Smart Cities Information System

Self-reporting guide


EU Smart Cities
Information
System

Contents

Glossary:

BIES	….	Building Integrated Energy Supply
BIPV	….	Building Integrated photovoltaics
HTC	….	Heat Transfer Coefficient (= “U-value”) in W/(m²*K)
ICT	….	Information and Communication Technologies
KPI	…	Key Performance Indicator
SCIS	…	Smart Cities Information System
PED	….	Positive Energy District

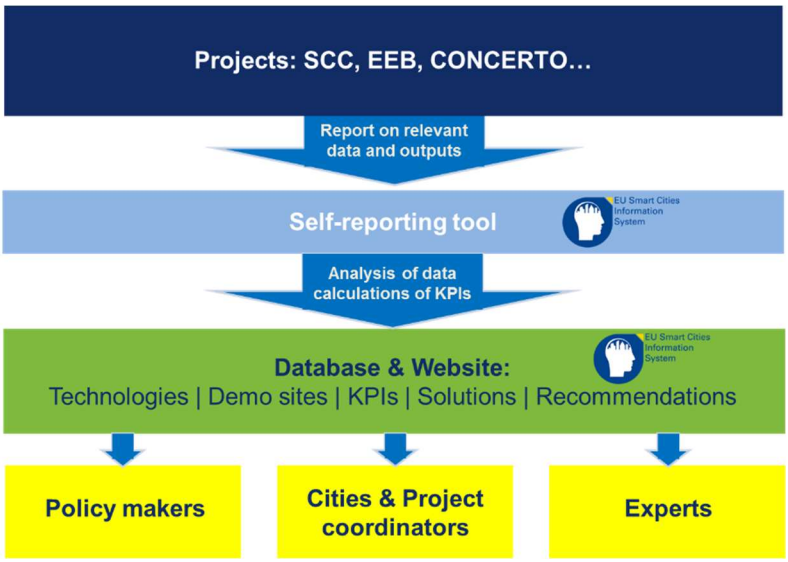
1. Introduction to the tool

The self-reporting Web based tool has been developed by the team working on SCIS. The objective of this development is to provide a tool for project coordinators to report on projects' relevant outputs and information and populate the SCIS database.

The users of the self-reporting tool (project coordinators, for example), will use this tool to upload the relevant information on the different interventions carried out on his/her project: new and refurbished buildings, energy supply units as well as mobility and ICT actions.

The information reported by the user will be stored in the SCIS database. This information will be:

- Visualised as KPIs at http://smartcities-infosystem.eu/
- Available for stakeholders to be exported.



Therefore, the self-reporting tool is the link between the information and outputs from the projects within the scope of SCIS and the stakeholders. The information reported will provide the stakeholders with information that is monitored under real conditions, allowing them to obtain first-hand information with the aim of fostering replication.

The development of this tool has been based on:

- The work done before in CONCERTO;
- The list of KPIs defined by SCIS;
- Agreement with projects coordinators.

Provision of meaningful and consistent energy data is not trivial. **All users of the SRT are strongly advised to take the information in this guide into account when working on the data supply.** Background information on the KPI can be found in the KPI guide.

2. Welcome to the Smart Cities Information System – Self-reporting!

The present guide will lead you through the self-reporting process. During the process you will be asked to:

Self-reporting level	Step
Demo Site level	1. Provide general data about the demo site 2. Create the "Fields of Action" which are relevant for the demo site
Field of Action level	3. Provide data on the "Fields of Action" which were created in step 2 a. Design data b. Monitoring data

Please select from the "DEMO SITES" dropdown list (upper left side), the demo site you are going to report on.


Cells can be left empty when the information is not relevant for the demo site.

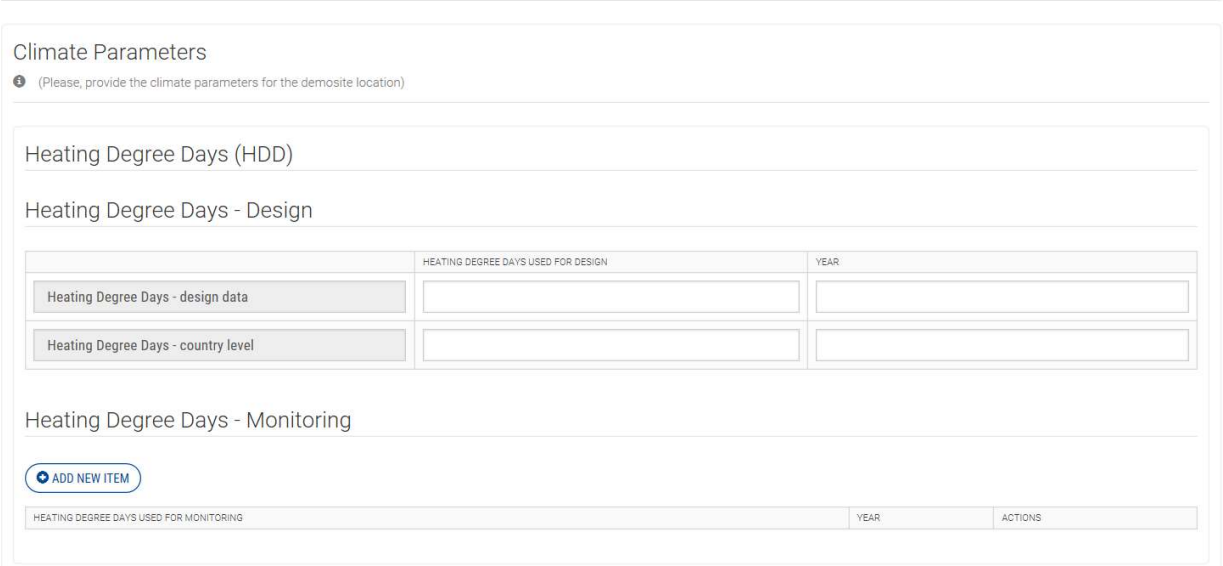
3. Demo site level information

The following fields relate to essential information of the demo site that you are reporting about.

3.1. Climate Parameters

3.1.1. Heating Degree Days (HDD)

Please provide the yearly Heating Degree Days (HDD) and the year that was used to calculate the design data and reference building(s). When the reference HDD refers to a range of years, please provide the average year.



Provide as well the HDD for the monitoring years when relevant. You can add and report as many years as needed with the "+ ADD NEW ITEM" button.

For example:

Let's say the reference HDD from literature for the period 2000-2010 is 3440 HDD. The year should be 2005.

Let's say you are reporting monitoring data for 2010 for a building and for 2011 for a charging station. Only HDD for 2010 are needed since the HDD are not relevant for the monitoring data of charging stations.

3.1.2. Cooling Degree Days (CDD)

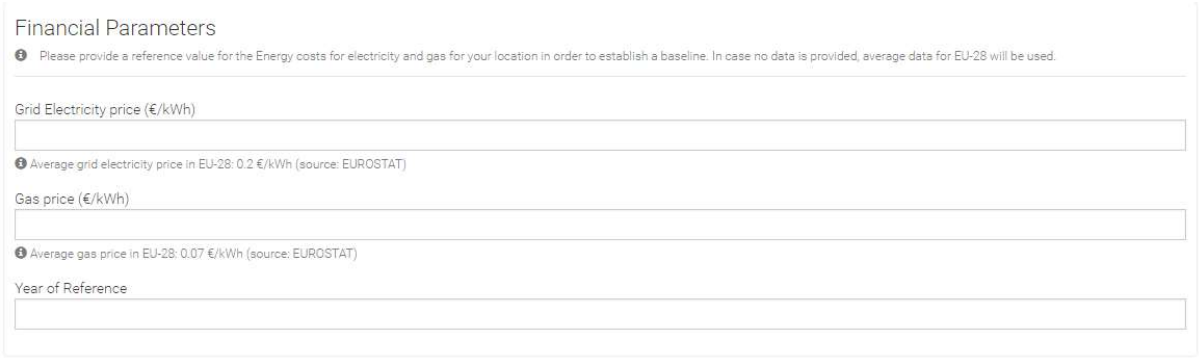
Please provide the yearly Cooling Degree Days (CDD), as done with the HDD, when cooling demand is relevant for your demo site.

3.1.3. Global solar radiation

Please provide the yearly global solar radiation for design and monitoring data, when solar radiation is relevant for the demo site.

3.2. Financial Parameters

The data reported as financial parameters will be used later to properly set the reference systems (reference buildings, reference energy supply unit) in order to calculate the KPIs in the next steps.



Below the entry cells, you can find the average prices which will be used if no data is reported.

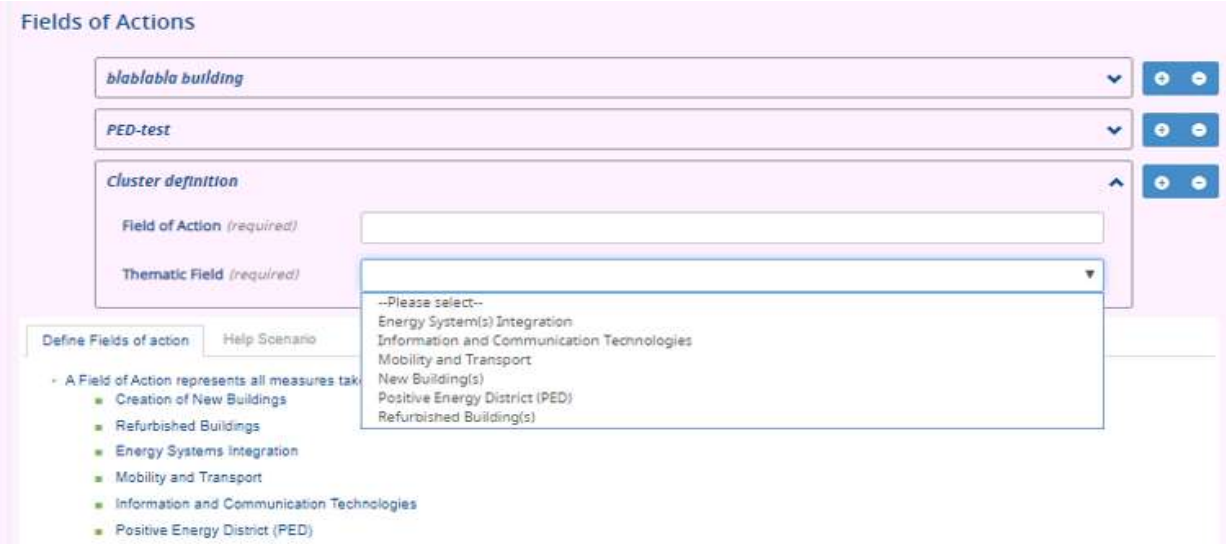
3.3. Fields of Actions

In this section, you will be asked to create a "Field of Action" for each of the interventions relevant for the demo site.

A "Field of Action" represents the different interventions taken within a certain thematic field, which are:

- New Building(s) and their building integrated energy supply (= BIES, such as boilers, PV panels etc.).
- Refurbished Building(s) and their BIES
- Energy Systems Integration not integrated in the building (large biomass plants, etc.)
- Mobility and Transport
- Information and Communication Technologies (ICT)
- Positive Energy Districts (PED)

You can create and delete "Fields of Actions" via the "**+**" and "**–**"**-** symbols from the toolbar.



For example:

Let's say the following measures have been taken at the demo site within the context of the project you are reporting for:

1) 2 new buildings were built, consisting of
   a) 1 new office building with a BIPV
   b) 1 new apartment block with 80% heat from a boiler and 20% from electrical heaters.
2) 10 buildings have been refurbished, consisting of
   a) 1 school
   b) 4 office buildings
   c) 5 apartment blocks
3) Some e-vehicle charging stations / rental have been implemented.
4) A Smartphone-App provides information about the status of the e-vehicle charging stations / rental and public transport.

In the case of this example, you would create at least 7 "Fields of Action":

1. "New Buildings" to report on the new office building
2. "New Buildings" to report on the new apartment block
3. "Refurbished Buildings" to report on the refurbishment of the school
4. "Refurbished Buildings" to report on the refurbishment of the 4 office buildings
5. "Refurbished Buildings" to report on the refurbishment of the 5 apartment blocks
6. "Mobility and Transport"
7. "Information and Communication Technologies"

Please select the Cluster Type(s) and provide a **descriptive and unique** name for each of the selected Clusters. It should be possible to identify the Cluster by the provided name as well as to clearly identify it within the Project Deliverables. We recommend using the project internal naming expanded by additional information, such as the quantity, location and other characteristics.

Examples:

Cluster Type	Cluster Name (given by you)
Energy Systems Integration	1 Biomass plant (4 MW) for district heating
Refurbished Building(s)	4 apartment blocks (12,000 m²; Papyrus Street)
New Building(s)	1 Office building ("Eco Tower 1"; Great Town Plaza)

3.3.1. Buildings

The following is true for both New Buildings and Refurbished Buildings.

 Under certain circumstances, multiple buildings can be clustered and reported as if they were a single building. All of the criteria as described below have to be met.

- The buildings are of the same type of use (e.g. residential building, office building, etc.).
- The buildings are treated as identical / as a building group within the project.

