

28 April 2014

Ref. jwh

Construction and energy efficiency

# Denmark's National Energy Efficiency Action Plan (NEEAP)

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## **1. Introduction**

Reducing energy consumption through increased energy efficiency and energy savings has traditionally been a priority for Denmark and is still an important part of Danish energy policy. The Danish Government has a long-term objective of being free of fossil fuels by 2050, and an important element in this objective is improving energy efficiency.

In March 2012, the Danish Government's objective was followed up by an energy agreement for the period up to 2020 in which energy efficiency and savings are a crucial element in the transition towards a society based on 100 % renewable energy sources. Initiatives in the energy agreement entail a fall in energy end use by almost 7 % in 2020 compared with 2006. This means that gross energy consumption in 2020 will be reduced by 12 % compared with 2006. In the energy agreement, emphasis is put on, among other things, energy renovation of existing buildings and energy saving by energy companies as two of the primary national instruments to drive energy efficiency forward in Denmark.

The latest calculations show that actual energy consumption in Denmark fell by 4.2 % between 2011 and 2012, while the adjusted energy consumption fell by 3 %. At the same time, the level of economic activity as measured by gross domestic product (GDP) fell by 0.5 %. This means that energy efficiency improved by 2.6 % in 2012. Compared with 1990, adjusted gross energy consumption fell by 4.1 %. In the same period, GDP has grown by 38.3 %.

In Denmark, the share of renewable energy rose in 2012, by 5.4 % to 184 PJ, with, among other things, increases in the use of wind power, wood pellets, wood waste and forestry wood chips. Calculated according to the EU's method, renewable energy accounted for 25.8 % of energy consumption in 2012 compared with 23.1 % in 2011. At the same time, production of electricity based on renewable energy accounted for 43.1 % of domestic electricity supply in 2012, of which wind power contributed 29.8 %.

Danish energy production and self-sufficiency have also changed. Danish production of crude oil, natural gas and renewable energy etc. fell by 7.9 % in 2012, to 801 PJ. In 2011, Denmark was the only country in the EU that was self-sufficient in energy. Denmark's degree of energy self-sufficiency was 102 % in 2012, compared with 108 % the previous year. This means that energy production was 2 % higher than energy consumption in 2012.

## **2. Overview of national energy efficiency targets and savings**

### **2.1. National 2020 energy efficiency targets**

Denmark's indicative national energy efficiency target for 2020 pursuant to Article 3 is an absolute target for primary energy consumption (gross energy consumption excluding consumption for non-energy purposes). For 2020, this target is 744.4 PJ (17.781 Mtoe). This entails a 12.6 % reduction in primary energy consumption in 2020 compared with 2006.

The corresponding indicative target for final energy consumption (excluding consumption for non-energy purposes) in 2020 is 615.5 PJ (14.797 Mtoe). This represents a 7.2 % reduction compared with 2006.

The indicative targets for primary energy consumption and final energy consumption are calculated on the basis of *Energistyrelsen's* (the Danish Energy Agency's) baseline projection for energy consumption. The baseline projection takes into account and includes the effects of all the instruments and measures included in the Danish energy policy agreement of 22 March 2012. The baseline projection also includes previously adopted measures which continue to influence energy consumption, such as the energy agreement of 2008 and the tax reform of 2009.

In addition, the Danish Energy Agency's baseline projection is based on a number of general economic assumptions (industrial output, private consumption, fuel prices, etc.), a number of technological assumptions (what different types of plant cost, how efficient they are, etc.) and assumptions concerning what energy market actors will do based on purely commercial considerations.

**Table 1: Estimates of key national energy production and consumption figures in 2020**

| <i>Estimate of energy consumption in 2020</i>  | <i>Units</i> |
|--|--------------|
| Total primary energy consumption in 2020 (including consumption for non-energy purposes) | 757 PJ       |
| Fuel input for electricity production <sup>1</sup> (thermal power generation)            | 116 PJ       |
| Fuel input for cogeneration <sup>2</sup>   | 136 PJ       |
| Heat generation from cogeneration – thermal <sup>3</sup>                                 | 78 PJ        |
| Electricity generation from cogeneration – electrical <sup>4</sup>                       | 44 PJ        |
| Energy distribution losses (all fuels) <sup>5</sup>                                      | 34 PJ        |
| Total final energy consumption   | 632 PJ       |
| Final energy consumption – industry (manufacturing)                                      | 135 PJ       |
| Final energy consumption – transport   | 229 PJ       |
| Final energy consumption – households  | 176 PJ       |
| Final energy consumption – services (public services + private services)                 | 79 PJ        |

Source: *Danmarks Energifremskrivning 2012* (Denmark's Energy Projection 2012)

<sup>1</sup> The calculation of fuel consumption linked to district heating at a combined heat and power plant is made using a thermal efficiency of 125 %. This is necessary in order to be able to divide the emissions between electricity and heat, but is somewhat arbitrary.

<sup>2</sup> Figures for the total fuel input for cogeneration therefore also cover both electricity and heat production. Industrial cogeneration is not included.

<sup>3</sup> District heating from industrial cogeneration is not included. This is estimated to amount to at most 6 % of the indicated heat generation from cogeneration.

<sup>4</sup> Does not include imports/exports as a result of differences between generation and consumption.

<sup>5</sup> Total figure with all distribution losses (fuel, electricity and district heating)

## 2.2. Additional energy efficiency targets

It is the Government's overall target to have an energy and transport system in Denmark based on 100 % renewable energy by 2050. This objective was presented by the Government in November 2011 in the strategy document *Vores energi* (Our Energy). *Vores energi* is a follow-up to the previous Government's strategy document *Energistrategi 2050 – fra kul, olie og gas til grøn energi* (Energy Strategy 2050 – from coal, oil and gas to green energy) and a follow-up to the Climate Commission's<sup>6</sup> work of September 2010.

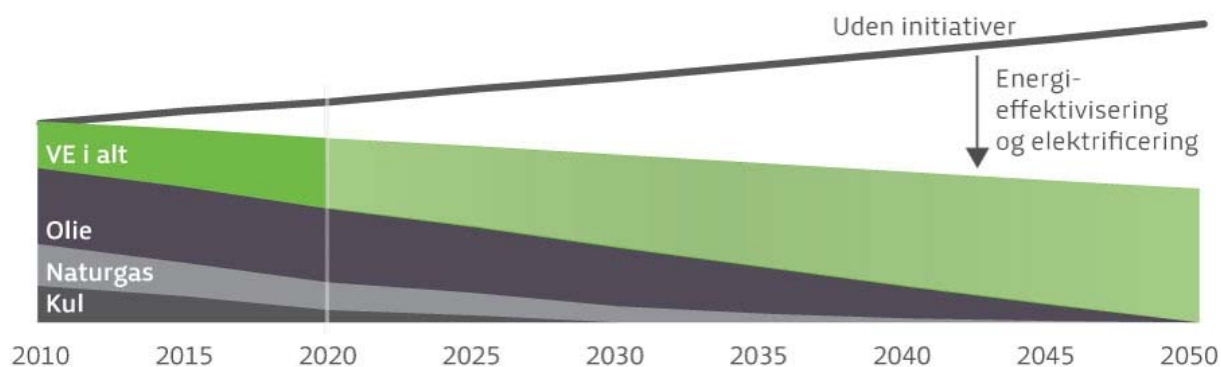


Figure 1: Illustration of energy consumption in Denmark up to the year 2050, *Vores energi*, November 2011

### Key to Figure 1

| Danish original                          | English translation                                |
|--|--|
| Uden initiativer                         | Without initiatives                                |
| Energieffektivisering og elektrificering | Energy efficiency improvements and electrification |
| VE i alt                                 | Renewable energy in total                          |
| Olie                                     | Oil  |
| Naturgas                                 | Natural gas  |
| Kul                                      | Coal   |

*Vores energi* presented a number of milestones to ensure progress towards the target of 100 % renewable energy by 2050. By 2020, it is the Government's target that half of traditional electricity consumption will be covered by wind power. At the same time, it is the target to achieve a 40 % reduction in total greenhouse gas emissions by 2020 compared with 1990. By 2030, the target is to phase out coal in Danish power stations and to replace oil-fired boilers in Danish households with renewable forms of energy. The combined initiatives in *Vores energi* will provide a 65 % reduction in coal consumption in 2020 compared with today, and a halving of the number of oil-fired boilers in 2020 compared with 2010.

According to the strategy, by 2035, electricity and heating will be covered by renewable energy, and use of fossil fuels for electricity and heating will be halved between 2010 and 2020. The target for the transport sector is to achieve 10 % renewable energy in 2020.

Since 2006, the grid and distribution companies in Denmark have been subject to energy efficiency obligations. The latest agreement is from 13 November 2012 and sets the overall

<sup>6</sup> In March 2008, the Government set up a climate commission consisting of 10 scientists. The commission was to give its opinion on how the Government's vision of Denmark becoming independent of fossil fuels in future could be achieved. The climate commission presented its report on 28 September 2010.

targets up to 2020. As a result of the agreement, in 2013 and 2014 the grid and distribution companies must ensure energy savings of 2.6 % per year in energy end use excluding transport. Between 2015 and 2020 the annual target is set at 3.0 %.

### *National intermediate target of almost energy-neutral buildings in 2015*

With the introduction of a voluntary ‘lavenergiklasse 2015’ (low-energy class 2015) in the building regulations, a clear target was set regarding the requirements that new buildings must meet by 2015. Buildings constructed according to low-energy class 2015 have an energy framework that is reduced by 50 % compared with the 2006 level. Low-energy class 2015 thus lives up to the objective of the Danish energy agreement of 2008 concerning the introduction of a building class in 2015 with a 50 % reduced energy consumption compared with 2006. Low-energy class 2015 will become a legal requirement in 2015.

In addition to low-energy class 2015, Denmark has also introduced ‘bygningssklasse 2020’ (building class 2020). Building class 2020 was drawn up in order to be able to satisfy the Building Directive’s requirement of almost energy neutral buildings. Building class 2020 was inserted into the current building regulations, BR10, as a voluntary building class until the time that it is introduced as a legal requirement. Building class 2020, which reduces the energy consumption of buildings by 75 % compared with the 2006 level, was introduced as a voluntary building class at a relatively early stage in the building regulations. The Building Directive’s requirement of almost energy neutral buildings will not enter into force until 31 December 2018 for publicly owned and used buildings and 31 December 2020 for other (private) buildings.

### **2.3. Primary energy savings**

As described in section 2.1, Denmark has an indicative national target of reducing primary energy consumption by 12.6 % in 2020 compared with 2006. The figures are based on the latest national projection from 2012, while the figures in Table 9 in Annex A are based on *Energistatistik 2012* (Energy Statistics 2012).

**Table 2: Projections of primary energy consumption**

| Gross energy consumption (PJ) | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|-------------------------------|------|------|------|------|------|------|------|------|------|
|                               | 799  | 786  | 783  | 782  | 784  | 782  | 773  | 759  | 757  |

Note: Including consumption for non-energy purposes

Source: *Danmarks Energifremskrivning 2012* (Denmark’s Energy Projection 2012)

The projections are based on a ‘frozen policy’ scenario in which instruments and measures from the latest energy agreement of March 2012 are included. In addition, the Danish Energy Agency’s baseline projections are all based on a number of general economic assumptions (industrial output, private consumption, fuel prices, etc.), a number of technological assumptions (what different types of plant cost, how efficient they are, etc.) and assumptions concerning what energy market actors will do based on purely commercial considerations. They may also include some qualitative estimates, e.g. concerning planning matters.

The baseline projections, including the models used, the assumptions and results are described in more detail in

- DANMARKS ENERGIFREMSKRIVNING 2012 (Denmark's Energy Projection 2012)  
[http://www.ens.dk/Documents/Netboghandel%20-%20publikationer/2012/Danmarks\\_energifremskrivning\\_2012.pdf](http://www.ens.dk/Documents/Netboghandel%20-%20publikationer/2012/Danmarks_energifremskrivning_2012.pdf)
- Background Note A: Models and projection principles  
<http://www.ens.dk/da-DK/Info/TalOgKort/Fremskrivninger/Fremskrivninger/Documents/BF2012/A%20-%20Modeller%20og%20fremskrivningsprincip.pdf>

**Table 3: Overview of estimates of primary energy consumption and final energy consumption**

|                 | <i>Primary energy consumption (PJ, GWh or ktoe)</i> | <i>Final energy consumption (PJ, GWh or ktoe)</i> |
|-----------------|---|---|
| 2012 - achieved | 785 PJ  | 616 PJ  |
| 2016 - forecast | 784 PJ  | 637 PJ  |
| 2020 - forecast | 757 PJ  | 632 PJ  |

Source: Figures for 2012 are based on *Energistatistik 2012* (Energy Statistics 2012), while the forecasts for 2016 and 2020 are based on *Danmarks Energifremskrivning 2012* (Denmark's Energy Projection 2012).

## 2.4. Final energy savings

This section contains a calculation of the final energy savings with a view to demonstrating that Denmark satisfies the requirements of the Energy Services Directive for annual energy savings of 1 % of the final energy consumption in the period from 2007 to 2016 and an accumulated saving of 9 % over the period. The calculation largely uses the same methods as in NEEAP-2. However, the targets and savings are calculated for the total final energy consumption, i.e. including consumption in plants covered by the CO<sub>2</sub> emissions trading system.

### 2.4.1 Final energy consumption and targets

In accordance with the Energy Services Directive, the target is calculated in relation to the average final energy consumption in 2002-2006. Consumption in the individual years and the average are shown in Table 4.

**Table 4: Total final energy consumption**

|                               | 2002  | 2003  | 2004  | 2005  | 2006  | Average |
|-------------------------------|-------|-------|-------|-------|-------|---------|
| Final energy consumption (PJ) | 643.7 | 649.1 | 660.5 | 666.3 | 679.7 | 659.9   |

Note: Including consumption for non-energy purposes

Source: *Energistatistik 2012* (Energy Statistics 2012)

On the basis of this, the annual and accumulated targets can be calculated.

**Table 5: Annual and accumulated targets**

|                                | PJ   |
|--------------------------------|------|
| Annual targets – 1 %           | 6.6  |
| Accumulated targets 2012 – 5 % | 33.0 |



|                                |      |
|--------------------------------|------|
| Accumulated targets 2016 – 9 % | 59.4 |
|--------------------------------|------|

### 2.4.2 Calculated energy savings

Only those calculations that are necessary to show that Denmark is meeting the targets have been carried out. This means that a complete calculation of the effects of all the initiatives has not been carried out.

Specifically, top-down calculations have been carried out for selected sectors and a bottom-up calculation has been carried out of the effect of energy saving by energy companies. For all other instruments, bottom-up calculations have not been made.

The calculations have been carried out on the basis of the methods in the Commission's draft guideline 'Recommendation on measurement and verification methods in the framework of Directive 2006/32/EC on energy end-use efficiency and energy services'.

Calculations were carried out for the period 2008-2012 (5 years), and rough calculations were made of the expected effect over the whole period 2008-2016 (9 years).

**Table 6: Calculated energy savings**

|           | 2008-2012 |       | 2008-2016 |       |
|-----------|-----------|-------|-----------|-------|
|           | PJ        | %     | PJ        | %     |
| Top-down  | 42.2      | 6.4 % | 57.6      | 8.7 % |
| Bottom-up | 28.8      | 4.4 % | 64.8      | 9.8 % |

### 2.4.3 Assumptions for the calculated energy savings

As mentioned in the previous section, the calculation of energy savings was carried out in relation to the total final energy consumption, so energy savings in enterprises and plants covered by the CO<sub>2</sub> emissions trading system are included.

Specifically, for the period 2008-2012 top-down calculations were carried out for

- heat consumption in housing (M2)
- electricity consumption in housing (P1)
- heat consumption in trade and services buildings (M3)
- electricity consumption in trade and services (P7)
- energy consumption in manufacturing industries

The calculations used climate-adjusted energy consumptions according to *Energistatistik 2012* (Energy Statistics 2012). For housing and for trade and services buildings, data on heated areas from Statistics Denmark were used. For manufacturing industries, data on production values from Statistics Denmark were used in the calculations.

