



# D4.1

---

## Guidelines for nearly zero energy neighbourhoods

“Guidelines to the pilots for decision”

**SINFONIA**

---

“Smart INitiative of cities Fully cOmitted to iNvest In Advanced  
large-scaled energy solutions”

---

|                        |                   |                   |                              |
|------------------------|-------------------|-------------------|------------------------------|
| <b>CONTRACT NUMBER</b> | <b>609019</b>     | <b>INSTRUMENT</b> | <b>COLLABORATIVE PROJECT</b> |
| <b>START DATE</b>      | <b>01-06-2014</b> | <b>DURATION</b>   | <b>60 MONTHS</b>             |

---



This project has received funding from the European Union's Seventh Programme for research, technological development and demonstration under grant agreement No 609019

## 1. PUBLISHABLE EXECUTIVE SUMMARY

# Guidelines for nearly zero energy neighbourhoods

<http://sinfonia.passiv.de/>

**Energy efficiency** is the key to integration of individual refurbished buildings into an intelligent energy network. The major goal of this guideline database is to facilitate the realization of the upcoming “**nearly zero energy**” standard requested by the EU for 2050 for the building stock, by means of knowledge of already available and **implemented best practice standards**, which sometimes even exceed these goals.

All this is done with a **special focus on refurbishment**. It can be seen as a helping resource for the implementation of already available innovative systems including environmentally-friendly building components, the latest HVAC technologies and low energy consuming devices.

Already during the integrated design process within the Sinfonia demo-projects all approaches to possible solutions and finally implemented solutions are collected in a database. Beside the development of the database a web based GUI-frontend was created making the collection usable as a supporting tool to assist in **finding and comparing already available and affordable best practice retrofit solutions** for buildings.

### What makes this resource unique?

#### Integrated design process

means bringing together the comprehensive knowledge of several project partners from **architecture, structural engineering, HVAC** and also **building lifecycle management** on the basis of already available and **implemented best practice solutions and standards**. All Sinfonia projects are undergoing this procedure of an integrated design process and the results are made visible through this guideline database.

#### A public resource of well implemented solutions

In particular, **smaller housing companies** and **private building owners** may have not the experiences and the resources to spend a huge amount of time and money on generating an internal resource of available and already implemented best practice solutions and standards. Bigger housing companies may set up their own resources of well implemented solutions in their own company infrastructures but normally keep it confidential. This often leads to the effect that one has to "reinvent the wheel" for every building project again and again, together with frequently changing partners in the usual design process. To make such **a resource available for public** was one of the biggest aims of this guideline database.



### Collecting implemented as well as alternative best practice solutions

To collect also the **"just discussed" alternative best practice solutions**, sometimes called "lost work", is of general importance as this can be an relevant added value for other building projects. Not implementing a solution in a particular project usually doesn't mean that it is not a best practice solution. It may fits best for another project which has to deal with perhaps only slightly different conditions (regulations, usage, climate, ...).

### Combining technical information with a "real life" evaluation

With this guideline database we combine technical information with a **comprehensive evaluation of the measures**. In practice it is not only important to know how to do it, it is also very helpful to get information on pros and cons of a measure in a specific project development. In this way you can get a much deeper picture of the refurbishment measures rather than just getting knowledge of their technical details.



---

## TABLE OF CONTENTS

---

|   |           |
|---|-----------|
| <b>1. PUBLISHABLE EXECUTIVE SUMMARY .....</b>                                   | <b>1</b>  |
| <b>2. INTRODUCTION .....</b>  | <b>4</b>  |
| <b>3. PURPOSE AND SCOPE .....</b>   | <b>6</b>  |
| 3.1 MAJOR FUNCTIONALITIES .....   | 6         |
| 3.2 IMPORTANT TOPICS .....  | 7         |
| 3.2.1 BUILDING ENVELOPE.....  | 7         |
| 3.2.2 INSTALLATIONS AND APPLIANCES .....  | 8         |
| <b>4. TARGET AUDIENCE .....</b>   | <b>9</b>  |
| <b>5. DISSEMINATION .....</b>   | <b>10</b> |
| <b>6. INVOLVED SINFONIA PARTNERS.....</b>                                       | <b>12</b> |
| 6.1 EXPERIENCED PRACTITIONER PARTNERS .....                                     | 12        |
| 6.2 SCIENTIFIC PARTNERS.....  | 12        |
| <b>7. DETAILED INTENTION .....</b>  | <b>13</b> |
| 7.1 AN INTEGRATED DESIGN PROCESS IS THE KEY .....                               | 13        |
| 7.2 MAKING AVAILABLE A PUBLIC RESOURCE OF WELL IMPLEMENTED SOLUTIONS .....      | 13        |
| 7.3 COLLECTING IMPLEMENTED AS WELL AS ALTERNATIVE BEST PRACTICE SOLUTIONS ..... | 13        |
| 7.4 COMBINING TECHNICAL INFORMATION WITH A "REAL LIFE" EVALUATION.....          | 14        |
| 7.5 OTHER RESOURCES.....  | 14        |
| 7.6 APPROACH AND ITS STRUCTURE .....  | 15        |
| 7.6.1 THE DATA FLOW.....  | 15        |
| 7.6.2 DISCRETE GROUPS OF MEASURES WERE IDENTIFIED .....                         | 15        |
| 7.6.3 A WIDE RANGE OF DIFFERENT DECISION CATEGORIES.....                        | 16        |
| 7.6.4 INPUT-OUTPUT SCENARIO .....   | 16        |
| 7.6.5 A SCHEMATIC ANALYSE OF THE DECISION-MAKING PROCESS.....                   | 17        |
| 7.6.6 THE PRACTICE IN STANDARD DESIGN PROCESSES .....                           | 17        |
| 7.6.7 THE SETUP OF A DATABASE LAYOUT .....                                      | 18        |
| 7.6.8 THE DATABASE.....   | 19        |
| 7.6.9 THE WEB-BASED DATA INPUT-GUI.....   | 19        |
| 7.6.10 POSSIBLE OUTPUT SCENARIOS OF THE GUIDELINE DATABASE.....                 | 24        |
| <b>8. TECHNICAL DOCUMENTAION AND BACKGROUND .....</b>                           | <b>26</b> |
| <b>9. OTHER RESOURCES.....</b>  | <b>28</b> |
| 9.1 ADVISIBLE LITERATURE ON ENERGY EFFICIENT REFURBISHMENT .....                | 28        |
| 9.2 OTHER ADVISABLE WEB RESOURCES .....   | 29        |
| <b>10. LIST OF ABBREVIATIONS.....</b>   | <b>30</b> |

---



## 2. INTRODUCTION

The deliverable D4.1 actually renamed from “Guidelines to the pilots for decision” to “Guidelines for nearly zero energy neighbourhoods” is mostly a web-based application which aims to assist finding available, affordable and within Sinfonia demo-projects practically tested (implemented) best practice retrofit solutions and gives suggestions on applicable alternatives for refurbishment. The renaming should make clearly visible that the resource is open to everyone interested on highly energy efficient refurbishment and is not restricted to the demo projects.

It is intended that this tool is kept alive and updated during the whole project with experiences from the refurbishment projects in the demo cities Bolzano and Innsbruck since practical experiences and conclusions are an essential part of the decision making process. Deliverable 4.1 is some kind of “rolling release” till the end of the project and hopefully further used and maintained beyond that.

The database, located at <http://sinfonia.passiv.de> contains data from the housing companies of Bolzano and Innsbruck on the different alternative renovation solutions that have been discussed while the planning process and those finally implemented for the demo-projects. It includes details and technical descriptions of measures taken, e.g. U-values of windows, walls etc.. Additional detailed solutions on thermal heat bridges and building service systems are incorporated. Further important and unique information that can be found in the database is a detailed evaluation by the implementing housing companies of each of the measures corresponding to nine different topics.



**Figure 1: Evaluation topics in database are getting merged to 5 main categories**

The collecting of the data and the compiling process of up to more than hundred values per measure was developed with the open-source program languages Python (a widely used open-source high-level, interpreted, dynamic programming language) together with PHP (an open-source server-side scripting language) in conjunction with an MariaDB SQL database (an open-source relational database management system). The web frontend was realised with a Drupal CMS (a user friendly and powerful content management platform).



The format of “D4.1 Guideline to the pilots for decision” was not defined in detail in the DOW so it was clarified in accordance with the EC to be a database tool holding all the analysed refurbishment solutions from Innsbruck and Bolzano.

The structure of deliverable 4.1 has now largely been laid out as follows:

1. A database, where details of discussed and finally implemented design variants (thermal envelope, building services, detailed evaluation, etc.) of a refurbishment strategy can be recorded by the implementing housing companies within SINFONIA.
2. Capability of output generation from database, via different filters (predefined and/or user-defined).
3. (Optional) Provision of further guidance combined with pre-existing data of other WP’s within SINFONIA project (eg. WP6 - Sets of solution) on how to optimise the refurbishment process, or even give guidance on other projects regarding how to achieve a highly energy efficient refurbishment.

The database **input** so long is restricted to Task 4.1 partners.

The database **output** is intended mainly for the participating housing companies in the two demo cities, the early adopting and follower cities of SINFONIA, but is also open to the general public.



### 3. PURPOSE AND SCOPE

**Energy efficiency** is the key to integration of individual refurbished buildings into an intelligent energy network. The major goal of this guideline database is to facilitate the realization of the upcoming “**nearly zero energy**” **standard** requested by the EU for 2050 for the building stock, by means of knowledge of already available and **implemented best practice standards**, which sometimes even exceed these goals.

