



Government Communication 2011/12:131

Towards nearly zero-energy buildings

Communication 2011/12:131

The Swedish Government hereby submits this

communication to the *Riksdag*. Stockholm,

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Main content of the communication

This communication provides an account of the action plan for nearly zero-energy buildings produced pursuant to Directive 2010/31/EU of the European Parliament and of the Council on the energy performance of buildings. The action plan sets out the Government's views on how the number of nearly zero-energy buildings in Sweden can be increased.

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1 The matter at hand and its preparation for the *Riksdag*

A recast version of the EU's Energy Performance of Buildings Directive entered into force in the spring of 2010¹ (referred to below as the recast Directive). The Government submitted its Government Bill 2011/12:120, Towards effective energy certification, to the *Riksdag* on 15 March 2012. In that Bill, the Government proposed how the recast Directive could be implemented in Sweden in relation to energy certification and certain related issues. The said Bill did not, however, deal with the provisions of the Directive on what are referred to as 'nearly zero-energy buildings'.

Issues relating to how the term 'nearly zero-energy buildings' is to be applied in Sweden have been analysed in a number of stages. Reports commissioned by the Government from the Swedish Energy Agency and the Swedish National Board of Housing, Building and Planning in 2010 formed the basis of a memorandum that was produced in Sweden's Government Offices, largely during the course of 2011. In connection with the work on the memorandum, further analyses were carried out by both experts within the civil service and consultants. The memorandum was circulated for comment in January 2012. The memorandum circulated also summarised the reports from the authorities that preceded it. The memorandum can be viewed in the Ministry of Industry, Employment and Communications, along with the responses from the consultation process and a compilation folder covering that process (N2011/7477/E). A summary of the main considerations in the memorandum can be found in *Annex 1* to this communication. A list of the bodies consulted can be found in *Annex 2*. Finally, the Directive can be found as *Annex 3* to this communication.

2 Action plan for nearly zero-energy buildings

This section sets out an account of the action plan for nearly zero-energy buildings produced in accordance with the recast Directive. The action plan sets out the Government's views on how the number of nearly zero-energy buildings in Sweden can be increased. The action plan is divided into four parts, as follows. Part 2.1 sets out the Government's view of how Sweden should apply the term 'nearly zero-energy buildings'. Part 2.2 sets out the Government's view in respect of measures to promote greater knowledge, and an effective implementation, of the work on nearly zero-energy buildings. Part 2.3 sets out the Government's view in respect of intermediate targets and an audit point in 2015. Finally, the Government sets out its view on the role of renewable energy in nearly zero-energy buildings in Part 2.4.

These Parts correspond to the points set out in Article 9(3) of the Directive in respect of what should be included in a national action plan for nearly zero-energy buildings. According to the Directive, the plan should set out each Member State's detailed application in practice of the definition of nearly zero-energy buildings, information on the policies and financial or other measures adopted for the promotion of nearly zero-energy buildings, etc., plus intermediate targets for improving the energy performance of new buildings by 2015. The definition of 'nearly zero-energy building' provided in the Directive also involves energy from renewable energy sources, which is the reason for the Part discussing such issues.

¹ Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (recast), OJ L 153, 18.6.2010, p. 13 (Celex 32010L0031).

2.1 A Swedish application of the term 'nearly zero-energy buildings'

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The Government's view: Given that the nearly zero-energy level will, from 2021, essentially be the legally binding level for energy economy requirements applied to all new buildings, a Swedish application of the term 'nearly zero-energy buildings' should include stricter requirements for energy economy in comparison with the requirements applying under current building regulations – in any case for most categories of buildings and climatic zones. There is not, at present, adequate information on which to base a quantified guideline for the extent of tightening-up that could be appropriate. Rather, this must be evaluated on a solid basis involving, amongst other things, an assessment of existing low-energy buildings, some demonstration projects for new energy-efficient buildings, economic analyses and so forth. Tightening-up must only take place when it is justified environmentally, socio-economically and from the point of view of real estate economics.

In Sweden, reviews are carried out of the energy economy requirements, including in light of the requirements laid down in the EU's Energy Performance of Buildings Directive. These reviews have consistently led to stricter requirements. Thus, as an example, the requirements pertaining to non-electrically heated residences in Climatic Zone III have been tightened up from a maximum permissible energy use level of 110 kWh/m² in 2006 to 90 kWh/m² as of January 2013. In light of factors such as the tightening-up that took place between 2006 and 2012 and technical and economic development, as well as socio-environmental factors affecting the property market, the Government's view is that forthcoming reviews will also give rise to such step-by-step tightenings-up as are justified environmentally, socio-economically and from the point of view of real estate economics. A first audit point for this is scheduled for 2015. These recurrent revisions are an important part of Sweden's strategy for moving towards nearly zero-energy requirements and tightening up requirements for energy economy and the work on nearly zero-energy buildings on a step-by-step basis.

The view expressed in the memorandum: This largely corresponds with the Government's view. The memorandum makes reference to the stricter energy economy requirements that will fully enter into force as of 1 January 2013 (the Swedish Board of Housing, Building and Planning's building regulations BBR 19). The judgement expressed in the memorandum was that, with the new energy requirements, Sweden meets the requirements under the Directive on the basis of what is technically and economically justified given national circumstances in Sweden. The assessment was, however, that it could be technically and economically justified, in future, for the application of the term 'nearly zero-energy building' in Sweden to mean an energy use that is lower than the highest levels for energy use per m² permissible pursuant to the energy economy requirements under BBR 19. The express intention under the memorandum is to tighten up the energy requirements in such ways as later analyses will show are justified socio-economically and from the point of view of real estate economics. The information currently available is not, however, believed to constitute a basis for further tightening-up of energy economy requirements.

Consulted bodies: *The National Board of Health and Welfare, the Swedish Tax Agency, the Swedish Fortifications Agency, the Swedish Data Inspection Board and the Swedish National Courts Administration* broadly support the memorandum, or have no objections to the views and proposals it contains, without explicitly stating a view on what form a suitable Swedish application of the term ‘nearly zero-energy building’ would take. The National Board of Health and Welfare points out that the impact on the indoor environment needs to be taken into account when carrying out a cost-effectiveness calculation and, specifically, states that an improved indoor environment as a result of a renovation to improve energy efficiency could constitute a benefit that should be taken account of.

When it comes to consulted bodies that provided more detailed opinions concerning how strict the requirements a Swedish application of nearly zero-energy requirements should be regarded as involving, the consulted bodies can essentially be divided into four groups, as set out below.

The Royal Institute of Technology (KTH), the Swedish National Board of Housing, Building and Planning, the Swedish Work Environment Authority, the Uppsala County Administrative Board, Vattenfall AB, the Swedish Association for Testing, Inspection and Certification (SWETIC), the Swedish Union of Tenants, Ramböll Sverige AB, The Swedish Wood-processing and Furniture Industry Employers’ Association (TMF), BWG Homes, JM AB, the Swedish Association of Public Housing Companies (SABO), the Swedish National Association of Housing Cooperatives and the Swedish Homeowners Association, a total of 14 consulted bodies, support the view expressed in the memorandum on application of the term and/or predominantly cite potential problems with laying down stricter requirements for energy efficiency improvements.

The Swedish Meteorological and Hydrological Institute (SMHI), the Halland, Kronoberg, Stockholm and Västra Götaland County Administrative Boards, the Cities of Gothenburg and Stockholm, Swedenergy (Svensk Energi), the Swedish Electricians’ Organisation (EIO), the Swedish Property Federation and NIBE AB, a total of 11 consulted bodies, partly support the view expressed in the memorandum on application of the term but at the same time predominantly express views pointing out that there are options to go further with energy efficiency improvements and/or that improving energy efficiency is an important issue for these bodies.

The Faculty of Engineering at Lund University, the Chalmers University of Technology, Dalarna University, the Swedish Environmental Protection Agency, the Swedish Environmental Management Council, the Swedish Governmental Agency for Innovation Systems (VINNOVA), the Swedish Energy Agency, the SP Technical Research Institute of Sweden, the Dalecarlia, Gotland, Jönköping, Norrbotten and Västerbotten County Administrative Boards, the Municipalities of Linköping, Västerås, Luleå and Umeå, Dalecarlia County Council, the Region of Västra Götaland, the Swedish Association of Local Authorities and Regions (SALAR), the Royal Swedish Academy of Engineering Sciences (IVA), the Swedish Society for Nature Conservation, the Swedish Ventilation Industry Association (Svensk Ventilation), the Swedish Federation of Consulting Engineers and Architects (STD), the Association of Swedish Ventilation System Testers (Funkis), the Association of Swedish Energy Efficiency Companies (EEF), the Swedish Society of HVAC Engineers (Swedvac), the Association of Swedish Building Inspectors (FSB), the Association of Swedish Energy Consultants, the National Federation of Tenants’ Savings and Construction Associations (HSB riksförbund), the Swedish Association of Plumbing and HVAC Contractors, the Swedish Insulation Industry Association (IF), the Swedish Heat Pumps Industry Association (SVEP), the Västra Götaland Passive House Centre, the Swedish Zero-Energy Housing Centre, Byggherrarna i Sverige AB, the Swedish Building Materials Industries’ Association (BMI), the Swedish Construction Federation (BI), the Contractors’ Federation (Entreprenörförbundet), NCC, Skanska AB, Veidekke, the Solar Energy Association of Sweden (SEAS), Peab, Tyréns AB, Swedisol AB, CIT Energy Management AB (CIT), Olof Hägerstedt² and the World Wide Fund for Nature (WWF), a total of 49 consulted bodies, broadly do not share the view expressed in the memorandum of how the term should be applied and take the clear position that it would be desirable to obtain more far-reaching energy efficiency improvements in buildings.

