SENTRO
EXECUTIVE SUMMARY FOR POLICY MAKERS

December 2008

SENTRO

Sustainable Energy systems in New buildings – market inTROduction of feasibility studies under the Directive on the Energy Performance of Buildings

Report no.: SENTRO/ D8 / 2008/WP5
EC-contract: EIE/06/102/SI2.445679
www.sentro.eu

Intelligent Energy Europe

Author(s):
Suzanne Joosen, Ecofys Nederland;

Contributing Author(s)
Onno Kleefkens, SenterNovem, Nederland;
Fieke Geurts, Ecofys Nederland;
Marjana Sijanec Zavrl, BCEI ZRMK, Slovenië;
Klaus Hansen, SBi, Denemarken;
Egidijus Norvaisa, LEI, Litouwen;
Natalia Makowska, Ecofys, Polen;
Hubert Despretz, Ademe, Frankrijk,
Svein Ruud, SP, Zweden

Date:
December 2008

Report no:
SENTRO/ D8/ 2008/WP5

EC contract:
EIE/06/102/SI2.445679

Project co-ordinator
Ecofys Netherlands BV
Utrecht, The Netherlands

Suzanne Joosen
S.Joosen@ecofys.nl

Supported by:
Intelligent Energy Europe

Project partners

Ecofys Netherlands BV Netherlands	
SenterNovem Netherlands	
Building and Civil Engineering Institute ZRMK, Slovenia	
Danish Building Research Institute, Aalborg University Denmark	
Lithuania Energy Institute, Lithuania	
Ecofys Poland Sp. Z.o.o., Poland	
Agence de l'environnement et de la maitrise de l'energie (Ademe), France	
SP Technical Research Institute of Sweden, Sweden	

Executive Summary For Policy Makers

In the European Union, the buildings sector accounts for 40% of the total energy use. It is the sector offering the biggest single potential for energy efficiency improvement and the reduction of CO_2 emissions.

An estimated one-fifth of current energy consumption in buildings could be saved by 2010. To translate this potential into reality, policies are needed that raise awareness and encourage more efficient building design and the use of more efficient technologies. In Europe, the Energy Performance of Buildings Directive (EPBD), is set to promote improvements in energy performance of buildings, with requirements that are expected to become more stringent over time.

One of the components (Art.5) of the Directive on the Energy Performance of Buildings (EPBD) (2002/91/EC) prescribes obligatory consideration of the feasibility of Alternative Energy Systems (AES) for all new buildings with a total useful floor area over 1000 m^2. The article has been included in order to promote energy savings that can be achieved by energy efficient supply systems and renewable energy systems, as opportunities for these systems are generally not explored to their full potential. Measures that reduce the energy demand (e.g. insulation) of a building are largely covered by other articles in the EPBD.

Feasibility studies in Article 5 of the EPBD (2002/91/EG)
[..] For new buildings with a total useful floor area over 1000 m^2, member states shall ensure that the technical, environmental and economic feasibility of alternative energy systems such as:

- decentralised energy supply systems based on renewable energy,
- CHP,
- district or block heating or cooling, if available,
- heat pumps, under certain conditions,

are considered and is taken into account before construction starts.

In November 2006 the European SENTRO project (Sustainable Energy systems in New buildings – market inTROduction of feasibility studies under the Directive on the Energy Performance of Buildings) is started. The main aim of the SENTRO-project is to develop and promote an approach to effectively incorporate the feasibility studies for alternative energy systems (Art.5 EPBD) in the common building practice.

This summary presents the main outcomes of the SENTRO-project for national and international policy makers.

General findings concerning the functioning Art.5 of the EPBD

The status concerning the feasibility study obligation is that most countries have transposed the requirements into their national legislation. However, operational legislation, technical guidelines and support tools take much more time to be fully in place [status March 2007, Sijanec Zavrl, M. et al. (2007); Joosen, S. et al. (2008)].

Moreover, the feasibility study requirement (Art.5 EPBD) is transposed in various ways into the national legislation of 27 EU-MS [Sijanec Zavrl, M. et al. (2007)]. Two main approaches were identified:

1. Direct transposition of Art.5 into the national legislation, usually combined with subsidiary legislation. This subsidiary legislation is based in either a definition of the protocol for feasibility studies or a list of obliged selected alternative energy systems.
2. Implicit transposition, Art.5 is integrated in either (already existing) EPBD calculation procedure and tools or legislation concerning heat supply and/or planning predefine the use of AES corresponding to the scope of Art.5.

It can be concluded that as far as the feasibility study obligation according to Art.5 of the EPBD is transposed into the national legislation, this legislation is functioning. Nevertheless, improvements are needed to achieve more impact in practice. This means that adjustments, tuning of legislation and/or support mechanisms are highly recommended.