New Building(s)

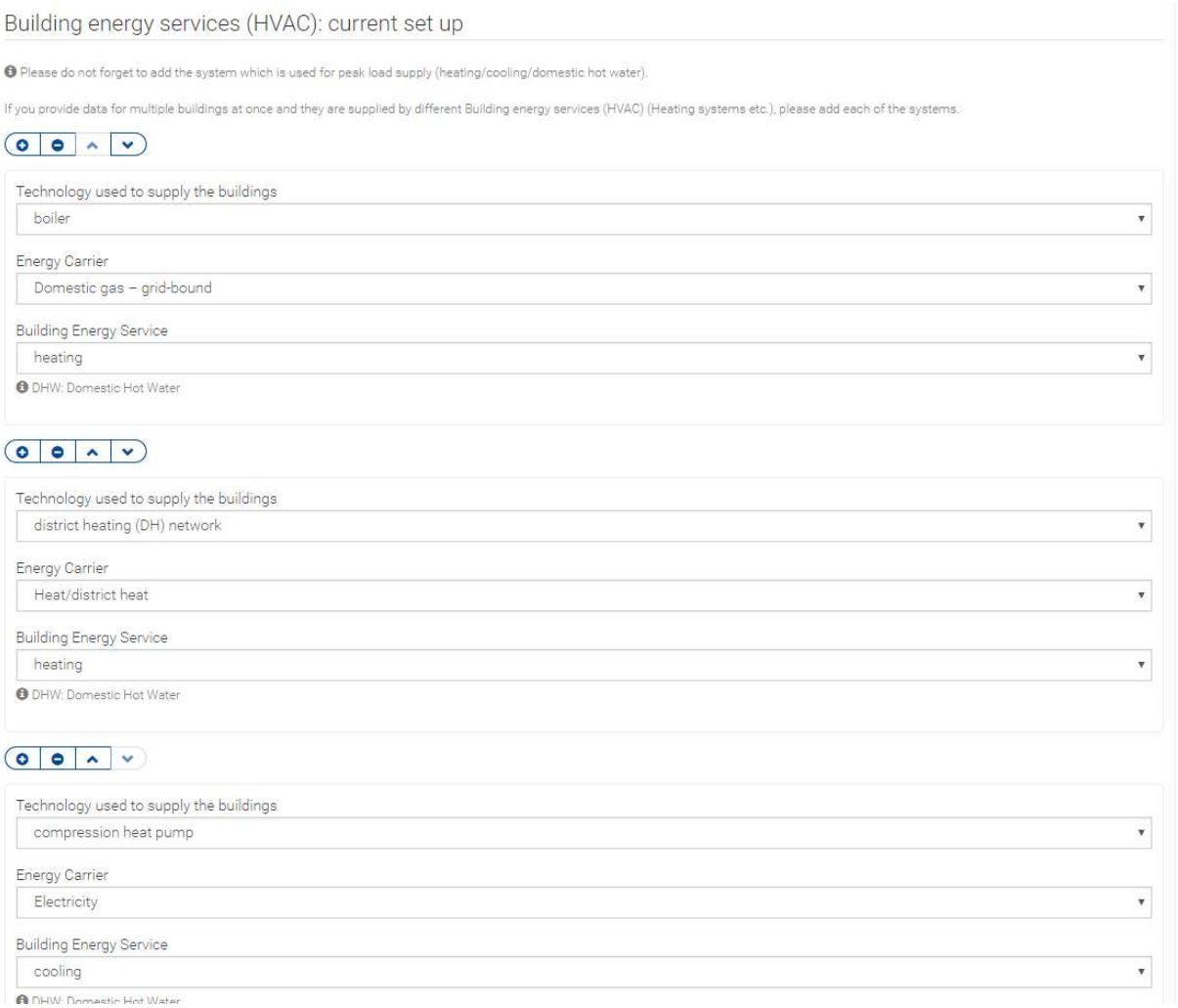
If you provide data for new building(s), you will be asked to provide the energy supply system(s) that is (are) used to supply the building(s). Please state all energy services in the building and report the energy carrier and the related energy services.

Please do not forget to add the system which is used for peak load supply (heating/cooling/DHW) and make sure you add the system "electrical equipment" (unless the building has no electricity connection, which is unlikely). This last system is needed to be able to provide the electrical energy consumption of the dwelling even if no interventions have taken place for this system.

If you provide data for multiple buildings at once and they are supplied by different **building energy supply system,** please add each of the systems. You can define the technology used, type of energy carrier and building energy service from a dropdown list.

For example:

Let's say the information is reported for multiple buildings clustered as one type –> one field of action. These buildings, clustered and reported as one, are supplied by different "Building energy services (HVAC)": 80% of the heat is provided by a boiler and 20% is derived from district heating, 100% of cooling is provided by a compression heat pump. Then, three building energy services should be created.



In the next step, information on **renewable energy** generated at the building is to be provided for the entire building group. You can choose the type of the installed technology based on renewable energy sources from a dropdown list.

- Solar thermal collectors.
- Photovoltaic modules.
- Hybrid collectors (= PVT).

In the next step you will be asked to report on the nominal power of the renewable energy reported.

Refurbished Building

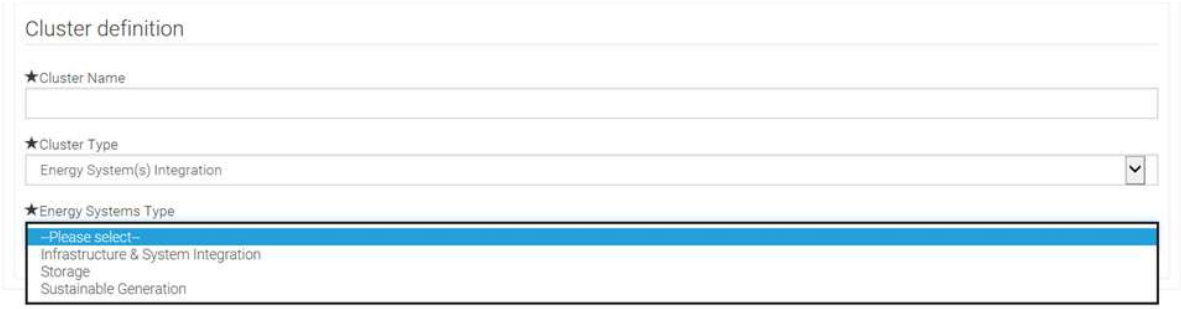
If you provide data for refurbished building(s), you will be asked to provide the Energy Services (HVAC system(s)) that are used to supply the building(s) before and after renovation. Please, create as many energy services as there were and are working on the building, and report the energy carrier and the energy service related.

You can define the technology used, type of energy carrier and building energy service from a dropdown list.

Renewable energy sources are to be filled out for the entire building group after the renovation process. You can choose from a dropdown list of the type of the installed renewables. In an additional field, information about the energy output is requested.

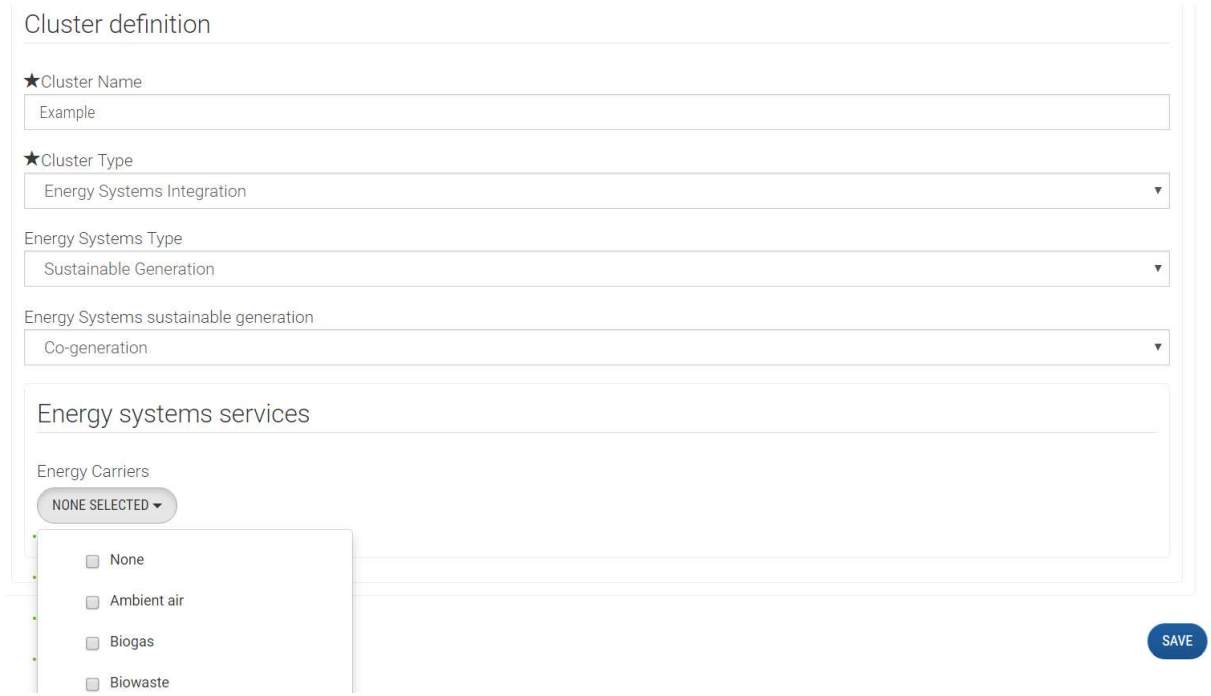
3.3.2. Energy System Integration

If you provide data for energy system integration, you will be asked to specify the type of the system in detail from a dropdown list:



- Infrastructure & System Integration: this is related to the extension of a district heating network. Next, you will have to choose the energy carriers that feed the unit, as many as there are involved.
- Storage: related to the implementation of large storage.
- Sustainable generation: related to the implementation of large energy supply units. If you are reporting on “Sustainable generation”, in the next step you will have to choose from the following dropdown list the system that applies to this cluster:
    - Boiler;
    - Co-generation;
    - Photovoltaic Power Plant;
    - Solar Thermal Plant;
    - Sorption chiller;
    - TRI-generation;
    - Waste heat;
    - Wind turbine.

  Next, you will have to choose the energy carriers that feed the unit, as many as there are involved.



3.3.3. Information and Communication Technologies

Create and name the ICT deployed in the demo site.

3.3.4. Mobility and Transport

When you provide data for the Field of Action “Mobility and Transport”, you will be asked to choose the type of intervention that has been realised:

- Infrastructure: e.g. when only charging stations are deployed within the demo site.
- Vehicles: when only vehicles are deployed within the demo site.

If both activities occur, then two FoA need to be created.

3.3.5. Positive Energy Districts (PED)

The form related with PED reporting is related to the last two EU calls for proposals in H2020 and focuses on the energy performance of a district as a whole. When this thematic field is selected, no further choices are required. The form is based upon the Building Estimate Specification Table (BEST) for positive energy districts. The entire district is one FoA.

3.4. End of the Demo site level

Thank you for selecting all the relevant “Fields of Action” for your Demo site! Please click SAVE to save the selected “Fields of Action” and continue by providing the data for them.

After you clicked “Save“, you will be returned to the top of the website, still within the demo site level. The Fields of Action you just entered during the cluster definition got created and are now listed here with the names you provided.

Please continue by clicking on one of them, to provide the design data and/or monitoring data. You are now at the “Field of Action” level.

To return to the demo site level, you can click on the name of the demo site (upper left side at the top of the website), e.g. in order to dismiss or create more “Fields of Action”.

3.5. The move from Design to Monitoring

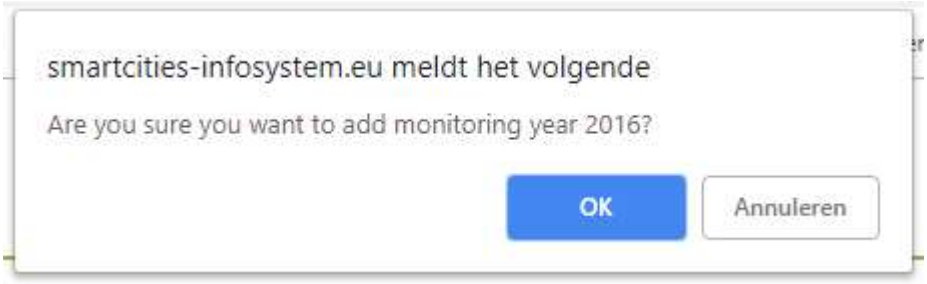
A former version of the SRT featured predefined monitoring forms, that were created for a large series of monitoring years. The user could pick a year and enter data in the form. These forms were created as soon as a field of action was designed in the demosite level of the SRT and saved. Over the years this led to ever increasing lists of years af which most years were not used. The current version only creates monitoring forms on demand. The moment to do this is when the demonstrators have been realized and the monitoring starts. This is important.

As the monitoring forms are created as copies of the design data forms, the data forms get „frozen“ when a monitoring form is created. The monitoring form is prefilled with the design data for ease of use, but of course most design values need to be updated with actual values.

Creating the design form is done by clicking the „Add monitoring“ tab at the top of the design form, see below.

A drop down list appears from which a year can be chosen.

When a year is selected, the user is prompted for a confirmation.



When confirmed, the form is created, but you still have to save the form.

The created monitoring form needs to be saved.

If wanted, the user can create more forms. For visualization purposes on the SCIS wegsite, one needs to be selected. By default this is the most recent year.

