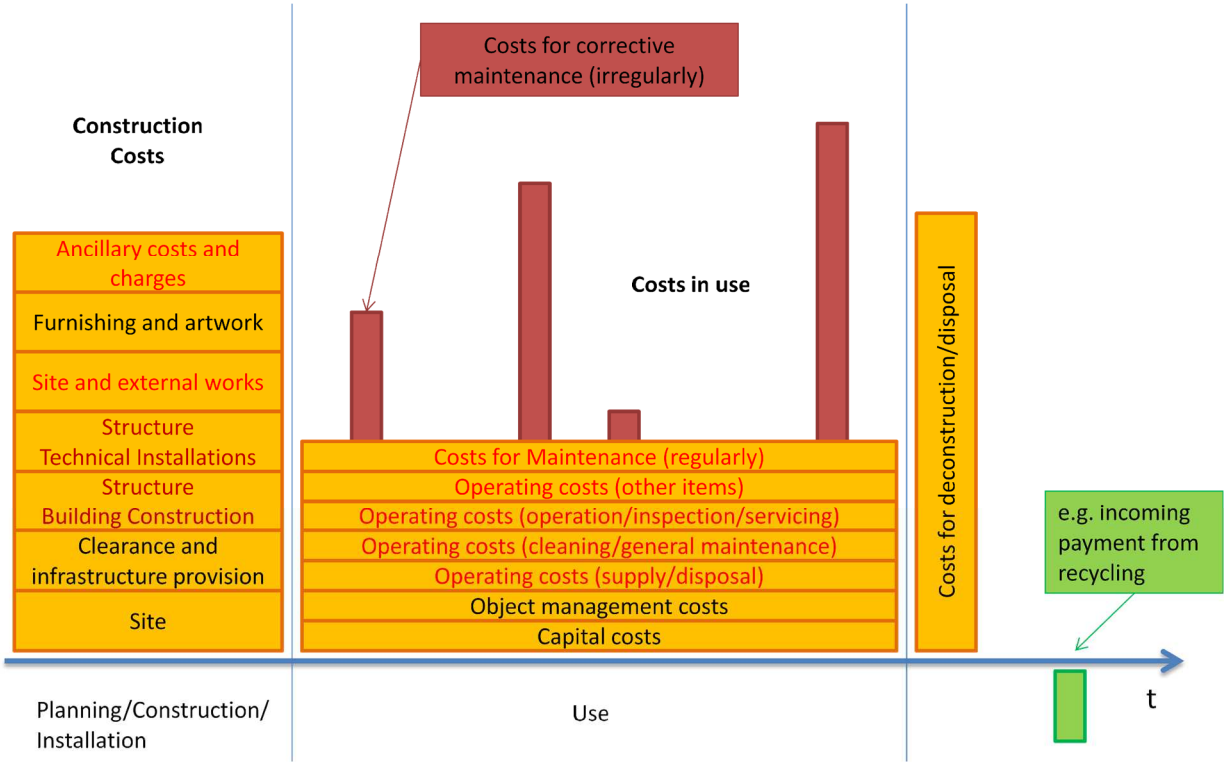

Figure 7-1: Overview of life cycle cost: costs that are relevant for the determination and assessment in the content of this guide are highlighted in red (source: CONCERTO Premium)

During the use or operational phase there are types of costs which occur either regularly or irregularly.

The determination and analysis of costs for maintenance and replacement of investments at the end of the life of building components or systems requires longer periods of monitoring of planned and targeted monitoring in the relevant years, because they only occur after a certain number of years. Those costs are linked closely to the technical reliability and the technical service life of such building components and systems.

8. ANNEX II: DETERMINATION OF COSTS IN NEW CONSTRUCTION PROJECTS

Annex II provides information on the determination of costs is new construction projects. Regarding the type and extent of the determination of costs in case of new construction projects, different cases can be distinguished. In SCIS we propose to use the same cases as it was done in CONCERTO.

- Case A is the preferred variant in case of new constructions. The approach for basic or reference buildings is analogous. A statement of actually invoiced costs after the commissioning of the completed building is the preferred method for collection of investment costs. In this context, at least those cost groups influenced by the energy concept of the building should be determined. Hereunder, we propose the definition of costs for SCIS, on the basis of the CEEC code.
- Case B is the preferred variant in case of packages of measures.
- Case C makes a combination of the features of Case A and B.