The Swedish District Heating Association, E.ON värme AB, AB Fortum Värme, Göteborg energi and the Swedish Bioenergy Association (Svebio), a total of 5 consulted bodies, largely take the view that the building regulations and ‘nearly zero-energy building’ must be defined taking considerably more account of primary energy, without explicitly taking a position in relation to what level of requirements is suitable for nearly zero-energy buildings.

Below is a selection of the opinions put forward by the 14 bodies that expressed support for the view set out in the memorandum and predominantly cited potential problems with laying down more far-reaching requirements for energy efficiency improvements.

KTH argues that strict energy requirements must not lead to anyone deciding not to build, that complex technical systems are needed for a low energy demand and that these require skill to operate and maintain.

The *Swedish National Board of Housing, Building and Planning* shares the view expressed in the memorandum that, with the new energy requirements in the Board’s building regulations, Sweden meets the requirements under the Directive in respect of nearly zero-energy buildings on the basis of what is technically and economically justified given national circumstances in Sweden. The Swedish National Board of Housing, Building and Planning believes that, on the basis of current information, it would be beneficial neither socio-economically nor from a real estate economics point of view to force energy requirements much lower than they already are. The Board goes on to argue that, under the Directive, Member States are not required to apply requirement levels for nearly zero-energy buildings where the cost-benefit analysis is negative over the economic lifecycle of the building in question. Furthermore, the Board believes that, when construction companies project energy use that is lower than the maximum level permitted under the building regulations, there are two main reasons. The first of these is that the requirement covers actual energy use once the building has been built and not projected energy use, which requires a margin of error. The second reason is in order for it to be possible to build the same type of building in multiple geographical areas with different climatic conditions and in order for buildings with different heated floor areas to be able to have the same construction solutions. The Board believes that many reports on low-energy buildings are based on projected values. When such buildings have later been evaluated, it has proved to be the case that the targets set have not been met in practice, for example Bo016 and the Lindåshusen, the Board observes.

BWG Homes argues that the energy economy requirements under BBR 19 are very close to the level that is supposed to be achieved for single and double family homes by 2021. *JM AB, SABO, the Swedish National Association of Housing Cooperatives and the Swedish Homeowners Association* also emphasise the cost aspects of stricter requirements.

² MD of the company Självständiga hus AB.

There is real variety in the opinions from the 11 bodies that partially support the view in the memorandum but at the same time emphasise the importance of improving energy efficiency. Some examples are given below. *Swedenergy* believes that the information referred to in the memorandum represents a sound basis for the view expressed in the memorandum, while it also points out that there are good examples of buildings. What is known as the passive house technique, in particular, strikes *Swedenergy* as having great potential, and it believes that greater efforts to disseminate such techniques could be important. *Swedenergy* also emphasises the importance of providing a clear message to the actors in the market. *The Swedish Property Federation* is positively disposed towards a gradual tightening-up of energy economy requirements for buildings with the aim of achieving energy and environmental targets. The Federation believes that the period up to 2015 should be used to evaluate and monitor the various low-energy projects that have been set up around the country. The Federation observes that there are already a good number of examples of new energy-efficient buildings that have been positively assessed from an economic and energy efficiency point of view. The Federation believes that, post 2015, the term ‘nearly zero-energy building’ should involve stricter energy economy requirements than those under BBR 2012. Furthermore, the Federation stresses the need for programmes to enhance skills which should be focused on relevant actors in order to avoid erroneous projections and similar problems. The Federation believes that the period up to 2015 should be used, amongst other things, for programmes to enhance skills in this way. *The Kronoberg County Administrative Board* supports the idea of carrying out further impact analyses but believes that the view that BBR 19 corresponds to the requirements under the Directive for nearly zero-energy buildings is patently absurd. Furthermore, the County Administrative Board believes that it has become evident that, under certain conditions, there are circumstances where it is beneficial both socio-economically and from a real estate economics point of view to lay down tougher energy economy requirements. The County Administrative Board therefore finds it self-evident that tougher requirements could be set and that impact analyses should be carried out as soon as possible in order to discover under what circumstances this could take place.

All the bodies in this group state that they either fully or partially support the view expressed in the memorandum, or in any case do not directly oppose it in its entirety, while any criticism that they express in this matter is mostly relatively guardedly expressed.

Considerably more substantial objections are expressed, without exception, in the group of 49 bodies that advocate an application of ‘nearly zero-energy building’ that involves tougher energy efficiency requirements.

A large number of these bodies strongly question the link that is made in the memorandum between current building regulations and a nearly zero-energy level. The arguments made against this vary in nature.

The Faculty of Engineering at Lund University, the Swedish Environmental Protection Agency and the Swedish Energy Agency, plus three other consulted bodies, believe it is impossible to argue that BBR 2012 formally satisfies Recital 17 of the Directive³. The reason for this, according to the consulted bodies, is that the energy economy requirements for buildings with electrical heating have not been revised since the entry into force of the EU Directive in 2010. BBR 2012 contained revisions only of the energy economy requirements for non-electrically heated buildings. The consulted bodies thus believe that it cannot be argued that BBR 2012 satisfies the criteria of being stricter than the current minimum requirements for the energy performance of buildings in Sweden, even if you interpret the relevant point in time for ‘current minimum requirements’ to be the date of adoption of the Directive.

The Swedish Energy Agency also points out that another possible interpretation of the term ‘current minimum requirements’ would be the level that applies at the point in time when the Directive is to be implemented in Sweden. The Agency believes that, under an interpretation of this kind, the interpretation in the memorandum becomes even more out of kilter with Recital 17.

³ A description of the content of Recital 17 is given below under Reasons behind the Government’s view.

The Swedish Energy Agency also believes that implementing the view expressed in the memorandum would mean a failure to comply with the requirements under the Directive (Article 4) for Member States to take the necessary measures to ensure that minimum energy performance requirements are set at cost-optimal levels. The Agency's argument for this is that it has been demonstrated that more ambitious minimum requirements than those proposed are justified under the Directive's cost-optimality factor. In this context, the Swedish Energy Agency interprets the concept of 'cost-optimality' under the Directive to mean cost-effectiveness in the usual economic sense. The Agency bases this on a combination of the results of the economic impact analyses carried out for the memorandum and a recently published licentiate's dissertation at the KTH Royal Institute of Technology which shows that building environmentally-adapted low-energy buildings becomes economically profitable after five years.

The argument that it is already possible to build more energy-efficiently and make a profit from it was also taken up in various ways by a number of other consulted bodies.

BI and *Veidekke* point out that the construction industry, via the Ecocycle Council and the Swedish Environmental Management Council, already recommends a maximum energy use for non-electrically heated buildings that is 15 kWh/m² lower than the maximum permitted levels under BBR 2012. *BI* also points out that many of its member companies already go further than that.

Dalarna University, the Dalecarlia and Jönköping County Administrative Boards, Dalecarlia County Council, the Royal Swedish Academy of Engineering Sciences (IVA), the Swedish Society for Nature Conservation, Byggherrarna i Sverige AB, NCC and Skanska, amongst others, advocate a definition of nearly zero-energy that is in line with the target levels previously proposed by the Swedish Energy Agency, which is to say by and large a halving of the maximum permitted energy use levels for new buildings under BBR 16 (which was adopted in 2006).

The municipality of Linköping and Skanska, for example, provide data relating to real buildings that have considerably lower energy use levels than the maximum permitted levels under the building regulations.

The SP Technical Research Institute of Sweden does not believe that the construction of buildings that are more energy-efficient than required under BBR 19 in some way conflicts with other technical functional requirements for buildings. The Institute has recently evaluated Sweden's first passive houses after nearly 10 years in use and finds it impossible to say that such houses would be worse than ordinary houses or would have been damaged in some way by being well insulated, to the contrary, in fact. It also observes that, after nearly ten years of use, the total energy use is also at the same level as when the buildings were new. The Institute believes that there are bigger risks of deteriorating functional requirements as a result of the continued construction of 'ordinary houses', as passive houses require more stringent quality assurance. Similar views are also expressed by other consulted bodies, such as *the Jönköping County Administrative Board and the Royal Swedish Academy of Engineering Sciences (IVA)*.

