[European projects]

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Summary of the recommendations of the ASIEPI project

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The other co-authors are mentioned on their respective pages.

All project materials are available on the project website: *www.asiepi.eu*

Note: in order not to burden this IP, it does not contain explicit references. The reader is referred to the summary reports and all the other project materials for the foundations of the recommendations and for more detailed treatment of the different topics: see §.8 on p.8 of this IP for further orientation.

Partner countries in ASIEPI

Similar Information Papers by ASIEPI and by other European projects can be found on the individual project websites and in the publications database of the BUILD UP Portal: *www.buildup.eu*

The main objective of the ASIEPI project has been to formulate suggestions to policy makers on how to improve the quality and the impact of the regulations on the energy performance of buildings with respect to 6 specific issues. This paper gives a brief overview of the major recommendations for each of these 6 topics, and serves as a general introduction to the project.

1 > What is the ASIEPI project?

The full project name is:

ASsessment and Improvement of the EPBD Impact
(for new buildings and building renovation)

This has been abbreviated to the acronym ASIEPI. The project took two and a half years and was completed in March 2010.

The focus has been on 6 specific topics that constitute particular challenges in the Energy Performance of Buildings (EPB) regulations:

- intercomparison of the levels of the EP-requirements
- impact, compliance and control of legislation
- effective handling of thermal bridges
- stimulation of good building and ductwork airtightness
- support for the market uptake for innovative systems
- stimulation of better summer comfort and efficient cooling

The main objective has been to formulate suggestions for policy development.

The project had full partners (dark blue) in 12 countries and subcontractors (light blue) in 5 more countries. Furthermore, there were 6 Europe-wide associations acting as associated partners. In this manner, a good reflection was obtained of the EPB-practices across all of Europe at the time of the project. For most topics, surveys have been made in these countries in order to see how the EPB-regulations deal with each of the issues.

Different aspects of each of the major topics have been analysed. The results are documented in a full suite of project data. Among others, these data provide insight into the potential problems and give guidance with respect to possible solutions. However, as the project had to conform to the objectives of the IEE-SAVE programme, no new, ready-to-use methods were developed, but instead awareness of the challenges was raised and existing best practices to achieve more effective EPB-regulations were highlighted.

This paper briefly summarises the major suggestions with respect to each of the topics. These recommendations are then discussed in more detail in the final reports. The relationship between these reports and all the other project results is further explained in §.8 on p.8 of this paper.

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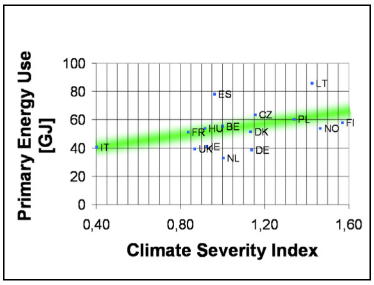
All project material on this topic can be accessed through *http://www.asiepi.eu/wp2-benchmarking.html*, and its subordinate pages.



The comparison method developed in ASIEPI will lead to three groups: an average group, a group which is a bit better and a group which is a bit worse than average.

This 'three-group approach' is seen as a big advantage of the method, since there are a lot of catches in the rest of the method to give a robust ranking of countries anyway.

The graph shows the total primary energy use for the semi-detached houses used in the comparison method.

2 > Intercomparison of the levels of the EP-requirements

Comparing the energy performance requirement levels among the countries of Europe constitutes a major challenge. From the comparison of for instance the Dutch requirement level of 0,8 with the Flemish level of E80, it is obvious that direct comparison is not possible. Within ASIEPI a method for comparing EP requirement levels was developed and while doing so, several lessons were learned which led to the following conclusions and recommendations:

- Although it seems easy to make a comparison of EP requirement levels between countries, it is, in fact, difficult to propose a fair and effective comparison method. In this respect care must be taken when interpreting the comparison results, since it is hard to completely understand a comparison study if all the boundary conditions are not known, and conclusions might therefore be misleading.
- Countries take into account a different set of energy uses in the assessment method of the EP requirements. Some only take into account heating and cooling needs, while others also incorporate heating and cooling systems, hot water and/or lighting. This is a problem for comparison since the methods are *performance* methods not *component* methods: a moderately insulated house with an efficient hot water boiler can be as effective as a very well insulated house with a less efficient hot water boiler. If the boiler is not taken into account in some countries, by definition this is like comparing apples with oranges.
- In addition, there is no harmonised way of assessing building components and systems. Current standards often mix common procedures with national choices, which make comparing assessment results far from evident.
- The previous two issues make effective comparison at this stage simply impossible. The situation will partly change due to the recast of the EPBD which explicitly demands that countries broaden the scope of their EP assessment to include technical systems, hot water and lighting. Continuing the development of harmonising CEN Standards is recommended because these are crucial for proper comparison. Relevant measures should be a variable part of the national EP methods and also CEN Standards should address all these relevant national measures, to make a uniform assessment possible. To achieve this it is important that all countries support the European methods. Developing European methods should be done by the intensive involvement of Member States.
- The severity of energy performance requirement levels varies within countries with, for example, building types, shapes, and system choices. Therefore, a simple ranking among countries does not exist, which makes comparison prone to unfair comparisons or even manipulation.
- The method developed within ASIEPI is far from perfect, but taking into account the complexity of the task, it is a good start. It is designed to suit the expected future developments, e.g. within CEN and ISO, which will make the comparison method more suitable in the future. The method includes an index to incorporate the severity of the climate.
  In general accuracy of say more than 20% will probably never be achievable for a comparison, even if in the future improved boundary conditions, such as more uniform EP-methods, would be put in place.
- Since the need for European and worldwide comparison of energy use will expand, further development of the climate severity index within CEN and ISO is recommended.

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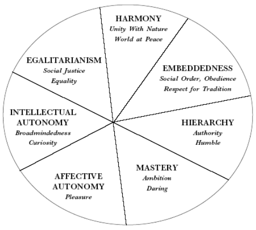
All project material on this topic can be accessed through *http://www.asiepi.eu/wp-3-compliance-and-control.html*, and its subordinate pages.

The main achievement of the work package was the elaboration of state of the art reports on Impact, Compliance and Control in: Belgium, Czech, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Lithuania, Netherlands, Norway, Poland and Spain

and 4 synthesis reports on

1. Evaluation of impact of national EPBD implementation in MS,
2. Evaluation of compliance and control in the different member states,
3. Barriers and good practice examples,
4. Identification of interesting approaches and possible bottlenecks for compliance and control of regulations

Above reports are also available in form of IP and can be found on *www.buildup.eu*



Schwartz's seven cultural value orientations

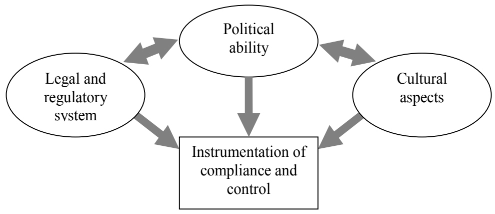
Was one of main dissemination activity of work package.

3 > Impact, compliance and control of EPBD regulations

The EPBD only imposes Member States (MS) to set requirements without any specification about the severity of the requirements, nor about the measures to be taken regarding the control on implementation. As such, MS can fulfil the requirements of articles 4 to 6 without increasing the original levels of requirement and without carrying out any kind of control.

A good view about the impact of the present EPBD on the requirements and how MS handle the compliance of requirements was a main goal of the ASIEPI project.

Compliance and control is an essential part of a successful implementation of the European Energy Performance of Buildings Directive (EPBD). The effectiveness of a compliance and control strategy is affected by three context related factors:



- How compliance and control is organised has to meet the **legal and regulatory system** of a country. For instance in case of a Member State where the responsibility is strongly delegated to regions, the federal legal structure might act as a framework to facilitate the regions to design their approach. In those Member States a centralised organization is not very likely and centralised control is not possible and diversity in compliance and control instruments can occur.
- Secondly, the **cultural aspects** related to the interaction between society and the government play an important role. The relationship between citizens and authorities depends on values that vary from country to country. In some countries a very strict enforcement is implemented, while in other countries the authorities can apply alternative control schemes partly based on self regulation.
- A third important aspect that affects the effectiveness is the **political views**. Policy priorities at a given time might not be fully in line with the objectives of the EPBD. The motivation to take the energy issue a step further does not always exist. Within the political spectrum the need for substantial CO_2-reduction is not endorsed by every party.