The calculations for manufacturing industries were only carried out at main sector level, and not broken down into the individual sub-sectors. This is because consistent data on energy consumption in the individual sub-sectors are not available.

The top-down calculations do not include any energy savings in the area of transport.

For 2016, calculations were only carried out for the individual main sectors, and not broken down into heating, electricity consumption, etc. This calculation uses data from the Danish Energy Agency's baseline projection of energy consumption from 2012.

**Table 7: Top-down calculations of energy savings for selected sectors**

| <b>TJ</b>   | <b>2008</b>   | <b>2009</b>   | <b>2010</b>   | <b>2011</b>   | <b>2012</b>   | <b>2016</b>   |
|---|---------------|---------------|---------------|---------------|---------------|---------------|
| <b>Households, in total</b>                         | <b>4 813</b>  | <b>13 175</b> | <b>13 387</b> | <b>11 181</b> | <b>20 182</b> | <b>29 957</b> |
| Heating   | 4 073         | 11 084        | 10 979        | 8 701         | 16 987        |               |
| Electricity consumption, excluding electric heating | 740           | 2 091         | 2 408         | 2 480         | 3 195         |               |
| <b>Trade and services</b>                           | <b>1 250</b>  | <b>5 419</b>  | <b>7 731</b>  | <b>5 902</b>  | <b>11 038</b> | <b>15 743</b> |
| Heating   | 690           | 2 983         | 4 789         | 2 808         | 6 516         |               |
| Electricity consumption, excluding electric heating | 560           | 2 436         | 2 941         | 3 094         | 4 522         |               |
| <b>Manufacturing, in total</b>                      | <b>-1 661</b> | <b>994</b>    | <b>806</b>    | <b>678</b>    | <b>10 939</b> | <b>11 948</b> |
| Agriculture, forestry and horticulture              | -4 842        | -1 930        | -1 964        | -3 805        | -3 724        |               |
| Fisheries   | 1 656         | 1 045         | 1 065         | 991           | 2 719         |               |
| Manufacturing                                       | 1 227         | 1 306         | 2 120         | 3 604         | 11 153        |               |
| Building and construction                           | 298           | 572           | -415          | -111          | 790           |               |
| <b>Total</b>  | <b>4 401</b>  | <b>19 589</b> | <b>21 924</b> | <b>17 761</b> | <b>42 159</b> | <b>57 649</b> |

The top-down calculation is considered to be very conservative. This applies, in particular, to the period up to 2016. Energy statistics for 2012 and the provisional energy statistics for 2013 therefore show much lower energy consumption than indicated in the projection.

The bottom-up calculations were only carried out for energy saving by energy companies. For the period 2008-2012, the actual realised energy savings reported by the energy companies to the Danish Energy Agency are used. When calculating the effect in 2016, it is assumed that the companies will fulfil their obligations over the period as a whole. It is therefore assumed that the over-fulfilment of the obligations up to 2012 will be matched by an under-fulfilment up to 2016.

An adjustment has been made for the fact that a small proportion of the reported energy savings have a lifetime of less than nine years. Specifically, it is assumed that 5 % of the energy savings have a lifetime of only one year, and that 10 % of the energy savings have a lifetime of two years or less. These adjustments are larger than the proportion of savings achieved through behaviour modification in the period up to 2009. As of 2010, the effect of behaviour modification cannot, in principle, be included.

**Table 8: Bottom-up calculation of the effect of energy saving by energy companies**

| <b>TJ</b>        | <b>2008</b> | <b>2009</b> | <b>2010</b> | <b>2011</b> | <b>2012</b> | <b>2016</b> |
|------------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Energy companies | 3 813       | 7 382       | 14 044      | 21 041      | 28 836      | 64 830      |

## 3. Policy measures implementing EED

### 3.1. Horizontal measures

#### 3.1.1. Energy efficiency obligation schemes and alternative policy measures (EED Article 7, Annex XIV, Part 2.3.2)

Denmark will meet its Article 7 obligations exclusively through the use of energy efficiency obligations. The obligations are part of the energy policy agreement of March 2012 and are laid down up to 2020 through the agreement of 13 November 2012 between the Minister for Climate, Energy and Building and the grid and distribution companies.

In accordance with Article 7(1) EED, the Danish targets are calculated as:

- Annual target – 1.5 %: 6.18 PJ
- Savings in 2020 (7 x 1.5 %): 43.23 PJ
- Accumulated savings 2014-2020 (28 x 1.5 %): 172.93 PJ

The basis for the calculations of the Danish targets pursuant to Article 7(1) are the official Danish energy statistics *Energistatistik 2012* (Energy Statistics 2012), which were published in November 2013. These data are the basis for reporting to Eurostat.

When calculating the Danish target, energy used for transport is not taken into account. Consumption for non-energy purposes is also disregarded. Otherwise, all final energy consumption is included in the calculation of the target.

The precise calculations and data sets are shown in Annex D, which also shows the breakdown of the final energy consumption by sector for 2010, 2011 and 2012.

In 2013 and 2014, the annual target for the Danish energy efficiency obligation is 10.7 PJ, corresponding to 2.6 % of energy end use. For 2015-2020, the annual target has been set at 12.2 PJ, corresponding to around 3.0 % of energy end use.

The Danish obligations under the energy policy agreement are thus considerably higher than required by the Directive.

Under the Danish system, obligated parties may to a certain extent take into account energy savings in transmission and distribution networks and in connection with the establishment of new collective solar farms for district heating generation. These savings, which are covered by the exemption in Article 7(2)(c), are expected, on the basis of experience, to be much less than 25 % of the total energy savings.

As can be seen from Annex D, the Danish target will entail energy savings of 83.9 PJ in 2020 and total savings of 331.1 PJ accumulated over the period 2014-2020, assuming that all of the implemented savings have a lifetime of at least 7 years.

These savings are almost twice the level of the Danish obligations under Article 7(1). Even if a small proportion of the savings have a lifetime of less than 7 years, and even if a small proportion are not achieved at the level of end use but are covered by the exemptions in Article 7(2)(c), Denmark will clearly meet its obligations with the targets set.

### *The national energy efficiency obligation scheme*

Denmark has had energy efficiency obligations since 2006. The obligations are enshrined in the electricity supply, natural gas supply and heat supply acts for electricity grid companies, natural gas distribution companies and district heating companies. There is therefore a legal basis for imposing an annual energy efficiency obligation on these companies, although in practice the action is implemented through an agreement with the sectors/companies concerned. All of the companies in these sectors have signed up to this agreement. In addition to the sectors referred to, the oil sector is also a party to the agreement, and thus also has an annual energy saving target. The option of exempting small companies has not been taken up.

The companies involved are:

- around 70 electricity grid operators,
- three natural gas distributors,
- around 400 district heating companies,
- the oil sector, which takes care of the activities on behalf of six oil companies.

At present, three agreements have been entered into concerning the energy companies' energy efficiency obligation, the latest being from 13 November 2012. The agreement with the sectors/companies only lays down the annual energy saving target for the individual sectors, and it is therefore up to the sectors to divide the target among individual companies.

The current agreement with energy companies concerning their energy saving efforts lays down the overall target up to 2020, but the specific rules, etc., including how the target is to be divided among sectors (electricity, natural gas, district heating and oil) only apply to the period 2013-15. In the course of 2015, the framework for the efforts from 2016 onwards will be established following an independent evaluation of the scheme, which will be completed at the beginning of 2015.

The obligated companies can only be credited with and report savings which the companies are involved in achieving through specific activities either themselves or on the basis of agreements with actors. There must therefore be a direct and clear link between the activity and the savings. Companies cannot report savings arising without their involvement. There must be an agreement concerning involvement before the realisation of the saving begins.

There are clear rules stipulating that the obligated parties' activities must have significantly contributed to achieving the energy savings claimed. The obligated parties' involvement may take various forms. It may take the form of advice or a grant to the final customer or, indeed, a combination thereof.

The activities that obligated grid and distribution companies can implement themselves are limited. A very large part of the action is therefore implemented by actors who have agreements with one of the obligated companies and who therefore take responsibility for

implementing the action in relation to end users. These actors may be installers, tradesmen, consultant engineers, or energy trading companies. Thus the grid and distribution companies cooperate with a large number of companies and actors who act as energy saving operators (energy service providers) in relation to households and enterprises.

In principle, energy savings in all end-use sectors and in relation to all types of energy can be taken into account. This therefore also includes energy savings in enterprises covered by the emissions trading system (ETS). However, there are a number of areas that are excluded because it is thought that the activities in question will largely be implemented without the involvement of the obligated parties.

An energy saving achieved through activities that increase efficiency and thus reduce energy consumption can be taken into account. Examples include improved insulation or the installation of more energy-efficient windows. Energy efficiency improvements in terms of the energy consumption of industry also fall within this category. Replacing old energy-efficient boilers with new high-efficiency boilers can therefore be included as an energy saving measure.

Energy savings in connection with converting from one type of energy to another can also be included if this leads to lower energy consumption. This could, for example, be conversion from an oil-fired boiler to district heating or a heat pump.

Some of the savings achieved as a result of installing new boilers or converting from one type of energy to another cannot be counted towards fulfilment of the requirements of Article 7 because the technologies are – or soon will be – covered by ecodesign requirements. In assessing whether targets have been met, the savings achieved under the Danish system will therefore be adjusted.

### *Calculation methodology*

Savings are calculated either using standard values (deemed savings), by means of a specific calculation of the saving resulting from the activity (scaled savings), or according to the effect of a specific market impact (surveyed savings).

#### Standard values

Calculation on the basis of standard values is applied in the case of smaller, standardised activities. Such savings will typically be found in homes or other buildings. If a standard value exists for a given saving, this will be applied.

The aim of establishing standard values for energy savings is to simplify the calculation of the realised energy savings. The calculation of the saving thus takes place through a simple multiplication of the standard value by the number of initiatives implemented.

In connection with the agreement on energy saving by grid and distribution companies, a technical working group was set up with representatives from the parties to the agreement. The technical working group is responsible for the work of drawing up the standard values. In practice, it is the Danish Technological Institute that performs the task of making assumptions and calculating the standard values. The values are approved by the Danish Energy Agency.

When drawing up the standard values there is a focus on, among other things, high additionality. Consideration is given to the extent to which a measure will take place independently of the involvement of the grid and distribution company.

The standard values are merely an expression of the energy savings that can be included in the grid and distribution companies' energy saving efforts. Not all measures that result in reduced energy consumption can be included as an energy saving under this scheme.

The standard values are an average of the individual energy improvement measures. Thus the specific energy savings may be either smaller or larger than the actual energy saving. In order to ensure fair and credible standard values there is openness about the drawing up of the catalogue of standard values. Comments and suggestions for the catalogue of standard values can be sent to the Danish Energy Agency. Any suggestions and amendments should have the nature of specific and well-founded proposals for amendments of specific values.

Each year an assessment is made of whether the standard values should be adjusted and whether new ones should be added in the light of, among other things, technological development. Any amendments enter into force on 1 January, but are published not later than 1 October. Amendments only have an impact on future energy savings. Existing and previous versions of the catalogue of standard values are available at: [svk.teknologisk.dk](http://svk.teknologisk.dk) (please note that 'www' should not be included in the address).

#### Specific calculation

Specific calculations are used in areas where there is no standard value. These are typically large, integrated projects in commercial enterprises or public institutions. If specific calculations are used for parts of an overall project, the entire project will be assessed on a specific basis, including the effect of initiatives for which standard values exist.

#### Market impact

The verifiable effect of a specific market impact, i.e. a reduction in energy consumption compared to a baseline, may be taken into account. This effect should, as far as possible, be calculated using standard values.

#### *Design of rules*

The rules are designed to prevent the same energy saving from being taken into account by several parties. The end user must, among other things, approve the reporting of the specific energy saving to a specific obligated company and be informed that, in so doing, the energy saving cannot be sold to another party. The random samples and the evaluations carried out have not identified any problems with double counting.

The evaluations show that the energy savings determined are new and that they have generally been calculated correctly. The obligated parties are involved and have contributed to achieving the energy saving.

However, some of the energy savings would be implemented within a reasonable time frame without the companies' involvement (free riders). It is very difficult to calculate the proportion of free riders, but the latest evaluations show that around 50 % of energy savings

in industry and around 80 % of energy savings in buildings would be implemented within three years.

A number of steps have been taken to reduce the proportion of free riders and to make adjustments for specific projects that would have been implemented in any case.

First, the annual target as of 2009 was increased by 15 % compared with the policy target. This was because some of the energy savings calculated would be implemented in any case. This increase has been continued in the current agreement.

Second, the effect of a number of initiatives which are expected to be implemented without the involvement of the energy companies cannot be taken into account. For example, the standard values are set to zero for most household appliances. The effects of behaviour modification and information campaigns cannot be taken into account either.

Finally, a number of standard values have been reduced by 10-50 % in order to compensate for the fact that some of the activities would be carried out in any case.

#### *Lifetimes of measures*

Under the Danish system, the effect in connection with the implementation of specific energy savings is calculated on the basis of the saving in the first year.

However, the saving in the first year is weighted by a simple factor that primarily reflects the lifetime of the saving, but also reflects the associated gross energy consumption and the expected CO<sub>2</sub> impact of the saving, particularly with regard to whether or not the saving is covered by emissions trading.

When converting from one type of energy to another, conversion factors reflecting the gross energy consumption are applied. The prioritisation and conversion factors and how they are applied in practice are set out in Annex 5 to the agreement. The agreement is available here (in English): [http://www.ens.dk/sites/ens.dk/files/forbrug-besparelser/energiselskabernes-spareindsats/Lovgrundlagkontrologresultater/Lovgrundlag/aftale\\_energiselskabernes\\_indsats\\_af\\_13\\_november\\_2012\\_-\\_engelsk.pdf](http://www.ens.dk/sites/ens.dk/files/forbrug-besparelser/energiselskabernes-spareindsats/Lovgrundlagkontrologresultater/Lovgrundlag/aftale_energiselskabernes_indsats_af_13_november_2012_-_engelsk.pdf)

On the basis of the notified data, it is thought that the average lifetime of the energy savings is at least 10 years. As regards the energy savings reported in 2012, only 6 % had a lifetime of less than 4 years, as a result of which they were multiplied by a factor of 0.5. 48 % had a lifetime of over 15 years.

#### *Approach taken to address climatic variations within the Member State*

Under the Danish energy saving scheme, energy savings are, in principle, calculated on the basis of a 'normal year'. For energy savings relating to heating consumption in buildings, standard values are generally applied which are calculated on the basis of the climate in a normal year. The scheme does not have any special rules to take account of climatic variations.

### *Quality standards*

Obligated grid and distribution companies are responsible for ensuring that their documentation of energy savings is correct and meets the requirements laid down. To this end, companies are required to implement quality assurance. This ensures that the company's documentation and reporting, including documentation concerning savings implemented by subcontractors or third parties acting on the company's behalf, are correct and meet the requirements laid down.

As a minimum, quality assurance should focus on:

- whether the size of the energy saving has been calculated in accordance with the applicable rules, and whether specific calculations are technically sound;
- whether energy savings have been implemented in respect of the relevant consumption and can be defined as an energy saving within the meaning of the agreement;
- whether the company was involved directly, financially or via a third party before the saving was realised;
- whether the company has obtained the right to report;
- whether the energy savings have been realised and correctly documented;
- whether the energy savings have been reported correctly;
- whether actors acting on the grid company's behalf are complying with the requirements of the agreement; and
- whether any errors linked to individual cases or the procedures of the company concerned are corrected as part of compliance with the agreement or the executive order.

### *Monitoring and verification protocols*

As part of the quality assurance, each year the obligated companies must carry out an audit to ensure and demonstrate that the reported savings have been realised and documented in accordance with the agreement and the executive order.

