NB: Unofficial translation, legally binding only in Finnish and Swedish

MINISTRY OF THE ENVIRONMENT **Memorandum**

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MINISTRY OF THE ENVIRONMENT DECREE ON IMPROVING THE ENERGY PERFORMANCE OF BUILDINGS UNDERGOING RENOVATION OR ALTERATION

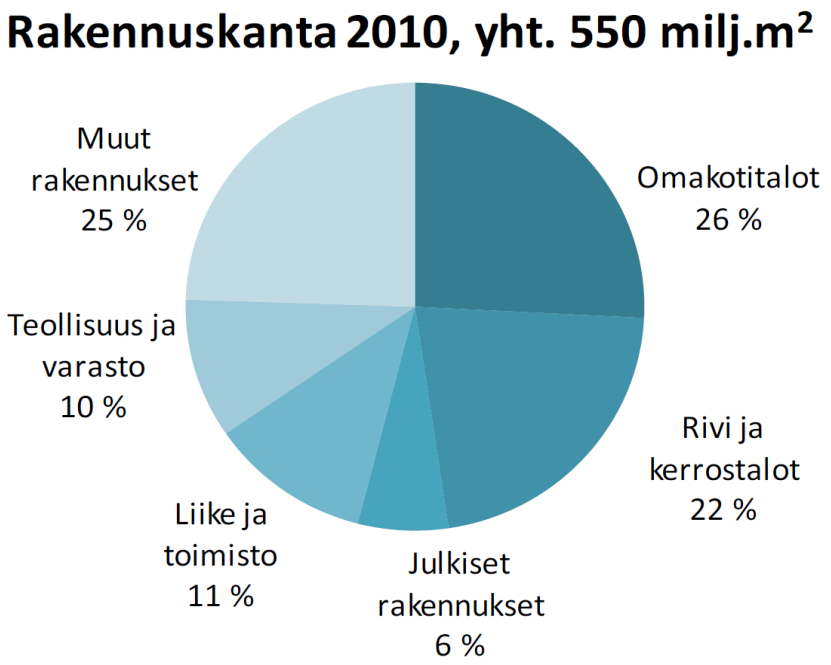
EXPLANATORY MEMORANDUM

1 General

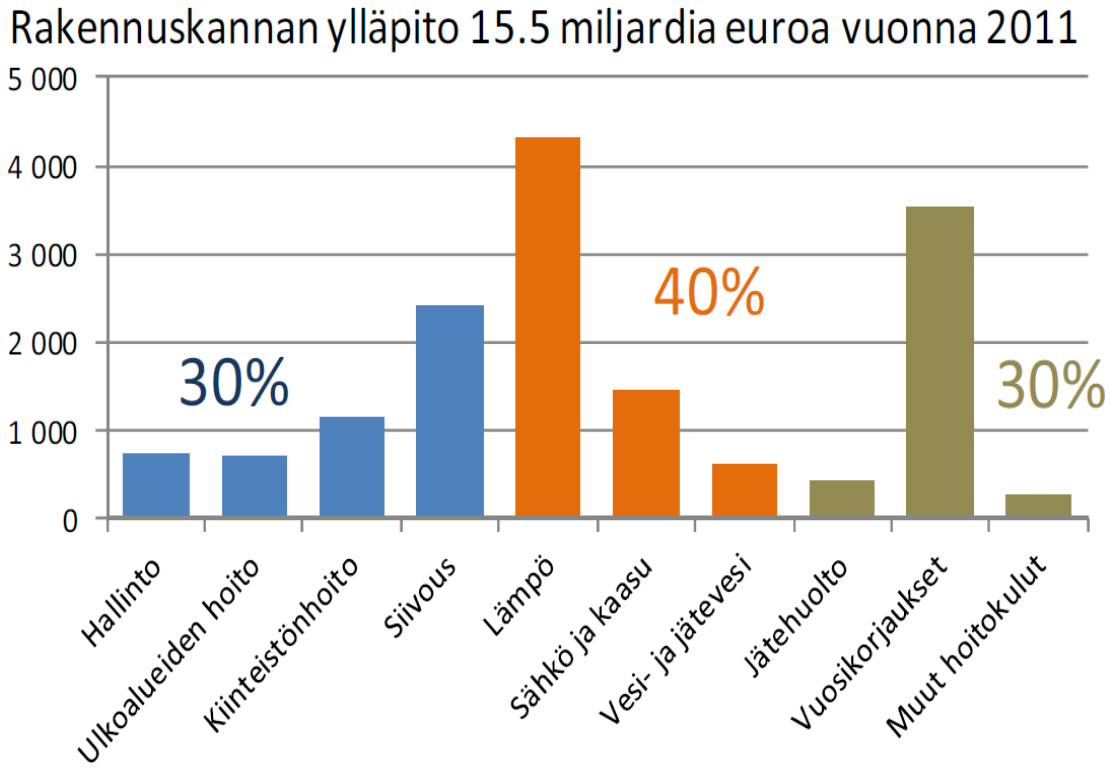
The key commitments of the European Union climate and energy policy are to reduce greenhouse gas emissions by 20%, to increase the share of renewable energy sources to 20% of final energy consumption, and, as a normative commitment, to improve energy performance by 20% by 2020. Finland must achieve a notable increase in the use of renewable energy sources and a significant improvement in both energy saving and energy consumption.

The renewable energy target set for Finland is 38%; in 2005, the share of renewable energy was 28.5%. This target requires that the use of renewables must be increased by 38 TWh.

In 2008, the strategic objective set by the Finnish Government in the national climate and energy strategy entailed halting and reversing the growth in final energy consumption so that, in 2020, final energy consumption will be approximately 310 TWh. In 2011, final consumption was 386 TWh.



Buildings account for about 40% of Finland's total energy consumption. Because buildings are designed and constructed to be durable, existing buildings affect Finnish energy consumption and emissions for decades. Half the building stock existing in 2050 will have been built before 2012.



Maintenance costs of building stock (real estate) were 15.5 billion euros in 2011. Fluctuations in energy price have a significant impact on the development of maintenance costs (Statistics Finland / real estate maintenance costs)

1.1 Objective

The objective of this Ministry of the Environment Decree on improving energy performance in connection with renovation and alteration, and of the promotion of systematic building management supporting the improvement, is to reduce energy consumption and carbon dioxide emissions of the existing buildings by approximately 25% and 45%, respectively, by 2050. Savings are gained, for example, by reducing heat losses, by adopting more efficient heat recovery systems, by more efficient use of electricity, and by increasing the use of renewable energy sources, such as ground-source heat. A more short-term objective is to reduce the energy consumption of existing buildings in the building stock by approximately 6% by 2020.

1.2 International developments and foreign and EU legislation

The obligations concerning the requirements set for existing buildings in the EU's recast Energy Performance of Buildings Directive were taken into account in the drafting of this Decree.

The directive also sets the following obligations:

Article 7, paragraph 5, lays down an obligation to encourage the consideration and taking into account of high-efficiency alternative systems when buildings undergo major renovation, in so far as this is technically, functionally and economically feasible. This obligation has been included in the national legislation and is given in conjunction with Act 958/2012 on amending the Land Use and Building Act (132/1999).

Article 8, paragraph 2, lays down an obligation to encourage implementation of intelligent metering systems whenever a building undergoes major renovation, and enables promotion, where appropriate, of the installation of active control systems that aim to save energy.

Article 9, paragraph 2, lays down an obligation to develop policies and take measures in order to stimulate the transformation of buildings that are refurbished into nearly zero-energy buildings. The Commission must be informed of these policies and measures.

Article 9, paragraph 3c, lays down an obligation to prepare national plans that include, inter alia, reports on the policies and measures for transforming the buildings that are refurbished into nearly zero-energy buildings. The national plans must also include information on financial or other measures adopted for the promotion of nearly zero-energy buildings, including details of national requirements and measures concerning the use of energy from renewable sources in new buildings and existing buildings undergoing major renovation in the context of Article 13(4) of Directive 2009/28/EC and Articles 6 and 7 of this Directive. (By 31 December 2014, Member States shall, in their building regulations and codes or by other means with equivalent effect, where appropriate, require the use of minimum levels of energy from renewable sources in new buildings and in existing buildings that are subject to major renovation. Member States shall permit those minimum levels to be fulfilled, inter alia, through district heating and cooling produced using a significant proportion of renewable energy sources.)

The purpose of the recast Energy Performance of Buildings Directive is to improve the energy performance of buildings within the EU. The increased level of ambition and technical progress in the construction industry were taken into account in recasting the directive. The regulations concerning improvement of the energy performance of buildings subject to renovation are part of national implementation of the directive.

1.2.1 Original directive on the energy performance of buildings (2002/91/EC)

Directive 2002/91/EC of the European Parliament and of the Council on the energy performance of buildings was issued on 16 December 2002. Among other things, the original directive required setting minimum energy performance requirements for new buildings and large (over 1,000 m^2) existing buildings that are subject to major renovation. The directive also required energy certificates and obligations concerning inspections to assess energy efficiency of the cooling equipment used in air-conditioning systems in buildings.

The original Energy Performance of Buildings Directive was implemented by the Act on Energy Certification of Buildings (487/2007), the Act on Inspection of Air-conditioning Systems (489/2007) concerning the energy efficiency of cooling equipment, and amendments to the Land Use and Building Act (488/2007), as well as by subordinate statutes given under the above legislation.

The minimum energy performance requirements of buildings laid down in the original directive were implemented at national level by amendments to the Land Use and Building Act (488/2007) which amended the scope of the said act and its provisions

on building maintenance. The amendments applied to both new and existing buildings.

In practice, the energy performance requirements were set at national level by reforming Sections C3, D2, D3 and D5 of the National Building Code of Finland regarding thermal insulation and energy management. These Ministry of the Environment decrees concern the construction of new buildings.

1.2.2 Recast directive on the energy performance of buildings (2010/31/EU)

The recast directive 2010/31/EU of the European Parliament and of the Council on the energy performance of buildings was issued on 19 May 2010. Compared with the original Energy Performance of Buildings Directive, the recast directive includes amended requirements for the energy performance, energy performance certificate, and inspections of heating and air-conditioning systems of new and existing buildings. The purpose of regulation is to ensure meeting the EU energy and climate policy objectives.

In Articles 6 and 7, the recast directive obliges Member States to set minimum energy performance requirements for new and existing buildings, respectively. These requirements must be set with a view to achieving cost-optimal levels, and according to Article 4, the requirements may differentiate between new and existing buildings and between different categories of buildings. On the one hand, the requirements concern major renovations and technical systems, but Article 7 also obliges the setting of minimum energy performance requirements for renovations that have a significant impact on the energy performance of the building.

Compared with the provisions on existing buildings laid down in the original directive, the 1,000-m² threshold has been eliminated from the recast directive. It has been estimated that the threshold laid down in the original Energy Performance of Buildings Directive excludes as much as 72% of the European building stock from the application of the directive. Eliminating the threshold provides huge potential for cost-effective energy savings in the existing building stock. At the same time it significantly extends the scope, as single-family houses are included within the sphere of energy performance requirements.

As a new requirement compared with the original directive, Article 8 of the recast directive lays down requirements for technical systems that oblige Member States to set minimum energy performance requirements for new, replacement and upgraded technical building systems.

Articles 7 and 8 oblige Member States to apply the requirements for energy performance and systems in so far as they are technically, economically and functionally feasible.

Member States must adopt and publish the laws, regulations and administrative provisions concerning implementation by 9 July 2012 at the latest. The provisions must be applied to buildings occupied by public authorities from 9 January 2013 at the latest and to other buildings from 9 July 2013 at the latest.

1.3 International developments

The solutions different Member States have used for implementing the recast Energy Performance of Buildings Directive in renovation construction have varied notably. A short summary of some of these solutions is presented below.

1.3.1 Sweden

In Sweden, the Energy Performance of Buildings Directive has been implemented by the act on land use and building (Plan- och bygglag, PBL SFS 2010:900), the act on building energy reports (Lag om energideklaration för byggnader, SFS 2006:985), supplementing decrees, as well as the building code and general guidelines (Boverkets byggregler 19, BFS 2011:26, BBR 19).

Under Swedish building regulations the energy management of a building is assessed as an entity. Provisions are issued on energy performance requirements for the building envelope and other building elements, but the housing developer has been provided with almost unlimited freedom of choice with regard to the implementation method. The provisions of the building code concern, for example, energy use in buildings, minimum thermal insulation level, efficient use of electricity, and installation of metering systems for monitoring the building's energy consumption.

Buildings that are excluded from the scope of the provisions include greenhouses and similar facilities whose use would become impossible due to the requirements, holiday homes whose usage is only part-time, and buildings that do not need heating or cooling for a major part of the year.

The principal starting point for buildings undergoing renovation or alteration has been that the technical building requirements are to be followed in a discreet way.

A building permit is required for a renovation or alteration work at least if the intended use of the building is changed or if the colour, material or appearance of the building's exterior walls or roof is considerably changed in an area covered by a local

detailed plan. In connection with the latest amendment, the provisions laid down in BBR 19 were amended to apply to all renovation. These requirements are applied to renovation, but the extent of the alteration, conditions of the building and the requirements of care are always taken into account.