The Swedish Governmental Agency for Innovation Systems (VINNOVA), the Swedish Energy Agency, the SP Technical Research Institute of Sweden, the Region of Västra Götaland and a large number of industry associations argue that high ambitions in respect of energy-efficient buildings have the potential to create jobs and exports, improve the competitiveness of Swedish companies in the sector and would be good for the innovation system, while an overly conservative position would hamper dynamism and, in the worst case scenario, could result in a drop in competitiveness and other problems.

The five consulted bodies that largely take the view that building regulations and ‘nearly zero-energy building’ must be defined taking considerably more account of primary energy, without explicitly taking a position in relation to what level of requirements is suitable for nearly zero-energy buildings, put forward the following.

The Swedish District Heating Association believes that district heating was largely overlooked in the memorandum, and that the impact of the regulations on the energy system was not investigated, nor even commented on. The Association is very critical of taking purchased energy as a starting point for the regulations for energy efficiency improvements in buildings.

The Association believes that the building’s net energy use should form the basis for the shape taken by energy economy requirements in the building regulations. According to the Association, this would mean that the building regulations would regulate the actual energy performance of buildings, which is to say the performance of the building envelope, rather than, as at present, regulating against a certain type of form of heating.

The Association believes that the consequences for district heating are very poorly investigated in the memorandum. The Association believes that the use of ‘purchased energy’ in the building regulations represents discrimination against collective forms of heating such as district heating. The Association believes that, by contrast with the requirements pertaining to net energy and primary energy factors, BBR 19 and the term ‘purchased energy’ do not satisfy the impact on society and requirements for reductions of primary energy that apply according to the set of objectives defined in current and expected future EU directives. In the Association’s view, the requirement for ‘purchased energy’ creates different conditions for different forms of heating, while also failing to take account of energy efficiency from a system point of view.

The Association believes that current building regulations also discriminate against collective forms of heating and limit the freedom of choice of form of heating, a choice that should be based on price, environmental performance and similar factors. The Association therefore calls for electrical energy in the building regulations to instead be calculated using a factor of 2.5 in relation to other sources of energy for heating, air conditioning and ventilation.

Reasons behind the Government’s view: In this communication, the Government takes the view that, given that the nearly zero-energy level will, from 2021, essentially be the legally binding level for energy economy requirements applied to all new buildings, a Swedish application of the term ‘nearly zero-energy buildings’ should include stricter requirements for energy economy in comparison with the requirements applying under current building regulations – in any case for most categories of buildings and climatic zones. This is on condition that any tightening-up must only take place when it is justified environmentally, socio-economically and from the point of view of real estate economics. The evaluation of such tightenings-up in future reviews of the energy economy requirements will be made in light of the tightenings-up that have taken place thus far in the reviews that have been carried out, technical and economic development and socio-environmental factors affecting the property market.

The Government observes that the assessment in the memorandum submitted for consultation was that it could be technically and economically justified for the application of the term nearly 'zero-energy building' to involve stricter requirements than BBR 19 and that tightening up the requirements in comparison with BBR 19 in this way would be justified socio-economically and from the point of view of real estate economics. The views of the consulted bodies that nearly zero-energy buildings should not be seen as synonymous with the requirements of BBR 19 thus need not necessarily be regarded as conflicting with the view taken in the memorandum.

The Government's view is also based on what is stated in the Directive in respect of nearly zero-energy buildings, a selection of which is as follows. Article 9 states that Member States must ensure that, by 31 December 2020, all new buildings are nearly zero-energy buildings and that, after 31 December 2018, new buildings occupied and owned by public authorities are nearly zero-energy buildings. The Directive further states that Member States must draw up national plans for increasing the number of nearly zero-energy buildings and that these national plans may include targets differentiated according to the category of building. It is also stipulated that Member States must stimulate the transformation of buildings that are refurbished into nearly zero-energy buildings.

Article 2(2) stipulates that a 'nearly zero-energy building' means a building that has a very high energy performance, as determined in accordance with Annex I to the Directive. The said annex lays down certain principles for calculating the minimum requirements for the energy performance of buildings. Article 2(2) further stipulates that the nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby. The Member States are expected, in their national plans, to put forward their detailed application in practice of the definition of this term in such a way as reflects their national, regional or local conditions, and including a numerical indicator of primary energy use expressed in kWh/m² per year.

It is observed in Recital 17 to the Directive that measures are needed to increase the number of buildings which not only fulfil current minimum energy performance requirements, but are also more energy efficient, thereby reducing both energy consumption and carbon dioxide emissions. For this purpose Member States should draw up national plans for increasing the number of nearly zero-energy buildings and regularly report such plans to the Commission.

Recital 8 to the Directive states that measures to improve further the energy performance of buildings should take into account climatic and local conditions as well as indoor climate environment and cost-effectiveness. These measures should not affect other requirements concerning buildings such as accessibility, safety and the intended use of the building.

Article 4(1) of the Directive states that a Member State shall not be required to set minimum energy performance requirements which are not cost-effective over the estimated economic lifecycle.

The Government believes that the provisions of the Directive, taken together with the overall energy performance demonstrated by the new production of buildings in Sweden, speak to the fact that, in any case, it is not obvious that maximum current levels for energy use should be regarded as equivalent to the term 'very high energy performance' in the Directive, at least not for all categories of building or climatic zones. If, at the same time, account is taken of the fact that there should be certain opportunities for technical development by 2021, this adds to the basis for reaching the conclusion that the nearly zero-energy level in 2021 should involve stricter requirements for energy economy than what is required under current building regulations, in any case for most categories of building and climatic zones.

Notwithstanding this, account must also be taken of the fact that there is not currently sufficient information available to be able to specify the extent to which it is justified to tighten up the requirements. The majority of the information that formed the basis of the memorandum submitted for consultation provided support to the idea that there were options, but all the analyses carried out were clouded by a certain degree of uncertainty, while the results were not conclusive either. The results of the consultation process were similarly inconclusive on this issue, even though it is clear that a majority of the consulted bodies advocate more far-reaching energy efficiency improvements than those deemed suitable in the memorandum. Despite the evident value of such an ambition, the Government observes that, though valuable supplementary information with good examples of energy-efficient buildings were provided in certain submissions to the consultation process, there is not, as yet, an adequately secure analytical basis on which to be able to establish a quantitative guideline for what nearly zero-energy should mean in Sweden in 2021. What is lacking, above all, is the basis for being able to make a judgement about what is effective socio-economically and from the point of view of real estate economics.

It can also be observed that there is a general probably with theoretical calculations about what level of energy efficiency improvements has what consequences. It is through following up real projects that high quality knowledge can be gained. It is in light of this, amongst other things, that the proposals for promotional measures in Section 2.2 should be seen. Promotional measures form part of what is required of Member States under the Directive; in a Swedish context, where experiences of energy-efficient construction have not been collected in a systematic and easily-accessible way at a national level, there is also an opportunity to carry out a systematic follow-up, which is justified in any case.

The promotional measures are one example of what is needed in order to provide a solid basis for deciding on a position for a more specific Swedish application of the term 'nearly zero-energy building'. There will also be a need for broader-based economic analyses and analyses of significant socio-environmental factors, in particular those affecting the property market.

One example of an economic analysis of this kind and relevant significant socio-environmental factors is how the general economic situation can affect the property market. The Government reported in its Budget Bill for 2012 that the international economic downturn hit the construction industry hard, which in turn led to a dramatic fall in house-building in 2009 (Government Bill 2011/12:1, expenditure heading 18). It is true that this trend did turn in 2010, but the example shows clearly enough the significance that the broader economic outlook has for construction and the importance of also taking account of such aspects. While it can be seen that the issue of upturns and downturns in construction is considerably more complex than it generally being possible to deduce a clear causal link between either upturns or downturns in construction and requirements for energy use, this does not prevent there being every reason to draft requirements that are also based on a sound socio-economic analysis.

It is also worth noting that, while there can be said to be broad support for more stringent energy requirements among industry associations for construction and civil engineering companies and the building materials industry, as well as among many large construction companies, property owner organisations and the public housing companies' organisations are expressing a more cautious or negative attitude. This also highlights the importance of there being a sound basis for any specific positions taken in future. It may be worth noting, in this connection, that there is a possibility, in specific and justified cases, of applying an exemption from nearly zero-energy requirements. It is the Government's view that such exemptions must be applied on a restrictive basis, but that it is worth noting that this option exists.

The Government takes the view that tightening-up must only take place when it is justified environmentally, socio-economically and from the point of view of real estate economics. At present, there is not sufficient information on these factors to be able to establish a quantitative guideline for what nearly zero-energy requirements could be applied in Sweden in 2021.

