**Consultation Document**

**13/02/18**

# Proposal for amendment to the Technical Building Works Regulations (TEK17) regarding energy supply requirements for buildings exceeding 1,000 $m^2$

**Glossary**

- **Direct acting electricity** covers heating equipment such as panel heaters, heating cables, electrical heating units in ventilation systems, electric boilers etc. Direct acting electricity does not cover electricity supplied to heat pump systems. There is no distinction made between electricity supplied from the power grid or produced at the building/property.
- **Energy carrier** is a mechanism or a material that stores energy for distribution. Examples of energy carriers are electricity, fuel oil and district heating.
- **Energy efficiency** is the increased benefit (comfort, energy services) for each unit of energy.
- **Multi-source heating systems** are systems for distribution of heat capable of using different heat sources. Most often this means installation of water based central heating. The water in the water based system can theoretically be heated using anything that produces heat. Multi-source heating systems do not entail having several heat sources accessible simultaneously, but that changing heat source is a possibility.
- **Energy source** covers solar energy, water in a reservoir, oil storage etc.

# 1. Introduction

On behalf of the Ministry of Local Government and Modernisation (KMD), the Norwegian Building Authority (DiKB) is submitting a proposal for a new Section 14-4 subsection two of the Technical Building Works Regulations (TEK17) for consultation. This provision regulates the energy supply to buildings.

The deadline for response to the document is 20/04/2018.
The consultation response should be submitted electronically via the authority's consultation solution.

Contact persons for questions regarding the consultation:

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The target is to determine new regulations during 2018 with entry into force at the latest 1st of January 2019. At the same time a transition period of six months is being proposed.

## 1.1 Applicable requirements for energy supply to buildings

The energy supply for buildings is regulated by the Technical Building Works Regulations (TEK17) Section 14, which have been in force since the 1st of January 2016. Requirements are set for how energy efficient buildings must be, and what energy supplies buildings can have.

The requirement for energy supply is regulated by section 14-4. The first paragraph of the provision prohibits heating installations using fossil fuels and means that energy usage for new buildings does not have any greenhouse gas emissions. The second paragraph requires that any building exceeding 1,000 $m^2$ heated floor space (BRA) must have multi- source heating systems[1], where the purpose is to ensure an environmentally friendly and secure energy supply in buildings.

## 1.2 The Storting desires amendments to the energy requirements

During the 2015 consultation of energy requirements, the provisions regarding multi-source heating systems were based on the provision of water-based heating systems in most large buildings. Arguments have since been raised[2] that the regulation does not adequately secure multi-source space heating. This issue was discussed during the Storting debate on the representative's suggestion to retain strict environmental requirements for heating in the new

[1] It will be seen from the regulation guidelines that the requirement can be fulfilled by building multi-source energy systems covering a minimum of 60 per cent of the standard net energy needs.
[2] The current requirement means it is possible to construct a residential block without multi-source space heating. This presupposes that more energy efficient buildings are constructed than the minimum requirements of TEK. It is also possible to construct a residential block where only small parts of the space heating are multi-sourced.

Technical Building Works Regulations, DOK 8:31 S (2015-2016). The following decision was made by the Storting:

Decision 642 (2015 – 2016)
*The Storting asks the government to introduce a provision so that where municipalities have decided on an obligation to connect to district heating in accordance with Section 27-5 of The Planning and Building Act, the municipality can decide that new buildings are equipped with heating systems for utilisation of district heating.*

Decision 644 (2015-2016-2016)
*The Storting asks the government to introduce requirements that 60 per cent of the net heating requirement for buildings exceeding the area limit of 1,000 $m^2$ can be covered by an alternative energy supply than direct acting electricity.*

The recommended provisions allow the municipalities to demand that buildings with an obligation to connect to district heating must have multiple source systems that cover 100 per cent of the heating requirement and that direct acting electricity shall be limited.