In principle, the provisions on energy performance apply to all alteration work, regardless of the extent of the renovation. However, the requirements are applied flexibly to ensure that compliance with other technical quality requirements or the building's architectural or cultural values are not endangered. The means for saving energy can be selected freely. Alteration must not decrease the energy performance of the building, unless this can be justified by a special reason.

In addition to the provisions, other means are also used in order to promote energy performance improvement in the existing buildings subject to renovation. Authorities maintain different guidelines, such as general guidelines on altering buildings (Almänna råd om ändring av byggnad, BÄR, Boverket 2006). The Swedish Energy Agency (Energimyndigheten) organises briefing sessions and has set recommendations for extensive renovations resulting in nearly zero-energy buildings. They also provide various advisory and technical assistance services at province and municipality level. Financial incentives for energy-efficient renovation include tax deductions and subsidies for solar thermal systems.

1.3.2 Norway

In Norway, building is regulated by the act on land use and building (Lov om planlegging og byggesaksbehandling, PBL 2008:71), the decree on building materials (Forskrift om byggesak, FOR 2012:488 SAK 10), and the building code (Forskrift om tekniske krav til byggverk, FOR 2010:489 TEK 10). The latest amendments to the provisions on energy performance are from 2007 and 2010 when the standard was tightened and the assessment of overall energy need was adopted.

In principle, the provisions of the building code are applied to both new buildings and renovation, and not bound to permit requirements. However, all significant repair and alteration work is in practice subject to a permit (with no amount or value limits). Exceptions to these permit requirements are small alterations inside the building and exterior alterations that do not change the appearance of the building.

With regard to renovation, the provisions of the building code are applied only to buildings that are subject to major renovation. A renovation is considered to be major if it changes the intended use of the building or, according to the local building authorities, corresponds to new building regarding the interior, structures or technology of the building. The provisions on new buildings are applied per building

element, if the renovation includes rebuilding the entire building element by, for example, demolishing the exterior walls and existing insulation.

Protected buildings are specified by a site-specific decision-making process, and the provisions on energy performance are applied to the appropriate extent only.

Renovations improving the energy performance of buildings are promoted by financial support offered through the Norwegian State Housing Bank and Enova. The Norwegian State Housing Bank provides support for performing an energy analysis as part of a renovation project by compensating 50% of the cost, but not exceeding an amount specified separately. Additional support for acquiring expert assistance, known as a competence grant, is also available for demanding projects. The Norwegian State Housing Bank can also issue loans on reasonable terms for renovation projects aiming at improving the energy performance, environmental friendliness and accessibility of the building. Enova can compensate 50% of the costs arising from investigating the potential to build a passive house, but in any case the compensation will not exceed an amount specified separately. Moreover, Enova awards investment grants that can cover up to 40% of additional costs. The investment grants are based on energy consumption (NOK/kWh). The minimum reduction goal is 10%.

1.3.3 Denmark

In Denmark, building is regulated by the building act (Byggeloven 2010), the act on protection of buildings and urban environment (Lov om bygningsfredning og bevaring af bygninger og bymiljøer), the act and provisions on energy labelling (Love og regler om energimærkning 2011) and the building code (Bygningsreglementet 2010, BR 10).

Major renovation projects are generally subject to a permit, but no building permit or notification is required for small alterations. The latest amendment to the building act was made in 2010, after which the provisions of the building code concern all renovation projects. In essence, the requirements for new buildings are applied to the building elements that undergo renovation, but each building element must only meet the energy performance level set for new buildings if this is cost-effective. Cost-efficiency is determined by multiplying the annual savings with life cycle and dividing the result by the investment – the resulting coefficient must be higher than that specified in the requirements.

The minimum levels of energy performance are determined by equations. One equation is used for residential buildings, dormitories and similar buildings, whereas another equation is for offices, schools and institutional buildings. Moreover, two low-energy categories were included in the building code in connection with the latest

amendment. These categories mainly concern new buildings but can also be required for major renovation projects.

Exemptions from strict compliance with the provisions of the building code are granted to protected buildings and other sites worth preserving. There are approximately 9,000 protected buildings in Denmark. According to section 22 of the building act, exemptions from strict compliance with the provisions can be granted if justifiable in terms of architectural or structural issues. Single-family houses are also entitled to some exemptions from the requirements.

Advisory services and financial support are also used to promote energy performance improvement in the existing building stock. Communication and training on energy saving is provided for households. The BEAT 2002 tool has been developed for construction industry projects. The majority of financial support is through tax deductions, and some public funds are allocated for campaigning and communications. Instead of providing public support, the starting point has been that funding should be raised from markets.

1.3.4 Germany

Improvement of energy performance is based on the energy saving act (Energieeinsparungsgesetz - EnEG). EnEG 2009 focuses on thermal insulation of buildings and efficient use of technical building systems. Provisions on existing buildings are also included in the act.

The energy conserving ordinance (Energieeinsparverordnung - EnEV) applies to all sizes of buildings. A major renovation is defined as a measure in which a certain external building element is altered by more than 10%, and as all extension projects from 15 to 50 m^2. The U-values of the building elements altered in a major renovation must not exceed the minimum levels specified in the energy conserving ordinance (EnEV). Alternatively, the primary energy demand of the entire renovated building must not exceed that of the reference building by more than 40%. In other than major renovation projects, the requirements set forth in standard DIN 4108-2 are applied to the renovated building elements.

Protected buildings are subject to the provisions of another, federal act. In a new building, at least 10% of the heating energy must be from renewable sources (renewable energies heat act; Erneuerbare-Energien-Wärmegesetz - EEWärmeG). At the federal level, the act can also be applied to existing buildings in cases where the building's heating system is to be altered.

Standard DIN 4108-2 specifies the minimum requirements for thermal insulation and thermal bridges for all buildings. The provisions on thermal insulation for new buildings are stricter than those specified in the standard.

Some subsidies can be granted for technical support and advisory services depending on the residential building type. Consultation must cover the entire building, including thermal insulation, heating system, heat distribution (including domestic hot water) and renewable forms of energy.

Special subsidy is granted for investigating the potential for low-energy construction. This requires that the energy use in residential buildings and other buildings must be 50% respectively 30% lower than the applicable requirements laid down in the energy conserving ordinance (EnEV). In the future, research will be focused on zero- and energy-plus construction, for example.

In Germany, there are a number of support programmes operating on federal funding, such as “On-site Energy Consulting” for detached and semi-detached houses and other residential buildings, or promotional funds by the KfW bank, such as “Energy-efficient refurbishment” that has a number of levels of support and enables, for example, a one-off grant or low-interest loan. The support level is determined by the level of primary energy demand of the building in relation to the primary energy demand of a new building specified in the energy conservation ordinance (EnEv). The support level is indicated as a percentage value for each energy standard that specifies how much the building consumes primary energy in relation to the building specified in the energy conservation ordinance (EnEv). A maximum amount of support in euros is also specified for each energy standard.

A new energy conserving ordinance (EnEV) to implement the amendments of the Energy Performance of Buildings Directive is currently being prepared and will enter into force on 9 July 2013 at the latest. At the moment, renovation requirements laid down in either DIN 4108-2 or the 2009 energy conserving ordinance (EnEV) are complied with, depending on the extent of the renovation. In general, all building operations are subject to a building permit. An exception is granted if the intended use of the building does not change, or all renovation is carried out inside the building, or the requirements of the building plan are (still) met.

1.3.5 The Netherlands

The Netherlands' Energy Performance Standard (EPN) establishes the energy performance requirements for new buildings and major renovations. Performance levels are also specified for individual building elements. Protected buildings, such as buildings that have historical value or have an impact on the townscape, are always

subject to a building permit. For historical buildings, a permit is also required for indoor changes.

The Energy Performance Standard (EPN) is further specified by two standards of the Netherlands Standardisation Institute, NEN 5128 (for residential buildings) and NEN 2916 (for public service buildings). The Energy Performance Standard (EPN) establishes requirements for entire buildings – minimum requirements for individual building elements are laid down in the Netherlands' national building code (Bouwbesluit).

The energy efficiency level is determined by the Energy Performance Coefficient (EPC) that takes account of the energy need for space and domestic hot water heating, lighting and ventilation. The Energy Performance Coefficient is calculated using a standardised method, and the regulation level is changed by altering the coefficient. The energy performance of existing buildings is examined through use of the Energy Index and energy labelling. The index is calculated with a fixed method known as Energy Performance Advice (EPA) and a calculation software which may be used by a certified consultant.

Tailored technical support and advisory services are available for renovation projects. A certified consultant will make the necessary calculations and provide guidance on selecting and implementing repair procedures related to energy efficiency. Some support programmes require that these tailored services are used, and provide a website that helps homeowners in finding a local consultant.

Support for energy-efficiency-related repairs offers various programmes and tax benefits for homeowners who invest in procedures that reduce energy consumption. Each form of support has its special requirements concerning the amount of investment and the achieved improvement in energy performance.

“More with less” (“Meer met Minder”; MmM,) was a project (16 July 2010 to 31 December 2011) motivating homeowners to improve the energy performance of their dwellings. The amount of subsidy was based on the achieved reduction in the Energy Index. This was evaluated by a certified consultant using the Energy Performance Advice method (EPA).

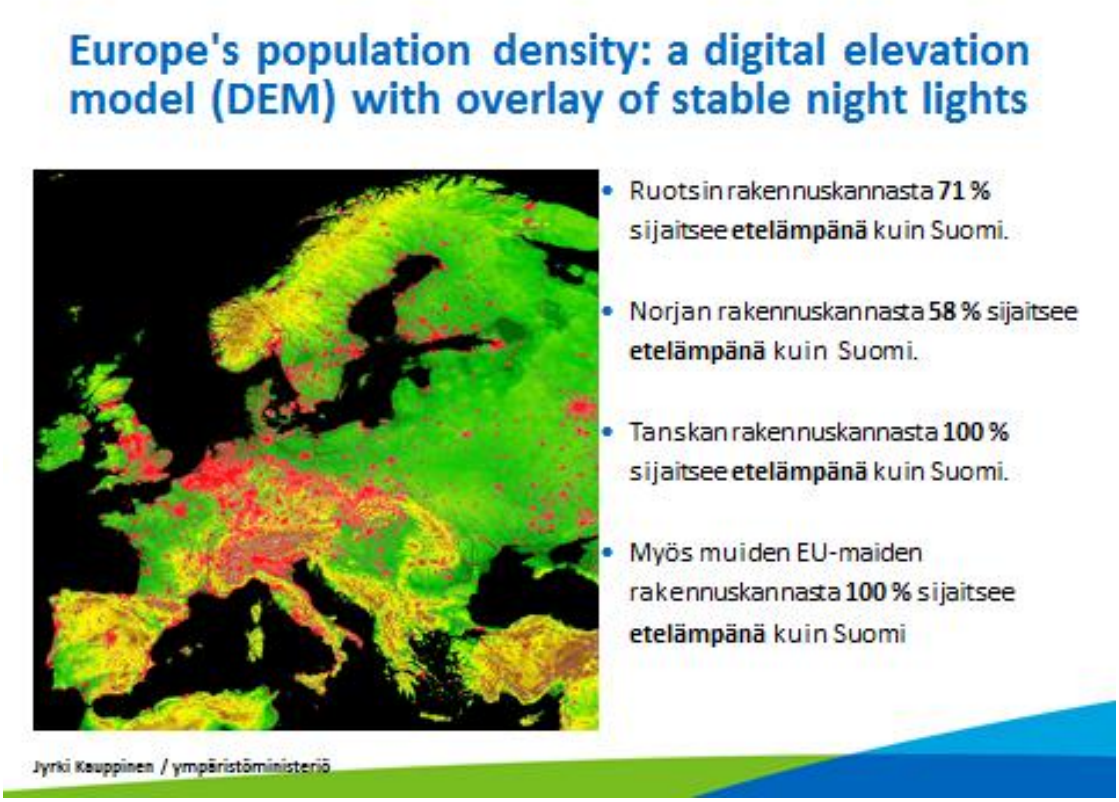
The energy performance legislation for residential and public buildings is being reformed, and the act was meant to enter into force in 2012. The decree on energy performance of buildings includes standardised procedures (NEN 7120, 15 April 2011) for evaluating the energy performance of new and existing residential and non-residential buildings. The act includes the requirements laid down in the Energy Performance of Buildings Directive (EPBD).

All procedures carried out in a protected building are subject to a building permit. Similarly, any changes to buildings that have an impact on the townscape are subject to a building permit. A precondition for a renovation permit is that the permit authority can, under the Dutch environmental management act (Wet Milieubeheer), require an energy report on the energy performance of the building and its equipment (for example, cooling equipment in the case of a commercial building). At the same time, the renovation procedures must be evaluated on the basis of the best available technologies. If the calculated payback period of the renovation is less than five years, the permit authority can require that the renovation is carried out using the best available technologies.

