1. Introduction

Directive 2002/91/EC on the Energy Performance of Buildings (EPBD) has been fully implemented in Norway since 2010. The transition period for the minimum requirements for new buildings is over, and the schemes for the certification of buildings, as well as for the inspection of boilers, heating systems, ventilation and cooling systems, are effective.

By the end of May 2013, approximately 301,000 energy certificates had been issued. The larger part concerns dwellings, whereas 15,000 concern non-residential buildings.

The recast EPBD has not been formally included in the Agreement on the European Economic Area (EEA), and is thus not implemented in Norway. The content of this Directive is, however, actively pursued in the planning of future regulations.

This report presents an overview of the current status of implementation, as well as of the further plans for the improvement of the EPBD schemes in Norway. It addresses certification and inspection systems, including the status for quality control mechanisms, the status for qualified experts in the market, information campaigns, incentives and subsidies.

2. Energy performance requirements

In 2012, the Norwegian government stated that all new buildings should be at passive house level in 2015, and Nearly Zero-Energy Buildings (NZEB) by 2020. Until now, the Norwegian requirements have been the same both for new buildings and major refurbishments. The Norwegian Building Authority is currently considering the need for separate requirements for refurbishments, as well as how these requirements could be designed.

2.1 Progress and current status

Following the implementation of the EPBD, the energy requirements in the Norwegian building regulations were revised in 2007.
In 2010, the requirements were further adjusted. The Norwegian Parliament has agreed that all new buildings should be at passive house level by 2015. The definition of the coming minimum requirements is currently under development, but two Norwegian standards regarding the criteria for passive houses and low-energy buildings are already in place. These are the NS 3700 for residential buildings and the NS 3701 for non-residential buildings. However, the definition of the passive house level to be implemented in the building regulations in 2015 will most likely not be identical to the requirements set in these standards.

2.2 Format of national transposition and implementation of existing regulations

The Norwegian building regulation has two options for how to fulfill the requirements. The first option contains specific energy limits for different building types. The requirements are set in kWh/m²·year within the building envelope, considering heat recovery from ventilation systems, but not considering system losses and energy export. If this option is chosen, one must also fulfill a set of absolute minimum requirements. The other option addresses different components of the building envelope, as well as technical installations and solutions. The requirements will be considered fulfilled if it is shown that 11 specific energy measures are applied. In addition to requirements concerning insulation and envelope airtightness, there are specific requirements for the heat recovery of ventilation air in the ventilation apparatus (yearly mean heat recovery rate), the specific fan power (SFP) factor, and the equipment for shading or other precautions to avoid the use of cooling systems. Energy demands for lighting, hot water and all technical equipment are also considered, but so far only standard values are applied. Requirements for an environmentally friendly energy supply for heat purposes are an important, supplementary part of the regulations.

The Norwegian energy requirements are set with regard to 13 different building categories. Indicatively, Table 1 shows the progress over time, of certain aspects which are necessary to fulfill the Norwegian minimum energy requirements, for: commercial buildings, single-family houses, and apartment buildings.

The Norwegian standard for the calculation of the energy performance of buildings is called NS 3031. This standard is built on the EN 15603.

The Norwegian regulations also include requirements for energy supply. It is not permitted to install a boiler using fossil oil to accommodate the baseload. Buildings with more than 500 m² floor area shall be designed and constructed so that a minimum of 60% of the net energy need for space and water heating may be obtained by an energy supply other than electric resistance heating or fossil fuels at the point of the end user. For buildings with less than

### Table 1: Progress over time, of certain aspects which are necessary to fulfill the Norwegian minimum energy requirements, for: commercial buildings, single-family houses, and apartment buildings.