Main recomendations and findings from reports collected:

- The various reports show a **significant variation in EPBD implementation**, with considerable differences in impact, compliance and control. The proposed recast may accelerate harmonisation within this process.
- **Not all countries** have **yet fulfilled all the requirements imposed by EPBD**. As guardian of the European Treaty, the European Commission must continue its efforts regarding infringement procedures.
- **It is essential to have an integrated approach** which covers all energy related building components and service systems to stimulate cost-optimised energy performance targets. In several Member States **interesting compliance and control approaches exist,** which do not increase the administrative burden.
- In addition, it is also important (to continue) **to promote awareness and motivation actions** e.g. educational and information campaigns.
- There are **success stories regarding market uptake** of innovative systems and technologies, whereby the **EPBD regulations have worked as a major driver for market uptake**.

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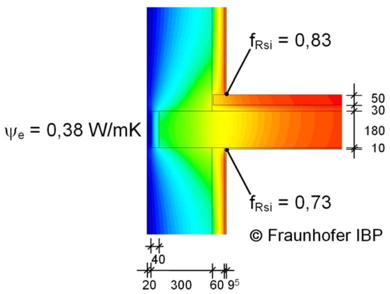
All project material on this topic can be accessed through *http://www.asiepi.eu/wp-4-thermal-bridges.html*, and its subordinate pages. A main result is the final report of the topic **"An effective Handling of Thermal Bridges in the EPBD Context"**.

Tasks concerning thermal bridges addressed within ASIEPI:

- EU Member States' approaches in regulations
- Quantification of thermal bridge effects to the energy balance
- Used software tools and thermal bridge atlases
- Available good practice guidance
- Promotion of good building practice
- Execution quality
- Advanced thermal bridge driven technical developments



Example of a thermal bridge effect at a concrete ceiling embedded in the external wall. Calculation of the thermal bridge loss coefficient and the dimensionless temperature coefficient. The colours illustrate the temperature distribution within the construction.

4 > An effective handling of thermal bridges

Thermal bridges can occur at various locations of the building envelope and can result in increased heat flow, lower interior surface temperature, moisture and mould problems and additional transmission losses. The additional transmission losses lead to a higher heating and cooling energy need and use and are becoming especially interesting with so-called low energy or high performance buildings. ASIEPI has collected and analysed international and national information from up to 17 EU Member States plus Norway on the topic of thermal bridges in building. Seven different tasks as listed on the left have been addressed. The results can be summarised as follows:

- For many of the tasks it can be said that various at least partly high quality information is available in most of the EU Member States such as software tools for calculating thermal bridges, thermal bridges atlases and the promotion of good practice guidance. It would be desirable that the material is used more often by building practitioners, and that some countries catch up with the others. Software for calculating thermal bridges should be validated and the validation results published.
- All EU Member States consider thermal bridges in the energy performance assessment of new buildings, but less in the assessment of existing building undergoing major renovation. A detailed assessment of thermal bridges allows for compensation of other energy influences due to better building junction solutions. The use of default values on the other hand makes the calculation of the energy performance quicker.
- Several Member States have included specific requirements concerning the quality of building junctions in their regulations. These can be maximum linear thermal transmittance coefficients or minimum dimensionless temperature factors.
- Some countries have a meticulous check of details during or after the design phase of a building. Few countries have a detailed quality assurance of the execution quality on the construction site. ASIEPI has collected methods to assess the execution quality, but also possible sticks and carrots to improve the realisation of building junctions.
- The search for thermal bridge driven industry developments was not an easy task. However we have found some products that can reduce thermal bridges in buildings significantly. It has to be mentioned that most of these products are produced and used in central Europe. A regulation that allows the detailed assessment of building junctions and is up-to-date with innovations supports these kinds of solutions.
- The project has derived detailed recommendations that are included in the final report of the task and are tailored to the different groups: policy makers, national standardisation bodies, CEN/ISO, building practitioners, associations of architects and engineers, universities, building owners, software companies and the building industry. The recommendations follow the results presented above.

Future directions

One national study showed that the reduction of thermal bridges can have the same impact on the final energy of a single-family house as the gains by a solar thermal collector for domestic hot water.

With the future of "nearly zero energy buildings" for both new and existing buildings good quality building component junctions will become even more important.

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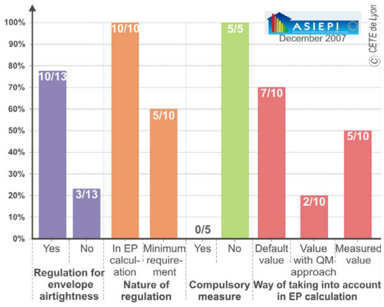
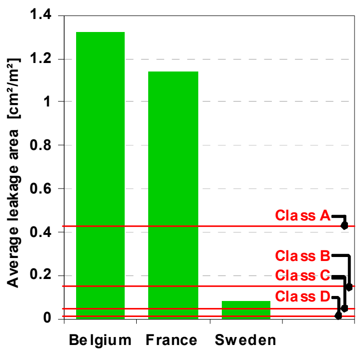
All project material on this topic can be accessed through *http://www.asiepi.eu/wp-5-airtightness.html*, and its subordinate pages.