An important issue that should be highlighted in this context is the ongoing work that has been carried out in Sweden in order to recurrently review the minimum requirements made of the energy performance of buildings. This is summarised in Table 2.1, which shows how energy economy requirements for housing have changed in three steps.

Table 2.1. Energy economy requirements for housing, 2006-2012

Year	2006	2009	2012
Form of heating	Electrically heated and non-electrically heated <u>kWh/m²</u>	Electrically heated buildings <u>kWh/m²</u>	Non-electrically heated buildings <u>kWh/m²</u>
Climatic Zone I	150	95	130
Climatic Zone II	130	75	110
Climatic Zone III	110	55	90

As the table above shows, energy economy requirements were tightened up in multiple stages between 2006 and 2012. As a first step, stricter energy economy requirements were introduced for electrically heated buildings in 2009. The requirement levels laid down at that time are still in force. The next review, BBR 19, which this year is being applied in parallel to the previous requirement levels prior to full implementation as of 2013, tightened up the requirements for non-electrically heated buildings compared with the levels that began to apply in 2006. It may also be worth noting that reviews of what requirements are made in respect of energy use in buildings were also carried out prior to 2006, but since the requirements took a different form at that time than they do now, it would be difficult to make a comparison that can be summarised in a table.

The table and the reasoning above highlight an important principle that applies to how work on the energy economy requirements is carried out in Sweden. Regular reviews of the requirements take place, and thus far they have always resulted in stricter requirements.

In light of factors such as the tightening-up that took place between 2006 and 2012 and technical and economic development, as well as socio-environmental factors affecting the property market, the Government's view is that forthcoming reviews will also give rise to such step-by-step tightenings-up as are justified environmentally, socio-economically and from the point of view of real estate economics. A first audit point for this is scheduled for 2015. Part 2.3 goes into detail about a number of aspects associated with this audit point. The recurrent revisions of the energy requirements are an important part of Sweden's strategy for moving towards nearly zero-energy requirements and tightening up requirements for energy economy and the work on nearly zero-energy buildings on a step-by-step basis.

Existing buildings

The judgments reached in this communication mostly relate to the requirement under the Directive for new buildings to be nearly zero-energy buildings by 2021 (2018 for those new buildings owned and occupied by public authorities). The Directive also prescribes that, when existing buildings are renovated, Member States must promote their renovation to a nearly zero-energy building standard. Given how Swedish legislation in the field of planning and building is currently organised, an energy economy requirement for new buildings of nearly zero-energy level would indirectly mean that, even when an existing building is modified, it could become necessary to put measures in place to improve the characteristics of the building where this is reasonable given the conditions of the building. The requirement of nearly zero-energy level for new buildings thus also promotes the improvement of energy efficiency in existing buildings to nearly zero-energy level where reasonable. Where an improvement of energy efficiency to this level is not reasonable, the Government's view is that the building in question should be brought up to the highest energy performance level that is reasonable. The legislation already provides flexibility in this regard.

When altering a building, the requirements may be adapted and derogations from the requirements granted, consideration being given to the extent of the alteration, to the possibilities for the building and to provisions governing cultural sensitivity and the retention of character (Chapter 8 Section 7 of the Planning and Construction Act [2010:900]). The fact that the term 'conditions for the building' also incorporates an economic aspect is clear from the legislative drafting documents for the previous Planning and Construction Act (Government Bill 1985/86:1). It can also be seen from later legislative drafting statements that the legislators had no intention of making any changes in that regard (Government Bill 2009/10:170).

Where renovation to nearly zero-energy level is possible and reasonable, with attention being paid to the conditions referred to above, this is still intended to happen. In addition to the indirect effect on the renovation of existing buildings that thus, in certain cases, results from an energy economy requirement of nearly zero-energy level for new buildings, renovation to nearly zero-energy level is also promoted by means of new construction to this level taking place on a larger scale. It is reasonable to assume that it contributes to knowledge if relevant applications of energy-efficient techniques become better known and disseminated, which in turn would be likely to reduce the additional costs for both new construction and renovation to more energy-efficient levels.

The Government's view is that this level of ambition for existing buildings is in line with what is laid down in Article 9 of the Directive.

Numerical indicator of primary energy use

Article 9(3)(a) of the Directive states that the action plan for nearly zero-energy buildings must include a numerical indicator of primary energy use expressed in kWh/m² per year. Annex I to the Directive further stipulates that the energy performance of a building is to be expressed in a transparent manner and must include an energy performance indicator and a numeric indicator of primary energy use, based on primary energy factors per energy carrier, which may be based on national or regional annual weighted averages or a specific value for on-site production.

Primary energy aspects are taken into consideration to a degree under current Swedish building regulations

The energy economy requirements laid down in Swedish building regulations are laid down in such a way that account is given to primary energy use for certain kinds of energy. Thus, the level of requirements is differentiated between buildings heated using electricity and those which are not. This is illustrated in Table 2.2 below, which provides some examples of the maximum energy use per m² and year permissible under current Swedish building regulations. The example relates to residential buildings and the values specified for non-electrically heated buildings are the levels applicable under BBR 19, which will fully apply as of January 2013.

Table 2.2 Requirements for electrically heated and non-electrically heated buildings pursuant to current building regulations

	Electrically heated houses, kWh/m ² per year	Non-electrically heated houses, <u>kWh/m² per year</u>
Climatic Zone I	95	130
Climatic Zone II	75	110
Climatic Zone III	55	90

As the table shows, Swedish building regulations in their current form lay down somewhat stricter requirements for energy economy in electrically heated buildings. This means that the Swedish building regulations, in their current form, also take account of the higher degree of efficiency in a primary energy context that it is possible to judge that, for example, district heating has, by means of the requirements pertaining to a specific end use are stricter for electrical heating than they are for, for example, district heating.

As the examples above show, the maximum permitted levels for end use in non-electrically heated houses are roughly 1.4 times higher than those for electrically-heated houses in Climatic Zone I. Similarly, the maximum permitted levels for non-electrically heated houses in Climatic Zone II are roughly 1.5 times higher than those for electrically-heated houses in the same climatic zone. Finally, in Climatic Zone III, the maximum permitted levels for end use for non-electrically heated houses are roughly 1.6 times higher than those for electrically-heated houses in the same climatic zone.

These stricter requirements for electrically-heated buildings are justified, not least, by the need to take account of primary energy aspects and the fact that district heating has positive aspects when seen from a primary energy perspective.

The example above was quoted on the basis of the requirement levels laid down for residential buildings under BBR 19. An application of primary energy aspects for a nearly zero-energy building can be expected to be based on energy economy requirements that will apply to this kind of buildings. With the same relationship between the requirements for electrically heated and non-electrically heated buildings, however, relatively much more stringent requirements would also be laid down in respect of electrically heated nearly zero-energy buildings in comparison with non-electrically heated nearly zero-energy buildings in the same climatic zone.

The account about shows that the existing building regulations do take account of primary energy aspects and that, through them, there are opportunities to account for primary energy aspects in accordance with the requirement for a numerical indicator for primary energy laid down in the Directive.

2.2 Promotional measures for knowledge and effective implementation

The Government's view: Promotional measures should be put in place in order to facilitate the implementation of the requirements for nearly zero-energy buildings. The overall purpose of these promotional measures is two-fold, namely to help minimise potential additional costs for energy-efficient construction by reducing learning costs and to help ensure, through improved knowledge, that the final, legally binding definition of nearly zero-energy building is built on a solid basis. The promotional measures should include, amongst other things, demonstration projects with a larger geographical spread than has hitherto been the case for the construction of low-energy buildings in Sweden, skill-enhancement schemes for key groups, continuous follow-up and assessment of both all the technical functional requirements and cost aspects associated with energy-efficient buildings. Target levels for demonstration projects that are to be realised should be for it to be possible to cover the energy demand of the building, by and large, with a maximum of 105.9 kWh/m², if the building is located in northern Sweden, and a minimum of 20 kWh/m². It should also be possible to realise demonstration projects with target levels between these limit values.

The view expressed in the memorandum: largely corresponds to what is set out in this communication. The main difference is that target levels were not given for promotional measures in the memorandum.