Every second year, the audit may be carried out internally by the company itself, with intervening audits being carried out externally by an independent auditor. The external audit must be carried out by a person/company who is independent of the grid/distribution company and who has undergone basic auditing training and has experience of carrying out a minimum of two audits together with an experienced auditor.

The company must document that both the internal and external audits have been carried out, stating how many and which cases have been selected. This documentation must be kept for five years. In connection with the annual reports, companies must indicate whether an internal or an external audit was carried out in the year in question.

All obligated companies must submit annual reports to the Danish Energy Agency indicating whether an internal or an external audit has been carried out.

In addition to the obligated parties' quality assurance and audits, once a year the Danish Energy Agency carries out an impartial spot check across all grid and distribution companies involved in order to verify that they meet the requirements of the agreement and of the executive order. The spot check covers all intermediaries from the reporting company down to the end user where the saving was implemented.



### *Audit protocols*

Apart from the requirements described above, there are no special audit protocol requirements for the calculated energy savings.

Each year, all obligated companies are required to inform *Energitilsynet* (the Danish Energy Regulatory Authority) of their costs in connection with complying with their energy efficiency obligations. These costs should be subject to the general requirements applicable to the auditing of the companies' accounts.

Denmark is meeting its obligations exclusively through the use of energy efficiency obligations and will therefore not be using alternative policy measures under Article 7(9).

### **3.1.2. Energy audits and management systems (EED Article 8)**

On 29 January, the Danish Government presented a Bill to the Danish Parliament containing the general rules for the implementation of the Directive's requirement for mandatory energy audits, Article 8(4). The Act was adopted by the Danish Parliament on 1 April 2014. It contains an obligation for enterprises to carry out a mandatory energy audit every fourth year. The enterprise can also satisfy the obligation by using and maintaining a certified energy or environmental management system that includes an energy audit as part of the management system. The Act also provides a legal basis for the Minister for Climate, Energy and Building to lay down detailed rules on, among other things, the content of energy audits and qualification requirements for the experts who are to carry out the energy audit.

The requirements apply to large enterprises in all sectors, including transport activities such as shipping and aviation. Every enterprise that offers goods and services in a given market is an economic operator and is therefore covered by the requirement for mandatory energy audits.

'Large enterprises' means enterprises with at least 250 employees and an annual turnover of more than EUR 50 million or an annual balance sheet of more than EUR 43 million. An enterprise must therefore have at least 250 employees and satisfy at least one of the two financial criteria.

In order to determine whether the criteria have been met, an assessment must be made of whether an enterprise is an independent enterprise, a partner or an affiliate. If more than 25 % of an enterprise's capital or voting rights are held by another enterprise, it is a partnership or affiliation as far as both enterprises are concerned.

The Act obliges large enterprises to have an energy audit carried out independently by qualified experts and to submit documentation of the energy audit performed. The energy audit must be carried out at least every fourth year, calculated from the date of the preceding energy audit. As the Act indicates, the first energy audits must be completed no later than 5 December 2015. Energy audits that satisfy the minimum requirements and have been carried since 4 December 2012, which is when the Energy Efficiency Directive entered into force, count towards the enterprise's fulfilment of the requirement. This means, for example, that if a large enterprise had an energy audit carried out on 27 June 2013, the next energy audit must be carried out no later than 27 June 2017.

The minimum criteria for energy audits will be laid down in an executive order issued on the basis of the Act. The scope of the energy audit will depend on the complexity of the elements to be included in a given energy audit. For energy audits in large enterprises with very complex processes, the requirements will be more extensive and different than if the large enterprise were a consultancy or office-based business or in the trade and services sector where energy consumption is simpler.

The Act states that enterprises that have a certified energy management system in accordance with the relevant international standards will be exempt from the requirement for energy audits if the management system concerned meets the minimum criteria of Annex VI to the Directive. The existing international and European standards, such as ISO 50001 on energy management and EN 16247-1 on energy audits, are considered by the Directive to satisfy the minimum requirements. These standards were already in use in a number of enterprises on a voluntary basis.

The Danish Energy Agency is in the process of drafting an executive order to implement the Act.

#### Documentation requirements

Large enterprises must submit documentation to show that they have met the requirement for mandatory energy audits or must show that they are exempt from the requirement by submitting documentation of the fact that the enterprise has a certified energy management system.

At the moment there is no list of the enterprises that will be covered by the Act. One of the Minister's tasks after adoption of the Act, will be to disseminate information through newspapers and magazines etc. about the fact that large enterprises are obliged to carry out an energy audit at least every fourth year. Similarly, information will be able to be bought from private agencies concerning which enterprises meet the criteria for being a large enterprise. In cases of doubt, the Minister will contact a potentially obligated enterprise to clarify whether the enterprise in question is covered.

#### Minimum criteria

The minimum criteria are in the process of being drawn up and will be included in the forthcoming executive order. In the light of the efforts to adopt European standards that comply with Annex VI to the Directive, these will be taken into account once they have been adopted. Meanwhile, EN 16247-1 and the energy audit element of ISO 50001 will be the minimum requirements to be met. However, the Danish Energy Agency is considering whether these standards may need to be supplemented.

#### Exemption from the requirement for energy audits

If an enterprise submits documentation of the fact that it uses and maintains a certified management system, the quality etc. of the management system is to be verified by an auditor who is accredited by an accreditation body. This may be DANAK (the Danish accreditation body) or a similar recognised accreditation body that has signed the European Organisation for Accreditation's (EA's) multilateral agreement on mutual recognition. The Minister's check consists of ensuring that the accreditation body is supervised in accordance with applicable international standards.

### *Quality assurance*

A description of the Danish scheme for the accreditation of energy audit consultants and qualifying courses, primarily in processing enterprises, can be found here:

<http://energisynteknologisk.dk/energisynteknologisk.aspx>. The Danish Energy Agency participates in the registration committee, which ensures that the qualification requirements are upheld.

A description of the Danish scheme for certifying energy audit consultants to carry out energy audits of buildings is can be found here:

<http://www.ens.dk/forbrug-besparelser/byggeriets-energiforbrug/energimaerkning/certificering-virksomheder-udforelse>

The EED must be fully implemented in Danish legislation by 5 June 2014, so the rules pursuant to Article 8 of the EED have not yet entered into force in Danish legislation. Therefore, Denmark cannot at present indicate how many energy audits were carried in general or at large enterprises (cf. Annex XIV, Part 2.3.3(a) and (b)). We will be able to present this statistic in connection with the next NEEAP. An analysis shows that the implementation of Article 8 in Danish legislation will cover almost 500 enterprises at group level in Denmark.

### *Small and medium-sized enterprises (SMEs)*

In the Act just adopted, large enterprises (cf. the EU's definition of non-SMEs) are obliged to carry out energy audits every fourth year. At the same time, the Minister for Climate, Energy and Building is being given powers to lay down detailed requirements concerning which enterprises are covered by the requirement for energy audits, the content of energy audits and the experts who are to perform the energy audits. At present, the new Act does not cover SMEs.

Over a number of years, Denmark has strived to focus on and spread the energy efficiency work of SMEs, so special initiatives aimed at SMEs have also been taken in Denmark to encourage them to carry out energy audits and to promote energy efficiency and energy savings.

### *'Energy management light'*

'Energy management light' is a version of an energy management system specially aimed at small and medium-sized enterprises. The system was developed in a collaboration between the Danish Energy Agency and Danish Standards and is a guide to how the energy management standard DS/EN 16001 or parts thereof can be implemented in small enterprises. In general terms, energy management is the tool an enterprise uses to ensure that consideration is given to improving the efficiency of energy consumption in all relevant activities and decisions. Part of this energy management system is an energy audit at the enterprise in the form of a mapping of energy consumption within the enterprise. The energy management light guide can be downloaded from the Danish Energy Agency's website at: <http://www.ens.dk/info/nyheder/nyhedsarkiv/energiledelse-light-vejledning-sma-mellemstore-virksomheder>

### *Renewable energy for production processes*

The 'VE til proces' scheme (RE for production processes) is part of the energy agreement of 2012, in which a fund of DKK 3.75 billion was allocated to the scheme. The scheme is based

on lov nr. 607 af 12. juni 2013 om tilskud til fremme af vedvarende energi i virksomheders processer (Act No 607 of 12 June 2013 on grants to promote renewable energy in the production processes of enterprises).

RE for production processes is aimed at converting energy consumption in the production processes of enterprises from fossil fuels to renewable energy and district heating. Grants are provided for energy efficiency measures in connection with converting production processes from fossil fuels to renewable energy. The scheme is aimed at all types of enterprise, including SMEs. There has been a strong demand for the scheme from SMEs in agriculture. The scheme provides investment aid to enterprises that convert their production processes to renewable energy or district heating and, where applicable, carry out energy efficiency improvements. The Danish Energy Agency is working on raising awareness of the scheme among SMEs in other sectors and thereby exploiting the potential that exists for converting production processes from fossil fuels to renewable energy or district heating and carrying out energy efficiency improvements at the same time. The Danish Energy Agency has, among other things, conducted a study of the potential for SMEs to also benefit from the scheme. The report identified a number of challenges in raising awareness of the scheme among SMEs and made recommendations on how to overcome those challenges. The Danish Energy Agency has initiated a project aimed at implementing a number of the report's recommendations.

The RE for production processes scheme was implemented through Act No 607 of 12 June 2013 on grants to promote renewable energy in the production processes of enterprises. Under the Act, the award of grants can also be made conditional on the beneficiary conducting an energy audit to demonstrate that the project concerned is energy efficient (Section 3(5)).

Guidance on the scheme, including application documents, can be downloaded from the Danish Energy Agency's website at: [www.ens.dk/ve-proces](http://www.ens.dk/ve-proces)

#### Energy saving by energy companies

The energy companies' energy efficiency obligation, as discussed in detail in the preceding section 3.1.1, is a crucial element in the Danish energy saving effort. The energy companies' energy efficiency obligation is also relevant to small and medium-sized enterprises since the scheme is aimed at all types of final customer, including SMEs. No specific programme has been set up for SMEs, but such enterprises can obtain assistance in the form of advice and/or grants in connection with the realisation of energy saving measures in line with all other end users. From the enterprises' perspective, this scheme is a way of making it easier to realise energy savings and to obtain co-financing for energy investments, and thus a way to make it more economically attractive for SMEs to conduct energy audits and subsequently implement energy saving measures.

## Information and advice

The Danish Energy Agency has also implemented a number of information and advice initiatives specifically aimed at SMEs. These are discussed in more detail in section 3.1.4 on Consumer information and training. That section also discusses Danish initiatives aimed at households and raising awareness of the benefits of having an energy audit conducted.

### 3.1.3. Metering and billing (EED Articles 9-11)

#### *Metering*

Article 9 of the Energy Efficiency Directive concerns the right of final customers to have individual meters installed to measure consumption. In Denmark, it is the Danish Energy Agency that lays down the rules for individual consumption metering of electricity, gas, water and heat in residential and commercial units. Under *bekendtgørelsen om individuel måling af el, gas, vand og varme* (Executive Order No 891 of 9 October 1996 on individual metering of electricity, gas, water and heat, as amended by Executive Order No 565 of 1 July 1997) (the Meter Order), meters for measuring heat consumption must be installed in individual residential units or commercial units in both existing buildings and new buildings. However, buildings may be exempt from this requirement on the grounds of, for example, special technical circumstances.

Customers of around half of the district heating plants now have smart meters. A majority of the meters installed on the market today enable consumers to read their consumption in both volume (m<sup>3</sup>) and MWh. Consequently, these consumers are able to obtain precise, regular meter information themselves, which satisfies the Energy Efficiency Directive's aim of providing consumers with a more rational use of, among other things, district heating.

The requirements of Article 9 EED concerning metering will be implemented in Danish legislation through an amendment of the Meter Order. The main purpose of this amendment is to introduce requirements for individual metering of consumption in order, among other things, to motivate final customers to reduce their consumption of resources.

The box below provides an overview of the amendments to the Meter Order that the Danish Energy Agency is considering making as part of the implementation of Article 9 EED:

#### **Scope**

- The scope of the Meter Order will be extended to cover individual metering of cooling.
- It will be made clear that the Meter Order also covers meter replacement.

#### **Individual metering of gas**

- A requirement will be introduced that, in new buildings and in connection with the reinstallation of gas systems in existing buildings, meters must be installed to measure the consumption of gas in individual residential or commercial units.
- A requirement will be introduced that, in existing buildings, meters must be installed to measure the consumption of gas in individual residential or commercial units if this is technically feasible and cost-effective.
- A requirement will be introduced that, in properties with several residential or commercial units that are heated from a central heating plant, meters must be installed to measure the consumption of gas at the place of delivery.
- An option will be introduced allowing gas used for cooking in residential units to be exempt from the requirement of billing based on measured consumption and instead allowing the consumer to choose flat-rate billing.

#### **Individual metering of domestic hot water**

- A requirement will be introduced that, in new buildings and in connection with the reinstallation of water systems in existing buildings, meters must be installed to measure the consumption of hot water in individual residential or commercial units.
- A requirement will be introduced that, in existing buildings, meters must be installed by 31 December 2016 to measure the consumption of hot water in individual residential or commercial units, if this is technically feasible and cost-effective.

#### **Individual metering of heat**

- A requirement will be introduced that, in new buildings and in connection with the reinstallation of heating systems in existing buildings, thermal energy meters must be installed to measure the consumption of heat in individual residential or commercial units.
- A requirement will be introduced that, in existing buildings, thermal energy meters or heat cost allocators must be installed to measure the consumption of heat in individual residential or commercial units.
- A requirement will be introduced that, when replacing meters in existing buildings, thermal energy meters must be installed in preference to heat cost allocators, if this is technically feasible and cost-effective.
- A requirement will be introduced that, in properties with multiple residential or commercial units heated by district heating, and in central heating plants serving multiple buildings, meters must be installed to measure the consumption of heat at the place of delivery.

#### **Individual metering of energy consumption for cooling**

- A requirement will be introduced that, in new buildings and in connection with the reinstallation of cooling systems in existing buildings, meters must be installed to measure the consumption of cooling in individual residential or commercial units.
- A requirement will be introduced that, in existing buildings, meters must be installed by 31 December 2016 to measure the consumption of cooling in individual residential or commercial units, if this is technically feasible and cost-effective.
- A requirement will be introduced that, in properties with multiple residential or commercial units cooled by district cooling, and in central cooling plants serving multiple buildings, meters must be installed to measure the consumption of cooling at the place of delivery.

### *Remote meters*

The Executive Order on remote electricity meters and metering of electricity at end use, which was most recently amended by *bekendtgørelse nr. 1358 af 3. december 2013 om fjernaflæste elmålere og måling af elektricitet i slutforbruget (Executive Order No 1358 of 3 December 2013 on remote electricity meters and metering of electricity at end use)*, contains requirements for grid operators to inform and advise end users about the use of remote electricity meters and the potential for their use.

Since 2011, around 1.6 million consumers have had remote electricity meters installed. The remaining around 1.7 million consumers will have remote electricity meters with hourly metering installed by the end of 2020 at the latest. The grid operators are responsible for the installation of electricity meters. They normally outsource the task to external actors.

*Bekendtgørelsen om fjernaflæste elmålere mv.* (the Executive Order on remote electricity meters etc.) contains provisions that ensure the fulfilment of the requirements of Article 9(2).

There are no equivalent rules on remote meters in the area of natural gas. However, the standard for natural gas meters is that consumers are able to read their consumption directly and that consumers report their consumption once a year and can freely choose whether to do so by telephone, letter or e-mail. This is considered to be a satisfactory scheme which it would not be economically viable to change by making electronic metering a requirement.

### *Billing electricity*

**Bekendtgørelse nr. 486 af 29. maj 2007 om elselskabers fakturering og specificering af omkostninger over for modtagere af transport- og energiydelser (Executive Order No 486 of 29 May 2007** on electricity companies' billing and itemisation of charges to recipients of transport and energy services) contains requirements concerning the billing of measured electricity consumption. The Executive Order applies to billing for energy services in connection with consumption below 100 000 KWh per year and transport services of any size.

