



COGENERATION OBSERVATORY
AND DISSEMINATION EUROPE

CODE

# Review progress of Directive

## D5.2 European Overview Report

www.code-project.eu

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# Table of contents

# 1. Introduction

### The Cogeneration Directive

The Cogeneration Directive 2004/08/EC outlines an enabling policy framework for the European Union to expand the deployment of cogeneration in Member States. The Directive was passed by the European Parliament in 2004 and encourages the use of cogeneration in the production of heat and power as a successful and well developed technique delivering primary energy savings. The background policy objectives in 2004 were security of supply and energy savings. The climate agenda which has grown in importance since 2004 has added further impetus to the wider use of cogeneration. Cogeneration is a highly energy efficient, technologically mature approach to generating electricity and providing useful heat. It is a key enabler for improving the efficiency of electricity production from fossil fuels.

One of the main achievements of the Cogeneration Directive has been to codify for Europe what is meant by high efficiency cogeneration. Any plant now carrying this status will in operation save a minimum of 10% primary energy compared to separate production of heat and electricity based on the same fuel. Using the framework of the Cogeneration Directive, promoting cogeneration to meet additional electricity needs gives a Member State a quantifiable primary energy saving per unit of electricity generated.

### The CODE project

The CODE project was established in October 2008 by COGEN Europe under the EU's Intelligent Energy Europe (IEE) programme. The objectives of CODE are to have stakeholders in the sector independently monitor the implementation of the Cogeneration Directive and to use stakeholder input to assess the progress being achieved through Member State initiatives. The project runs until 2011 and will report in sequence on 1) the identified European potential for cogeneration; 2) the barriers and support mechanisms for cogeneration existing across the Member States; 3) best practise and progress in Member States; and 4) a draft CHP roadmap for Europe.

# 2. Method of research and analysis

In order to monitor the progress of the implementation of the Cogeneration Directive by the 27 EU Member States and analyse and compare the results, the CODE team developed a questionnaire which addresses the following six main issues:

1. Has your Member State implemented the Cogeneration Directive 2004/08/EC?
2. Which are the instruments put in to practice by your Member State to promote the high efficiency cogeneration?
3. What is your opinion: is the Directive effective in improving the penetration of cogeneration in your Member State?
4. Is cogeneration growing in your Member State?
5. Assess the actual position of cogeneration compared to the estimated potential in 2020.
6. Progress Report.

The questionnaire was sent by the responsible CODE Region partner to the key national stakeholders with the request to fill in and send back. In case there was no response, the data was gathered the following way:

Phone conversations with Member State representatives

Other available reports and sources of data

## 2.1. Directive implementation

Below is an overview of the extent to which the 27 Member States have implemented the Cogeneration Directive 2004/08/EC. This includes discussion on reporting of CHP potentials, legislative framework and barriers, guarantees of origin and progress reporting.

### Northern Europe Region

| Country | Implemented the Directive? | Remarks |
|---|---|---|
| Austria | YES | |
| Belgium | YES | |
| Denmark | YES | |
| Finland | YES | |
| Germany | YES | |
| Ireland | YES | |
| Netherlands | YES | |
| Sweden | YES | |
| United Kingdom | YES | |

*Table 1: Directive implementation in the Northern Europe Region*

Based on the received questionnaires (as represented in table 1) and detailed analysis we can conclude that Directive 2004/08/EC was successfully implemented in all Member States in the Northern Europe Region.

### Eastern Europe Region

| Country | Implemented the Directive? | Remarks |
|---|---|---|
| Czech Republic | YES | |
| Estonia | YES | |
| Hungary | YES | |
| Latvia* | YES | |
| Lithuania | YES | |
| Poland | YES | |
| Slovakia | YES | |
| Slovenia | YES | |

*Table 2: Directive implementation in the Eastern Europe Region*

Based on the received questionnaires (as represented in table 2) and detailed analysis we can conclude that Directive 2004/08/EC was successfully implemented in all Member States in the Eastern Europe Region.

### South Eastern Europe Region

| Country | Implemented the Directive? | Remarks |
|---|---|---|
| Bulgaria | YES | |
| Cyprus | YES | |
| Greece | YES | |
| Romania | YES | |

***Table 3: Directive implementation in the South Eastern Europe Region***

Based on the received questionnaires (as represented in table 3) and detailed analysis we can conclude that Directive 2004/08/EC was successfully implemented in all Member States in the South Eastern Europe Region.

### South Western Europe Region

| Country | Implemented the Directive? | Remarks |
|---|---|---|
| France | YES | |
| Italy | YES | |
| Luxembourg | YES | |
| Malta | YES | |
| Portugal | YES* | *An important piece of legislation is still missing which will encompass the regulation for the calculation of the exported electricity tariff |
| Spain | YES | |

***Table 4: Directive implementation in the South Western Europe Region***

Based on the received questionnaires (as represented in table 4) and detailed analysis we can conclude that Directive 2004/08/EC was successfully implemented in all Member States in the South Western Europe Region. However, in Portugal an important piece of legislation is still missing which will encompass the regulation for the calculation of the exported electricity tariff

## 2.2. Measures adopted to improve cogeneration

Outlined below are the mechanisms by which CHP is promoted in each CODE Region Member State.

### Northern Europe Region

| Country | Supportive measures |
|---|---|
| Austria | • Support schemes (feed-in tariff for biomass-gas or waste-gas CHP)<br>• Investment support for new (built after July 2006) high efficiency (municipality) CHP<br>• Exemption from levy towards system balancing costs for generators or groups of generators under 5MW |
| Belgium | • CHP certificates (Flanders)<br>• green certificates (Wallonia and Brussels)<br>• tax benefits<br>• non-financial incentives (e.g. priority access to the grid) |
| Denmark | • support schemes (feed-in tariffs)<br>• obligation for new and existing buildings to connect to DH<br>• financial mechanism to support the move to RES and micro-CHP<br>• triple feed-in tariff for small plants to compensate for sunk costs involved with production<br>• renewable CHP (including use of waste as the primary fuel) receives a tariff on kWh of production |
| Finland | • capital grant<br>• barrier removal since market liberalisation |
| Germany | • support scheme (feed-in /generation tariff)<br>• CHP is exempted from Ecotax |
| Ireland | • support schemes (feed-in tariffs, capital grant support)<br>• decreased network charges for industrial/commercial |
| Netherlands | • support schemes (feed-in tariff)<br>• tax support<br>• capital grant |
| Sweden | • capital grant |
| United Kingdom | • support schemes (feed-in tariffs)<br>• tax support<br>• capital grant |

***Table 5: Supportive measures in the Northern Europe Region***

Based on the received questionnaires (as represented in table 5) and detailed analysis (e.g. CODE WP3) we can conclude the following for the Northern Europe Region:

- majority of the countries has a feed-in tariff
- tax support (Belgium, Netherlands and United Kingdom) and capital grants (Finland, Netherlands Sweden and United Kingdom) are also well-established
- Belgium is the only country with a certificate scheme
- a vast number of additional national support mechanisms exist

**Eastern Europe Region**

| Country | Supportive measures |
|---|---|
| Czech Republic | • support schemes (feed-in tariffs)<br>• barriers removal (grid connection, administrative, etc.) - very slow, there are grid connection problems due to solar power support.<br>• tax allowances - not significant |
| Estonia | • support schemes (feed-in tariffs, green certificates, etc.)<br>• investment subsides |
| Hungary | • support schemes (feed-in tariffs, stopped mid 2011)<br>• investment subsides<br>• barriers removal (grid connection, administrative, etc.) |
| Latvia | • support schemes (feed-in tariffs - mandatory fixed price procurement<br>• Investment subsidies (renewable energy sources) |
| Lithuania | • support schemes (feed-in tariffs)<br>• Investment subsidies (modernisation of fossil CHP and renewable CHP) |
| Poland | • support schemes ( red/yellow certificates, etc.) |
| Slovakia | • support schemes (feed-in tariffs, green certificates, etc.)<br>• investment subsides<br>• barriers removal (grid connection, administrative, etc.) |
| Slovenia | • support schemes (feed-in tariffs) |

***Table 6: Supportive measures in the Eastern Europe Region***

Based on the received questionnaires (as represented in table 6) and detailed analysis (e.g. CODE WP3) we can conclude the following for the Eastern Europe Region:

- majority of the countries has a feed-in tariff
- no tax support
- Poland is the only country with a certificate scheme
- a vast number of additional national support mechanisms exist

**South Eastern Europe Region**

| Country | Supportive measures |
|---|---|

| | |
|---|---|
| Bulgaria | • support schemes (feed-in tariff) |
| Cyprus | • support schemes (feed-in tariff) |
| Greece | • support schemes (feed-in tariff)<br>• tax allowance |
| Romania | • support schemes (feed-in tariff)<br>• capital grant |

***Table 7: Supportive measures in the South Eastern Europe Region***

Based on the received questionnaires (as represented in table 7) and detailed analysis (e.g. CODE WP3) we can conclude the following for the South Eastern Europe Region:

- Bulgaria, Greece and Romania have a feed-in tariff
- only tax support in Greece
- Romania is the only country which provides capital grant
- all countries (except Romania) have additional national support mechanisms

**South Western Europe Region**

| Country | Supportive measures |
|---|---|
| France | • support schemes (feed-in tariffs)<br>• barriers removal (obligation to purchase cogenerated electricity)<br>• tax allowances |
| Italy | • support schemes (feed-in tariffs)<br>• tax support<br>• capital grant |
| Luxembourg | • support schemes (feed-in tariffs)<br>• heat bonus<br>• VAT reduction |
| Malta | • tax support |
| Portugal | • capital grant |
| Spain | • support schemes (feed-in tariffs)<br>• tax support |

***Table 8: Supportive measures in the South Western Europe Region***

Based on the received questionnaires (as represented in table 8) and detailed analysis (e.g. CODE WP3) we can conclude the following for the South Western Europe Region:

- France, Italy and Spain have a feed-in tariff – Malta is currently developing one
- tax support in Italy, Luxembourg, Malta and Spain
- only Italy and Portugal give capital grant
- all countries (except Italy) have additional national support mechanisms

## 2.3 Effectiveness of the Cogeneration Directive

### Northern Europe Region

#### Austria

The report "*Progress report according to Article 6(3) of Directive 2004/8/*EG" was submitted to the Commission in 2007 and states that support schemes hadn't been in place long enough to measure progress. A subsequent report detailing changes in deployment of CHP against the identified additional CHP potential for 2005-2020 of 2,379 MWe should be due this year (*2011*) but was not yet available from the Commission's website. Large scale industrial predominantly from the pulp and paper industry in Austria are generally CHP, producing 8 TWh p.a. Little support is provided for this scale of CHP as a solid investment case provides adequate incentive. Municipal CHP and district heating contributes another 7 TWh to Austria's annual 60 TWh electricity demand. The main area of CHP growth is smaller rural biomass CHP plants, which currently receive a feed-in tariff. This growth has been driven in large part by the Renewable Directive as opposed to the Cogeneration Directive.