All this is done with a **special focus on refurbishment**. It can be seen as a helping resource for the implementation of already available innovative systems including environmentally-friendly building components, the latest HVAC technologies and low energy consuming devices.

Already during the integrated design process within the Sinfonia demo-projects all approaches to possible solutions and finally implemented solutions are collected in a database. Beside the development of the database a web based GUI-frontend was created making the collection usable as a supporting tool to assist in **finding and comparing already available and affordable best practice retrofit solutions** for buildings.

#### 3.1 MAJOR FUNCTIONALITIES

##### 1. The database itself and its **input-GUI**:

Here are incorporated all discussed and implemented best practice solutions per project site by the related project and task partners. This encompasses all twenty demo-projects of SINFONIA in Bolzano and Innsbruck. After the SINFONIA-project ends, when all twenty SINFONIA demo-projects will be finalized, more than 500 submissions are expected. As about 100 values per submission have to be specified, the database at the end will contain more than 5000 values.

##### 2. The database **output-GUI**:

this is a web-based application which aims to assist finding and comparing already available, affordable and tested (implemented) best-practice retrofit solutions within Sinfonia demo-projects (laid out in the database) and suggests possible alternatives for refurbishment.



## 3.2 IMPORTANT TOPICS

Important topics of the analysed and implemented building components were:

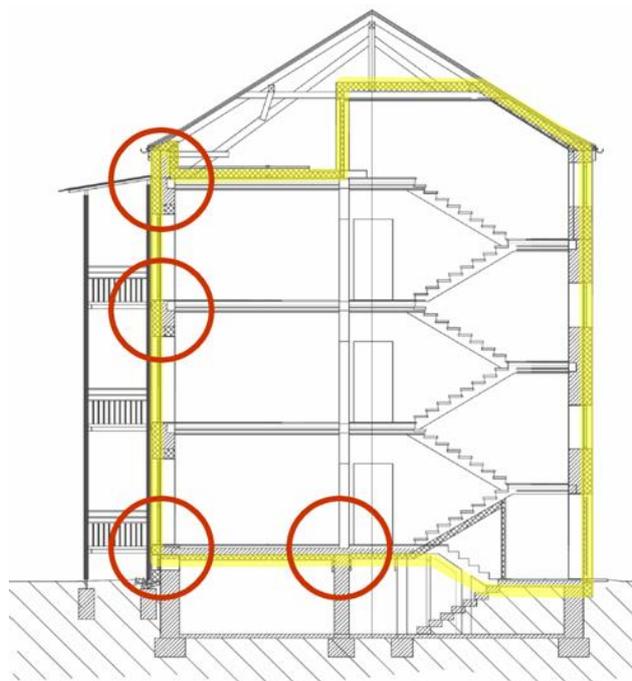
- Recommendations and specified values for products and construction materials.
- Guidelines for refurbishment extensions; in particular numerous thermal heat-bridges were analysed.
- Analysis of the building process with regard to:
  - standardised elements,
  - high-quality prefabrication,
  - integrated technology,
  - fast and user-friendly refurbishment.
- Recommending and supporting environmentally-friendly and low-energy-consuming components.
- Strengthening local economies through the development of better handcraft / trade skills
- Newly available technologies controlled by quality management.
- Evaluation of façade systems regarding moisture issues and lifespan-prolonging properties (robustness).

The following two main groups of **energy efficient refurbishment measures** (including several sub measures) are covered by this database:

### 3.2.1 BUILDING ENVELOPE

Based on locally differing practical approaches, the aim is to find detailed and best-practice economic solutions in a well-integrated process with architects, property-companies and local authorities in energy-efficient refurbishment, in accordance with already implemented best practice tools and best replication performance.

Well-defined target values for refurbishment, recommended construction details with a maximum thermal bridge heat loss coefficient for energetically relevant interfaces and specific recommendations for components (including the thermal bridge-minimised building component connection) are implemented.



**Figure 2: An uninterrupted insulating envelope – even in old buildings has to be the goal;**

Resource: [PASSIPEDIA](#) (c) Passive House Institute



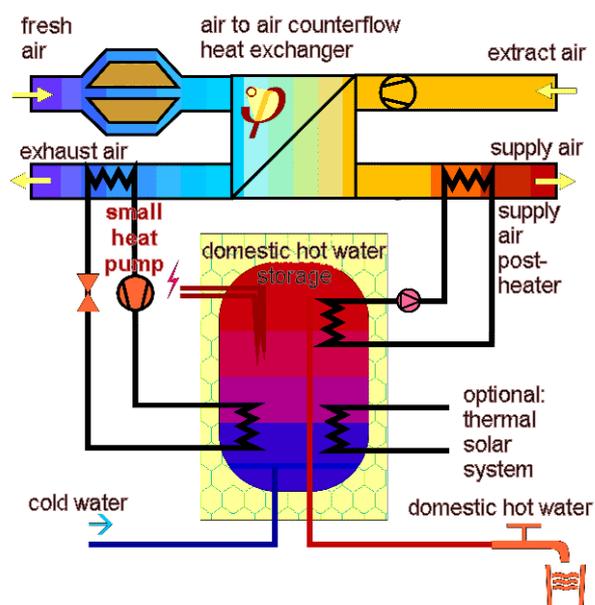
Different solution approaches for facades (windows, various materials, thermal bridges, thermal insulation and air tightness) can be compared and analysed. The economic and ecological aspects in order to optimize the construction process, with reference to efficiency as well as long-term properties, are evaluated by the implementing housing companies. The results can be seen as a useful resource for the implementation of already available innovative systems and building components.

### 3.2.2 INSTALLATIONS AND APPLIANCES

Concepts for building services in energy-efficient refurbishment, which are suitable for the transformation process and for switching to regenerative energy sources are implemented.

Based on the fundamental principle that energy savings of up to 90 % can be made even with refurbishments, detailed concepts and economic solutions in a well-integrated process with the architects, property-companies and authorities are shown up.

These are appropriate for high- as well as low-performance ranges regarding the best possibility of replication.



**Figure 3: Example of compact heat pump unit combines heating, ventilation and hot water generation in one easy to handle unit;**

**Resource: [PASSIPEDIA](#) (c) Passive House Institute**

## 4. TARGET AUDIENCE

Within the Sinfonia project the database is used by the **housing companies** in the demo cities making discussed variants comprehensible and by the involved **early adoptor cities** as guiding examples.

Beyond Sinfonia it is usable for all involved parties into the decision process for buildings. In particular, **smaller housing companies** and **private building owners** may have not the experiences and the resources to spend a huge amount of time and money on generating an internal resource of available and already implemented best practice solutions and standards. To make such a **resource available for general public** was one of the biggest aims of this guideline database.

The database application as a support tool has **two major functionalities**, as are the publication levels:

1. The **database input GUI**, where all data per project site are incorporated by the related project and task partners. This part has restricted access, and is only accessible by **project and task partners involved in the data input**.



The screenshot shows a user login interface with fields for 'User name' (containing 'h.k.malzer') and 'User email' (containing 'sinfonia@phi-ibk.at'). Below the login fields, there is a dropdown menu titled 'Please first choose type of new input:' with options including 'None', 'General information', 'Thermal envelope', and 'Building Services'. The 'Thermal envelope' section is expanded, listing various components like 'Transparent components (TR)', 'Shading system (SH)', 'Exterior door (DO)', etc. A 'Preview data' button is visible at the bottom of the dropdown menu.

Figure 4: Picture shows a part of the database input GUI

2. The **database output GUI** is intended mainly for the early adopting and follower cities, but is also open to the public. Here it is possible to search and compare best practice solutions, which were discussed and implemented within the SINFONIA demo-projects. This part is **open to everyone**, to be accessed via standard internet browser software.



Figure 5: Picture shows a result template of the database output GUI



## 5. DISSEMINATION

The Passive House Institute has a long and successful tradition in disseminating all kind of knowledge in behalf of highly energy efficient building technology. Beside the **Sinfonia inbuilt dissemination channels of WP10** additionally the following channels by PHI will be used to promote this guideline database:

- The PHI is hosting several online wikis like [www.passipedia.org](http://www.passipedia.org) (constitutes a vast array of cutting edge, scientifically sound, Passive House relevant articles) and platforms like [www.europhit.eu](http://www.europhit.eu) (an already finished EU-project; it is all about applied knowledge on deep energy retrofits for step-by-step refurbishments). The Sinfonia – Guideline database will be available there as one of the well-used tools offered already there.
- The PHI is carrying out several international activities like the yearly held [International Passive House Conference](#) (about 2000 participants out of 45 countries).



**Figure 6: “Passive House for all” is the theme for the 21st International Passive House Conference next year in Vienna. A special Sinfonia workgroup is planned here.**

Since year 2015 we provide a special **Sinfonia booth** at the International Passive House Conference with overall information about the project and the possibility of deep knowledge extension on refurbishment. As the next conference 2017 will be held in Vienna, we will take the opportunity to organize a special **Sinfonia workgroup** to share first results and skills within the conference. The Guideline database will be sure one part of this.