**Bekendtgørelse nr. 937 af 11. september 2006 om naturgasselskabers fakturering og specificering af omkostninger over for modtagere af transport- og energiydelser (Executive Order No 937 of 11 September 2006** on natural gas companies' billing and itemisation of charges to recipients of transport and energy services) contains requirements concerning the billing of the measured gas consumption.

According to the above executive orders, the consumption of electricity and natural gas must be measured at least once a year, either through the consumer's own meter reading or through a reading taken by the network operator. Bills are normally issued four times a year using estimated consumption based on the latest meter reading. The fourth bill contains the final annual statement based on the measured consumption and the previous on-account billing. It is possible to bill more frequently or less frequently, but there must be at least one bill per year based on the measured consumption.

Electricity consumers can obtain information about their own consumption from Energinet.dk's DataHub. Consumers with hourly metering will be able to obtain information on their hourly metered consumption once a facility has been established in the datahub to process hourly data in a cost-effective way, which is expected to happen in 2015.

Billing information in connection with intelligent electricity meters  
Information about consumption must be provided once a year in connection with the annual statement (end users with consumption below 100 000 kWh) – see Section 5 of *faktureringsbekendtgørelsen* (the Billing Order) (Danish Energy Regulatory Authority) <https://www.retsinformation.dk/Forms/R0710.aspx?id=22678>.

There is no corresponding datahub for gas consumers.

**Bekendtgørelse nr. 196 af 27. februar 2013 om forbrugerbeskyttelse i medfør af lov om elforsyning (Executive Order No 196 of 27 February 2013** on consumer protection pursuant to the Electricity Supply Act) requires electricity trading companies and grid operators to offer their consumers a wide choice of payment methods without unreasonable discrimination between customers.

**Bekendtgørelse nr. 311 af 20. marts 2013 om forbrugerbeskyttelse i medfør af lov om naturgasforsyning (Executive Order No 311 of 20 March 2013** on consumer protection pursuant to the Natural Gas Supply Act) contains corresponding requirements regarding natural gas (in Section 12).

**Bekendtgørelse nr. 1452 af 16. december 2013 om energispareydelser i net- og distributionsvirksomheder (Executive Order No 1452 of 16 December 2013** on energy saving services in grid and distribution companies) contains requirements concerning

information on the development of the energy consumption of consumers, including information on their energy consumption over the last year, a comparison with their energy consumption over the previous three years, and comparability with other similar consumers. The requirements apply to all grid and distribution companies for electricity, natural gas and district heating.

### *Billing for heat*

In connection with the billing of consumers, district heating plants are subject to the billing provisions of the Danish VAT Act. The billing requirements can be found in Sections 52 to 55 of the VAT Act (Act No 106 of 23 January 2013) and Chapter 12 of the VAT Order (Executive Order No 814 of 24 June 2013).

The VAT Order also states that a full invoice must contain:

- the date of issue (invoice date);
- a serial number based on one or more series that identifies the invoice;
- the vendor's VAT number (CVR number);
- the vendor's name and address;
- the purchaser's name and address;
- the quantity and nature of the goods supplied or the extent and nature of the services provided;
- the date on which the supply of the goods or services took place or was completed, if such a date is different to the date of issue of the invoice (invoice date);
- the VAT base, unit price excluding VAT, any price reduction, bonus or discount, if not taken into account in the unit price;
- the applicable rate of VAT;
- the amount of VAT to be paid.

Supply companies may, however, disregard the serial number requirement, as indicated in section A.B.3.3.1.4 of SKAT's (the Danish Customs and Tax Administration's) legal guidance.

Billing information in connection with the use of district heating in production processes  
The various tax laws include provisions that oblige supply companies to provide commercial enterprises that use district heating in production processes with information about the size of energy taxes at least once a year.

Example:

Section 9(9) of *Kulafgiftsloven* (Act No 1292 of 17 November 2010, **the Coal Tax Act**)  
Enterprises that supply heating and cooling must, at least once a year, provide the information necessary for the calculation of the tax in accordance with Section 8(2). The Minister for Taxation may lay down the detailed rules on this.

Information obligation under *varmeforsyningsloven* (the Heat Supply Act) (Act No 1184 of 14 December 2011)

Under Section 28b of the Heat Supply Act, the heat distribution companies must provide consumers with annual information on their heat consumption and map the total heat consumption in the supply area. Data from this mapping must be published or be made available on request. However, heat supplies with a thermal capacity of less than 1 MW and



heat supplies established in connection with large buildings, where the purpose is to supply a closed group or pre-determined number of users with energy for the heating of the building and with hot water, are exempt from the provision.

According to Section 5 of the Executive Order on energy saving services in grid and distribution companies (Executive Order No 1452 of 16 December 2013), heat distribution companies must, at least once a year, provide consumers with information about the development of their energy consumption. The information must include:

- a. information on their energy consumption over the last year;
- b. a comparison with their energy consumption over the previous three years;
- c. a comparison with the energy consumption of similar categories of consumer, to the extent that there is a relevant basis of comparison. The comparison shall take place by indicating the consumer's position on a relative scale of consumption that shows best practice.

According to Section 5(2), the information for consumers on the development of their energy consumption must be provided at the same time that the bill for the latest consumption period is issued, either by sending the information together with the bill or by informing consumers where they can obtain the information.

According to the industry organisation for district heating plants in Denmark, *Dansk Fjernvarme* (Danish District Heating Association), the plants provide the above-mentioned information to consumers either by issuing a '*styringstabel*' (consumption management table) together with the annual statement, or through information for individual consumers on their websites, where consumers have access to information on their consumption via their own login. Eventually, the use of app-based solutions will also become more widespread.

On the consumption management table or on the website, the plants also inform individual consumers of their expected monthly consumption and, at the same time, allow consumers to input their actual monthly consumption. This enables consumers to continuously keep track of their own consumption.

District heating plants are therefore already making a major effort to comply with the rules by making it possible for consumers to calculate their actual consumption.

#### *Electronic billing*

Only public authorities (national and local end users) currently wish to receive their bills electronically. It is estimated that these account for around 1 % to 3 % of all bills.

If remote metering is used, the plants are also able to bill several times a year on the basis of actual consumption. It is estimated that around half of the plants currently have smart meters installed, but not all of them take advantage of the opportunity to retrieve meter data more frequently.

#### **3.1.4. Consumer information programmes and training (EED Articles 12 and 17)**

Under Articles 12 and 17 EED, Member States are obliged to focus on and strengthen consumer information, and information and training about energy efficiency. The Danish

Energy Agency has drawn up an action plan and strategy for the information campaign on energy efficiency at end-user level. The aim of this information campaign is to promote energy-efficient solutions and purchasing and energy-efficient behaviour among end users. The information campaign focuses on end users, with home owners, the public sector and commercial enterprises as specific focus areas.

Improving the energy efficiency of buildings and modifying behaviour in connection with buildings is a priority in the Danish public and consumer information campaign. This involves preparing material on energy-efficient solutions, information on building regulations, and better access to information and knowledge about energy renovation. The Danish Energy Agency's website [www.spareenergi.dk](http://www.spareenergi.dk) is the backbone of the Agency's communications with end users concerning energy-efficient solutions both in private households and in public and private enterprises.

The target for the campaign at [www.spareenergi.dk](http://www.spareenergi.dk) is to:

- ensure a solid and effective communications platform for the efficiency campaign;
- ensure the greatest possible access to information;
- become the citizen's preferred starting point for energy efficiency improvements;
- support users of tools and information.

*BedreBolig* (Better Homes) is a new scheme that will be introduced in Denmark on 1 January 2014. The aim of the scheme is to make it easier and clearer for home owners to renovate their homes by offering comprehensive, expert advice throughout the energy renovation process. In connection with the launch of *BedreBolig*, DKK 15 million has been allocated to the launch of a special information campaign.

*BedreBolig* focuses on, among other things, developing cooperation between home owners and financial institutions. This means that tools are being developed to facilitate dialogue between home owners, *BedreBolig* advisers, banks and mortgage institutions. The aim is to make information more easily available to banks and mortgage institutions so that they can advise their customers on the financing of energy improvement projects on a sound basis.

The Danish Energy Agency is also giving a lot of attention to energy labelling of buildings and has therefore developed a website [www.maerkdinbygning.dk](http://www.maerkdinbygning.dk) which focuses on this. The aim is primarily to make it easier for building owners to use energy labelling and, among other things, to facilitate an analysis of energy saving opportunities for detached houses on the basis of the data gathered through energy labelling.

The conversion from oil-fired and natural gas boilers in existing buildings is largely concerned with improving energy efficiency. For this initiative, the Danish Energy Agency has started providing impartial advice to building owners. This will consist of specific advice for building owners together with other advice and information initiatives, such as the establishment of local partnerships (see <http://spareenergi.dk/forbruger/varme/varmepumper/spoerg-om-varmepumper>).

Via the *Spareenergi* (Save Energy) website a large number of tools are being provided to help final customers improve energy efficiency, such as *Ny Varme* (New Heating), which will provide home owners with an easily accessible overview of the economics of switching from

oil and natural gas to heat pumps or district heating. *Det dynamiske energimærke* (the dynamic energy label) provides home owners with an overview of opportunities for energy improvements. *Casebiblioteket* (the Case Library) is a collection of illustrated examples from all around the country of home owners who have energy-renovated their own homes. The collection will become part of SparEnergi.dk.

In addition to buildings, the Danish Energy Agency is also focusing on appliances and renewable energy technology as part of the public and consumer information campaign. The effort in the area of appliances is intended to ensure that consumers continue to have guidance and information on both purchasing and using energy-efficient appliances and solutions. For example, in the area of lighting a lot of information material has been developed consisting of shop material, educational films and pamphlets.

#### Energy saving by energy companies

The scheme for energy saving by energy companies is discussed in detail in section 3.1.1. In the course of 2013, as part of the marketing of the scheme, the Danish Energy Agency focused on information about the scheme for end users and on disseminating rules and requirements both to energy companies and external actors, including tradesmen, installers and advisers.

The campaign will continue in 2014, when the focus will still be on raising awareness of the scheme, including through the distribution of brochures about the scheme and holding meetings with relevant actors, as well as coordinating information with the parties to the agreement.

The aim of the information campaign is 1) to help spread awareness of the scheme for energy saving by energy companies among end users and actors, 2) to ensure that energy saving by energy companies is taken into consideration in the communication of other initiatives and vice versa, and finally 3) to ensure that there is coordination between the various campaigns so that the combined energy saving effort achieves the best possible synergy and impact.

#### *Information campaign aimed at SMEs*

The Danish Energy Agency publishes *Energiledelse: Små og mellemstore virksomheder* (Energy management: Small and medium-sized enterprises), which is a guide for enterprises on using energy more efficiently. The guide is distributed via the website [www.spareenergi.dk](http://www.spareenergi.dk)

In addition, the Danish Energy Agency issues checklists which are primarily aimed at small and medium-sized enterprises that are conducting energy reviews of existing plants. In connection with the purchase of new plants and installations by enterprises, the Danish Energy Agency has drawn up requirement specifications to help draw up the correct requirements for plants or requirements in connection with tenders.

#### *Smart meters*

In connection with the installation of remote meters for end users, grid operators must inform and advise end users about the use of remote electricity meters and the potential for their use (cf. Section 3 of the Executive Order on remote electricity meters and metering of electricity at end use, Executive Order No 1358 of 3 December 2013) (<https://www.retsinformation.dk/Forms/R0710.aspx?id=160434>).

### *Training*

Training and awareness-raising about energy efficiency are important elements in the Danish Energy Agency's work to improve energy efficiency. The *BedreBolig* scheme contains a large element of training. In connection with the scheme, a training course for tradesmen has been set up. At least one employee in an enterprise must undergo the training for the enterprise to be accredited by the Danish Energy Agency under the scheme. With *BedreBolig* training, the enterprise's employees are given the best possible starting point for advising on energy renovation, and the enterprise receives an official, independent accreditation of its skills which can be shown to potential customers.

### **3.1.5. Availability of qualification, accreditation and certification schemes (EED Article 16)**

Denmark currently has various schemes for conducting energy audits of buildings and production processes in enterprises; the latter under the name of 'Registration scheme for energy audit consultants'. At the same time, in connection with the setting up of the *BedreBolig* scheme (see above section), a training course has been set up with the aim of training advisers to offer comprehensive, professional advice on energy renovation of homes.

### *Buildings*

Energy labelling of buildings must be carried out by an energy consultant employed by a certified energy labelling company. In order to obtain certification, the company must introduce a quality assurance system in accordance with ISO 9001 with certain supplementary skills requirements for energy consultants. Energy audit consultants must be qualified engineers or similar and must participate in a refresher course every third year. The specific requirements are set out in the memo '*Energistyrelsens krav til virksomheder der udfører energimærkning*' (The Danish Energy Agency's requirements for companies that carry out energy labelling), which can be found at: [http://www.ens.dk/sites/ens.dk/files/forbrug-besparelser/byggeriets-energiforbrug/energimaerkning/certificering-virksomheder-udfoerelse/ENS\\_krav\\_per\\_1\\_oktober\\_2011\\_til\\_virksomheder\\_der\\_udfoerer\\_energimaerkning.pdf](http://www.ens.dk/sites/ens.dk/files/forbrug-besparelser/byggeriets-energiforbrug/energimaerkning/certificering-virksomheder-udfoerelse/ENS_krav_per_1_oktober_2011_til_virksomheder_der_udfoerer_energimaerkning.pdf)

More information about the scheme is available at: <http://www.maerkdinbygning.dk/>

### *Registration scheme for energy audit consultants*

Registration applies to individuals. The scheme is a combined registration and quality assurance scheme for energy audit consultants at levels A and B, technical experts and verifiers for the benefit of industry and commercial enterprises.

The registration and quality assurance scheme is aimed at ensuring that energy audit consultants registered under the scheme are qualified to:

- perform voluntary energy audits;
- assist enterprises that wish to enter into an energy efficiency agreement with the Danish Energy Agency in drawing up and implementing energy management systems, including carrying out energy mapping, screening and drawing up energy action plans;
- assist enterprises in selecting and performing special audits.

In addition, the scheme is intended to ensure that technical experts are qualified to assist with verifications in connection with the conclusion of agreements.

Registered energy audit consultants have an engineering background, advanced marine engineer, professional bachelor degree in marine engineering or technical manager offshore, and have proven theoretical and practical experience in implementing energy efficiency improvements and energy saving measures in commercial enterprises.

The following qualifications and professional experience must be able to be demonstrated:

- Basic training and graduate year
- Relevant further training
- Experience of project management:
  - A level: with several cooperation partners
  - B level: with external advisers
- Mapping of energy consumption and prioritisation of action areas
- Drawn up descriptions of installations on the basis of energy saving considerations
- Carried out technical/economic assessments of energy efficiency opportunities
- Responsibility for establishing the subsequent savings-related technical changes
- Evaluation of various energy saving measures
- Design/commissioning of energy management systems
- For A level, the requirement is a total of three years' experience within the last six years (3 000 hours)
- For B level, the requirement is a total of five years' experience within the last ten years (5 000 hours)
- B consultants are required to have knowledge of energy/environmental management or quality control.

More information about the scheme is available at:

<http://energisynteknologisk.dk/energisynteknologisk.aspx>

### *Renewable energy (RE) accreditation scheme*

Denmark has also set up a voluntary accreditation scheme for enterprises that install small renewable energy systems. 'Small renewable energy systems' means biomass boilers and stoves, solar photovoltaic and solar thermal systems, and heat pumps. Enterprises can choose to be accredited for one or more of the technologies. The aim of the scheme is to promote efficient energy use and consumer protection. The accreditation scheme implements Article 14(3) of Directive 2009/28/EC on the promotion of the use of energy from renewable sources.