#### Belgium (Flanders)

The Cogeneration Directive has had a powerful impact on the uptake of cogeneration in Flanders with rapid increase in growth of CHP – the majority of which has been in industrial applications. Growth in CHP installed capacity was greatest in 2005. The subsequent slowing of growth may, in part, be attributed to early progress towards the Flanders Government 2012 CHP target which was passed in 2008, with a total of 1.832MW of installed capacity. This shows a significant growth from the 1.100 MW baseline at the point the white certificate scheme started in 2004. The Flanders Government is seeking to continue the increase in deployment of CHP and, in light of the issues of potential oversupply of white certificates; the Government is carrying out a review of support for CHP.

#### Denmark

The Cogeneration Directive has had little impact on uptake of CHP in Denmark due the level of existing support and advanced level of deployment at the time the Directive came into force. A mechanism for issuing Guarantees of Origin was established following the Cogeneration Directive, but these, however, have attracted little value in Denmark and are rarely traded. Consequently they have had little impact on the market or deployment of CHP.

#### Finland

As there is no support for CHP in Finland and, considering that most barriers to market entry were removed with the 1995 market liberalisation, the Cogeneration Directive has had a very limited impact on the attractiveness of CHP investment. As noted above, the existence and expansion of heat networks enables CHP plant to sell both heat and power competitively into the market. The natural efficiency of CHP over separate forms of generation ensures that CHP investment is attractive and the Finnish CHP installed capacity is gradually growing. Key to the ongoing growth in

the CHP market and maintenance of existing operations is the ability of CHP operators to obtain a fair and realistic price for both the heat and power generated.

## Germany

It has been hard to ascertain the impact of implementation of the Cogeneration Directive in Germany as the new CHP law was introduced at the height of the financial crisis in 2009 and investment in CHP slowed concurrently. Through 2010, investment was seen more in small scale plant from up to 2000 kW CHP, however, it is anticipated that investment in all forms of CHP will pick up in 2011. A study is currently being undertaken by Prognos AG and Berliner Energieagentur to assess whether the current support mechanisms are anticipated to achieve Germany's target of 25% electricity generation from CHP by 2020.

## Ireland

There has been little progress towards the potential of 800 MWe of installed CHP capacity by 2020, identified in 2009, from a 2008 baseline of 300 MW. The exception to this is the modest growth in the sub-1 MW sector, but this has fallen to near zero following the removal of the SEI deployment grant scheme and recent network changes. Ireland, however, will need growth in large scale industrial plant in order to meet the identified CHP potential. It is also believed that the lack of binding CHP target and defined responsibility for CHP within Sustainable Energy Authority Ireland is a problem.

## Netherlands

The Cogeneration Directive has not had a significant impact in The Netherlands. Apart from the implementation of Guarantees of Origin, no other barrier removal or support for CHP has been bought into force. Currently (*2011*), the proportion of electricity generated by CHP in The Netherlands is just under 55%. In the forthcoming years, however, not much growth is expected in the installed capacity and there may even be some decline.

## Sweden

The Cogeneration Directive has not directly stimulated growth in Swedish CHP, as the financial support for CHP was put in place before the Cogeneration Directive. Further to this, the Directive has not stimulated additional uptake of high efficiency cogeneration, as all plant installed in Sweden have been high efficiency as standard practice since before the Directive came into force. Due to the advanced state of efficient generation in Sweden plant being installed now is bioenergy and the amount of fossil fuelled CHP is falling[1]. The proportion of district heating fuelled by CHP has increased over time. The Swedish Energy Agency concluded in their 2010 Cogeneration Directive progress report that CHP electricity production was growing in both absolute terms and as a proportion of electricity production, see table below illustrating growth in GWh generated by CHP by year.

[1] **Report pursuant to Article 6(3) of the Cogeneration Directive (2004/8/EC), Swedish Energy Agency, 1 June 2010, Ref.: 10-2010-487**

## United Kingdom

The Cogeneration Directive provides the framework for existing support for both gas fired and renewable CHP, however, as the Directive does not require of a member states to develop incentives for operating CHP it has not been a key driver in UK Government policy. The Renewable Energy Directive has created a far more powerful focus on delivering increased renewable energy. A key value of the Directive has been using it to demonstrate that CHP saves a minimum of 10% primary energy. This objective document is a valuable reference for industry and Government when detractors of CHP suggest that it is of no value. The current proposals for a relief from the new carbon tax and the potential for additional incentives for CHP will rely on the Directive for determining good quality CHP. The UK Government and other organisations have commissioned reports into the potential for CHP. The UK low carbon transition plan indicated that CHP capacity would more than double to 15.5 $GW_e$ by 2020. Current 2010 levels are estimated to be around 7 GW. The policies to ensure such growth have not however been put in place so it is difficult to see how such a step change in growth will occur without a significant shift in policy.

# Eastern Europe Region

## Czech Republic

The CHP Directive has positive influence on improvement of cogeneration legislation and support, although support scheme is still not sufficient for faster CHP progress, differences between taxes are low and the non-balanced support between RES and CHP electricity is barrier for CHP market.

## Estonia

The CHP Directive has positive influence, especially with implementation of new support scheme in 2007, which is key instrument in as Estonia is in the early stages of opening an electricity market (*wholesale prices are very low – 30.4 €/MWh in the closed part of the market in 2009*) and the end use prices are the lowest in the region. Cogeneration projects without additional support are not economically feasible at all.

## Hungary

As new regulation - Second electricity act (*2001*) - established the incentive conditions (*FIT*) for fast and intensive development of CHP plants in Hungary, the transposition of CHP Directive has not influenced significantly to the development of CHP plants.

## Latvia

The first CHP support legislation in Latvia was approved already in 1996 which triggered significant cogeneration development with prevailing share of natural gas. The growth is evident also in the period after implementation of CHP Directive, where electricity generation from small CHP plants was increased from 306 GWh in 2004 to 580 GWh in 2008 and in large CHP units from 1.228 GWh to 1.524 GWh.

## Lithuania

Key pillars in Lithuania are a proper position and targets of cogeneration in National Energy Strategy (*2007*) – 35% share of CHP in generation till the year 2020, followed by Cogeneration Development Plan (*approved 2008*) linked with the incentive support. An explicit answer on what was the role of CHP Directive or the influence of closure of Ignalina nuclear power plant in this process is difficult to give.

## Poland

The general conclusion is that the Directive implementation has not significantly contributed to the development of CHP plants in Poland, as key barriers are still to be removed for faster progress:

- Low acceptance of and competitiveness of district heating (*bad past experiences, dependency, not always efficient and competitive, more expensive options for new real estate sector, high costs of needed grid refurbishment, additional CO2 costs for large units in ETS and for fulfilment of new environmental standards - IPPC*), resulted in disconnections from the grid.
- Risk of the current cogeneration support system based exclusively on high-efficiency cogeneration power certificates of origin as substitute fee and the requested quota are set at the too low level (*regulation uncertainty and administrative barriers*).
- The end use heat price regulation oriented to customers protection does not always reflect all costs occurred by the heat supply system, resulting in difficult economic situation for cogeneration.

## Slovakia

Linked with the established support system (*feed-in*) and long tradition on cogeneration in district heating systems, the CHP Directive has had positive influence on CHP policy by removal of barriers (*grid connection, administrative, etc.*), development of new support instruments (*investment subsidies from cohesion founds*) and better position of cogeneration in national energy policy. As incentive support of RES and CHP has significant influence on high final electricity prices, certain reduction and optimisation is foreseen in the next year.

## Slovenia

The CHP Directive has had positive influence. It was important reason for proper position of cogeneration in national energy strategy on one side and especially for the complete renovation of CHP support legislation which resulted in new modern and incentive support scheme for cogeneration in all sectors (*Feed-In, end of 2009*) where first positive results are already registered.

# South Eastern Europe Region

## Bulgaria

The transposition of the Directive 2004/4/EC in the legal system improved the conditions for further penetration of CHP and the government started again to reconsider CHP as on valuable asset in their struggle to reach the "20-20-20" targets set by Lisbon Treaty.

## Cyprus

The transposition of the CHP Directive improved the conditions for further penetration of CHP and the government started again to reconsider CHP as on valuable asset in their struggle to reach the "20-20-20" targets set by Lisbon Treaty. This was a breakthrough especially as there was no policy before for the promotion of CHP and CHP was underestimated for its benefits. On the other hand, the transposition of the Directive in Cyprus (done within the time framework set by the Directive) did not create any remarkable development of CHP in all sectors, except the agriculture one, where there are now CHP units installed with biomass (i.e. biogas from pig farms). These units present the technological state-of-the-art but the given F-I-T is considered low. This is due to the fact that the Cypriot Energy market is considered as peculiar (no NG, all fuels are imported, island mode electricity network, etc.).

