CONCERTED ACTION
ENERGY EFFICIENCY
DIRECTIVE

Core Theme Series Report:
Concerted Action Energy
Efficiency Directive

7

# Efficiency in Energy Supply, high efficiency CHP and heating/cooling

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# Content





# 1 Introduction and context

The Concerted Action for the Energy Efficiency Directive (CA EED) was launched in spring 2013 in order to support the effective implementation of the Directive on Energy Efficiency (2012/27/EU) in all EU Member States as well as Norway. By providing a trusted forum for exchange of experiences and collaboration, the CA EED helps countries learn from each other, avoid pitfalls and build on successful approaches when implementing the Directive. The CA EED is financed under the Intelligent Energy Europe Programme of the European Commission.

This report summarises the work carried out by the CA EED between January 2013 and March 2014 on district heating, district cooling and combined heat and power. The objectives of the work were for the Member States (MS) to gain a deeper understanding of Article 14 of the EED and to exchange experiences relevant to the implementation of Art.14.

The main objectives of the Core Theme are:

- To ascertain a clear and common understanding of the purpose of Article 14 and Article 15 and the associated annexes.
- To exchange experience of relevant implementation practices already in place in member countries.
- To support the ongoing implementation of Article 14 and Article 15 in the EED through exchange and development of best practices.
- To share experiences of opportunities and barriers to the transfer of best practice experiences between MS.
- To make available to all participants existing tools and methods as inspiration.

The main objective of Article 14 of the EED is to encourage identification of the potential for cost effective delivery of energy efficiency in heating and cooling, and to foster secure delivery of these measures. It principally encourages exploration of the use of high efficiency cogeneration and efficient district heating and cooling, but also addresses other energy efficient heating and cooling supply options. This report looks at the lessons learned regarding implementation of the comprehensive assessment.

A large number of participants from MS provided input in the form of presentations, provision of relevant documents and participation in Working Groups, providing an overview of challenges as well as good practices related to implementation.

# 2 Mapping of demand for cooling and heating

Comprehensive mapping of demand for heating and cooling is a key foundation for any assessment of potential for increased efficiency of energy supply.

The availability of data on energy demand varies considerably across MS. The best coverage is on heat demand in residential buildings. Industrial energy demand is more challenging, and the mapping of cooling demand is less well-developed in almost all MS.

MS apply different methodologies for assessing heat demand and performing a geographical distribution of the demand.

According to the CA questionnaire, the majority of MS seem to be planning to outsource at least some parts of the comprehensive assessment to external partners outside government. To the extent that this is the case, the role of the national energy authorities regarding the analytical work is primarily that of defining the tasks and setting the requirements for the results of the tasks tendered out.

In March 2014, the CA EED discussions showed that a very low number of MS already had experience in the mapping of heating/cooling demand and waste heat,

## Good practice examples

### Heat Atlas in the Netherlands

The Heat Atlas is an online, open, interactive, digital geographic mapviewer, showing heat supply and demand in the Netherlands. On the supply side, you will find (potential) suitable locations of deep geothermal, thermal storage, biomass and waste heat. On the demand side, the atlas shows an overview of the heat demand of residential areas, industry and horticulture. This instrument will contribute to the energy efficiency and sustainability of the Dutch energy system.

#### The advantages

The Heat Atlas:

- Is a source of inspiration for new thermal projects
- Is used in all sectors: Built Environment, Greenhouse Horticulture, Industry and Energy
- Stimulates the synergy between spatial planning and energy at provincial and municipal levels
- Provides quick insight into local heat demand and the availability and quality of renewable heat sources
- Grows by displaying comprehensive sustainable heat utilisation projects
- Aims to provide a current picture of all heat demand and supply.