Enterprises can obtain accreditation from the Danish Energy Agency as either RE fitters or RE installers. Accreditation entitles the enterprise to use the designation '*VE-montørvirksomhed*' (RE fitters) or '*VE-installatørvirksomhed*' (RE installers) in its marketing and the enterprise will be included on a list of accredited enterprises on the Danish Energy Agency's website. For accreditation as RE installers, the enterprise must already be authorised as electrical or plumbing and heating installers. In order to become accredited, the enterprise must also have a quality control system approved by a supervisory body for RE fitters and RE installers. The staff of the enterprise must meet specific training requirements,

see: <http://www.ens.dk/forbrug-besparelser/byggeriets-energiforbrug/ve-godkendelses-ordningen/virksomhed>

### *Accreditation of verifiers*

The Danish accreditation body (DANAK) was selected by *Sikkerhedsstyrelsen* (the Danish Safety Technology Authority) to be the national accreditation body in Denmark. In connection with accreditation, DANAK assesses the skills of, for example, a certification body.

At present, there are three certification bodies accredited by DANAK to certify energy management systems as complying with DS/ISO 50001. In addition, there are at present five certification bodies accredited by DANAK to certify environmental management systems as complying with DS/EN ISO 14001.

If enterprises subject to Article 8 EED can satisfy the requirement of energy audits on the basis of a certified ISO 50001 energy management system, there are at present certification bodies which may be expected to be able to undertake such audits under ISO 50001. Where the energy audit requirement can be met on the basis of certified ISO 14000 energy management, it shall be determined whether certification bodies are available. It shall also be determined whether accreditation is being issued for energy audits under EN 16247-1 or whether inspections should take place in another way.

### *Further development*

It is considered that, at present, Denmark has several good schemes in place to ensure competence, objectivity and reliability among suppliers of energy services, energy audits, etc. (Article 16). With regard to Article 8 and the implementation of mandatory energy audits for large enterprises, consideration is currently being given to whether the existing schemes are satisfactory or need to be modified.

### **3.1.6. Energy Services (EED Article 18)**

The definition of energy services is given in Article 2(7) of the Directive. On the basis of the Directive's definition, Denmark is working with a relatively broad definition of energy services. Thus, energy services include a wide range of activities promoting energy savings and energy efficiency. In Denmark, the term '*energitjenester*' (energy services) therefore covers various activities such as advice, information, training, installation of equipment and appliances, technological development, and financing models. Energy services can also be a combination of these activities.

In connection with energy saving by energy companies, there are, as described in section 3.1.1, a large number of energy saving actors offering households, public institutions and enterprises various types of energy services. These actors include various types of tradesmen and installation companies, consultant engineers, and more specialised energy saving companies. They are typically focused on the realisation of energy savings, and they offer consumers advice and other professional assistance prior to the actual realisation.

In addition, several initiatives have been taken in Denmark to promote energy services. The Danish Energy Agency's website ([www.spareenergi.dk](http://www.spareenergi.dk)) has been developed to be an entry point for all final customers, including households and the public and private sectors, who

want to improve energy efficiency. The website provides guidance, advice and tools aimed at the target groups. This means that [www.spareenergi.dk](http://www.spareenergi.dk) is the entry point for various types of energy service providers and advice services. This includes the following:

- *Håndværkerlisten* (the tradesman list), <http://spareenergi.dk/forbruger/vaerktoejer/haandvaerkerlisten/>  
The aim of the tradesman list is to give the final customer an easy way to find energy solutions and, at the same time, to point to some tradesmen who could carry out the task. The focus is on energy savings in buildings.
- *Varmepumpelisten* (the heat pump list), <http://spareenergi.dk/forbruger/varme/varmepumper/varmepumpetyper>  
The aim of this list is to provide an overview of the different types of heat pump and help in choosing the right one.
- *BedreBolig* (Better Homes) advisers  
As part of the Danish Energy Agency's new *BedreBolig* scheme (see section 3.1.4), a number of *BedreBolig* advisers are being trained, who through training and upskilling will become accredited as *BedreBolig* advisers. These are trained to provide comprehensive advice on energy renovation of homes.
- Advice on replacing oil-fired boilers, <http://spareenergi.dk/forbruger/varme/raadgivningstjeneste>  
The Danish Energy Agency has financed an advice scheme aimed at helping and advising home owners who want to replace their oil-fired or natural gas boilers with another form of heating. The advice will be provided by a partnership consisting of *Energitjenesten* (the Energy Service), *Bolius* and *Teknologisk Institut* (Danish Technological Institute).
- *Videncenter for energibesparelser i bygninger* (Knowledge centre for energy savings in buildings), <http://www.byggeriogenenergi.dk/>  
A scheme which was continued in the latest energy policy agreement of March 2012. The knowledge centre collects and disseminates knowledge about concrete and practical ways to reduce energy consumption in buildings. The knowledge centre does this by helping the parties in the construction industry to improve their qualifications and gain new tools to implement energy saving measures in buildings. The knowledge centre is aimed both at the construction industry and individuals seeking advice and guidance.
- *Energiselskabernes Spareindsats* (Energy saving by energy companies) is also part of the Danish effort to promote energy services, <http://www.ens.dk/forbrug-besparelser/energiselskabernes-spareindsats>  
The initiative is discussed in more detail in section 3.1.1. As part of the scheme, grid and distribution companies can provide advice and information on savings and enter into agreements with actors and direct contracts with consumers concerning financial involvement in and realisation of savings in their own networks.

In addition to the specific initiatives started by the Danish Energy Agency to promote energy services, various other organisations are also working on promoting energy services. These include, among others:

- *Energitjenesten* (the Energy Service) ([www.energitjenesten.dk](http://www.energitjenesten.dk)), which provides free and impartial information on energy savings and renewable energy.

- Bolius ([www.bolius.dk](http://www.bolius.dk)), which was established for the purpose of providing home owners with impartial, understandable and accessible knowledge on housing. Bolius is owned by Realdania, a non-profit commercial association.
- *Teknologisk institut* (Danish Technological Institute) ([www.teknologisk.dk](http://www.teknologisk.dk)), which is a GTS (*godkendt teknologisk service*, accredited technological service) institute, a non-profit organisation working for innovation and technological development in Danish enterprises.

ESCOs (energy service companies)

A number of Danish enterprises also offer more specific energy services in the form of various kinds of ESCO cooperation. Danish municipalities in particular have made use of various ESCO models. The Danish Energy Agency has not systematically collected information on this area, and therefore does not have a complete overview of which enterprises offer these energy services.

#### *The national market for energy services*

In connection with the development of markets for energy services, the focus from the Government side has been on advice and information. The Danish Energy Agency's work on energy services is largely focused on gathering advice on energy services and focusing on the areas in which many people will benefit from receiving energy services. This also entails lists of available and qualified suppliers of energy services. The advice is aimed at all types of end user, including households, the public sector and enterprises. The Danish Energy Agency has also promoted the market for energy services on the transport side through strategic partnerships for the rolling out of electric vehicles.

Households, including private housing, are a large part of the Danish Energy Agency's work of promoting energy services. A large number of the above-mentioned energy services are therefore focused on households, not least the renovation of housing. The latest initiative, *BedreBolig* (Better Homes) is important in this regard for promoting a market for energy services among private home owners. As with energy saving by energy companies, a major element consists of promoting the market for energy services in the form of a focus on advice and support for the implementation of energy saving measures in, among others, private households.

Enterprises, both small and large, can also receive a lot of help to promote energy efficiency from the Danish Energy Agency, with [www.spaerenergi.dk](http://www.spaerenergi.dk) forming the backbone of the advice effort. Special advice tools have been developed for SMEs which can also be of benefit to large enterprises. RE for production processes is another initiative aimed at enterprises (see section 3.4.1) in which support is provided for the implementation of energy efficiency measures in production processes in connection with the conversion to renewable energy and district heating.

In the public sector, there has long been a focus on various models for energy services, and, in particular, various forms of ESCO model have been used in Danish municipalities. Many municipalities have made use of these energy services to promote energy efficiency and energy savings, primarily in connection with energy optimisation of the municipalities' existing buildings. In December 2013, a study of the use of ESCOs by Danish municipalities



found that around 30 out of 98 municipalities use ESCOs.<sup>7</sup> According to this study, experience of ESCOs in the municipalities is still limited, because the lifetime of the projects is relatively long. One conclusion from the study was that there are large variations in the various ESCO cooperations and projects, depending on the size of the project and the municipality's own size and resources.

Back in 2009, some trials were made of standard contracts for ESCO models. There were also various attempts to promote ESCOs through, for example, workshops. Meanwhile, the above-mentioned study of the use of ESCOs by municipalities concluded that designing standard contracts did not necessarily make any sense in the light of the many different ways of conducting ESCO projects.

There are a large number of private ESCO providers who, depending on the size of the project, help with advice, installation and operation. The vast majority of the projects are aimed at buildings, whether they concern households, enterprises or municipalities.

### **3.1.7. Other energy efficiency measures of a horizontal nature (EED Articles 19 and 20)**

On 5 February 2014, the Minister for Housing, Urban and Rural Affairs presented Bill No L 129, *Forslag til lov om ændring af lov om leje, lov om midlertidig regulering af boligforholdene, lov om byfornyelse og udvikling af byer og forskellige andre love* (Proposal for an Act amending the Rent Act, the Housing Regulation Act, the Urban Renewal Act and various other Acts). The aim of the Act is, among other things, to make it more attractive for landlords and tenants to carry out energy saving measures.

In particular, the proposals concerning cost-effective energy improvements and agreed green urban renewal ensure that, relative to the existing legal situation, the gains from carrying out energy improvements in private rented properties will be divided differently between the landlords and tenants so that it is more attractive for landlords to make energy improvements without changing the tenants' overall housing costs.

An evaluation of the elements of the legislative proposal will be carried out after the Act has been in force for two years. The evaluation will show the extent to which L 129 has worked as intended or whether there is a need to make adjustments.

#### *National energy efficiency fund*

At the moment, Denmark has established the grant scheme RE for production processes (see section 3.4.1). At the same time, energy saving by energy companies (see section 3.1.1) is making a large contribution to the realisation of energy savings, and the obligated parties are making a substantial contribution to consumers' energy efficiency measures. Therefore, there is not considered to be a need to set up a national energy efficiency fund at present.

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<sup>7</sup> 'ESCO i danske kommuner, en opsamling af motiver, overvejelser og foreløbige erfaringer med ESCO i kommunale bygninger' (ESCOs in Danish municipalities: a collection of themes, reflections and experiences so far with ESCOs in municipal buildings), *Statens byggeforskningsinstitution* (Danish Building Research Institute), Aalborg University 2013.

### **3.1.8 Financing of horizontal measures**

In 2014, the Danish Energy Agency's information campaign on energy efficiency at end-user level, with home owners, the public sector and commercial enterprises as target groups, will be financed by information funds from the energy efficiency contribution (DKK 17.9 million), funds from the energy agreement of 2012 concerning energy renovation (DKK 4.5 million), support from the energy saving action (energy saving by energy companies – DKK 1 million) and promotion of alternatives to oil-fired boilers (DKK 13.6 million). There will also be information activities in connection with *BedreBolig* in 2014.

The Danish municipalities have good opportunities to take up loans for energy saving measures. On the basis of the Municipal Loan Order (*bekendtgørelse nr. 1580 af 17/12 2013 om kommunernes låntagning og meddelelse af garantier m.v.* – Executive Order No 1580 of 17 December 2013 on borrowing and provision of guarantees etc. by municipalities), municipalities can automatically take up loans for energy savings. First, for measures concerning energy consumption as a result of energy labelling prepared in accordance with *bekendtgørelse om energimærkning af bygninger* (Executive Order on energy labelling of buildings). Second, loans may be taken up to replace lighting and electrical fittings with more energy efficient types.

## **3.2. Energy efficiency in buildings**

### **3.2.1. Addressing the requirements of the recast Energy Performance of Buildings Directive (EPBD) (2010/31/EU)**

In connection with the reporting requirements on the energy performance of buildings, Denmark has produced calculations of cost-optimal levels of minimum energy performance

requirements. These calculations can be found in the report 'Cost-optimal levels of minimum

energy performance requirements in the Danish Building Regulations'.

The report is available at:

[http://ec.europa.eu/energy/efficiency/buildings/implementation\\_en.htm](http://ec.europa.eu/energy/efficiency/buildings/implementation_en.htm)

In addition, in accordance with the requirements of Article 10(2) of Directive 2010/31/EU on the energy performance of buildings, Denmark has drawn up a list of measures and instruments aimed at promoting the objectives of the Directive. The list can be found at:

[http://ec.europa.eu/energy/efficiency/buildings/doc/dk\\_letter.pdf](http://ec.europa.eu/energy/efficiency/buildings/doc/dk_letter.pdf)

### **3.2.2 Building renovation strategy (EED Article 4)**

See Annex B, Denmark's building renovation strategy

### **3.2.3 Additional measures addressing energy efficiency in buildings and appliances**

#### *Energy-efficient appliances and equipment*

A campaign to improve the energy efficiency of appliances and products is an important part of the Danish effort to improve energy efficiency, in which energy labelling and ecodesign

requirements are the two most important schemes. In addition, there are the Energy Star programme and European industry agreements. All of these share a European dimension in which Denmark is following the EU's targets and energy requirements for products and appliances.

At the end of 2013, there were requirements for a total of 46 product types, and at least 85 product types are expected to be covered by the rules in 2020. Previously, the schemes mainly covered household appliances, but in future they will also cover building components (e.g. windows) and products aimed at enterprises (e.g. various types of pump, electric motor, etc.).

In 2013, the Danish Energy Agency conducted an analysis of the Danish energy saving impact as a result of ecodesign requirements and energy labelling for products. The analysis calculated the impact of the ecodesign requirements to be 5 640 GWh per year in 2020, corresponding to 5 % of energy consumption in 2011 excluding transport. The requirements are therefore making a significant contribution to reducing Danish energy consumption.

### **3.3. Energy efficiency in public bodies**

#### **3.3.1 Central government buildings (EED Article 5)**

In its implementation of the Energy Efficiency Directive, Denmark is considering using Article 5(6) EED and setting an energy saving target expressed in MWh. An inventory of heated and/or cooled central government buildings is not mandatory if a Member State opts for the alternative approach in Article 5(6) and if the energy saving target is expressed in terms of values (see page 29 of the Commission's guidance).

#### **3.3.2 Buildings of other public bodies (EED Article 5)**

In Denmark, agreements have been entered into with regional and local parties concerning their energy efficiency efforts. In 2007, the then Ministry of Transport and Energy entered into a voluntary agreement with Local Government Denmark (LGDK) concerning the realisation of energy savings in municipalities. In 2009, the Minister for Climate and Energy entered into a corresponding agreement with Danish Regions concerning energy savings in the regions. The agreements concern energy-efficient behaviour, purchasing and buildings, including the introduction of energy management, the implementation of cost-effective energy saving projects and energy-efficient operation, maintenance and conversion.

In addition, in connection with *Vækstplan DK* (Growth Plan DK), the Danish Government has adopted increased investment in the renovation of public housing and energy renovation of government buildings which can help encourage public bodies and public sector organisations to adopt and implement energy efficiency plans. A political agreement has therefore been entered into to increase the investment framework of *Landsbyggefonden* (the Danish National Building Fund) by DKK 4 billion in 2013 for renovation. In addition, DKK 100 million has been set aside in the period 2015-2016 to bring forward maintenance of central government buildings where energy optimisation can be carried out at the same time.