## Greece

In Greece, a country without a strong previous background and experience on industrial cogeneration or District Heating Systems, as in Bulgaria and Romania, there is a notable development in the promotion of CHP by the Greek state. Firstly in 2006 in the Law for the promotion of RES was introduced the definition of High Efficiency of CHP with favourable F-I-T, equal in amount to those for RES, except PV that were getting far more favourable tariffs. Secondly in 2009, the Greek State transposed the Directive 2004/8/EC, with favourable treatment to CHP systems, up to 1 MWe (small cogeneration). Then, a new Law 3851/2010 promoted further HECHP with more favourable F-I-T for two categories of cogenerators; those using N.G., as fuel and those using CHP, with NG, for heating up high efficiency glass greenhouses and are using their exhaust gases for agricultural purposes. It is important to note that many of cogenerators that installed CHP with NG as fuel (either with EU incentives (2nd and 3rd CSF) or with the incentives of the National Development Law) kept their units out of operation, because of unfavourable energy prices in Greece. When an extra F-I-T of an extra 30% was given to them as bonus after the implementation of the Law, they started to produce high efficiency cogenerated electricity again. This percentage is calculated based on the average monthly price of NG, a price given by DEPA SA (the Greek State NG company). For those using above all, the exhaust gases for agricultural purposes there is an extra F-I-T of 18%.

## Romania

The transposition of the Directive 2004/4/EC in the legal system improved the conditions for further penetration of CHP and the government started again to reconsider CHP as on valuable asset in their struggle to reach the "20-20-20" targets set by Lisbon Treaty.

### South Western Europe Region

## France

Although the Directive has not been fully implemented, the first cogeneration tariff allowed starting the use of cogeneration in France. However the following tariffs (*1999 and 2001*), with harder conditions and lower tariffs and with a decreasing of 1% since 2001 (*-10% in 2011*) have less and less reduced the possibilities to realize new cogeneration plants. The easiest investment at the lowest prices was made first and then investment prices of new projects become more and more expensive. In addition heat sources for new projects are more and rarer, due to the reduction of the heat loads. The only possibility given today by the law is to have the opportunity to run the existing plants for a new period of 12 years at condition to put the plant in accordance with the last specifications of the tariff C-01 in renewing equipment for a minimum amount of 350 EUR/$kW_e$ in 2005, indexed. In the end, the directive is not effective: the growth of new plants for the sector is barely zero (*2 $MW_e$ in 2010*). Club Cogénération in France considers that minimum of 30 to 40% of the total installed 5 GW capacities should be dismantled in the next 2 years, adding the fact that the clean spark spread is not competitive now, and could remain non-competitive until 2015.

## Italy

The European legislation transposed by Legislative Decree February 8$^{th}$, 2007, n.20 sets stringent criteria for the recognition of high-efficiency cogeneration along with the reduction of the analysis on the primary energy savings to a single parameter (*PES*). It is interesting that the electricity from cogeneration is identified with the gross production that is different from the net production. The Directive also introduces new benchmarks for thermal and electrical efficiencies that are the only function of the fuel and it is not depending on plant size (*as it was in Resolution 42/02 of the Authority, along with a coefficient that accounted for the transmission losses*). What is needed is an express support to be allocated in the period of utilization of the CHP plants and that compensates for the lower CO2 emissions of the CHP plant. This support could be assessed in 30÷40 € per $MW_{he}$. In Italy, photovoltaic generation gets ten times this value. The unstable legislative scenario is also a strong obstacle to the development of any CHP plant and there is much confusion on the existing laws. The Directive on the whole is a good instrument, but it needs to be fully implemented, with the issue of the missing operation decrees.

## Luxembourg

Parts of the laws and regulations transposing the Directive 2004/08/EC are quite old (*Law of August 5$^{th}$, 1993, Grand Ducal Regulation of May 30$^{th}$, 1994*). So there is no real change in the situation. The recent legislations refers mostly to the renewable energy CHP (*namely: remuneration system*) and high efficiency CHP (*namely: subsidies grant*). The number of installed cogeneration plant in Luxembourg since 2001 has not a spectacular evolution after year 2004. We can even conclude that after 2006, the evolution is quite constant.

## Malta

Though in practical terms the implementation of the Directive has as yet to provide results, it served as a catalyst to conduct the feasibility study, to bring the knowledge to the interested parties and for the latter to plan projects.

## Portugal

The general opinion regarding the CHP Directive is that the application of the Directive tends to treat more favourably District Heating (*DH*) schemes. The new directive introduces a different methodology in the calculation of Primary Energy Savings. In the case that the high efficiency CHP thresholds are not met it is necessary to calculate non-cogeneration energy. Notably it is necessary to evaluate the power to heat ratio (*C*) calculated upon operational data of the CHP plant obtained through energy auditing. Generally speaking, the feeling of the CHP operators about the directive implementation is that it increases the Complexity (*bureaucracy*) of the new framework compared to the existing one, or has even a Negative impact on the CHP sector: the new Directive is more complex to implement with respect to the previous legal framework. Thus, the new legal framework may hinder projects in the revamping of CHP plants and the development of new projects. Furthermore the legislative framework is too demanding especially in what concerns energy efficiency in certain industrial sectors, as mentioned above.

## 2.4 Status of cogeneration - Incentives and barriers

### Northern Europe Region

#### Austria

Small scale biomass CHP is the main area of growth in Austria and this sector is supported through a feed-in tariff. As only a small segment of the CHP industry receives financial support, the remaining proportion is reliant on the spark spread (*difference between gas and electricity prices*) for their investment case. The volatility of the spark spread is viewed as a barrier to further CHP growth. A 2009 report was submitted to the Commission entitled "*Report on the results of the analysis and evaluations carried out in accordance with Article 9 of Directive 2004/8/EC – Cogeneration Directive Administrative procedures*", which outlines the way in which CHP installations are authorised. It was noted in the report summary that as CHP plant may have adverse effects on local populations or the environment, these procedures have become increasingly complex and lengthy, some taking several years to complete, which presents a material barrier to CHP deployment.

#### Belgium (Flanders)

As noted earlier, the most rapid growth in the installed capacity of CHP occurred in 2005. As CHP capacity has grown rapidly (*the 2012 target was achieved four years ahead of schedule*), the risk of oversupply of white certificates could lower the marginal value of certificates, for transmission connected CHP plant, to zero. The impact of such an oversupply of certificates would have a direct impact on the investment case for new CHP and on the operational case for existing plant. It may be that some investors foresaw the potential oversupply issues which led to the slowing of CHP capacity growth in 2008-2009. Current estimates are that, with no intervention, the predicted oversupply of white certificates would not be abated until 2020. Whilst distribution grid connected CHP plant receive a minimum of 27€ per MWh, in many cases it is thought that this will not be sufficient to keep the plant profitable; the market price for certificates historically sat at 40€ MWh. As a result, there is an expectation that the current growth in CHP installed capacity will cease for a period of one to two years. It should be noted that these problems are due to the support system's own success and that use of a market mechanism, such as white certificates, carries the risk of oversupply as seen in Flanders.

#### Denmark

CHP in Denmark stopped growing in 2004/05 when the Danish Government moved its attention to wind. A recent study by the Danish Energy Agency identified that whilst wind turbines are increasing their contribution to electricity generation, small scale CHP is decreasing its share of the market. Large scale condensing CHP power stations, however, have retained their contribution. It is hard to isolate where demand for differing generation types originates due to the internationally connected electricity markets. In 2007 Denmark's report to the Commission identified that although some barriers to CHP uptake had been removed, the price of electricity would continue to be a barrier. Grid barriers have largely been removed and local distribution and transmission companies and

system operators are obliged to set up a programme for internal monitoring with the aim of preventing discrimination towards the users of the grid. In coming years the price of electricity will not be high enough to allow for investment in new cogeneration capacity. This is attributed to the fact that the electricity price is below the long-term marginal costs for a new plant. As older plants are taken out of service, capacity will gradually fall and the price of electricity will rise to a level at which investments may be profitable.

## Finland

Only minor barriers to the further uptake of CHP were identified in 2009. The risk of policy changes affecting funding and in turn investor confidence is still applicable in 2011. Variability and volatility in the price of renewable fuels is also continues to be a significant barrier, due to the attraction of tax rebates for the use of renewable fuels within electricity generation projects. CHP capacity is continuing to grow steadily in Finland. The Finnish potential for CHP is considered to be a function of the growth in heat networks and the total heat and electricity demand that is still met by separate generation. The CHP potential has been identified as sitting principally within the heat network market rather than in larger scale industrial deployment.

## Germany

The amount of CHP in Germany is increasing from the baseline of 20.8 $GW_e$ in 2009. 2010 saw small scale plant up to 2 MW built, whereas it is anticipated that larger scale installations will be commissioned from 2010. In 2007 barriers to further CHP uptake in Germany were identified as low payback periods compared to the level of risk involved with installation. This has been exacerbated by the initial reduction of wholesale and retail electrical prices from the electricity market liberalisation, availability and competition for fuels, additional costs of the EU ETS and administrative and approval procedures.

## Ireland

Two 80 MW installs contribute to around 50% of Irelands installed capacity. This decision by a single organisation leads to the impression that uptake of CHP in Ireland is progressing, whereas there is not a widespread use of this technology. The original identification of barriers to CHP uptake suggested the following: Lack of a mature energy intensive industry and Ireland's population and urban density. The definition of CHP under the Cogeneration Directive was perceived to be a barrier, in particular the definition of the term, "*economically justifiable demand*", support may have to be "*scaled back*" to reflect the proportion to which they qualify under the requirements of the Directive. Typical payback periods sought by many of the sites in Ireland is three to four years, with some sites requiring a payback period as short as one year. CHP projects often fail to make these required "*hurdle rates*". Grid connection delays are also a recurrent problems faced by potential CHP installations. It has been suggested that underpinning all issues listed above is a lack of commitment to CHP from within Government.