The decisions are similar to provisions that were removed in 2016. The earlier provisions were linked directly to the heating requirement and required that developers must complete detailed calculations to document that they have fulfilled the requirements. The requirements varied depending on the size of the building and were also dependent on the municipality having decided on connection to district heating. In addition, part of the buildings heating requirements should be covered by an energy supply other than direct acting electricity. This restriction covered both electricity from the power grid and electricity for heating produced locally.

The requirements were amended to make the regulation more clear and simple. At the same time there was a smaller requirement for the provisions when the heating requirement for new buildings decreased. Today's energy supply requirements regulate the heating system itself.

## 1.1 The proposal in brief - the requirement for multi-source heating systems is being tightened up

This consultation document suggests a follow-up of the recommended provisions by tightening up the present requirement for multi-source heating systems. Specifically it is proposed to regulate that buildings exceeding 1,000 $m^2$ heated BRA must have multi-source heating systems covering a minimum of 80 per cent of standard net heating requirement. This is an increase from the minimum of 60 per cent stated in the regulation guideline, and means that the main approach of the energy supply requirement is maintained.

The requirement for 80 per cent will in practice mean that residential blocks (exceeding 1,000 $m^2$) must have multiple source space heating. Alternative solutions can be selected for smaller parts of the heating requirement where appropriate. For example ventilation heating

or some rooms can be excluded from the multi- source system. The proposal facilitates heating solutions such as district heating, heat pumps and bio energy.

# 2. Proposal for amendments to requirements in the Technical Building Works Regulations Section 14 Energy

This section refers to the proposal for an amendment to Section 14-4 second paragraph of the Technical Building Works Regulations (TEK17). The proposal does not entail any amendment to Technical Building Works Regulations for Longyearbyen[3].

## 2.1 Proposal for amendments to Section 14-4, second paragraph

The amendment to the regulation text is highlighted in italics.

New Section 14-4 shall read:

***Section 14-4 Requirements for energy supply solutions***

(1) The installation of fossil fuel heating installations is not permitted.

(2) Buildings with a heated gross internal area of more than 1,000 $m^2$ shall

a) have multi-source heating systems *covering a minimum of 80 per cent of the standard net heating requirement calculated as specified in Norwegian Standard NS 3031:2014 Calculation of buildings' energy performance - Method and data.*

b) be adapted for the use of low-temperature heating solutions

(3) The requirements in the second paragraph do not apply to houses.

(4) Dwelling units in houses shall have a chimney. This requirement does not apply if:

a) the dwelling unit has a water-borne heating system, or

b) the annual net energy need for heating does not exceed the requirements for passive buildings, calculated as specified in Norwegian Standard NS 3700:2013 Criteria for passive buildings and low energy buildings – Residential buildings.

**Remarks on the proposal**

- The present requirements for multi-source heating systems are maintained in the regulations.
- The proportion of the building's heating requirement that must be multi-sourced is determined in the regulation. This is at present stipulated as pre-accepted performance requirements in the guidelines.
- The requirement for how large a part of the heating requirement shall be covered by a multi-source system is increased from a minimum of 60 per cent (pre-accepted performance requirement in the guidelines) to a minimum of 80 per cent.

[3] https://lovdata.no/dokument/SF/forskrift/2016-11-15-1329

### 2.1.1 The proportion of standard net heating requirement that must be covered by multi-source systems is increased from a minimum of 60 per cent to a minimum of 80 per cent

Methods that influence the energy usage in buildings must ensure a good interaction between the building and energy sectors. New buildings will last for a long time, and the choice of energy solutions contributes to deciding energy usage and the degree of flexibility of the energy system. The requirements, and the costs, of different forms of heating in a single building may vary over time and for different situations.

Multi-source solutions that can utilise various energy sources for heating buildings offer more flexibility in the energy system. Multi-source solutions enable buildings to interact with the energy system over time.