With regard to the implementation of AES in buildings in general (the goal of Art.5) progress is observed [Sijanec Zavrl, M. et al. (2007); Hansen, K. et al. (2007)]. International legislation, as Art.5 of the EPBD, combined with other driving forces such as: 1) existing national energy polices, 2) market for low energy buildings and green image 3) favorable economy for several AES 4) currently strongly fluctuating energy prices, contribute to this successful implementation.

Furthermore, Art.5 of the EPBD offers opportunities to broadening the scope of the consideration of AES and to generate a fair level playing field for various options for a sustainable energy supply in buildings. The potential for AES is considerable: only by heat pumps and solar thermal systems savings up to 10% of the final energy demand in buildings in 2020 can be reached [EHPA, (2008); ESTIF, (2007)].

During the SENTRO-project the following ***preconditions*** towards optimal functioning of the feasibility study requirements of Art.5, are observed:

- Increase **awareness** of the obligation of Art.5 and its national transpositions.
- **Structural embedding** of the consideration of the energy concept (building shell & AES) into the activities of key actors in the building process
- **Guarantee of the quality** of a feasibility study

  Currently, it is often not clear yet how the quality of the feasibility study is guaranteed, and who is responsible for the control.
- **Proper compliance systems** (Art.5 EPDB).

  Without a proper compliance system in place, the feasibility study requirement (Art.5 EPDB) holds the risk that calculations/reports are made, but there will not be much impact in practice.
- Coherent requirements, supported by simplified clarifications and tools. Indication of which **software is reliable and starting points** for the detailed feasibility calculation.
- Extend the feasibility requirement to buildings with a total useful floor area over 1000 m^2 as it is common that new housing areas exist with large number of small houses.

Possible solutions for:

Improved quality quarantee

- The SENTRO handbook can be regarded as first step towards a quality protocol for performance of feasibility studies.
- Arrange clear responsibility for the quality of a building, including energy performance from beginning to realization. For instance, by use of a partnering organizational scheme. Involve energy experts and/or installers in an early stage.
- Improve conditions for proper (holistic) and reliable investment cost evaluation.
- Increase awareness of the sensitivity of the outcomes for energy prices and environmental issues (especially emission factor of used electricity).
- Gain insight in reliable performance data of alternative energy systems.
- Standardize technical regulations and outcomes. For instance at least the following topics could be requested as outcomes of a feasibility study per alternative energy system: 1) total final energy use, 2) primary energy use, including corresponding CO_2 emissions 3) kind of renewable energy used 4) percentage of renewable energy used. A next step could be to make it mandatory to present these outcomes on energy certificates.
- Insight on national, regional and preferable also on local level in the potential of alternative energy systems (as mentioned in Art.5 of the EPBD) should be available. This means maps indicating geothermal conditions, available waste heat sources, energy-infrastructure etc. This type of information should be available during the planning phase of a building project.

Improved compliancy

- Issue the building permit not until detailed specification of building and systems have been defined (for example as in Germany and Switzerland). In addition, it is essential that alternative energy systems are requested by design terms or at least valued within design terms.
- Set obligations to implement cost-effective alternative energy systems selected by national studies (for example as in Spain and Portugal).
- Control if the consideration of the feasibility of alternative energy systems has properly taken place by random checks. These random checks have to cover the calculations as well as the building practice.
- Introduce penalties for ignoring or not fulfilling the legislation.
- Assure sufficient capacity, resources, and skills at local authorities for their enforcement tasks.

Specific national findings concerning the functioning Art.5 of the EPBD

The lessons learned of the evaluation depend on the national status and way of transposition. Three situations have been distinguished.

For *countries with implicit transposition* for proper functioning of Art.5 fine-tuning towards tailor made solutions is needed. Usually implicit transposition concerns existing legislation, such as energy performance requirements in building standards and/or predefine of district heating system under certain circumstances. From the evaluation it appears that the legislation is functioning. Nevertheless, adjustments are recommended to optimize the impact, for instance by:

1) Take surrounding aspects[1] into account in the energy performance calculation
2) Anticipate on the possible future role of district heating.
3) Planning of energy infrastructure should include feasibility studies on the potential for inclusion of alternative energy systems at district level or at building level.

In addition, strengthening of the compliance system is recommended.

Countries which have lately directly transposed Art.5 into their legislation have to focus on raising awareness, reliable supporting tools and a proper compliance system.

For *countries with no or little legislation in place* the focus for the coming period should be on awareness and on dissemination of the learning experiences from other countries with comparable building practice and energy infrastructure.