## Netherlands

In line with the Cogeneration Directive, The Netherlands submitted a report to the Commission in 2010 updating their analysis of additional potential for CHP as well as assessing progress against the initial appraisal. This report identified a technical potential 7.7 $GW_e$ of new cogeneration in the period up to 2020, in addition to the existing 12.9 $GW_e$ (from a baseline of 8.8$GW_e$ in 2005). The lower economic potential for new cogeneration, which will vary with the carbon price, was estimated to be between 2.3 and 3.4 $GW_e$. There is extensive use of CHP in The Netherlands currently, with CHP contributing 55% of Dutch power. COGEN Nederlands however, expect this to decline in coming years, being pushed from the market by newly built non-CHP coal and gas plants due to lack of financial support. Barriers identified in 2007 included the following: fuel price volatility following electricity market liberalisation, uncertainty in the CHP subsidy scheme due to its foundation on the "*spark spread*" (*differential between gas and electricity prices*), the shortage of high tension grid capacity is slowing down, or in some cases refusing, connection of renewable and sustainable cogeneration plants to the networks.

## Sweden

No specific report is available on the Commission's website regarding barriers to uptake of CHP. The Öhrlings PricewaterhouseCoopers report "*An assessment of the potential for high-efficiency cogeneration in Sweden*" produced in February 2005 however, identifies a range of areas whose uncertainty has a negative impact on the investment case. The primary barrier to CHP uptake is the removal of Green Certificate support planned for 2016. In the absence of the green certificate system, the investment case becomes more sensitive to issues such as $CO_2$ tax on cogeneration and allocation of emission allowances. In addition uncertainty around taxation of cogeneration energy, environmental aspects, the regulatory framework and the electricity market have an impact. This impact can be observed through a lower than estimated volume of cogeneration actually implemented.

## United Kingdom

Installed CHP is growing slowly in the UK. The greatest area of market activity is in the sub 5 MW market supplying public buildings and the commercial sector with CHP plants. Such CHP plants can benefit from generating onsite power which is substantially cheaper than the cost of electricity supply. The work for the CODE work package three project indicated that the 1 MW project had the best modelled rates of return. There are some large scale CHP projects under construction or consideration within industry but the current policy uncertainty is creating an investment hiatus. Small scale CHP operators fail to achieve good value for exported electricity, often being offered supplier rates which are so low as to cause a negative return with the cost of generating being higher than the value of export. As a result small scale CHP plants are often run to scale down generation when nearing generation export. The UK electricity market is highly complex and entry is almost impossible. The large suppliers hedge market risk through vertical integration – having both generation and supply businesses. New entrants are unable to operate as vertically integrated entrants as this would require securing equal generation assets and demand (*customers*) simultaneously. As many CHP operators are independent market players, they are subject to risks not experienced by large vertically integrate players which presents a highly significant barrier to market entry. The UK electricity market is highly illiquid further increasing the risk to new entrants.

The lack of an established series of heat networks and a policy on domestic, commercial and industrial heat has led to significant policy uncertainty for CHP operators and developers.

## Eastern Europe Region

### Czech Republic

The share of CHP generation is around 15%, slightly decreasing in last years, mainly due to decreased heat demand (*energy efficiency in buildings and district heating networks, where the majority of cogeneration in the Czech Republic is used*) and more accurate reporting on only high efficiency cogeneration. Approximate capacity of new installed CHP units after 2007 is 14 $MW_e$.

### Estonia

After the drop in 2007, the share of CHP generation is growing again toward 10%, also as result of new installed capacities. 60 $MW_e$ of new installed CHP capacity after 2007 is the largest volume in the whole Eastern region, showing that clear policy targets with proper support for CHP are key instruments for success, especially in the environment with low electricity market prices.

### Hungary

Significant growth of CHP electricity generation till 2007 (*40% growth compared to 2004*) started already in 2002 after approval of Second electricity act (*2001*), especially with installation of new gas engine units in district heating systems and industry, which stopped in 2008 with stagnation in 2009 due to change of support scheme with very restricted and limited support for new cogeneration projects.

### Latvia

With high 41% share of cogeneration in total electricity generation, Latvia is on the second place (*after Denmark*) in EU-27. Cogeneration capacity has been expanded considerably in the energy sector in Latvia since 2000, where share in centralised heat supply has increased by 14% (*52% of total heat*) and with 5% yearly growth in electricity share till 2008. Significant decrease of CHP share in 2009 from graph is not consistent with Latvian governmental data, where share is even higher (*36%*) and volume of electricity is stable since 2006.

### Lithuania

Share of CHP electricity in gross electricity generation is rather stable (*increase in 2005 is result of significant decrease of generation by shot down of 1.unit in Ignalina nuclear PP and similar is expected in 2010 with stop of unit 2 in 2009*). Shown statistical data (*Eurostat*) with 20% decrease of CHP electricity generation seems rather uncertain and deviate from higher reported generating values in progress report.

## Poland

In current conditions the status of CHP is rather stable with the 17% share of CHP in the gross electricity generation and volume of around 26 TWh of CHP electricity generation in last 5 years. Listed economic barriers, administrative barriers, regulation uncertainties are the main barriers for further CHP development and potential exploitation.

## Slovakia

Share of CHP generation has significant jump in 2006 (*larger units installed*) but is facing gradual decrease afterwards and is moving toward 20%, influenced also by close down of old nuclear power plant unit (*Bohunice V1 reactor end of 2006*).

## Slovenia

Incentive support and consecutive development of new CHP units in district heating systems balanced the decreased CHP production in industry and keep share of CHP electricity stable in the shown period. New support scheme in 2010 triggered fast development of small scale CHP units with delayed response in industry, where due to economic crisis the real development has not yet started.

# South Eastern Europe Region

## Bulgaria

In Bulgaria, the CHP is growing slowly, mainly due to the existing energy prices and all the barriers are described below:
Legislative barriers: The unresolved problems relative to the heat trading in the district heating sector have a negative impact on the development of cogeneration. Bulgaria is the only country in Europe where the heat supply company sells the heat not "*to the building*", but to each individual apartment.

- There is no support scheme for micro-CHP. In fact there is no possibility for a single micro-CHP producer, installed in houses and buildings, to sell the surplus energy to the grid.
- There is no fixed and firm feed-in tariff preferential cogenerated electricity price, which according to the existing Law has to be based only on the gas price and has to be valid for a relevant period. In Bulgaria this preferential electricity price is set individually for each CHP producer from the SEWRC regulator (*State Energy and Water Resources Commission*). Usually this price is related on gas price, investment and operational costs plus 7-8% returns of the equity capital. Thus, a producer with higher costs will obtain a higher price. Moreover, every time when the gas price is changed every CHP producer have to apply for new price and to provide again tons of paper to SEWRC, a quite bureaucratic procedure.
- Another problem, that many industrial facilities are facing, is the so called "*own electricity consumption*". In the Bulgarian Energy Act it is stated that the electricity, produced from a high efficiency CHP is subject of a preferential feed-in tariff, but excluding the consumption of the producer. There is an unclear definition of what is the definition of means "*producer*"

- the CHP installation or the whole industrial plant, which consumes heat and electricity resources. For example, for a large industrial customer that consumes ~ 20t/h of steam and 12 $MW_e$ electricity, the ideal is the installation of a 15 $MW_e$ CHP; common procedure in EU Member States countries. In Bulgaria, this is not the same situation - the Bulgarian Energy Act states that it is subject of preferential price only the difference of the 15 $MW_e$ installed to 12 $MW_e$ (*own consumption*). Therefore only 3 $MW_e$ will be awarded with the preferential price. So, the customer has no benefit for installing a high capital system, like CHP, and it is cheaper to produce steam in steam boilers with NG and to purchase the needed electricity from the grid.

Technical barriers: The requirements for connection of new CHP installations to the grid are considered as barrier, for building new cogeneration capacities in the country. The same applies to the natural gas supply.

Financial barriers: The high natural gas prices in mid-term perspective are considered as a serious barrier to the development of high efficiency cogeneration schemes in the country.

## Cyprus

Limited grow of HE CHP, mainly due to the existing energy market (*no NG, no Liberalization*) and of the barriers described below:

Climatologic conditions of the country: It becomes understandable that the climatic conditions of Cyprus encourage the use of tri-generation CHP systems, for covering and the cooling loads, particularly in the tertiary sector.

Processes of Interconnection of Cogenerators to the Network: Today, no recorded experience exists for the connection of HECHP systems with the Grid, either by the investors or the Administrator or the EAC-AHK.

Priority Right for installations HECHP: In Law 174 (I) /29.12.2006, Article 8 it is reported in that "*it is comprehended that priority right is in effect for installations of electricity production up to 7 $MW_e$*". Also, it is reported that "*in the case where the auto-producer produces electric energy through high-efficiency co-generation the priority right is in effect for installations of electricity production up to 11 $MW_e$*". It obviously contradicts with the objectives and the spirit of Directive 2004/8/EK.

## Greece

There are signs that the existing situation of slow grow of CHP is going to change; but it is a slow process, mainly due to the immature energy market and the barriers described below:

Climatologic conditions of the country: the climatic conditions Greece, especially in its south parts encourage also the use of tri-generation CHP systems, for covering and the cooling loads, particularly in the tertiary sector.

Priority Authority for CHP units throughout the electrical load distribution: In Law 2773/99, which determined the terms of the liberalization of electricity market in Greece, the Article 35 specified that CHP units, up to 35 $MW_e$, can get priority to the Network. It obviously contradicts with the objectives and the spirit of Directive 2004/8/EK.

Connection Procedures of Cogenerators with the Network: The access of cogenerated electricity to the Network is a rather complicated issue for cogenerators, as no clear and well-defined regulations,

by the HTSO and PPC exist, driving the cogenerators to negotiate with them the terms of access from a lagging position.

Fuel Pricing and Availability for CHP units: An important issue, regarding the further penetration of CHP in Greek system, is the existing energy pricing policy, especially the low electricity pricing for both industrial, tertiary and household sectors and the high gas pricing, knowing the price connection of gas with crude oil and its implications. It is partially solved for cogenerators with NG as fuel.

