COGEN Europe

Briefing Note

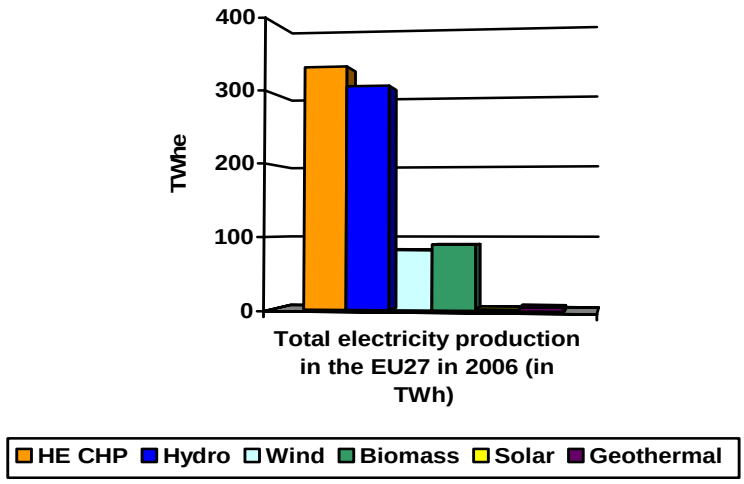
16 July 2009

Accelerate the adoption of cogeneration in Europe: the no-regrets option for energy savings in Europe

Cogeneration in the EU today

Cogeneration, also referred to as combined heat and power or CHP, provides 11% of the EU27's total electricity production today, placing cogeneration ahead of wind, solar and biomass combined, in terms of the amounts of electricity generated. This is only half the story as cogeneration plants simultaneously supply heat to a wide range of businesses and buildings, ranging from heavy, energy-intensive installations such as oil refineries, to small-scale residential applications.

Figure 1 High efficiency CHP and renewable total electricity production in the EU for 2006[1]



Typically over 80% of the primary fuel used in a cogeneration plant is converted into useful energy compared to the 45% average efficiency of the traditional condensing power plants or even the best available technology (BAT) operational performance of 52.5% for

[1] SOURCES: Eurostat, December 2008. Eurostat, Data in Focus 22/2008

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condensing power stations using CCGT technology today. Cogeneration saves a minimum of 10%, and typically 25%[2]of primary energy compared to separate production of heat and power. It is available and an effective technology. It is one of the few technologies which offers a substantial and realistic near term opportunity for energy savings in Europe: a no-regrets option.

Cogeneration is a fuel independent technology. The Commission assumes deployment of cogeneration applications as part of the bio-energy expansion, and the EEA have shown the advantages of this[3].[2] The CO2 emissions associated with fossil fuelled cogenerated electricity are around 400mg/kWhe for coal fired power generation and 200mg/kWhe for gas fired power stations, roughly halving the emissions of the condensing power stations running on the same fuel. Emissions levels on gas drop further to 120g/kWhe for CHP combined cycle gas turbine applications, better (today) than the levels which are expected from Carbon Capture and Storage (CCS) at coal power plants in 2020. Additionally, unlike CCS, which increases primary fuel demand in order to power the CCS capture processes, cogeneration achieves these unbeatably low levels of emissions while also reducing overall fuel consumption.

Saving energy, not demanding more:

Cogeneration is a very efficient, low CO2 approach for generating electricity and heat from the widest possible range of fuels. It is the no regrets technology in the EU's energy tool kit.

The most recent projections of the economic potential of cogeneration by the European Commission[4], the IEA[5] and the latest Member States studies under the Cogeneration Directive[6] (Germany, Spain, UK) suggest that a doubling of cogenerated electricity by 2020 is feasible. The net additional savings to Europe in primary energy would be a minimum annual saving of 35 Mtoe by 2020 and an associated reduction in CO2 emissions of 100 Mt per annum[6]. The DG-GRID[7] study assessed the potential impact of increasing cogeneration on the grid stability in Europe. The modelling shows that, unlike the instability introduced by the periodic availability of large scale renewables, the predictability, scalability and availability of distributed cogeneration has a neutral or positive effect on the stability of the grid up to a penetration of 50%-60%. Additionally, as cogeneration is sited close to the heat demand, much of the electricity generated is used locally. Often limited or no additional infrastructure work is required by the TSO, rather a minimum intervention approach by the DSO.