Envelope airtightness: results of an enquiry among 13 Europeans experts involved in the ASIEPI project



Except for Scandinavia, many European countries have very leaky ventilation systems

5 > Stimulation of good building and ductwork airtightness

Building and ductwork leakage are detrimental to energy conservation, comfort, hygiene, and can cause building damage and prevent proper control of the ventilation airflow rates. Today more than ever, with the objective of all new construction being "nearly zero energy buildings" in 2020, policy makers need to know how to implement improved airtightness. ASIEPI recommends the following on:

Promoting a market transformation of envelope airtightness?

- Airtightness is often included and can greatly benefit the national EP calculation methods (see figure) as it represents both a key element for low-energy buildings and a cost-effective measure to reduce energy consumption. Combined with compulsory measurements for claiming a reward in the EP-calculation,this has been identified as a major push for a market transformation. This also applies to labels or subsidies. Recent experience with quality control management as proof of compliance including measurement of random samples is also promising.
- Promote cooperation with building professionals through the development of practical tools with relevant recommendations to construct airtight building envelopes starting at the design stage (only existing in DE, NO and FR); and through pilot and research projects which are, in most countries, considered as significant drivers for a market transformation.
- Initiate and promote a global dissemination strategy that includes training, communication and events, tailored for each of the diverse target groups which include owners, builders, designers, craftsmen and measurement technicians.

Supporting a market transformation of ductwork airtightness?

Focussing on the Scandinavian success stories (see figure) produced the following recommendations :

- Develop information actions on the benefits of efficient ductwork airtightness for the building and industry professional communities. The building community should be more informed about the impact of inferior ductwork airtightness on energy efficiency, comfort, indoor air quality, ventilation efficiency and fire protection. It is also crucial to inform industries and then convince them that airtight circular duct systems have many additional benefits (low costs, space efficiency) over both rectangular duct systems and circular duct systems without gaskets.
- Support industrial development of efficient products because a technology push was clearly observed in Scandinavia where 90-95% of the ductwork installed is spiral-seam steel circular ducts with factory-fitted sealing gaskets.
- It is important to include requirements in the national regulations, with penalties for non compliance. Technical guidelines and/or standards exist in every Scandinavian country. As a result, requirements and references to the guidelines are commonly included in building contracts and great attention is paid to commissioning all ventilation and air conditioning systems. Penalties on the building energy labelling for instance in case of higher leakage rates are also an incentive for building professionals to pay particular attention to duct leakage.

As a global perspective, the main pitfall to avoid is underestimating the challenge. Standardising effective envelope and ductwork airtightness for every construction is a tremendous challenge that calls into question some traditions in the design and erection of buildings. It requires retraining, quality assurance processes and regulations, to develop specific regulation or certification frameworks.

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BBBRI
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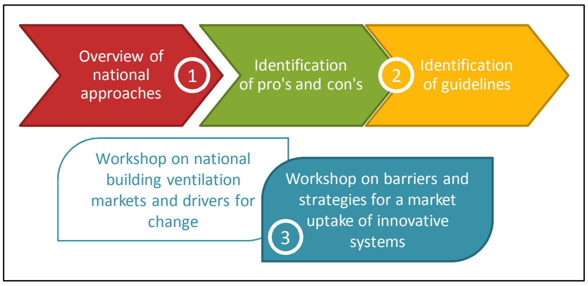
All project material on this topic can be accessed through *http://www.asiepi.eu/wp-6-innovative-systems.html*, and its subordinate pages.

6 > The EPBD as support for the market uptake for innovative systems

In the context of EPB regulations, *innovative systems* (or technologies) are defined as:

- Systems (or technologies) that, in most case, improve the building's energy performance, and
- Whose performance cannot be assessed by the standard EP calculation procedure in a particular country.