1.3.6 Finland

Compared with the rest of the Europe, the Finnish thermal resistance requirements for new buildings have been notably stricter for quite some time. Because the Finnish building stock is relatively young, energy performance has been taken into account when the current buildings were built. Nevertheless, buildings account for approximately 40% of final energy consumption in Finland. The majority of this energy is consumed for heating and cooling, generation and distribution of domestic hot water, and lighting.

Energy consumption is divided as follows, by building type: detached houses 27%, industrial and warehouse buildings 27%, blocks of flats 19%, commercial and office buildings 17%, public service buildings 8%, and terraced houses 6%.



The amount of energy consumed in buildings is highly influenced by Finland's northerly location, and because of this, measures aiming at decreasing the amount of energy needed for heating are usually cost-effective.

The share of the building stock taken by new buildings is small (approximately 1 to 2%), and the overall energy use in buildings cannot be reduced significantly or rapidly by setting requirements for new buildings. As the focus of construction is moving from new buildings towards renovation, the key potential for energy savings lies in the existing building stock. A major role in renovation is played by residential buildings, 70% of which are privately owned.

Scope exists for a reduction in energy use in the existing buildings. According to a report by VTT Technical Research Centre of Finland (VTT) assessing the impact of energy performance measures in renovation and maintenance of building stock in terms of energy saving, CO2e, costs and profitability ("Rakennuskannan korjaamisen ja kunnossapidon energiantehokkuustoimenpiteiden vaikuttavuuden arviointi energiansäästön, CO2 ekv päästöjen, kustannuksien ja kannattavuuden näkökulmista"), the potential for savings in the building stock, with the specified preconditions, is approximately 6% by 2020. At the macro level, a renovation carried out to achieve the thermal resistance level for new buildings is almost as cost-effective as reducing the thermal transmittance of exterior walls by half.

Energy-efficiency-related repairs are not normally cost-effective if implemented separately. The potential for cost-effective measures lies in situations where existing buildings are renovated for other reasons. Some renovations improving energy management can be carried out separately because they do not require other renovation operations in the building in question. These measures are usually carried out because the owner of the building seeks energy saving and the resulting savings in costs. The measures can be related to objectives for improving indoor climate, for example.

Alteration and renovation work in existing buildings vary because of the diversity of the building stock. The majority of renovations are carried out in stages as the building elements and systems age. The most typical targets for renovation are windows, doors, exterior walls, roofing, and water, sewage and ventilation systems. Electricity and antenna systems are also commonly renovated – either separately or in connection with a more extensive renovation project. It is likely that a large share of the buildings, especially those built in the 1960s and 1970s, will fall due for renovation in the near future.

Energy performance can be improved in connection with alteration and renovation work in a cost-effective manner by, for example, replacing windows that are in poor condition and in some cases improving thermal insulation of walls or roofs, and by improving the energy performance of technical systems when they are replaced.

Lower energy consumption can also be attained by adopting and developing control technology. Energy savings in the existing building stock can be generated by maintaining proper heating and ventilation control settings. These savings fall under maintaining the original energy performance of the building and are not actual additional savings resulting from improvement in the properties of the building.

In order to decrease energy consumption in buildings, it is important to spark the interest of the buildings' owners and users in the different possibilities of saving energy, and encourage them to take appropriate action on their own initiative to improve energy performance. In addition to voluntary measures, Finland, as a Member State of the European Union, is required to adopt national regulations concerning energy performance improvement in order to implement the binding obligations relating to climate and energy policy.

1.4 National focal points

In the Government Foresight Report on Long-term Climate and Energy Policy: Towards a Low-carbon Finland (Prime Minister's Office Publications 28/2009), one of the conclusions for Finland is: "Marked improvement of energy efficiency is necessary in all sectors irrespective of the energy sources utilised to meet the need. This requires, among other things, stricter building standards leading towards the zero energy level. Requirements also need to be set for renovations. Owing to the slow renewal rate of the building stock, the targets set for 2050 must already be taken into account when houses are built in the 2010s. More stringent efficiency standards need to be set at EU level for household appliances and other equipment."

The report (28/2009) also lists the typical characteristics of "Good steering":

- coherent and sustained: actors can prepare for the changes envisaged

- consistent: decisions will hold firm, and various measures operate in support of each other

- effective: steering brings significant benefits

- cost-effective and market-based: benefits are obtained at reasonable cost

- technology-neutral: a target is set through steering, and detailed technical solutions are left for actors to decide.

The Government Programme of Prime Minister Jyrki Katainen's Government, presents the key issues related to the subject matter as follows:

> "Energy-efficiency requirements entailing cost-efficient implementation will be laid down with regard to renovation."
>
> "The energy-efficiency of construction will be improved through decrees and other control mechanisms and by creating incentives."

In its report of 2 February 2012, the Ministry of Finance working group studying business trends in the construction industry (Rakennusalan suhdanneryhmä) states that "Improving energy performance must already be considered at the planning stage as part of other renovations. The future energy regulations for renovation must be based on systematic property management and assessment of energy-efficiency-related repairs as part of other renovations, as well as on solutions that are technically, functionally and economically justifiable."

1.5 Drafting

This Decree has been drafted by the permanent staff in the Construction group within the Department of the Built Environment at the Ministry of the Environment, in co-operation with other groups.

Preliminary ideas regarding the extent and objectives of regulation required by the Energy Performance of Buildings Directive were presented to the key stakeholders from late April 2011 onwards. As the project entity developed, a number of discussion events were organised during the drafting process. The key stakeholders included RAKLI - the Finnish Association of Building Owners and Construction Clients, the Finnish Real Estate Federation (FREF), the Finnish House Owners' Association and the Helsinki Housing Production Department (ATT). Rakennustarkastusyhdistys (RTY, Finnish building control association) compiled a report that discussed, among other things, impacts on official activities and impacts in general. This report also provided development proposals concerning the content of the requirements. A hearing session known as "Learning Cafe" was organised with the stakeholders for polling thoughts and expectations. Some fears were expressed, although these were alleviated with correct information. During the drafting process, ideas were presented to designers and planners, building supervision authorities and other representatives of stakeholders in dedicated events. We have given introductory presentations, providing contemporary data in various events held by different actors, including ELY Centres (Centres for Economic Development, Transport and the Environment), building supervision authorities, various advisory organisations, the Finnish Association of Civil Engineers (RIL), the Finnish Association of Architects (SAFA), Aalto University, the Ministry of the Environment, vocational adult education centre Amiedu, various universities of applied sciences, housing managers, etc. The key themes of the project entity have also been well covered in newspapers and magazines.

In late 2011, four support team meetings lasting about half a day were organised regarding the preparation of the content of technical requirements. In addition to the Ministry of the Environment, participation in this unofficial support team included the Public Works Department of the City of Helsinki, LVI-Tekniset Urakoitsijat LVI-TU ry (association of HPAC technical contractors in the HVAC industry), Säätölaitehuolto Oy, Pihlavan Ikkuna Oy, Sähkölämmitysfoorumi ry (association for promoting electric heating), Ensto Oy, Optiplan Oy, Dirair Oy and Fenestra Oy. These parties had participated in different events and separately shown their interest in participating in the preparation of technical matters.

The meetings clearly indicated a real need for regulations on renovation. The possibility of meeting the required performance levels when the building undergoes a

normal renovation has been regarded as a good solution. This will also promote systematic, long-term building management.

Performance levels, potential for savings and secure solutions have been investigated through studies carried out by VTT and the Tampere University of Technology (TUT). Moreover, a joint project with the building supervision authorities of the City of Oulu has been under way to seek easily replicable renovation solutions particularly for single-family houses. Some of the research projects are still continuing and the results can be used in preparing instructions in support of the regulations.

With regard to communication, special attention must be paid to the fact that the obligation to improve energy performance is not generated merely on the basis of energy use. On the other hand, a clear distinction must be made between the Energy Performance of Buildings Directive (EPBD) that is to be implemented now and the Energy Efficiency Directive (EED) that entered into force in December 2012.

Comments on the draft Decree were requested from 127 parties (Request for comments YM5/600/2012). The period for submitting comments was from 4 June 2012 to 9 July 2012. The request for comments was on public display on the website of the Ministry of the Environment; parties other than those included in the distribution list were also allowed to give their comments on the documents. The number of commentators was 80. Three of the written statements were joint statements.

Of the commentators, 62 were parties from whom a comment was requested, and 18 were parties who submitted a statement on the basis of the general request for comments published on the website of the Ministry of the Environment.

The statements included both general and detailed comments.

The draft Decree has been subjected to technical notification and submitted to the WTO for information to verify that it does not create unnecessary obstacles to trade. During the notification period (from 13 July to 15 October 2012), the Commission commented on the conformity of the draft Decree content with the requirements laid down in the directive. The comments were acknowledged and did not result in any changes. Some comments referred to the Land Use and Building Act already containing provisions on building, and these provisions will not be repeated in the decree. The Commission's comments also included a remark that the draft is not sufficiently strict principally regarding the types of buildings excluded from the scope of the Decree, i.e. the draft would not comply with the directive in this respect. These comments were mostly caused by misunderstanding because clear grounds for the kind of national interpretation applied can be found in the Energy Performance of

Buildings Directive. The comments submitted as a result of the notification procedure have not changed the content of the draft.

2 Brief summary of commented key matters

It was stated that drafting was carried out as an interactive process in an exemplary manner. This was considered positive, although this method also uses the resources of all parties more than the normal method. A small number of other kinds of views were also presented.

The content of the draft Decree was said to be logical and comprehensible. On the other hand, some proposals were made to change the order of the sections, and clarification as well as proofreading were also hoped for concerning some parts of the text. Highly detailed proposals for improving the provisions were also received.

The general view of the commentators was that improving energy performance and saving energy are important for society and individuals, and that these issues must be addressed. It was also pointed out that the existing building stock consumes a substantial share of the energy we use and therefore the impacts of the measures improving energy performance are quite significant, and that the Decree in question is an excellent and long-awaited improvement in the steering of construction.

The schedule was considered challenging in some statements, but the reason for this was also recognised. Emphasis was also placed on the importance of assessing impacts both before and after.

The high number of options was widely supported. A proposal for a totally new calculation method for renovation was made, but some also suggested leaving out some calculation methods. Calculative methods were considered both good and bad, and a desire expressed for more detailed specification in the guidelines concerning standardised use. Commentators reacted favourably to the possibility of taking voluntary measures into account in a more extensive project that would be subject to a permit and carried out at a later date. With regard to compensation, the possibility of taking account of renewable energy produced on the building site was also considered positive, although some comments suggested this should extend beyond the mere use of energy.

In general, linking the obligations of requirements to permit requirements was considered to be a proper and functional solution that reduces the need for interpretation. Additional flexibility deriving from technical, functional and economic issues was also accorded a welcome here with a view to finding the best possible

solution, in addition to previous flexibility concerning renovation. On the other hand, guidance on how technical, functional and economic issues are assessed was requested.

A risk that cities would protect a large number of buildings as jewels of their time, based on their own lists, was also brought up. Some also suggested that the Decree should not be issued at all in this form.

Separate regulations on renovation and alteration were considered to be a better solution than extending the regulations on new buildings to renovation as such. The statements included a large number of comments on expertise and resources. Many hoped for advisory material to facilitate training and to help public authorities as well as planners, designers and building owners in their work. Increasing use of experts was also considered to improve the quality of construction on a more general level. Often, renovations were said to be initiated by moisture and indoor air quality problems affecting health.

Provision of extensive communication on the availability of advisory material was also hoped for in connection with the publication of the Decree. A further request related to guidance on applying the draft Decree to urgent indoor air quality renovations and moisture damage repairs.

The impacts on renovation-related employment, increased business opportunities and improved international competitiveness were considered positive.

The decision to release buildings intended mainly for worship and religious activities was considered worthwhile, although it was also pointed out that the energy performance of churches could be improved.

Attention was paid to the fact that the properties of the building can still be taken into account, which is important for successful implementation of renovation in terms of technical properties and for the preservation of the built heritage. Attention was also paid to the aim to keep the healthy buildings healthy and to the related provisions of the Decree. Moreover, a request was made that the decree should mention all the numerous provisions under which the protected building stock exists and under which individual buildings and the built environment and incorporated buildings can also be protected in the future.

It was considered important that the existing tools related to systematic property management could also be used for assessing the possibilities for improving the energy performance of buildings and for assessing the success of completed improvements.

Support was also offered in the form of, for example, expert and communication services to facilitate communications when the project entity is implemented.