Permit Procedures for all types of CHP units: The procedure for obtaining the permit, for any type of CHP units, is complicated and time consuming. For applying for a permit, the involvement of different public authorities (*i.e. RAE, Ministry of Development, Ministry of Environment and Public Works, local authorities, Prefecture, etc.*) is required. The most notable delay occurs during the procedures for the "*environmental consequences*" permit, issued by the Ministry of Environment and Public Works.

## Romania

In Romania, the CHP is growing rather gradually, mainly due to the existing energy prices, the high cost of CHP systems and all the barriers are described here. The old age of the existing thermal energy production, transport and distribution facilities constitute a major problem for local producers of electrical and thermal energy in cogeneration do not have the investment capacity required to upgrade and modernise them. At the same time, the spectacular rise in equipment costs means that correspondingly higher investments are required. Consequently an unrealistically long period of exploitation is required, for any given installed thermal power, in order to make such investments acceptable to investors. In these circumstances, the conventional heat production plants continue to be preferred since they require less capital investment and hence involve less risk. Due to the substantial drop in technological steam consumption resulting from decreased economic activity and industrial restructuring, many plants are functioning below their minimum technical limit. In addition, many thermal energy consumers stopped using the services of centralised systems and thermal energy demand in the residential sector also fell significantly. There are also typical market obstacles, such as unfavourable natural gas and electrical energy prices. The larger the gap between the price of electricity and that of natural gas the more attractive cogeneration becomes and the more advantageous compared to conventional production. The current situation where gas prices are rising, while electrical energy prices are not, makes it difficult to recover the investment and hence investors are reluctant to invest. The implementation of environmental protection measures is also a major obstacle because it involves extra funds, which have to be allocated at the start of investment, especially for coal-powered power stations. Another obstacle to the development of cogeneration is the fact that external costs – such as CO2 emissions are not realistically included in energy prices. The transport and distribution of electrical energy require additional investment to extend grids, in certain areas, which can have a negative impact on the price.

## South Western Europe Region

## France

Due to the reasons mentioned at point 2 above, CHP is no more growing in France:

- Technical specifications improving (*1997, 1999, 2001*)
- Continuous decreasing of the tariffs
- Easiest projects already made, new projects more and more difficult to realize on the technical side and consequently on the financial feasibility side

Today government has decided to maintain the level of cogeneration in France at his actual level of about 4 $GW_e$. Lot of projects made in the years 1998 to 2000 arrive to the end of their 12 years agreement with EDF for the purchasing of their electricity. In order to maintain a maximum of these plants running, government has decided to make applicable the last tariff C-01 to renewed plants (*see above*). Due to the sharpening of the conditions of the C-01 tariff compared to the previous, performances (*especially efficiencies*) of the renewed plants must be increased and optimized. In the end, the barriers that hamper CHP in France are essentially economic reasons: There is no financial feasibility without subsidies. The subsidies are made through the tariff of obligation to EDF to buy the cogenerated electricity. This tariff is financed by the CSPE (*Contribution to the Public Service of Electricity*) tax paid through all electricity users (*950.4 MEUR in 2009, 36% of the globalism of the CSPE*).

In France the average price of electricity is low due to the high amount of nuclear and hydraulic electricity. Cogeneration tariff C-01 is still valid since the July 31$^{st}$, 2001 (*10 years*), with a decrease of 1% each year. That means that a project which has not be decided in year n, has less feasibility if decided in year n+1. The only possibility to make a cogeneration possible is to decrease the investment price. This is the case for renovations where the tariff C-01 is applicable for a new period of 12 years at the condition that the investment is more than 350 EUR/$kW_e$ indexed. Government has clearly said that they will maintain the level of cogeneration in France through renovation of gas cogenerations and new biomass cogenerations. Public tenders for biomass cogenerations are published periodically since 2005, will be published annually for 200 $MW_e$/y, and the tariff has been modified recently, unfortunately with a decrease of 3.6%!

## Italy

Many causes hamper the CHP in Italy:

- Engineers and in general technical personnel have low cogeneration technical knowledge. This often causes engineer and planners to prefer traditional solutions like boilers and standard grid connection, even when the CHP can offer economic and environmental advantages.
- Poor skills in sizing the CHP plant consistently with the actual thermal and electrical loads of the user.
- The load profiles are often unknowns.

- High investment costs that involve financial risks to the user. The problem is bigger for small and micro CHP system where the specific costs are higher (in terms of € / kW).
- Moreover, the connections cost of cogeneration systems (hydraulic and electric) are quite high.
- The increase in bio fuel prices (oil, wood, biogas) heavily reduces the profitability of biomasses plant that are often stopped.
- Heavy bureaucracy: the procedures to install a cogeneration system are very long and sometimes not well defined.
- The problem is greater in proportion for small sized CHP plant, and in particular for micro CHP plants considered like bigger CHP plants. Customer must relate to many institutions in order to obtain the permissions to install a CHP system; this has often a negative effect on the customer which prefers traditional solutions.
- Impossibility in residential housing to exchange the electricity produced from one building to another one.

It is mandatory to declare and register the power station as an "*officina elettrica*" (*electrical workshop*), independently from the size of the generator: every plant producing electricity with capacity greater than 20 $kW_e$, must be registered as "electrical workshop" before it starts, in accordance with the Legislative Decree 504/1995.

As for fuel it's possible to pay according to the metered quantity or to pay to the custom agency a fixed amount according to estimation. For small CHP (*below 1 $MW_e$*) a monthly estimation of fuel consumption must be sent monthly to the gas authority (*which applies the excise*). According to environmental restrictions for each Italian Region, there are authorizing limit to the plant size and production depending also on the fuel (*fossil, biomasses)*. Connection costs for plant smaller than 15 kW is not economical. From a speculative point of view, biomasses plants are more profitable if arranged as CHP plants. Biomasses suppliers are interest in selling the bio fuels to CHP operators, since the y can sell at higher prices. Moreover, support mechanism to photovoltaic in Italy is very strong, whereas thermal renewable are almost ignored. In the end, the barriers to CHP in Italy are mostly bureaucratic and also economical. To help cogeneration in Italy:

- The buying price of the CHP electrical $kW_h$ should be equalized to the selling price
- Bureaucracy has to be simplified, and authorization times reduced
- The exemption from taxation mechanism of the fuel should be clarified and finalized to the diffusion of the CHP plants.

## Luxembourg

The CHP in Luxembourg had not (*at least lately*) a spectacular evolution. The classic CHP (*meaning here plants fired with natural gas and not a high efficiency cogeneration*) had not enjoyed lately of a new supportive legislative framework. So its development was not very much encouraged. That doesn't mean that new classic CHP did not manage to emerge even with the old legislative

framework. It means only that the main actors on the market, started to question about the profitability of such projects, having in mind also the important barriers still existing for the classical CHP (*guaranteed electricity tariffs limited to 1.5 MW per installation, tariffs not guaranteed during the lifecycle of the installation, mechanism of retribution for installed power bearing risks*). The benefits resulting from the recent legislations refers mostly to the renewable energy CHP (*namely: remuneration system*) and high efficiency CHP with renewable energy (*namely: subsidies grant*). That proves that CHP is still in the attention of the Ministry, but the wish is to promote plants with high efficiency and production of electricity from renewable energies. The main barrier that still hampers a new natural gas cogeneration plant is the uncertainty of the legislative framework. As the electrical remuneration is still submitted of the Grand Ducal Regulation of May 30$^{th}$, 1994, the risk of a change in the legislation is very high. For a CHP with RES, the main barrier is due to the Luxembourg small size. Because of the high costs of such project, in order to be profitable they have to run maximal charge during the year; in Luxembourg, such demand is very difficult to find.

## Malta

Currently there are no CHP units installed however the interest is growing and a small number of entities are trying to put projects into practice.

## Portugal

The delay in implementing the directive leads to the postponing of CHP projects by the main stakeholders. For the time being the elaboration of CHP feasibility studies is impaired by incomplete legislative framework and less CHP projects have been recently licensed.

Problems that hinder CHP development are:

1. Legislative framework / bureaucratic barriers:

- The legislative framework does not create an effective investment climate for the CHP promotion;
- The new CHP legislative framework is not yet fully published;
- Secondary legislation waiting publication (*i.e. the new regulation for CHP electricity feed-in tariff*);
- Main players in the CHP field are waiting for the legislative framework to be complete;
- Higher costs for the implementation of the CHP directive that have to be supported by the promoters;
- Complexity, notably through the creation of the *EEGO* (*Issuing Authority for Guarantees of Origin*) that will significantly increase the costs and bureaucracy as well as senseless control. Potential harm to the CHP sector.

2 . Licensing procedure barriers:

- The licensing procedure should be more expedite.

3. Connection to the grid barriers:

- Connection to the grid is often refused by DSO´s and TSO's based on highly conservative criteria for safe grid operation;
- Access to the grid is the main bottleneck to CHP implementation.

4. Project financing barriers:

- Banks impose restrictions on credit and charge high interest rates that can jeopardize economic feasibility of CHP projects;
- The high interest rates will require higher rates of return on the projects which are not being considered in the calculation of the feed-in tariff.

5. Primary energy source barriers:

- There is a strong support for renewable energy projects which has a competing effect on more "*traditional*" CHP projects.

6. Fiscal barriers:

- Thermal energy delivered by DHC plants is subject to a higher VAT when compared to other forms of energy (*e.g. natural gas*).

