Overview of national approaches for the assessment of innovative systems in the framework of the EPBD

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This report summarises the key facts of the national approaches for the assessment of innovative systems in the framework of the EPBD or, more precisely, in the framework of the national Energy Performance of Building (EPB) regulations.

More information can be found at the ASIEPI project website:
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1 > Introduction

The EPBD [1] is one of European Union's tools to reduce its energy consumption. New and innovative products, systems and technologies may help to achieve this final goal. It is therefore of first importance that EPBD related regulations don't become barriers to innovation.

The EPBD requires that each Member State defines EPB calculation procedures. Member States are free to develop calculations as they want; the EPBD itself only gives a list of parameters that should be included. In some Member States, calculations are based on a simplified monthly steady state approach; in other Member States, calculations are based on dynamic simulations. But independently of the complexity of the calculation procedures, they can not cover all types of building systems or technologies that will be invented in the future – and they probably do not cover all those that are already on the market.

This is a real problem for such technologies, as reported by a manufacturer: *"The fact that our products are not included in the national EPB calculation procedure is a barrier to their market uptake because the architects firstly try to fulfil the EPB requirements. After having paid for this, they don't have money left for products that saves energy, even if these products have good return on investment."*

Consequently, if a Member State does not want its EPB regulations to be a barrier to innovation in the building sector, it should design its EPB regulations in such a way that the assessment of innovative systems (or buildings) is legally and technically possible.

One of the tasks of the IEE SAVE ASIEPI project was to analyse the way this has been made possible in several countries across Europe. This report presents some important characteristics of the national approaches by answering some key questions. It is based on the results of inquiries amongst the project partners, subcontractors, sponsors and contacts. [Some very general recommendations are included in this report, but those will be detailed further in a second report to be published later. The national approaches of 7 Member States is given in the annex.

Additional definitions
Energy need for heating or cooling: heat to be delivered to, or extracted from a conditioned space to maintain the intended temperature conditions during a given period of time (EN ISO 13790 - § 3.4.1)

Energy use for space heating or cooling: energy input to the heating or cooling system to satisfy the energy need for heating or cooling, respectively (EN ISO 13790 – § 3.4.9)

Primary energy: energy that has not been subjected to any conversion or transformation process (for a building, it is the energy used to produce the energy delivered to the building. It is calculated (…) using conversion factors) (EN 15217 - § 3.33)

A quasi-steady-state method is a method that calculates the heat balance over a sufficiently long time (typically one month or a whole season), which enables one to take dynamic effects into account by an empirically determined gain and/or loss utilization factor. (EN ISO 13790 – § 5.3)

A dynamic method is a method that calculates the heat balance with short times steps (typically one hour) taking into account the heat stored in, and released from, the mass of the building. (EN ISO 13790 – § 5.3)

Note: EN ISO 13790 covers three different types of method:
- a fully prescribed monthly quasi-steady-state calculation method;
- a fully prescribed simple hourly dynamic calculation method;
- calculation procedures for detailed dynamic simulation methods.

Definitions

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

- systems (or technologies) that, in most cases, improve the building's energy performance

AND

- whose performance cannot be assessed by the standard EPB calculation procedure in a particular country.

Similarly, the concept of *innovative buildings* should be used for buildings whose performance cannot be assessed by the standard EPB calculation procedure, not because they are using innovative systems, but because of their novel/unconventional design.

The alternative assessment framework for the assessment of innovative systems or buildings is often called the *Principle of Equivalence*. This comes from The Netherlands, where the *Gelijkwaardigheid Principe* is well established. However, in this report, we will use the terminology "*alternative assessment framework or procedure*".

Additional information

2 > Is it necessary to have a legal framework for the assessment of innovative systems/buildings?

At first glance, if a Member State does not want the EPB regulation to be a barrier to innovation, the answer is clearly "yes", but…

The EPDB has been implemented very differently in all Member States. Large differences can be observed not only with respect to the calculation procedures, but also on the administrative procedures and on the control and compliance issues. Therefore, the answer to the question is not as straightforward as it looks like, as shown by the Belgian, Portuguese/Norwegian and Danish situations.

In **Belgium**, studies have shown that the previous regulation related to building insulation and ventilation was not well applied, mainly due to a lack of controls by the authorities. For that reason, Belgium has chosen to implement the EPBD with a very strong control scheme. As consequence, the way to calculate the building energy performance (EPB) had to be well defined and had not to be open to any discussion between the authorities and the person in charge of the EPB calculations. Belgium has therefore defined a calculation procedure that must be followed to the letter. (Belgium has also chosen to provide official software that must be used to deliver the EP declaration to the authorities.) Consequently, if Belgium does not want its EPB regulation to become a barrier to innovation, it must have a legal framework for the assessment of innovative systems/buildings.