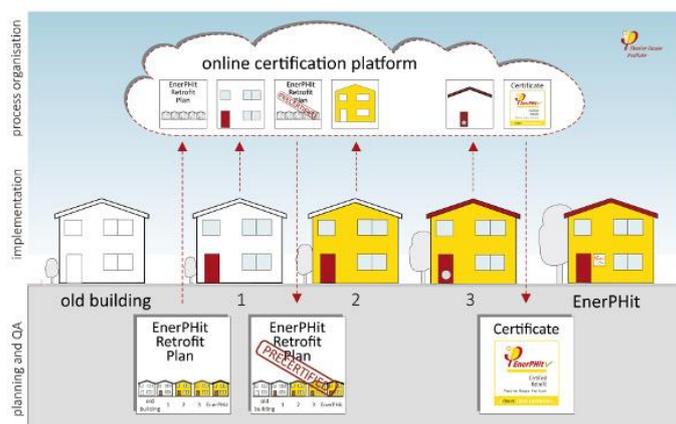
- The Mid-year Passive House days together with the [International Passive House Days](#)



**Figure 7:** Two times a year the Mid-year Passive house days (in June) and the International Passive House days (in Nov.) offer visitors the chance to experience the benefits of highly energy efficient buildings at first hand.

put on by **iPHA** (International Passive house Association) and its international Affiliates, will take place for the 13th year in a row now. By participating with your own Passive House home, office, or even construction site, Passive house owners can share their experiences and show what Passive House is all about. Spread the word and offer others the chance to experience the benefits of highly energy efficient buildings live. The International Passive House Days are held in up to **25 countries**, opening about **700 homes, offices and public buildings** like schools (also yet finished Sinfonia projects in Innsbruck will take part this year for the first time) to about **10-15.000 visitors** each year.

- Within the EU-project [EuroPHit](#) a new **online certification platform** was introduced by PHI. It is expected that the “Sinfonia - Guideline database” will be connected to this certification platform as a central part to collect further more best practice solutions. The aim is to fill the database additionally with solutions other than just Austrian and north Italian to be able to consult Passive House planners and designers all over the world with high energy efficient retrofit best practice solutions.



**Figure 8:** New online certification platform

**Quality assurance**, like it is also foreseen in WP7 and WP8, is since nearly 15 years a major task by the PHI to foster the paradigm shift on how to build an environmentally friendly future. For **building certification**, a certificate is only issued if the exactly defined criteria have been

met without exception. Actually there are 40 accredited Passive House certifiers and 537 certified Passive House Designers/Consultants to certify Passive House buildings and EnerPHit retrofits anywhere in the world on behalf of the Passive House Institute and in accordance with their criteria. The usage of the newly introduced **online certification platform** in combination with the “Sinfonia - Guideline database” is obligatory and will so foster a quick and wide spread of high energy efficient retrofit best practice solutions.

## 6. INVOLVED SINFONIA PARTNERS

A close collaboration of experienced practitioner and scientific partners is important to gain the goal of integrated design on Sinfonia project level the same as on local building project level.

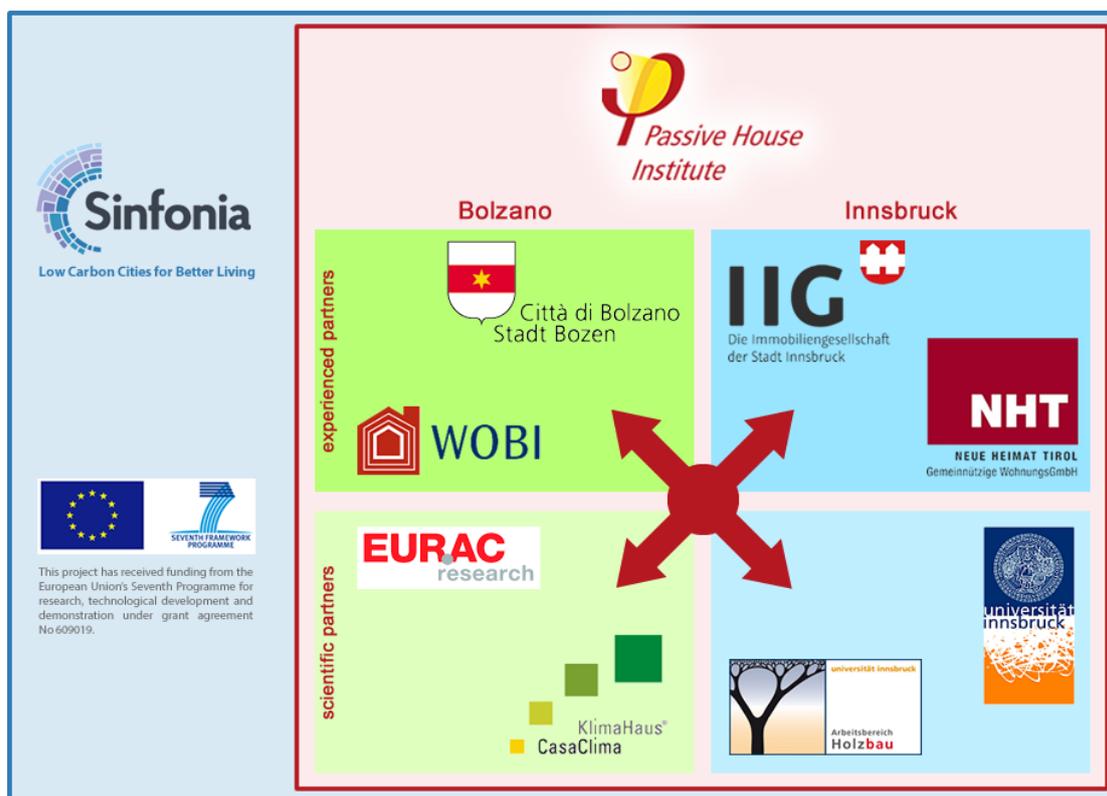


Figure 9: Partner-structure of Task 4.1

### 6.1 EXPERIENCED PRACTITIONER PARTNERS

- **BOZ** - integral design process, implementation, evaluation and data input
- **IIG** - integral design process, implementation, evaluation and data input
- **IPES** - integral design process, implementation, evaluation and data input
- **NHT** - integral design process, implementation, evaluation and data input

### 6.2 SCIENTIFIC PARTNERS

- **ACC** - assisting integral design process and data input of Bolzano partners
- **EURAC** - assisting integral design process, research on best practice solutions
- **UIBK** - assisting integral design process, research on best practice solutions
- **PHI** - assisting integral design process and data input of Innsbruck partners, research on best practice solutions, development and maintenance of web based guideline database



## 7. DETAILED INTENTION

### The idea(s) behind this guideline database

What makes this resource unique?

#### 7.1 AN INTEGRATED DESIGN PROCESS IS THE KEY

An **integrated design** process is the key to achieve the goal of “nearly zero energy” standard, especially when undertaking **large-scale refurbishments**.

It means bringing together the comprehensive knowledge of several project partners from **architecture, structural engineering, HVAC** to also **building lifecycle management** on the basis of already available and **implemented best practice solutions and standards**.

All Sinfonia projects are undergoing this procedure of an integrated design process and the results are made visible through this guideline database.

#### 7.2 MAKING AVAILABLE A PUBLIC RESOURCE OF WELL IMPLEMENTED SOLUTIONS

Bigger housing companies do take the integrated design seriously nowadays, which in some cases leads to the fact that they set up their own resources of well implemented solutions in their own company infrastructures.

In particular, **smaller housing companies** and **private building owners** may have not the experiences and the resources to spend a huge amount of time and money on generating an internal resource of available and already implemented best practice solutions and standards. This often leads to the effect that one has to “reinvent the wheel” for every building project again and again, together with frequently changing partners in the usual design process.

To make such a **resource available for public** was one of the biggest aims of this guideline database.

#### 7.3 COLLECTING IMPLEMENTED AS WELL AS ALTERNATIVE BEST PRACTICE SOLUTIONS

The first and probably most commonly taken step is to collect all relevant data of an **implemented best practice solution**. Within Sinfonia all serious approaches to solutions are collected already during the planning process also in the very first design phases.

So in addition, it was decided here not only to collect data of the finally implemented best practice solutions (as usual if it’s done at all) but also the **“just discussed” alternative best practice solutions**. They usually come up in a first design step and may be overhauled later in the design process.



To collect this "lost work" is of general importance as this can make the decision process more transparent. Not implementing a solution in a particular project usually doesn't mean that it is not a best practice solution. It eventually fits best for another project which has to deal with only slightly different conditions (regulations, usage, climate, ...).

All thoughts, taken decisions and detailed data is now still available and one is now able to handle the design process of upcoming building projects much faster and more reliably.

#### 7.4 COMBINING TECHNICAL INFORMATION WITH A "REAL LIFE" EVALUATION

With this guideline database we try to combine technical information with a **comprehensive evaluation of the measures**. In practice it is not only important to know how to do it, it is also very helpful to get information on pros and cons of a measure in a specific project development. The implementing housing companies are doing an evaluation on up to 50 values categorized into 9 topics:

- **costs**
- **legal affairs**
- **position and orientation**
- **architectural design**
- **ecological impact**
- **construction process**
- **technical feasibility**
- **general risks**
- **energy efficiency**

In this way you can get a much deeper picture of the refurbishment measures rather than just get knowledge of their technical details.

#### 7.5 OTHER RESOURCES

It is surprising, but doing an intense search on best practice refurbishment solutions in the WWW mostly brings up some descriptions of single measures or projects, often by other research projects or by companies manufacturing and selling refurbishment materials and components.

Additionally there are some good written compendiums available (an regularly updated list of advisable literature on energy efficient refurbishment is also available [here](#)). A collection of realized projects was done during the EU-project [EuroPHit](#) - Retrofitting for the energy revolution, one step at a time - it is all about applied knowledge on deep energy retrofits to the oft-overlooked yet critical area of step-by-step refurbishments (for an regularly updated collection of advisable web resources see also [here](#)).