Europe employs over 100 thousand workers in the cogeneration sector. Europe leads the world in its existing knowledge and deployment of cogeneration. Entrepreneurial action in the sector has brought the first generation of new highly efficient small engines to the market. Europe is very well placed to rapidly expand cogeneration in the 2020 time frame,

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[2] Report to the European Commission in application of the Cogeneration Directive 2004/8/EC 21 February 2007 Danish Energy Authority Ministry of Transport and Energy

[3] Maximising the environmental benefits of Europe's bioenergy potential. EEA Technical report No 10/2008. European Environment agency Copenhagen 2008.

[4] EU SET Plan document tabling on a doubling of the share of CHP electricity by 2020.

[5] Combined Heat and Power: Evaluating the benefits of greater global investment © OECD/IEA, 2008

[6] The D-ploy project uncovered a technical CHP potential of 50 million tCO2 focusing on 4 industrial sectors alone (refineries, chemicals, paper, food) using a very conservative methodology. Information available under Deliverables on www.d-ploy.eu.
Additionally, the European Commission publishes the available member state reports under the CHP Directive on its website at http://ec.europa.eu/energy/efficiency/cogeneration/cogeneration_en.htm

[7] DG-GRID project, led by the Energy Centre of the Netherlands (ECN). Deliverables available at www.dg-grid.org

the technology the skills and supply chain are all established. Yet despite the EUs attempts to stimulate the use of cogeneration the market has remained flat from 2000 onwards. Industry is ready and able to act but the market has not responded to the EU's current policy efforts, more must be done.

The Challenge

In the period 2010-2030 the European Union faces serious challenges to maximise the efficiency of use of its primary fuels for heat and electricity while driving the development of the new renewable technologies to decarbonise overall energy supply. Renewables are expanding to supply increasing amounts of power and heat but the recognised challenges to renewables of: availability and deployment, intermittence of supply, and now investment constraints, make the overall time frame of penetration uncertain. A further challenge lies in supplying heat from renewables to the heat energy market. Industry, agriculture and economic processes demand reliable high temperature process heat, applications which renewables are only now beginning to address. Additional options lie in nuclear electricity and purely for CO2 reduction CCS. Both of these present unique technical and political challenges and even the best timescales carry a high uncertainty and lead to mid-term and longer deployment. Hence burning fuels, including fossil fuels, will remain a feature of Europe's overall heat supply system, and also its power system, well into the 2030 to 2050 time frame. Indeed, the Trends to 2030 report[8] states that *"the share of fossil fuels in total energy consumption falls only marginally by 2030, reaching 78% (compared with 79% in 2005)."*

Europe's challenge is to make its consumption of primary fuel as efficient as possible over the 2009-2050 timeframe. The first step on the road is its 2020 energy savings target.

In November 2008 the European Commission announced that based on current performance Europe will not reach its Energy Savings target of 20% by 2020, and that a lesser reduction of only 13% is anticipated. Given the proven ability of cogeneration to deliver real energy savings in the very near term the Commission must now seriously consider how best to deliver its ambitions on cogeneration expansion. Doubling the share of cogeneration in Europe requires action to engage the investment and the entrepreneurial interest of those sectors with substantial heat loads into the sophisticated market of electricity generation and sale. Just as through a sustained policy effort by governments, Europe has seen the acceptance of: increased land use for renewables generation; the renting of roofs for photovoltaïcs; the switch of land use for bio-fuels crops, and the marginal technologies of renewables become main stream, cogeneration must be moved from the margins of European policy to the centre. The same interest in the commercial harnessing of heat loads for low carbon electricity generation, must be consistently and firmly promoted by the EU and member states across a range of as yet uninvolved enterprises and sectors.