Consulted bodies: Views on the proposal for promotional measures were submitted by *the National Property Board Sweden (SFV), Linköping University, the Faculty of Engineering at Lund University, the Chalmers University of Technology, the Swedish National Heritage Board, the Swedish Environmental Protection Agency, the Swedish National Board of Housing, Building and Planning, the Swedish Agency for Economic and Regional Growth, the Swedish Governmental Agency for Innovation Systems (VINNOVA), the Swedish Energy Agency, the SP Technical Research Institute of Sweden, the County Administrative Boards of Dalecarlia, Gotland, Jönköping and Västra Götaland, the Municipalities of Västerås and Luleå, Dalecarlia County Council, the Swedish Association of Local Authorities and Regions (SALAR), Swedenergy (Svensk Energi), the Swedish District Heating Association, the Swedish Federation of Consulting Engineers and Architects (STD), the Swedish Association for Testing, Inspection and Certification (SWETIC), the Swedish Asthma and Allergies Alliance, the Swedish Electricians' Organisation (EIO), the Swedish Union of Tenants, Ramböll Sverige AB, the Swedish Zero-Energy Housing Centre, the Swedish Centre for Innovation and Quality in the Built Environment, Byggherrarna i Sverig AB, the Swedish Building Materials Industries' Association (BMI), the Swedish Construction Federation (BI), the Contractors' Federation (Entreprenörföretagen), NCC, the Swedish Association of Public Housing Companies (SABO), CIT and the World Wide Fund for Nature (WWF).*

The *Swedish Environmental Protection Agency* supports the measures proposed in the memorandum, and there is, in principle, no body that opposes promotional measures. The differences lie in which subject areas, etc., that the bodies see as top priority.

SFV highlights the need for promotional measures for greater knowledge of energy efficiency improvements in culturally and historically important buildings, something that *the Swedish National Heritage Board* also stressed.

The Faculty of Engineering at Lund University believes that the proposal for promotional measures is a good idea but would be rendered uninteresting if the view taken were that nearly zero-energy buildings should correspond to buildings that meet the requirements under BBR 19. The Faculty also believes that demonstration buildings must be evaluated impartially with regard to their energy use, indoor climate, user-friendliness and so on, and the information disseminated to the industry and the public. This kind of impartial evaluation programme must, in the Faculty's view, be 100 % state-funded.

The Chalmers University of Technology points out that demonstration projects must concern buildings that fulfil stricter energy economy requirements than the statutory minimum requirements, while the *Swedish Energy Agency* argues that, without target levels that are stricter than the existing minimum requirements, demonstration projects cannot be justified.

The Swedish National Board of Housing, Building and Planning shares the view expressed in the memorandum that the proposed promotional measures satisfy the Directive's requirements for national plans to increase the number of nearly zero-energy buildings. The Board believes that a follow-up analysis of all the technical functional requirements and cost aspects associated with the construction of low-energy buildings is of the utmost importance. The Board believes that, despite the schemes that there have been in this area, there have been very little in the way of results in the form of usable knowledge in the context of regulating construction. The Board also stresses its role as an expert authority in relation to all the technical functional requirements made of buildings and that this could help to ensure higher quality when regulations are developed.

The Swedish Agency for Economic and Regional Growth highlights the possibility of implementing broader-based efforts than demonstration projects in which, above all, the construction industry should participate in order to reduce the risk of inter-industry techniques and innovation being limited.

VINNOVA, too – which believes that the Swedish Energy Agency should be commissioned to realise the promotional measures at the earliest opportunity – emphasises the importance of exploiting opportunities for cooperation in relation to the demonstration projects. *VINNOVA* believes, for example, that opportunities for cooperation should be sought with the Delegation for Sustainable Cities and the projects to which the Delegation has provided investment support. What is more, *VINNOVA* believes that the Swedish Energy Agency should cooperate with it and be involved with *VINNOVA*'s efforts in connection with its Challenge-driven Innovation programme. *VINNOVA* points out that both these forms of cooperation could help to provide a more effective use of resources.

Alongside the promotional measures, a review should also be carried out into what solutions there are in or near the marketplace that could help improve energy performance so as to help bring about better-informed analyses. As well as technical solutions, VINNOVA believes that process and organisational innovations should also be taken into account.

The *Swedish Energy Agency* observes that the market for low-energy buildings is developing quickly, that numerous projects have got under way over the last two years and that major actors in the market are working with stricter requirements than those under the building regulations. At the same time, the Agency observes that there will be a number of market failures with regard to energy-efficient buildings, as well as a lack of information, technological uncertainty and principal-agent problems. In order to remedy these problems and drive development forward, the Agency believes there is a need for more national support efforts, with follow-up, evaluation and the dissemination of information as the key functions.

The Swedish Energy Agency agrees with the view expressed in the memorandum in respect of the need for promotional measures for energy-efficient buildings with a focus on cost-optimality and technical development in combination with effective energy use through a demonstration programme. In order to make a demonstration programme relevant, the Agency is calling for target levels in the action plan. Without these, the Agency argues, the promotional efforts proposed in the memorandum cannot be justified.

The Dalecarlia County Administrative Board believes that the first step should be to develop incentives to remedy the existing property stock. *Gotland County Administrative Board* supports the measures proposed in the memorandum. *Jönköping County Administrative Board* believes that a greater number of, and more vigorous, promotional measures are needed in order to achieve the targets under the Directive. *Västra Götaland County Administrative Board* stresses the importance of making early efforts to produce a comprehensive information basis for the audit point.

The Chalmers University of Technology, like *the SP Technical Research Institute of Sweden*, points out that, if the target of halving energy use in buildings by 2050 is to be achieved, programmes relating to new buildings are not enough. Instead, the University argues that measures are needed to reduce energy use in the existing building stock.

A number of other bodies have also highlighted other aspects that could complement the proposals for promotional measures in the memorandum.

In that context, *Linköping University* stresses the major importance for energy use of questions of behaviour. In this vein, the University observes that a great deal of research has demonstrated that creating a way to technically optimise buildings is not enough to achieve the potential energy savings and energy efficiency improvements in the real world. According to the University, the technical solutions provide the framework conditions for success, but there is also a need for measures that reach those who use, manage and maintain the buildings. The University observes that better knowledge of users' energy use could help reduce the gap between potential energy savings and potential energy efficiency improvements and the results actually achieved. However, this does require better feedback in relation to energy use in buildings than is currently the case. The environment, property owners, residents and other users would all benefit if the gap between potential and results could be reduced, the University believes.

The University makes reference to research results that have shown, amongst other things, the important influence residents have on energy use in passive houses. The residents of the passive houses in Lindås learnt, bit by bit, to manage the warmth in their houses. The study also showed that the residents had different wants and desires when it came to temperature, and this how warm they tried to keep their houses. Another study indicated the need to build correctly from the outset, what lessons can be learnt and what difficulties must be overcome when building passive houses. The University points out that there is also a need for energy-related thinking in the workplace and that it is worthwhile to satisfy the demand for learning in various forms, both in terms of dissemination seminars and the transfer of knowledge from experts to colleagues with (initially) less expertise in projects and ways of working.

The Swedish Asthma and Allergies Alliance argues that the skill-enhancement schemes should include training and information about how to link energy economy measures with a good indoor environment. The Alliance goes on to say that the assessment of technical functional requirements linked to low-energy buildings should be supplemented by analyses of the health of users and residents with allergies and other hypersensitivities in the buildings and whether any energy economy improvement measures are unsuitable from a health and allergies point of view. The Alliance says that this could be done in collaboration with another authority, such as the National Board of Health and Welfare.

Reasons behind the Government's view: The Swedish Energy Agency proposed 12 categories of promotional measures in its report A Strategy for Low-Energy Buildings. These included demonstration projects for new construction and renovation to nearly zero-energy level, scaling-up demonstration projects that have already been carried out to form major schemes, follow-up and information in order to share experiences from demonstration projects in order to achieve the large-scale construction of nearly zero-energy buildings, long-term and ongoing follow-up and cost-benefit analyses when building nearly zero-energy buildings and information and training schemes for actors.

The Government takes the view that many of these proposals seem to be relevant, even if no definitive position can be taken in this communication about the scope of promotional measures or exactly how many and which measures are to be carried out. It is clear that it is justified to carry out certain demonstration projects in order to ensure relevant information, not least about the framework conditions in place for energy-efficient construction in those parts of Sweden where there has been little experience of this kind of construction hitherto.

It is, moreover, quite clear that both the Swedish Energy Agency and the Swedish National Board of Housing, Building and Planning will need to play an active role in the implementation of the promotional measures. In order to ensure the basis required in order to draft building regulations, there is a need for expertise both in the energy field and in respect of buildings as systems, and all the technical functional requirements that they have to meet. The views expressed in its consultation submission by VINNOVA in respect of the importance of coordinating work with similar activities carried out within its work on challenge-driven innovation and with relevant activities that have benefited from the support of the Delegation for Sustainable Cities seem to us extremely relevant to ensuring a rational use, in the overall perspective, of limited resources.

The Government otherwise takes the view that it is very much justified to exploit what knowledge is already out there and see what options there are for relevant evaluations of low-energy buildings that have already been built.

The background to the target levels set out in the Government's view is that there is a need for relevant target levels for the demonstration projects in order to make it possible to produce a usable basis for the establishment of a legally binding application of nearly zero-energy requirements.