## 7.6 APPROACH AND ITS STRUCTURE

To develop a robust and flexible structure for such a resource, always having in mind that the database must be accessible and user-friendly, is very important. The following stages will demonstrate the used approach:

### 7.6.1 THE DATA FLOW

from acquisition to a possible guideline first was analysed:

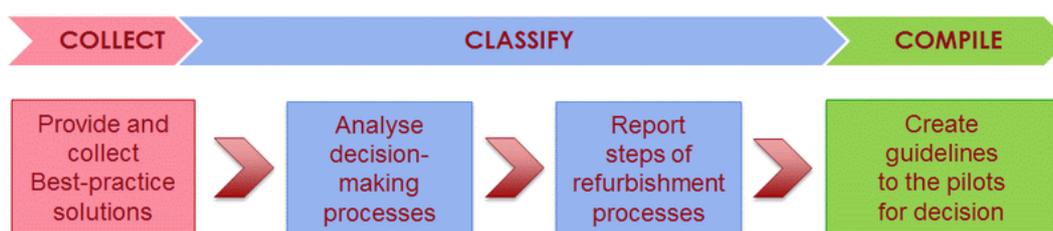


Figure 10: Data flow from acquisition to guideline

### 7.6.2 DISCRETE GROUPS OF MEASURES WERE IDENTIFIED

as the parts that make up an integrated design process with the goal of “nearly zero energy” refurbishment, and inserted into a database input-GUI:

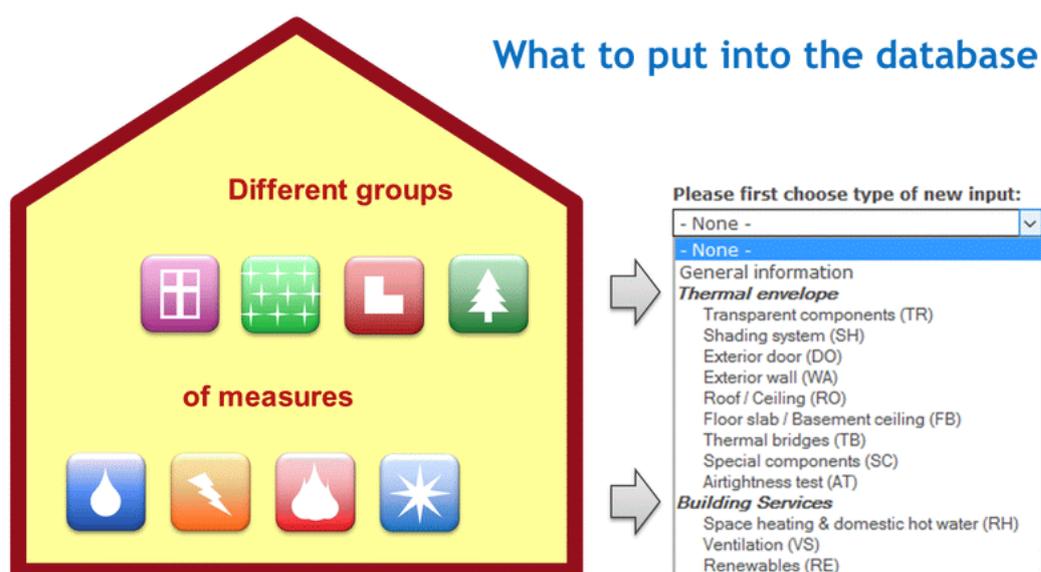


Figure 11: Identified groups of measures



7.6.3 A WIDE RANGE OF DIFFERENT DECISION CATEGORIES

have to be made in practice; thereby an **evaluation** takes place:

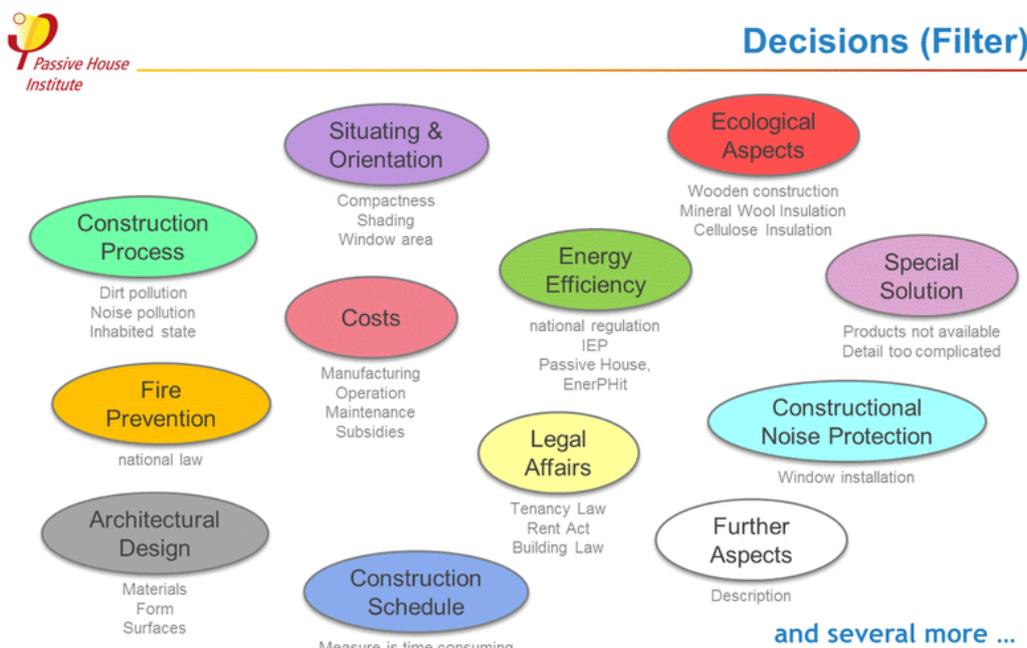


Figure 12: Range of decisions for evaluation

7.6.4 INPUT-OUTPUT SCENARIO

This leads to a possible I/O-scenario, building upon the measure and evaluation input:

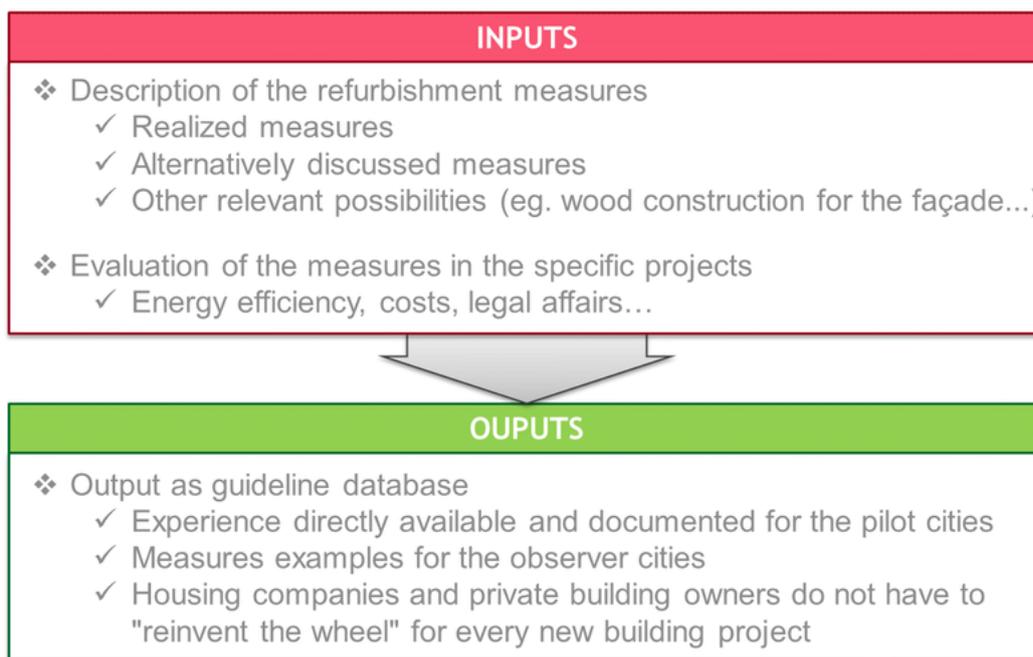


Figure 13: Diagram of input-output scenario



7.6.5 A SCHEMATIC ANALYSE OF THE DECISION-MAKING PROCESS

took place at planning stage right within the integrated design process:

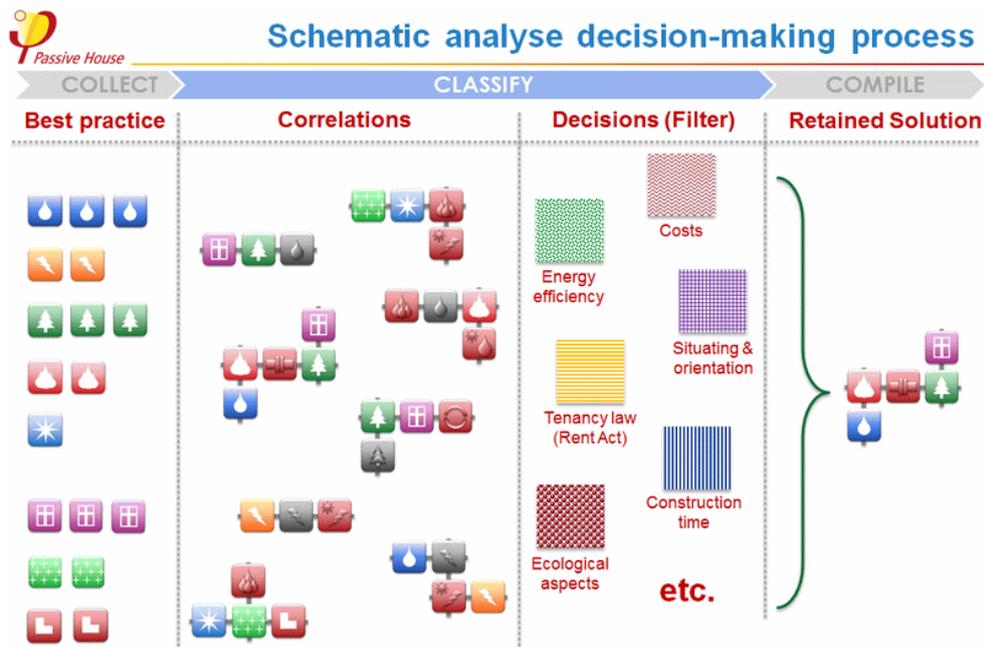


Figure 14: Diagram of schematic decision-making process

7.6.6 THE PRACTICE IN STANDARD DESIGN PROCESSES

in comparison to the schematic analyse is often more like the following:

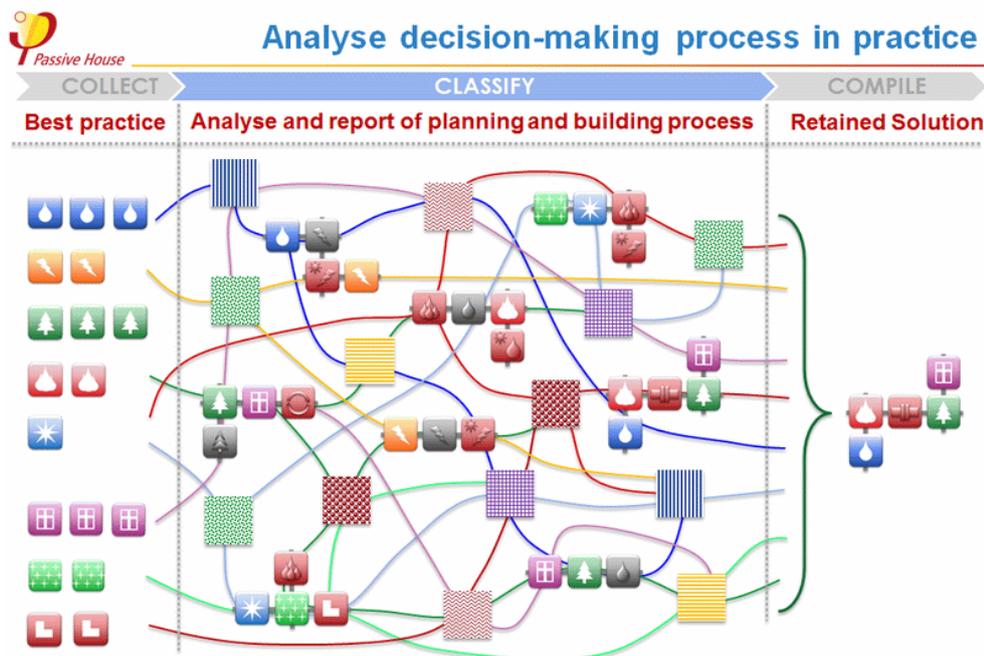


Figure 15: Diagram of decision-making process in practice



SINFONIA; "Smart INITiative of cities Fully cOMmitted to iNvest In Advanced large-scaled energy solutions" has received funding from the European Union's Seventh Programme for research, technological development and demonstration.

7.6.7 THE SETUP OF A DATABASE LAYOUT

upon these initial thoughts and findings has to be the next step:



Data collection (Transparent Components)

| TR-01             |   | description / name            |                     |
|-------------------|---|-------------------------------|---------------------|
| <b>Properties</b> |   |                               |                     |
| Frame             | Material/Product: _____   |                               |                     |
|                   | U <sub>f</sub> -value: _____ [W/m <sup>2</sup> K] *range=0,20-2,50* |                               |                     |
| Glazing           | Description/Product: _____  |                               |                     |
|                   | U <sub>g</sub> -value: _____ [W/m <sup>2</sup> K] *range=0,30-5,80* |                               |                     |
|                   | g-value: _____ *range=0,10-0,90*                                    |                               |                     |
| Glazing edge      | Ψ-value: _____ [W/mK] *range=0,020-0,060*                           |                               |                     |
| Installation      | In wall construction  | Flush with outer edge of wall | In insulation level |
|                   | Frame not insulated   | Frame insulated               |                     |
|                   | Ψ-value: _____ [W/mK] *range=-0,020-0,100*                          |                               |                     |
| Percentage        | Ratio of the building: _____ [%] *range=0-100*                      |                               |                     |
| <b>Decisions</b>  |   |                               |                     |



Data collection (Decisions)

| XX-01  |  | description / name                      |                                 |
|--|--|---|---------------------------------|
| <b>Properties</b>  |  |   |                                 |
| <b>Decisions</b> (only contra-decisions to choose, pro-decisions are set as default) |  |   |                                 |
| Costs  | Investment product                             | Investment installation                 | Running/ Operating              |
| Legal affairs  | Tenancy law                                    | Rent Act                                | Building law                    |
| Situating & Orientation  | Compactness                                    | Shading                                 | Window area                     |
| Architectural design   | Materials                                      | Form?                                   | Surfaces                        |
| Ecological aspects   | Embodied energy                                | Petroleum product                       | Greenhouse gas                  |
| Construction process   | Dirt pollution                                 | Noise pollution                         | Inhabited state                 |
| Technical feasibility  | Products not available                         | Detail too complicated                  | Conflict with other measures    |
| Risks  | Fire prevention                                | Legionella                              | Building damage                 |
| Heat loss building service   | Storage  | Distribution                            | Other: _____                    |
| Energy efficiency  | SINFONIA?                                      | National regulation?                    | EnerPHit?                       |
|  | Heating demand: _____ [kWh/(m <sup>2</sup> a)] | Heating load: _____ [W/m <sup>2</sup> ] | Freq. of overheating: _____ [%] |
| Further aspects / Other  | Other: _____                                   |   |                                 |

Figure 16: Setup of data collection for the database layout



SINFONIA; “Smart Initiative of cities Fully cOMmitted to iNvest In Advanced large-scaled energy solutions” has received funding from the European Union’s Seventh Programme for research, technological development and demonstration.



General info on your user data:



User name ..... Date .....

sinfonia 07.06.2016

Please use the corresponding "Submissions"-link on the left side menu to **find and edit previously submitted input variants** - e.g. to add evaluation to previously submitted input variants !

If you want to add a **new input variant**, please choose it from the drop down menu below:

Please first choose type of new input:

Transparent components (TR) ▾

Name of input variant:

For further help on how to choose the right input name, version number and date for this input variant, please use the "Help on ..." -link below for info and examples:

—▷ Help on input name, version number & date? - click here...

Name of this input variant \*

[New refurbishment window]

To see the list of previously used names here, try autocomplete with "a", "e", "i", "o" or "u".

Element code: TR ▾

1. Enter this element code into the textbox "Version number" -

Version number: \* TR-02.2 ○

2. Select ascending version number in drop down menu - Example: [TR-01.0] - for similar measures please use [TR-01.1] to [TR-01.5] - otherwise go on with [TR-02.0]

Thermal envelope:

Transparent components (TR):

Short description

This is a brand new development on refurbishment window.

Please enter details below ...

Properties:

Frame properties:

Frame percentage

Percentage of this frame-type used in the building = 100 %

100% = this frame type is used for the whole building

Frame material

- Plastic / PVC  
 Wooden  
 Aluminium  
 Steel  
 Other...

If necessary please choose more than one material here (e.g. Wood + Aluminium).

Frame U-value

Uf = 0,82 [W/m²K]

Input the U-Value of the window frame. Reasonable range = 0.2 to 2.5 (e.g. Uf = 0.85 [W/m²K]).

Product datasheet window frame

Durchsuchen... Keine Datei ausgewählt.

Upload

Please upload the product datasheet or a related design plan here ...

Files must be less than 2 MB.

Allowed file types: jpg jpeg png pdf.

Link to product datasheet window frame

http://

www.product\_datasheet.com

... or provide a link to the product datasheet here.

Information to window frame

Durchsuchen... Keine Datei ausgewählt.

Upload

Upload document here.

Files must be less than 2 MB.

Allowed file types: jpg jpeg png pdf.

Glazing properties:

Glazing percentage

Percentage of this glazing-type is used in the building = 100 %

100% = this glazing type is used for all the transparent components of the building

Glazing G-value

g = 0,52 [1/100 %]

Input the G-Value of the window glazing. Reasonable range = 0.25 to 0.80 (e.g. G = 0.55 [%]).

Glazing U-value

Ug = 0,63 [W/m²K]

Input the U-Value of the window glazing. Reasonable range = 0.45 to 1.2 (e.g. Ug = 0.70 [W/m²K]).

Glazing edge Psi-value

Psi = 0,03 [W/mK]

Input the Psi-value of the window edge (spacer). Reasonable range = 0.020 to 0.060 (e.g. Psi = 0.035 [W/mK]).



**Product datasheet window glazing**

Durchsuchen... Keine Datei ausgewählt.

Upload

Please upload the product datasheet here ...  
Files must be less than 2 MB.  
Allowed file types: jpg jpeg png pdf.

**Link to product datasheet window glazing**

http://

... or provide a link to the product datasheet here.

**Information to window glazing**

Durchsuchen... Keine Datei ausgewählt.

Upload

Upload document here.  
Files must be less than 2 MB.  
Allowed file types: jpg jpeg png pdf.

---

**Window installation:**

**Position of installation**

Inner edge of wall construction

In line with insulation

Flush with outer edge of wall

Other...

Please mark the planned window position (preferred: in line with insulation).

Please mark the planned window frame extra insulation (preferred: Frame insulated). Info: this refers to additional insulation at the outside of the frame, not insulation within the frame itself.

**Additional frame insulation**

Frame not insulated

Frame insulated

Other...