3. Observations by section on the comments to the draft of the Ministry of the Environment Decree on improving the energy performance of buildings undergoing renovation or alteration (version circulated for comments)

Observations on the comments by section

3.1 Scope of application

Interpretation of 'technically, functionally and economically feasible' was considered broad but also necessary because the regulation is new. Special attention was paid to the fact that interpreting 'economically feasible' would be difficult. The risk of increasing the number of permit requirements and the level of permit levels was also raised; for example, so that in the future a building permit would be required for issues that could previously be solved with an action permit. Increase in costs due to the permit level increase was considered possible, and was also seen as a factor which may decrease renovation activity. Increasing the resources of the authorities in terms of quantity and quality was considered necessary. Positive views were also expressed on encouraging improvement in energy performance by different means, not only in connection with work subject to a permit. Respondents requested that other protection possibilities based on legislation should also be emphasised as reasons for granting an exception. The decision to maintain the current principle of flexible application was considered worthwhile. However, it was noted that interpretations can vary substantially among municipalities and thereby cause inequality between citizens. On the other hand, some comments pointed to this kind of renovation regulation reducing the possibility of widely different project interpretation. The possibility of small building supervision units providing interpretation, steering and advisory services was considered problematic. More detailed specification was requested concerning 'technically, functionally and economically feasible', one reason being that even if preconditions were met, these would not necessarily be cost-effective or reasonable in terms of allocation of funds.

3.2 Planning improvement of the energy performance of buildings

The availability of experts and their expertise in understanding the impacts of different renovation options were considered a potential risk factor. The availability of consultancy services was considered to be a risk in some comments. The possibility of taking auxiliary energy into account when the properties of the building are improved was requested. Positive views were expressed on the subsection stating that energy

use can increase if the properties of the building are improved, even though energy performance of the building improves, or at least remains at the previous level. An alternative option based on actual consumption was proposed in addition to the option based on calculated use.

3.3 Calculation principles

Some statements commented on the proposed dimensioning method for the calculated maximum energy need concerning ground-source heating systems. Attention was also paid to the fact that this kind of requirement was not laid down for other heating systems. The possibility of taking hybrid systems and cost optimisation into account was considered important. The removal of this provision was proposed, but there were also comments stating it to be a proper provision, and one that should present a proof of dimensioning and of implementation of dimensioning for maximum energy need. Specifying the calculation rules in more detail was considered important. There was also a wish for the text of the section in question to be more specific, for example, to include the basis on which the gain from renewable energy is divided between the buildings that participate in generating this energy. It was also proposed that renewable energy produced on the building site could be fully counted as a gain regardless of whether or not it is used in the building. A wish for more detailed instructions for cost-efficiency was expressed.

3.4 Options for improving energy performance

The comparison of alternative methods and the decision-making based on the comparison was seen to require a professional and comprehensive understanding of the properties of the building. Also, emphasising the different nature of the overall energy use assessment compared with that for new buildings was considered important in order to avoid misunderstandings. In some statements attention was paid to the fact that the objective is to reduce energy use but, for example, electricity consumption or waste heat generated by electric appliances as the main heating system was not taken into account. Some commented that it is necessary to clarify the assessment regarding renovation by building element and system. Harmonisation of terminology with the requirements for new buildings was requested where this differed. It was proposed that windows should be subject to a g-value requirement, and that the definition of energy use should be more specific. It was also requested that E-value and U-value requirements should be tightened, and, for some buildings, relaxed. It was stated that one of the options is always useful depending on the extent of the renovation. A proposal for leaving out the option based on the energy use in building was also made. Clarification was requested on the difference between a ventilation system and an air-conditioning system. The impacts of passive structures and technical building systems on the indoor climate were considered good. Specification of the scope of obligations was requested. It was also proposed that the

requirement for the annual efficiency of heat recovery of the ventilation system should be lower. The meaning of improving air tightness was considered and it was also hoped that its impacts would be highlighted. A proposal was also made for launching an F-value whose calculation would not include, for example, replacing district heating or cooling with a ground-source system, or converting electric heating to ground-source heating. A mention of thermal mass was wanted in connection with massive structures.

3.5 Planning energy performance of a building as a combined effect of multiple renovations

It was found that the use of competent designers and the design obligations in general will incur costs regardless of the permit type. Carrying out systematic building management was considered a good way of improving energy performance and of taking account of partial renovations, even to the extent where focus would be on long-term maintenance and service. Attention was also paid to the possibility of using energy audit and home assessment as tools for planning energy performance improvement.

3.6 Voluntary measures for improving energy performance

It was proposed that, for example, replacing electric radiators with modern versions could be taken into account in the option based on energy use; taking account of savings gained through adding a metering system was also requested. The calculation method based on standardised use prompted criticism for not taking into account the reduction in energy use that would potentially result from renewal of equipment.

3.7 Building envelope and technical systems

The obligation to ensure structural physical behaviour, as well as the provision on ensuring the quality of indoor climate, were considered especially good points. The availability of designers and their level of expertise was noted. Some comments also considered the sufficiency of building supervision authorities' resources.

3.8 Ventilation

A clearer status for wall exhaust systems designed to extract exhaust air was hoped for, because interpretations by the building supervision authorities vary considerably among municipalities and ventilation implemented by apartment-specific systems equipped with heat recovery is considered a cost-effective option. It was proposed that the concept ‘ilmanvaihto’ (ventilation) should be replaced with the concept ‘sisäilmasto’ (indoor climate) because the latter would include both exchange and purity of air. A proposal for including an obligation to prevent a situation in which the

quality of indoor climate deteriorates was also presented. It was also mentioned that the section steers towards mechanical ventilation.

3.9 Control of technical systems

A wish was expressed for the possibility of phasing renovations and the obligation to adopt control of technical systems, based on the idea that costs could be then distributed over a longer period of time. It was found that the obligation will incur costs. It was also proposed that presenting a plan on making the necessary settings to the building supervision authority during the final inspection would be sufficient. A question was presented on the required level that must be reached with the settings.

3.10 Demonstrating improvement in energy performance

Detailed instructions for interpreting ‘economically feasible’ were hoped to facilitate authorities' work when receiving assessments. A specification was also requested making clear whether assessments were intended for actual or standardised use. Assessment of the overall impact of the measures improving energy performance carried out now and in the future was considered important, although consideration of the energy use of appliances was requested as part of the properties of the building. There was a request for emphasis on the significance of supervision and quality assurance during the implementation stage.

3.11 Entry into force

The time of entry into force for buildings occupied by the public authorities was considered problematic from the viewpoint of lessors.

4 Key proposals

The objective of this Decree is to impose requirements for improving energy performance of buildings during renovation and to provide three alternative options for demonstrating the improvement. The selection is made by the owner of the property/building. Preconditions are also laid down for planning and demonstrating the energy performance improvement.

The Decree provides the owner of the building with three options for determining and also demonstrating the level of energy performance improvement.

- The first option is to improve the thermal resistance of building elements so that they comply with the required values.

- The second option is to comply with the requirement for the appropriate building type. The requirement is a value indicated as kWh/m^2/year. The balance limit is the energy use in the building, calculated for standardised use. Calculation instructions for new buildings can be applied for the calculation.

- The third option is to calculate the building's specific overall energy use as an E-value and reduce the energy use by the required amount. This will be calculated for standardised use. Calculation tools and instructions for new buildings can be applied.

- The requirements for technical systems would be followed, regardless of the options selected, when the systems are updated, renovated or completely replaced with new ones.

The majority of the building stock was built in the 1960s and 1970s. Typical external wall structures of that era (for example, concrete sandwich structure) are now clearly past their technical service life and require renovation.

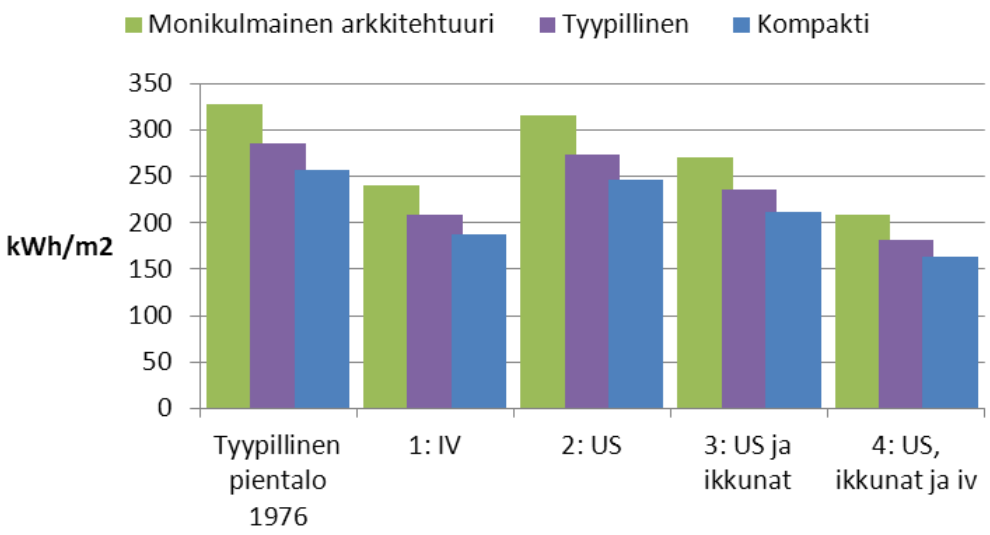
The appropriate solution for structures is to reduce thermal transmittance by at least half the original level, while in most cases insulation to the level of new buildings is fully feasible and often also cost-effective. When assessing reinsulation it is obviously essential to check that the properties of the structure are correct in terms of building physics.

With regard to floors, it would be unreasonable to impose requirements other than the current objective of improving thermal resistance where possible.

For window renovations the most cost-effective solution is window replacement to achieve at least the level for new buildings. Often, windows that exceed the requirements for new buildings are more cost-efficient. Another advantage of windows with good thermal transmittance is that they reduce the solar radiation entering the building and thus prevent overheating in summer. A window with low g-value helps to reduce overheating in summer.

The architecture of the building also has a major impact on energy use. Because of the variety of the existing building stock and of the heating systems used in the buildings, a number of different options are required to enable cost-effective improvement in energy performance in connection with renovation and alteration of buildings and building elements. This is to prevent situations in which the requirements may become unreasonable. Buildings with numerous corners and big windows typically consume more energy than buildings with more compact architecture. Absolute differences between the highest and lowest energy use values are greater in old buildings (approximately 50 to 60 kWh/m^2) than in newer buildings (approximately 25 to 30

kWh/m^2). Regardless of the year of construction, the relative difference is approximately 18 to 20%.



A typical single-family house, built in accordance with the 1976 building code.
1: Adoption of mechanical ventilation (SFP: 2 and heat recovery 75%),
2: U-value of external walls from 0.4 to 0.2.
3: External walls and replacement of windows, U from 2.1 to 1.
4: External walls, windows and ventilation

The required performance level can be achieved through a combination of measures.

The energy use requirement for blocks of flats laid down in the Decree proposal corresponds approximately with blocks of flats constructed in the late 1990s and the early 2000s, depending on their geometry. For example, a block of flats from the 1970s can be renovated to comply with the requirement by adding an efficient heat recovery system to the ventilation system, upgrading the windows to the level required for new buildings, and halving the U-values of the exterior walls.

Depending on the building and the option selected, the required level can be achieved, for example, without adding insulation to the building envelope.

The E-value requirement is compared with the building itself. This means that the building's E-value is first calculated on the basis of the original solutions, and must then be reduced by the required percentage. The E-value approach emphasises energy-efficient use of electricity and makes it possible, for example, to benefit from the increased use of renewable energy in the assessment.

A typical way of meeting the E-value requirement in a single-family house is, for example, by replacing the windows (if they are at the end of their service life), update

the ventilation with an efficient heat recovery system while retaining the existing heating system.

In the case of blocks of flats (from the 1970s), the E-value requirement can typically be met by adding a heat recovery system to the ventilation system and upgrading the windows (at the end of their service life) to the level required for new buildings. Changes in the heating system are rare because blocks of flats are normally connected to a district heating system.

In office buildings, the E-value requirement is typically met by improving ventilation heat recovery and the control of lighting and ventilation (demand-controlled lighting and ventilation). If the windows are at the end of their service life it is also sensible to upgrade them at least to the level required for new buildings. In connection with this, it is possible to reduce overheating in summer by adopting solutions related to window glass coatings and window shading. If the office building uses oil or electric heating, the E-value requirement can usually be met by replacement of the current heating system with district, ground-source or wood-pellet heating.

In projects subject to a permit from authorities, compliance with the requirements would be supervised by the building supervision authority. The supervision of renovation projects that are not subject to a permit would fall under the property owner's responsibility and be within the owner's own interest only.

The requirements for specific building elements contribute, for example, to the exclusion during window replacement of windows that fail to meet the national requirements. In Finland, CE marking has been voluntary, but will be mandatory from 1 July 2013. Windows that do not meet Finnish national requirements may bear a CE marking affixed in another Member State; however, merely invoking the CE marking would not mean such windows could be installed on buildings in Finland. The same risk concerns certain other construction products. This issue is emphasised in increasingly problematic small “grandma's cottage” type buildings, and there is a great risk that unsuitable products would be marketed specifically to private citizens unfamiliar with such issues. The risk of malpractice is always present, but legal safeguards are stronger in case of dispute when able to refer to the national requirements that must be met by the product to be installed.

When compared with the reference countries, the fundamental idea of the draft Decree is closest to the new Swedish building code, with the restriction that the drafted Finnish requirement levels are conservative. The German requirement system has similar division in which the requirement levels are different for new and existing buildings.