#### Hurdles in setting up an atlas

- Lack of good industrial waste heat data.
- How to deal with confidential data

Target group and application
The Heat Atlas Netherlands is intended for anyone who starts sustainable heat projects, such as municipalities, developers, engineering firms, universities, national and regional governments, industry associations and other interested parties.

www.WarmteAtlas.nl

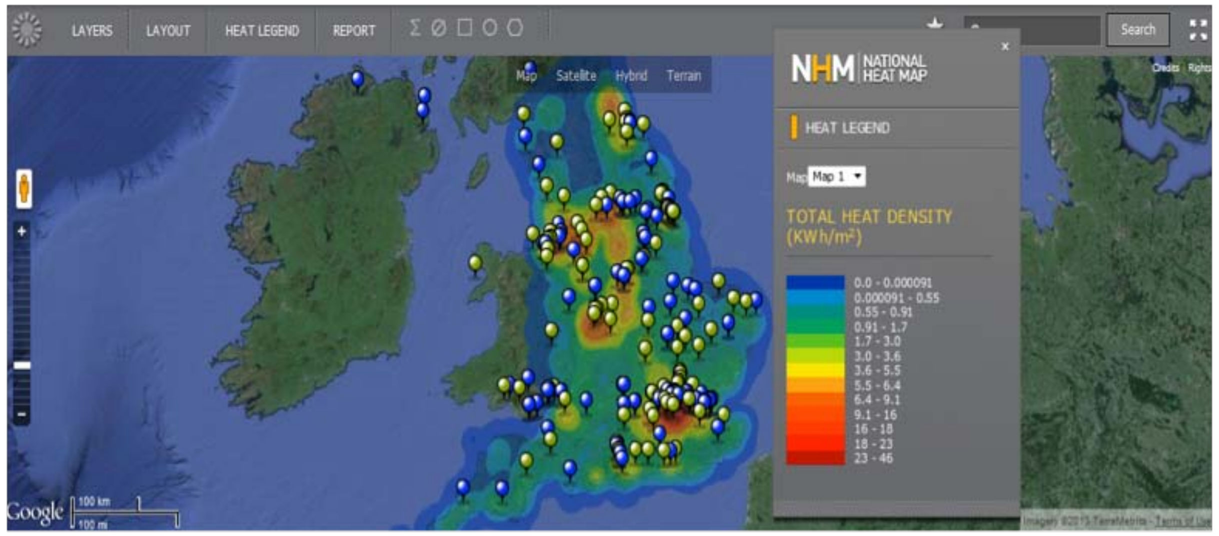
### The National Heat Map, England

The UK Department of Energy and Climate Change (DECC) is developing a policy to support good quality natural gas CHP. Part of this work involves the development of a National Heat Map for England. The main purpose of the initiative is to assist local authorities in planning for heat supply.

The map is high resolution and offers many of the same functions as Google Maps. It shows heat demand density as well as potential heat supply points. Through this, the map helps identify areas where district heating could match potential heat sources with a corresponding heat demand.

Heat demand is assessed on the basis of information on building type obtained from the NEED framework and Ordnance Survey data. The map is produced using meter readings for public buildings. A study of the viable district heating demand in England suggests a potential of 20%. Areas of more than 3 MW/km2 could potentially be viable. The main sources of energy are natural gas CHP, supplemented by lower carbon fuels such as biomass and biogas.

DECC is in the process of developing a heat networks model to better understand the potential. The development of the heat map has been good value for money: The cost of developing the map was £150,000. If each local authority had done their own mapping, costs could be £4-20 million for England.A Neat Network Delivery Unit was established by DECC to provide guidance and funding to local authorities in heat network development.




### The CODE2 project on promotion of combined heat and power production

The CODE2 project, which is co-financed under the Intelligent Energy Europe Programme, is developing national roadmaps for cogeneration across Europe. The project builds on the findings of the CODE project, which concluded that many non-economic barriers to cogeneration remain, awareness of cogeneration outside traditional user groups is low and much policy is poorly targeted.

CODE2 focuses particularly on bio-energy and micro CHP. It uses MS published data and projections. Of particular relevance to the CA EED are:

- Micro CHP roadmap for each member state and supportive analysis
- Bio-energy roadmap for each member state and supportive analysis
- 7 National CHP roadmaps for pilot member states
- Web based tool for first pass assessment of economic feasibility of a specific CHP installation
- "How-to" guide for potential users of CHP interested in how to approach a development of CHP (hotels, hospitals, food industry, paper industry and small commercial are particular targets)