**Window installation Psi-value**

Psi =  [W/mK]

Please input the Psi-Value of the window installation. Reasonable range = 0.020 to 0.100 (e.g. Psi = 0.040 [W/mK]).

**Sketch to window installation**

Durchsuchen... Keine Datei ausgewählt. Upload

Upload sketch or design plan here.  
Files must be less than 2 MB.  
Allowed file types: jpg jpeg png pdf.

Figure 18 (above) & 19 (below): Input of technical data and evaluation for measure “transparent component”

Evaluation

**Please evaluate this refurbishment measure carefully:**

**Please notice:**

- please check the box "**irrelevant**" ONLY if the investigated measure does not say anything about the topic (for example "operation costs" for an external door).
- please check the box "**no info**" if you have no information on the specific topic.  
**Please don't forget to complete the form as soon as you get the information!**
- checking the box "**prohibitive**" or "**not acceptable**" means that BECAUSE of this specific topic, this measure can hardly be realized for a refurbishment project under the current conditions.
- checking the box "**neutral**" or "**acceptable**" means that the investigated measure has no particular impact on this specific topic.
- checking the box "**beneficial**" or "**attractive**" means that there is a good or strong advantage in the implementation of this measure for a typical refurbishment project relatively to this specific topic.

Click here for the evaluation of the current measure:

---

**Evaluation of the costs:**

Please evaluate the costs of the refurbishment measure described above.

|                                  | irrelevant                       | no info               | prohibitive           | acceptable                       | attractive                       |
|----------------------------------|----------------------------------|-----------------------|-----------------------|----------------------------------|----------------------------------|
| Investment in product .....      | <input type="radio"/>            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>            | <input checked="" type="radio"/> |
| Investment in installation ..... | <input type="radio"/>            | <input type="radio"/> | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/>            |
| Operation costs .....            | <input checked="" type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>            | <input type="radio"/>            |
| Maintenance costs .....          | <input checked="" type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>            | <input type="radio"/>            |
| Subsidies possibility .....      | <input type="radio"/>            | <input type="radio"/> | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/>            |
| Other costs (optional) .....     | <input type="radio"/>            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>            | <input type="radio"/>            |

Please add a short description to other costs here ...



**Compatibility with legal affairs:**

Please evaluate the compatibility of this refurbishment measure with legal affairs.

|                                     | irrelevant            | no info               | not compatible        | compatible                       | beneficial            |
|-------------------------------------|-----------------------|-----------------------|-----------------------|----------------------------------|-----------------------|
| Building law .....                  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> |
| Rent act .....                      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> |
| Tenancy law .....                   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> |
| Tenants approval .....              | <input type="radio"/> | <input type="radio"/> | < 50% approval        | 50% - 90%                        | all tenants agree     |
| Cityscape protection .....          | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> |
| Other legal affair (optional) ..... | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>            | <input type="radio"/> |

Please add a short description for this other legal affair here ...

**Evaluation of the architectural design:**

Please evaluate impact of the architectural design of the refurbishment measure.

|                        | irrelevant            | no info               | prohibitive           | standard              | attractive                       |
|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|----------------------------------|
| Materials .....        | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input checked="" type="radio"/> |
| Shape .....            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input checked="" type="radio"/> |
| Surfaces .....         | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input checked="" type="radio"/> |
| Other (optional) ..... | <input type="radio"/>            |

Please add a short description on other impact of design here ...

**Evaluation of the ecological impact:**

Please evaluate this refurbishment measure in terms of its ecological impact.

|                                      | irrelevant            | no info               | prohibitive           | standard                         | low                              |
|--------------------------------------|-----------------------|-----------------------|-----------------------|----------------------------------|----------------------------------|
| Amount of embodied energy .....      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/>            |
| Amount of petroleum based content .. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>            | <input checked="" type="radio"/> |
| Impact on greenhouse gas emissions   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>            | <input checked="" type="radio"/> |
| Other impact (optional) .....        | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>            | <input type="radio"/>            |

Please add a short description to other ecological impact here ...

**Disturbances in the construction process:**

Please evaluate the disturbances generated during the realisation of this refurbishment measure.

|                                     | irrelevant                       | no info               | prohibitive           | acceptable                       | low                              |
|-------------------------------------|----------------------------------|-----------------------|-----------------------|----------------------------------|----------------------------------|
| Generation of dirt pollution .....  | <input checked="" type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>            | <input type="radio"/>            |
| Generation of noise pollution ..... | <input checked="" type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>            | <input type="radio"/>            |
| Duration of construction .....      | <input type="radio"/>            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>            | <input checked="" type="radio"/> |
| Obstacles due to occupancy .....    | <input type="radio"/>            | <input type="radio"/> | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/>            |
| Other (optional) .....              | <input type="radio"/>            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>            | <input type="radio"/>            |

Please add a short description on other obstacle on constr. process here ...



**Evaluation of the technical feasibility:**

Please evaluate this refurbishment measure in terms of technical feasibility.

|                                     |                       |                       |                       |                       |                                  |
|-------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|----------------------------------|
|                                     | irrelevant            | no info               | not available         | standard quality      | high quality                     |
| Availability of the products .....  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input checked="" type="radio"/> |
|                                     | irrelevant            | no info               | no fit                | acceptable            | ideal fit                        |
| Dimensions adapted to the project   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input checked="" type="radio"/> |
|                                     | irrelevant            | no info               | prohibitive           | acceptable            | low                              |
| Complexity of the realization ..... | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input checked="" type="radio"/> |
|                                     | irrelevant            | no info               | prohibitive           | acceptable            | beneficial                       |
| Impact on the structure .....       | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input checked="" type="radio"/> |

**Evaluation of risks:**

Please evaluate the risks incurred by the realization of the refurbishment measure.

|                             |                                  |                       |                       |                       |                                  |
|-----------------------------|----------------------------------|-----------------------|-----------------------|-----------------------|----------------------------------|
|                             | irrelevant                       | no info               | prohibitive           | acceptable            | beneficial                       |
| Fire prevention .....       | <input checked="" type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>            |
|                             | irrelevant                       | no info               | prohibitive           | acceptable            | beneficial                       |
| Legionella .....            | <input checked="" type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>            |
|                             | irrelevant                       | no info               | prohibitive           | acceptable            | beneficial                       |
| Building damage .....       | <input checked="" type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>            |
|                             | irrelevant                       | no info               | prohibitive           | acceptable            | beneficial                       |
| Acoustic comfort .....      | <input type="radio"/>            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input checked="" type="radio"/> |
|                             | irrelevant                       | no info               | prohibitive           | acceptable            | beneficial                       |
| Thermal comfort .....       | <input type="radio"/>            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input checked="" type="radio"/> |
|                             | irrelevant                       | no info               | prohibitive           | acceptable            | beneficial                       |
| Other risk (optional) ..... | <input type="radio"/>            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>            |

Please add a short description of other risk here ...

**Evaluation of global energy efficiency:**

Please evaluate the impact of this refurbishment measure on the global energy efficiency of the building.

|                                      |                                  |                       |                       |                                  |                                  |
|--------------------------------------|----------------------------------|-----------------------|-----------------------|----------------------------------|----------------------------------|
|                                      | irrelevant                       | no info               | higher                | equal                            | lower                            |
| Heating demand .....                 | <input type="radio"/>            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>            | <input checked="" type="radio"/> |
|                                      | irrelevant                       | no info               | higher                | equal                            | lower                            |
| Cooling demand .....                 | <input type="radio"/>            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>            | <input checked="" type="radio"/> |
|                                      | irrelevant                       | no info               | higher                | equal                            | lower                            |
| Domestic hot water consumption ....  | <input checked="" type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>            | <input type="radio"/>            |
|                                      | irrelevant                       | no info               | higher                | equal                            | lower                            |
| Electricity consumption .....        | <input type="radio"/>            | <input type="radio"/> | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/>            |
|                                      | irrelevant                       | no info               | higher                | equal                            | lower                            |
| Other consumption or gain (optional) | <input type="radio"/>            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>            | <input type="radio"/>            |

Please add a short description of other consumption or gain here ...

**Evaluation on an additional topic:**

If you weren't able to evaluate or find an important topic above, you can add it here.

—▷ Other evaluation (optional)

**Personal rating / Global review:**

Please enter additional personal information here (e.g. why do you like this measure, or you don't like it; whether there are negative evaluations above, but it is really preferable in a other context; etc.). Feel free to document your personal expression on this measure.

This is a great refurbishment window.