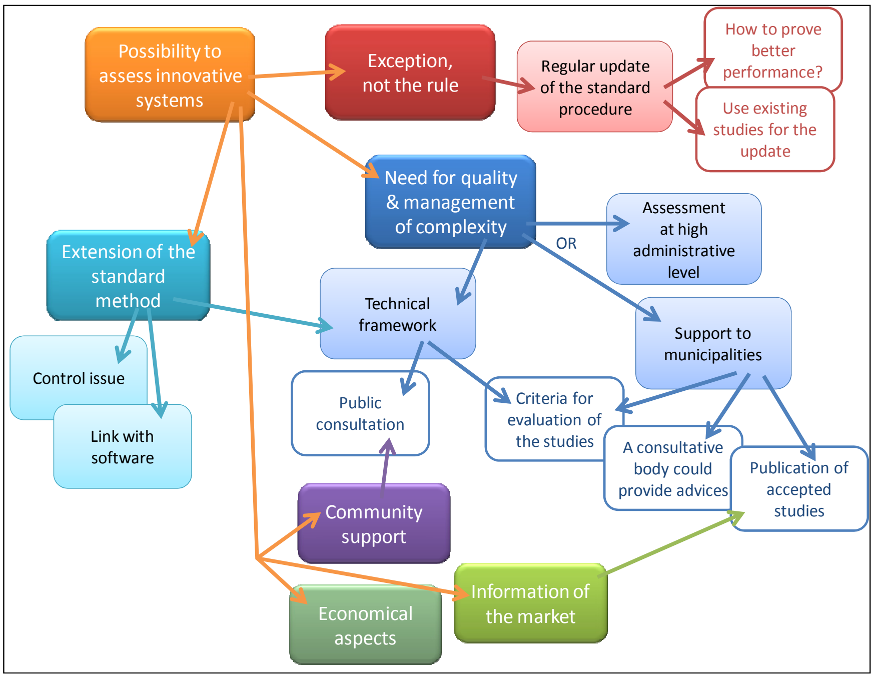


ASIEPI "innovative systems" issue was articulated in three main steps.

As a first step, ASIEPI has made an overview of the current situation regarding the assessment of innovative systems across the EU; this overview can be read in a *report* and has been discussed in a *presentation-on-demand*.

From the various ways innovative systems are handled by the national EPB approaches, some key points of attention have been identified, as shown in the figure. This information is available in a report and has been presented in the presentation-on-demand that summarised the project. Those points of attention could inspire both the Member States that do not have a framework for the assessment of innovative systems and those that would like to improve their existing framework.

The three main points of attention could be summarised as:



Identified key points of attention that could inspire Member States.

1. It is important that Member States explicitly foresee the possibility of assessing technologies not covered by the standard calculation procedure, so that their EPB regulation does not become a barrier for innovation. If a legal framework is defined, the extent of its application should be clearly defined. Is it applicable to systems not covered by the standard calculation procedure only? Is it also applicable to prove a better performance than that included in the standard calculation procedure? Is there also an approach for "innovative buildings" which are only valid for a single building?
2. As this alternative assessment procedure **should be the exception rather than the rule**, different approaches should be combined (if legally possible) to limit its use: the standard calculation procedure should be updated on a regular basis (on basis of the equivalence studies) and should include the specifications to prove better performances than the default value.
3. **Given the need for quality and the complexity of a coherent assessment of innovative systems, it is important to have a framework that can ensure the quality of the studies.** Several options have been identified to go in that direction: e.g. the assessment of the study should not be performed by the municipalities but by a sufficiently high administrative level, a technical framework could be defined, etc.

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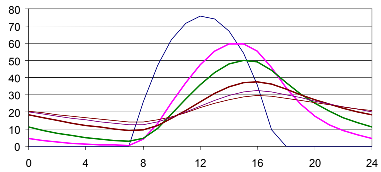
All project material on this topic can be accessed through *http://www.asiepi.eu/wp-7-summer-comfort.html*, and its subordinate pages.

In the context of ASIEPI, ***alternative cooling techniques*** are considered to be the cooling techniques that improve summer comfort substantially, without (or in a very limited manner) increasing energy consumption and which in general do not rely on the vapour compression refrigeration cycle.



Solar heat gains released to the air of the space in a room depending on the thermal inertia of the room

7 > Stimulation of better summer comfort and efficient cooling

One of the main goals of the ASIEPI project is to increase the awareness of the challenges for an effective stimulation of summer comfort and efficient cooling of buildings. Another goal is to improve the relevant procedures in several MS.