A survey was conducted for the Danish municipalities in December 2013 in which 53 municipalities said they had an energy efficiency plan. This concerns the following municipalities:

|                 |                |                   |
|-----------------|----------------|-------------------|
| Allerød         | Guldborgsund   | Odense            |
| Ballerup        | Halsnæs        | Ringkøbing-Skjern |
| Billund         | Hedensted      | Rødovre           |
| Bornholm        | Herning        | Roskilde          |
| Brøndby         | Hjørring       | Samsø             |
| Brønderslev     | Hørsholm       | Silkeborg         |
| Dragør          | Hvidovre       | Slagelse          |
| Egedal          | Ishøj          | Sønderborg        |
| Esbjerg         | Køge           | Svendborg         |
| Fredensborg     | Kolding        | Syddjurs          |
| Fredericia      | Lyngby-Taarbæk | Thisted           |
| Frederikshavn   | Mariagerfjord  | Tønder            |
| Frederikssund   | Middelfart     | Vejen             |
| Furesø          | Næstved        | Vejle             |
| Faaborg-Midtfyn | Norddjurs      | Aabenraa          |
| Gentofte        | Nordfyns       | Aalborg           |
| Glostrup        | Nyborg         | Aarhus            |
| Greve           | Odder          |                   |

At regional and local level, many municipalities and regions have entered into various types of agreement in which the local authority undertakes to work to reduce energy consumption or reduce CO<sub>2</sub> emissions locally. This concerns, for example, the Danish Society for Nature Conservation's Climate Communities and the European Commission's Covenant of Mayors. A climate community is a municipality which has signed up to reducing the municipality's CO<sub>2</sub> emissions by a minimum of 2 % per year until an agreed date. The agreement applies to the municipality as a business and there are no limits to the initiatives the municipality can take to achieve its target. It may be anything from energy savings in the municipality's own buildings to major renewable energy projects (see [www.klimakommuner.dk](http://www.klimakommuner.dk)). The Covenant of Mayors is a European movement involving local and regional authorities that have voluntarily committed themselves to increased energy efficiency and the use of renewable energy sources in their areas. The signatories to the Covenant of Mayors have undertaken to fulfil and exceed the EU's target of reducing CO<sub>2</sub> emissions by 20 % by 2020 (see [www.borgmesterpagten.eu](http://www.borgmesterpagten.eu)).

### 3.3.3 Purchasing by public bodies (EED Article 6)

The current Danish circular on energy efficiency in state institutions No 9787 of 1 October 2009 contains requirements for energy-efficient public procurement. Denmark is working on a revision of the circular on energy efficiency in state institutions in order, among other things, to implement obligations under Article 6 EED. After the revision, the wording of the circular will state specifically that services are covered by the energy-efficient procurement requirements for government authorities.

As mentioned in point 3.3.2, the current agreements with local and regional parties cover energy-efficient procurement. In connection with new agreements with municipalities and

regions, it is the aim that they should also contain a direct and explicit reference to the procurement of energy-efficient services.

### **3.4. Other end use energy efficiency measures, including in industry and transport**

#### **3.4.1 Main policy measures addressing energy efficiency in industry**

##### *Voluntary agreement scheme*

From 1996 to 31 December 2013, the Danish Energy Agency entered into energy efficiency agreements with large, energy-intensive businesses in Denmark. In order to take part in the scheme, the businesses agree to implement energy management and improve energy efficiency in their production in exchange for a substantial rebate on their energy-saving tax.

Participation in the scheme meant that the businesses entered into a binding three-year programme in which the business had to, among other things, implement the international energy management standard DS/EN ISO 50001, conduct special investigations of the business's energy consumption, and conduct thorough analyses of production processes or plants, or an analysis of whether, in the long term, it would be possible to introduce new technology in order to thereby reduce energy consumption.

The basis for this agreement disappeared on 31 December 2013 in connection with *Vækstplan DK*, which abolished the payment by the businesses of energy-saving tax (formerly CO<sub>2</sub> tax) on electricity for production processes as of 1 January 2014.

Work is currently under way to follow up the success of the voluntary agreement scheme, possibly in the form of a new scheme providing subsidies to businesses towards payment of part of the PSO tariff (public service obligation tariff). The support will initially be conditional on entry into energy efficiency agreements. The scheme requires approval under the EU's new environmental protection and energy framework, which was adopted on 9 April 2013. It must therefore be considered what such a scheme *could* look like under the new state aid rules.

##### *Renewable energy for production processes*

In connection with the energy agreement of March 2012, a fund of DKK 3.75 billion was allocated from 2013 to 2020 inclusive to support enterprises that replace fossil fuels with renewable energy in their production processes or switch to district heating. The scheme can provide grants for conversion of fossil fuel installations, connection to district heating, conversion of large energy systems producing energy for production processes for enterprises, and energy efficiency improvements in connection with conversion projects. The expected effects of this scheme in 2020 are calculated as:

- reduction in fossil energy: around 16 PJ/year
- increase in share of renewables: around 1.1 %
- reduction in CO<sub>2</sub> emissions: around 1.5 % (1990), corresponding to 1 million tonnes of CO<sub>2</sub>e per year

##### *Energy saving by energy companies*

Since 2006, the grid and distribution companies in the areas of electricity, natural gas, district heating and oil have been key actors in the energy saving effort and have been subject to annual energy savings. The aim of the agreement is to create a solid basis for more cost-effective and market-oriented energy saving, with a particular focus on achieving cost-effective savings.

With the energy agreement of March 2012, the savings target for supply companies was increased to 10.7 PJ per year in 2013 and 2014 and 12.2 PJ per year in 2015-2020. From 2015, the savings target for supply companies will correspond to around 3 % of Denmark's final energy consumption (excluding energy consumption in the transport sector). With the exception of 2006, the energy companies have met their targets.

The agreement is aimed in particular at energy savings among all final customers, but the commercial sector accounts for a relatively large share of the energy savings achieved. 47 % of savings reported by companies in 2012 were in the commercial sector, of which 83 % in manufacturing and 17 % in trade and services. Households and the public sector accounted for 33 % and 6 % of the year's savings respectively. Energy savings achieved in connection with network optimisation (primarily in connection with district heating) and collective solar thermal systems accounted for 4 % and 2 % respectively, while conversions accounted for around 9 % of the energy savings. The latter were previously included in the savings of individual sectors, but can no longer be broken down by sector. (For more information about the agreement, see section 3.1.1)

#### *International cooperation on energy efficiency in industry*

In addition to the national focus on energy efficiency in industry, for a number of years Denmark has done a lot of work on spreading energy efficiency in enterprises in other countries. The aim is to spread and transfer Denmark's many positive experiences with energy efficiency, focusing on, among others, enterprises and industry.

The international work is based on a specific cooperation agreement with China and the setting up of a Low Carbon Transition Unit (LCTU) under the Ministry of Climate, Energy and Building. In *Klimapuljen 2012* (the Climate Envelope for 2012), the Government allocated a total of DKK 20 million to the LCTU, which shall assist selected growth economies in the transition to low emissions over two years. The cooperation with China is based on, among other things, Denmark's many positive experiences with energy efficiency in energy-intensive Danish businesses, including experience with the voluntary agreement scheme (see above) and other tools to promote renewable energy and energy efficiency.

### **3.5 Energy efficiency measures in transport**

#### **3.5.1 Main policy measures addressing energy efficiency in transport**

In Denmark, a large number of initiatives have been taken to promote energy efficiency in the transport sector.

#### *Measures which can improve energy efficiency in public transport*

- Conversion from diesel to electric trains on main lines. The conversion is being financed by *Togfonden* (the Train Fund; see below) and is taking place until 2025.
- Fuel saving and energy-efficient buses give advantages in public tenders
- Energy efficiency requirements for taxis

#### *Measures which can make public transport more attractive*

- Grants (until 2013) for bus mobility and service improvements
- Grants for improved access to train stations and platforms.
- Metro expansion and development of light railways. Being established in particular to improve mobility and may not yield any energy efficiencies.

#### *Zones*

- Environmental zones in large towns. Established out of consideration for the environment and have no or very little effect on transport efficiency.

#### *Programmes to encourage eco-driving?*

- 'Kør grønt' (Green driving) measures on buses and trains can provide contractual benefits
- 'Kør grønt' (Green driving) campaign for car drivers (until 2013, but the advice is still available)
- Mandatory refresher courses for professional drivers which include 'green driving'. The refresher courses are mandatory under EU law, but the 'green driving' element is a Danish national interpretation within the framework of the Directive.
- Certification scheme for transport in municipalities and enterprises to reduce CO<sub>2</sub> emissions.

#### *Financial support for sustainable transport measures*

- *Togfonden* (the Train Fund) (around EUR 7 billion) for improvement and electrification of railways
- Accessibility fund for the improvement of accessibility at stations, transport fund for station modernisation and new stations and a fund for better access to public transport, including parking
- Cycle fund for, among other things, establishing cycle paths
- Fund for energy-efficient transport solutions
- Infrastructure fund for electric, gas and hydrogen vehicles. However, gas vehicles do not improve energy efficiency.

#### *Tax incentives*

- In 2007, vehicle taxation was changed so that the registration tax was reduced for cars with low fuel consumption
- A green owner's tax related to the vehicle's fuel consumption has existed since 1997
- Electric and hydrogen vehicles are exempt from tax until 2015 inclusive

### **3.5.2 Savings arising from transport measures**

#### *Savings up to 2012*

The energy consumption of the transport sector in Denmark rose in the period between 1990 and 2007, when the energy consumption was 224 PJ. From 2007 to 2012, energy consumption in the transport sector fell, amounting to 204.8 PJ in 2012. It is difficult to ascribe this fall in energy consumption to the individual measures mentioned in section 3.5.1. Ex ante and ex post analyses of the energy savings achieved or expected to be achieved as a result of the implementation of the above-mentioned measures have only been conducted to a limited extent.

The financial crisis which took hold in 2008 led to reduced fuel consumption in both the private sector and in industry. The change in vehicle taxation in 2007 had a major influence on what new cars are bought, especially by private individuals. Today's new vehicles are 20 to 40 % more fuel efficient than seven years ago, and Denmark has already achieved the EU target for 2015 of average CO<sub>2</sub> emissions for new cars of 130 g CO<sub>2</sub>/km.

#### *Expected savings up to 2020*

Denmark is short of the target of a 40 % reduction in CO<sub>2</sub> in the non-quota sector by 2020, having a shortfall of around 6 percentage points. A climate plan has been drawn up, and measures to close the CO<sub>2</sub> reduction gap will be taken in the housing, agricultural and transport sectors. Measures in the transport sector are, with few exceptions, expensive compared with measures in the housing and agricultural sectors, which are therefore expected to have to bear a large share of the reduction.

The measures mentioned in the above section are expected to provide a basic development with continued slackening of the transport sector's energy consumption up to 2020. Among other things, the electrification of the railway network, which will be completed in the mid 2020s, is expected to lead to an annual reduction in CO<sub>2</sub> emissions of 220 000 tonnes.

### **3.5.3 Financing of energy efficiency measures in transport**

The Danish Parliament has allocated DKK 8.7 billion to electrification of the Danish railway network.

## **3.6 Promotion of efficient heating and cooling**

### **3.6.1. Comprehensive assessment**

According to Article 14(1), by 31 December 2015, all Member States must carry out a comprehensive assessment of the potential for the application of high-efficiency cogeneration and efficient district heating and cooling. The procedure for carrying out these assessments of potential is set out in Annex VIII to the EED, and the method for conducting the cost-benefit analyses is described in Annex IX, Part 1 to the EED.

This reporting describes the status of the work of preparing the comprehensive assessment, including the methods used, the process so far, and the plans for the completion of the work. The Danish Energy Agency is responsible for the analysis work (Annex VIII, 1(a) to 1(j), with the exception of 1(g).

1(g) concerns the establishment of strategies, policies and measures to be able to realise defined socio-economic potentials for high-efficiency cogeneration and efficient district heating and cooling in accordance with the Directive's definitions. The establishment thereof requires a decision by the Danish Government.

The comprehensive assessment of the heating and cooling sector will be based on the following sub-analyses, all of which are in the process of being completed:

- An analysis of the future role of district heating. This analysis is being carried out as a follow up to the energy policy agreement of 22 March 2012, which the Danish Government entered into with the Liberals, the Danish People's Party, the Red-Green Alliance and the Conservative People's Party. The analysis looks at, among other things,



the socio-economic and corporate-economic potential for the spread of district heating and which forms of district heating production are the most cost-effective.

- An analysis of the opportunities to make better use of the waste heat from industry. This analysis is also included in the energy agreement of 22 March 2012. The analysis contains, among other things, an assessment of the business-economic potential for the utilisation of waste heat and the current framework conditions. The analysis is currently being extended to include an analysis of the socio-economic potential with a view to satisfying the reporting requirement in Annex VIII.
- An analysis of the national cooling needs and estimates of the technical and socio-economic potential for district cooling from waste heat etc. This analysis is designed so that the requirements for analyses in Annex VIII will be satisfied in the area of cooling.
- Long-term scenario analyses of the whole energy system.

The energy policy agreement also comprises national analyses of other parts of the energy system (electricity system, gas system, use of biomass, large heat pumps, biogas, energy renovation of the building stock, etc.). The long-term scenario analyses cover the whole energy system and have been prepared in order to identify relationships between the various sub-sectors (electricity, gas and district heating) and the need for strategic choices in a cost-effective transition of the energy system to one based on renewable energy sources.

When designing the district heating analysis and the waste heat analysis, some consideration has been given to the method specified in Annex VIII. However, as these two analyses are primarily carried out to meet national policy needs, there may be small supplementary analyses in the area of district heating and waste heat in order to satisfy the content requirements of the EED.

Standardised assumptions have been used with regard to the discount rate and fuel price developments as well as standardised assumptions for the technologies used in the analyses, supplemented by further technological data where necessary. The Danish Energy Agency prepares and regularly updates standardised assumptions which have been used. The studies include impact analyses of the following parameters: primary energy consumption, CO<sub>2</sub> emissions from the energy sector, and socio-economic and corporate-economic costs.

The above-mentioned analyses were prepared, as mentioned, as a follow-up to the energy policy agreement of March 2012. The energy policy agreement also contains a requirement to prepare an analysis of the existing subsidy and tax system with a view to investigating the need for adjustments thereof in order to ensure the correct incentives for the green transition of the energy system, corresponding to the results of the above-mentioned national analyses. The analysis of the subsidy and tax system is expected to be completed in spring 2015.

The analysis part of the comprehensive assessment is planned to be completed in the second half of 2014. Afterwards, work will start on assessing the need for strategies, policies and tools with a view to realising the socio-economic potential of increased cogeneration, district heating and district cooling. The results of the subsidy and tax analysis are expected to have a key role in this regard.

### 3.6.2. Individual installations: cost-benefit analysis and results

The Directive's requirement to carry out a cost-benefit analysis applies to power stations, industrial installations and district heating and cooling networks at the time they are established or have to undergo extensive renovation. Energy production installations that are planned to be built in connection with a district heating or cooling network are also covered. The requirements only apply to installations with a thermal input of over 20 MW.

Many of the Energy Efficiency Directive's requirements are already existing Danish law. Collective heating systems (cogeneration installations with electrical output of up to 25 MW, heat production installations and district heating networks) are already subject to project approval today, which includes the preparation of socio-economic assessments and analyses. The approval authority is the municipal council.

The current rules on project approval for *collective heating systems* will be maintained, and the existing requirements for cogeneration and socio-economic benefits can be regarded as tougher measures than the EED obligations to utilise waste heat, which are based on a cost-benefit analysis.

The current rules on collective heating systems are designed to promote cogeneration of heat and electricity. If a planned installation is going to have a thermal capacity of over 1 MW, the installation must in principle be designed as a cogeneration installation, unless it is economically more advantageous to establish a pure heat-producing installation. The current rules therefore contain a direct requirement to utilise waste heat from electricity generation in collective heating systems. The municipalities' assessment of a collective heating system project includes both socio-economic and corporate-economic assessments as well as a cost-benefit analysis. It is also a requirement to prepare a socio-economic analysis of relevant scenarios in which the project is compared with possible alternatives. A project can only be approved if it shows better socio-economic results than the relevant alternatives. If, for example, the utilisation of waste heat is the best option from a socio-economic perspective, the municipal council will only approve that project and not another project in which the waste heat is not utilised.

*Power plants with an electrical output of over 25 MW* currently require permission for the establishment of or substantial changes to the installation, but there is no requirement to carry out a cost-benefit analysis. The approving authority is the Minister for Climate, Energy and Building, and the task is delegated to the Danish Energy Agency.