However, Finland is significantly further north than Sweden; 71% of Sweden's building stock is located further south than Finland. The corresponding figure for

Norway is 58%. Other reference countries are entirely located in areas whose climate is clearly milder than that of in Finland.

This statute is issued under the Land Use and Building Act, and proposed for issue as a Ministry of the Environment Decree and then to be compiled to form a section of norm collection. The compilation will also include parts of the explanatory memorandum to facilitate interpretations. On grounds of the general jurisdiction of the Ministry of the Environment, it is also possible to prepare explanations, and by following these explanations it would be possible to meet the requirements laid down in the Decree. In terms of usability, the result would correspond quite well with the traditional building code.

In the recast Energy Performance of Buildings Directive (2010/31/EU) 'energy performance of a building' means the calculated or measured amount of energy needed to meet the energy demand associated with a typical use of the building, which includes, inter alia, energy used for heating, cooling, ventilation, hot water and lighting. When the properties of the building that comply with intended use are improved, energy use may increase even if the energy performance of the building is improved. The energy performance of a building is a relative concept consisting of the energy use and properties of the building.

Preventing overheating in summer is also a matter that should be taken especially into account in renovation. Overheating can also be reduced efficiently by passive means, such as by selecting new windows with a low g-value.

4.1 Authorisation to issue

The Land Use and Building Act (132/1999) contains provisions on the construction of buildings and
the authorisation to issue is provided in section 117 g of the Land Use and Building Act.

4.2 Effectiveness and requirements

The Finnish building stock has a significant potential for energy savings. Studies indicate that currently buildings are renovated when they are clearly past their technical service life.

According to studies, the energy savings gained among the entire building stock is approximately 6% by 2020 if the structures of a building at the end of its service life are renovated so that the level achieved is about 50% higher than the original level.

The provisions only obligate the carrying out of such improvements that are technically, functionally and economically feasible. Cost-efficiency is included as an additional parameter, and assessed from the viewpoint of economic profitability, such as payback periods.

Estimates on effectiveness vary because the building stock is heterogeneous and because it is impossible to forecast the order of renovations and the types of buildings undergoing the renovations at each stage of their life cycle. The frequency of renovations also varies – some buildings are renovated proactively and some too late from the viewpoint of systematic building management.

Some measures, such as ventilation-related renovations, are difficult to forecast because the decision is made by the owner of the building. For example, the owner of a block of flats is represented by a meeting of shareholders, and the owner of a single-family house is represented by the owner or owners of the building.

Measures improving the energy performance of a building will also improve the quality of living conditions and reduce the upward pressure on operating costs. Improving the energy performance also impacts on the preservation of buildings, because a building survives best when it has reasonable and also economically viable use. Studies also show that a building survives and retains its value best on this basis.

5 Detailed rationale

Section 1 – Scope of application

"This Decree applies to buildings in which energy is used for lighting, for heating of spaces and ventilation or for cooling to maintain the appropriate indoor climate conditions and that are subject to renovation or alteration for which a building or action permit is required under the Land Use and Building Act (132/1999) or whose intended use is changed.

The buildings and the categories of buildings specified in section 117 g(2) of the Land Use and Building Act to which the obligation to improve energy performance does not apply are:

1) *buildings to the extent to which they are protected, and where observing the provisions would change the protected parts in a way that cannot be considered acceptable;*

2) *industrial buildings in which the amount of thermal energy generated by the production process is so high that no or only a minor amount of other heating energy is required to achieve the desired room temperature, or industrial buildings in which a high amount of thermal insulation would cause a harmful increase in the room temperature outside the heating season or essentially increase the energy use for cooling;*

3) *buildings with a maximum area of 50 m²;*

4) *non-residential agricultural buildings with a low energy use;*

5) *greenhouses, emergency shelters or other buildings, whose use for their original intended use would become unreasonably difficult if the requirements on the improvement of energy performance laid down in this Decree were applied ;*

6) *holiday homes for which no heating system intended for year-round use has been planned;*

7) *movable buildings, intended to remain in the same location for a limited time, whose intended use is not essentially changed in connection with relocation;*

8) *buildings that are intended for worship and religious activities."*

The provisions would apply to reparations of buildings for which a permit is required under the Land Use and Building Act, where the energy performance could be improved in connection with the reparation in so far as this is technically, functionally and economically feasible.

Technically feasible means a solution that is planned and implemented in such a way that the essential technical requirements, such as properties related to moisture, fire safety, noise and indoor climate, are not impaired.
Functionally feasible means a solution that will not result in a substantial impairment of the intended use of the building or building unit when compared with the original solution.

Economically feasible means a solution that can be implemented in a cost-effective manner. The grounds given for the Land Use and Building Act specify that, as applicable, the factors used for the economic assessment are the same as those used for the calculation of cost-optimal levels for general assessment of national energy performance requirements; the assessment period is 30 years for residential buildings

and 20 years for other buildings, if the normal life cycle of the assessed building element, system or part thereof is not shorter.

The scope of application in accordance with the Land Use and Building Act is provided in the Decree to facilitate practical application. With regard to renovation and alteration of officially protected buildings, this Decree would be applied to the extent to which the changes resulting from the application can be considered acceptable. Buildings that are mainly intended for worship and religious activities would be released.

The obligation to assess cost-efficiency would apply only to situations in which the party engaging in the building project wants an exception to the requirements laid down in the Decree on the basis of the cost-efficiency assessment.

The starting point for official building supervision is supervision that is in proportion to the supervision need of the building project in question. A building permit is always required when constructing a new building. Minor building projects, such as those related to structures or a piece of equipment, are usually subject to an action permit, and in some cases notification procedure may be sufficient. The interpretation of permit requirements varies by municipality because the practical application of the provisions is largely based on the broad discretionary power of the building permit authorities.

The supervision of the land use and building legislation is largely based on advance supervision implemented through the permit procedure. The permit procedure brings the administrative means of obtaining legal relief within the scope of the building project.

Typical industrial buildings specified in paragraph 2 include process industry facilities, such as steel and paper mills; a smaller building, however, can also be an industrial building.

With regard to improvement of energy performance, for example, reinsulation carried out in connection with renovation of gable end walls is a significant improvement in the overall building performance in buildings of a certain age, even if the gable end area is not large when compared with the entire building envelope area, and even if the renovation would be carried out as a separate measure. This reasoning also applies to replacing windows in stages. Replacing a single window or a few small windows, such as typical bathroom windows, does not usually have a significant effect on the overall performance of the building. Studies indicate that selecting a normal window that at least meets the requirements is also a good solution in these cases, and is usually the least expensive option.

The basic principle of the Land Use and Building Act concerning renovation has long been that even if a single measure does not have a significant impact on the building as a whole, the current situation must not be impaired.

Section 2 Planning the energy performance improvement

"The Ministry of the Environment Decree on the Energy Performance of Buildings ("Ympäristöministeriön asetus rakennusten energiatehokkuudesta", National Building Code of Finland 2/11) is applied to the energy calculation related to renovation or alteration work or a change in the intended use of a building, the selection of calculation tool and the presentation of results.

If the intended use of the building is not changed, the calculation of room temperature in summer may be omitted if it can be otherwise ensured that the building properties are not impaired as a result of the renovation or alteration.

The party engaging in the renovation or alteration project must, in connection with the planning required for the appropriate permit, present the measures intended to improve the energy performance of the building by building element, system or for the entire building in accordance with the extent of the project and the selected option.

If the properties that comply with the intended use of the building are improved, the energy use in the building may increase by an amount calculated from the improvement of the properties."

This section applies to a situation in which the party engaging in the building project selects the calculation option. There would not be a general calculation requirement if requirements for specific building elements were followed.

This section contains the obligation to apply the Ministry of the Environment Decree 2/11 for energy calculation, the selection of calculation tool and the presentation of results. This would enable the use of the same calculation parties as for new buildings thus eliminating the need for extensive new instructions or software for calculation. The maximum energy use levels for new buildings specified by building category would not be applied to renovation. Renovation would be regulated by the requirements to be applied in connection with the planning of renovation, laid down in sections 4 to 7.

If the intended use of the building were not to be changed, the calculation of room temperature in summer could be omitted, regardless of the selected option, if it could

be otherwise demonstrated that conditions would not change. In this respect, there would be no requirement to improve the conditions. Overheating in summer can be efficiently reduced in connection with window renovation by, for example, paying attention to the issue when selecting the new windows or by other passive means.

If the overall assessment option is selected instead of the option to improve the building elements to the required level, calculation would be based on standardised use of the building. Standardised use means established use of a building. The actual use of a building often differs from the standardised use because of the activities of the various occupants. Standardised use is required so that all calculations can be based on the same input parameters related to the use of the building (amounts of air, limit values for heating and cooling, electric appliances, lighting, people, operating time, utilisation rate and ventilation operating time). Building properties can thus be steered by regulations, and occupant-specific behaviour does not affect calculation. According to some studies, the impact of differences in occupant behaviour can be 10 to 20%. If standardised use is considered to represent the average level, the difference between the two extremes can be 20 to 40%. In addition to the improvement of the building properties in connection with renovation, there is also a need for guidance and advisory services.

This section would also enable the improvement of the building's properties even if the absolute energy use would increase. The most typical example of this kind of situation can take place in connection with the adoption of mechanical ventilation in buildings that have district heating, for example, and whose ventilation has been insufficient for some reason. Adopting a balanced ventilation system will increase the electricity consumption, but reduce the need for heating and, in most cases, also improve the indoor climate. In this case, energy performance of the building is improved in relation to its properties. This subject was studied, for example, in the EEmontti project in connection with old detached houses subject to renovation. The objective of the project was to cut heating costs in half. In the case of a building with direct electrical heating and an extract ventilation system, significant energy savings were gained and the indoor climate also improved notably when a balanced ventilation system with a heat pump and heat recovery system was adopted and the electric radiators were replaced with modern versions. In this kind of case, energy use is reduced and the indoor climate usually improved, but in a building that has had no functional ventilation the absolute energy use can increase.

Normally, when carrying out measures subject to a permit, a precondition for the issuing of such a permit would be the provision of special plans. Instructions on calculation methods are annexed to this explanatory memorandum.

Section 3 Calculation principles

"If measures that improve the energy performance of a building and concern building elements or technical systems are, fully or partially, omitted, this can be compensated by performing other planned measures so that the required level is exceeded.

Renewable energy produced on the building site can be counted as a gain in relation to the use and to the extent the energy is used in the buildings participating in the energy production, provided that the energy is jointly produced and used by several buildings located close to each other.

The main heating system of the building must be dimensioned at least to the calculated maximum heating load. It is not necessary to include the share of domestic hot water in the heating load.

Adopting passive means to prevent overheating in summer can be counted as a gain when the improvement of the energy performance of the building is planned."

This section would provide a possibility for compensation so that the calculated overall energy use requirement for the building would be met even if an individual building element does not meet the requirements. This means that the thermal resistance level of some other building element should be higher than required.

This would also enable the utilisation of renewable energy that is produced jointly by several buildings. However, this would only apply to buildings and building groups that are in close proximity to each other, but this would not be applied, for example, to buying back energy sold to commercial actors. The gain could be utilised only to the extent that the energy could be used in the building, and the energy should be jointly produced.

The main heating system should be dimensioned at least to the calculated maximum heating load, without the share of domestic hot water. The energy needed for domestic hot water should be taken into account when assessing the total heating energy, but domestic hot water could be produced by utilising some other energy carrier than that used for heating the building. The purpose of this provision is to enable the implementation of so-called hybrid solutions when such a system would be more cost-efficient than producing all heating energy from only one energy carrier.
Subsection 3 specifies that the main heating system of the building should be dimensioned at least to the calculated maximum heating load of the building. It would not be necessary to include the share of domestic hot water in the heating load.

For example, if the main heating system of a building was to be replaced with a ground-source heating system and both the dimensioning and planning would be done

in accordance with this section, condensing heat would not be counted as a factor decreasing the heating need. However, this could be included to some extent in commercial buildings and other special buildings that have equipment generating a substantial amount of heat or in which a substantial amount of condensing heat is generated by refrigeration systems. It would be reasonable to dimension the ground loop on the maximum heating load because further construction afterwards would usually be difficult, and incur costs. The space required by the heat pumps would also be dimensioned for the maximum heat load, but the heat pump that provides space heating (provided that the pump is installed in a system specified above) could be dimensioned just to the additional heating load, and the condensing heat from the system could also be taken into account in dimensioning. This would ensure more reasonable updating costs of the main heating system in case the intended use of the building is changed later during its life cycle.

Subsection 3 would not apply to a situation in which the building has a fully functional heating system that is dimensioned to the calculated maximum heating load, but the owner of the building wants to produce part of the heating energy by utilising and increasing the amount of renewable energy produced on the building site.

Subsection 4 also enables passive means for reducing overheating to be taken into account in the calculated assessment in renovation. This section also makes it possible to take passive means into account in calculation when assessing the energy performance of the existing building stock. This would ensure that the available passive means are utilised, while these means are also promoted by highlighting them.