The exact distribution of resources between different sub-projects should be left to the authorities to decide, with a certain degree of flexibility. The wordings in the Directive do provide some boundaries for prioritisation of this kind, however. It can thus be observed that the most stringent requirements for nearly zero-energy buildings in the Directive relate to new construction, which, in all likelihood, should be reflected in the prioritisation of promotional measures. Measures relating to the follow-up and evaluation of both actual energy use and other technical functional requirements and any additional costs involved in realising more energy-efficient buildings are important both for a number of political objectives – including, but not limited to, energy policy objectives – and for the socio-economic effectiveness of the implementation of the Directive.

The Government also takes the view that analyses of innovation aspects and behaviour-related issues do have value, and that there should be an evaluation of the extent to which room can be found for these in the promotional measures.

No final conclusion has been reached in respect of how extensive measures should be. The Government will return to this issue in its 2013 Budget Bill and later in appropriation directions to the affected authorities. It is worth noting that some measures that promote nearly zero-energy buildings are already in place in the current budget year, one example being the skill-enhancement project Build up skills (BUSS). This has been accommodated within existing funds in expenditure area 21: Energy.

2.3 Audit point and intermediate targets for 2015

Communication 2011/12:131

The Government's view: There should be an audit point for Sweden's implementation of the Directive's requirements pertaining to nearly zero-energy buildings in 2015. The intention is that the following qualitative objectives will be satisfied by that year. By that time, an adequately large number of relevant schemes should have been put in place, followed up on and evaluated in such a way that the information basis covering the relationship between stricter energy economy requirements and other technical functional requirements, actual additional costs linked to energy-efficient construction and actual environmental benefits of energy-efficient construction has been improved considerably. The schemes should provide experiences that have a wider geographic spread across Sweden than is currently the case. Furthermore, schemes should have been realised that markedly increase the dissemination of knowledge about quality-assured, energy-efficient construction to relevant actors. Construction projects with the objective mentioned initiated in the construction and property sector should be encouraged in a clear way during the period, irrespective of who initiates them.

Proposals in the memorandum: These correspond with the Government's view.

Consulted bodies: *The Swedish National Board of Housing, Building and Planning, the Municipality of Luleå, the Swedish Society for Nature Conservation, the Swedish District Heating Association, Ramböll Sverige AB, the Swedish Asthma and Allergies Alliance, the Swedish Centre for Innovation and Quality in the Built Environment, the Swedish Bioenergy Association (Svebio) and the Swedish Association of Public Housing Companies (SABO)* commented on the section about the audit point, etc.

The Swedish National Board of Housing, Building and Planning shares the view expressed in the memorandum that the current information basis is not sufficient to constitute grounds for further tightening up energy economy requirements. The Board is positively disposed towards initiatives being taken to provide a better empirical data basis before any legally binding energy economy requirements going further than the requirement levels in BBR 2012 are introduced.

The objective of ensuring that there is sufficient knowledge and information available for the audit point in 2015 is ambitious, the Board believes. The Board is highly sceptical about the idea that there is enough time to implement schemes with sufficient quality and evaluate them for the audit point in 2015. By way of example, damp and mould on a large scale were only discovered in single-step plaster facades 10-15 years after this building industry solution became commonplace in new buildings.

The Board also points out that the process for making changes to the regulations is a long one. This process normally takes at least a year based on the requirements in place for impact assessments, consultation processes and EU notification. Without major changes in technology, costs or energy prices, it will probably not be beneficial either socio-economically or from a real estate economics point of view, in the view of the Board, to build to a standard higher than the requirements laid down under BBR 2012. The Board also shares the view that the current level of knowledge does not permit a binding quantified intermediate target for nearly zero-energy buildings in the form proposed by the Swedish Energy Agency in its report A National Strategy for Low-Energy Buildings (ER 2010:39).

The Swedish Society for Nature Conservation observes that the Directive stipulates that intermediate targets must be established for 2015 and that the memorandum rejects binding quantified targets for that date and instead proposes a series of qualitative knowledge-based targets, despite the fact that the Swedish environmental targets system very much facilitates quantitative intermediate targets. The Society believes that a quantitative intermediate target that requires a halving of the building code from 2006 should be put in place for 2015 in order to then tighten up the requirements in order to rapidly increase the number of nearly zero-energy buildings.

The Association for Innovation and Quality in the Built Environment supports the proposals under the memorandum but argues that the qualitative objectives must be firmed up so that the actors in the community building sector know what is meant by ‘an adequately large number of relevant schemes have been put in place and followed up on’ and ‘schemes that markedly increase the dissemination of knowledge about quality-assured, energy-efficient construction to relevant actors’.

Without a firming up of this kind, the Association believes it will be difficult to follow-up on the schemes at the audit point in 2015 and that the actors involved also do not know what measures they should take in order to be able to contribute to the targets being met. The Association approves of encouraging initiatives from actors in the construction and property sector, but calls for a firming up in this area, too. From the organisation’s point of view, initiatives that involve a combined approach to research, innovation and skill-enhancing measures are particularly well suited to squeezing the maximum possible benefit from these schemes. The Association also believes that the various programmes receiving support from the Swedish Energy Agency could be better coordinated in order to yield the most benefit.

The Swedish Asthma and Allergies Alliance thinks it essential that evaluation initiatives and the like should get underway as soon as possible in order for there to be as few errors and omissions as possible as a result of mistaken energy efficiency improvement measures.

Amongst other things, *SABO* has emphasised the value of standardised methods of calculation when energy requirements are to be tightened up and, in that regard, highlighted the ‘SVEBY’ model, which provides for standardised calculations.

Reasons behind the Government’s view: The Directive states that Member States’ national plans for increasing the number of nearly zero-energy buildings must contain intermediate targets for improving the energy performance of new buildings, by 2015, with a view to preparing the implementation of requirements for 2020 and 2018.

The current information basis does not permit the setting of binding quantified target for 2015. This is the background to the Government’s decision to word its views as more qualitative objectives that should be met.

The Swedish Energy Agency’s proposal for a strategy for low-energy buildings and its budgetary data for 2012 include proposals for demonstration projects and skill-enhancement schemes. No precise assessment is made in this communication of the suitable scope for schemes of this kind. As stated above, this will be investigated further and further considerations presented in the 2013 Budget Bill.

For 2015, the intention is that sufficient schemes will have been put in place to have significantly increased the information basis required in order to specify legally binding requirements for nearly zero-energy buildings and that experiences will also have been shared with relevant actors. Demonstration projects are very valuable, but self-initiated projects within affected sectors should also be encouraged, something that could take place, for example, within the networks in which the Swedish Energy Agency and the Swedish National Board of Housing, Building and Planning already participate. It is desirable for self-initiated projects of this kind to be based on the same target levels as those projects forming part of the promotional measures. The Government believes that building considerably more energy-efficient buildings would most likely result in significant environmental benefits and improved security of supply for energy. It is an important aim of systematically monitoring more energy-efficient buildings – alongside the issues of the impact on other technical functional requirements and potential additional costs – to shed more light on these aspects.

As can be seen from Parts 2.1 and 2.4, the Government has reached the conclusion that the way Sweden's building regulations are framed means that they do take account of primary energy aspects and that, through them, there are opportunities to account for primary energy aspects in accordance with the requirement for a numerical indicator for primary energy laid down in the Directive (Article 9(3)(a)). The instruments Sweden uses generally promote the use of renewable energy, irrespective of whether or not the use of the energy takes place in buildings. Of course, there is always the possibility of further developing or supplementing instruments in order to make them more effective. The opinions of the consulted bodies make the case for the potential for development in this way both in respect of investigating and taking account of primary energy aspects in a clearer way than at present and of taking account of renewable energy sources in a more consistent way. If an analysis were to highlight possibilities of improving the technological neutrality of the building regulations in a way that did not result in disadvantages elsewhere, changes of this kind, too, could be on the agenda. These types of question, too, should be analysed over the years leading up to the audit point in 2015.

2.4 The role of renewable energy in nearly zero-energy buildings

The Government's view: The definition of nearly zero-energy buildings laid down in the Directive also includes wordings to the effect that the low amount of energy required should come, to a very significant extent, from energy from renewable sources. Sweden has a high proportion of renewable energy sources in its energy use, including energy use in buildings. Sweden applies general instruments to support the supply and use of energy from renewable sources, lays down requirements in its legislation on energy certification relating to the analysis of alternative energy supply systems and provides relatively advantageous conditions in the Swedish National Board of Housing, Building and Planning's building regulations for heating and air conditioning systems powered by energy from renewable sources. Sweden has implemented the EU Directive on the promotion of the use of energy from renewable sources, including those provisions relating to renewable energy in buildings. In light of this, Sweden can be regarded as satisfying the requirements laid down in respect of renewable energy in nearly zero-energy buildings.

The view expressed in the memorandum: This corresponds with the Government's view.