In case this is really necessary, monitoring forms can be deleted by SCIS team members with sufficient credentials. When the monitoring forms are deleted, it is possible to modify the design form again. In order to save all the monitoring data already entered, please press ctrl-P in the form and then save the result as pdf.

The request to remove monitoring forms can be sent to info@smartcities-infosystem.eu. Please do not forget to include the URL of the form..

In the next section, you will be guided through the self-reporting of individual interventions created in the previous step

 Design, reference and monitoring data should be reported for the individual interventions.

4. KPI and intermediate parameter calculation .

This section explains the methodology for KPI and intermediate parameter calculation through the self-reporting tool.

4.1. Provision of factors.

In order to calculate the main KPIs, there is a need for specific factors, which are different for every demo site (city) and technology. As an example, if we take from the KPI guide the definition of **"primary energy"** (as will be seen, the Primary energy factor for individual energy carriers is always 1 or larger):

Unit: [kWh/(m²a)]

Input parameters

Name	Symbol	Unit
Delivered energy per energy carrier	$E_{del,,EC}$	[kWh/a]
Exported energy per energy carrier	$E_{exp,EC}$	[kWh/a]
Primary energy factor for the delivered EC	$f_{del,EC}$	-
Primary energy factor for the exported EC	$f_{exp,EC}$	-
Floor area of the building	A	[m²]
Reference time period	t_{ref}	[year]

Calculation

$$E'_P = \frac{\sum(f_{del,EC} \cdot E_{del,EC}) - \sum(f_{exp,EC} \cdot E_{exp,EC})}{A \cdot t_r}$$

Please note that the delivered (consumed) and exported energy per energy carrier in this table are defined per unit of time .

The following factors from the equation cannot be estimated by SCIS:

- “delivered energy per energy carrier”,
- “exported energy per energy carrier”,
- “floor area of the building”,
- “reference time period”

Therefore, they should be self-reported from the projects.

On the other hand, there are a series of basic factors to calculate KPIs that are standardised at national and European level. These factors can be:

- Economic data: prices for energy carriers such as electricity.
- Environmental data: GHG produced per kWh for specific energy carriers.
- Technical data: conversion factors to estimate primary energy consumption per kWh used of a specific energy carrier.

These factors vary not only per technology and energy carrier, but as well per country and technology. Using standardised European values is a valid approach when no other value is available, but the KPIs will be more accurate if specific factors are provided by the projects and therefore used to calculate the KPIs. The list of factors per technology and energy carrier can be observed in following table, the primary energy factor indicates the ratio between the amount of primary energy that is used to generate a unit of electricity or a unit of useable thermal energy, so kWhprim/kWh_e or kWhprim/kWh_{th}:

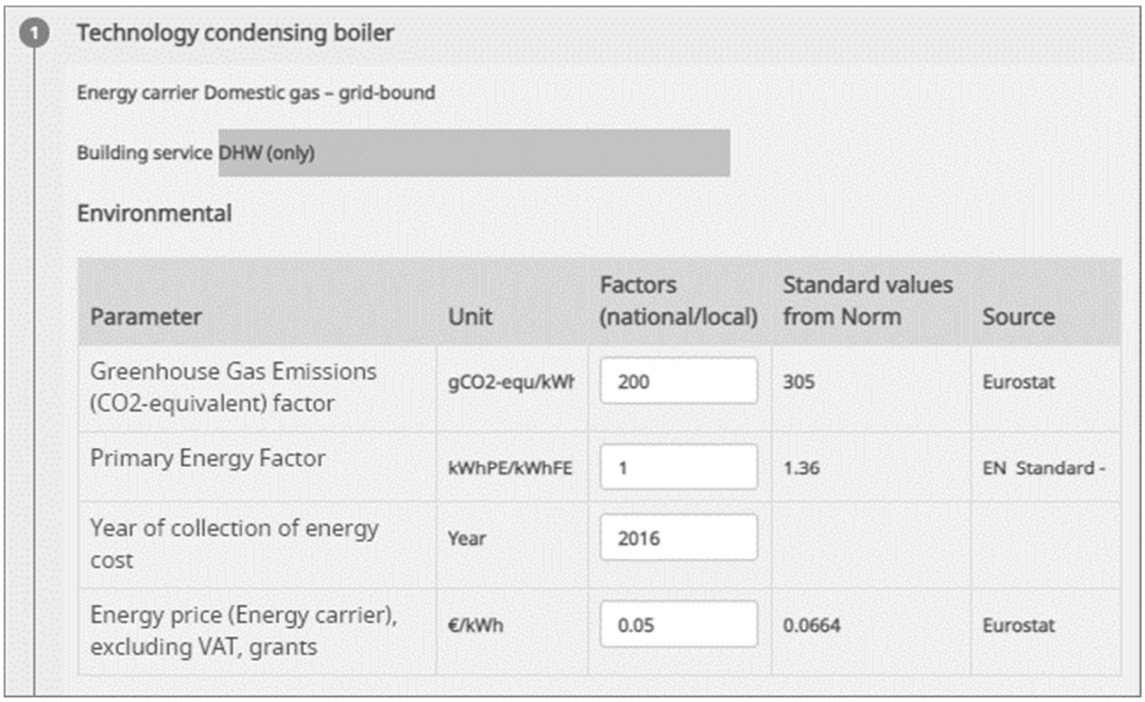
	CO2 -eq factor	Source	Primary Energy factor	Source	Cost	Source
	(g CO2-eq/kWhe)		(kWh/kWhe)		€cent/kWh	
Light oil	299	Covenant of Mayor	1.35	EN Standard - 15603	3.68	Eurostat
Heavy oil	267	Covenant of Mayor	1.35	IINAS	3.475	Eurostat
Domestic gas – grid-bound	305	Eurostat	1.36	EN Standard - 15603	6.64	Eurostat
Domestic gas – from gas tank	305	Eurostat	1.36	EN Standard - 15603	6.64	Eurostat
Hard coal	467	Eurostat	1.53	EN Standard - 15603	3.15	Energy efficiency and renewable energy handbook
Lignite	375	Covenant of Mayor	140	EN Standard - 15603	2.6	Energy efficiency and renewable energy handbook
Wood Chips, 30% moisture	4	Eurostat	1.06	EN Standard - 15603	3.61	Eurostat
Pellets	2	Covenant of Mayor	1.3	IINAS	4.55	proPellets Austria
Energy crop	16	EN Standard - 15603	1.1	EN Standard - 15603	4.55	proPellets Austria
Biogas	98	BRE	2.71	INNAS	4.55	proPellets Austria
Heat/district heat	305	Eurostat	1.36	EN Standard - 15603	5	Eurostat
Cold/district cold	305	Eurostat	1.36	EN Standard - 15603	4	RESCUE Project
Solar radiation	35	Covenant of Mayor	1.14	IINAS	5	Eurostat
Geothermal heat	0	Covenant of Mayor	1.02	IINAS	4	RESCUE Project
Wind energy	7	Covenant of Mayor	1.03	IINAS	7	Eurostat
Potential energy	24	Covenant of Mayor	1.01	IINAS	6	Eurostat
Electricity	617	EN Standard - 15603	3.31	EN Standard - 15603	20.78	Eurostat

List of factors that will be provided to the user within the self-reporting tool.

This list has been updated with the following info:

	Co2 emission factor		Primary energy factor		Cost	
	gCO2-eq/kWhe	Source	kWh/kWhe	Source	eurocent/kWh	Source
Lignite			1,4	EPBD		
Ambient air	0		1		0	
Biowaste	98	as for biogas (lack of data)	2,71	as for biogas (lack of data)	5	as for biogas (lack of data)
LPG	240	SenterNovem	1,1	Ecofys	5	Ecofys
Green Electri	24	Covenant of Mayors	1,01	IINAS	21	Eurostat
Biomass	0	SenterNovem	1,1	Ecofys	4	Ecofys
Waste derive	40	Ecofys	1,3	Ecofys	4	Ecofys
Waste heat	0	SCIS estimation for pure waste heat	1	SCIS estimation for pure waste heat	3	Ecofys

Within the self-reporting tool, these factors will be already prefilled and shown to the user reporting on the demo site, as can be observed in the next figure:



1 Technology condensing boiler

Energy carrier Domestic gas – grid-bound

Building service DHW (only)

Environmental

Parameter	Unit	Factors (national/local)	Standard values from Norm	Source
Greenhouse Gas Emissions (CO2-equivalent) factor	gCO2-equ/kWh	200	305	Eurostat
Primary Energy Factor	kWhPE/kWhFE	1	1.36	EN Standard -
Year of collection of energy cost	Year	2016		
Energy price (Energy carrier), excluding VAT, grants	€/kWh	0.05	0.0664	Eurostat

Provision of factors to ensure filling data gaps within self-reporting.

The user reporting on the data will be able to provide specific values for the factors. Hereby, the factors entered by the user, which are more accurate than those extracted from literature, will be used later to calculate the KPIs.

4.2. Reference

The main KPIs that will be calculated, visualised and used as a basis for providing an insight about the different projects are:

- Final energy consumption and savings.
- GHG emission and savings.
- Primary energy consumption and savings.

These savings refer to a baseline, which can be:

- Previous situation when a renovation is taking place.
- Set by the projects when a new development is taking place. This baseline refers to business as usual (BAU).

SCIS encourages the projects to provide a valid reference to properly calculate the KPIs.

New buildings: SCIS recommends the projects to refer to the minimum technical requirements that a building needs to fulfil at national level, related to national legislation, technical codes etc.

4.3. KPI and intermediate parameter calculation within Self-reporting design forms

4.3.1. Introduction

During the self-reporting, SCIS will provide an automated service of KPIs and intermediate parameter calculation. The KPIs calculated will be shown on the screen to the user and reported in the SCIS website.
The user is able to provide different KPIs calculated by the project if those are more accurate than the ones calculated from SCIS. These ones will be reported in the SCIS website instead of the ones calculated by SCIS.
This section presents the calculations behind the self-reporting tool. These calculations are used to calculate KPIs based on the input reported by the user. The calculated KPIs will be:

- stored in the SCIS database together with the raw data entered by the user;
- visualised in the website.

The included calculations are based on the KPIs guide developed by SCIS. This guide was developed in accordance with European standards and European projects.

4.3.2. New building level

Financial data for the renewable energy source

$$Payback = \frac{\ln\left(total\ revenues \cdot (1+i)\right) - \ln\left(I_{energy} \cdot (1+p) - I_{energy} \cdot (1+i) + (1+p) \cdot total\ revenues\right)}{\ln(1+i) - \ln(1+p)} - 1$$

In order to calculate this value, the following information was previously requested within the self-reporting tool:

- Total investments costs (new building level).
- Grants and subsidies (new building level).
- Electricity production (new building level).
- Heat production (new building level).
- Total operating costs (new building level)
- Grid Electricity price (demo level).
- Gas price (demo level).

Energy related investments (I_{energy})= Total energy related investments costs – grants and subsidies

In the case of PV

Total revenues = electricity production * Grid Electricity price (€/kWh)-operating costs

In the case of solar thermal

Total revenues = (heat production * gas price (€/kWh) /0.9) -operating costs

In the case of hybrid

Total revenues = (electricity production * Grid Electricity price (€/kWh) + heat production * gas price (€/kWh) /0.9) -operating costs

We set the following values:

p = 3% (Inflation of energy)

i = 3% (Discount rate)

The factor of 0.9 takes into account the estimated efficiency of a gas boiler that needs to provide "heat production" less heat.

Financial data for the technology/energy carriers

Total investments costs

Provide this value for the energy carrier related investment as well as the reference (the investment for a business as usual solution)

Total operating costs

Provide this value for the energy carrier related total operating costs as well as the reference operating costs (the operating costs for a business as usual solution)

Grants and subsidies

Provide this value for the energy carrier related grants and subsidies as well as the reference grants and subsidies (the grants and subsidies for a business as usual solution)

Total energy costs

$$Total\ energy\ costs = Final\ energy\ input * energy\ price$$

In order to calculate this value, the following information was previously requested within the self-reporting tool:

- Final energy input (new building level).
- Energy price (new building level). This factor has a default value that can be updated from the user.

Dynamic Payback period

The following formula is used:

$$Payback = \frac{\ln\left(total\ revenues \cdot (1+i)\right) - \ln\left(I_{energy} \cdot (1+p) - I_{energy} \cdot (1+i) + (1+p) \cdot total\ revenues\right)}{\ln(1+i) - \ln(1+p)} - 1$$

In order to calculate this value, the following information was previously requested within the self-reporting tool:

- Total investments costs (new building level).
- Grants and subsidies (new building level).
- Total operating costs (new building level)
- Total investments costs for the reference (new building level).
- Grants and subsidies for the reference (new building level).
- Total operating costs for the reference (new building level)
- Total energy costs (new building level). This value is calculated (as explained above). This value can be also entered by the user, it then overrides the SCIS calculated value.
- Total energy costs for the reference (new building level) . This value is not calculated and must be estimated by the user by multiplying the energy price with the previously used amount of final energy input for this building service

Energy related investments (I_{energy})= (Total investments costs – grants and subsidies) - (Total investments costs_reference -grants and subsidies_reference)

Total revenues = total energy costs_reference - total energy costs value- (operating costs_value-operating costs_reference)

We set the following values:

p = 3% (Inflation of energy)

i = 3% (Discount rate)

Technical KPIs for the building

Total final energy demand

$$= \sum_{1}^{z} final\ energy\ input_{energy\_carrier(i)} + \sum_{1}^{P} final\ energy\ input_{renewable\ energy(j)}$$

Z=total number of energy carriers

P=total number of renewables

Thus, total Final energy demand Is the sum of all given final energy inputs (metered values) PLUS the sum of the RES production values. This way of calculation gives a good impression of the performance of the building, separate from the energy systems.