The recommendations drawn from the ASIEPI project on summer comfort and efficient cooling can be summarised into 3 main points:

1. **Protect the building against overheating and against the need to install active cooling in the future.**

There are many techniques and methods available that have great potential in limiting the chances of active cooling system installation and overheating emergence in buildings in the future. As energy efficiency and reduced energy consumption during the cooling season have only recently become a primary concern for many countries, these techniques and methods still do not receive the attention they deserve in national EP regulations. These methods are critical mostly for buildings with no active cooling and they include: fictitious consumption for cooling, overheating analysis, use of floating conditions, comfort indicators (e.g. Balance Point Temperature indicator), use of the Adaptive Approach in non-air conditioned buildings.

2. **Make alternative cooling techniques a top priority in national regulations and practical applications against conventional cooling systems.**

Alternative cooling techniques have great potential of reducing the cooling load and the cooling energy consumption in buildings. However, their implementation in EP regulations is not very robust at the moment, a fact that constitutes a hurdle to their use. Ways of reversing the current trend towards the use of conventional cooling systems are: establishment of financial incentives for alternative cooling systems; inclusion of more alternative cooling techniques along with their performance calculation methods in national regulations; but also, mandatory requirements for using alternative cooling techniques, such as solar and heat protection and modulation and dissipation cooling techniques (see Figure), before using conventional systems.

3. **Improve the current national EP procedures and thus enhance energy savings from cooling.**

There are many restrictions that if integrated in the national EP procedures can result in decreased energy consumption for cooling and enhanced energy efficiency. Restrictions that can be considered are: reduction of the over sizing capacity of the A/C installations during the design phase; minimum COP requirements and consideration of the COP of cooling systems during the peak and part load conditions instead of only under the nominal conditions; restrictions on the use of cooling during peak periods; application of modular pricing policy for large cooling consumers.

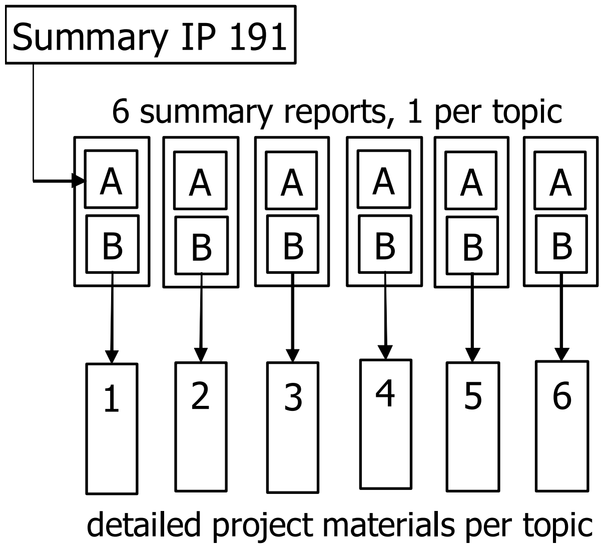
Other recommendations for the refinement of EP-procedures that involve summer comfort and cooling include: attention to proper setting of default values; integration of all aspects that have an impact on the cooling energy consumption in the procedures; avoidance of complex input data; make alternative cooling techniques part of the thermal balance equations but also integrate them in the global calculation method; revision of modelling levels and assumptions of the current calculation methods so that they become sensitive to relevant design decisions in summer performance.

8 > More information

The ASIEPI project has produced a broad set of dissemination materials.

As illustrated in the figure, the project results are structured as follows:

- This information paper briefly summarizes the main conclusions and constitutes the gateway into the project.
- The major findings and all the final recommendations are described more extensively in part A of the summary report on each of the 6 topics. Part B then gives a synthetic overview of all the other information that the project has made available on that topic.
- Finally, a wide range of information materials provides a more comprehensive, in-depth coverage of many different aspects of each of the topics.



The different project outcomes come in a variety of electronic formats:

- summary reports
- detailed technical reports
- information papers
- recordings of internet information seminars
- presentations-on-demand
- conference abstracts and papers
- other related material, such as documents supplied by third parties

All materials are available on the project website *www.asiepi.eu*.

Tip: Part B of the summary reports allows the reader to quickly identify the best source for the full, detailed information on any specific aspect(s) he is looking for at any given time.

ASIEPI partners:
BBRI (BE; technical co-ordinator), NKUA (GR; financial & administrative co-ordinator), TNO (NL), Fraunhofer IBP (DE), SINTEF (NO), CSTB (FR), CETE de Lyon (FR), REHVA (BE), ENEA (IT), AICIA (ES), NAPE (PL), VTT (FI), E-U-Z (DE), Enviros (CZ), SBi (DK)

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