Software competition is open in CZ, FR, DE, ES, HU, IT, NL, NO and UK, but not in BE, DK, IE and LT.

Conversely, **Portugal** has chosen a very open approach. The designer must calculate the EP of a non-residential building under nominal use conditions, with a detailed hourly simulation. The regulation specifies those nominal use conditions, but for the rest, the designer has much freedom. For instance, he can use any simulation software he wants, as long as this software is "recognised" by the national certification system. Consequently, any innovative systems can be assessed by the designer and no legal framework for assessment of innovative systems/buildings is necessary. **Norway** allows similar flexibility in choice of software, as long as the software meets minimum requirements given in a national standard. The only parameters related to user behaviour are 'fixed' – and only for building regulation calculations, not for energy certificate calculations.

Another specificity of Portugal is that the actual building energy consumption has to be monitored and has to be below the requirements

A third situation is the Danish one. As Belgium, **Denmark** has implemented a fully-described approach. But in reality, the system is much more open than in several countries as the designer may change the values of some parameters that are fixed in other countries. Therefore, innovative systems are handled as usual ones. If a building designer considers that the calculation procedure does not match its design, he can ask the authority in charge of the calculation procedure how to make the calculation for its building. Moreover, the calculation procedure can be quite quickly upgraded. Consequently, even without a specific legal framework for the assessment of innovative systems/buildings, the EPB regulation is not considered as a barrier for innovative systems/buildings.

Currently, there are legal frameworks in BE, ES, FI, FR, FR, DE and NL and there is no frameworks in CZ, DK, GR, HU, IT, LT, PO, PT, and UK.

The answer to the question can therefore be "yes" or "no", according to the way the EPBD is implemented but the situations in Portugal and Denmark are quite unique. Indeed, most of Member States have implemented the EPBD in a way that is closer to Belgium than Portugal/Norway, and where no flexibility is possible as in Denmark, and therefore need to have a legal framework for the assessment of innovative systems/buildings.

Even if this is required neither by the EPBD nor by the proposed EPBD Recast, ASIEPI recommends the Member States that do not have such a legal framework to analyse the necessity to define one.

3 > In which cases is the alternative assessment procedure applicable?

The scope of the alternative assessment procedure varies from Member State to Member State.

Only for innovative buildings and/or also for innovative systems?

In most Member States, the building owner or designer of an *innovative building* can apply for an alternative assessment for its building.

Example: two building designers A and B want to apply an innovative system X. In BE, ES, FR, the manufacturer of the system X will apply for an alternative assessment for its system If this alternative assessment is accepted, A and B will be able to make the EP-calculation of their building on basis of the accepted alternative assessment. In DE, NL, the manufacturer of the system X will let make a study and will provide it to the designers A and B. A and B will use that study to apply for an alternative assessment of their own buildings.

In some Member States, such as **Belgium**, **France** and **Spain**, the manufacturer of an *innovative system* may directly apply for an alternative assessment for its system. If this is accepted, the alternative assessment will specify in which type of buildings it can be used.

In Member States that do not have such a system, the legal framework states that the building owner or designer may apply for an alternative assessment. So, from a legal point of view, there are no innovative systems, but only innovative buildings. However, in most cases, the same study can be used in several buildings, and *innovative systems* exist de facto.

Only for systems that cannot be assessed, or for systems that cannot be correctly assessed, by the standard EPB calculation procedure?

We have defined innovative systems as systems (…) *whose performance cannot be assessed by the standard EPB calculation method in a particular country*. However, this definition does not cover the variety in scope of the national alternative assessment procedures.

Examples:

- *Heat recovery efficiency in BE: there is no default value; the efficiency has to be measured according to EN 308; there is no need for alternative assessment. Humidity controlled ventilation in FR: there is a default value; better performances can be proved with an "Avis Technique".*
- *Auxiliary energy of the heating system. In BE, this auxiliary energy is given by fixed values; the alternative assessment can not be used to prove better performances. In NL, this auxiliary energy is given by default values; the alternative assessment can used to prove better performances.*
- *Demand controlled ventilation systems in BE: the aspect demand controlled is not included; the alternative assessment can be used.*
- *Lighting in residential buildings in many Member States.*

The following situations may occur for a specific system.