For the final energy inputs of building services with electricity as the energy carrier (at least one should be present) the final energy input value can be negative if the RES electricity production exceeds the total amount of electricity used.

Final energy demand for Space heating

$$= \sum_{1}^{n} final\ energy\ input_{energy\_carrier(i)} + \sum_{1}^{l} final\ energy\ input_{renewable\ energy(j)}$$

N=number of energy carriers that provide **heating (only)**

L=total number of renewables that provide heating

Final energy demand for Cooling

$$= \sum_{1}^{n} final\ energy\ input_{energy\_carrier(i)}$$

N=number of energy carriers that provide **cooling (only)**

Final energy demand for domestic hot water

$$= \sum_{1}^{n} final\ energy\ input_{energy\_carrier(i)}$$

N=number of energy carriers that provide **DHW (only**)

Final energy demand for electricity

$$\sum_{1}^{n} final\ energy\ input_{energy\_carrier(i)} + \sum_{1}^{l} final\ energy\ input_{renewable\ energy(j)}$$

N=number of energy carriers (service) that use **electricity (only)**

L=total number of renewables that provide electricity

(Please remember that the value entered for the energy carriers should be the net metered values and should be normalised with their specific HDD and CDD, and can be negative if there is a lot of RES electricity production.)

Environmental KPIs for the building

Total GHG emissions

$$\mathrm{Total}_{\mathrm{GHG_{emission}}} = \sum_{i}^{z} \mathrm{energy}_{\mathrm{carrier(i)}}.\ \mathrm{GHG}_{\mathrm{factor}} * final\ energy\ input_{energy\ carrier(i)}$$

z=number of energy carriers

NOTE: The energy_carrier(i).GHG_factor in the SCIS DB has an initial value than can be changed by the user!

Total primary energy demand, see also paragraph 4.1

$$\text{Total}_{primary\ energy\ demand} = \sum_{i}^{z} \text{energy}_{\text{carrier(i)}} . \text{primary}_{\text{factor}} * final\ energy\ input_{(i)}$$

z=number of energy carriers

The primary energy factor used for renewable energy sources is 1 or slightly above, see the table.

Total share of renewable energies

$$\text{Total}_{sha\quad of\ renewable\ energies} = \sum_{1}^{l} final\ energy\ production_{renewable\ energy(j)} / Total\ final\ energy\ demand$$

L=total number of renewables

Economic KPI for the building

The following formula is used, similar to the dynamic payback time for the energy carriers:

$$Payback = \frac{\ln\left(total\ revenues \cdot (1+i)\right) - \ln\left(I_{energy} \cdot (1+p) - I_{energy} \cdot (1+i) + (1+p) \cdot total\ revenues\right)}{\ln(1+i) - \ln(1+p)} - 1$$

In order to calculate this value, the following information is requested within the self-reporting tool:

- Total investments costs (new building level).
- Grants and subsidies (new building level).
- Total operating costs (new building level)
- Total investments costs for the baseline situation (new building level).
- Grants and subsidies for the baseline situation (new building level).
- Total operating costs for the baseline situation (new building level)
- Total energy costs (new building level). This value is calculated. This value can be also entered by the user.
- Total energy costs for the baseline situation (new building level) . This value is not calculated and must be estimated by the user by multiplying the energy price with the previously used amount of final energy input for all building services together

Energy related investments (I_{energy})= (Total additional energy related investments – grants) - (Total additional energy related investments baseline situation -grants baseline situation)

Total revenues = total energy costs_baseline situation - total energy costs_SCIS- (operating costs_demonstration building- operating costs_ baseline situation)

We set the following values:

p = 3% (Inflation of energy)

i = 3% (Discount rate)

4.3.3. Refurbishment level

In case of refurbished buildings, no financial data for the "before refurbishment" situation are requested. Hence no payback calculations take place for the before refurbishment situation. The KPI calculations are similar as those described for new buildings.

4.3.4. Energy system integration level

In this case, the only calculations taking place are those for Environmental KPI and Economic KPI. No energy carrier calculations.

 For all ESI forms the Economic KPI section looks like:

Economic KPI for the Energy System Integration Unit

Title	Unit	Value	Reference value	SCIS calculation
Total Investments (excl. VAT)	€	xxxxxxxx		
Grants	€	xxxxxxxx		
Energy sales revenues for electricity	€/a	xxxxxxxx		
Energy sales revenues for delivered heating energy	€/a	xxxxxxxx		
Energy sales revenues for delivered cooling energy	€/a	xxxxxxxx		
Total Operating costs per year	€/a	xxxxxxxx		
Dynamic Payback Period	a			
Return on Investment	%	xx		
Total energy cost Domestic gas - grid-bound	€/a	xxxxxxxx		

This has been done to facilitate the visualization of results. Not all data are relevant for every situation. This will be dealt with in chapter 6. The last lines provide the possibility to include the energy cost of renewable energy carriers (zero for wind and solar energy).

Sustainable generation

Environmental KPI

Standard values for the Primary energy factor and CO_2 emission factor are used for the calculation of Primary Energy and CO_2 emission (LCA CO_2 Emission factor for Solar Radiation).

For Wind energy the standard values are suggested, but they can be overruled in the energy carrier section.

Total CO_2 emissions = Sum over all energy carriers of (Total Energy Generation [output] * Standard CO_2 Emission factor)

Total Primary Energy Demand = Sum over all energy carriers of (Total Energy Generation [output] * Primary energy factor)

Savings are calculated as Reference value minus Demonstration power plant.

Economic KPI for the energy system integration unit

The following formula for the dynamic payback time is used in the case of solar and wind as primary sources, similar to the dynamic payback time for the energy carriers:

$$Payback = \frac{\ln\left(total\ revenues \cdot (1+i)\right) - \ln\left(I_{energy} \cdot (1+p) - I_{energy} \cdot (1+i) + (1+p) \cdot total\ revenues\right)}{\ln(1+i) - \ln(1+p)} - 1$$

In order to calculate this value, the following information is requested within the self-reporting tool:

- Total investments (excl VAT). (no SCIS calculation)
- Grants. (no SCIS calculation)
- Total investments costs for the reference situation (no SCIS calculation)
- Grants for the reference situation. (no SCIS calculation)
- Sum of all energy sales revenues for delivered energy. This value is not calculated and must be estimated by the user.
- Sum of all energy sales revenues for delivered energy for the reference situation. This value is not calculated and must be estimated by the user.
- Total Operating costs both for the demonstration situation and the reference situation

Energy related investments (I_{energy})= (Total investments – grants) - (Total investments reference situation -grants reference situation)

Note: the reference situation is often zero for investment and grant.

Total revenues = Sum of all energy sales revenues value - Sum of all energy sales revenues reference situation- (Total operating costs value – Total operating costs_reference) – (Sum of all Energy carrier energy costs value - Sum of all Energy carrier energy costs reference situation)

There are a few special cases:

For Trigeneration, the sales revenues are the sum of electricity, heat and cold sales.

For solar thermal, PV and wind energy the energy sales obviously is only electricity.

We set the following values:

p = 3% (Inflation of energy)

i = 3% (Discount rate)

 For energy carriers with a cost, the payback calculation includes in the total revenue calculation the cost of energy in the demonstration and reference situation, see above. This cost is (SCIS calculation) calculated as: Total energy costs <energy carrier>= Energy price *Final energy input.

Storage

Both for electricity and for thermal storage, no calculations of the environmental KPI take place (except for the savings calculation based on the figures provided by the user).

Savings are calculated as Reference value minus Demonstration power plant.

The economic KPI are calculated as under sustainable generation above, where the energy sales revenue for electricity must be interpreted as all annual income generated by the storage, the unit is EUR/a). For example in the case of electricity storage this includes annual fees received for providing primary control reserve. So:

$$Payback = \frac{\ln\left(total\ revenues \cdot (1+i)\right) - \ln\left(I_{energy} \cdot (1+p) - I_{energy} \cdot (1+i) + (1+p) \cdot total\ revenues\right)}{\ln(1+i) - \ln(1+p)} - 1$$

In order to calculate this value, the following information is requested within the self-reporting tool:

- Total investments (excl VAT). (no SCIS calculation)
- Grants. (no SCIS calculation)
- Total investments costs for the reference situation (no SCIS calculation)
- Grants for the reference situation. (no SCIS calculation)
- Sum of all energy sales revenues for delivered energy. This value is not calculated and must be estimated by the user.
- Sum of all energy sales revenues for delivered energy for the reference situation. This value is not calculated and must be estimated by the user.
- Total Operating costs both for the demonstration situation and the reference situation

Energy related investments (I_{energy})= (Total investments – grants) - (Total investments reference situation -grants reference situation)

 Note: the reference situation is often zero for investment and grant

Total revenues = Sum of all energy sales revenues value - Sum of all energy sales revenues reference situation- (Total operating costs value – Total operating costs_reference). Interpreted as indicated above.

Infrastructure and system integration

Primary energy factor and Greenhouse gas emission factor for the energy carrier are used for the calculation of Primary Energy and CO_2 emission.

Total GHG emission factor is provided as CO_2 equivalents.

No financial data in energy carrier block, financial data (investment, grant, operating cost) need to be given at the KPI section for the energy carriers together. The energy cost of the energy carriers is calculated as: Sum of (energy carriers Final energy input * Energy price (of the carrier))

Environmental KPI

Total Primary Energy Demand = Primary energy factor * Final Energy Input

Savings are calculated as Reference value minus Value (of the Demonstration power plant*).

* or the calculated value if no value is entered

Economic KPI

The economic KPI are calculated as under sustainable generation above.

$$Payback = \frac{\ln\left(total\ revenues \cdot (1+i)\right) - \ln\left(I_{energy} \cdot (1+p) - I_{energy} \cdot (1+i) + (1+p) \cdot total\ revenues\right)}{\ln(1+i) - \ln(1+p)} - 1$$

In order to calculate this value, the following information is requested within the self-reporting tool:

- Total investments (excl VAT). (no SCIS calculation)
- Grants. (no SCIS calculation)
- Total investments costs for the reference situation (no SCIS calculation)
- Grants for the reference situation. (no SCIS calculation)
- Sum of all energy sales revenues for delivered energy. This value is not calculated and must be estimated by the user.
- Sum of all energy sales revenues for delivered energy for the reference situation. This value is not calculated and must be estimated by the user.
- Total Operating costs both for the demonstration situation and the reference situation

Energy related investments (I_{energy})= (Total investments – grants) - (Total investments reference situation -grants reference situation)

 Note: the reference situation is often zero for investment and grant.

Total revenues = Sum of all energy sales revenues value - Sum of all energy sales revenues reference situation- (Total operating costs value – Total operating costs_reference) – (Sum of all Energy carrier energy costs value - Sum of all Energy carrier energy costs reference situation)

4.3.5. Mobility and transport level

Vehicles

Technical KPI

The calculations are:

Improvement (%) =100* (After intervention-Baseline situation) / Baseline situation

In the section on modal split, no improvement calculations on the lines public and collective transport, private vehicles and biking and walking

For energy consumption, the calculation is:

Savings (%)=100*(Baseline situation- Value after intervention)/ Baseline situation.

Environmental KPI

The calculations are:

Savings (%)=100*(Baseline situation- Value after intervention)/ Baseline situation.

Economic KPI for the mobility action

The following formula is used

$$Payback = \frac{\ln\left(total\ revenues \cdot (1+i)\right) - \ln\left(I_{energy} \cdot (1+p) - I_{energy} \cdot (1+i) + (1+p) \cdot total\ revenues\right)}{\ln(1+i) - \ln(1+p)} - 1$$

In order to calculate this value, the following information is requested within the self-reporting tool:

- Total investments (Mobility and transport level).
- Grants (Mobility and transport level).
- Net energy savings/value of improvements (Mobility and transport level).
- Total operating costs (Mobility and transport level).

Mobility related investments (I_{energy})= Total investments costs – grants

Total revenues = Net energy savings/value of improvements - Total operating costs

Infrastructure

Energy consumption data aggregated by sector fuel (GJ)

No calculations

Transport system

Percentage improvement calculations: Improvement (%)=100*(Value after intervention-Baseline situation)/ Baseline situation.

Kilometers

No calculations

Environmental KPI

Percentage savings calculations: Savings (%)=100*(Baseline situation- Value after intervention)/ Baseline situation.

Economic KPI for the mobility infrastructure action

The following formula is used

$$Payback = \frac{\ln\left(total\ revenues \cdot (1+i)\right) - \ln\left(I_{energy} \cdot (1+p) - I_{energy} \cdot (1+i) + (1+p) \cdot total\ revenues\right)}{\ln(1+i) - \ln(1+p)} - 1$$

In order to calculate this value, the following information is requested within the self-reporting tool:

- Total investments (Mobility and transport level).
- Grants (Mobility and transport level).
- Net energy savings/value of improvements (Mobility and transport level).
- Total operating costs (Mobility and transport level).