Case A: determination of costs for the entire building according to CEEC

In case of the determination of costs for the entire building according to CEEC (case A), at least the costs for structural elements and technical equipment (cost groups A to J in Figure 8-1) should be determined. In those cost groups, inter alia, the costs for the building envelope, the technical equipment and the selected costs for site and external work are included. Additionally, at least planning costs (cost group L) are determined. Figure 8-1 gives an overview on the cost groups according to CEEC for the determination of investment costs.

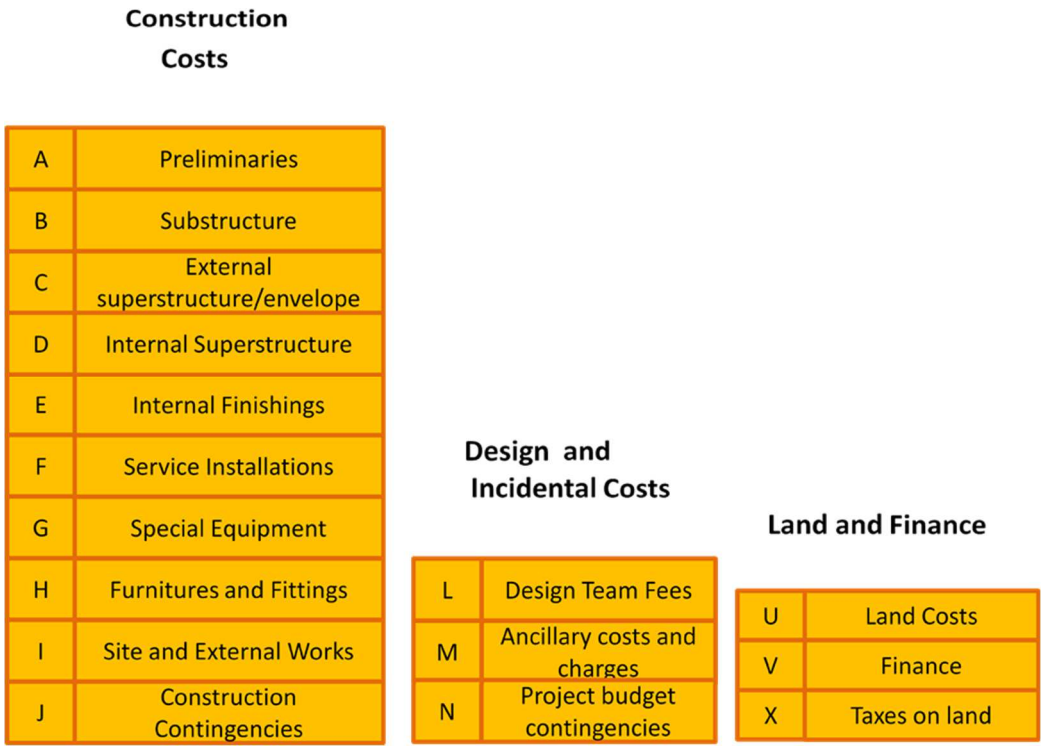

Figure 8-1: Relevant cost groups according to CEEC

During the collection of cost data, the price level has to be documented exactly, i.e. for the determination of costs, the time of the settlement of the costs has to be specified. Furthermore, it has to be stated whether the cost information contains VAT and if so also the amount of VAT (VAT included with x%).

To assure the comparability of the determined costs of different projects (e.g. of the object to be analysed or of the reference or basic object) which special characteristics, levels of difficulties or equipping standards are realised or which special equipping features are implemented, must be included. It can be stated e.g. if a low, middle or high equipping standard of an individual characteristic has been realised. In case of some special elements, like e.g. excavation, distinction should be made referring to the respective level of difficulty.

Case B: determination of costs for energy-efficiency-related additional measures

As an alternative, there is a possibility of specifying selected costs or cost compilations for energy-efficiency-related additional measures or packages of measures.

Generally, additional measures can be divided into:

- energy related and
- non-energy related

Energy-related additional measures improve the energy quality of a building compared to a defined basic variant or which lead to application of renewable energy technologies. Some examples of above mentioned measures are given below:

- insulation windows,
- high level of building shell insulation,
- alternative insulation systems (e.g. VIP – vacuum insulation panels),
- heating systems with increased use of renewable energy sources.