Section 4 Requirements for specific building elements

"If the improvement of the energy performance of a building is planned and implemented according to building element, the following requirements must be observed:

1) *External walls: The original U-value x 0.5, but not higher than 0.17 W/(m2 K). If the intended use of the building is changed: the original U-value x 0.5, but not higher than 0.60 W/(m2 K), or better.*

2) *Roofs: The original U-value x 0.5, but not higher than 0.09 W/(m2 K). If the intended use of the building is changed: the original U-value x 0.5, but not higher than 0.60 W/(m2 K), or better.*

3) *Floors: The energy performance is improved as far as possible.*

4) *The U-value of new windows and external doors must be 1.0 W/(m2 K) or better. If old windows and external doors are repaired, the thermal resistance must be improved where possible."*

This section sets forth the requirements for thermal transmittance specific to building elements, and these requirements are applied if the first option in section 8 is selected.

The performance levels were studied in co-operation with VTT, and the assignment included preconditions specifying the ability to meet the requirements by using normal, known technology and solutions so that the costs incurred would be reasonable, i.e. cost-optimal, when the entire building stock is considered from the macroeconomic perspective. For example, adding insulation up to a certain thickness does not cause a higher risk than a thinner insulation, provided that planning and implementation are carried out properly. But if planning and/or implementation is carried out in a careless manner, the result is practically the same regardless of the amount of insulation. The reinsulation requirements are conservative.

With regard to windows and doors, the U-value is the same as the U-value specified for new buildings in the current building code. In the case of replacement of normal doors or windows, the requirements enable the use of mass-produced products that are usually the least expensive option due to the high production numbers.

If the windows are repaired, achieving the original or better level would be sufficient, but there would not be actual obligation to improve.

Studies indicate that when the building envelope is renovated, special attention should be paid to the protection from weather and elements, and to its proper implementation regardless of, for example, the amount of insulation.

Section 5 Requirements for technical systems

"*If the technical systems of a building are updated, replaced or otherwise renovated, the following requirements must be observed;*

1) *The quantity of heat that must be recovered from the extract air of the building's ventilation system must correspond to at least 45% of the quantity of heat required for the heating of ventilation, i.e. the minimum annual efficiency of heat recovery must be at least 45%.*

2) *The maximum specific fan power of a balanced ventilation system is 2.0 kW/(m³/s).*

3) *The maximum specific fan power of a mechanical extract ventilation system is 1.0 kW/(m³/s).*

4) *The maximum specific fan power of an air conditioning system is 2.5 kW/(m³/s).*

5) *The efficiency of heating systems must be improved where possible when the related equipment and systems are renovated.*

6) *The provisions on new buildings apply to the renovation of water and/or sewage systems."*

This section sets forth the requirements for technical systems of a building when the systems are renovated, updated or completely replaced.

After consideration, the performance requirements for technical systems were set to the same level as for new buildings. The reasons are largely the same as in the case of windows and doors – a mass-produced product is usually the least expensive option. Exceptions to these performance levels can be granted if sufficient reasons are shown.

For example, if the ventilation installation equipment is replaced, the requirements for the equipment should be met, but achieving the required performance level for the entire existing system would not be necessary if only the equipment is replaced. If the entire system is renovated or a new system is built, the required level should usually be met. An exception to this rule could be, for example, an old building in which the lack of space sometimes makes it impossible to meet the system requirements in terms of ducts.

Section 6 Energy use requirements by building category

"*If the planning and implementation of the improvement of energy performance of a building is carried out by reducing the energy use based on standardised use of the building, the following energy use requirements specified by building category must be observed:*

1) *Single-family houses and terraced and other attached houses ≤ 180 kWh/m^2*

2) *Blocks of flats ≤ 130 kWh/m^2*

3) *Office buildings ≤ 145 kWh/m^2*

4) *Educational buildings ≤ 150 kWh/m^2*

5) *Day-care centres ≤ 150 kWh/m^2*

6) *Commercial buildings ≤ 180 kWh/m^2*

7) *Hotel buildings ≤ 180 kWh/m^2*

8) *Sports halls other than ice rinks and swimming pools ≤ 170 kWh/m^2*

9) *Hospitals ≤ 370 kWh/m^2*

This section defines the maximum energy use values by building category if the second option in section 8 is selected. The unit is kWh/m^2, and the period one year. Brief instructions on calculation are annexed to this explanatory memorandum. The calculation principles are mainly the same as for new buildings.

Energy use means the total amount of energy consumed in a building for heating, appliances and cooling during one year; this consumption does not include energy production loss of energy produced inside or outside the building from various energy carriers.

The performance levels were studied in co-operation with VTT, and the assignment included preconditions specifying the ability to meet the requirements by using normal, known technology and solutions so that the costs incurred would be reasonable, i.e. cost-optimal, when the entire building stock is considered from the macroeconomic perspective. Project-specific exceptions to these performance levels may be granted.

Studies indicate that when the building envelope is renovated, special attention should be paid to the protection from weather and elements, and to its proper implementation regardless of, for example, the amount of insulation.

Section 7 E-value requirement by building category

"If the planning and implementation of the improvement of energy performance of a building is carried out by reducing the overall energy use based on standardised use of the building (E-value, kWh/m²), the specific energy use of the building by building category must be calculated in accordance with the following equations:

1) *Single-family houses and terraced and other attached houses: E required ≤ 0.8 x E calculated*

2) *Blocks of flats: E required ≤ 0.85 x E calculated*

3) *Office buildings: E required ≤ 0.7 x E calculated*

4) *Educational buildings: E required ≤ 0.8 x E calculated*

5) *Day-care centres: E required ≤ 0.8 x E calculated*

6) *Commercial buildings: E required ≤ 0.7 x E calculated*

7) *Hotel buildings: E required ≤ 0.7 x E calculated*

8) *Sports halls other than ice rinks and swimming pools: E required ≤ 0.8 x E calculated*

9) *Hospitals: E required ≤ 0.8 x E calculated"*

This section presents the definition principles of the requirements according to building category for reducing the overall energy use in a building if the third option in section 8 is selected. The unit is E-value, kWh/m^2, and the period one year. This option allows the possibility of taking the increase of the use of renewable energy into account. The calculation is carried out by applying the E-value calculation model for new buildings which entered into force on 1 July 2012. The calculation also includes the energy carrier factor, if this option is selected.

Brief instructions on calculation are annexed to this explanatory memorandum. However, the calculation principles are mainly the same as for new buildings. During the drafting process, the assessment was carried out so that the E-value was calculated by using the solutions applied in the construction year of the building for buildings whose intended use has not changed, while for buildings whose intended use has changed, the calculation was carried out by using the solutions applied during the last change in the intended use.

The performance levels were studied in co-operation with VTT, and the assignment included preconditions specifying the ability to meet the requirements by using normal, known technology and solutions so that the costs incurred would be reasonable, i.e. cost-optimal, when the entire building stock is considered from the macroeconomic perspective. Project-specific exceptions to these performance levels may be granted.

Studies indicate that when the building envelope is renovated, special attention should be paid to the protection from weather and elements, and to its proper implementation regardless of, for example, the amount of insulation.

Section 8 Options for improving the energy performance

"A party engaging in a building project subject to a permit must select one of the following options for improving energy performance of the building elements or of the building:

1) *with regard to the renovated, updated and new building elements, the building meets the requirements for specific building elements laid down in section 4;*

2) *the energy use in the building meets the requirements laid down in section 6;*

3) *the overall energy use in the building meets the requirements laid down in section 7.*

If the technical systems of the building are updated, replaced or otherwise renovated, the requirements laid down in section 5 are applied regardless of the selected option on a building element or building referred to in subsection 1."

This section would oblige the party engaging in the building project to select one of the alternative methods for improving the energy performance in connection with renovation:

- The first option would be to improve the thermal resistance of building elements so that they comply with the specified reference values. The reference values are specified in section 4 of the Decree proposal.

- The second option would be to comply with the energy use requirement for the appropriate building type. The requirement is a value indicated as kWh/m^2/year. The balance limit is the energy use of the building. Calculation instructions for new buildings can be applied for the calculation. Calculation is based on standardised use and net heated area, which is the sum total of heated storey areas including the inside areas of their external walls. The net heated area can also be calculated from the gross heated area less the areas occupied by external walls. The requirements set for the energy use in a building by building category are specified in section 6 of the Decree proposal.

- The third option would be to calculate the specific overall energy use in the building as an E-value and reduce the use by the required amount. Calculation tools and instructions for new buildings can be applied for the calculation. The balance limit is the overall energy use in the building. Calculation is based on standardised use. The

requirements set for the overall energy use in a building by building category are specified in section 7 of the Decree proposal. The energy carrier factors are issued separately by government decree, and are the same as for new buildings.

- If the technical systems are updated, replaced or otherwise renovated, the values specified in section 5 should be followed whichever of options 1 to 3 is selected.

Sections 4 to 7 of the Decree proposal specify the requirements that should be met with the selected methods.

Massive external walls

Because timber buildings with a wall thickness of 180 mm meet the wall requirements for new buildings, normally there will be no obligation to add insulation to the walls. In the case of a thinner wall structure, the U-value can be compensated with other renovations, if this is deemed reasonable in a case-specific assessment. Normally, timber walls are not subject to such renovation measures that would create an obligation to improve energy performance. This also applies to massive brick wall structures in buildings whose original intended use is not changed. If the intended use is changed so that the requirements to be applied become stricter, the walls should also be taken into account in order to ensure that, for example, the living and usage conditions will be healthy. Reinsulating the walls referred to above should, however, be allowed if the owner of the property so wishes and it is not be prevented by the plan or other provisions. In this method, the owner of the property would have the possibility of selecting among different measures.

Ventilation systems

With regard to ventilation systems, the efficiency is improved if the new equipment meets the requirements set for new buildings when the ventilation unit is replaced. New ventilation systems should be planned and implemented to comply with the ventilation requirements for new buildings. Old buildings do not necessarily have sufficient space for installations, such as for ducts that meet the requirements for new buildings, so this could be a reason to accept a system-specific efficiency value that is lower than required for new buildings, if the situation is properly demonstrated to the authorities. With regard to replacing the ventilation unit, this is usually not a problem.

Plumbing renovations

The basis would also be the same for plumbing renovations. Factors affecting energy savings include, for example, correct dimensioning and implementation of the water distribution system, adjustment of water system pressures and water equipment flow rates, property-specific water pressure reducing valve (if required), adjustment of domestic hot water temperature, design flow of the domestic hot water circulation pipe, thermal insulation of the domestic hot water system, apartment-specific water metering and billing, hydraulic integrity of the water system and detectability of leaks, maintenance of toilet equipment and other water equipment, monitoring and analysis of water consumption, and regular communication with residents.

Water meters can also be used for monitoring the hydraulic integrity of the water system, and submeters make locating a leak easier than with just the information of a property meter. These offer a vast number of benefits, and both water and energy is saved. Energy is saved in two ways. Firstly, processing and transporting cold water in the piping system consumes energy, and secondly, heating of domestic hot water consumes even more energy. This saving is more visible in the heating bill than in the water bill if water is heated, for example, by using district heating, or is in any case heated by using the same energy carrier as that used for heating the building in the cold season.

As wastewater is discharged from the building, the heat contained in wastewater and generated in the building by a certain item of equipment is also discharged. Wastewater heat recovery technology is developing further, and will also become cost-effective on a larger scale in the future. It must also be possible to utilise this technology in the existing building in such a way that the recovered heat can be considered in the building's energy balance calculation.

Air-tightness of a building

Improving the air-tightness of the building is a way to improve its energy performance. It will also reduce draughts and improve living comfort. If possible, the air leakage rate should be measured before installing the surface material, for example, after installing the air barrier but before installing the wall coating. By improving the air tightness, the energy use in the building can be reduced by several percentage points when compared with previous, similar use. Saving is generated through improved operation of the ventilation system and also from the reduced heating need. The improvement of air tightness can be demonstrated with a measurement carried out both before and after the renovation. The achieved improvement is part of the overall energy performance improvement. Here, it must be ensured that the amount of make-up air is sufficient and that the whole ventilation system operates properly.

Highly energy-efficient windows

The issue of condensation forming on the outside of windows with high insulation properties under certain weather conditions, at certain times of day and during certain seasons is a common issue that frequently arises when discussing highly energy-efficient windows. There are a number of means that can be used to prevent this effect completely or at least reduce it significantly, and this is an issue that it is advisable to mention in the planning documents if the selected window is prone to condensation under certain conditions. The different means of reducing the effect can be chosen when selecting the windows. It would be possible to select windows that exceed the requirements in order, for example, to compensate other measures. The same means that can be used to reduce condensation can be used to reduce overheating in summer. Passive means that work for both issues include, for example, shade-providing vegetation, overhangs and coatings. If the windows are replaced, selecting windows with a low g-value is also a viable passive means.

Components of technical systems

The efficiency requirements for boilers are given in Section D7 of the National Building Code of Finland ("Kattiloiden hyötysuhdevaatimukset").

The Commission Regulation on circulators (641/2009) entered into force on 1 January 2013.

The Commission Regulation on fans (327/2011) entered into force on 1 January 2013.