Consulted bodies: The following bodies submitted comments in respect of the views expressed in the memorandum on renewable energy and nearly zero-energy buildings: *the Swedish National Board of Housing, Building and Planning, the Swedish Energy Agency, the Gotland County Administrative Board, the Municipality of Luleå, Swedenergy (Svensk Energi), the Swedish District Heating Association, the Swedish Federation of Consulting Engineers and Architects (STD), the Swedish Asthma and Allergies Alliance, Ramböll Sverige AB, the Swedish Zero-Energy Housing Centre, the Swedish Bioenergy Association (Svebio), the Solar Energy Association of Sweden (SEAS) and CIT.*

The Swedish National Board of Housing, Building and Planning and Ramböll Sverige AB share the view expressed in the memorandum that the role of renewable energy in nearly zero-energy buildings is safeguarded under existing legislation. *Swedenergy*, too, shares the conclusion that requirements for more renewable energy in the energy system should be laid down at the supply end, not the user end.

The Swedish National Board of Housing, Building and Planning's comments included the following. The proportion of renewables in the energy mix for buildings is already high, and major efforts to further increase this will only lead to marginal improvements, while the marginal cost can be expected to be high. Sweden has a target of having 50 % of end consumption of energy from renewable sources by 2020. In buildings, the proportion of renewable energy is around 62 %. This proportion is most dependent on the energy sources used for the production of heat and electricity, which are beyond the control of building owners. If all the electric heating in the form of direct electric heating and electricity in electric boilers were replaced by heat pumps with an annual heating factor of three and if all the fossil fuels in individually-owned combustion boilers were switched to district heating, it is calculated that the proportion of renewable energy for heating would only increase by 6 percentage points (to 68 %).

The Swedish Energy Agency points out, at the same time, that in certain cases the building regulations work against the renewable energy installations. The current system boundary in the building regulations means that they are not technology-neutral, according to the Agency. The Agency believes that the make-up of the requirements in the current building regulations means that, in practice, different requirements for the energy efficiency of buildings are laid down depending on the type of energy used in the building. The Agency goes on to say that, since the tightening-up of energy economy requirements for new buildings that was introduced in BBR 2012 only included requirements for non-electrically heated buildings, the effect is that the previous ratio of how strict the requirements were for electrically-heated and non-electrically heated buildings has been shifted. The Agency takes the view that shift that has taken place will have a detrimental impact on biofuels. In light of this and other factors, the Swedish Energy Agency advocates a review of the system boundaries.

The Swedish District Heating Association believes that the current building regulations do not sufficiently advantage heating systems operated using energy from renewable sources, while *the Swedish Federation of Consulting Engineers and Architects* believes that the memorandum leaned far too heavily in favour of electricity.

The Swedish Zero-Energy Housing Centre has carried out an alternative analysis (LCA) based on data from IVL Swedish Environmental Research Institute's report 'Resource index for energy'. The Centre's conclusion is that houses with heat pumps and a district heating connection – classed as non-electrically heated – tend to be favoured at the expense of houses heated entirely using district heating and that this tends to be ineffective considering both the primary energy and the fact that it leads to increased use of non-renewable energy.

The Swedish Bioenergy Association believes that the building regulations satisfy the requirement under the Directive for renewable energy sources, while *the Solar Energy Association of Sweden* believes that the current building regulations offer both advantages and disadvantages to the use of solar energy.

The Swedish Asthma and Allergies Alliance emphasises the health aspects of the small-scale burning of biofuels. The Alliance thinks that renewable energy sources are a good thing, but that they should not be introduced at the expense of people's health. The Alliance believes that, with good legislation, the use of effective modern techniques and adequate supervision from the municipalities, such problems can be avoided. The Alliance therefore believes that instruments should be designed that encourage people to install renewable energy sources that do not give rise to harmful particles and poor air quality. The Alliance believes that older technologies should be phased out.

Reasons behind the Government's view: Sweden's building regulations, which are general in nature, cannot lay down what energy sources and forms of heating are to be used in individual buildings. The intention with this, amongst other things, is to allow flexibility in the choice of technical solutions and to ensure that the building regulations themselves do not end up forming an obstacle to technical developments in construction.

The Government has adopted ambitious targets for the use of energy from renewable energy sources in Sweden and, as a rule, applies general economic instruments in order to achieve this. A clear example of instruments of this kind is the certification system for electricity from renewable sources, which has worked well and had a major impact on increasing electricity production from renewable energy sources in Sweden. There are also other general instruments that have long been employed by the Swedish Government in order to promote the supply and use of energy from renewable sources, and these have been successful.

In light of this, the Government would like to point out that, first of all, there are factors that provide an argument that promoting electricity from renewable sources through the building regulations is, to some extent, not very compatible with the logic on which Swedish legislation for construction and energy markets is built and that, at the very least, a strong element of control in this form would be ineffective, not to mention the fact that this would be difficult to formulate in regulations. Secondly, there are general instruments to be used for a broad-based promotion of energy from renewable sources in Sweden, and the experiences with these have generally been good.

The Government would further like to point out that the rules that Sweden has been applying since the entry into force of the 2002 Directive in its legislation on energy certification also promote greater use of energy from renewable energy sources through the requirement for analysis when there is new construction. The tightening-up under the Directive in this regard will also mean that the Swedish application of these requirements will be tightened up, which thus means that this support for the use of energy from renewable sources in buildings will be increased.

Current building regulations also promote heating and cooling systems operated using energy from renewable energy sources and conversion technologies for biomass, in the following ways.

- The energy economy requirements in the BBR specify a maximum permissible energy use per m² for a building.
- When this energy use is to be calculated, account has to be taken of insulation through windows, as well as energy via solar collectors insofar as this energy can be used in the building. In order to reduce the need for purchased energy, there is thus no need, when carrying out an installation of solar collectors or solar cells on a building, to add in the collected quantity of energy from these when calculating the specific energy consumption for the building and weigh this against the energy economy requirement.
- The requirement for a building's specific energy consumption may be reduced in the same way as for energy obtained from the ground, air or water from a heat pump installation.

- Air conditioning produced from electricity in non-electrically heated buildings has to be multiplied by a factor of three when determining a building's specific energy consumption. This promotes the use of the likes of district cooling and free cooling (which are not electrically produced and therefore are not calculated in this way). Free cooling is renewable by definition. In Sweden, district cooling and district heating largely come from renewable sources. In addition, it is worth noting that Sweden has transposed Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources, including those provisions in the Directive that relate to use of energy from renewable sources in buildings.

It can be seen that the proportion of renewable energy in buildings in Sweden is currently at least 62 %, which makes an effective contribution to Sweden's target of obtaining 50 % of all end consumption of energy from renewable sources by 2020.

In light of this, the Government concludes that the stipulations in the Directive on the use of energy from renewable sources in nearly zero-energy buildings are satisfied through existing instruments.

Summary of the memorandum ‘Recast
Energy Performance of Buildings Directive –
Assessments and proposals concerning nearly
zero-energy buildings’

Communication 2011/12:131
Annex I

Views concerning the application of the term ‘nearly
zero-energy building’

The following assessment was made in the memorandum in respect of the application of the term ‘nearly zero-energy building’. For buildings, there is a target of reducing total energy use per heated area unit in residences and business premises by 20 % by 2020 and 50 % by 2050 in comparison with the usage in 1995. These targets are subordinated targets under the environmental quality objective of achieving ‘a good built environment’. In order to reduce the buildings’ energy use it is justified for the economic instruments to be accompanied by regulation. In light of the recast Energy Performance of Buildings Directive and other legislation, the Swedish National Board of Housing, Building and Planning drew up more stringent energy economy requirements that will apply in full as of 1 January 2013 (BBR 2012). Our judgement is that, with the new energy requirements, Sweden meets the requirements under the Directive on the basis of what is technically and economically justified given national circumstances in Sweden. The assessment is, however, that it could be technically and economically justified, in future, for the application of the term ‘nearly zero-energy building’ in Sweden to mean an energy use that is lower than the highest levels for energy use per m² permissible pursuant to the energy economy requirements under BBR 2012. However, the information currently available does not constitute a basis for further tightening-up of energy economy requirements. The issue is what is beneficial socio-economically and from a real estate economics point of view. There is to be an audit point in 2015. Up to that date, schemes are to be realised that can provide an empirical basis for what level legally binding energy economy requirements applying the term nearly zero-energy buildings should occupy. The intention is to tighten up the energy requirements in comparison with BBR 2012 in such ways as later analyses will show are justified socio-economically and from the point of view of real estate economics.