For more information, please refer to:
www.code2-project.eu/

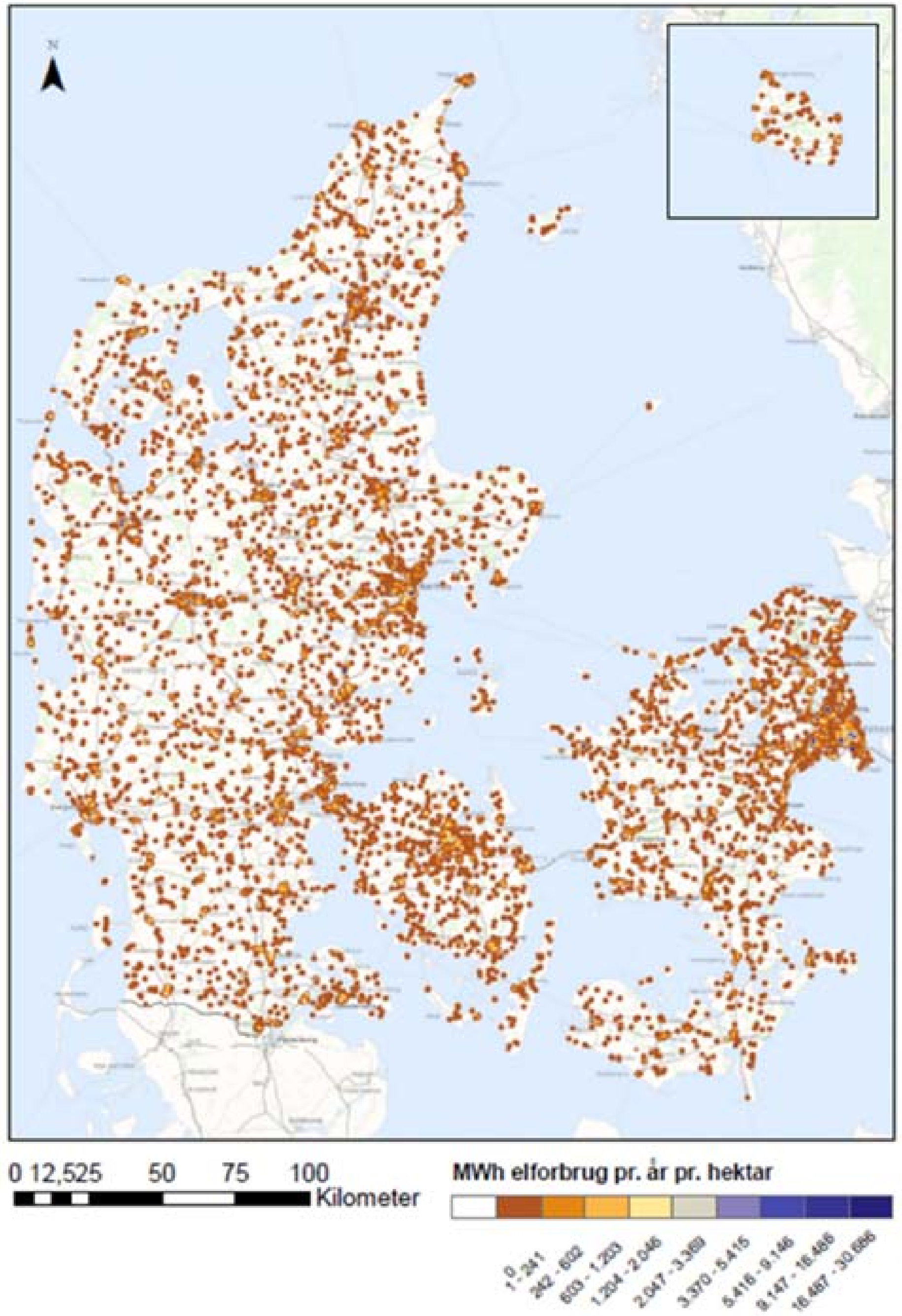
### Cooling potential assessment, Denmark

Danish Energy Agency has undertaken a comprehensive assessment of the potential for district cooling and recovery of waste heat from cooling systems.

A GIS mapping was done using building and enterprise registries in combination with detailed mapping of energy demand for cooling by industry sectors.

District cooling costs and benefits were compared with those of individual cooling systems to assess the potential for district cooling.

The analysis showed a district cooling potential of 40% of total cooling demand. Most of the excess heat from cooling could be profitably recovered for heating purposes.




# 3 Socio-economic cost-benefit analysis

The fundamental reason and purpose of carrying out a socio-economic cost-benefit analysis (CBA) for a project is to improve the basis for a qualified prioritisation of scarce resources (within the society, normally at national level).