# 2.5 Assess the real diffusion of cogeneration against the potential

## Northern Europe Region

### Austria

Reported installed capacity in 2009 was 4.25 $GW_e$. From this baseline an estimate 7.6 $GW_e$ of additional technical potential was estimated in WP2 however, only 3.0 $GW_e$ of this is seen as additional capacity that may economically be installed. A report entitled "*Potential study for cogeneration*" (*Endbericht Studie über KWK-Potentiale in Österreich*) was submitted to the Commission in 2005, as required by articles 6.1 and 10.1 of the Cogeneration Directive, outlining the potential for CHP in Austria. Based on a 2002 reference year the report identified growth potential of 2.379 MWe between 2005-2020, however, it is not clear whether this is technical or economic potential. This assessment does not specify the potentials in relation to the timeframes 2010, 2015 and 2020 with appropriate cost estimates for each of the timeframes in line with Annex 4 (C) of the Cogeneration Directive. CHP has an established use on industrial applications, which have a solid investment case. In the recent past CHP was promoted in municipal applications to provide district heating and reduce city pollution. Currently small scale biomass CHP is the main area of growth in Austria and this sector is supported through a feed-in tariff. As only a small segment of the CHP industry receives financial support, the remaining proportion is reliant on the spark spread (*difference between gas and electricity prices*) for their investment case. The volatility of the spark spread is viewed as a barrier to further CHP growth.

### Belgium (Flanders)

Belgian reported installed capacity in 2009 was 2.1 $GW_e$. From this baseline, 1.2 GW of additional capacity was estimated in WP2, with no difference between technical and economic potential implying all 1.2 GW should be economical to install. As a result of the success of the scheme, current oversupply of white certificates, the 2012 CHP potential was reached 4 years early, in 2008 (*see previous questions*). Subsequently in 2009, the Government of Flanders re-evaluated the potential for CHP in the region. Two scenarios were estimated; business-as-usual (*BAU*) and pro-CHP. Under the BAU scenario the Government estimated that CHP could grow to 2500 $MW_e$ installed by 2020 but under the pro-CHP "*growth*" stance that figure could grow by 500 MW to 3000$MW_e$. The adequacy and longevity of Government support are considered to be key features to achieving these targets. Growth can be seen in particular areas. The figure below shows the number of CHP certificates (*directly related to the primary energy savings*) issued in Flanders per technology. It can be seen that the largest amount is for internal combustion engines, many of which are in green houses. Almost 50% of electricity generated for new greenhouse installations is from CHP. The growth of CHP in buildings and biomass CHP continues to be rather limited.

### Denmark

In 2007, The Danish Energy Authority issued the "*Report to the European Commission in connection with the implementation of the Cogeneration Directive 2004/8/EC 21*" in line with articles 6.1, 6.3, 9.1, 9.2, 10.1 and 10.2; which details CHP legislative framework, barriers, potential and promotion of

cogeneration to date. Across a range of sectors this report identified installed capacity of 9.6$GW_e$, a technical potential of an additional 13.9 $GW_e$, but only 10.1 $GW_e$ as economically viable. Reported installed capacity in 2009 was 9.7 $GW_e$. From this baseline 4.2 $GW_e$ of additional technical potential was estimated in WP2, however, only 0.4 $GW_e$ of this is seen as additional capacity that may economically be installed. It is assumed that Denmark is on track to achieve their potential of an additional 10-13 $GW_e$ increase from 9.7 $GW_e$, as stated in their report to the Commission in 2007. Whilst there could be an increase in district heating and consequent increase in demand for CHP, as energy efficiency of buildings improves, the heat demand is not likely to increase overall. There is likely to be additional growth seen in the microCHP market.

## Finland

Reported installed capacity in 2009 was 5.9 $GW_e$. From this baseline an estimate 1.2GW realistic additional capacity was estimated in WP2, with no difference between technical and economic potential implying all 1.2 GW should be economical to install. The 2009 report for the Ministry of Employment and the Economy identified specific targets for industrial and district heating cogeneration in 2010 and 2025. The combined total for 2025 is 41.9 $TWh_e$. Currently, CHP supplies about 40 per cent of total electricity demand (*as of 2010*) which equates to about 27 $TWh_e$ compared to a total demand of between 80 and 90 TWh annually. Of district heating networks, which deliver the heating requirements for 50 per cent of buildings in Finland, between 70 and 80 per cent of the heat was delivered from CHP. With such a high penetration of CHP both in the electricity market and in the district heating market, the potential for further growth in installed capacity is clearly limited. It is anticipated, however, that there will be continuing demand for new installations of small CHP in part to replace ageing CHP assets on heat networks.

## Germany

Reported installed capacity in 2009 was 20.8 $GW_e$. From this baseline 66.8 GW of realistic additional capacity was estimated in WP2, with no difference between technical and economic potential implying all 66.8GW should be economical to install. The 2007 report on potentials identified 328 $TWh_{th}$ pa and 351 $TWh_e$ pa as the economic potential in Germany. The German Government commissioned a study in December 2010 to assess the diffusion of CHP to date against the stated potential of 66.3 $GW_e$ stated by the German Government in their "*Analysis of National Potential*" submitted to the Commission. This document is intended to inform the evolution of the German CHP law and will be available later in 2011.

## Ireland

Reported installed capacity in 2009 was 0.3$GW_e$. From this baseline an estimate 1.9 $GW_e$ of additional technical potential was estimated in WP2, however, only 0.8 $GW_e$ of this is seen as additional capacity that may economically be installed. The potentials report submitted to the Commission in 2009 identified a range of potential capacity from 366 to 773 MW in 2020. A progress report for Ireland has not yet been submitted to the Commission and therefore progress to date, against this identified potential cannot be assessed.

## Netherlands

Reported installed capacity in 2009 was 9.7 $GW_e$. From this baseline no additional capacity was identified. The 2010 report on potentials submitted to the Commission identified a maximum technical potential of 7.7 $GW_e$ of new cogeneration by 2020 (*on top of the existing 12.9 $GW_e$*) but of this an economic potential for new cogeneration of just 2.3 to 3.4 $GW_e$. The Netherlands has achieved approximately half of its identified technical CHP potential (*at 12.9$GW_e$ in 2010 with a further 7.7$GW_e$ potential, this corresponds to just under 55% of the country's electricity being generated by CHP*), however, under the current regime this is likely to contract without additional support. Evidence of this trend in industrial CHP has already been identified, by COGEN Nederland, where run hours have declined as plant is switched off during off-peak hours. Whilst the amount of installed power is roughly stable for industry, the question facing industry in the future will be whether to replace existing plant with new cogeneration or separate production of heat and purchase of electricity from the grid. The only sector in which CHP has grown over the last few years was horticulture (*gasmotoren - gas engines*).

## Sweden

Reported installed capacity in 2009 was 4.0 $GW_e$. From this baseline, 3.8 GW of realistic additional capacity was estimated in WP2, with no difference between technical and economic potential implying all 3.8 GW should be economical to install. The 2005 report on potentials to the Commission reported an economic potential of 14 TWh for 2010, approximately 15.5 TWh for 2015 and 17 TWh for 2020. Anecdotally, renewable CHP is the area that is growing. There have been just two new CHP-CCGT built recently but it is unlikely that there will be any more. New CHP uses biomass or waste as fuels.

## United Kingdom

Reported installed capacity in 2009 was 5.4 $GW_e$. From this baseline 10.6 GW of realistic additional capacity was estimated in WP2, with no difference between technical and economic potential implying all 10.6 GW should be economical to install. The report to the Commission in 2005 identified an installed baseline of 1.502 CHP units with a total electrical capacity of 5.440 $MW_e$, generating 27TWh of electricity and 51 TWh of heat. Potential to 2015 suggested 94 $TWh_{th}$, 81TWhe (*12.5$GW_{th}$ and 10.5$GW_e$*). This does not include renewable CHP, trigeneration or microCHP. The current target identified by the UK Government in the Low Carbon Transition Plan is 15.5GW by 2020. As the UK CHP market is principally located in the industrial sector (*from an installed capacity perspective*) potential studies have tended to focus on a growth in industrial centres. The potential for CHP serving extensive district heating networks in the UK has not been significantly explored by Government and, therefore, it may be that the potential for CHP in the UK is greater than currently considered. The support for CHP, in the form of exemptions from the CCL and Enhanced Capital Allowances (*not accessible by energy utilities*) has led to a broadly sustaining level of subsidy with very limited net growth in CHP capacity. To achieve the potentials such as the 15.5 GW by 2020, the industry believes that a far more significant level of support for CHP is needed. In addition large CHP plants are associated with facilities often owned by large multinational corporations. In these circumstances the support for CHP is not evaluated compared to installing a boiler but also to support in other nations. With both support and policy rhetoric in Germany and Flanders being stronger, the potential for companies to relocate or invest in CHP in these countries may be greater.

The need to decarbonise the UK economy by 2050 has led to a series of projects focussing on how this should be done. The impact of these has often been a foreshortening of vision within Government leading to a perspective that all that would be needed in 2050 should happen in the immediate future. CHP has suffered as a result of this narrative as the role of gas in the decarbonisation process is often lost. Renewable CHP is growing in the UK and there are a number of projects under construction or consideration. The effectiveness of the new renewable heat incentive will be the determinant of whether renewable CHP grows significantly in the near future. The requirements under planning law to seek opportunities to operate plant in CHP mode rather than as power only appears to have ensured that plant are located away from a potential heat load due to the substantial costs of building heat networks. There are a number of biomass power-only projects that could effectively operate as CHP plants making optimal use of the limited biomass resource but currently, it appears that, if built, the projects will operate in power only mode.

## Eastern Europe Region

### Czech Republic

We are very slowly moving toward estimated potential. Not balanced support of RES of CHP electricity, especially too high support of PV units resulted in tremendous expansion of PV market and almost stops interest in cogeneration. Installation of close to 2000 $MW_e$ of PV plants till mid of 2011 caused huge grid connection problems (*connecting to the grid was stopped in February 2010 for all, even for CHP*) and financial burden for financing the support (s*upport for PV was significantly decreased in 2011*). As many old CHP of the plants are inefficient (*not fulfilling emissions standards, especially in district heating systems*), there is still large potential for replacing and/or upgrading the plants and switch from coal to natural gas.