It should be considered that an energy concept can also lead to an omission of costs for construction elements (e.g. omission of costs for heating installations in case of a transition to zero energy buildings or solar photovoltaic modules integrated in roof or façade).

Non-energy related additional measures are measures that do not influence the energy concept of buildings. Examples for non-energy related additional measures are:

- modifications in the layout compared to the basic variant,
- higher equipping standard of the bathrooms, floor covering, etc.
- additional measures due to complex subsoil conditions.

Additional measures can be described either as individual measures or packages of measures (a technical concept). In case of packages of measures, the type and extent of the measures included in the package have to be specified. Furthermore, the benefit (in this context the reduced energy consumption) of each individual measure or of the package of measures has to be stated.

The figure below illustrates the typical features of the approaches in case A, B and C.

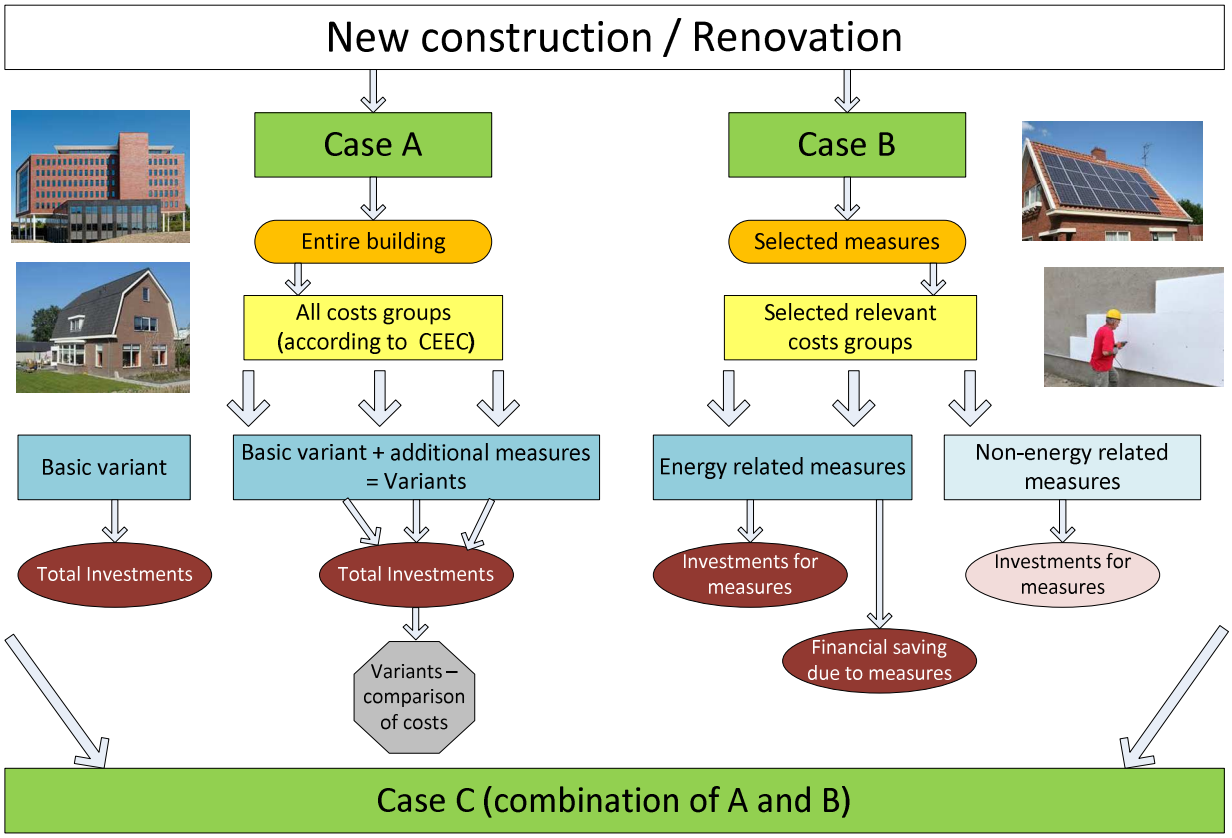

Figure 8-2: Typical features of Case A, Case B and Case C

9. ANNEX III: DETERMINATION OF COSTS OF RENOVATION PROJECTS

Annex III provides additional information on the determination of costs in renovation projects. It uses a similar distinction between projects (Case A, B and C) as in Annex II. In majority of cases, buildings will be renovated and modernised after a certain period in use. Modernisation measures are intended to adapt to new requirements and technical possibilities in contrast to renovation or maintenance measures that focus on the mere enhancing of the quality of constructions and installations. Usually, it should be possible to distinguish renovation and modernisation measures, but sometimes, it can be the same. In numerous cases, modernisation measures are realised in the context of renovation measures that have to be taken anyway. Similar to the approach for new construction projects, the A, B and C cases should be applied, depending on the extent of costs to be determined.