Even though new buildings are very energy efficient, there is still a significant difference in energy usage in summer and winter because of the variation in outside temperature. This means that the total output need - how much energy is used at a given time - will be significantly higher in the winter than in the summer for new buildings as well. Since a large part of the heating in Norway is electric, there might be an output supply shortage in the transmission network during the winter. While energy usage for space heating varies according to the outside temperature, the energy usage for tap water is relatively even all year round.

Multi-source heating systems allow for the use of other energy carriers than electricity for heating. This means that this can contribute to reducing the basic challenge of high electricity usage in the heating season, something that can reduce the requirement for investments in the power grid. At the same time multi-source heating systems provide opportunities to recycle, store and redistribute energy between different sources and users in an efficient manner.

Solutions facilitating multi-source heating systems based on electricity can contribute to short-term flexibility in the power system. An electric boiler can for example be turned off for shorter or longer periods without having an effect on heating comfort. This flexibility can be utilised during periods when the power grid is stretched if good solutions are put into place.

Enova informs that multi-source heating systems come up against many of the same barriers as other energy- and climate-effective solutions on the market. This means that despite the fact that profitable measures exist that can reduce and/or safeguard against increased expenses for energy and output, these are not implemented. A further review of the barriers is provided in Enova’s potential and barrier study of the energy efficiency of Norwegian buildings of 2012.

The suggested regulation amendment will result in increased long-term energy flexibility for the consumer and building owner and thereby increase the future opportunities for change or supplement by using other energy sources, for situations where it is desirable or necessary.

Increasing the part of the heating requirement to be covered by multi-source systems to at least 80 per cent will in practice contribute to energy-flexible space heating for large buildings. At the same time it will be possible to choose alternative solutions for smaller parts of the heating requirement if this is appropriate. For example ventilation heating or some rooms can be excluded from the multi-source system of the building.

The proposal is a follow-up of the Storting's recommended provision 642 (2015-2016) and 644 (2015-2016) cf. Doc 8:31 S (2015-2016).

In summary it is proposed to increase the demand for multi-source heating systems from a minimum of 60 to a minimum of 80 per cent for several reasons:

- Clear targets that buildings exceeding 1,000 $m^2$ are to be constructed with multi-source systems covering most of the space heating requirement.
- Increased long-term flexibility of the energy system.
- Flexibility for building owners, who can change the energy source on demand or as desired in the future.

### 2.1.2 The proportion of heat requirements to be covered by the multi-source heating system is moved from the guidelines to the regulation.

The current legislation requires that buildings exceeding 1,000 $m^2$ heated BRA must have multi-source systems. The proportion that defines the minimum size of the heating requirement that must be multi-sourced is given as a pre-accepted performance requirement in the guidelines. There are several reasons for proposing determining the minimum proportion in the regulation.

Firstly the minimum proportion of the heating requirement to be covered by multi-source system is basically mandatory. This means that this is a performance that must be met for a building to be constructed in a legal manner. Such requirements should be included in regulation and not the guidelines. Secondly, the proportion of heat requirements to be covered by multi-source systems will have consequences for a number of different stakeholders. Among others, this means the building industry, building owners, providers of various energy carrying heating systems and heating solutions. Furthermore the level of requirements will influence the building costs. A provision that is of great importance to affected groups should be part of the regulation. This ensures that the affected groups are heard in the event the provisions are amended at a later point in time.

## 3. Economic and administrative consequences of the proposal

In this section we describe the expected consequences of the proposal for a new energy supply requirement. The current requirements, as stated in the Technical Building Works Regulations Section 14-4 second paragraph, together with the guidelines dated 01/07/2016

are used as a starting point and zero option. Asplan Viak[4] has calculated the consequential costs of the proposal.

## 3.1 Present requirements - reference building

The Technical Building Works Regulations do not regulate what energy source should be used, other than prohibiting the installation of a heating system using fossil fuel. Buildings exceeding 1,000 m$^2$ heated BRA must have multi-source systems. Multi-source heating systems mean that the building is able to be heated using different energy sources.