The developed approach to incorporate the consideration of AES in the building process

In the SENTRO project an approach is developed and tested to effectively incorporate feasibility studies of alternative energy systems in the common building process. The approach considers what activities are needed from the various key actors to guarantee a proper performance of the consideration of various AES during the building process.

At district level, the planning stage should include feasibility studies of the potential for inclusion of AES at district level or at building level, so that considerations and limitations regarding the use of alternative energy systems at building level are well thought out. Municipal energy plans can have a considerable influence on the possibilities for incorporation of AES at building

[1] Think of surrounding aspects such as: geothermal conditions, opportunities to use waste heat, infrastructure and specific environmental legislation.

level, and some AES's are maybe better integrated in a district heating system than in the individual buildings.

At building level, awareness for the opportunities of AES has first of all to be raised during the program and proposal of the building project.

As support shining examples of successful implementation and answers to frequently asked questions can be used. Next step is to filter out unrealistic AES options. For this purpose the *checklist* can be used. The aim is to identify at least two interesting AES options considering the local conditions and building characteristics.

A more detailed feasibility study will then be performed for these AES of interest. The *handbook*[2] serves as protocol how to carry out a feasibility study: e.g. what technical, financial, environmental and organizational aspects have to be taken into account, which tools can be used and which sensitivity analysis provide more insight.

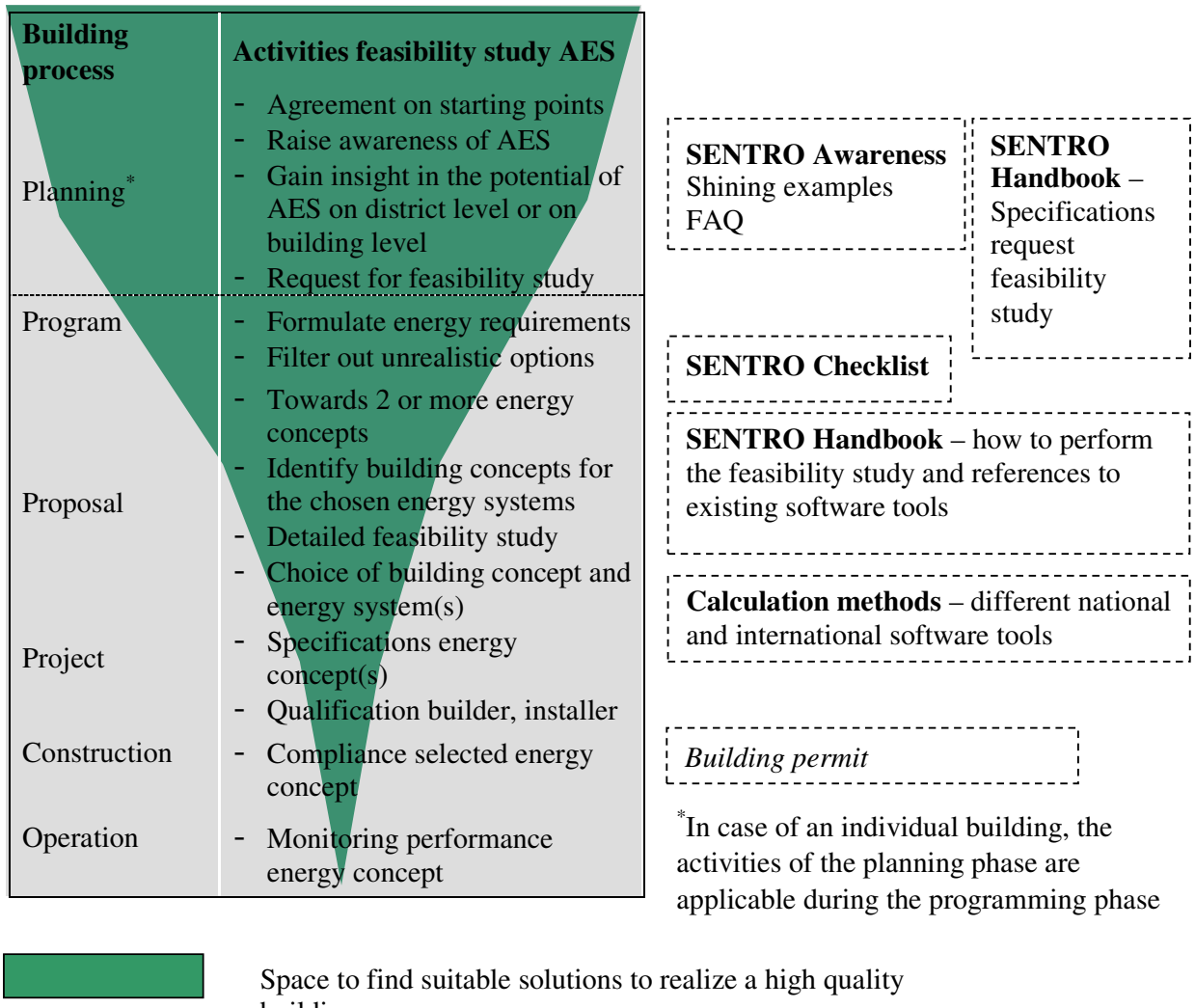
The results of these more detailed feasibility studies must be available when the final decision is made (often at project stage, preferable before that stage) on the building's energy system.