In the context of the SCIS, the analysis of the economic efficiency of measures will focus on the energy-related modernisation of existing buildings. The energy-related modernisation intends to improve the thermal comfort, prevent and remove construction deficiencies and defects, save energy, deploy renewable energy sources as a contribution to the protection of resources, reduce energy costs as well as reduce emissions as a contribution to the protection of the local and global environment.

During the monitoring period, the task is to identify measures of energy related modernisation, to separate them from the other renovation and modernisation measures and to assign the resulting effects (benefits) to them. Therefore, the objective of the of cost data collection is to identify costs that are directly connected to the measures for the improvement of the energy related quality of the building as a whole. These are divided to costs for measures as follows:

- energy related modernisation of the building envelope
  - > e.g. installation of a thermal insulation composite system or renewal of windows;
  - > modernisation of the technical equipment e.g. renewal of the heat generator or installation of renewable energy systems. The costs for energy-related modernisation can either be determined as full or additional costs. The full cost approach is chosen if the energy-related modernisation measures are realised independently from a regular, long-term planned or other renovation activities. In this case, the full costs for the measures taken are assigned to the energy-related modernisation. Figure 9-1 illustrates this situation.

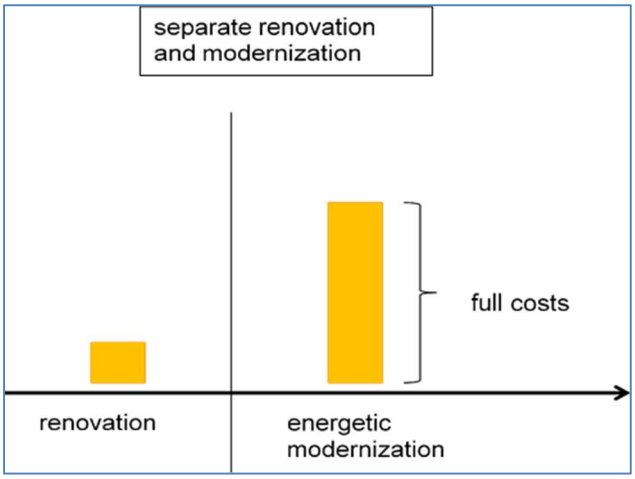

Figure 9-1: Full-cost approach in case of modernisation measures independent of renovation (Source: CONCERTO Premium)

In case of an interlinking with a necessary, regular or long-term planned renovation measures, the full costs for the measures taken can be split into one part, which is assigned to the abovementioned renovation and the other, which is assigned to the energy-related modernisation. The part, which is assigned to the energy-related modernisation is called energy-related additional costs. As related to SCIS, the other part of the full costs is called "fictive costs for the renovation". Figure 9-2 gives an overview on full, additional and fictive renovation costs.

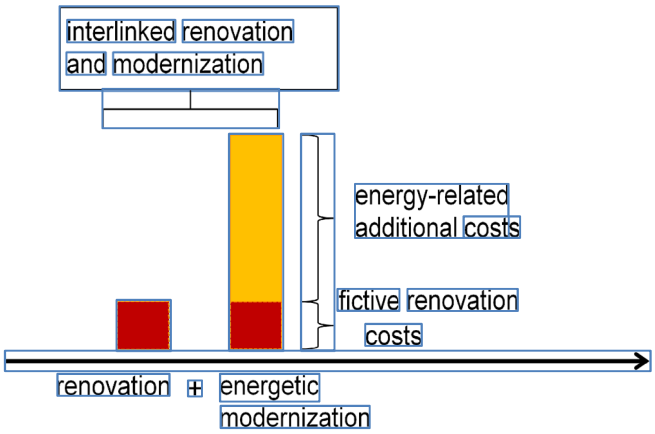

Figure 9-2: Additional cost approach in case of interlinked renovation and modernisation measures (Source: CONCERTO Premium°