In order to establish a sensible prioritisation of resources across sectors and with varying time horizons, assessments must be made based on uniform and transparent preconditions, assumptions and methods. Furthermore special issues and non-monetised impacts need to be described in the best way possible. Hereby, the basis for political decision-making can be improved – even though it will always be a balance of both economic and non-economic considerations, including social and ethical matters etc.

While financial CBA is widely used as an indicator of the viability of specific projects and technologies, only a few MS currently apply socio-economic cost-benefit analysis as a foundation for policy development. Projects related to energy efficiency or renewable energy are often more viable from a socio-economic than from a financial perspective. The main reason is that, in most MS, the socio-economic discount rate is lower than the typical financial discount rate. Further, the socio-economic CBA would also take account of external costs and benefits such as carbon emissions. In most cases – although not always - the external costs of conventional technologies are higher than those of efficient technologies.

## Good practice examples

**Summary of Danish national guidelines for socio-economic cost-benefit analyses**

In Denmark, socio-economic analysis and assessments have been used within many parts of the public sector: health and welfare, environmental management, energy, transport, social security etc.

A socio-economic analysis (of a project) is a statement of cost and benefit of a new/proposed project and, further, a comparison of these with a reference scenario - typically the current situation or business as usual.

The main points of the analysis can be summarised in this way:

1. The total net heat demand for the town is estimated, in physical terms like GJ
2. The heat demand is calculated for both the reference and the new project
3. The fuel demand is calculated based on figures for efficiency of individual oil fired boilers and efficiency for a wood chip boiler and heat loss in the district heating pipelines
4. Investment costs for the new project is calculated and includes costs for:
   - district heating boiler
   - district heating grid
   - minus scrap value as the network has longer life-time than the boiler
   - conversion of installations at individual users

   For the reference, necessary investments in renewal of oil burners and installations are calculated
5. Maintenance costs is worked out both for the reference and the new project
6. Environmental effects for the reference and the new project are calculated and summed up – these include greenhouse gases: $CO_2$, $CH_4$ and $N_2O$ as well as $NO_x$ and $SO_2$
7. Finally all relevant figures for the reference and the new project is summed up
8. The new project can be compared with reference:
   - costs and benefits seen from a socio-economic point of view
   - Differences between costs of the project and of the reference

Of the wide range of effects resulting from the implementation of a project, only a small proportion can be valued in practical life. Among effects with no direct value which can be fixed on a market are:

- Security of supply (diversification of energy sources)
- Non valued environmental impacts:
  - Air emissions other than $CO_2$, $SO_2$ and $NO_x$
  - Emissions into the aquatic environment
  - Visual / landscape effects
  - Odour
- Derived development of technology
- Safety, comfort and health
- Effects on distribution of income and wealth

Damages caused by environmental impacts are typically determined by geographical conditions. General values for such effects might be difficult to fix and must be evaluated on a project by project basis.

Employment is normally ignored in cost-benefit analysis based on the argument that in the long term total employment is determined by other factors (primarily the functioning of the labour market). The workforce is able to obtain employment elsewhere, i.e. labour is a scarce resource in the long term

For the purpose of consistency, the Danish Energy Agency has issued a broad framework of technical and economic data to be used for the cost-benefit analyses. http://ec.europa.eu/energy/efficiency/eed/doc/article7/2013/article7_en_sweden.pdf

# 4 Enabling regulation

Political and regulatory frameworks vary considerably across MS. These variations are reflected in the policies applied to promote efficient supply of energy.

## Good practice examples

**Feed-in tariffs for CHP and renewable energy systems in Slovenia:**

- **10 years guaranteed support for <u>new plants (15 years RES)</u> :**
  - All CHP plants – up to 200 MWe (all sectors up to 10 years old)
  - Special treatment of refurbished old plants
  - Individual treatment of new immature technologies
  - Higher support for units with up to 4.000 operation hours (heating)
  - <u>Shape of support</u>
  - Guaranteed purchase electricity price - units up to 1 MWe or
  - Premium on all generated electricity – units > 1MWe
  - Predictable methodology for yearly adjustment of supports
  - based on forecast of natural gas and wood biomass market price and electricity market price (minimize market risks for the investors)