The regulation guidelines specify that multi-source systems must cover a minimum of 60 per cent of the standard net heating requirement. The requirement for multi-source systems does not mean that there must be several accessible heat sources, but that a change of energy source is a genuine opportunity for the future.

*Table 1 Net heating requirement for three reference buildings Source: Asplan Viak*

| Oppvarming BRA [m2] | Boligblokk | | Kontorbygg | | Forretningsbygg | |
|---|---|---|---|---|---|---|
| | kWh/m2 | % av totalt oppvarmings-behov | kWh/m2 | % av totalt oppvarmings-behov | kWh/m2 | % av totalt oppvarmings-behov |
| Romoppvarming [kWh/år] | 24,6 | 42,9 % | 19,2 | 63,9 % | 41,7 | 68,0 % |
| Ventilasjonsvarme [kWh/år] | 3,1 | 5,3 % | 5,8 | 19,4 % | 9,5 | 15,5 % |
| Oppvarming av tappevann [kWh/år] | 29,8 | 51,8 % | 5,0 | 16,7 % | 10,1 | 16,5 % |
| Totalt oppvarmingsbehov [kWh/år] | 57,5 | 100 % | 30 | 100 % | 61,3 | 100,0 % |

Table 1 summarises how the net heating requirement is distributed between space heating, ventilation heating and heating of tap water for a residential block, office block and a commercial building respectively. The energy calculation is based on DiBK's standardised building models (typical buildings of a simple rectangular design).

**Residential block**

For residential blocks, reference buildings are based on developers mainly adhering to the current regulations by constructing multi-source tap water and part of the space heating (25 per cent of the gross internal area). In 2016 approximately 1,000 residential blocks were constructed in total, about half of which exceeded the area limit of 1,000 m$^2$.

**Office and Commercial buildings**

For office and commercial buildings, reference buildings cover the space heating requirement for 64 per cent and 68 per cent of the total net heating requirement respectively (cf. table 1). This means that multi-source space heating is sufficient to meet the requirement that multi-source systems must cover a minimum of 60 per cent of the heating requirement.

[4] Asplan Viak (2017) – Further calculations linked to the report "Energy flexibility in buildings – a study of the consequences of pre-accepted performance".

## 3.2 Consequences of increasing the requirement for multi-source heating systems to a minimum of 80 per cent of the heating requirement

There might be both positive and negative consequences of a more stringent requirement. The most important monetised and non-monetised effects of the proposal have been considered below.

### 3.2.1 Monetised effects

Table 2 shows the additional cost of investment from increasing the requirement of multi-source heating systems from a minimum of 60 per cent to a minimum of 80 per cent, for the reference buildings described above. The additional costs include both larger distribution systems within the building and increased output[5] in the heating plant. Dependent on what heating source is actually selected, the increased requirement for multi-source heating systems can result in changing energy costs. This has not been reflected in the costs shown in the table below.

*Table 2 Additional costs for increasing the proportion from a minimum of 60 per cent to a minimum of 80 per cent in buildings exceeding 1,000 m². Source: Asplan Viak*

| Type of building | Increase in additional cost of investment year 0 |
|---|---|
| Residential block | 15-165 NOK/m² |
| Commercial building | 70-150 NOK/m² |
| Office building | 60-100 NOK/m² |

**Residential block**

It is assumed that the regulation amendment will mean that residential blocks will be constructed including multi-source heating systems that cover all the tap water and space heating requirement. This means an increase in the investment cost in year 0 between 15 – 165 NOK/m². The costs are dependent on what solution is selected in practice. If the developer selects a simple solution for space heating[6], the additional costs will fall into the lower range in the range of outcomes.

**Commercial building**

It is assumed that the regulation amendment will result in the construction of commercial buildings with multi-source ventilation heating, as well as multi-source space heating. This entails an increase in the investment cost in year 0 between 70 – 150 NOK/m². The investment costs are dependent on what heating solution is selected in practice.