Under the CHP Directive, Germany, Spain and Belgium have made substantial strides in building a policy framework to support cogeneration. Germany has set itself a target to double cogeneration by 2020. The positive lessons from these member states must be learned and exchanged through the EU27. Most importantly the issues and difficulties which are now emerging as a second level of barrier to wider deployment of cogeneration must be given priority for attention and addressed swiftly and effectively. Through the CHP Directive Europe has the basic framework to develop cogeneration and with it, technology skills and jobs in Europe. Now is the time to declare a mandatory binding target for cogeneration in

[8] DG TREN, Trends to 2030 – 2007 Update. Prepared by NTUA. Feb 2008. ISBN 978-92-79-07620-6

Europe and to move forward with the secondary legislation which will remove the remaining barriers to the wider deployment of CHP in Europe. The first and vital opportunity is the review of the EEAP which must feature strong policy support for CHP.

Annex: FAQ on Cogeneration

What are the main challenges for the cogeneration sector?

Cogeneration is an energy efficiency approach which brings immediate benefits of economy and control in oil refining and petrochemicals in markets which are fully liberalised, however in its wider applications like university campuses and public buildings, the benefits increasingly fall to society at large.

1) Moderately sized heat hosts (food industry, hospitals and universities) which could use cogeneration to lower the local electricity system CO2 intensity, need to take on additional costs and take on a new business (electricity generation) if they are to adopt cogeneration. The commercial risk of dealing in both power and primary fuel is often assessed by the heat hosts as too high. Society receives the overall benefit from the heat hosts risks, but for the heat host the only reason to adopt cogeneration is if the business case is good. At the moment the business case is not strong for small to medium enterprises, largely due to the fact that CHP installations operate in "must-run" mode and are not rationale electricity market players as they will run at off-peak periods despite the low price electricity fetches.

2) Large heat hosts of 50MW and upwards (steel, chemicals, paper) find it difficult to get reasonable access to the electricity network and as cogeneration is not their core business, the internal competition for investment is ever present and cogeneration suffers from arbitrage opportunities.

As with the need to fund the social good of renewable, the cogeneration sector requires some limited targeted policy support in order to grow.

What will it cost?

The investment cost in the cogeneration equipment is significant. The payback time is application-dependent. The fact that cogeneration is the technology of choice in the paper, oil refining and chemical sectors shows that despite market uncertainties the technology remains competitive in energy performance terms. However in smaller applications, the payback is longer due to higher risk and uncertainty and the consequent cost of investment (and can thus reach or exceed 5-7 years).

District heating involving cogeneration is a special investment challenge as the heat load must be gathered over time (through a network of heating pipes) and the pipe infra structure is a considerable additional investment cost.