**Summary of Danish policy experiences of efficiency in energy supply:**

- **Economic feasibility** (art. 14.3 + 14.5) has always been the main criterium in Danish heat planning – however combined with a **central determined energy policy direction**:
  - Partial heat planning: <u>Substitution of oil</u>
  - Nationwide heat planning: <u>Use of indigenous resources</u>
  - Project specific heat planning: <u>Use of NG, biomass, biogas, waste, surplus heat etc. + primary energy</u> savings. "Shift backwards" from CHP to HOB in general not allowed
  - National and municipal energy planning: <u>EE and substitution of fossil fuels with renewables – under development</u>
- Nationwide heat planning and comprehensive heat assessments (art. 14.1) <u>was</u> used in 80'ies to identify potential for CHP, potential for local energy resources and make strategic decisions at national level
- Zoning/separation of the heat market <u>was/is</u> used to:
  - National zoning: Some parts of the country did never receive natural gas supply due to better indigenous alternatives (biomass, surplus heat)
  - Local zoning: Avoiding double supply at consumer level (<u>either</u> natural gas network <u>or</u> DH-network)
- **Project specific c/b – analyses and app. procedures** (art. 14.5) <u>is</u> being used, so: a) national guidelines are followed and b) local market for CHP/heat-only boilers are secured.
- Very important to secure sufficient incentives and measures:
  - <u>Generel</u>: Securing the DH-market; sufficient financial viability; loan guarantees by municipalities
  - <u>Urgent heat planning</u>: Heat pricing - giving "full CHP-advantage" to the heat side – sufficent – rapid dev.
  - <u>Nationwide heat planning</u>: Heat pricing - paying same heat price for CHP as for HOB if same fuel (political agreement in 1986) – not sufficient – slow dev.
  - <u>Project specific heat planning</u>:
    - 90'ies: Focus: Expanding CHP-production. Incentives: Feed in premium, investment subs. – sufficient – rapid dev.
    - 00'ies: Focus: Maintaining CHP-capacity. Incentives: Premium for installed CHP-capacity; payment for regulation capacity (fluctuating electricity from wind) – now need for revision (current incentives expire in 2018)