<table>
<thead>
<tr>
<th>Requirement</th>
<th>1997</th>
<th>2007</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net energy demand (kWh/m²·year)</td>
<td>-</td>
<td>Single-family house: 125 + 1,600 m²·W/year</td>
<td>Single-family house: 120 + 1,600 m²·W/year</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Apartment: 120</td>
<td>Apartment: 115</td>
</tr>
<tr>
<td>Total area of glass / doors (%)</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td>U-value: exterior wall (W/m²·K)</td>
<td>0.22</td>
<td>0.18</td>
<td>0.18</td>
</tr>
<tr>
<td>U-value: roof (W/m²·K)</td>
<td>0.15</td>
<td>0.13</td>
<td>0.13</td>
</tr>
<tr>
<td>U-value: exposed floors (W/m²·K)</td>
<td>0.15</td>
<td>0.15</td>
<td>0.15</td>
</tr>
<tr>
<td>U-value: glass / doors (W/m²·K)</td>
<td>1.5</td>
<td>1.2</td>
<td>1.2</td>
</tr>
<tr>
<td>Thermal bridges</td>
<td>-</td>
<td>Single-family house: 0.03 m²·K</td>
<td>Single-family house: 0.03 m²·K</td>
</tr>
<tr>
<td>Heat recovery of ventilation air (%)</td>
<td>60%</td>
<td>Other buildings: 0.06 m²·K</td>
<td>Other buildings: 0.06 m²·K</td>
</tr>
<tr>
<td></td>
<td></td>
<td>70%</td>
<td>70%</td>
</tr>
<tr>
<td>Air tightness</td>
<td>Single-family house: 4.0</td>
<td>Single-family house: 2.5</td>
<td>Single-family house: 2.5</td>
</tr>
<tr>
<td>(Air changes/hour at 50 Pa pressure difference)</td>
<td>Other buildings (more than two floors): 1.5</td>
<td>Other buildings (more than two floors): 1.5</td>
<td>Other buildings (more than two floors): 1.5</td>
</tr>
<tr>
<td>SFP factor</td>
<td>-</td>
<td>Dwellings: 2.5 kW/m³</td>
<td>Dwellings: 2.5 kW/m³</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Commercial building: 2.0 kW/m³</td>
<td>Commercial building: 2.0 kW/m³</td>
</tr>
<tr>
<td>Screening factor for glass / window (g)</td>
<td>-</td>
<td>-</td>
<td>0.15 (all buildings)</td>
</tr>
</tbody>
</table>

### Table 2: Absolute minimum requirements one must fulfill if using the option of net energy demand limit.

<table>
<thead>
<tr>
<th>U-value exterior wall (W/m²·K)</th>
<th>U-value roof (W/m²·K)</th>
<th>U-value exposed floors (W/m²·K)</th>
<th>U-value glass / doors (W/m²·K)</th>
<th>Air tightness (air changes/hour at 50 Pa pressure difference)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 0.22</td>
<td>≤ 0.18</td>
<td>≤ 0.18</td>
<td>≤ 1.6</td>
<td>≤ 3.0</td>
</tr>
</tbody>
</table>
500 m² usable floor area, the requirement is 40% of the net energy need for space and water heating. These requirements do not apply in cases where it can be documented that it is practically impossible to fulfill them due to local conditions. For residential buildings, the requirements do not apply if the net heat demand is calculated to be below 15,000 kWh/year, or where the requirements result in higher costs over the life cycle of the building. Residential buildings that are exempted from these requirements must, however, install a chimney and an enclosed heating unit suitable for biofuels. This requirement shall not apply to dwellings with less than 50 m² usable area or dwellings that fulfill the passive house criteria set in the NS 3700.

2.3 Cost-optimal procedure for setting EP requirements
The cost-optimal procedure is under evaluation. An undergoing investigation is currently gathering information regarding the development of construction costs in relation to the development of building requirements. The costs of renovating different types of buildings from various periods are gathered as well. The results will be used when the requirements for 2015 are to be set.

2.4 Action plan for progression to NZEB
The Norwegian Government stated that the building requirements in 2020 will be NZEB. A private consultancy company has been contracted by the National Building Authority to develop a proposal for the national definition of NZEB, evaluating different approaches for both residential and non-residential buildings. The proposal is the first milestone in the work towards NZEB. The national standards for passive houses, as well as the 2015 building regulations, will also be an important background material for the development of a NZEB definition.

3. Energy performance certificates
The scheme for the certification of buildings is under the responsibility of the Ministry of Petroleum and Energy. The Water Resources and Energy Directorate (NVE) is the managing body for certification and inspection schemes. The legislation is in place since the 1st of January 2010, but following a political discussion, the regulation was revised as of the 1st of July 2010. The main change was the design of the label, to highlight the two dimensions: the energy performance and the share of renewables in the heating system. There were also clarifications on the exemptions from the obligation to certify. Another revision was effective as of the 1st of January 2012, taking account of the new comments from the European Surveillance Authority (ESA). The changes should clarify and limit exemptions from the obligations. Further, buyers who do not receive an energy certificate have the right to order a certification by an expert, at the expense of the seller.

The regulation requires that every residential dwelling shall have an energy certificate. This applies to both apartments and single-family houses. The political background for this was the wish to stimulate the households’ own interest and activity related to energy qualities and energy performance.