### Estonia

By the year 2020, Estonia would like to ensure that electricity produced in CHP forms 20% of the gross consumption (*the share in gross electricity production was close to 10% in recent years*). Estonia is the only Member State in the region that is moving toward the estimated potential.

### Hungary

Due to very intensive cogeneration expansion after 2001 till 2007, high penetration (*65-70% of district heat produced by cogeneration*) and foreseen decrease of heat demand, the past growth of cogeneration units should decrease, concentrated mainly to the services and small scale application and with gradually increased share of renewable energy sources (*explicit capacity potential has not been reported*). Due to stop of the support in 2011 there is no progress within new project at the moment.

### Latvia

Available data on CHP development in Latvia show that cogeneration is growing and is moving toward evaluated economic potential in the year 2020 (*600 $MW_e$*).

## Lithuania

Current support of CHP offers attractive economic conditions for further development of cogeneration in Lithuania, especially in district heating sector and biomass fuelled CHP. As cogeneration is recognised as important low carbon technology, integrated in planning procedures and grid connection is not recognised as obstacle, the access to the affordable finance resource is representing the main barrier for the faster utilization of the evaluated potential. In National Energy Strategy (*2007*) Lithuania has set the ambitious long-term goal to produce 35% of electricity and 75% of district heat from cogeneration till 2025. Cogeneration Development Plan (*approved 2008*) Plan for Implementation of the National Energy Strategy in 2008–2012, total capacity within the entire period (*2008–2020*) would make up from 1.133 $MW_e$ to 2330 $MW_e$ in industry (*25%*) and district heating systems with increased importance after close down of Ignalina Nuclear power plant in 2009.

## Poland

Although the government has set ambitious target of doubling cogeneration use by 2020 compared to 2006 in draft Energy Efficiency Law (*October 2010*), current progress is very slow and far from huge economic potential till the year 2020 (*close to 9 GW in large systems and small units*). Barrier removal to establish predictable and stable economic conditions for new investments are key issues for the success (*Draft Ordinance have already been prepared to induce increased use of cogeneration by improving pricing incentives to for cogeneration facilities*), where modernization of existing CHP plants and partial switch to natural gas will significantly decrease emissions and contribute also to the environmental goals.

## Slovakia

Traditionally well established and supportive environment for cogeneration in Slovakia is drive force for cogeneration growing, where close to 20 MWe has been installed after 2011 (*E.ON 417 MWe combined cycle unit Malzenice, starting with operation in the beginning of 2011 not included*). As total economic potential till 2020 was estimated to 2.4 $GW_e$ (*1.9 $GW_e$ reconstructions of existing units and 0.5 $GW_e$ of new units*), by current trend Slovakia is slowly moving toward estimated potential.

## Slovenia

Due to economic crisis new investments of CHP in industry have not yet started in spite of the highest evaluated potential and simulative support since 2010. Installation of well approved additional gas engine units in district heating systems continued from starts in 2004. New support triggered larger number of small scale and micro CHP units in service sector (*hotels, schools, commercial centres, etc.*) and increased interest also in other sector and active players on the market so faster development in all sectors is expected in next years.

## South Eastern Europe Region

The actual position of CHP in all Member States of the South-Eastern European Region is lagging compared to the estimated potential. This is explained in the different sections of this Report. For Bulgaria the collected data shows that there are twenty nine CHP installations where seventeen of them are characterized as non-HECHP (*58.6 %*) where five of these installations are old power plants with coal. Regarding Greece no sector's thermal or electrical power can be satisfied by CHP. Taking into account that in late 90s the cogenerated electricity was 2.4 % of the total electricity production and in 2010 this percentage dropped to 1.8 % this can verify the above statement. Also the large amount of investment required to refurbish old CHP stations in Romania and Bulgaria, the new tendencies by customers in these countries of independent heating systems in their establishments, the existing energy prices and the continuing economic crisis creating a difficult environment for CHP to satisfy even partially their electricity or heating requirements.

## South Western Europe Region

### France

According to the document "*Analyse du potentiel national pour l'application de la cogénération a haut rendement*" published the October 20th, 2010 by the Ministry of Ecology, Sustainable Development, Transports and Housing, on pages 14 and 15, for collective residential sector out of DH there will be a decrease of 39% of technical heat needs from 2008 to 2020 (*75.4 $TW_h$/y down to 45.9*). For individual residential sector -23%; for the tertiary sector average -55%; for tertiary DH's -28%. The only sector, where the report see an increase of the annual needs is the Residential DH's with +60% (*14.6 $TW_h$/a to 23.3*) In totality of all sectors the need will decrease of -22% (*from 510 $TW_h$/a down to 397*). Another document "*Analyse du potentiel national pour l'application de la cogénération a haut rendement*" issued by the Ministry of Ecology, Sustainable Development, Transports and Housing reports that shows that the CHP technical potential is 30 $GW_e$ by 2020, but actually limited to 5 $GW_e$ the possible existing capacities at the same time horizon (*no growth, partial development of biomass CHP, losses of capacities for natural gas CHP*). The technical potential of cogeneration is assessed considering the technical feasibility of CHP plants with the priority on the thermal load, not considering economic issues. Table below compares the situation of CHP in France at 2008 with the 2020 potential

### Italy

Currently, in Italy, cogeneration is not widespread. In particular, there is still a good potential, to be exploited, especially for small and micro CHP. Industry has already exploited most of the potential, although there are still some sectors where an improvement is possible. Besides, there has been a good growth of small district heating networks, whereas the industrial sector has lost some ground. Municipalities show an increasing attention to the environmental and energy independency issues and then to the use of the HE CHP. A recent interesting study by RSE-GSE - "*Hypothesis of high efficiency cogeneration development in Italy to 2020*" assessed the CHP potential at 2020 in the industry, tertiary and residential allowing for both technical and economic constraints as follows:

## Luxembourg

As reported in §3.3, the Directive implementation has not changed substantially the situation of the CHP in Luxembourg. The total installed power is reported to be around 76 MWe, and the scenario seems to be stable, with a feeble positive trend. The only available data on the CHP potential in Luxembourg are the official data provided by the report as per article 6 of the directive on the national potential issued by the *Fraunhofer Institute for Systems and Innovation Research* in 2008. The main potential for expansion of cogeneration is in industry and in district heating.

## Malta

The potential has been analysed and specific sectors indicated that there is even an economic feasibility. The only data available are, again, from the document issued on June 2009 by the Malta Resources Authority *"Analysis of Potential for Co-Generation on the Maltese Islands"*. According to this document, there is a potential of 71 $GW_h$ in terms of Primary Energy Savings that could be achieved installing a total power of 4.3 $MW_e$ of CHP plants. The Primary Energy Savings potential reaches 150 $GW_h$ allowing also for the waste treatment plants and industry running on thin fuel oil.

## Portugal

During the last three years (*2008 – 2010*) the licensed CHP capacity in Portugal was the following:

| Year | No. of Projects | Installed Capacity (MVA) |
|---|---|---|
| 2008 | 22 | 372 |
| 2009 | 21 | 100 |
| 2010 | 17 | 51 |

***CHP capacity in Portugal***

This table clearly shows a decline in the licensed CHP projects in Portugal. There is no available data concerning the first three months of 2011 but the trend should correspond to stagnation in the licensed projects. During the last three years some HFO (*Heavy Fuel Oil*) CHP units have been converted to Natural Gas (*NG*) corresponding to an installed power of roughly 40 MVA. These units are not included in the table above. To our knowledge since January 2008 no more requests for information on interconnection issues for CHP projects were presented to DGEG.

## 2.6 Progress Report

### Northern Europe Region

#### Austria

As of April 2010 a second report detailing progress against the identified potential in respect of Article 6.3 (*deliverable 10.2*) of the Cogeneration Directive had not been submitted to the Commission. Anecdotal feedback suggested that the Progress Reports are a useful lobbying tool and provide a basis by which to contrast countries, but did not drive CHP deployment in their own right. No suggestions for improvement were put forward.

#### Belgium (Flanders)

As of April 2010 a second report detailing progress against the identified potential in respect of Article 6.3 (*deliverable 10.2*) of the Cogeneration Directive had not been submitted to the Commission. Overall the Member State progress report is of value, although this is limited in part due to the fact that energy policy is devolved to the three regions of Belgium. The member state report, therefore, combines information from all the three regions and specific differences, both in type of CHP potential and Governmental disposition towards the growth of the CHP market in a given region may be lost. Consultants VITO, prepare an annual statement for the Flanders Government on an annual basis. As well as being region specific and, therefore, taking account of the opportunities for industrial CHP development, the report being produced annually, proves a more dynamic source of information about the progress of CHP in Flanders. This report, therefore, is a more valuable report than that produced for the whole of Belgium and submitted to the Commission.

#### Denmark

As of April 2010 a second report detailing progress against the identified potential in respect of Article 6.3 (*deliverable 10.2*) of the Cogeneration Directive had not been submitted to the Commission. Denmark does not consider the Cogeneration Directive progress report a valuable instrument in improving penetration of CHP. The focus in Denmark is very much about a move from fossil to renewable fuelled CHP.

#### Finland

As of April 2010 a second report detailing progress against the identified potential in respect of Article 6.3 (*deliverable 10.2*) of the Cogeneration Directive had not been submitted to the Commission. The Progress report is not seen as valuable in Finland since CHP uptake is not driven by CHP specific policy. The uptake and growth of the CHP market is widely anticipated to be steadily growing and reliable so that investors are less likely to use the progress report as part of an assessment of the regulatory environment.

#### Germany

As of April 2010 a second report detailing progress against the identified potential in respect of Article 6.3 (*deliverable 10.2*) of the Cogeneration Directive had not been submitted to the Commission. Germany views the Member State progress reports as a valuable tool to assess progress within each Member State. They are, however, less useful for cross country comparison as, even though every effort has been made to create an equal footing for comparison, this has not been achieved and, for example, analysis works from different base years within reports.