Example: If a thermal insulation composite system is installed, costs for scaffolding, removal of the plaster, installation of the thermal insulation composite system, etc. incur. If the full cost approach is applied, those costs are fully charged to the energy-related modernisation. If the installation of the thermal insulation composite system is interlinked with a renewal of the plaster which had to be done anyway the "fictive renovation costs for scaffolding, the removal of the damaged plaster as well as the installation and coating of the new plaster can be subtracted from the full costs. The resulting costs are the energy-related additional costs.

Additionally, for rental buildings, it has to be clarified if and to what extent rents can be raised because of energy-related modernisations. A possibility of increasing the rents is subject to national legislatives, for example in case of social housing. However, it is also possible that a rent increase will be compensated by lower costs of energy.

Case A: determination of costs for the entire building according to CEEC

The given measures (construction work) are assigned to the related cost groups as defined by CEEC for new constructions. During the collection of cost data, the price level has to be documented exactly. For example, for the determination of costs, the time of the settlement of the costs has to be specified. Furthermore, it has to be stated whether the cost information contains VAT and if this is the case also the amount of VAT (VAT included with x%).

If the costs for all measures at the existing building are determined and described, the type and extent of the measures taken as well as the additionally incurred costs must be either specified quantitatively (partial costs) or at least qualitatively (ticking boxes). The type and extent of energy-efficiency-related modernisation measures should be addressed in particular.

In addition to the cost information, detailed information on grants is needed for the economic assessment.

Assuring the comparability of the determined costs of different projects (e.g. of the object to be analysed or of the reference or basic object), it must be additionally mentioned which special characteristics, levels of difficulties or equipment standards are realised or which special equipment features are implemented, respectively. It can be stated e.g. whether a low, middle or high equipping standard of an individual characteristic has been realised. In case of some special elements, like e.g. excavation, the distinction is made referring to the respective level of difficulty.

Case B: determination of costs for selected individual measures or packages of measures

Costs for energy-efficiency-related modernisation measures or packages of measures are determined. Possibly, costs for dismantling, demolition and disposal of building components and systems are added as well. It must be stated if the modernisation measures are implemented in the context of a renovation which Data must be included whether the renovation measures had to be included regardless or not. Depending on this fact, it can be decided if a full or additional cost approach will be applied. If the additional cost approach will be applied, the costs for dismantling, demolition and disposal of removed building components and systems can be possibly assigned to the “fictive renovation costs”.

10. ANNEX IV: STRUCTURE OF THE COSTS TO BE DETERMINED

Annex IV provides information which aides in the pragmatic structuring of the costs to be determined. This structuring enhances the transparency and comparability of the costs to be determined. Different countries have different regulations and practices regarding this structure. This is why, in the context of SCIS, a common structure for the determination of costs has to be used. This possibly requires a restructuring or a reassignment of the types of costs.

The cost structure proposed in SCIS is based on the CEEC Code of Measurement for Cost Planning edited by the European Committee of Construction Economists (European Committee of Construction Economists, 2008). The result is a rather rough structure of the types of costs that occur in the life cycle. For the further approach a more detailed sub-division is necessary. It is proposed to use a sub-division which is based on the German codes for the determination of investment costs (DIN 276-1:2008-12, 2008) and operational costs (DIN 18960:2008-02, 2008) and the regulations of the ISO 15686-5:2008 (ISO 15686-5:2008, 2008), respectively. *Table 10-1* shows the cost groups according to CEEC and the sub-division based on DIN 276. As an example, cost group A (Preliminaries) is sub-divided.

See also Figure 8-2 in Annex II for all relevant cost groups, divided into Investment costs, Design and Incidental costs and Land and Finance Costs.

Table 10-1: Construction cost group subdivided according to CEEC based on DIN 276 and DIN 18960

Cost groups according to CEEC	Detailed sub-division according to DIN 276
A Preliminaries	a1 Protective measures
	a2 Demolition work
	a3 Removal of residual pollution
	a4 Site surface clearance
	a5 Clearance, other items
	a6 Compensations
B Substructure	b1 …
	b2 …
	b3 …
	b4 …
C External superstructure/envelope	c1…
D …	D1…