- The standard calculation procedure may specify a fixed/default value for the considered system and specifies on which conditions better values can be used, or does not specify any values but only how to prove the system performance. Usually, this is not through the national alternative assessment procedure but will require e.g. a measurement according to the relevant standard. In some cases however, the way to prove better values falls under the national alternative assessment procedure.
- The standard calculation procedure specifies a fixed/default value for the considered system but does not specify under which conditions better values can be used. In some Member States, the national alternative assessment procedure can be used to prove better values, whereas in other Member States, this is not possible.
- The standard calculation procedure does not integrate the system/technology in question. The system is therefore innovative according to the above mentioned definition and the national alternative assessment procedure (if any) can be used to assess its performances.
- The standard calculation procedure does not integrate this type of energy use. There is no need for alternative assessment.

4 > Is it necessary to have a technical framework for the assessment of innovative systems/buildings?

With *technical framework*, we mean a set of boundary conditions that specify the way to perform the assessment of innovative systems/buildings; this would include, for example building use, pollutant emissions, climate, and all other input values that are necessary to perform the alternative calculation.

Belgium intends to have such a technical framework in a long term.
Italy intends to have such a technical framework, if a legal framework is set up.
France has a technical framework that is applicable in some cases only (e.g. Avis Technique for ventilation systems).

Currently, among the Member States that have a legal framework, there is usually no technical framework. Only general requirements might be given, such as the fact that the basic assumptions of the standard calculation procedure may not be changed (e.g. the assumed internal temperature).

To some extent, such a technical framework can also be found in **Portugal**, as the dynamic simulations must be carried out with a validated software and under nominal use conditions, specified by the legislation. Similarly, **Norway**'s national EP calculation standard also acts as a technical framework for assessing buildings with new technologies, using monthly or dynamic simulations as necessary.

The EP assessment is based on monthly steady state calculations in BE, DK, FI, DE, HU, IE, IT, NL, PO, PT*, RO, UK* and on dynamic simulations in FR, HU*, PT*, UK*. (* means "for some cases")*

Obviously, setting up such a technical framework is not an easy task, for several reasons:

- the evaluation of the innovative systems/buildings is often based on dynamic simulations, whereas in several Member States, the standard calculation is based on simplified monthly steady-states calculations. Therefore, there might be no detailed information to fix the many input data that are necessary for the dynamic simulations,
- it might even be difficult to know in advance which assumptions are necessary for systems and building designs that do not exist yet!

However, there are several advantages to have such a technical framework. Some of them are:

- it makes the equivalence studies more reliable, as the results are less depending on the person who makes the study,
- consequently, it reduces the responsibility of the persons in charge of evaluating and accepting the studies,
- and it also reduces the risk of misusing the principle of equivalence and therefore increase the public acceptance of it.

ASIEPI recommends the Member States that do not have such a technical framework to analyse the necessity to define one, at least a minimal one.

5 > What are the main features that the alternative assessment framework should present?

In 2004 already, the European research project RESHYVENT had identified some of the main features that such a framework should have [2]. In the framework of ASIEPI, this question was submitted to industries that produce innovative systems.

From the answers obtained, the main features that the alternative assessment framework should have are:

- Most of all, it should be **available now** and it should be **reliable**.
- Secondly, it should not only pay attention to energy, but also to **indoor climate** (as expressed in EPBD art. 4), and it should allow **optimisation studies**, so that industries could easily see the impact of any change on the calculated EP.

In all Member States, the costs are supported by the demander.

- Thirdly, the **delay** to carry out the study and to make it accepted should not be longer than 6 months and the **costs** should be limited.

The following features should also be considered:

- The technical framework should be **transparent**, in the sense that it should not be too difficult to obtain a good understanding of the philosophy of the assessment approach, of the parameters of influence and of the possibilities for optimisation,
- Consequently, the parameters that are known to influence the performances of the systems to be analysed should be identified and input data should be made available by the authorities; in other words, a technical framework is desirable, as said previously.
- At the European level, a disadvantage for the industry is that the alternative assessment procedures vary from Member State to Member State. This problem has been only partly addressed by the new European Standards that were developed to support the EPBD. This clearly acts as a barrier for the free circulation of goods, but this is inherent to the fact that the EP calculation procedures themselves are national. This barrier could be weakened if there was an agreement at European level on general guidelines about how equivalence studies should be performed (or how the national regulations and EP calculation methods can be made more flexible so as to make such studies redundant).