At the same time, the Directive’s requirements for public buildings in Norway relate to all non-residential buildings. Thus, the regulation does not distinguish between public and private buildings.

3.1 Progress and current status on sale or rental of buildings
More than 300,000 energy certificates have been issued over a period of 3 years. It is estimated that this implies that more than 250,000 buildings/apartments have been certified.

1 www.lovdata.no/cgi-wift/ldles?doc=/sf/sf/sf-20091218-1665.html
More than 90% of the certificates are issued for dwellings. It is assumed that the sale of dwellings is the main trigger for the certification process—more so than the rental of dwellings. In December 2011 and in June 2012, a control was held for 5 announced sales from each county, all together 95 dwellings. In December 2011, only 52% of the dwellings were certified. This modest first result led to an improved dialogue with the estate agents, who then established better routines. Six months later, the result was considerably better: by then, more than 75% were certified.

The rate of certification appears to be slower for non-residential buildings. In the autumn of 2012, a corresponding control was held, which showed that only 37% of the buildings in question were certified. This result will be used in the information to stimulate an improved result.

The Energy Certificate is the legal document produced during the energy certification. The regulation requires that this document be shown to potential buyers and renters. However, parts of the certificate, for instance the Energy Label, can be used as a short version.

The Energy Certificate (Energiattesten) has the following content:

**Identity data**
On top of the front page, there are the address and the necessary data for the identification of the building or the apartment, the name of the person or organisation responsible for the certification (normally the owner), as well as the name of the person who has registered the data.

**The Energy Label**
This matrix presents the result of the calculation in two dimensions. Firstly, on the vertical axis, the Energy Grade (grades A to G) represents the calculated delivered energy needs. New buildings will normally achieve the energy grade C, although this depends on the efficiency of the heating system in place. Grades A and B are normally reserved for buildings with energy quality better than that required. Secondly, on the horizontal axis, the Heating Grade represents the extent to which the heating of space and water can be accomplished with renewable energy sources—other than electricity and fossil fuels. The character represents the Energy Grade and the color represents the Heating Grade, where green is predominantly based on renewables, and red means heating based on fossil fuels or electricity. An explanation is given on the front page of the certificate.

**Measured energy consumption**
An average of the energy use per energy carrier for the last three years is shown on the bottom of the front page. For non-residential buildings, this is obligatory, but for residential buildings it is only encouraged.

**User influence**
On page 2, a paragraph is devoted to general advice on energy use which can save energy, even if it does not affect the calculation of energy performance.

**Recommendations**
A summary of the recommendations is listed, whereas a more extensive description is given in the Appendix.

**Central input data**
On page 3, most of the key input data given by the owner are presented, in order to allow the reader to check obvious data such as the building type, the year of construction, etc..

**Information and Help Desk**
The last page is devoted to general information on the Energy Certification, as well as to contact data for the helpdesk established by the Norwegian authorities.

A short version of the Energy Label is the profile of a building with the same combination of letter and colour as that in the Energy Label matrix.

There are small differences between certificates for residential and non-residential buildings. The differences mostly concern the language and the relevance of content.
For the certification of new buildings and of all non-residential buildings, a high level of technical competence is required. Certification of non-residential buildings requires a bachelor degree in building techniques or energy systems, as well as two years of relevant experience. For new buildings, a certificate can only be issued by a person with the same level of competence that is required for the building designer, as defined in the building regulations. By performing the certification, the expert declares that he/she meets the requirements and can document this on request. For existing dwellings, there is a system of self-registration, where the owner or another person is guided through a menu of registration with restricted options. The main input used for the calculation is printed on the certificate for the reader (i.e., buyer) to check. This option has been developed to give the owner of the dwelling the option of a quick and low-cost registration, as well as to stimulate the individual owners’ interest in their own energy use, as well as in possible efforts towards greater efficiency. The system uses built-in conservative default values, so that the owner will normally obtain a better energy rating from a more detailed registration or from an expert’s registration.

When using the self-registration option, the owner gives input data on-line to the Energy Certification System. The system takes the input concerning the building's year of construction, room area, type, etc. and finds the corresponding typical values for the parameters needed for the calculation. Then, the certificate is immediately produced. The user can choose between a ‘simple registration’ version, which is the quickest and is suited only for buildings with typical values, and a ‘detailed registration’, where a larger amount of details is needed. A detailed registration is required for a person to be able to get recognition for refurbishments or to get a building standard that is better than the norm for the building's year of construction. The list of recommendations following the self-assessment can only be a vague indication of the best efficiency efforts for this building. However, when an expert performs the certification (see requirements above), he/she is responsible for all input data, as well as for detailing of recommendations for improvement. This implies that the recommendations in certificates generated by a non-expert will be more general than those of an expert.