Mobility related investments (I_{energy})= Total investments – grants

Total revenues = Net energy savings/value of improvements - Total operating costs

4.3.6. ICT level

Demand Side Management

The calculations are:

Improvement (%) =100* (Baseline situation- After intervention) / Baseline situation

Infrastructure

The calculations are:

Improvement (%) =100* (After intervention-Baseline situation) / Baseline situation

Focus on Energy Savings

The calculations are for:

- Flexibility from energy players by increase of load capacity participating in demand side management
- RES and DER hosting capacity
- Hosting capacity for electric vehicles and other new loads

Improvement (%) =100* (After intervention-Baseline situation) / Baseline situation

For:

- Energy price (averaged over a year)
- Peak load level

Improvement (%) =100* (Baseline situation- After intervention) / Baseline situation

Consumers engagement

Percentage improvement calculations: Improvement (%)=100* (After intervention-Baseline situation) / Baseline situation

Environmental KPI

The calculations are:

Savings (%) =100* (Baseline situation- After intervention) / Baseline situation

Economic KPI for the ICT action

The following formula is used

$$Payback = \frac{\ln\left(total\ revenues \cdot (1+i)\right) - \ln\left(I_{energy} \cdot (1+p) - I_{energy} \cdot (1+i) + (1+p) \cdot total\ revenues\right)}{\ln(1+i) - \ln(1+p)} - 1$$

In order to calculate this value, the following information is requested within the self-reporting tool:

- Total investments (ICT level).
- Grants (ICT level).
- Annual value of improvements (ICT level).
- Total operating costs (ICT level).

ICT related investments (I_{energy})= Total investments – grants

Total revenues = Annual value of improvements - Total operating costs

4.3.7. Positive Energy District level

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4.4. KPI and intermediate parameter calculation within Self-reporting monitoring forms

4.4.1. Introduction

During the self-reporting, SCIS will provide an automated service of KPIs and intermediate parameter calculation. The KPIs calculated will be shown on the screen to the user and reported in the SCIS website.
The user is able to provide different KPIs calculated by the project if those are more accurate than the ones calculated from SCIS. These ones will be reported in the SCIS website instead of the ones calculated by SCIS.
This section presents **(for the monitoring forms)** the calculations behind the self-reporting tool**)**. These calculations are used to calculate KPIs based on the input reported by the user. The calculated KPIs will be:

- stored in the SCIS database together with the raw data entered by the user;
- visualised in the website.

The included calculations are based on the KPIs guide developed by SCIS. This guide was developed in accordance with European standards and European projects.

4.4.2. New building level monitoring forms

Financial data for the renewable energy source

$$Payback = \frac{\ln\left(total\ revenues \cdot (1+i)\right) - \ln\left(I_{energy} \cdot (1+p) - I_{energy} \cdot (1+i) + (1+p) \cdot total\ revenues\right)}{\ln(1+i) - \ln(1+p)} - 1$$

In order to calculate this value, the following information is previously requested within the self-reporting tool:

- Total investments costs (new building level-design form).
- Grants and subsidies (new building level-design form).
- Electricity production (new building level-for this monitoring year).
- Heat production (new building level-for this monitoring year).
- Total operating costs (new building level-for this monitoring year)
- Grid Electricity price (demo level).
- Gas price (demo level).

Energy related investments (I_{energy})= Total energy related investments costs – grants and subsidies. For this calculation, **the data from the design form are taken**, please make sure these are filled out)

In the case of PV

Total revenues = Electricity production * Grid Electricity price (€/kWh)-Total operating costs

In the case of solar thermal

Total revenues = (Heat production * gas price (€/kWh) /0.9) - Total operating costs

In the case of hybrid

Total revenues = (Electricity production * Grid Electricity price (€/kWh) + Heat production * gas price (€/kWh) /0.9) -Total operating costs

We set the following values:

p = 3% (Inflation of energy)

i = 3% (Discount rate)

The factor of 0.9 takes into account the estimated efficiency of a gas boiler that needs to provide "heat production" less heat.

Financial data for the technology/energy carriers

Total operating costs

Provide this value for the energy carrier related total operating costs as well as the reference operating costs (the operating costs for a business as usual solution)

Total energy costs

$$Total\ energy\ costs = Final\ energy\ input * energy\ price$$

In order to calculate the total energy costs, the following information was previously requested within the self-reporting tool:

- Final energy input (new building level monitoring form).
- Energy price (new building level monitoring form). This factor has a default value that can be updated from the user.

Dynamic Payback period

The following formula is used:

$$Payback = \frac{\ln\left(total\ revenues \cdot (1+i)\right) - \ln\left(I_{energy} \cdot (1+p) - I_{energy} \cdot (1+i) + (1+p) \cdot total\ revenues\right)}{\ln(1+i) - \ln(1+p)} - 1$$

In order to calculate this value, the following information was previously requested within the self-reporting tool:

- Total investments costs (new building level-design form).
- Grants and subsidies (new building level-design form).
- Total operating costs (new building level-monitoring form)

- Total investments costs for the reference (new building level-design form).
- Grants and subsidies for the reference (new building level-design form).
- Total operating costs for the reference (new building level-monitoring form)
- Total energy costs (new building level-monitoring form). This value is calculated (as explained above). This value can be also entered by the user.
- Total energy costs for the reference (new building level-monitoring form) . This value is not calculated and must be estimated by the user by multiplying the energy price with the reference used amount of final energy input for this building service

Energy related investments (I_{energy})= (Total investments costs – grants and subsidies) - (Total investments costs_reference -grants and subsidies_reference)

Total revenues = total energy costs_reference - total energy costs_value*- (operating costs_value-operating costs_reference)

* SCIS calculation if no value is provided

We set the following values:

p = 3% (Inflation of energy)

i = 3% (Discount rate)

Technical KPIs for the building

These calculations are the same as for the design form.

Total final energy demand

$$= \sum_{1}^{Z} final\ energy\ input_{energy\_carrier(i)} + \sum_{1}^{P} final\ energy\ input_{renewable\ energy(j)}$$

Z=total number of energy carriers

P=total number of renewables

Thus, total Final energy demand Is the sum of all given final energy inputs (metered values) PLUS the sum of the RES production values. This way of calculation gives a good impression of the performance of the building, separate from the energy systems.

For the final energy inputs of building services with electricity as the energy carrier (at least one should be present) the final energy input value can be negative if the RES electricity production exceeds the total amount of electricity used.

Final energy demand for Space heating

$$= \sum_{1}^{n} final\ energy\ input_{energy\_carrier(i)} + \sum_{1}^{l} final\ energy\ input_{renewable\ energy(j)}$$

N=number of energy carriers that provide **heating (only)**

L=total number of renewables that provide heating

Final energy demand for Cooling

$$= \sum_{1}^{n} final\ energy\ input_{energy\_carrier(i)}$$

N=number of energy carriers that provide **cooling (only)**

Final energy demand for domestic hot water

$$= \sum_{1}^{n} final\ energy\ input_{energy\_carrier(i)}$$

N=number of energy carriers that provide **DHW (only**)

Final energy demand for electricity

$$\sum_{1}^{n} final\ energy\ input_{energy\_carrier(i)} + \sum_{1}^{l} final\ energy\ input_{renewable\ energy(j)}$$

N=number of energy carriers (service) that use **electricity (only)**

L=total number of renewables that provide electricity

(Please remember that the value entered for the energy carriers should be the net metered values and should be normalised with their specific HDD and CDD, and can be negative if there is a lot of RES electricity production.)

Environmental KPIs for the building

These calculations are the same as for the design form.

Total GHG emissions

$$\mathrm{Total}_{\mathrm{GHG_{emission}}} = \sum_{i}^{z} \mathrm{energy}_{\mathrm{carrier(i)}}.\ \mathrm{GHG}_{\mathrm{factor}} * final\ energy\ input_{energy\ carrier(i)}$$

z=number of energy carriers

NOTE: The energy_carrier(i).GHG_factor in the SCIS DB has an initial value than can be changed by the user!

Total primary energy demand, see also paragraph 4.1

$$\text{Total}_{primary\ energy\ demand} = \sum_{i}^{z} \text{energy}_{\text{carrier(i)}} . \text{primary}_{\text{factor}} * final\ energy\ input_{(i)}$$

z=number of energy carriers

The primary energy factor used for renewable energy sources is 1 or slightly above, see the table.

Total share of local renewable energies

$$\text{Total}_{sha\quad of\ renewable\ energies} = \sum_{1}^{l} final\ energy\ production_{renewable\ energy(j)} / Total\ final\ energy\ demand$$

L=total number of renewables

Economic KPI for the building

The following formula is used, similar to the dynamic payback time for the energy carriers:

$$Payback = \frac{\ln\left(total\ revenues \cdot (1+i)\right) - \ln\left(I_{energy} \cdot (1+p) - I_{energy} \cdot (1+i) + (1+p) \cdot total\ revenues\right)}{\ln(1+i) - \ln(1+p)} - 1$$

In order to calculate this value, the following information is requested within the self-reporting tool:

- Total energy related investments costs (new building level-design form).
- Grants and subsidies (new building level-design form).
- Total operating costs (new building level-design form) (This does not need to be entered for every monitoring year)
- Total energy related investments costs for the baseline situation (new building level-design form).
- Grants and subsidies for the baseline situation (new building level-design form).
- Total operating costs for the baseline situation (new building level-design form)
- Total energy costs (new building level-monitoring form). This value is calculated. This value can be also entered by the user.
- Total energy costs for the baseline situation (new building level-monitoring form). This value is not calculated and must be estimated by the user by multiplying the energy price with the used amount of final energy input for all building services together in the baseline situation.

Energy related investments (I_{energy})= (Total additional energy related investments – grants) - (Total additional energy related investments baseline situation -grants baseline situation)

Total revenues = total energy costs_baseline situation - total energy costs_value*- (operating costs_demonstration building- operating costs_baseline situation)

* SCIS calculation if no value is provided

We set the following values:

p = 3% (Inflation of energy)

i = 3% (Discount rate)

4.4.3. Refurbishment level

In case of refurbished buildings, no financial data for the "before refurbishment" situation are requested. Hence no payback calculations take place for the before refurbishment situation. The energy carrier and KPI calculations are similar as those described for new buildings.

4.4.4. Energy system integration level

In this case, the only KPI calculations taking place are those for Environmental KPI and Economic KPI. No energy carrier calculations.

Sustainable generation

Environmental KPI

Standard values for the Primary energy factor and CO_2 emission factor are used for the calculation of Primary Energy and CO_2 emission (LCA CO_2 Emission factor for Solar Radiation).

For Wind energy the standard values are suggested, but they can be overruled.

Total CO_2 emissions = Total Energy Generation [output] * Standard CO_2 Emission factor

Total GHG emissions is currently not calculated

Total Primary Energy Demand = Total Energy Generation [output] * Primary energy factor

Savings are calculated as Reference value minus Demonstration power plant.

Economic KPI for the energy system integration unit

The following formula for the dynamic payback time is used in the case of solar and wind as primary sources, similar to the dynamic payback time for the energy carriers:

$$Payback = \frac{\ln\left(total\ revenues \cdot (1+i)\right) - \ln\left(I_{energy} \cdot (1+p) - I_{energy} \cdot (1+i) + (1+p) \cdot total\ revenues\right)}{\ln(1+i) - \ln(1+p)} - 1$$

In order to calculate this value, the following information is requested within the self-reporting tool:

- Total investments (excl VAT) (ESI level-design form).
- Grants (ESI level-design form) .
- Total operating costs (ESI level-design form)
- Total investments costs for the reference situation (ESI level-design form)
- Grants for the reference situation (ESI level-design form).
- Energy sales revenues for electricity. This value can be also entered by the user. Also fill reference value
- Similar for heating and cooling energy
- Total operating costs for the reference situation (ESI level-design form)

Energy related investments (I_{energy})= (Total investments – grants) - (Total investments reference situation -grants reference situation)

Note: the reference situation is often zero for investment and grant

Total revenues = Net energy sales revenues value - Net energy sales revenues reference situation- (Total operating costs value – Total operating costs_ reference)

There are a few special cases:

For Trigeneration, the sales revenues are the sum of electricity, heat and cold sales

For Waste heat, *Total revenues*=Net energy sales revenues for delivered heating energy - Total waste heat energy cost per year (incl electricity) - Total operating costs

We set the following values:

p = 3% (Inflation of energy)

i = 3% (Discount rate)

For energy carriers with a cost, the KPI payback calculation includes in the total revenue calculation the cost of energy in the demonstration and reference situation.

Storage

Both for electricity and for thermal storage, no calculations of the environmental KPI take place, only the savings are calculated if both reference and "demonstration power plant" values are filled.

The economic KPI are calculated as under sustainable generation above. So:

$$Payback = \frac{\ln\left(total\ revenues \cdot (1+i)\right) - \ln\left(I_{energy} \cdot (1+p) - I_{energy} \cdot (1+i) + (1+p) \cdot total\ revenues\right)}{\ln(1+i) - \ln(1+p)} - 1$$

In order to calculate this value, the following information is requested within the self-reporting tool:

- Total investments (excl VAT) (ESI level-design form).
- Grants (ESI level-design form) .
- Total investments costs for the reference situation (ESI level-design form)
- Grants for the reference situation (ESI level-design form).
- Energy sales revenues for electricity. This value can be also entered by the user. Also fill reference value
- Similar for heating and cooling energy
- Total energy cost

Energy related investments (I_{energy})= (Total investments – grants) - (Total investments reference situation -grants reference situation)

Note: the reference situation is often zero for investment and grant

Total revenues = Net cost savings.