6 > Who should be allowed to carry out the equivalence studies? Who should evaluate them?

In Belgium, the equivalence studies for the assessment of innovative systems are under the responsibility of a central body, the Belgian Union for Technical Approvals. However, this option has mainly been chosen to have a common evaluation system for the 3 Regions.

In general, there is no or little limitation of the persons allowed to carry out equivalence studies.

The evaluation of the equivalence studies may take place at national (or regional) level, or at local level. The advantages or disadvantages of those approaches are summarised in the next table.

The evaluation take place at national or regional level in BE, ES, FR, IT, and at local level in DK, ES*, FI, DE, NO, NL.*

National/regional level		Local level	
+	It's easier to set up a structure that has the human resources to evaluate such studies, which might be very complex.	-	Local authorities, especially in small municipalities, might not have the technical competence to evaluate equivalence studies.
+	Similar innovative systems are evaluated in a similar way.	-	An innovative system might be accepted in one city and refused in another one.
+	An innovative system must be evaluated once.		
-	Centralisation may create some delays.	+	Decentralisation might reduce some delays.

ASIEPI has shown that there is a clear preference among relevant stakeholders, including industries, to have an evaluation at national or regional level. ASIEPI recommends the Member States to evaluate this option. If there are some barriers to organise it at national or regional level, including some legal barriers that could not be solved, a good compromise could be to have the study accepted at local level, but on basis of acceptance criteria developed at national level and/or with the support of a central body.

7 > Are there other interesting aspects in the national approaches?

BE: www.energiesparen.be/epb/gelijkwaardigheid
FR: www.rt-batiment.fr

In **Belgium**, **France** and **Spain**, the accepted equivalence studies for innovative systems are **published** on an official website, whereas in other Member States, they are not made public by the authorities.

In **Spain**, the energy certificate of an innovative building will include two scales: one with and one without the innovation. This can make the certificate a little bit more complex, but might increase its acceptance by various stakeholders.

8 > Conclusions

- As for the requirements, the calculation procedures, the software, the control and compliance issues, Member States that have implemented alternative assessment procedures have implemented them in very different ways. These can be a source of inspiration for Member States that do not yet have such a framework. In any case, adaptation to the national EPB regulation will be necessary.
- The main advantage to have an alternative assessment framework is that all products/systems get a chance to be taken into account – at least all products/systems that use energy for a purpose that is considered in the EPB regulation. This removes (some of) the barriers for innovation that can be created by EPB regulations.
- However, in some of the Member States where an alternative assessment framework exists, it has been used to overestimate the saving potential of some systems. This is particularly true in the Member States where anyone can perform the study and where the evaluation takes place at local level. To overcome this, some of the following options, or a combination of some of them, should be considered:
    1. A centralised body could perform the studies, but this might increase the delay to carry out the studies, as well as the costs.
    2. A centralised body could evaluate the studies…
    3. …or, at least, clear national acceptance criteria could be defined.
    4. A technical framework for the assessment of innovative systems/buildings could be defined.
- An agreement at European level on general guidelines about how equivalence studies should be performed could help the Member States and could facilitate the free circulation of products.

9 > References

1. EPBD (2002). Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the energy performance of buildings, Official Journal of the European Communities, 04.01.2003.
2. Energy Performance of Buildings - Assessment of innovative technologies, SAVE ENPER-TEBUC project (01/04/2001 - 30/09/2003).
3. P. Wouters, N. Heijmans, X. Loncour, Outline for a general framework for the assessment of innovative ventilation systems, RESHYVENT project, 2004.
4. IEE SAVE ASIEPI project, *http://www.asiepi.eu*.
5. ASIEPI WP6 - The EPBD as support for market uptake for innovative systems - "State-Of-The-Art" analysis - Questionnaire to ASIEPI partners, available on *www.asiepi.eu*.

Annex 1 > Belgium

A1.1 > General framework

It is important to note that the EPBD implementation is under the responsibility of the 3 Regions. The 3 regulations are similar but slightly different; the calculations procedure are however (almost) identical.

The building energy performance is expressed the so-called E-level, which is a ratio between the primary energy and a reference value for the primary energy.

The E-level must be calculated according to a fully prescribed monthly quasi-steady-state calculation method published in the regional law (Ministerial Orders).

As the calculation procedures are included in 3 regional laws, they are not expected to change very often.