The conclusion was also reached that the binding requirements under the Directive in relation to nearly zero-energy buildings predominantly relate to new buildings. Member States are also required to make efforts to promote transformation to nearly zero-energy level when buildings are renovated. More stringent energy economy requirements in accordance with the view above would indirectly mean that, when renovating existing buildings, opportunities to improve energy economy would have to be seized. As a maximum, this would be realised to such an extent that the buildings achieve the same level as new constructions, which is to say a nearly zero-energy level. However, this presupposes that that is technically feasible and economically reasonable in the real world case. Where an improvement of energy efficiency to this level is not reasonable, the intention is that the building in question should be brought up to the highest energy performance level that is reasonable. Even if, that being the case, statutory requirements for nearly zero-energy level can thus, in the main, be expected to apply to new buildings, promotional measures of the kind proposed in this memorandum can still create a better framework not just for the achievement of nearly zero-energy level in new buildings, but also for renovation to that level in relevant cases.

When it comes to promotional measures, it was proposed in the memorandum that such measures should be put in place in order to facilitate the implementation of the requirements for nearly zero-energy buildings. The overall purpose of these promotional measures is two-fold, namely to help minimise potential additional costs for energy-efficient construction by reducing learning costs and to help ensure, through improved knowledge, that the final, legally binding definition of nearly zero-energy building is built on a solid basis. The judgement was also reached that the promotional measures should include, amongst other things, demonstration projects with a larger geographical spread than has hitherto been the case for the construction of low-energy buildings in Sweden, skill-enhancement schemes for key groups, continuous follow-up and assessment of both all the technical functional requirements and cost aspects associated with energy-efficient buildings.

The role of renewable energy in nearly zero-energy buildings

When it comes the role of renewable energy in nearly zero-energy buildings, the following judgements were expressed. Alongside the stipulation of high energy performance – which aims to produce efficient energy use – the definition of nearly zero-energy buildings laid down in the Directive also includes wordings to the effect that the low amount of energy required should come, to a very significant extent, from energy from renewable sources. The judgement reached is that this is ensured through a combination of the general instruments that the Swedish Government applies in order to support the supply and use of energy from renewable sources and the requirements laid down in Swedish legislation on energy certification relating to the analysis of alternative energy supply systems and the relatively advantageous conditions in the Swedish National Board of Housing, Building and Planning's building regulations for heating and air conditioning systems powered by energy from renewable sources. It must also be ensured that this requirement is implemented in a way that is consistent with the Swedish implementation of the Articles of the Directive concerning renewable energy sources, which cover the promotion of the use of energy from renewable sources in buildings.

Audit point and intermediate targets for 2015

It was proposed in the memorandum that there should be an audit point for Sweden's implementation of the Directive's requirements on nearly zero-energy buildings in 2015. The following qualitative objectives are to have been met by that year. An adequately large number of relevant schemes are to have been put in place, followed up on and evaluated in such a way that the basis of information collected about the relationship between more stringent energy economy requirements and other technical functional requirements, real-world additional costs associated with energy-efficient construction and real-world environmental benefits from energy-efficient construction has been improved considerably. The schemes should provide experiences that have a wider geographic spread across Sweden than is currently the case. Moreover, schemes are to have been put in place that markedly increase the dissemination of knowledge about quality-assured, energy-efficient construction to relevant actors. Construction projects with the objective mentioned initiated in the construction and property sector are to have been encouraged in a clear way during the period, irrespective of who initiates them.

Three analyses produced of the stricter energy economy requirements

An analysis of the economic impact of stricter energy economy requirements was produced in the spring of 2011 by experts at the Swedish National Board of Housing, Building and Planning and by two consultancy firms, WSP and CIT, on behalf of the Swedish Energy Agency. There follows a summary of the main results of the analysis. All the studies it is technically possible in nearly all the cases studied to reach a specific energy consumption for the buildings studied that is lower than the maximum permitted under BBR 2012. The only exception is WSP's evaluation of the situation for small residential buildings with heat exchangers and district heating in Kiruna. The assessment of how much lower energy use than the maximum permitted level under the BBR can be achieved varies between the studies. There are also some general tendencies that are common to all the evaluations, however. All three analyses showed, for example, that it is relatively easier to reduce specific energy use in electrically-heated buildings than in those with district heating. Both the information basis for the Swedish National Board of Housing, Building and Planning's study and that from WSP indicate that it is technical possible to reduce the specific energy consumption in electrically-heated small residential buildings to a level around 50 % lower than the maximum permitted level under BBR 2011. The corresponding technical potential for small residential buildings heated by district heating is smaller, while the lowest potential of all is deemed to be that for small residential buildings with heat exchangers and district heating in WSP's analysis.

When it comes to economic reasonableness, the assessments vary considerably between the different information bases. According to the Swedish National Board of Housing, Building and Planning's experts, all the technically possible levels of energy use lower than that of BBR 2012 are uneconomic except in one case: electrically-heated multi-dwelling buildings in Kiruna. WSP's analysis, meanwhile, is that there are economic solutions or solutions that, despite their values being negative at this point in time, could be regarded as economically justifiable with a view to achieving 50 % energy use compared with the maximum permitted energy use under BBR 2012. In CIT's analysis the judgement made is that – for new buildings – there are solutions to achieve 50 % lower energy use compared to the maximum permitted energy use under BBR 2012, with a return of between 4 and 11 % on invested capital in order to realise this more stringent level. For existing buildings, CIT's report judges it technically possible to achieve no more than 25 % lower energy use than the maximum permitted energy use under BBR 2012. For existing buildings, the return on invested capital is judged to be a maximum of 3 % and a minimum of no return at all.

The analyses are all, without exception, associated with a significant number of assumptions and thus uncertainty. It is worth noting that more stringent energy requirements can have a negative impact on other technical functional requirements for buildings, but that the effect is hard to quantify and evaluate. It has not been possible to carry out an overall socio-economic impact analysis, even if some attempts have been made in the basic data.

In order to reduce the uncertainty to some extent, WSP and CIT carried out a supplementary analysis of some of the aspects involved:

- Alternative assumptions about the development of energy prices over time and the extent to which energy prices are assumed to be fixed or floating;
- alternative assumptions about economic lifespan for energy-saving measures when designing new buildings or renovating existing ones;
- a comparison between analysis using the total tool calculation method and a marginal cost method; and
- additional evaluations of socio-economic aspects.

In summary, the results of these sensitivity analyses indicate the following. Overall, it can be observed that the sensitivity analyses do not in any of the cases provide clear grounds to question the main features of in the companies' original analyses. The uncertainties that result from a shortage of time and difficulties in coming up with empirical basic data are unchanged, but the fact that the sensitivity analyses do not show any decisive effect indicates that the calculations as such may be regarded as somewhat robust.

In its original analysis, CIT carried out all its evaluations using a calculation method known as the 'total tool method' which is characterised by calculating the average benefit of a package of energy efficiency improvement measures and find out which packages of measures are beneficial in consideration of a specified required yield for the whole package. Total tool calculations have been compared with calculations assessing the benefit of each individual energy efficiency measure using a marginal cost model. CIT's sensitivity analysis indicates that there is a tendency for the total tool to indicate a larger potential for beneficial energy efficiency measures than that identified if you use the marginal method. As the same time, it can be observed that the differences in the results for new construction are differences of degree rather than of nature: in no case did the calculation using the marginal method indicate that a lower energy use than the maximum permitted level pursuant to BBR 2012 would be unbeneficial in a case where the total tool had indicated that it would be beneficial. The differences when evaluating the opportunities in existing buildings are larger, but it turned out in every case that the choice of interest in the calculation has a greater impact than the choice of whether to use the total tool or the marginal method. WSP's calculations, too, indicate that the choice of the level of interest in the calculation is highly significant.

The additional analyses that have been carried out also make it possible to assess the significance of the choice of economic lifespan on the results of the calculations. Judging from the available information, the economic lifespan is significant, but the difference of having a 30-year lifespan instead of a 40-year lifespan for technical building measures does not change the fact that there are beneficial ways to reach a level of energy use that is below the maximum permitted under BBR 2012. The life spans used by CIT in its original analysis appear to match up well to the EU standard for economic evaluations of energy systems in buildings, which can be regarded as a reasonable indication that the life spans used are also relevant in an EU perspective.

The additional analyses also very clearly confirm the pattern that was discernible in the original reports, namely that what is technically possible and economically reasonable seems to vary depending on the category of building, form of heating and location.

The additional socio-economic analysis carried out by CIT is not directly linked to the requirements for nearly zero-energy buildings under the EU's Directive *per se*, but largely to the wider issue of how the *Riksdag*'s target of a 50 % cut in energy use in buildings by 2050 can be achieved. On the other hand, the results of the analyses do indicate that there is a lot of work to be done if the target is to be achieved.

In light of the uncertainties associated with the analyses, an overall assessment was provided in the memorandum. It stated that there is, to a large extent, a lack of overarching socio-economic analyses in the basic data. This is true even if CIT's additional analyses do provide something of a clearer picture. Moreover, there are numerous uncertainties, even in the assessments of real estate economics and of the possible effects of other technical functional requirements. The overall assessment is that the uncertainty in the existing analyses means that they do not provide sufficient grounds to further tighten up the energy economy requirements.