The approach, including supporting tools as the checklist and the handbook is visualized by Figure 1.

It has to be stressed that besides new buildings the developed approach and the supporting tools are as well applicable for refurbishment projects in which the energy supply system has to be reconsidered. The focus of the approach is on the development of individual buildings. Often the development of a new building area is more complex and demands more research. In this case the planning stage should include an exploratory study on the potential for inclusion of AES on district level or on building level.

[2] There is a universal English version available (Wahlström, Å. et al (2007)). This universal format can serve as guidance for the preparation of national handbooks. This is necessary, because great variation in national circumstances with respect to as well legislation in place as building practice. For the 7 SENTRO-country these national handbooks are available.

Figure 1 Activities to incorporate the feasibility study in the building process, including supporting tools.



Lessons learned from testing the approach (field trials)

There are large differences in: 1) the national status of the transposition of the feasibility study part of Art.5 2) the existing building practice and energy infrastructure in the countries. This means that the actual activities in the field trial to test the developed approach, including supporting tools, had to be tuned to fit these differences in the national context.

The focus of the tests was on the approach and the checklist, because the handbook was still in preparation. Based on the experiences in the field trial the approach (including the checklist and handbook) were interactively improved and tuned to the national context.

In general, it can be concluded from the experiences during the field trial regarding the SENTRO approach for the structural consideration of AES, that:

- Intervening early in the building process is crucial.
- Most successful if started in programming phase and elaborated during proposal phase. For the first filtering out unrealistic options, some basic data have to be available (for instance basic estimation of heat, cooling, electricity demand).
- Team work is important.
- Objective comparison is not easy, actors only rely on their own experience.
- Accessibility of expertise of new techniques has to be improved.
- Restrictions regarding obligatory connection to district heating or natural gas district may restrict the use of AES at building level.

Specific conclusions regarding the checklist are:

- Useful decision support tool, especially for non-energy experts.
- Useful for communication in the project and/or design team, which includes key actors with various backgrounds. Especially structural attention for all type of AES.

Recommendations for further improvements of the approach

The field trial concentrated on the early stages of the building process. In almost all cases this has lead to serious consideration of various types of AES. In a number of cases it already contributed towards the final decision upon a promising AES. However, in most countries the realization of a building requires a number of years. As a result within the project only one or two stages can be covered. It would be interesting to test and extend the approach for the complete building process: from planning to exploitation.

In addition, the approach can be further tuned for several involved key actors. In the end the approach should be embedded in the instruments key actors use in their daily decision / investment making.

Until now, the checklist and handbook are more or less 'living tools'. It is recommended that they are further tested in practice and updated after a certain period.

It is recommended that as long as the checklist and handbook are interactively changed that the discussions are attended by an energy expert who is informed about the SENTRO-approach, including its tools.

For more detail background information is referred to the reports published on the project website www.sentro.eu.

References

EHPA, (2008), European Heat Pump Action Plan 2008

ESTIF, (2007), Solar Thermal Action Plan 2007

Hansen, K. et al. (2007), " Inventory of building practice, barriers and solutions for market introduction of alternative energy systems (status 3/2007), SENTRO 2/2007/WP3, September, 2007", available at: http://www.sentro.eu/

Joosen, S et al (2008), "Towards an optimal approach to effectively incorporate feasibility studies of alternative energy systems (Art.5 EPBD) in the common building process", reviewed paper IEECB conference 10-12 April 2008, Frankfurt, available at: http://www.sentro.eu/

Joosen, S. et al (2009), "Towards an optimal consideration of alternative energy systems (Art.5 EPBD) in the common building process - Results of the field trial and evaluation". SENTRO D7/2009/WP5 (to be published in 2009)

Sijanec Zavrl, M. et al. (2007), "Inventory of implementation of feasibility studies from EPBD Art.5 in EU-27 (status 3/2007), SENTRO 1/2007/WP2, September, 2007", available at: http://www.sentro.eu/

Wahlström, Å. et al (2007), "Handbook for performing feasibility studies of alternative energy systems, SENTRO 3/2007/WP4, December, 2007", will published at: http://www.sentro.eu/