In the Flemish Region, the official software is the EPB-software. In the Region of Brussels-Capital, the official software is currently the EPB-software Brussels, but another application is being developed for both the Walloon Region and the Region of Brussels-Capital.

There is only official software applications. These must be used to send the EPB declaration to the authorities.

The building energy performance must be reported when the building is erected (dossier as-built).

The control scheme is quite strong. Controls are made by the authorities on basis of the submitted EPB declarations and of in site visits. If the requirements are not fulfilled, administrative penalties are automatically sent.

A1.2 > Alternative assessment

At the time this report was written, only one procedure was in force in the Flemish Region.

Ministerial Order of 10-04-2007 regarding the assessment of equivalence of innovative construction concepts or technologies in the framework of the energy performance regulation ("Ministerieel besluit betreffende de vaststelling van de gelijkwaardigheid van innoverende bouwconcepten en technologieën in het kader van de energieprestatieregelgeving")

This procedure is known as the "*assessment of equivalence*". This procedure can only be used for innovative systems (there is no procedure for systems that perform better than the default or fixed value included in the calculation standards). The procedure can not be used for innovative buildings, for which another procedure is in preparation.

http://www.energiesparen.be/epb/gelijkwaardigheid

The study can only be done by one organisation, the Belgian Union for Technical Approval (UBAtc). The UBAtc appoints a group of experts to make the study; a larger group evaluates it. Once the study is approved, according to UBAtc rules, a document called ATG-E is delivered to the manufacturer, who will provide it to the Region. The Region decides how to take the innovative system into account in the official EPB-software. This decision is published on a website. The system can be used in any building (within the scope specified) without further administrative work.

In the Flemish Region, the alternative assessment method can not be used for what concerns the certification of existing buildings that are sold or rented.

Annex 2 > Denmark

A2.1 > General framework

The building energy performance is expressed as the primary energy need.

SBi-Direction 213: Energy demand in building

The primary energy need must be calculated according to a fully prescribed monthly quasi-steady-state calculation method published in a publication of the Danish Building Research Institute SBi. However, the procedure is much more open than in other countries, in the sense that the designer may modify some parameters that are fixed in other countries.

The calculation method can be updated if necessary. From April 2006 to February 2009, 4 versions were released.

The official software is Be06 and is included in SBi-Direction 213.

There is one official software application; alternative applications are allowed as long as they give the same results and use the same calculation engine core as in the official one.

The proof of compliance with the energy requirements must be made twice; once to get a building permit and one after the completion of the building in order to obtain a permit to use the building. The control of compliancy is the responsibility of the local authority.

A2.2 > Alternative assessment

There is no specific legal framework for alternative assessment. This is due to the fact that the legal framework, the procedure and the software are quite open, as stated above. Innovative systems/buildings are therefore handled as usual systems/buildings.

For what concerns innovative systems, the calculation procedure can be updated gradually and quite quickly to be able to take into account the effects of innovative systems.

For what concerns innovative buildings, the building owner the building owner will be responsible for assessing the energy performance of innovative systems typically made by consulting engineers often in dialogue with SBi and the local building authorities will accept or reject the assessment. It is up to the building developer to provide satisfactory documentation (e.g. energy calculations) when applying for dispensation. There is no formal format for such applications.

The alternative assessment is usually integrated in the software by changing a specific input data.

As the certification of existing building that are sold or rented is based on the same methodology, the alternative assessment methods could also be used in this context.

Annex 3 > Finland

A3.1 > General framework

At the present time, there are no requirements on the total building energy use. The regulation specifies the maximum building heat losses (building envelope, ventilation, infiltration) and requires calculating the energy use containing the space heating, hot water heating, space cooling and electricity. Currently, the requirements do not contain the primary energy calculation. Overall requirements are expected in 2012.

Guideline D5 "Calculation of power and energy needs for heating of buildings" is included in the Building Code since 1985.

For small residential buildings (less than 6 apartments), the energy use concerning the Energy Performance number must be calculated according to a fully prescribed monthly quasi-steady-state calculation method published in the Building Code and known as Guideline D5.

For other types of buildings, the procedure to calculate the Energy Performance number is open: the energy performance may be calculated according to Guideline D5, but EN standards and other calculation methods can also be used.

A modification of the Guideline D5 has to follow the legislative process of a decree and would typically take 1 year. Last major changes took place in 2002 and 2007.

There is no official software implementation of the Guideline D5, but a few commercial software applications are on the market.