The current rules on conditions and procedures for granting permission for the establishment of new electricity generation installations or substantial changes to existing installations will be changed so that in future an application will have to be accompanied by a cost-benefit analysis in accordance with Annex IX, Part 2 of the Energy Efficiency Directive which can be included in the Danish Energy Agency's decision.

Under current legislation, *industrial installations* must have approval for any supply of waste heat to the district heating network, but the establishment of the installation itself does not require approval. With regard to *district cooling installations*, only municipal installations require approval pursuant to *lov om kommunal fjernkøling* (the Municipal District Cooling Act), so there is no requirement to prepare a cost-benefit analysis.

On 29 January 2014 a Bill was presented amending the Heat Supply Act and the Municipal District Cooling Act. The amendments mean that the Minister for Climate, Energy and Building has the authority to approve the establishment and comprehensive renovation of industrial installations and district cooling installations and to lay down rules for the approval of projects for such installations in order to satisfy the requirements of the Energy Efficiency Directive. As part of the approval procedure for installations, there is a requirement to prepare a cost-benefit analysis in accordance with Annex IX, Part 2 of the Energy Efficiency Directive. The processing of applications for approval will be delegated to the Danish Energy Agency.

### **3.6.3. Individual installations: exemptions and exempting decisions**

With regard to the approval procedure for *collective heating systems* regulated under the Heat Supply Act, specific exemptions from the requirement to prepare a cost-benefit analysis will not be laid down. As indicated in point 3.6.2., the current procedure for collective heating systems, which means that enterprises must prepare a socio-economic analysis, will be maintained. The municipal council, which is the approving authority, can only approve a project if, on the basis of a specific assessment, it is socio-economically the most advantageous project. Therefore an application for the approval of a proposed project must be accompanied by a socio-economic assessment and analysis. The municipal council may, in the light of the different natures and backgrounds of the proposed projects, decide that certain information, including the socio-economic assessment and analysis, is not required.

In the light of the fact that the municipal council must assess whether the project is socio-economically the most advantageous project, a socio-economic assessment and analysis would normally be required, unless there are no alternatives to the project.

With regard to the permit requirements for *electricity generation installations* covered by the Electricity Supply Act which are designed as cogeneration installations, it will not be mandatory to submit a cost-benefit analysis. The purpose of the analysis is to assess whether it may be worthwhile to utilise waste heat from the electricity generation. A cost-benefit analysis is therefore irrelevant in cases where the project is already designed to utilise the waste heat. The preparation of a cost-benefit analysis is therefore only required in relation to applications concerning electricity generation installations without heat utilisation.

Denmark is considering allowing the following exemptions from the requirement to prepare a cost-benefit analysis in relation to electricity generating businesses:

1. Projects for installations where the assessment under the national cost-benefit analysis pursuant to Article 14(3) EED is that the conditions are not suitable for the supply of district heating or district cooling.
2. Projects for installations where the utilisation of waste heat would require the establishment of a transmission pipeline to the district heating or district cooling network longer than 5 km.
3. Projects for peak and reserve load electricity generation installations which are planned to operate for less than 1 500 hours per year as a rolling average over a five-year period.
4. Projects for installations that need to be located close to a geological storage site approved under Directive 2009/31/EC which facilitates storage of CO<sub>2</sub> from the electricity generation installation.

An electricity generating installation which is exempt from the requirement to prepare a cost-benefit analysis must still obtain a permit in order to verify compliance with the applicable emission requirements.

Most of the electricity generation installations in Denmark utilise waste heat. There are only a few installations that have been or are expected to be established that do not utilise heat.

With regard to *industrial installations and district cooling installations*, it will similarly not be mandatory to submit a cost-benefit analysis if the project is designed to utilise waste heat. However, the project will still have to be presented for approval as evidence that the project includes utilisation of waste heat.

Denmark is considering allowing the following exemptions from the requirement to prepare a cost-benefit analysis in relation to industrial installations and district cooling installations:

1. Projects for installations where the assessment under the national cost-benefit analysis pursuant to Article 14(3) of the Energy Efficiency Directive is that the conditions are not suitable for the supply of district heating or district cooling.
2. Projects for industrial installations where the utilisation of waste heat would require the establishment of a transmission pipeline to the district heating or district cooling network longer than 5 km.
3. Projects for district cooling installations where the utilisation of waste heat to operate the installation would require the establishment of a transmission pipeline to the installation longer than 5 km.
4. Projects for industrial installations where the temperature of the waste heat is lower than 10 degrees.
5. Projects for district cooling installations where the temperature of the waste heat which could otherwise be used is lower than 70 degrees.

Because the sole purpose of the approval procedure is to ensure that a cost-benefit analysis is prepared for industrial installations and district cooling installations, in cases where it is not considered relevant to have a cost-benefit analysis, the installation does not require project approval.

It is estimated that each year the Danish Energy Agency will receive around seven or eight applications for approval of industrial installations or district cooling installations.

The 'comprehensive assessment' at Member State level (see Article 14(1) EED) is expected to result in a verification/qualification of the above-mentioned exemptions for electricity generation installations, industrial installations and district cooling installations.

The comprehensive assessment must be completed no later than the end of 2015. Analyses and assessments will follow the guidelines in Annex VIII.

Threshold values governing when enterprises can be exempt from preparing cost-benefit analyses pursuant to Article 14(5)(a) to (d) are expected to be verified/qualified for the following parameters:

- Minimum values for available quantities of waste heat and relevant temperature levels.

- Minimum values for sales opportunities for waste heat.
- Distance between industrial installations and district heating networks or other large heat customers.
- Relationships between the above parameters.

With regard to the exemption for installations where utilisation of waste heat would require a transmission pipeline longer than 5 km, this is based on provisional results from the analysis of the role of district heating. In Denmark, district heating is more widespread than in other Member States. The analysis has shown that it is generally not socio-economically advantageous to designate new areas for district heating. Only the extension of existing district heating networks is considered to be socio-economically advantageous.

The exemption for peak and reserve load electricity generation installations is an exemption permitted under Article 14(6)(a) of the Directive.

The exemption for electricity generation installations which will be able to store CO<sub>2</sub> is an exemption permitted under Article 14(6)(c) of the Directive.

### **3.7.1. Energy efficiency criteria in network tariffs and regulations**

#### *Network tariffs*

According to Section 73 of the Electricity Supply Act, grid operators must price their services according to reasonable, objective and non-discriminatory criteria relative to the costs that the individual customer categories give rise to. The starting point is therefore a requirement of cost-oriented prices and the same prices for comparable consumer categories.

With a view to promoting efficient network utilisation and security of supply, price differentiation will be permitted from 1 October 2014, although the date of a forthcoming legislative proposal is expected to be postponed until 1 October 2015. The date is connected with the fact that this is the date of a fundamental change in the Danish retail market for electricity with the introduction of the ‘wholesale model’.

Price differentiation on the basis of geographic criteria is only permitted for a limited period of time. The aim of this is to give enterprises the opportunity to develop and test, for example, time-differentiated tariffs with a view to promoting better network utilisation by reducing demand on the networks at peak periods.

The prices will be set according to methods to be approved by the Danish Energy Regulatory Authority. The individual enterprises will subsequently set their prices within the framework of the approved methods.

#### *Wholesale model*

Under the wholesale model, electricity trading companies will be the central actors in the electricity retail market. The electricity trading companies will buy network services from the grid operators and sell a packaged product ‘supplied electricity’ to consumers. Thus, the grid operators will no longer bill consumers directly, but will bill the individual electricity trading companies for a total amount once a month. The electricity trading companies are not obliged to pass on the grid operators’ tariffs to the consumers unchanged. If the grid operators want to

influence consumers, their price signals will have to be strong enough for electricity trading companies to recognise that it is in their own interest to pass them on in their tariffs.

The electricity trading companies set their own tariffs. They need no approval from the authorities. This must be seen in the light of the fact that electricity consumers are free to choose their supplier and free to choose between the products on offer.

#### *Fixed and consumption-related tariffs*

The grid operators have a lot of freedom in their methods for setting the balance between fixed and consumption-related tariffs. Until the middle of 2013, around 50 % of the grid operators' total income consisted of subscription charges and the remaining 50 % of consumption-related tariffs. In 2013, *Dansk Energi* (the Danish Energy Association)<sup>8</sup> issued a guideline on a relative reduction of the fixed charge which resulted in, among other things, the largest grid operators reducing their subscription charges by 43 %.

It is expected that the introduction of the wholesale model will create the basis for further reductions in the grid operators' subscription charges. The mere fact that a large share of the payment for network services will become consumption-related will give consumers an incentive to improve efficiency and reduce their energy use.

#### *Connection fees*

With the introduction of the wholesale model, the grid operators' contacts with customers will be reduced to being responsible for meters and ensuring connections to the grid based on connection agreements.

The grid operators may, among other things, as part of intelligent network utilisation, need to enter into agreements on interruptibility of supplies in special situations. Therefore, from the date that the wholesale model enters into force, the grid operators will be able to take the initiative to enter into interruptibility agreements as part of their connection agreements with consumers with consumptions over 100 000 kWh.

### **3.7.2. Energy efficiency in demand response**

#### *Demand response*

Apart from the grid operators' relatively high demands for subscription charges, which are expected to become much smaller with the introduction of the wholesale model in 2015, the payment for transmission and system services, electricity taxes and VAT is consumption-related (øre/kWh).

However, at present there is widespread use of *skabelonafregning* ('template billing'), which is an obstacle to demand responses from non-hourly billed consumers. Under template billing, consumption is measured once a year and the same per kWh tariff is paid regardless of when the consumption takes place. Around 50 % of Danish electricity consumption is subject to template billing.

Consumers with consumption over 100 000 kWh, who also account for around 50 % of total electricity consumption, have to be billed on an hourly basis. Consumers with consumption

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<sup>8</sup> Industry organisation for energy companies in Denmark

below 100 000 kWh have the option of hourly metering and hourly billing, but the transaction costs have been so high that very few have taken up the option.

### *Remote electricity meters*

With **Executive Order No 1358 of 3 December 2013** on remote electricity meters and metering of electricity at end use, grid operators will be obliged to install remote electricity meters with hourly reading for all electricity end users by the end of 2020. The Executive Order lays down requirements concerning the functionality of the meters, including that it must be possible for consumers to connect external devices and continuously extract consumption-related data.

The Executive Order replaced Executive Order No 783 of 29 June 2011, which contained the same technical specifications, but required the meters to be installed on a voluntary basis.

Remote electricity meters are expected, to a certain extent, to raise consumers' awareness of their consumption and thus their interest in using energy more efficiently.

Once a cost-effective model for hourly billing of end users has been introduced, the grid operators will be obliged to report hourly data on their remotely metered consumers to Energinet.dk's datahub, from which the electricity trading companies will retrieve consumption data for billing purposes.

### *Flexible billing*

*Fleksafregning* (flexible billing) is a cost-effective model for hourly billing of end users which is being developed as part of Energinet.dk's datahub. Flexible billing is expected to come into operation in 2015.

Once flexible billing is introduced, all consumers with remote electricity meters will be able to use electricity products with time-differentiated tariffs. It will then be up to the grid operators and electricity trading companies to offer such products.

Over half of Danish electricity consumers already have remote electricity meters installed. This proportion is expected to rise to two thirds in 2015.

### *Nordic retail market*

Since 2008, Denmark has worked, in cooperation with the other Nordic countries, on the development of a harmonised, efficient Nordic end-user market. The aim is to reduce market obstacles so that electricity customers can buy from suppliers throughout the Nordic region, and electricity traders can more easily set up business throughout the region. The work is supported by the Nordic regulators (NordREG), who have continuously drawn up recommendations for the implementation of a harmonised Nordic end-user market, including a single customer entry point to the market via the electricity supplier, combined billing, information exchange, free choice of supplier, information exchange[sic], access to consumption data, transparency, and phasing out of supply obligations.

Denmark is a long way towards implementing NordREG's recommendations. Demand response is high on the agenda in the Nordic countries, and a study has been initiated to look into the potential for demand response in the Nordic electricity market and possible strategies

for exploiting this potential. Particular emphasis is being placed on the role of consumers and on how best to make use of the interplay between the electricity market and other energy markets in the Nordic region. The analysis is expected to be completed in 2014.

### *Regulating power market*

The increased integration of wind power, resulting in more fluctuating production, increases the need on the system operator side to be able to utilise flexibility on the consumer side. The threshold for bids in the Nordic regulating power market has limited the exploitation of the potential for consumption flexibility for many operators in Denmark. System operators in Finland, Norway, Sweden and Denmark have reached agreement on strengthening the regulating power market and investigating the possibility of improving the conditions for also including electricity consumption in the market as a resource for flexible balancing of the electricity system. The investigations will focus on the possibility of lowering the threshold for bids in the regulating power market from 10 to 5 MW and removing the requirement for online metering of consumer units below 5 MW. Pilot projects are therefore being conducted in all four countries, and the Danish project will involve a Danish company and its Norwegian balance responsible party (BRP).

### **3.6.4. Energy efficiency in network design and operation**

By no later than 30 June 2015, Member States must make an assessment of the progress achieved with regard to the assessment of the energy efficiency potential of their gas and electricity infrastructure as well as planned and adopted measures for the introduction of cost-effective energy efficiency improvements in the network infrastructure, with a timetable for their introduction (see EED Article 15(2), Annex XIV, Part 2.3.5).

The Danish Energy Agency has asked the Danish transmission system operator (TSO), energinet.dk, to take charge of the analysis part (assessment of the energy efficiency potential in the transmission part of the gas and electricity infrastructure). Energinet.dk is in the process of preparing proposals for how the task can be achieved.

With regard to the energy efficiency potential in the distribution part of the gas and electricity infrastructure, the Danish Energy Agency will ensure, in cooperation with energinet.dk and the industry organisation *Dansk Energi* (the Danish Energy Association), that there is a corresponding definition of the task, and ensure, on the basis thereof, that the task is carried out.

## **Annex A Annual report in accordance with the Energy Efficiency Directive**

### **A.1 National energy efficiency target for 2020**

Denmark's indicative target in accordance with Article 3 is absolute primary energy consumption (gross energy consumption apart from consumption for non-energy purposes) of **744.4 PJ (17.781 Mtoe)** in 2020. This involves a 12.6 % reduction in primary energy consumption compared with 2006.



The corresponding indicative target for final energy consumption (excluding consumption for non-energy purposes) in 2020 is **619.5 PJ (14.797 Mtoe)**. This is a reduction of 7.2 % compared with 2006.

The indicative target is a result of the Danish Energy Agency's baseline projection for energy consumption. This baseline projection includes all the tools and measures contained in the energy policy agreement of 22 March 2012.

In addition, the Danish Energy Agency's baseline projections are all based on a number of general economic assumptions (industrial output, private consumption, fuel prices, etc.), a number of technological assumptions (what different types of plant cost, how efficient they are, etc.), and assumptions concerning how energy market actors will act on the basis of purely commercial considerations. It may also include some qualitative estimates, e.g. concerning planning matters.

The baseline projections, including the models used, the assumptions and results are described in more detail in

- DANMARKS ENERGIFREMSKRIVNING 2012 (Denmark's Energy Projection 2012)  
[http://www.ens.dk/Documents/Netboghandel%20-%20publikationer/2012/Danmarks\\_energifremskrivning\\_2012.pdf](http://www.ens.dk/Documents/Netboghandel%20-%20publikationer/2012/Danmarks_energifremskrivning_2012.pdf)
- Background Note A: Models and projection principles  
<http://www.ens.dk/da-DK/Info/TalOgKort/Fremskrivninger/Fremskrivninger/Documents/BF2012/A%20-%20Modeller%20og%20fremskrivningsprincip.pdf>

What data are to be reported pursuant to Annex XIV is shown in Table 9 below.