## Ireland

As of April 2010 a second report detailing progress against the identified potential in respect of Article 6.3 (*deliverable 10.2*) of the Cogeneration Directive had not been submitted to the Commission.

## Netherlands

The Energy Research Centre of the Netherlands submitted a report to the Ministry of Economic Affairs, "*The potential for high-efficiency cogeneration in the Netherlands*", in March 2010 in order to comply with the Cogeneration Directive's requirement for a four yearly progress report. The report, however, is not viewed as a valuable tool for driving CHP uptake in its own right. This is possibly because the Cogeneration Directive itself has not facilitated positive change for CHP in The Netherlands.

## Sweden

Sweden submitted original progress report in June 2010; consequently the subsequent second progress report will not be due until 2014. The Cogeneration Directive has had a very small impact on the development of CHP in Sweden, as the financial support for CHP was put in place before the Cogeneration Directive.

## United Kingdom

As of April 2010 a second report detailing progress against the identified potential in respect of Article 6.3 (*deliverable 10.2*) of the Cogeneration Directive had not been submitted to the Commission. The principle of the progress report is a good one but it is vital that the Commission ensures that all member states submit a progress report and sets out a series of key questions and a template to ensure that the necessary data for comparative evaluation are available. The progress report currently appears to indicate the attitude of the member state towards CHP rather than an objective assessment as to whether that member state could grow CHP and by how much. The UK is efficient at submitting progress reports to the Commission but the lack of a full suite of reports from all countries means that they UK submission is of limited value. As the Cogeneration Directive does not require that CHP be actively supported, the progress report is not measured against any clear requirement of the member state. A stronger commitment to CHP in the Revised Directive will enable member states to indicate how CHP has benefitted or not. A potential improvement to the reports could be a requirement to list the installed capacity of power-only generation stations and the installed capacity of CHP stations commissioned over a given time period such as a rolling four

year period. This would enable the Commission to determine whether the Member States was actively perusing energy efficiency in generation.

## Eastern Europe Region

### Czech Republic

Unbalanced and too high RES electricity support (*explosion of PV plants*) has completely stopped the CHP market and blocked the grid connection of all new power plants.

### Estonia

Set policy target and effective support are resulting in CHP growth and moving toward evaluated potential.

### Hungary

Stop of support and uncertain conditions in the future has frozen new cogeneration investment at the moment.

### Latvia

Cogeneration is growing based on the long tradition of fixed purchase obligation. Stable and predictable support is key issue for successful development.

### Lithuania

Cogeneration of heat and electricity is a service of public interest with policy goal to reach 35% share of CHP in generation till the year 2020. Current support of CHP offers attractive economic conditions for further development of cogeneration in Lithuania, especially in district heating sector and biomass fuelled CHP.

### Poland

The largest economical potential in the region is still almost untapped due to current economic and administrative barriers and regulation uncertainties, where implementation of CHP Directive has not significantly contributed to the faster development.

### Slovakia

Traditionally well established and supportive environment for cogeneration in Slovakia is drive force for cogeneration growing where CHP Directive has positive influence on CHP policy by removal of barriers (*grid connection, administrative, etc.*) development of new support instruments (*investment subsidies from cohesion founds*) and better position of cogeneration in national energy policy.

### Slovenia

New support scheme motivated by CHP Directive has triggered investment cycle in small scale cogeneration in district heating; industry is still on stand-by due to economic crisis.

## South Eastern Europe Region

The four reports of the Member States reflect the existing status of the liberalisation of their energy markets, the importance that the Member States place on energy efficiency methods and techniques and on the sustainability and environmental issues, as well as on their previous experience on cogeneration systems, i.e. large thermal power plants operating with fossil fuels with large district heating networks – typical examples are Bulgaria and Romania. The reports of each Member State were considered as useful, but different in its format and of its methods of the collection and analysis of the existing data. So, during the examination of these reports it was almost unable to locate similar data for common evaluation and comparison. It is strongly recommended that the PR content should be the same for all Member States, in order to be easier for the Commission to extract solid and comparable picture of the Cogeneration in Europe. There is no any indication about the new report, from any Member States.

## South Western Europe Region

### France

The progress report is not a valid instrument for evaluating the improvements of the CHP in your Member States because this report describes in its current version, the French potential, without any warranty and analysis of means to achieve it, even if only partially. Each year ATEE Club Cogeneration is maintaining the pressure to develop, or at least maintain the level of cogeneration in France. ATEE Club Cogeneration organizes each year in November a two days symposium, inviting all the actors of cogeneration to present their view and visions. At the last symposium in November 2010, the Government presented said that the level of the gas cogeneration plants should keep constant for the future, and the focus will be more on the biomass cogeneration plants for who are the ambitious objectives are 500 $MW_e$ in 2012 and 2.3 GWe in 2020.

### Italy

Italy has issued its report on May 2009. The report is considered a good instrument to have a global vision of the CHP in Italy, but it should be issued more frequently, at least every two years. The most useful information for the CHP operators are those who permit to: a) understand the trend of the market, b) elucidate the legislative framework, in order to make it clearer, to examine; c) exploit the support mechanism and diffuse the use of energy efficient technologies. At a European level, what is needed is a set of report that allows the comparison among the Member States, in other word; the report should be standardized, to provide readily information for foreign operators.

**Luxembourg**

As mentioned before, Luxembourg completed the obligations stated in the Directive 2004/08/EC (*Article 6*) regarding the analysis of the national potential for the application of high-efficiency cogeneration. The report was published in 2008, by the Fraunhofer-Institute ISI, Karlsruhe. The report gives a useful analysis of Luxembourg potential. His main disadvantage is that, even if it is edited in 2008, the data used in the analysis are older than 2006 (*even 2005*). As now we are in 2011, and a lot of economic aspects are different and changes occurred in the legislative framework, the analysis offered by the report has limited value. At the moment (*March 2011*) we have no news about a new report for Luxembourg.

**Malta**

The previous report has been issued on June 2009. The new report, it is planned to send it by the first quarter of 2011. Since the CHP market is not developed in Malta, no opinions are available on the progress report efficaciousness.

**Portugal**

The previous report have been issued on February 2010, no information are available about a new report.

## 2.7 Conclusions

### Northern Europe Region

Some Northern Region Member States considered the Cogeneration Directive a more helpful tool for increasing deployment of CHP than others and this is due, in part, to their different stages of development with regards to CHP. This in turn affects the type of support offered for CHP and the patterns of CHP growth. Some assessment of the history of cogeneration as well as emphasis given to energy independence and decarbonisation within a country would provide valuable context when considering the impact of the Directive in Member States and the related additional CHP deployment.

By way of example, lack of support for fossil fuel CHP could mean two very different things; a country has not yet recognised its potential and should put some support in place or fossil CHP has been very well supported for years and is the norm, the country may now only be supporting renewable CHP with the aim of moving all generation to renewables.

For those countries which had significant penetration of CHP when the Directive was instated in 2004, this grounding of a comprehensive appreciation of efficient generation has led to a current focus on decarbonisation. Over this time period, financial support for CHP in countries such as Denmark and Sweden has moved from gas-fired plant, to currently incentivising only renewable CHP. Where support for CHP or a particular branch of CHP is not available, this does not necessarily indicate a lack of support by the Member State, but could reflect the fact that there is a solid investment case for CHP without support, such as industrial CHP in Austria.

Following logically on from this, whether countries attributed CHP growth in their Member State to the Cogeneration Directive was dependant on the areas of growth. For example, those countries which had a high level of CHP penetration at the point the Cogeneration Directive came into force would not attribute continued growth to this Directive. Growth in renewable CHP could well be attributed to the Renewable Energy Directive.

Article 6 (3) of the Cogeneration Directive states: *"Member States shall for the first time not later than 21February 2007 and thereafter every four years, following a request by the Commission at least six months before the due date, evaluate progress towards increasing the share of high-efficiency cogeneration."* None of the nine Northern Region countries had submitted second report of Progress against Potential, in respect of Article 6.3. the Netherlands submitted a report in 2010, but this appeared to be a more detailed appraisal of technical and economic potential building on the 2007 appraisal, rather than assessing progress to date. A lack of enforcement from the Commission on timely reporting means that reports are developed by Members Sates at different times. In addition to this temporal aspect, a clear area of improvement could be development of a Progress Report template which would facilitate cross country comparison as well as ease completion.

Just over half of the Northern Region members reported that the Progress Reports were a useful tool for driving CHP deployment. Others cited the reports as a useful lobbying tool and for providing a basis from which to compare countries.

## Eastern Europe Region

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### Estonia

Set policy target and effective support are resulting in CHP growth and moving toward evaluated potential.

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### Slovenia

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## South Eastern Europe Region

The analysis of the reports for CHP and HECHP in the South-Eastern European Member States shows that there is remarkable potential in all sectors (*industrial, tertiary and residential*), mainly with NG as the fuel and with biomass as there are significant stockpile of different type of biomass (*energy plants, vegetable, animal and residual wastes, etc.*). In order though to achieve the implementation of the above mentioned potential into CHP installations, it is required to work harder in a regional basis to overcome the existing barriers and old-fashion concepts. The energy markets of the four Member States should be more open, transparent and adaptive to cogenerated electricity, taking into serious account the environmental and other benefits of CHP.

## South Western Europe Region

### France

In France the effect of the former legislation has left a situation where "*first come, first served*" and the worsening of the conditions has left little chances for new plant. Basically the Directive has not changed the situation.

### Italy

Here the Directive is not fully implemented (*some decrees are still missing*); moreover the new conditions for HE-CHP defined by the Directive are a little more severe than the existing regulation. The legislative framework is then not clear and still in evolution. Although there are several support mechanisms to CHP, they are not effective or just planned and waiting for enter in force.

### Luxembourg

In Luxembourg the Directive found an already favourable panorama for CHP and the effect of the Directive has not changed to much the situation.

### Portugal

Portugal has implemented late the Directive and again, this has not simplified the situation, where CHP has a negative growth ratio. Probably the effect of the Directive has still to come.