How many stars you would give this measure personally? Please choose from none up to five stars! (the more the better)

★★★★★



7.6.10 POSSIBLE OUTPUT SCENARIOS OF THE GUIDELINE DATABASE

Following figures showing up a bandwidth of already realized and possible output scenarios:

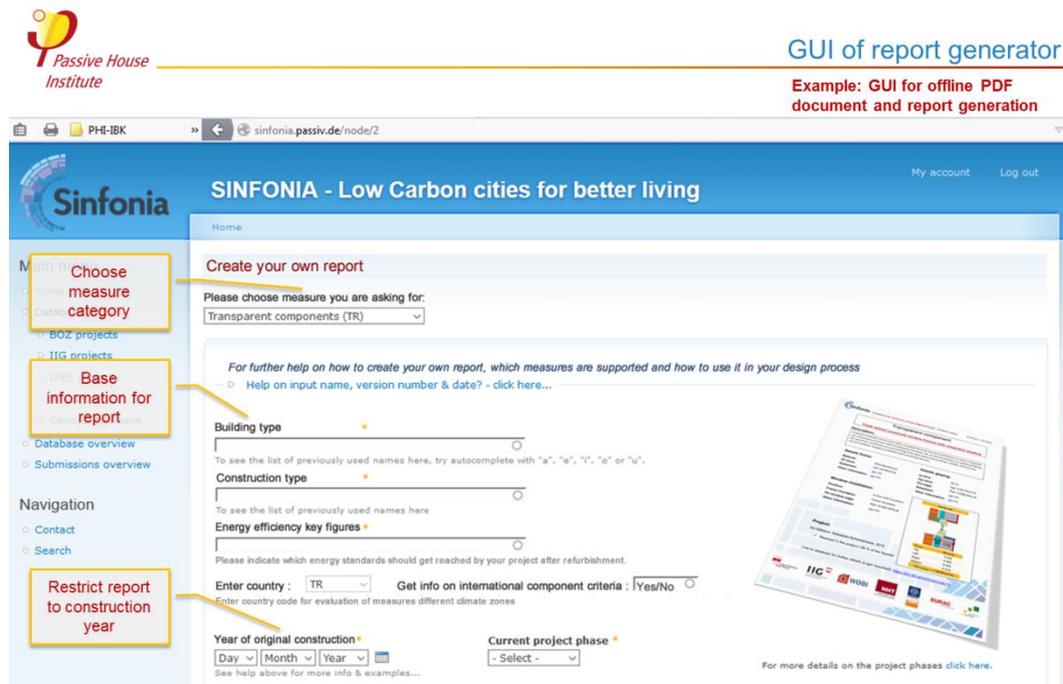


Figure 20: The report generator is the starting point to generate output. There will be more and more choices to take as there become more and more input data available.

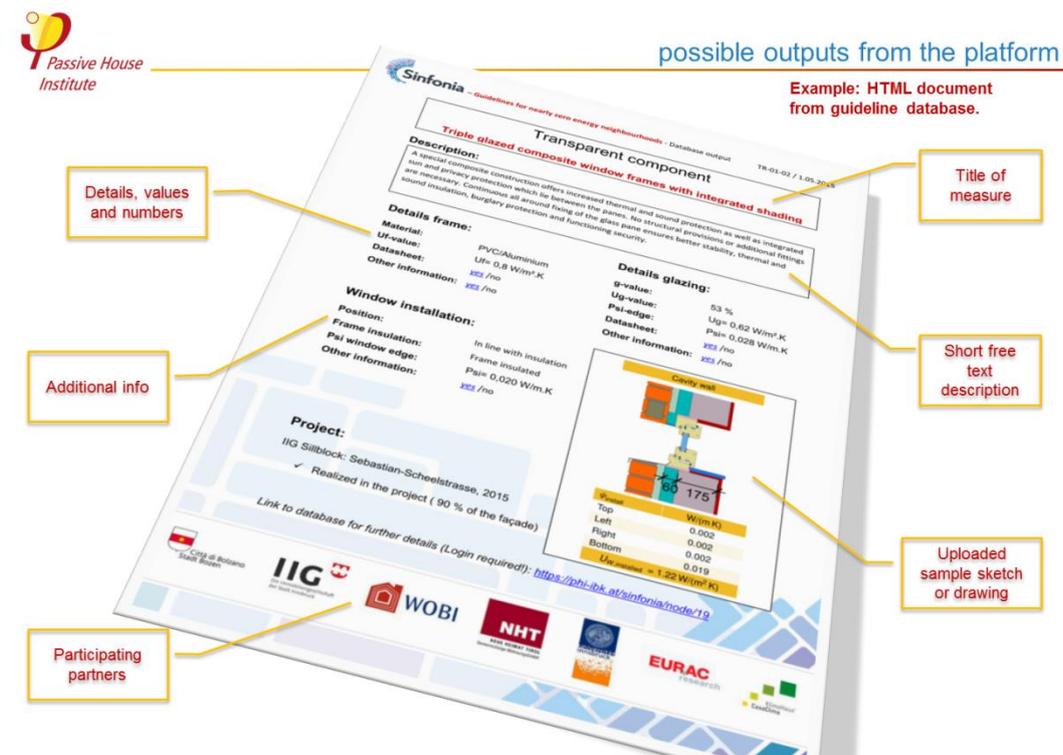


Figure 21: As a first step HTML-documents are generated by the report generator, which can then be locally stored or printed.





review and comparison of refurbishment measures

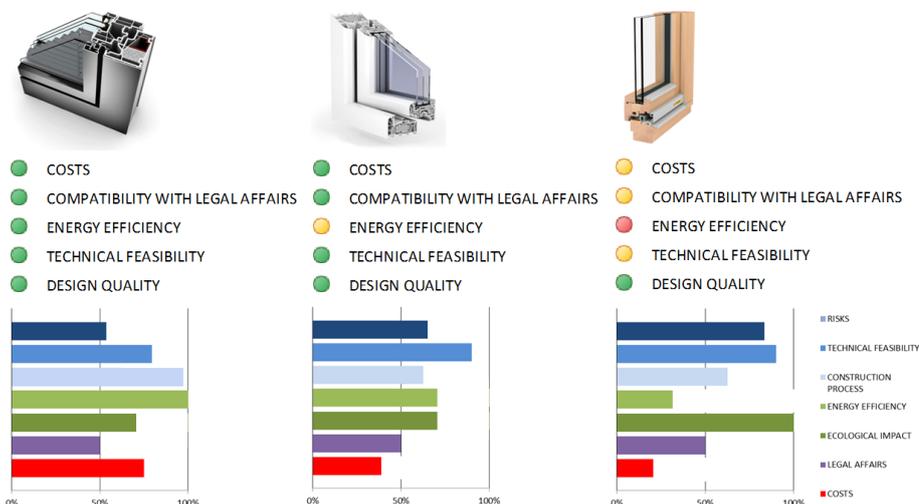


Figure 22: These reports can be used eg. to compare different implemented or suggested single measures on behalf of the given evaluation by the implementing housing companies.



analyse the steps of refurbishment process

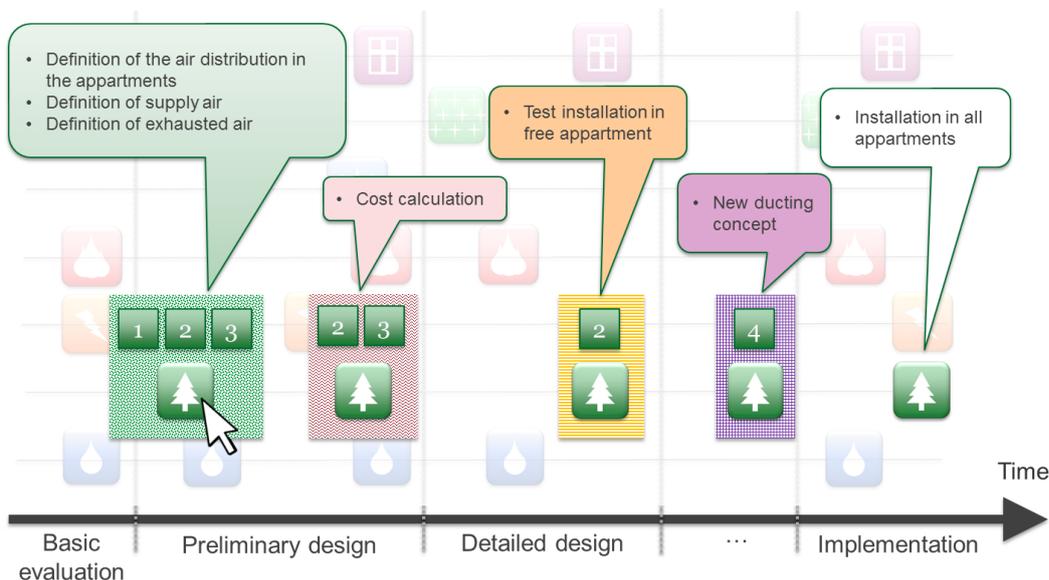


Figure 23: In principal it would be possible to use the collected data to analyse the steps of refurbishment (not yet implemented). This only can take place if the given data is as accurate as possible along the layout of the developed database structure.



## 8. TECHNICAL DOCUMENTAION AND BACKGROUND

This guideline database is established on several open-source technologies:

- **Content Management System (CMS)** by [Drupal](#)
  - It is used to generate the main web front end to the user and to provide the data input to the project partners. It is a user friendly and powerful content management platform for building nearly any kind of website: from blogs and micro-sites to collaborative social communities.
    - Drupal is distributed under the [GNU General Public License](#).



Figure 24: Screenshot of *sinfonia.passiv.de* web frontend realised with Drupal 7.0

- **PHP** a server-side scripting language designed primarily for web development but is also used as a general-purpose programming language. PHP code was used to extend the functionality of the Drupal CMS system e.g. in case of the comprehensive data input forms. Drupal CMS itself is also based on PHP.
  - The standard PHP interpreter, powered by the Zend Engine, is free software released under the [PHP License](#).



Figure 25: PHP logo



- **SQL Database System** by [MariaDB](#)  
an open-source relational database management system (RDBMS). It was used to setup the according database layout for this task. As about 100 different values per submission have to be specified, the database at the end will contain more than 5000 values.
  - MariaDB is intended to remain free under the [GNU GPL](#).