**Office building**

It is assumed that office buildings are constructed with multi-source space heating and ventilation heating. This entails an increase in the investment cost in year 0 between 60 – 100 NOK/m². The investment costs are dependent on what heating solution is selected in

[5] However, the output needed for the remaining part of the building's heating will be reduced
[6] This means that radiator/underfloor heating is connected to the distribution network for hot tap water.

practice.

**Total estimated costs**

Investment costs for the building industry are estimated to increase by approximately 20 - 225 million NOK per year for residential blocks. For buildings other than residential blocks, the investment costs are estimated to increase in total by 131 – 328 million NOK per year. The range of costs is dependent on what energy and heating solution is selected[7]. There is great uncertainty associated with the figures. It is assumed that everyone is building in accordance with the reference buildings presented above. Area figures for 2016 form the basis. For comparison, the building industry had a turnover of approximately NOK 520 billion in 2016[8].

For a residential block exceeding 1,000 $m^2$, the proposal means an increased investment cost between 0.07 and 0.7 per cent per square metre, if we use the basis that building costs per $m^2$ gross area for a residential block represent approximately NOK 22,000[9].

### 3.2.2 Non-monetised effects

The most important non-monetised effects of the regulation amendment proposal are considered below.

**Consequences for the energy system**

Setting requirements for a flexible energy infrastructure will provide greater long-term flexibility in the energy system. The choice of an energy solution for buildings influences the demand for power from the power grid. It is reasonable to assume that the proposal will contribute to the buildings covered by the regulation achieving a lower power and energy consumption from the power system than they would have achieved in the absence of this proposed amendment. This may reduce the requirement for investment in the power grid.

Multi-source heating systems based on electricity can also contribute to short term flexibility in the power system. Water-borne central heating plants have a longer response time for temperature regulation; this means that for example an electric boiler can be turned off for shorter or longer periods without having an effect on the heating comfort. This flexibility can then be exploited during periods when the power grid is stretched.

**Consequences for the building owner**

Increased flexibility

Multi-sourced heating systems can use different heat sources for heating. The proposal means that the building owner is less locked into the heating source chosen when the

[7]The calculation is based on Statistics Norway's area statistics (for the relevant building categories) and is multiplied by the costs shown in table 2.

[8] http://www.bnl.no/politikk-og-analyse/statistikk-og-marked/

[9] BA building analysis - cost analysis for amendments to the requirements in TEK10:

building is erected. The building owner is provided with a greater opportunity to choose other or alternative heating sources if this is desired in the future. This means that innovation, technology and price can influence what heating source the building owner chooses to employ after the building has been erected.

Reduced user friendliness

Water based solutions have a longer temperature regulation response time than point heating (electrical). This is of great significance to residential dwellings and especially for rooms where temperature regulation is desired throughout the day and night, such as bedrooms. Experience from evaluations of residential dwellings with a low energy requirement [10] (EBLE) (low energy housing evaluation) shows that some building owners think it is difficult to regulate the temperature in water-based plants.

**Energy consumption**

Increased use of multi-source heating systems can influence the energy consumption (delivered/purchased energy). The production and distribution efficiencies will, for some solutions, be worse for multi-source systems compared to direct acting electricity. This may lead to an increased energy requirement. However, when selecting a heat pump, the energy requirement will be reduced. Depending on what energy source is actually chosen, the increased demand for multi-source heating systems may lead to changed energy costs for the consumer. The Technical Regulations for Building Works do not regulate what heating solution the building owner chooses to employ.

**Consequences for the industry**

Markets and stakeholders – water-based energy solutions

The proposal means that the demand for water-based energy solutions is likely to increase somewhat. The proposal may contribute to an increased demand for water-based heating from suppliers. This applies to, for example, district heating, air-water heat pumps and pellets.

Markets and stakeholders – direct acting electricity

The proposal will provide a reduced demand and turnover in the market for electrical solutions, except for electric boilers. Demand is likely to reduce for suppliers of panel heaters.