Infrastructure and system integration

Primary energy factor and Greenhouse gas emission factor for the energy carrier are used for the calculation of Primary Energy and CO_2 emission.

Total CO_2eq emissions= Greenhouse gas emission factor * Final Energy Input

Total Primary Energy Demand = Primary energy factor * Final Energy Input

Savings are calculated as Reference value minus Demonstration power plant.

The following formula for the dynamic payback time is used in the case of Infrastructure system integration.

$$Payback = \frac{\ln\left(total\ revenues \cdot (1+i)\right) - \ln\left(I_{energy} \cdot (1+p) - I_{energy} \cdot (1+i) + (1+p) \cdot total\ revenues\right)}{\ln(1+i) - \ln(1+p)} - 1$$

In order to calculate this value, the following information is requested within the self-reporting tool:

- Total investments (excl VAT) (ESI level-design form).
- Grants (ESI level-design form) .
- Total investments costs for the reference situation (ESI level-design form)
- Grants for the reference situation (ESI level-design form).
- Energy sales revenues for electricity. This value can be also entered by the user. Also fill reference value
- Similar for heating and cooling energy
- Total energy cost

Energy related investments (I_{energy})= (Total investments – grants) - (Total investments reference situation -grants reference situation)

 Note: the reference situation is often zero for investment and grant

Total revenues =Sum of energy sales revenues values - Sum of energy sales revenues reference situation- (Total operating costs value – Total operating costs_ reference)

4.4.5. Mobility and transport level

Vehicles

Technical KPI

The calculations are:

Improvement (%) =100* (After intervention-Baseline situation) / Baseline situation

The modal split has no calculations

Environmental KPI

For the environmental KPI and the Energy consumption, the calculations are:

Savings (%) =100* (Baseline situation- After intervention) / Baseline situation

Economic KPI for the mobility action

The following formula is used

$$Payback = \frac{\ln\left(total\ revenues \cdot (1+i)\right) - \ln\left(I_{energy} \cdot (1+p) - I_{energy} \cdot (1+i) + (1+p) \cdot total\ revenues\right)}{\ln(1+i) - \ln(1+p)} - 1$$

In order to calculate this value, the following information is requested within the self-reporting tool:

- Total investments costs (Mobility and transport level).
- Grants (Mobility and transport level).

- Net energy savings/value of improvements (Mobility and transport level).
- Total operating costs (Mobility and transport level).

Mobility related investments (I_{energy})= Total investments costs – grants

Total revenues = Net energy savings/value of improvements - Total operating costs

Infrastructure

Energy consumption data aggregated by sector fuel (GJ)

No calculations

Transport system

Percentage improvement calculations: Improvement (%)=100*(Value after intervention-Baseline situation)/ Baseline situation.

Kilometers

No calculations

Environmental KPI

Percentage savings calculations: Savings (%)=100*(Baseline situation- Value after intervention)/ Baseline situation.

Economic KPI for the mobility infrastructure action

The following formula is used

$$Payback = \frac{\ln\left(total\ revenues \cdot (1+i)\right) - \ln\left(I_{energy} \cdot (1+p) - I_{energy} \cdot (1+i) + (1+p) \cdot total\ revenues\right)}{\ln(1+i) - \ln(1+p)} - 1$$

In order to calculate this value, the following information is requested within the self-reporting tool:

- Total investments (Mobility and transport level – design form).
- Grants (Mobility and transport level – design form).
- Net energy savings/value of improvements (Mobility and transport level).
- Total operating costs (Mobility and transport level).

Mobility related investments (I_{energy})= Total investments – grants

Total revenues = Net energy savings/value of improvements - Total operating costs

4.4.6. ICT level

The calculations are:

Improvement (%) =100* (After intervention-Baseline situation) / Baseline situation

Infrastructure

The calculations are:

Improvement (%) =100* (After intervention-Baseline situation) / Baseline situation

Focus on Energy Savings

The calculations are for:

- Flexibility from energy players by increase of load capacity participating in demand side management
- RES and DER hosting capacity
- Hosting capacity for electric vehicles and other new loads

Improvement (%) =100* (After intervention-Baseline situation) / Baseline situation

For:

- Energy price (averaged over a year)
- Peak load level

Improvement (%) =100* (Baseline situation- After intervention) / Baseline situation

Consumers engagement

Percentage improvement calculations: Improvement (%)=100* (After intervention-Baseline situation) / Baseline situation

Environmental KPI

The calculations are:

Savings (%) =100* (Baseline situation- After intervention) / Baseline situation

Economic KPI for the ICT action

The following formula is used

$$Payback = \frac{\ln\left(total\ revenues \cdot (1+i)\right) - \ln\left(I_{energy} \cdot (1+p) - I_{energy} \cdot (1+i) + (1+p) \cdot total\ revenues\right)}{\ln(1+i) - \ln(1+p)} - 1$$

In order to calculate this value, the following information is requested within the self-reporting tool:

- Total investments (ICT level – design form).
- Grants (ICT level – design form).
- Annual value of improvements (ICT level).

- Total operating costs (ICT level).

ICT related investments (I_{energy})= Total investments – grants

Total revenues = Annual value of improvements - Total operating costs

4.4.7. Positive Energy District level

cvcvc

5. How to fill out the forms

5.1. Building level – New buildings and Refurbished buildings

5.1.1. Design Data

 Design, reference and monitoring data should be normalised with their specific HDD and CDD.

General Data

In the general data field, you are asked to fill in the number of buildings, number of monitored buildings and the year the building or building group is designed to be completed.

Building typology characteristics, dimensions and HTC

In the section on building typology the building is to be described in terms of type (industrial, municipal, residential or tertiary), number of apartments and inhabitants in case of a residential building and number of occupants (users) in case of a non-residential building. Furthermore, values for total gross floor area, total heated net room area (used for KPI calculations) and total cooled net room area have to be entered.

Envelope - Heat Transfer Coefficient (U-Value) and ICT interventions

In this section the planned heat transfer coefficients of the individual parts of the building envelope are entered. Additionally, the heat transfer coefficient according to national requirements and the year of publication of said national guideline are required. At the end of this section you can choose one or more planned ICT technologies included in the new building or new building group (demand response, mobile applications for citizens, neighbourhood energy management system) and one or more building features (Active ventilation control, active sun influx control (shutter, louvers), passive ventilation control (cooling by natural convection of cold air during summer nights), thermal storage (including thermal inertia)).

Parameters - technologies & energy carriers

This section deals with the environmental and economic parameters of the technologies used in the new building or building group as specified on the demo site level. It is split in two sections.

First, environmental and economic data about renewable (solar) energy sources and associated technologies are entered if these were selected at the stage of Field of Action creation. In the case of a photovoltaic system that would be the planned annual energy yield, total investment costs, total annual operating costs and the amount of financial support from grants and subsidies in absolute numbers. The system nominal power is already provided at the FoA creation stage. (Building bound wind energy needs to be provided through a separate FoA on Energy System Integration-> Sustainable generation).

Following the renewable energy sources and technologies each and every technology that is planned to be used in the building according to the data entered on demo site level is defined in more detail (Energy Carriers - Environmental & Economic Parameters). The detailed energy carriers block is divided in three parts: Environmental, Consumption, Financial. (In the case of a **refurbishment buildings form**, the energy carriers section starts with energy carriers before refurbishment. For these, only Environmental and Consumption data are needed.)

Environmental

If Standard Values from Norms are available for the energy carrier indicated for the specific building service, then these data are prefilled. More accurate values can be provided. These will then replace the prefilled ones.

Consumption

The next essential value for energy performance analysis is the annual final energy input (metered value for the energy carrier and normalised with their specific HDD and CDD). With the provision of the overall system performance (ratio of output to input) the characteristics of energy distribution inside the building or building group are presented. ~~Those two parameters allow for the calculation of an annual consumption.~~ E.g. a gas boiler has an efficiency (overall system performance) of about 90%. This means that 90 % of the final (gas) energy input is converted to heat for the building.

 For the final energy inputs of building services with electricity as the energy carrier (at least one should be present), the final energy input value can be negative if the RES electricity production exceeds the total amount of electricity used.

Financial

As far as economic parameters go, the total investment costs and total annual operating costs have to be entered as well as the grants and subsidies used for the construction and operation of the technology. The value for the total annual energy costs of the technology is calculated by multiplying the Energy price (under environmental) with the Final energy input. The SCIS calculation value can be overridden by providing your own calculation. The data in the Value and reference column provide the basis for the (type C) dynamic payback period which is the last parameter of every technology's input module. See the KPI guide section on General Economic Performance Indicators. The reference column should hold the values for the business as usual (BAU) situation (these most likely have zero grants and subsidies, lower investment and higher energy costs)

5.1.2. Key performance indicators

Technical KPI

Once the above-mentioned parameters are entered for each and every technology specified at demo site level, the technical, environmental, economic and social key performance indicators (KPI) can be input. The technical KPIs are demands (= planned energy consumption) for different energy uses such as space heating, domestic hot water and electricity as well as the total final energy demand. The reference building can have different characteristics depending on the national calculation standard. Therefore, the energy demand savings compared to the reference building have to be entered as well. Please note:

All values are kWh/m2a

Total Final energy demand Is the sum of all given final energy inputs (metered values) PLUS the sum of the RES production values. This way of calculation gives a good impression of the performance of the building, separate from the energy systems.

Final energy Demand for Space heating is the sum of all given final energy inputs (metered values) that have the selection: (space) heating only

Final energy Demand for Cooling is the sum of all given final energy inputs (metered values) that have the selection: cooling only

Final energy Demand for DHW is the sum of all given final energy inputs (metered values) that have the selection: DHW only

Final energy Demand Electricity is the value of the given final energy inputs (metered values) for lighting and appliances (has energy carrier electricity) PLUS the sum of the RES production values solar electricity

Environmental KPI

The environmental KPIs focus on the total CO_2-eq emissions, the specific primary energy demand and the total share of local technologies based on renewable energy sources. Values for these KPIs are calculated using the data entered so far.

Total CO2 Emissions is the sum of products final energy input * Greenhouse gas emission factor

Total PE demand is sum of products final energy input * PE factor, plus renewable energy (PE factor =1.

If you have calculated a different value with a proven method, you can input that value and overwrite the calculated figures by entering the figures in the column Value (optional - overrules calculation).

For the reference values please fill the value in the case of a building constructed to building code performance.

Economic KPI

The expenditures are split up into total investment costs (excluding VAT), the total energy related investment costs, the total annual energy costs and operating costs. On the budget side, state the financial amount received from grants. Again, for the baseline values please fill the value in the case of a building constructed to building code performance.

The dynamic payback period and return on investment for the whole building or building group are essential KPIs for future decision making. For all financial KPIs the value for the baseline situation and the values for the demonstration building or building group are required.

Social KPI

The social KPIs encompass citizens directly involved in the project and the number of jobs created due to the project activities (total permanent jobs because of the project, not per year).

5.2. End of the Design Data level

Thank you for filling out all the relevant “Design Data” for this intervention!

- Please save your input.
- Open the monitoring form with the year id that you want to provide data for, see section 3.5.

- Once you have created a monitoring form, the design form is frozen as the monitoring is a copy of it. Do not forget to save data in a form before leaving it.

5.3. Monitoring Data

5.3.1. Energy data

Similar to the section about design data, you can provide monitored energy data for technologies based on renewable energy sources such as photovoltaic and solar thermal applications. Total operating costs (servicing, maintenance,…) excluding the costs of the energy carrier can be provided as well.

The specific energy price per energy carrier and greenhouse gas emission as well as primary energy factors are the first values to input for every energy carrier. If not provided, the standard values from norms are used as stated next to the input fields. Similar to the design data, final energy input (how much has been consumed of this energy carrier, based on actually metered data) and overall system performance should be provided. The last two points to be filled out are the total operating costs for the respective technological application and the total annual energy costs for the respective energy carrier used. The dynamic payback time for the energy carrier is then calculated, but you can also fill your own value.

5.3.2. Key performance indicators

Similar to the input of design data, technical, environmental, economic and social key performance indicators for the demonstration building or group of buildings and the savings compared to the reference building can be entered. The indicators are the same as for the input of design. The economic indicator Total Energy cost per year is the sum of the cost associated with all metered energy carriers. Remember not to forget a building service for electrical appliances, which is especially important to provide the right information if RES production is higher than electricity consumption. In this case the net electricity consumption is negative.

5.4. End of the Monitoring Data level

Thank you for filling out all the relevant “Monitoring Data” for this intervention for all the relevant years!

- Please save your input.

6. How to fill out the forms: Energy system Integration

6.1. Infrastructure and system integration

6.1.1. Design (and monitoring) data

General Data

In this section the user is asked to provide the type of infrastructure system integration (District heating, cooling or both) some details on the system (drop down lists) and the commissioning date for the infrastructure system integration.

Interventions

In this section the user is asked to provide technical information on the system.