The building permit application must include the building energy performance. The application is checked by the municipality. The building should be built according to this design; in case of changes, the building energy performance should be recalculated.

Even if foreseen by law, there is usually no control after building construction, for what concerns the building's energy performance.

A3.2 > Alternative assessment

The Building Code specifies that "Guidelines are not binding and it is possible to apply solutions other than those given in guidelines, provided that such solutions meet the requirements set for construction work." ("Ohjeet eivät ole velvoittavia, vaan muitakin kuin niissä esitettyjä ratkaisuja voidaan käyttää, jos ne täyttävät rakentamiselle asetetut vaatimukset.")

There is a procedure is known as "*separate clarification*" and is foreseen in the Building code. This option can be used for both innovative systems and innovative buildings. This option can also be used to prove a better performances that the default or fixed value included in the calculation procedure.

The study is performed by a "neutral" consultant and evaluated by the municipality. There is no technical framework that specifies how to make an alternative assessment.

The alternative assessments are not published.

Annex 4 > France

A4.1 > General framework

The calculation procedures are known as Th-C-E and are included in the Ministerial Order of 24-05-2006 related to the thermal characteristics of new buildings and new parts of buildings.

The first thermal regulation has been introduced in 1974.

The building energy performance is expressed through the primary energy.

The primary energy must be calculated according to a fully prescribed simple hourly dynamic calculation method published in the law and commonly known as Th-CE 2005.

The regulation has been introduced in 2000 and modified in 2005. The future regulation will come in force on 2012.

There are several certified commercial software applications using a kernel produced by CSTB.

The building permit don't require including the predicted primary energy use. The energy certificate is issued when the building is erected (dossier 'as-built').

The compliance with the energy regulation can be checked by the Technical Studies Centre (CETE) of the Ministry of Equipment on basis of the submitted EPB declarations and of in site visits. Since 2008, the controls become stricter.

A4.2 > Alternative assessment

The alternative assessment is foreseen in Title V, § 81-82 of the Order of 24-05-2006.

The EPB regulation includes an alternative assessment and complementary procedures:

1. The alternative procedure is known as "Title V" and is foreseen in the EPB regulation. This procedure can be used for both innovative systems and innovative buildings. A study must be sent to the Ministry for Ecology Sustainable Development and Spatial Planning. The content of the study is specified in the regulation. The Ministry selects a group of expert to evaluate it. Once approved, the Title V is published if it concerns an innovative system applied to all buildings, and can be used without further administrative work.

   Usually, the result of the alternative assessment will be immediately introduced in the calculation software, by changing some values.

2. The complementary one is know as "*Avis Technique*" and can be applied to prove a technical value of the product and used instead of the default included in the standard calculation procedures. A study must be written following a directive document and sent to CSTB. On basis of additional experimental and numerical evaluations, the study is evaluated by a group of experts. Once approved, the Avis Technique is published and can be used without further administrative work.

The certification of existing buildings that are sold or rented can be based on operational rating or can be calculated with another method than the one for new buildings. Alternative assessment methods can not be used for what concerns the certification of existing buildings that are sold or rented. However, the legislation explicitly foresees the use of "Title V" for existing buildings that are renovated.

Annex 5 > Germany

A5.1 > General framework

The current procedures are included in two standards:
DIN V 4108-6 and DIN V 4701-10 for residential buildings and
DIN V 18599 for non-residential buildings.
From autumn 2009, all buildings can be calculated with the same standard (DIN V 18599).

The building energy performance is expressed as the primary energy.

The primary energy must be calculated according to a fully prescribed monthly quasi-steady-state calculation method published in national standards. Standards are reviewed and partly revised (extended for new systems and technologies) about every second year.

There are no official softwares, but there are several commercial softwares, some for residential building calculations, others for non-residential building calculations, few for both. Most of the software products for non-residential building calculations use a common kernel. The software products are not certified by the authorities, but some comparative studies on the tools have been made.

The application for the building permit must include the calculated primary energy of the building. The application is checked by the municipality. The building should be built according to this design; in case of changes, the building energy performance has to be recalculated and the energy performance certificate is issued.

There is no control required after building construction, for what concerns the building's energy performance. Due to the signature of the building owner on the application of the building permit he/she is responsible that the building is realised as designed and certified.

A5.2 > Alternative assessment

Energieeinsparverordnung EnEv - §23 Anderweitige Bewertung für Baustoffe, Bauteile und Anlagen

It is important to note that the German standard calculation procedures include many systems that are not included in other national calculation procedures. There are therefore less systems that must be considered as "innovative systems" according to the definition mentioned on page 2 than in many other Member States.