**A.2 Table 9: Key statistics**

| <b>a) an estimate of following indicators in the year before last (year X-2):</b> |                   | <b>2011</b> | <b>2012</b> |
|---|-------------------|-------------|-------------|
| i. primary energy consumption (gross energy consumption)                          | Adjusted, PJ      | 809         | 785         |
| ii. total final energy consumption; (including non-energy purposes)               | Adjusted, PJ      | 643         | 616         |
| iii. final energy consumption by sector   |                   |             |             |
| industry (manufacturing)  | Adjusted, PJ      | 96          | 91          |
| transport (split between passenger and freight transport, if available)           | Adjusted, PJ      | 210         | 205         |
| households  | Adjusted, PJ      | 197         | 189         |
| services (trade and service industries);  | Adjusted, PJ      | 85          | 81          |
| iv. gross value added by sector   | Fixed 2005 prices |             |             |
| industry (manufacturing, excluding refineries)                                    | DKK billions      | 169         | 174         |
| services (trade and service industries);  | DKK billions      | 1 042       | 1 042       |

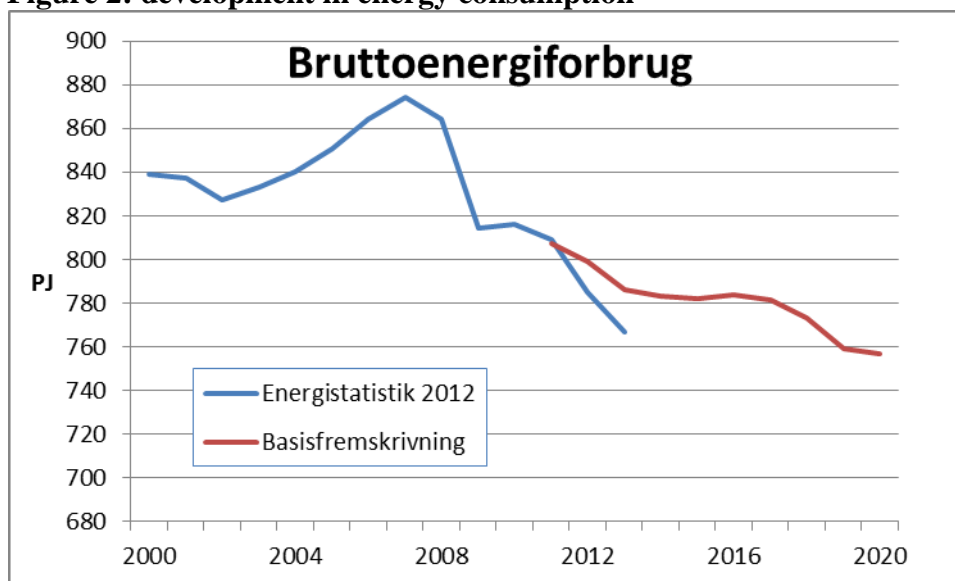
|   |                              |           |           |
|---|------------------------------|-----------|-----------|
| v. disposable income of households;   | DKK billions 2005 prices     | 781       | 777       |
| vi. gross domestic product (GDP);   | DKK billions 2005 prices     | 1 557     | 1 551     |
| vii. electricity generation from thermal power generation;                                  | PJ                           | 92        | 74        |
| viii. electricity generation from combined heat and power;                                  | PJ                           | 58        | 55        |
| ix. heat generation from thermal power generation;  | PJ                           | 132       | 136       |
| x. heat generation from combined heat and power plants, including industrial waste heat;    | PJ                           | 101       | 99        |
| xi. fuel input for thermal power generation;  | PJ                           | 265       | 225       |
| xii. passenger kilometres (pkm), if available;  | million passenger kilometres | 71 105    | 71 322    |
| xiii. tonne kilometres (tkm), if available;   | million tonne kilometres     | 16 120    | 16 679    |
| xiv. combined transport kilometres (pkm + tkm), in case (xii) and (xiii) are not available; |                              |           |           |
| xv. population (Jan 2011).  |                              | 5 560 628 | 5 580 516 |

Source: *Energistatistik 2012* (Energy Statistics 2012) and Statistics Denmark

### A.3 Analysis of energy consumption trends

Energy consumption in Denmark has changed relative to the baseline projections in ‘*Danmarks energifremskrivning 2012*’ (Denmark’s Energy Projection 2012). Figure 2 below shows the development in Denmark’s energy consumption compared with the baseline projection.

**Figure 2: development in energy consumption**



Source: *Energistatistik 2012* (Energy Statistics 2012) and *Danmarks Energifremskrivning 2012* (Denmark’s Energy Projection 2012)

Key to Figure 2:

|                      |                          |
|----------------------|--------------------------|
| Danish original      | English translation      |
| Bruttoenergiforbrug  | Gross energy consumption |
| PJ                   | PJ                       |
| Energistatistik 2012 | Energy statistics 2012   |
| Basisfremskrivning   | Baseline projection      |

Energy consumption in Denmark has fallen in recent years, and the graph clearly shows that gross energy consumption has fallen considerably more than foreseen in the baseline projections. This is partly because there has been lower growth, but at the same time there has also been increased energy efficiency and falls in energy consumption in individual sectors. According to Table 9, all sectors experienced a fall in final energy consumption of 4 to 5 % between 2011 and 2012. Another reason for the falling energy consumption is a fall in energy losses in the production of electricity. Overall, the graph shows a 4.1 % improvement in energy efficiency in 2012.

#### **A.4 Update on major measures implemented in the previous year**

In March 2012, Denmark adopted an energy policy agreement which lasts until 2020. There were no major changes relative to this agreement last year.

#### **A.5 Central government buildings**

Total floor area

In June 2013, Ole Michael Jensen of *Statens Byggeforskningsinstitut* (SBI, the Danish Building Research Institute)/Aalborg University prepared a report for the Danish Energy Agency entitled '*Implementering af artikel 5 i EU's energieffektiviseringsdirektiv*' (Implementation of Article 5 of the Energy Efficiency Directive).

The report states, among other things:

'Measured in terms of area, the Government has a total of 8.2 million square metres, according to the BBR register (*Bygnings- og boligregistret* – the Building and Housing Register). The share representing buildings which are larger than 250 square metres and are not protected amounts to 6.5 million square metres. Almost half of these buildings are energy-labelled, of which 2.6 million square metres is labelled in a class below the current standard ..., i.e. energy labels C-G. Independent institutions are not included in this survey.'

It is assumed, on the basis of the above, that the proportion of central government buildings (6.5 million m<sup>2</sup> of buildings over 250 m<sup>2</sup>, of which half is energy-labelled, of which in turn 2.6 million m<sup>2</sup> has an energy label in a class below the current standard) is representative of the whole central government building stock. When indicating the total central government floor area, the share of 2.6 million m<sup>2</sup> must be multiplied by 2. This means that the total central government floor area in buildings larger than 250 m<sup>2</sup> with an energy label below the current standard – energy label B – is 5.2 million m<sup>2</sup>.

#### *The total area renovated in 2013*

To provide an indication of the central government's renovated floor area in 2013, a number of ministries that own and/or administer the Danish Government's buildings contributed figures for renovated square metres. Contributions from *Bygningsstyrelsen* (the Danish Building & Property Agency), *Forsvarets Bygnings- og Etablissementstjeneste* (the Defence

Construction and Establishment Service), *Styrelsen for Slotte og Kulturejendomme* (the Agency for Palaces and Cultural Properties), *Naturstyrelsen* (the Danish Nature Agency) and *Kriminalforsorgen* (the Danish Prison and Probation Service) were combined to use for Denmark's reporting to the EU in accordance with the energy efficiency action plan. Their total renovated area in 2013 is 1 090 643 m<sup>2</sup>.

### *The alternative approach*

Denmark is considering implementing the obligations in Article 5 EED through the alternative approach (see Article 5(6) EED) in connection with a revision of the circular on energy efficiency in central government institutions (Circular No 8797 of 10 October 2009). If it opts for the alternative approach to achieving energy savings in central government buildings, Denmark will use, among other things, the following measures:

- Behaviour modification
- Replacement with energy-saving appliances
- Transition to energy-efficient construction
- Optimisation of land use
- Renovation of buildings
- Operational optimisation of, among other things, installations

## **Annex B Building renovation roadmaps**

### **Overview of the national building stock**

As a basis for the Danish Government's strategy for energy renovation of the existing building stock, '*Vejen til energieffektive bygninger i fremtidens Danmark*' (The road to energy-efficient buildings in the Denmark of the future), analyses have been carried out of the Danish building stock and potential for energy savings in the report, '*Potentielle varmesparelser ved løbende energirenovering frem til 2050*' (Potential heat savings with ongoing energy renovation up to 2050), SBI 2014:01 (the SBI Report).

The report is available at <http://www.sbi.dk/miljo-og-energi/energibesparelser/potentielle-varmesparelser-ved-lobende-bygningsrenovering-frem-til-2050>

The analysis is based on a detailed description of the building stock in Denmark produced using statistical extracts from the Danish Energy Agency's database of building data from the energy labelling scheme for buildings. This database contains data on around 300 000 buildings. These data are combined with data from BBR (the Building and Housing Register) to produce a description of the total building stock. (See the section *Metode og antagelse* (Methods and assumptions) in the SBI Report).

### *Points (a) to (d)*

A description of the building stock has been drawn up in which the buildings are broken down according to usage category and construction period (see Table 32[sic] in the SBI Report). No distinction is made between climatic zones as Denmark is a small country.

### *Points (e) to (f)*

It was not considered relevant to distinguish between forms of ownership and urban/rural location.

*Point (g)*

The energy condition of the building stock is described by providing a breakdown of ceilings, external walls, floors and ground slabs, and windows in the existing buildings by U values (see the section *Energimærkningsdata 2012* (Energy labelling data 2012) in the SBi Report).

Please note that the strategy only describes opportunities for reducing the net heat requirement of the building stock, which means that the buildings are not broken down by type of supply/energy carrier.

Energy consumption in buildings is calculated on the basis of the building stock's energy characteristics using a special building model (see the section *Beregningsmodel* (Calculation model) in the SBi Report).

**Cost-effective approaches to renovations relevant to the building type and climatic zone**

*Points (a) to (f)*

The strategy's energy saving measures have been analysed on the basis of the assumption that energy savings will be carried out in conjunction with the replacement or renovation of the individual building elements when they reach the end of their life. For this purpose, a programme has been drawn up for the replacement of roofs, external walls and windows up to 2050.

In connection with the drawing up of a business-as-usual scenario, it is assumed that energy efficiency improvements will be carried out in connection with the renovation/replacement of the individual building components at the end of their life. It is assumed that the energy requirements of the current building regulations will be applied. It is noted in this regard, that these requirements are laid down on the basis of an assessment of the cost-effectiveness for the building owner, such that the additional costs of implementing the requirements are paid for through the energy savings.

Alternative scenarios were also drawn up in which additional energy savings are included.

These were drawn up on the basis of assumptions that there will be a tightening of energy requirements for existing buildings in the building regulations and that compliance with the building regulations will improve. In addition, scenarios were drawn up which illustrate the effect of the spread of mechanical ventilation with heat recovery and the introduction of automatic control of the heat distribution systems in large buildings.

These scenarios are described in the section *Scenarier for varmebesparelser* (Heat saving scenarios) in the SBi Report.

*Point (g)*

It is assumed that all savings will be implemented on an ongoing basis in line with the renovation and replacement of worn-out building parts.

### **Policies and measures to stimulate cost-effective deep renovations of buildings, including staged deep renovations**

The Government's building renovation strategy contains 21 initiatives to promote energy renovation (see the attached strategy '*Vejen til energieffektive bygninger i fremtidens Danmark*' – The road to energy-efficient buildings in the Denmark of the future).

### **Forward-looking perspective to guide investment decisions of individuals, the construction industry and financial institutions**

It is part of the Government's strategy to make a large effort to inform citizens of the opportunities to carry out energy renovations through, among other things, the energy labelling scheme for buildings, the establishment of voluntary energy classes for existing buildings, and highlighting the energy status of the buildings so that the market can price the value of the energy efficiency.

One of the assumptions of the strategy is that the best way to finance energy renovations is through the Danish mortgage system, which is considered to be stable and robust and provides loans on relatively favourable terms compared with other available sources of finance. There is therefore no proposal to change the financing conditions.

However, the strategy does include the conduct of analyses of the financing conditions in order to assess whether in time there may be a need for alternative financing schemes, including financing via energy prices, as in the Green Deal in the United Kingdom.

### **Evidence-based estimate of expected energy savings and wider benefits**

It is considered that the initiatives in the strategy will lead to a 35 % reduction in net energy consumption for heating and hot water in the existing building stock by 2050 compared with today.

This assessment is based on Scenario B10 in the SBI Report (see the section *Sammenfatning og resultater* (Summary and results)).

#### *Point (a)*

Part of the strategy is the introduction of an extensive information campaign to inform citizens of the opportunities for and benefits of energy renovation.

#### *Point (b)*

The building renovation strategy is an important part of energy policy. The strategy will contribute to the fulfilment of the objective of reducing CO<sub>2</sub> emissions and the overall objective of basing energy supply on renewable energy from 2050.

#### *Point (c)*

Opportunities to convert the external benefits of energy renovation into internal effects benefiting investors are part of the strategy. This is being done via:

- the energy companies' efficiency obligations, under which the energy companies can make a financial contribution to citizens and enterprises that carry out energy renovations in return for including the efficiency saving in the energy company's obligations.

- highlighting energy efficiency through energy labelling has already led to a rise in property prices for energy-efficient housing. The strategy includes taking steps towards supporting this through information and improvement of the labelling scheme.

### Denmark's building renovation strategy

See 'Strategi for energirenovering af bygninger – Vejen til energieffektive bygninger i fremtidens Danmark' (Building renovation strategy – The road to energy-efficient buildings in the Denmark of the future)

### Annex C National plan for nearly zero-energy buildings

The National action plan for nearly zero-energy buildings can be found here:

[http://ec.europa.eu/energy/efficiency/buildings/implementation\\_en.htm](http://ec.europa.eu/energy/efficiency/buildings/implementation_en.htm)

### Annex D Data used to calculate targets (see EED Article 7(1))

#### Final energy consumption

Source: Energy Statistic 2012

<http://www.ens.dk/info/tal-kort/statistik-noglestal/arlig-energistatistik>

| PJ                             | 2010         | 2011         | 2012         | Average      |
|--------------------------------|--------------|--------------|--------------|--------------|
| Households                     | 194.1        | 197.4        | 189.1        | 193.5        |
| Commercial and Public Services | 83.9         | 84.9         | 81.0         | 83.3         |
| Agriculture and Industry       | 136.5        | 138.3        | 130.1        | 135.0        |
| <b>Total</b>                   | <b>414.5</b> | <b>420.6</b> | <b>400.1</b> | <b>411.7</b> |
| Transport                      | 209.7        | 210.2        | 204.8        | 208.2        |
| Non-Energy use                 | 11.0         | 12.4         | 11.5         | 11.6         |
| <b>Total</b>                   | <b>635.3</b> | <b>643.1</b> | <b>616.5</b> | <b>631.6</b> |

PJ

1.5 % of final energy, excluding transport and non-energy

6.18

Saving in 2020

43.23

Cumulative savings 2014-2020

172.93

#### Cumulative savings with the Danish energy saving obligations

|              | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020        | total        |
|--------------|------|------|------|------|------|------|-------------|--------------|
| <b>2014</b>  | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 | 10.7        |              |
| <b>2015</b>  |      | 12.2 | 12.2 | 12.2 | 12.2 | 12.2 | 12.2        |              |
| <b>2016</b>  |      |      | 12.2 | 12.2 | 12.2 | 12.2 | 12.2        |              |
| <b>2017</b>  |      |      |      | 12.2 | 12.2 | 12.2 | 12.2        |              |
| <b>2018</b>  |      |      |      |      | 12.2 | 12.2 | 12.2        |              |
| <b>2019</b>  |      |      |      |      |      | 12.2 | 12.2        |              |
| <b>2020</b>  |      |      |      |      |      |      | 12.2        |              |
| <b>total</b> |      |      |      |      |      |      | <b>83.9</b> | <b>331.1</b> |