Building industry

The proposal does not call for new building technical solutions. Multi-source heating systems are well known to the building industry, and the proposal does not mean any reorganisation costs or further requirements for competence. Moving the multi-source heating systems from the guidelines into the regulation makes the requirement clearer for the building industry.

**Administrative consequences**

A clearer regulation will produce gains for the public sector in its efforts to guide, follow-up and enforce the regulation.

[10] http://lavenergiprogrammet.no/kunnskapsbank/forskning-pa-passivhus/#publikasjoner

### 3.2.3 Uncertainties linked to the choice of reference building for residential blocks

The present requirement makes it possible to construct residential blocks where only the tap water solution is multi-sourced. However, this assumes that investments are made in energy efficiency measures[11] that reduce the requirement for room and ventilation heating. In order for this solution to be cost effective, the cost of reducing the room heating and ventilation requirements must be lower than the costs of constructing water-based heating for part of the space heating. We do not know of any cases where it is possible to calculate a saving by building in this manner. To increase the requirement for flexibility to a minimum of 80 per cent makes this solution less attractive, because it will require a very comprehensive energy measure to avoid the requirement for multi-source room heating.

For a residential block that only has multi-source tap water, the investment costs for year 0 will increase by between 105 and 250 NOK/$m^2$. The actual increase in investment costs will depend on the cost to reduce the space and ventilation heating (must be deducted from the cost estimate of between 105-205 NOK/$m^2$).

## 3.3 Summary of consequences

The investment costs for the developer are likely to increase between 15 - 165 NOK/m2, dependent on the building category and what energy supply solution the developer selects (district heating, water pump, pellets or electric boiler). In total this could entail a cost increase for the building industry of between 150 - 550 million NOK, if building activity in 2016 is used as a basis.

The additional costs are potentially greatest for a residential block. The new proposal will mean that in practice residential blocks will have to be constructed with multi-source tap water and room heating. Given the current pre-accepted performance it is possible to utilise electric heating that is not based on water based systems in the whole of or parts of the room heating system. However, the developer may choose a simplified solution for room heating[12]in order to meet the new requirement of 80 per cent. This may significantly reduce the cost of the regulation amendment.

The proposal will provide the building owners with increased flexibility to choose alternative energy carriers in the future. This means that future price and technology development can be the driving force for what energy carrier is selected.

It is reasonable to assume that the proposal will contribute to the buildings covered by the regulation drawing lower power and energy consumption from the power system than they would have achieved in the absence of the proposed requirement. This may reduce the requirement for investment in the power grid. Setting requirements for a multi-source

[11]Energy savings for different energy efficiency measures are found in the Asplan Viak report - further calculations linked to the report “energy flexibility in buildings - a study of the consequences of pre-accepted solutions”. Costs and energy savings for single measures outside the requirements of TEK are detailed in the report by Multiconsult - impact assessment of energy rules 2015.

[12] Marketed by LK systems/ Agder Energi. This means that radiator/underfloor heating is connected to the distribution grid for hot tap water.

infrastructure that is capable of utilising different energy carriers for heating will provide greater flexibility in the energy system.

**Summarised regulation proposal**

Regulation for amendment to regulations on technical requirements for buildings (Technical Building Works Regulations)

Statutory authority: Laid down by the Ministry of Local Government and Modernisation on xx/xx/2018 pursuant to the Act of 27 June 2008 No. 71 relating to planning and the processing of building applications (Planning and Building Act) Section 29-5

**I**

In regulations of 19 June 2017 No. 840 regarding technical requirements for buildings, the following alterations are made:

Section 14-4 Second paragraph shall read

(2) Buildings with a heated gross internal area of more than 1,000 $m^2$ shall

a) have multi-source heating systems *covering a minimum of 80 per cent of the standard net heating requirement calculated as specified in Norwegian Standard NS 3031:2014 Calculation of buildings' energy performance - Method and data.*

b) be adapted for the use of low-temperature heating solutions

**II**

The Regulation shall enter into force on 01/01/2019.