The EPB regulations include the possibility to use "*alternative assessment methods for building material, building components and building systems*". Two methods are available:

1. The first method applies to systems that perform better than the default or fixed value included in the calculation standards. In this case, measurements in national or international labs followed by an assessment for the national adaption at the German admission office (DIBT) are required. Then, the system performances are published in the German Federal Gazette, and they can be used instead of the default value, without further administrative work.
2. The second method applies to systems or technologies whose performances can not be assessed with the standard procedure (e.g. solar wall for preheating of supply air). An alternative calculation method (e.g. simulation program) has to be used to assess the performance of the specific system. The improved performance can then be applied in the standard calculation procedure. For the example of the solar wall a heat recover rate representing the the solar preheating effect can be used. The evaluation of the alternative calculation is made by the municipality.

The two alternative assessment methods can also be used for what concerns the certification of existing buildings that are sold or rented, as the certification is based on the same calculation procedure.

Annex 6 > The Netherlands

A6.1 > General framework

This prescriptive approach prescribes several sets of energy saving measures. If you apply one of those sets, the EP-level of the house must not be calculated as it is set by default on 0.8, which is the current maximum EP-level allowed to receive a building permit.

The building energy performance is expressed by the so-called EPC level, which is a ratio between the primary energy use and a reference value for the primary energy use. In 2009, a simplified prescriptive approach has been introduced for residential buildings, but all buildings using that simplified approach get the same EPC.

The calculation methods are included in:
NEN 5128:2004 for residential buildings and
NEN 2916:2004 for non-residential buildings.

The EPC must be calculated according to a fully prescribed monthly quasi-steady-state calculation method published in national standards.

Since the publication of the first EP standard in 1995, the standard for residential buildings changed in 1998, 2001 and 2004. The next update will be published in 2010.

Every few years, the Dutch Standardisation Committee decides if it is necessary to update the standard. Small changes can be made via a so called "change document" in which only the change are described. This is relatively easy, but when it covers more than correcting errors, the official procedure needs to be followed. This includes a public inquiry and formal legislative changes. This will easily take half a year to a year. A formal change of the standard itself is an even bigger operation.

The Dutch standardisation committee releases the official software. But it is not mandatory to use that software; there is also commercial software available. There is no accreditation for the software.

A list of software is available on: www.senternovem.nl/epn/regelgeving/normen_en_rekenprogrammas.asp

The building permit must include the building EPC. The EP calculation is checked by the municipality. The building should be built according to this design. In case of changes, the performance should be recalculated, or at least the building should be build conform the performance level on which the building permit was given. In practice this is often not done.

A6.2 > Alternative assessment

The "principle of equivalence" is applicable to all requirements of the building code.

There is a procedure known as the "principle of equivalence" and is foreseen in the Building code. This option can be used for both innovative systems and innovative buildings, as defined on page 2. This option can also be used to prove a better performance than the default or fixed value included in the calculation procedure.

The study can be performed by anyone, often it will be performed by a consultant. The study is evaluated by the municipality. There is no technical framework that specifies how to make an alternative assessment.

Depending on the situation, the result of the alternative assessment can not directly be introduced in the available software. In that case, the one who makes the alternative assessment needs to make some additional hand calculations to calculate the final EP value.

The alternative assessments are not published automatically.

The alternative assessment methods can not be used for what concerns the certification of existing buildings that are sold or rented.

Annex 7 > Norway

A7.1 > General framework

The building regulations (revised 2007) give quantitative requirements for kWh/m²yr *net energy demand*, not primary energy. In addition, at least 40% of the delivered energy must be from renewables or district heating, except for small houses or cases where this rule increases LCC. Requirements for indoor climate shall of course also be satisfied (Class II in EN 15251), but this need not be documented for a building permit. EP calculations are not necessary for simple buildings that fullfill a checklist of 11 criteria (prescribed minimum U-values, 70% heat recovery, airtightness, SFP etc.). The energy labelling scheme has not yet been implemented.

The EP calculation method is described in national standard NS 3031:2007. This describes fixed parameters (mostly related to user habits, such as internal loads and set-point temperature), and gives guidance on values for other 'non-fixed' variables. The dynamic hourly method is used for buildings with cooling, but the quasi-steady monthly method may otherwise optionally be used. There is no national software, but commercial software is available. Any software can be used that is validated in accordance with the EN standard on software validation. Validation need not be certified/accredited by a 3rd party.