Parameters - technologies & energy carriers

This section deals with the environmental and economic parameters of the technology used in the integrated infrastructure energy system as specified on the demo site level.

For the technology that is planned to be used in the renewable energy system according to the data entered on demo site level is defined in more detail (Energy Carriers - Environmental & Economic Parameters). The detailed energy carriers block is divided here in two parts: Environmental, Consumption.

Environmental

If Standard Values from Norms are available for the energy carrier indicated for the specific energy system, then these data are prefilled. More accurate values can be provided. These will then replace the prefilled ones.

Consumption

The next essential value for energy performance analysis is the annual final energy input (metered value for the energy carrier).

Key Performance Indicators (KPIs)

Technical KPI

In this section the user is asked to provide data on the amount of energy flowing in and out of the network.

Environmental KPI

Total CO_2 emissions) and Total Primary Energy Demand should be provided.

Economic KPI for the Energy System Integration Unit

In this section the actual value (of the demonstrator) and a reference value need to be provided for

- Total investments (excl VAT).
- Grants.
- Energy sales revenues for electricity
- Energy sales revenues for delivered heating energy
- Energy sales revenues for delivered cooling energy

- Total operating costs per year
- Dynamic Payback Period
- Return on Investment
- Total energy costs for the energy carrier

A calculation of the dynamic payback time is automatically provided if everything relevant is filled out (including reference values), see section 4.3.4.

Social KPI

The social KPIs encompass citizens directly involved in the project and the number of jobs created due to the project activities (total permanent jobs because of the project, not per year). If there is information on the gross floor area in m² served by the new system, then this can be entered.

6.2. Storage

6.2.1. Design (and monitoring) data

General Data

In this section the user is asked to provide the commissioning date for the energy storage system.

Key Performance Indicators (KPIs)

Depending on the chosen technology (electrical or thermal), KPI on the performance on the storage system should be provided (e.g. maximum charging/discharging power, energy density, storage volume).

Some explanations:

Roundtrip efficiency: This is the ratio of the energy that can be discharged from the battery to the energy that was needed to charge it. For complete battery systems, measured at the grid connection this is of the order of 90%

Discharge time: This is the time for a battery to discharge when no wilfully charging or discharging occurs. This is usually more than a year to half the capacity. It is therefore usually not a crucial parameter as batteries are economically only attractive if they are charged and discharged frequently.

Environmental KPI

Total CO_2 emissions and Total Primary Energy Demand should be provided.

Economic KPI for the Energy System Integration Unit

In this section the actual value (of the demonstrator) and a reference value need to be provided for

- Total investments (excl VAT).
- Grants.
- Energy sales revenues for electricity*
- Energy sales revenues for delivered heating energy*
- Energy sales revenues for delivered cooling energy*
- Total operating costs per year

- Dynamic Payback Period
- Return on Investment
- Total energy costs for the energy carrier

A calculation of the dynamic payback time is automatically provided if everything relevant is filled out (including reference values), see section 4.3.4.

* Applicability dependent on the type of storage

Social KPI

The social KPIs encompass citizens directly involved in the project and the number of jobs created due to the project activities (total permanent jobs because of the project, not per year). If there is information on the gross floor area in m² served by the new system, then this can be entered.

6.3. Sustainable generation

6.3.1. Design (and monitoring) data

General Data

In this field the user is asked to provide some specifics about the technology for the chosen renewable energy system.

Interventions

In this field the user is asked to provide some specifics about the size and performance for the chosen renewable energy system.

Parameters - technologies & energy carriers

This section deals with the environmental and economic parameters of the technology used in the renewable energy system as specified on the demo site level.

For the technology that is planned to be used in the renewable energy system according to the data entered on demo site level is defined in more detail (Energy Carriers - Environmental & Economic Parameters). The detailed energy carriers block is divided here in two parts: Environmental, Consumption.

Environmental

If Standard Values from Norms are available for the energy carrier indicated for the specific energy system, then these data are prefilled. More accurate values can be provided. These will then replace the prefilled ones.

Consumption

The next essential value for energy performance analysis is the annual final energy input (metered value for the energy carrier).

Key Performance Indicators (KPIs)

Depending on the chosen technology, KPI on the performance on the renewable energy system should be provided (e.g. total energy generation output, global solar radiation).

Environmental KPI

Total CO_2 emissions and Total Primary Energy Demand should be provided.

Economic KPI for the Energy System Integration Unit

In this section the actual value (of the demonstrator) and a reference value need to be provided for

- Total investments (excl VAT).
- Grants.
- Energy sales revenues for electricity*
- Energy sales revenues for delivered heating energy*
- Energy sales revenues for delivered cooling energy*
- Total operating costs per year
- Dynamic Payback Period
- Return on Investment
- Total energy costs for the energy carrier

A calculation of the dynamic payback time is automatically provided if everything relevant is filled out (including reference values), see section 4.3.4.

* Applicability dependent on the type of sustainable energy generation

The energy sales revenues for delivered energy for the situation after the project as well as for the reference situation is not calculated and must be estimated by the user.

Social KPI

The social KPIs encompass citizens directly involved in the project and the number of jobs created due to the project activities (total permanent jobs because of the project, not per year). If there is information on the gross floor area in m² served by the new system, then this can be entered.

7. How to fill out the forms: ICT cluster

The following concerns the main information on the ICT intervention deployed within the demo site.

7.1. Design (and monitoring) Data

7.1.1. General Data

In the general data you will be asked to give a name to the intervention and to choose a thematic field of ICT intervention from a dropdown list (Building, Energy System(s) Integration, Mobility&Transport, City Level). Once the field of action is chosen, you will be asked to specify the type of intervention within the thematic field. Please also fill when the intervention was commissioned.

Building	Energy System(s) Integration	Mobility&Transport	City Level
Building Energy Management System Demand Response Monitoring – Feedback to users Mobile applications for citizens Serious Gaming Other	Demand Response Connection to Smart Grid Smart District Heating and Cooling Grids - demand Neighbourhood Energy Management System Other	Mobile applications for citizens Traffic control systems Travel demand management Other	Mobile applications for citizens Urban Data Platform Smart Lampposts Other

7.1.2. Key Performance Indicators (KPIs)

Demand Side Management

In the demand side management section you will be asked to provide data in two main fields in the units given:

- Reliability in terms of power interruptions (Number/a). In this field you will be asked to fill out data in the categories for **baseline situation** and **After intervention**. The self-reporting tool will then calculate the improvement as a percentage of the baseline.
- Power Quality and Quality of Supply (DSO+TSO) in terms of time needed for awareness and solution of grid faults (Minutes). In this field you will be asked to fill out data in the categories for **baseline situation** and **After intervention**. The self-reporting tool will then calculate the improvement as a percentage of the baseline.

Infrastructure

In the infrastructure section you will be asked to provide data in one fields in the units given:

- Number of Smart lampposts (Number). In this field you will be asked to fill out data in the categories for **baseline situation** and **After intervention**. The self-reporting tool will then calculate the improvement as a percentage of the baseline.

Focus on Energy Savings

In the focus on energy savings section you will be asked to provide data in six main fields in the units given:

- Flexibility from energy players by increase of load capacity participating in demand side management (MW): In this field you will be asked to fill out data in the categories for **baseline situation** and **After intervention**. The self-reporting tool will then calculate the improvement as a percentage of the baseline.
- Energy price (averaged over a year) (€/kWh)): In this field you will be asked to fill out data in the categories for **baseline situation** and **After intervention**. The self-reporting tool will then calculate the improvement as a percentage of the baseline.
- Peak Load (in kW): In this field you will be asked to fill out data in the categories for **baseline situation** and **After intervention**. The self-reporting tool will then calculate the improvement as a percentage of the baseline.
- RES and DER (distributed energy resources) hosting capacity (MW): In this field you will be asked to fill out data in the categories for **baseline situation** and **After intervention**. The self-reporting tool will then calculate the improvement as a percentage of the baseline.
- Hosting capacity for electric vehicles and other new loads (MW): In this field you will be asked to fill out data in the categories for **baseline situation** and **After intervention**. The self-reporting tool will then calculate the improvement as a percentage of the baseline.

Consumers engagement

In the consumers engagement section you will be asked to provide data in two main fields:

- Number of end users involved.
- Number of people with increased ability to manage their energy consumption

Environmental KPI

In this section you will be asked to provide data in two main fields in the units given:

- Total CO2 Emissions (in kgCO2eq/a): In this field you will be asked to fill out data in the categories for **baseline situation** and **After intervention**. The self-reporting tool will then calculate the savings as a percentage of the baseline.
- Total Primary Energy Demand (due to the ICT measure implemented) (kWh/a): In this field you will be asked to fill out data in the categories for **baseline situation** and **After intervention**. The self-reporting tool will then calculate the savings as a percentage of the baseline.

Economic KPI

In the Economic KPIs section you will be asked to provide data in the following fields in the units given:

- Total investment excl. VAT (in €): In this field you will be asked to fill out data only for the **intervention state**.

- Grants (in €): In this field you will be asked to fill out data only for the **intervention state**.
- Annual value of improvements (€/a): In this field you will be asked to fill out data only for the **intervention state**.
- Total Operating costs (in €/a): In this field you will be asked to fill out data only for the **intervention state**.
- Dynamic Payback Period (in a)
- Return on Investment (in %)

The dynamic payback period calculation is as for buildings.

Social KPIs

In the social KPIs section you will be asked to fill the following information:

- Citizens directly involved.
- Number of jobs created. (total permanent jobs because of the project, not per year).

7.2. End of the Design Data level

Thank you for filling out all the relevant "Design Data" for this intervention!

- Please save your input.
- Click on the year of the monitoring data you want to provide to continue to the "Monitoring Data" level.

8. How to fill out the forms: Mobility

8.1. Design (and monitoring) Data

After choosing an option from the ones described in section 3.3.4 in this guide, you will be forwarded to the information in the mobility level as follows:

If the type of intervention you chose is **INFRASTRUCTURE:**

8.1.1. General Data

In the general data section you will be asked to fill the following information:

- Technology used (select from drop-down list;
- Description of the intervention;
- Date of commissioning.

8.1.2. KPI's

Energy consumption data aggregated by sector fuel

In this section you will be asked to fill out the values for the following (if applicable for the intervention):

- LPG
- Motor Spirit
- Kerosene - Jet Fuels
- Diesel Oil
- Heavy Fuel Oil
- Natural gas
- Biodiesel
- Electricity - grid
- Electricity – RES

For public transport (BEFORE and AFTER) as well as for private vehicles (BEFORE and AFTER).

Transport system

You are asked to provide data in four main fields in the units given:

- New e-hub/charging/fueling stations [outlets]
- Deployment of bicycle lanes and pedestrian roads [km]
- Deployment of public transport system [km/100000 inhabitants]
- New car sharing/car pooling locations [spaces]

In these fields you will be asked to fill out data in the categories for **baseline situation** and **After intervention**. The self-reporting tool will then calculate the improvement.

Kilometers

You are asked to provide data for public transport (BEFORE and AFTER) as well as for private vehicles (BEFORE and AFTER). Unit is passenger-kilometer.

Environmental KPIs

In the environmental KPIs section you will be asked to provide data in two main fields in the units given:

- Total CO_2 Emissions (in kgCO2-eq/a);
- Total Primary Energy Demand (in kWh/a).

Economic KPIs

In the economic KPIs section you will be asked to provide data (for this intervention) in several fields in the units given (no comparison with a baseline or reference situation):

- Total Investment excl. VAT (in €);
- Grants (in €);
- Net Energy Savings /value of improvements (in €/a);
- Total Operating Cost (in €/a);
- Dynamic Payback Period (in years);
- Return on Investment (in %).

Social KPIs

In the social KPIs section you will be asked to fill the following information:

- Citizens directly involved;
- Number of jobs created (total permanent jobs because of the project, not per year).

If the type of intervention you chose is **Vehicles:**

8.1.3. General Data

In the general data section you will be asked to fill the following information:

- Technology used (electric, hydrogen or biofuel vehicles);
- Description of the intervention;
- Date of commissioning.

8.1.4. KPI's

Number of biofuel/electric/hydrogen vehicles deployed in the area

In this section you will be asked to fill out the values for the following categories:

- Number of cars;
- Number of buses;
- Number of bikes;
- Others;

In these section you will be asked to fill out data in the categories for **baseline situation** and **After intervention**. The self-reporting tool will then calculate the improvement.

Clean mobility utilization

In this section you will be asked to fill out the values for the following categories:

- Number of km's with electric, hydrogen or biofuel vehicles;
- Number of trips with electric, hydrogen or biofuel vehicles;

In these fields you will be asked to fill out data in the categories for **baseline situation** and **After intervention**.

Modal split

In this section you will be asked to fill out the values for the following categories:

- modal split over : public and collective transport/private vehicles/biking and walking; Please make sure the sum of the three percentages you enter is 100%.
- Average occupancy (of all vehicles).

In these fields you will be asked to fill out data in the categories for **baseline situation** and **After intervention**.

Energy consumption

In this section you will be asked to provide data in the following fields in the unit given:

- Final Energy Consumption (in kWh/a): In this field you will be asked to fill out data in the categories for **baseline situation** and **After intervention**. The self-reporting tool will then calculate the savings.