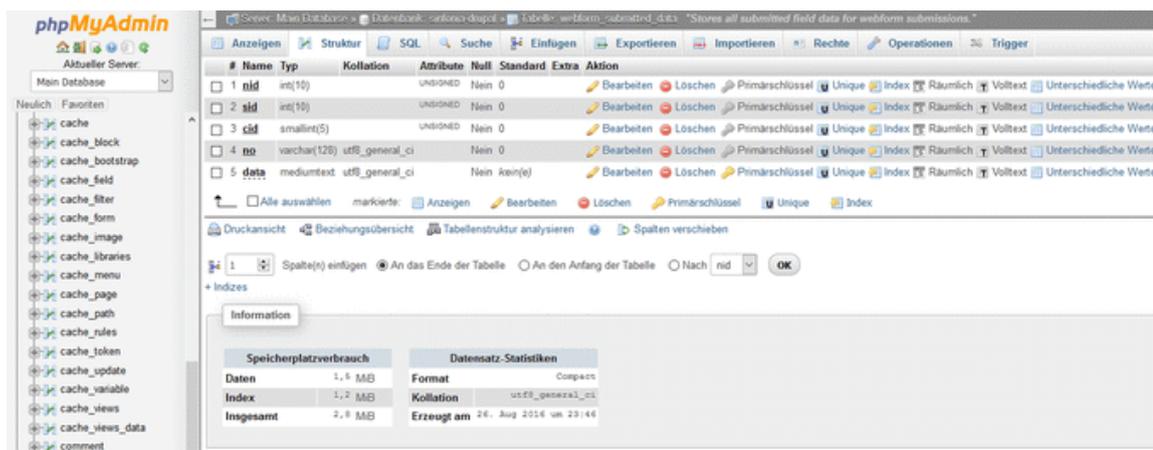


Figure 26: Guideline database layout viewed in [phpMyAdmin](#) SQL database administration tool.

- **Python** a high-level, interpreted, **dynamic programming language**.  
It was used to generate the dynamic database output to the public. Python supports multiple programming paradigms, including object-oriented, imperative and functional programming or procedural styles.
  - [CPython](#), the reference implementation of Python, is [free and open-source software](#).



Figure 27: Python logo

## 9. OTHER RESOURCES

### 9.1 ADVISIBLE LITERATURE ON ENERGY EFFICIENT REFURBISHMENT

- **Wolfgang Feist, Passive House Institute:** various refurbishment related literature:
  - [Research Group Volume 30](#): 2004 - Ventilation in refurbishments - [Link](#)
  - [Research Group Volume 32](#): 2005 - Factor 4 reduction for sensitive retrofits: Passive House components + interior insulation - [Link](#)
  - [Research Group Volume 39](#): 2009 - Step-by-step refurbishment with Passive House components - [Link](#)
  - [Research Group Volume 48](#): 2009 - Refurbishment of non-residential buildings - [Link](#)
  - [EnerPHit Planning Handbook](#): 2012 - Compendium of refurbishing existing buildings with Passive House Components - [Link](#)
  - [Passive House Planning Package Version 9](#): 2015 - an easy to use planning tool for energy efficiency for the use of architects and planning experts. Now with special output file for EnerPHit Retrofit and step-by-step retrofits. - [Link](#)
- **3enCult - Energy Efficiency Solutions for Historic Buildings** - Combining the existing know-how of the experts involved, it is a helpful guide for many building owners and professionals tackling the renovation of their specific historic building. - [Free PDF Download](#)
- **R. Vallentin:** Energieeffizienter Städtebau mit Passivhäusern – Begründung belastbarer Klimaschutzstandards im Wohnungsbau, Dissertation TU; München, Göttingen: 2011 (ISBN 976-3-86955-673-4)
- **Doris Haas-Arndt, Fred Ranft:** Informationspaket „Altbauten sanieren“, BINE Informationsdienst, FIZ Karlsruhe, 2008 ([ISBN 978-3-934595-78-1](#))
- **Burkhard Schulze Darup:** Energieeffiziente Wohngebäude, BINE Informationsdienst, FIZ Karlsruhe, 2009 ([ISBN 978-3-934595-82-8](#))
- **Ingo Gabriel, Heinz Ladener** (Hrsg.): Vom Altbau zum Niedrigenergie + Passivhaus, ökobuch Verlag, Staufen bei Freiburg, 2010 ([ISBN 978-3-936896-46-6](#))
- **Friedrich Heck:** Energiekosten senken – Kosten und Nutzen von Wärmedämmmaßnahmen, Fraunhofer IRB-Verlag, Stuttgart 2007 ([ISBN 978-3-8167-7372-6](#))
- **4. Internationales Anwenderforum:** Energetische Sanierung von Gebäuden, OTTI, Regensburg, 2010 (ISBN 978-3941785-11-3)
- **Josef Maier:** Ausbau von Dachgeschossen – Ein Praxisleitfaden zum Bauen im Bestand, Fraunhofer IRB-Verlag, Stuttgart 2005 ([ISBN 3-8167-6691-9](#))



## 9.2 OTHER ADVISABLE WEB RESOURCES

- [EuroPHit project](#) - **Retrofitting for the energy revolution, one step at a time** - it is about applied knowledge on deep energy retrofits to the oft-overlooked yet critical area of step-by-step refurbishments. - [Link](#)
- [3enCult](#) - **Efficient energy for EU cultural heritage** - The project 3ENCULT bridges the gap between conservation of historic buildings and climate protection, which is not an antagonism at all: historic buildings will only survive if maintained as living space. - [Link](#)
- [Passipedia](#) - **The Passive House Resource** - Passipedia constitutes a vast array of cutting edge, scientifically sound, Passive House relevant articles. - [Link](#)
- [PassREg](#) - **Solutions Open Source** - This Wiki database contains useful information supporting the local transition to zero energy construction. It provides an interactive, continually growing Solutions Open Source (SoS) on Passive House technology and compatible renewable energy supply. - [Link](#)
- [CasaClima](#) - **Refurbishment** - Energetic redevelopment using the most advanced technology reduces energy up to 90% compared to older buildings. Saving energy means saving money, but in addition also helps protect the environment and increases the cosiness of the home. - [Link](#)
- [Built2Spec](#) - **Built to Specifications** - is a Horizon 2020 EU-funded project involving 20 European partners that seeks to reduce the gap between a building's designed and as-built energy performance. - [Link](#)



## 10. LIST OF ABBREVIATIONS

|         |  |
|---------|--|
| ACC     | Agenzia Casa Clima                     |
| AEW     | Azienda Energetica Etschwerke          |
| BBT     | Brenner Basistunnel                    |
| BOZ     | City of Bolzano                        |
| CEN     | European committee for Standardization |
| EIB     | European Investment Bank               |
| EURAC   | European Academy of Bozen/Bolzano      |
| G!E     | Greenovate!Europe                      |
| IBK     | City of Innsbruck                      |
| IIG     | Innsbrucker Immobilien Gesellschaft    |
| IKB     | Innsbrucker Kommunalbetriebe           |
| IPES    | Istituto per l'Edilizia Sociale        |
| KPC     | Kommunalkredit Public Consulting       |
| MAG IBK | Magistrat Innsbruck                    |
| MoB     | Municipality of Bolzano                |
| NHT     | Neue Heimat Tirol                      |
| PHI     | Passive House Institute                |
| PUM     | Urban Mobility Plan of Bolzano         |
| PUT     | Urban Traffic Plan                     |
| SAT     | Standortagentur Tirol                  |
| SEAP    | Sustainable Energy Action Plan         |
| SEL     | Società elettrica altoatesina SpA      |
| TIGAS   | TIGAS Erdgas Tirol GmbH                |
| TIS     | Techno Innovation South Tyrol KAG      |
| TIWAG   | Tiroler Wasserkraft AG                 |
| UIBK    | Universität Innsbruck                  |
| WP      | Work package                           |
| GUI     | Graphical user interface               |
| CMS     | Content management system              |
| SQL     | Structured Query Language              |
| RDBMS   | Relational database management system  |
| PHP     | a server-side scripting language       |
| PHPP    | Passive House Planning Package         |



## Annex: DOCUMENT INFORMATION

| SINFONIA DELIVERABLE FACT SHEET  |  |
|--|--|
| PROJECT START DATE   | 1 June 2014  |
| PROJECT DURATION   | 60 months  |
| PROJECT WEBSITE  | <a href="http://www.sinfonia-smartcities.eu">http://www.sinfonia-smartcities.eu</a>              |
| <b>DOCUMENT</b>  |  |
| DELIVERABLE NUMBER:  | 4.1  |
| DELIVERABLE TITLE:   | Guidelines to the pilots for decision  |
| DUE DATE OF DELIVERABLE:   | Sept. 2016   |
| ACTUAL SUBMISSION DATE:  | 30.09.2016   |
| EDITORS:   |  |
| AUTHORS:   | PHI and task 4.1 partners  |
| REVIEWERS:   |  |
| PARTICIPATING BENEFICIARIES:   |  |
| WORK PACKAGE NO.:  | 4  |
| WORK PACKAGE TITLE:  | Integrated refurbishment processes coupling building, electricity grids and heat/cold networks   |
| WORK PACKAGE LEADER:   | SP   |
| WORK PACKAGE PARTICIPANTS:   | SP, IKB, NHT, UIBK, BOZ, EURAC, IPES, ACC, PHI, LIE, TIGAS, IIG                                  |
| <b>DISSEMINATION LEVEL:</b>  |  |
| CO (CONFIDENTIAL, ONLY FOR MEMBERS OF THE CONSORTIUM INCLUDING THE COMMISSION SERVICES)  | -  |
| PU (PUBLIC)  | <b>PU</b>  |
| PP (RESTRICTED TO OTHER PROGRAMME PARTICIPANTS, (INCLUDING THE COMMISSION SERVICES)      | -  |
| RE (RESTRICTED TO A GROUP SPECIFIED BY THE CONSORTIUM INCLUDING THE COMMISSION SERVICES) | -  |
| DRAFT/FINAL:   |  |
| NO OF PAGES (INCLUDING COVER):   | 32   |
| KEYWORDS:  | high energy efficient, refurbishment, best practice solutions, guideline, database, web resource |