To gain a building permit, EP documentation must be submitted to the local municipality. There is no statutory control of actual energy consumption after the construction is completed.

A7.2 > Alternative assessment

Norway views its EP calculation standard as relatively flexible, and thus not *unwittingly* a barrier to innovative systems/buildings. The two main reasons being (a) choice of software, and (b) few 'fixed' parameters. The calculation standard is probably sufficient as a technical framework for evaluation of non-standard/novel technologies, such that the need for a legal framework for alternative assessment has been avoided.

There are three points to note here:

- As a general rule, documentation of the performance of building subcomponents (e.g. window U-value, heat recovery efficiency) should be submitted together with the EP calculation, irrespective of whether the subcomponents are high or low performance. This documentation requirement is not at all rigorously vetted by the municipality; it can for example be a short reference to a specific product name or a construction detail in document. The onus is on the building designer/contractor to collate accurate documentation, in order to avoid possible future litigation by the owner. If such documentation is not available from the manufacturer, then the building designer will have to use an appropriate method (e.g. EN standard) to calculate and document its performance (e.g. heat pump seasonal COP) and apply this input data in the validated EPC software.
- The fixed parameters (internal equipment, lighting, domestic hot water, people, and set-point temperatures) may act as barriers, especially to very low energy buildings. However, the lighting load can actually be reduced (to a lower minimum) if a lighting calculations are documented according to EN standard. Furthermore, it will actually be possible to deviate from other fixed parameters too in the near future when a new standard for low-energy and passive houses is published.
- Since the building regulations give strict limits on *net energy demand*,

this might act as a barrier to market penetration of energy delivery systems (e.g. heat pumps). This has been done on purpose by the building authorities, to promote investment in passive energy-efficiency measures (e.g. insulation), which are generally robust and last as long as the building. There is therefore no 'alternative assessment' method to circumvent this potential problem. However, the builder can try to apply to the building authorities for dispensation in individual cases, providing sufficient documentation of low primary energy consumption. The authorities are generally obliged to reject such applications, unless there are very good reasons, such as safety considerations.

The current requirements cover:
- *Maximum U values*
- *Solar factor for windows…*
- *Minimum efficiency for thermal and for lighting installations*
- *Minimum natural lighting, solar contribution to domestic hot water, photovoltaic.*

HE-1 Energy Saving

The official software tools are LIDER to calculate the energy needs and CALENER to calculate primary energy use and CO_2 emissions in order to issue the certificate.

Example of Subsidies for dwellings:
3600 € for Class A
2800 € for Class B
2000 € for Class C

Annex 8 > Spain

A8.1 > General framework

At the present time, there are no overall requirements on the building primary energy use or Co2 emissions but those are expected in the near future. The requirements at present are referred to individual aspects such as heating and cooling energy needs, efficiency of thermal installations etc. However, the primary energy use and the Co2 emissions must be calculated in order to produce the energy certificate

The energy performance for certification purposes can be calculated according to a fully prescribed hourly dynamic calculation method (CALENER).

The method can be updated thanks to "*additional capabilities*", as explained in § X.2.

There are official software applications; alternative applications are allowed but none were developed so far.

The building permit demand must include the building energy performance. The building permit demand is checked by the municipality. If subsidies are requested due to a good energy class a specific inspection by the regional authorities (energy agencies) is foreseeable. The building should be built according to this design; in case of changes, the building energy performance should be recalculated.

The control is under the responsibility of the 19 regions. Even if foreseen by law, there is usually no control after building construction, for what concerns the compliance with the building energy regulations.

A8.2 > Alternative assessment

There are two procedures known as "*additional capabilities*", one for innovative systems, one for innovative buildings.

For innovative systems, a methodology has to be developed and to get approved. This approval is done at national level by an advisory commission for energy certification but includes a public inquiry; the approval of the relevant union of manufacturers is essential. The procedure can also be used for systems that perform better than the fixed value included in the standard calculation procedures.

For innovative buildings, there is no need of approved documents. Anyone can make an alternative assessment. The evaluation is made by the municipality although the regional government can ask for an external control in some circumstances.

The integration of the additional capability within the software can take various forms: it can be by changing a default value or by adding a specific calculation kernel to the software.

The building will get two certificates, one without the innovative systems, one with the innovative systems, but the subsidies may be obtain on basis of the certificate that includes the innovative systems.

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Disclaimer

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