The Commission Regulation (EU) on electric mains-operated air conditioners with a rated capacity of ≤ 12 kW for cooling, or heating if the product has no cooling function, and comfort fans with an electric fan power input ≤ 125 W has also been issued (206/2012).

Section 9 Improving energy performance as a combined effect of multiple renovations

"If a party engaging in the building project has selected the option referred to in Section 8(1), paragraph 2 or 3, a plan must be prepared on improving energy performance of the building as a combined effect of multiple renovations. The plan must be submitted to the building supervision authorities in connection with the permit application. The planned measures can be implemented in stages in several separate renovation projects. The plan can be amended at later stages as necessary.

The party engaging in the building project must demonstrate the total impact of the measures improving energy performance in connection with the planning of the reparations improving energy performance as a combined effect.

A separate assessment of the total impact is not required if the requirements for specific building elements laid down in section 4 and the requirements for technical systems laid down in section 5 are explicitly followed in the building project, or if the impact of energy performance improvement carried out in connection with a renovation subject to a permit on the energy performance of the building is low or negligible.

If the owner of the building improves the energy performance of the building in connection with a planned service, renovation or maintenance procedure that is not subject to a permit, the impact of such measures can be taken into account in connection with a permit application for a project to be carried out later."

This section specifies how to proceed if the overall assessment referred to in section 8, paragraph 2 or 3, is selected.

The purpose of this section would be to enable advance assessment of the total impact of renovations that will take place in stages. It would also promote systematic, long-term building management. The key principle for assessing compliance with the section would be the feasibility of the measures to be implemented. The purpose would not be to enable neglecting the measures by, for example, resorting to a new heating system that uses renewable energy and that will possibly be installed later on. The necessary amendments mentioned in subsection 1 refer to changes to the means of carrying out the energy performance improvement related to the renovation stage in question. The purpose of this section would not be to enable postponing the obligation but to enable compliance with the obligation by some means other than that originally planned.

The section also describes how to demonstrate the energy performance improvement by an overall plan or by demonstrating that the U-values of building elements are improved or the requirements for systems are observed.

The plan could be part of tools used for systematic building management. Applicable documents could include, for example, use and maintenance instructions or a maintenance plan that is based on, for example, home assessment and which could also include an energy audit or condition survey report.

The maintenance plan could provide initial data for a renovation programme. A long-term renovation programme could be also used for planning the measures for

improving or maintaining energy performance, to be performed in various stages in connection with renovations. An annual renovation programme could be used for describing the parts of the renovation programme that are to be performed annually.

Also other tools related to systematic building management could be utilised, provided that their information content is sufficient. The plan could also be a separate plan, or part of other special plans required for the permit.

In addition, the plan could also consist of applicable parts of an energy report that complies with the Ministry of the Environment Decree 2/11 concerning the energy performance of new buildings ("Rakennusten energiatehokkuus, Määräykset ja ohjeet 2012").

This section would make it possible to take minor documented energy performance measures into account in the overall plan, if such measures are carried out later at a particular renovation stage.

This would be used to promote energy performance improvement in connection with renovations that can improve energy performance and for which a permit is not required under the Land Use and Building Act; for example, installation of solar panels is not always subject to a permit. The party engaging in the building project should demonstrate the impact of the measures on the calculated energy performance improvement based on standardised use of the building.

The total impact of several minor improvements can be as high as that of one major improvement. The purpose would be to emphasise the long-term benefits for the property owner to be gained from supervising his/her own interest. The party engaging in the building project should demonstrate the impact of the measures on the calculated energy use based on standardised use of the building, if the party wants to utilise the performed measures in connection with a permit procedure.

Sufficient documentation of the measures should be presented when the impact of the measures is demonstrated. Sufficient documentation could be included, for example, in the use and maintenance instructions.

Section 10 Building envelope and technical systems

"In connection with measures improving the energy performance of the building envelope, the party engaging in the building project must ensure that the building envelope and the joints between all windows or external doors and the surrounding structures are sealed so that the thermal insulation layers are protected from the detrimental effects of air flow on the thermal insulation properties.

When planning or implementing a renovation or replacement project concerning the building envelope or technical systems, the measures must be selected so that thermal, noise, moisture and fire safety performance of the structures is ensured."

This section would set forth requirements on issues that should be taken into account during planning and implementation. The requirements would relate to the structural physical behaviour of structures and to the consideration of noise insulation and fire safety issues.

The reinsulation work phase performed in connection with a minor or major renovation of the building envelope is very demanding in terms of both moisture performance and the protection from weather and elements during the work. If the protection from weather and elements is planned and implemented carefully, and also properly supervised, it can be ensured that moisture entering the structures does not undermine the designed structural physical behaviour of the completed structure. Proper protection from weather and elements is equally important in minor renovations of the building envelope, such as when roofing, windows, sidings or coatings are replaced, if the water protection properties of the exterior wall are temporarily impaired due to, for example, removal of rendering or boarding.

Moreover, insulation should be selected so that the overall properties related to noise and fire safety are not impaired in any way. The sound insulation and fire properties of different insulation materials and products differ from each other, and it is essential that this issue is already taken into account at the initial stages of planning.

Section 11 Ventilation

"The Ministry of the Environment Decree on the indoor climate and ventilation of buildings (National Building Code of Finland 1/11) is applied to the planning of the ventilation system.

When calculating the energy use or overall energy use in residential buildings, the minimum ventilation rate to be used in the calculation is 0.5 1/h, if the designed rate is not higher. In the calculations for other than residential buildings, the ventilation rate specified for new buildings must be used, if the designed rate is not higher.

In the plans concerning the measures improving energy performance of the building, the party engaging in the building project must, where appropriate, demonstrate how the correct operation of the ventilation system and the sufficient supply of supply air

are ensured, if the building is equipped with a mechanical exhaust air system or natural ventilation system.

If the energy performance of the building is improved by adopting apartment-specific, balanced ventilation systems equipped with heat recovery, the systems must be planned and implemented so that air supply or exhaust at an external wall does not cause adverse health effects in other apartments. Otherwise, the provisions laid down in section 10 of this Decree are applied."

This section would contain the obligation to demonstrate that the new ventilation system to be installed will not decrease the energy performance of the building both in terms of overall performance and in relation to the building properties. The minimum ventilation rate to be used for planning is specified, and the section presents an obligation to take ventilation into account in the calculated overall assessment, if the measures improving the energy performance are assessed in accordance with options 2 or 3 referred to in section 8. The purpose would be to ensure that an inoperative ventilation system would not provide any benefit in the calculation over a building equipped with a functional ventilation system.

The section also contains the obligation to ensure the correct operation of the ventilation system and the sufficient provision of supply air already at the planning stage if the measure in question could impair the operation of the ventilation system or the provision of supply air. Requirements would also be set for planning and implementation of retrofitted apartment-specific ventilation systems equipped with heat recovery.

Promoting the adoption of such systems requires that functional and easily replicable solutions for wall exhaust systems are found.

Section 12 Ensuring the operation of technical systems

"*The party engaging in the building project must ensure, in a verifiable manner, the correct and energy-efficient operation of the heating and ventilation system and perform the necessary measures to balance and adjust the technical building systems in connection with reinsulation or improvement of air tightness concerning the building envelope or a significant part thereof, or in connection with replacement of windows or improvement of their energy performance, or after performing measures that improve ventilation.*

The proof of the measures performed must be presented to the building supervision authority during the final inspection of the work subject to a permit."

This section would contain the obligation to make the basic adjustments of technical systems and ensure the correct operation of the heating system in connection with reinsulation, improvement of air tightness, replacement or improvement of windows or doors and improvement of ventilation. If the systems were not serviced and adjusted in connection with the above procedures, the risk of ventilating the heat savings out of the building would be highly probable. This requirement would also be used to ensure that the indoor climate conditions would remain at the original level at minimum.

The importance of documentation for ensuring regular maintenance should be taken into account in connection with the basic system adjustments and service. Documentation could be implemented by, for example, logging the performed measures to the use and maintenance instructions of the building, or by preparing a separate document that would be attached to the use and maintenance instructions. The essential objective would be that the information remains in the building's maintenance history even if the housing manager and/or maintenance company or, in the case of a single-family house, the owner, changes.

In the case of work subject to a permit, the proof of the measures performed would be presented to the building supervision authority. The building supervision authority would be permitted to archive the proof as an annex to the final inspection report.

Section 13 Demonstrating the improvement in energy performance

"The improvement in energy performance of windows, external doors and building envelope can be demonstrated with thermal transmittance that complies with, or is lower than, that specified in section 4. The improvement in energy performance of technical systems can be demonstrated by an implementation that complies with, or is more efficient than, the requirements laid down in section 5.

The plan concerning the total impact of the alteration measures is used to demonstrate that the entity of measures improving the energy performance performed in connection with alterations and renovations improves the energy performance of the building based on standardised use so that it complies, at minimum, with the performance requirements laid down in section 6 or 7.

If the party engaging in the building project wants that some previously performed voluntary measures that comply with the provisions laid down in section 9 and that improve the energy performance of the building based on standardised use are considered as a gain, the party must submit the necessary proof of measures taken to the building supervision authority in connection with the permit application."

This section specifies how the implementation of the measures improving the energy performance carried out in connection with renovations is demonstrated. It also describes how the building owner should proceed if he/she wants to utilise any voluntary measures that comply with the provisions laid down in section 9.

Section 14 Entry into force

"This Decree enters into force on 1 June 2013. However, it shall be applied to buildings other than those occupied by the public authorities only from 1 September 2013."

This section would specify when the Decree enters into force. The Decree would be applied to the buildings occupied by public authorities from the date of entry into force, and for other buildings only from 1 September 2013. The variation would be used to emphasise the idea of leading by example with the buildings occupied by public authorities. This idea is suggested to Member States by the Energy Performance of Buildings Directive (2010/31/EU), and the directive is partially implemented by this Decree.

The Decree would be applied to projects for which a permit is required under the Land Use and Building Act and whose application has become pending after this Decree is applied. This means that with regard to the buildings occupied by public authorities, this Decree would be applied to projects whose application becomes pending on 1 June 2013 or later, and with regard to all buildings, to projects whose application becomes pending on 1 September 2013 or later.

In this context, 'buildings occupied by public authorities' would mean buildings that are mainly intended to be occupied by institutions that have administrative functions pursuant to statutes.

6 Economic impact of the Decree proposal

The same information related to impact assessment has also been used for assessing the impacts of the proposal for amendment to the Land Use and Building Act to the extent the amendment has provided the authorisation to issue a decree on the energy performance improvements subject to renovation and described potential impacts of

the decree. Some assessments are such that they are only used in this explanatory memorandum, although they are partly based on the same material and assessments.

Impact on households

The objective is that the improvement of energy performance performed in connection with renovation would be cost-effective. Usually, it is justified to schedule the measures for improving energy performance to be carried out in connection with renovation work to be performed due to other reasons. The measures are thus also economically viable. The majority of the Finnish building stock is used by households. In Finland, the number of residential buildings is approximately 1,246,000, and the number of buildings used for some purpose other than habitation is approximately 214,000. The improvement of the energy performance of a building can result in savings in energy costs in the long run, and can also have a positive effect on the building's market value in areas with a well-functioning housing market. The costs vary by project. From the viewpoint of property owners, renovation projects that are usually cost-effective could include, for example, insulation of roof, new energy-efficient windows and improvement of the air-tightness of walls, if these are carried out in connection with some other renovation, and changing the heating system when the previous system is at the end of its service life.

Studies (by VTT, among others) on, for example, normal single-family houses (140 m^2) indicate the following approximate renovation costs: reinsulation of roof from above (attic) without structural changes: 2,000 euros; reinsulation of external walls from the outside: 7,000 euros; reinsulation of ventilated floor from below: 9,000 euros; and replacement of windows with triple-glazed windows: 11,000 euros. The above costs include labour costs. The additional cost of updating a mechanical extract ventilation system to a balanced ventilation system is approximately 3,500 euros. The total cost of updating a mechanical extract ventilation system to a balanced ventilation system ranges from 4,000 to 6,000 euros, of which the equipment investment (ventilation unit and supply air ducts) accounts for approximately 2,900 to 3,000 euros and the labour costs for 2,000 to 2,500 euros. In general, the total cost of adopting a ground-source heating system is approximately 10,000 to 25,000 euros on average in a normal building, depending on whether the building already has a water-based distribution system or not. The equipment investment and labour costs account for 6,000 to 15,000 euros and 4,000 to 10,000 euros, respectively. Investments are balanced by savings in energy costs, which will reduce housing costs once the investment is repaid. Design-related costs account for approximately 4% of all construction costs. Planning related to the improvement of energy performance is part of these design-related costs, but improving energy performance does not increase design costs if the energy performance of the building is improved in connection with other renovations. The design costs of technical building systems account for approximately 1.5% of the total construction costs of a new building and slightly more

in renovation projects, depending on the type and extent of the project. The studies also suggest that the impact of the required additional investment in the design and supervision on the overall quality of the project's implementation would also be positive in other respects.