The validity of energy certificates is 10 years.

Certification of new buildings requires a Qualified Expert (QE). The Energy Certification System is designed to import the result of the calculations from external energy calculation systems. This is beneficial particularly for developers of new buildings who can use the same expert, the same software and, for the most part, the same input data as that in the calculation, in order to check the compliance with minimum requirements. This way, the developer can easily take the energy grade into consideration at an early stage of the project. The QE will also be able to set the data for technical installations that are not accessible to unqualified people making a self-registration, e.g., efficiency of recovery units in ventilation, COP of heating and cooling installations.

The developer is obliged to present a certificate when the building is at the market, even if it is only at the planning stage, and correct this later if the actual building differs from the project plans. As an alternative, they can choose to give a guarantee of Energy Label, and document this at the time of completion.

Major renovations require the same certification as the new buildings; reference is made to the building regulation.

3.2 Progress and current status on public and large buildings visited by the public

The Directive has some special requirements for public buildings. The government has decided that all non-residential buildings shall have the same obligation. This implies that all non-residential buildings with a floor area above 1,000 m² shall have a valid energy certificate, and a summary of it has to be displayed to the public.
For non-residential buildings, the rate of certification seems to have been slower in 2012 than in 2011. At the same time, control activities are in the start-up phase, firstly concerning the existence of certificates and secondly concerning their quality. Information activities will also focus on this issue.

The calculation method (NS 3031) describes a normalised use of the building. The measured energy use is required to be submitted, but is not part of the calculated label. This basis for the label is very well suited for a situation of sale or rental, but less suited for a number of public buildings which are never on the market for sale and rental. In the early phase after certification became mandatory, municipalities have been slow at certifying their own buildings. The message to the municipalities is that certification is a requirement, it shall be on display for users and, last but not least, can serve as a basis for long term improvements in the building management. The message is also that the establishment phase is over, that controls will be stepped up, and that sanctions will be levied.

3.3 Implementation of mandatory advertising requirement – status
Implementation of the recast Directive is pending. The current regulation requires that the energy certificate shall be part of the marketing of apartments and buildings. At least, the certificate shall be included in the property description. The dominant market place for advertising on the Internet (Finn.no) has already facilitated the inclusion of the Energy Label in advertisements, but on a voluntary basis. For a considerable share of internet advertisements, the label is already in use. In newspaper advertisements, only a few estate agents practice the use of Energy Labels.

3.4 Information campaigns
The first year (2010) of operation had the most intense information activity. This was also a period of great demand for information about the new requirement. In 2012, the most important information activities were:

> Advertisements in magazines, etc..
> Production of editorial material, which is offered in relevant media. One example is the description in the trade agents’ media of the regulatory amendment which states that the buyer can order an expert certification at the expense of the seller, if the latter cannot present a certificate.
> The Help Desk gives advice for the certification process and the regulation, as well as for possible measures to improve the buildings’ energy qualities.
> Energy Label Calculator: The Calculator was launched in September 2012 for the use of dwelling owners. Its aim was to make the effect of rehabilitation measures visible on the label. The Calculator can also be the starting point of formal certification.
> A guide for experts on energy certification and inspection of technical systems is under preparation.
4. Inspection requirements - heating systems, air-conditioning

Articles 8 and 9 of the original EPBD are implemented in the same regulation as the energy certification, and the requirements for inspections are in force since the 1st of January 2010, without any transition period. It must, however, be noted that the practical implementation is slower. Up to the 1st of July 2010, the regulation had a transition period, which was later withdrawn. This change came as a surprise to the building owners. Also, in the public information campaigns over the first two years (2010-2011), the main emphasis was on energy certification.

Norway has adopted option a) of the article 8 of the EPBD, establishing a regular inspection of boilers, in line with the inspections according to article 9. The regulation has been set according to the size limits given in the Directive. However, regarding article 9, the inspections must cover both air-conditioning (AC) and ventilation systems. Rather than the EPBD’s minimum size defined in effective rated output, the regulation sets the threshold in the area ($m^2$) served by the system. This is considered more practical to the building owners. In addition, the regulation:

- Includes split units.
- Enables the inspection of pure ventilation systems without cooling devices. This is a fairly common way of heating and cooling in Norway.