Environmental KPIs

In the environmental KPIs section you will be asked to provide data in two main fields in the units given:

- Total CO_2 Emissions (in $kgCO_2$-eq/a);
- Total Primary Energy Demand (in kWh/a).

Economic KPIs

In the economic KPIs section you will be asked to provide data in several fields in the units given (no comparison with a baseline or reference situation):

- Total Investment excl. VAT (in €);
- Grants (in €);
- Net Energy Savings/value of improvements (in €/a);
- Total Operating Cost (in €/a);
- Dynamic Payback Period (in years);
- Return of Investment (in %).

Social KPIs

In the social KPIs section you will be asked to fill the following information:

- Citizens directly involved.
- Number of jobs created (total permanent jobs because of the project, not per year).

-

8.2. End of the Design Data level

Thank you for filling out all the relevant "Design Data" for this intervention!

- Please save your input.
- Click "Add monitoring year" to continue to the "Monitoring Data" level.

9. How to fill out the forms: Positive Energy Districts (PED)

9.1. Design (and monitoring) Data

After choosing an option from the ones described in section 3.3 in this guide and after saving, the information, a form will be created designed for PED monitoring. If you click it in the left-hand list, you will be forwarded to the information in the Positive Energy District level as follows:

9.1.1. General Data

In the general data section, you will be asked to fill the following information on the buildings involved in the district:

- Name of the building
- Type of building creation (New/refurbished)
- Year of commissioning.
- Use of building (industrial/tertiary/residential
- Gross conditioned floor area

Buildings can be added and removed by using the action buttons. The next sections on the buildings synchronize with what is entered here. The up and down arrows allow arranging the order of the items.

9.1.2. Energy needs

Next, the energy needs for the buildings needs to be entered, see the figure below

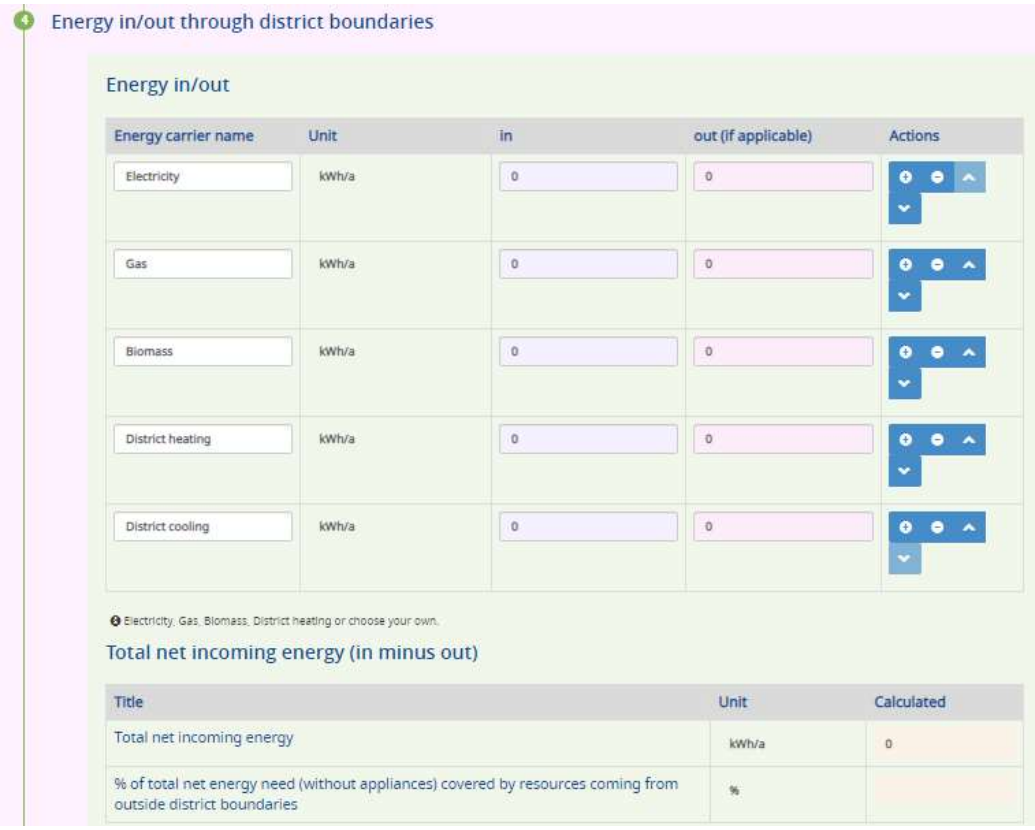
Some attention needs to be paid to the energy needs for heating, cooling and air conditioning and hot water. What needs to be included is the energy content of consumed fuels (e.g. gas) and the used electricity (final energy). So, in the case of a heat pump in a building it is about the electricity use of the heat pump and not the total of heat produced. Only the columns with units including /m2 and the hot water need to be filled. The others are calculated. The totals over the buildings will be calculated.

9.1.3. Local RES

Per building/location the data for local renewable energy need to be provided. The form automatically determines the totals. Saving the form triggers the calculations. Please do that frequently.

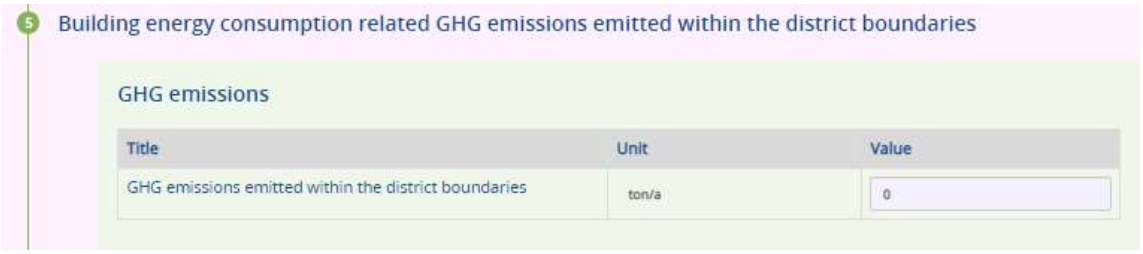
9.1.4. Energy in/out through district boundaries

This part is about the energy balance. Under Column “in”, the consumed energy from a specific energy carrier needs to be provided, Under Column “out”, the produced energy from a specific energy carrier needs to be provided. Values are for final energy.



9.1.5. Greenhouse gas emissions

Provide the greenhouse gas emission associated with the energy consumption within the district. Calculate the emission for each energy carrier separately by multiplying the consumption of a specific energy carrier with their (CO_2 equivalent) emission factor. If there is e.g. net electricity production of electricity, this gives a reducing contribution to the total. If there are emissions of other greenhouse gasses as e.g. CH_4 then the emission in ton/a is obtained by multiplying the emission with the Global Warming Potential.

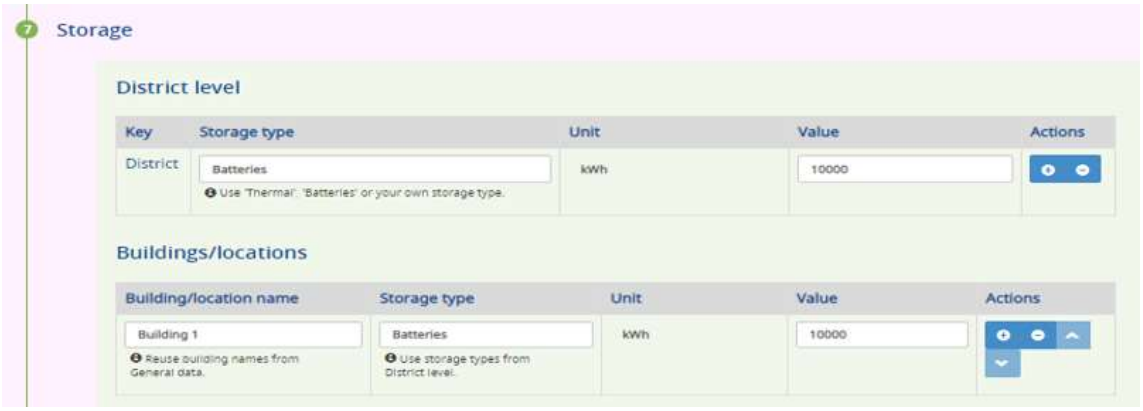


9.1.6. Energy management measures

In this section, it is sufficient to indicate yes/no whether energy management systems, smart grids, user interaction systems or other measures are applied at district level. I Also please indicate what measure is applied for what building/location, if applicable.

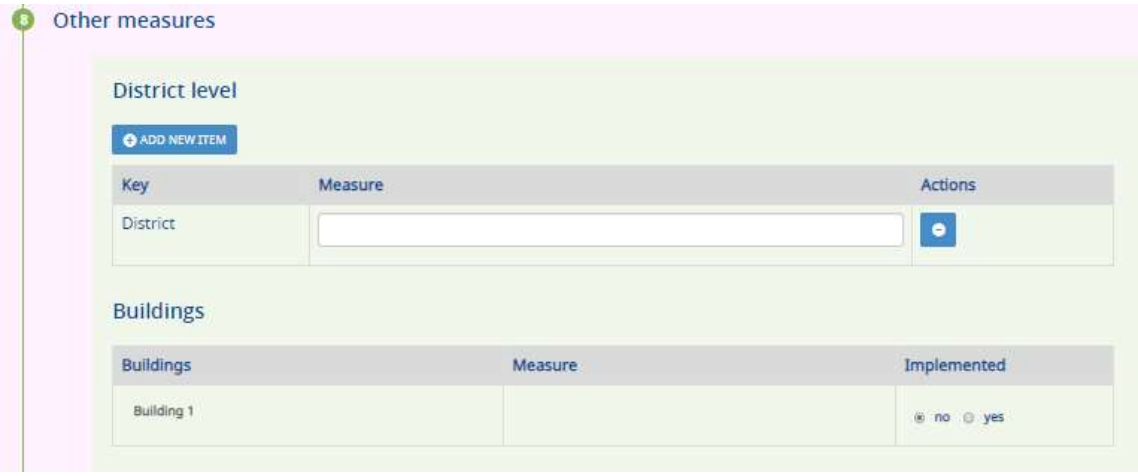
9.1.7. Storage

Storage of energy can be reported in the section below. The amount of kWh to report is the yearly cumulatively amount of energy stored in the system. This gives an impression of the size/use of the system. It does not reflect the efficiency of the system as losses are not included.



9.1.8. Other measures

If any other measures are taken, they can be indicated here. The district level here is a summary of the measures at the buildings. Please indicate at the district level which measures occur in the various buildings (one measure per row). Then at the buildings level it is a matter of clicking which measure occurs at which building. Defaults are no.



9.2. KPI

9.2.1. Technical KPI

The values here are automatically derived from the section filled out earlier. If desired, the values can be overridden by the user.

9.2.2. Environmental KPI

The values here are automatically derived from the section filled out earlier. If desired, the values can be overridden by the user.

9.2.3. Economic KPIs

In the economic KPIs section you will be asked to provide data (for this intervention) in several fields in the units given (no comparison with a baseline or reference situation):

- Total Investment excl. VAT (in €);
- Grants (in €);
- Net Energy Savings /value of improvements (in €/a);
- Total Operating Cost (in €/a);
- Dynamic Payback Period (in years);
- Return on Investment (in %).

9.2.4. Social KPIs

In the social KPIs section you will be asked to fill the following information:

- Citizens directly involved;
- Number of jobs created (total permanent jobs because of the project, not per year).

9.3. End of the Design Data level

Thank you for filling out all the relevant "Design Data" for this intervention!

- Please save your input.
- Click "Add monitoring year" to continue to the "Monitoring Data" level.

10. SRT Data Visualisation

Two possibilities for visualization of the SRT data are included. One is a tool that enables the usere of SCIS to explore all KPI in the SCIS Self Reporting Tool, by making a set of choices on what they want to see. The other is a visualisation of the most relevant and common KPI over the entire portfolio of projects. These are available in the Impact tabs of the various project and demosite pages.

10.1. The visualisation tool

This tool can be found at https://smartcities-infosystem.eu/scis-kpis#., In the SCIS website, choose Experieces -> Project data visualization. A separate manual of the tool is provided at https://smartcities-infosystem.eu/sites/www.smartcities-infosystem.eu/files/document/visualisation_tool_guide_scis-srt_data.pdf in the Library -> Resources -> Monitoring guides.

At the bottom of the visualisation tool there is the possibility to do a SRT database dump in .csv format for off-line research purposes.

10.2. Visualisation at the SCIS project/demo pages

A condensed set of the most common KPI's is shown at the project/demo pages. An example is shown below. This feature ensures that there is only a single source of data (the SRT) for the visualisation. This avoids confusion. It shows both design and monitoring data side by side (when available)


SRT data
CO2 savings (kgCO2eq/a)
Design
Monitoring
NEXT-BUILDINGS Site Amsterdam
NEXT-BUILDINGS Site Helsingborg
NEXT-BUILDINGS Site Lyon
Demonstration area (m2)
Design
Monitoring
NEXT-BUILDINGS Site Amsterdam
NEXT-BUILDINGS Site Helsingborg
NEXT-BUILDINGS Site Lyon
Weighted average for Total final energy consumption (kWh/m2a)
Design
Monitoring
NEXT-BUILDINGS Site Amsterdam
NEXT-BUILDINGS Site Helsingborg
NEXT-BUILDINGS Site Lyon