A major impact on the permit costs is connected to whether the measure improving energy performance of the building is subject to a building permit or action permit under the Land Use and Building Act. Because the measures that improve the energy performance of the building would be cost-efficiently scheduled to be performed in connection with renovation projects subject to a permit, the renovation would incur permit costs even if no energy performance measures were carried out. Below are some examples of permit costs related to replacement of windows and doors in a large, relatively large and median municipality, calculated for a 150-m^2 detached house and a 1,500-m^2 block of flats. The window area used for the calculation is 15% of the reference building's area. In the case of a block of flats in a large municipality, the permit fees for windows and doors would be as follows: building permit 1,543 euros, action permit 1,053 euros and notification procedure 318.50 euros. In a relatively large municipality, a building permit would cost 600 euros, action permit 270 euros and notification 80 euros. The median costs for a building permit, action permit and notification are 431, 116 and 65 euros, respectively. In the case of a detached house in a large municipality, the permit fees for replacing the windows and doors would be as follows: building permit 1,543 euros, action permit 220 euros and notification procedure 176.75 euros. In a relatively large municipality, a building permit would cost 195 euros, action permit 120 euros and notification 80 euros. The median costs for a building permit, action permit and notification are 147.50, 116 and 65 euros, respectively. In the long run, these fees may increase because the municipalities use the building-related fees for funding the operation of their building control departments. The permit type has impacts on the costs.

Impact on businesses

The new energy performance obligations related to renovation will concern renovation of buildings that are owned by companies. The obligations will increase the investment costs of renovations depending on the extent and type of the project. The obligations related to renovation increase the value of renovation and the required amount of project-specific planning. The obligations increase the demand for construction products and systems that have an impact on energy performance. Renovation has a positive impact on employment. For example, engineering offices and construction companies that specialise in energy-efficient renovations will benefit from new business opportunities as the amount and quality of renovation projects develops further. The legislation submitted as a government proposal enables the development of expertise and products related to the increasing energy-efficient renovation operations by increasing the demand for energy-efficient construction

products. This may also promote the companies' competitiveness in the European market.

Impact on public finances

One of the questions presented in the impact assessment related to the drafting of the building code (2011) was: “Does the proposal have an impact on the financing of public corporations or on the allocation of resources?” Rakennustarkastusyhdistys (RTY, Finnish building control association) commented: “More resources should be targeted at municipal building control – the resulting increase in expenditure could be covered by permit fees and increases thereof.”

It is expected that the more central role of energy performance aspects will increase the workload of municipal building control. If the municipalities cannot target more resources at their building control, it is anticipated that the times for processing permit applications will become longer. Taking the energy performance aspects into account will increase the need for training of building control staff. In addition, the proposal will increase the amount of guidance-related tasks undertaken by building control. It is difficult the estimate the amount of additional costs. The new energy performance obligations related to renovation will concern renovation of buildings that are owned by the state. The same obligations will also concern renovation of municipality-owned buildings in connection with other renovations in order to improve energy performance. The obligations will increase the investment costs of renovations depending on the extent and type of the project.

Impact on the costs of individual projects

According to a survey by VTT, economic impacts on individual projects vary greatly depending on the prevailing market situation and geographical location. The renovation requirements are based on the key idea that the structure/equipment is renovated when it is at the end of its service life or when the structure/equipment must be replaced or renovated due to, for example, change in the intended use. This is why the cost impacts of energy performance improvements are mainly relatively small, if they are carried out in connection with other projects.

TUT has studied, using the EKOREM model, how the energy performance of the Finnish residential, commercial and public building stock can be improved (Heljo 2005). According to the study, economically profitable renovation measures include the following, listed by building element:

- *Ventilation*

Energy saving by itself is not a viable reason to change a natural or mechanical

extract ventilation to a balanced ventilation system. If one wants to make such a renovation in order to, for example, improve the indoor air quality, it would be of benefit to
select a heat recovery technology that is more efficient than the basic option. (TUT)

- *Roof*
Roof reinsulation is a common renovation work in old buildings, but insulation thicknesses can still be increased. Reinsulation of ridged-roof buildings can be an independent measure.
Reinsulation of unvented attics can in practice be made in connection with roofing renovation projects. (TUT)

- *External walls*
It would be worthwhile reinsulating external walls if cladding is to be replaced in any case. The costs of external wall reinsulation increase if other building elements must be renovated due to reinsulation. (TUT)

- *Windows*
When replacing old windows at the end of their service life, it is worth selecting new windows with as good a U-value as possible. (TUT)

- *Apartment-specific water metering*
Adopting apartment-specific water metering and billing decreases consumption permanently by approximately 20%. The decrease can be even higher for some time after the apartment-specific metering is started. (TUT)

- *Lowering the indoor temperature*
Lowering the indoor temperature is an inexpensive and easy measure. Continuous monitoring and control makes it permanent. (TUT)

- *Demand-controlled ventilation and lighting*
Adopting demand-controlled ventilation and lighting systems are the most important saving measures in public service buildings. (TUT)

- *Changing the heating system*
It is beneficial to replace oil heating with a ground-source heat pump. (TUT)

Estimates on the marginal costs of energy performance measures carried out in connection with renovations vary from 0 to 25% depending on the source. These estimates are not directly comparable with the increase in costs because they are calculated for the entire building stock. The costs can be very small in an individual

project, but there are also buildings whose renovation in order to comply with the required level would incur very high costs. In average buildings, the costs are reasonable compared with the benefits obtained, and their payback period is shorter than the life cycle of the renovation. Of the total renovation cost, the share of the cost related to the energy performance improvement is only the cost incurred by the improvement compared to the original level because the renovation would have been carried out in any case.

Renovation measures that do not normally incur real additional costs even if energy performance is improved in connection with them include, for example, replacement of windows and doors and replacement of an existing ventilation unit if the measure would be carried out in any case.

An example of the other extreme is adoption of ventilation in connection with, for example, plumbing or exterior wall renovation. Estimating the cost impact of this type of renovation is also difficult. The main factor affecting the estimation is what share of the new ventilation installation is considered as an improvement of energy performance. On the other hand, the regulations do not contain an obligation to improve the quality level so that, for example, a ventilation system must be installed. Hence, this will be a case of increasing the level by a basic improvement. Because the requirements for ventilation also apply to a situation in which the ventilation system would be installed or an existing ventilation system would be improved in any case, the additional cost incurred by the requirements would not be very high and its payback period would be reasonable.

Below are listed some estimated renovation costs by building, collected from a number of sources:

Exterior walls

Reinsulation in connection with external wall surface renovation in terraced houses and blocks of flats (Virta & Pylsy 2011)

- total cost €120 to €190 per m^2 of net floor area, marginal costs 10 to 20%
- total cost €90 to €140 per m^2 of gross floor area, marginal costs 10 to 20%

Insulated rendering over old structure (KIMU)

- total cost €130 per m^2 of external wall area, marginal costs 20%
- total cost €80 per m^2 of gross floor area, marginal costs 20%

Reinsulation in connection with external wall surface renovation in blocks of flats (Aho, Matilainen & Hekkanen 2012)

- total cost €175 per m^2 of external wall area, marginal costs 25%
- total cost €105 per m^2 of gross floor area, marginal costs 25%

The total cost include materials, labour, project and site costs, and taxes.

Replacement of windows

Replacement of windows (Virta & Pylsy 2011)
* total cost €60 to €90 per m^2 of net floor area
* total cost €35 to €55 per m^2 of gross floor area

Replacement of windows (KIMU)
* total cost €80 to €100 per m^2 of net floor area
* total cost €60 to €75 per m^2 of gross floor

Replacement of windows (Aho, Matilainen & Hekkanen 2012)
* total cost €380 per m^2 of window area, marginal costs 20%
* total cost €55 per m^2 of gross floor area, marginal costs 20%

Pressure reduction and water-saving water equipment

Based on answers to interview questions
* total cost €7 to €12 per m^2 of net floor area
* total cost €5 to €10 per m^2 of gross floor area

Ventilation heat recovery

Ventilation renovation (Virta & Pylsy 2011)
* total cost €100 to €250 per m^2 of net floor area
* total cost €75 to €190 per m^2 of gross floor area

Ventilation renovation (KIMU)
* total cost €165 to €220 per m^2 of net floor area
* total cost €125 to €165 per m^2 of gross floor area

Ventilation renovation (Aho, Matilainen & Hekkanen 2012). The marginal cost is the cost difference between a basic solution and a system that is equipped with the most efficient heat recovery system possible.
* total cost €165 per m^2 of net floor area, marginal costs 25%
* total cost €125 per m^2 of gross floor area, marginal costs 25%

Investing in energy performance reduces the operating costs and reduces the increase in housing costs. Throughout the 2000s, the price of energy to consumers has continued to follow a clear upward trend, and this is why paying attention to energy performance in building design and construction is also economically reasonable. Moreover, studies indicate that if energy performance is taken into account in planning, the overall quality of construction is improved.

Renovation can also be promoted by adopting financial incentives, which are especially effective for activating residential buildings. For example, it is likely that a grant for replacing the heating system with a more energy-efficient and greener system encourages many to take action, at least when the old system is at the end of its service life. The best end result is achieved if financial incentives can influence the making of renovations so that they exceed the required levels.

The survey by VTT estimates the impact of heating energy savings as follows:

With regard to blocks of flats, a 40% saving in heating costs means a 13% reduction in the maintenance fee. A similar saving in a detached house means a 19% reduction in the operating costs. This helps in reducing the ever-increasing housing costs.

In schools and buildings for institutional care, a 40% decrease in energy use means a decrease of 7 to 8% in the operating costs.

The regulations can make the competitive environment in the real estate business more versatile. Some customer companies (tenants) are willing to pay a higher rent for energy-efficient properties because of the benefits of a positive corporate image.

In commercial properties, operating costs are increased by cleaning and electricity, among others. With regard to offices and
commercial buildings, a 40% saving in heating energy produces a decrease of only 6 to 7% in the operating costs.

This section of VTT's study does not estimate the total savings in a situation where energy use is reduced by updating the ventilation and electrical systems, such as lighting.

According to TUT's study on renovation-related energy savings potential in the building stock (“Energiansäästömahdollisuudet rakennuskannan korjaustoiminnassa”, EPAT), the efficiency of energy-saving measures can be affected by recommending or ordering the use of, for example, more energy-efficient windows, thicker additional insulation or a more efficient ventilation heat recovery system than the standard solution in connection with renovations.

This study also shows that emissions can be reduced, especially in detached houses, by switching to heating systems that use renewable energy. These changes will probably cut the greenhouse gas emissions of the building stock more than energy-saving measures in buildings. However, both are necessary to reach the emission reduction targets.

In addition to requirements, efficient guidance and communication is needed for housing construction actors, housing companies and private owners of detached houses, as well as training for planners, designers and professionals in the real estate business. In addition to the energy performance properties of different solutions, the long-term performance aspects of the whole system should be emphasised.

4.3 Environmental impact

The energy used in buildings and in construction account for over 40% of final energy consumption and for almost 40% of greenhouse gas emissions. Because the renewal rate of the building stock is slow and because the focus of construction is moving towards renovation, the regulations on the energy performance of buildings are essential for energy performance. Good energy performance has a positive effect on the sufficiency of natural resources. The energy performance of buildings is improved and emissions are reduced. Construction products used in renovation increase the use of materials. However, calculations indicate that emissions during the lifetime of a building are significantly higher than the emissions caused by materials production, and hence the use of additional material is justifiable. Renovation generates waste and emissions regardless of whether the energy performance of the building is then improved or not.

Regulations enhance the owners' awareness of the energy consumption of buildings and steer their decisions and selections. If they also activate the owners to indoor air quality renovations, the quality of living is improved. If carried out professionally, many energy renovations reduce draughts and thus improve the quality of living per se. Bad planning and careless implementation can backfire in the form of, for example, indoor air quality problems regardless of whether the energy performance of the building was then improved or not.

The related objectives of the regulations are to reduce the use of fossil fuels, reduce greenhouse gas emissions and increase the use of renewable energy, such as wood. The regulations are applied to both major and smaller renovations that can be used to influence the energy performance of buildings. Renovations can help in reducing energy use, and emissions can be reduced up to 10% through changing the heating systems by 2020. If the major renovations are implemented, emissions from heating would decrease by 500 MMT CO2e over the next 10 years, if the emissions from the production of construction products required for renovations are ignored. Target-oriented building management and use can generate as high an impact as renovations. Because more construction products are used in renovations, the amount of production and emissions will increase either in Finland (domestic products) or in the countries where imported products are manufactured. Renovation operations increase the need for construction product transport and also increase the amount of waste. The amount of waste is also increased if, instead of renovation, buildings in poor condition are

demolished and replaced by building new ones. This option will also increase the production of construction products and related environmental impacts. The regulations are applied to existing buildings. Building envelope renovations can be utilised as a tool for improving the townscape.

7 Comments

The draft Decree has been circulated for comments from 4 June to 9 July 2012.

8 Revision

The Decree proposal has been revised by the Unit of Legislative Inspection, Law Drafting Department of the Ministry of Justice.