The inspection requirements, thus, are the following:

- Boilers fueled by fossil fuels with an effective rated output above 20 kW are to be inspected every 4 years (every 2 years for boilers with an output above 100 kW).
- Heating systems fueled by fossil fuels with an effective rated output above 20 kW, and older than 15 years: one time inspection.
- AC systems with an effective rated output above 12 kW or serving a heated area above 500 $m^2$: every 4 years.

The building owner has the duty to have an inspection made by a competent inspector. The report from the inspection shall be uploaded to the Energy Certification System at NVE; it shall also be available on the premises. The content of the report is outlined in the regulation:

- Identification of building and system;
- Description of system;
- Summary of evaluation with any deviations from normal situation;
- Registered data;
- Recommendations;
- Signature of the expert;
- General information on the inspection report, including dates, sources of information, etc..

NVE has presented a template form for each type of inspection. These forms can be downloaded in excel format and used directly by the expert. Other formats and technical systems are allowed as long as the data and evaluations are given at a level comparable with the template produced by NVE. The minimum level of competence is stated in the regulation according to each type of inspection. The requirements include formal competence and practical experience. By performing the inspection, the expert declares that he/she meets the requirements and is ready to document this on request.

The template given by the NVE defines a large number of check-points and data to be registered. These are considered necessary to fulfill the objectives of the inspection and to give a reasonable return of the cost. For building owners who have good documentation of the systems and carry out regular maintenance works, the task of inspection will not cause high extra cost.

![Figure 9: Advertisement for Energy Label Calculator for dwellings.](image)

![Figure 10: First page of template form for inspection of boilers and heating systems.](image)

![Figure 11: Advertisement on inspection of boilers and air-conditioning systems.](image)
because it is allowed to use an expert who is already involved in the maintenance – as long as he/she meets the requirements of competence. For building owners who neglect the continual need for maintenance, the cost of inspection can be very high. The first objective of the government is to give an incentive to all owners of technical systems to establish good regular routines for service and maintenance.

The duty of inspection is not connected to the duty of energy certification. However, there are obvious benefits in coordinating the tasks. Any inspection report will be for the benefit of the certification expert. It will be useful for the expert who inspects a heating system to use the calculations for the energy performance of the building in question. And, for the owner, the whole process can be more effective if done by a limited number of experts working in cooperation.

4.1 Progress and current status on heating systems
The number of heating systems that have been inspected by November 2012 is less than 1,000. This low number shows that this scheme has hardly been established, in spite of the voluntary schemes running for several years. It is of major concern to find better ways of communication, and to seek to integrate the inspections with the voluntary activities already in place.

Reports from experts show that:

> The forms introduced by the NVE require relevant and important information.
> The task is well suited to integrate with normal maintenance activities.
> The combination with energy certification can effectively lower the total cost of the processes.

Due to the government policy to phase out fossil fuels for buildings, the number of systems using fossil fuels is in decline, as well as the use of each system. This development will naturally influence the building owners’ motivation for long term strategies for their oil and gas fired systems.

4.2 Progress and current status on AC systems
By November 2012, approximately 10,000 inspection reports from air-conditioning (AC) systems have been uploaded. The largest share represents ventilation systems, which is natural under Norwegian climate conditions. Still, this is a small part of the systems that must be inspected, and a large task lies ahead. This task includes more intense information activities, including guidance, as well as the commencement of controls for compliance.

Reports from experts prove that this inspection can be accomplished quite satisfactorily in combination with the energy certification. Reuse of expertise and input data enables cost to be kept down.

5. Conclusions and future plans
In December 2012, the Norwegian Government had not yet decided as to the European Economic Area (EEA) relevance of the recast Directive on the Energy Performance of Buildings (EPBD). Still, it is widely expected that the contents of the recast Directive will be included in Norwegian regulations. The investigation to define the level and the steps towards Nearly Zero-Energy Buildings (NZEB) by 2020 has started on the basis of the recast EPBD and of political commitments for increased energy efficiency in buildings in the years to come.

Regarding the energy certification and inspections, the most obvious development ahead is to move, from mere guidance, to control and sanctions.
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More details on the IEE Programme can be found at ec.europa.eu/energy/intelligent

This individual report and the full book of national reports 2012 can be downloaded from www.epbd-ca.eu and also from www.buildup.eu