Figure 1. Decoupling of GDP and GHG emissions in DK

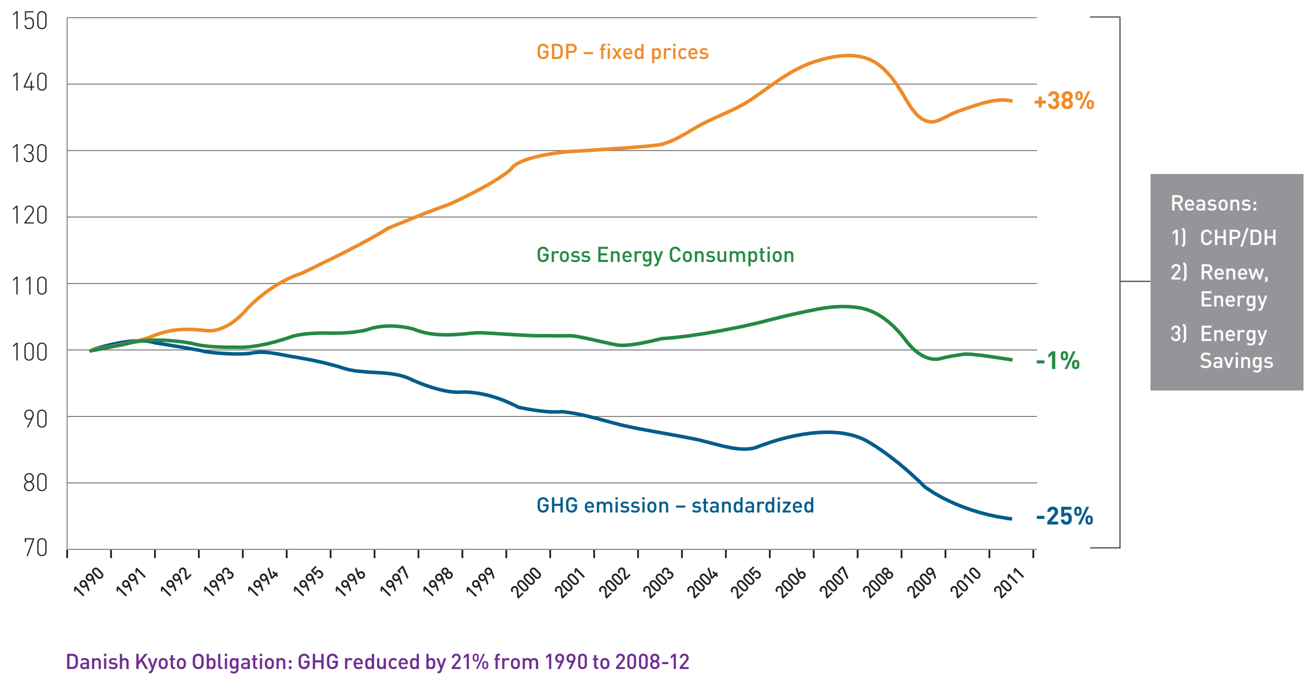
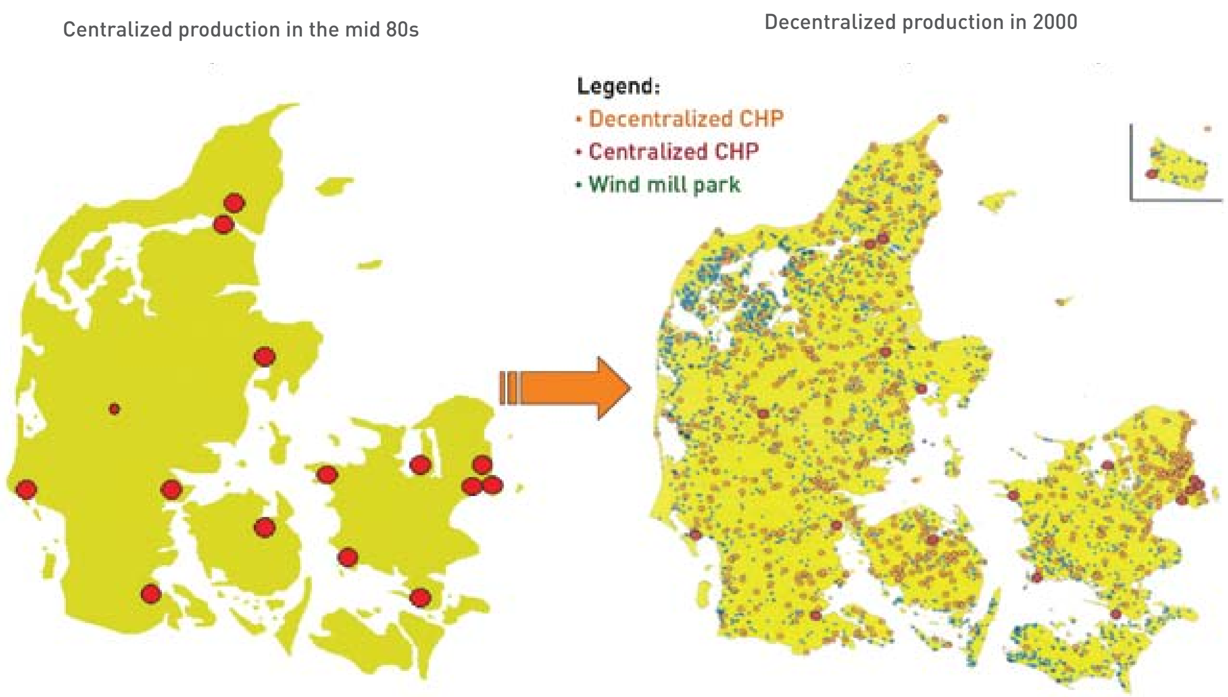



Figure 2.From centralised to decentralised production of electricity. The vast majority of thermal power plants are CHP plants.




# 5 Concluding remarks

The history of energy sector regulation varies a lot across MS, as do the overall energy policy framework and climate conditions. This is reflected not only in the level at which MS have prepared and implemented regulation to promote efficiency in energy supply but also the policy measures applied. There is, therefore, significant potential for exchange of experience regarding the development of regulation to improve efficiency in energy supply.

This Core Theme has picked up a large variety of good practices pertaining the implementation of Art. 14 including mapping of energy demand, economic analysis and potential assessment and regulatory mechanisms applicable.

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The Concerted Action for the Energy Efficiency Directive (CA EED) was launched by Intelligent Energy Europe (IEE) in spring 2013 to provide a structured framework for the exchange of information between the 28 Member States and Norway during their implementation of the Energy Efficiency Directive (EED).

For further information please visit **www.ca-eed.eu**
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