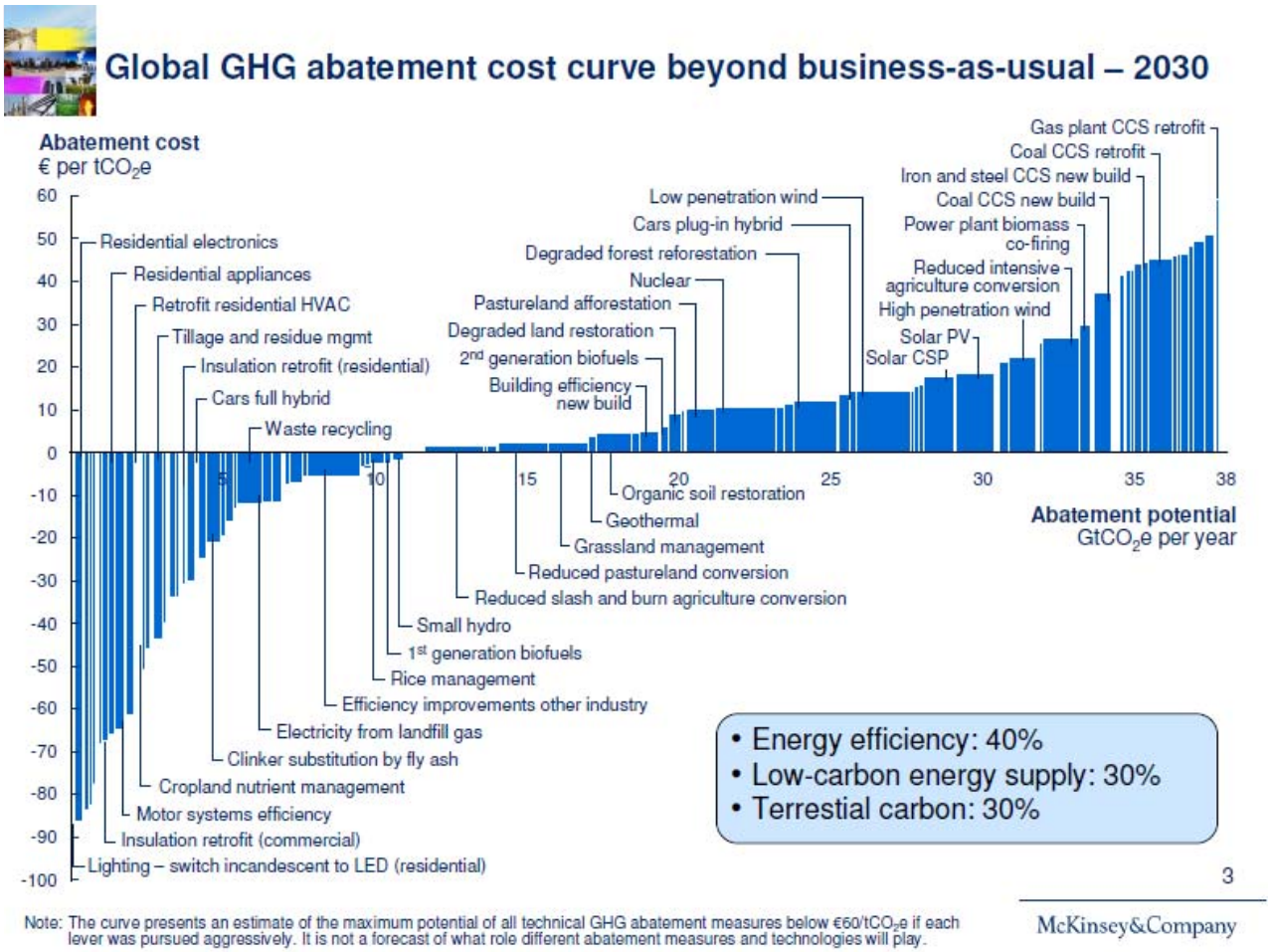
What is the cost per tonne of CO2 reduction using CHP?

The Mackinsey report "Pathways to a low-carbon economy" [9] McKinsey tried to estimate the cost of CO2 reductions associated with different technologies, and the potential contribution under a set of assumed constraints.

The contribution of cogeneration as a reduction technology was not maximised under the modelling assumptions but its contribution from the three sectors highlighted was none the less significant:

[9] Pathways to a low-carbon Economy, McKinsey and Company, February 2009.

	MtCO2e per annum reduction (additional)		EUR/TCO2e reduction (cost)	
	2020	2030	2020	2030
Iron and steel	180	280	-59	-66
Petroleum and gas	40	110	5	10
Chemicals	120	200	-1	-5



<u>Where do we start with Cogeneration?</u>

- *<u>Industrial CHP (150 TWhe of electricity production and 60 GWe of installed capacity in 2006)</u>*

Industrial CHP – and beyond this, industrial heat itself - is huge potential resource for decarbonising the electricity sector.

Industry should be encouraged to invest in energy efficiency cogeneration measures around industrial heat. The recent emergence of new concepts such as heat clusters and the opportunities provided by district heating schemes are two areas for consideration.

Unfortunately, neither the EU ETS nor the IPPC/IED actively shape the market for industrial heat. Given the magnitude of this sector this is an important opportunity

- *Commercial space-heating (176 TWhe of electricity production and 86 GWe of installed capacity in 2006)*

Whether through district heating or single building CHP systems, commercial heating and cooling needs are increasing and there are tens of thousands of large buildings across the EU which would be prime applications for cogeneration technology. At this size, renewable-based cogeneration systems are not only technically feasible but also fetch better rates of return than power-only renewable systems.

- *Residential heating (Projected installed capacity of 1-5 GWe in 2030)*

Micro-cogeneration as it is known is the last frontier of cogeneration. While market operators have been investing heavily for years in developing micro-CHP technology, products are only now reaching the market and aim to replace the widely used stand-alone (condensing) boiler.

Micro-CHP is also the sector which attracts the highest level of interest from large consultancies, investors and gas companies as the size of the sector is huge (400000 condensing boilers are sold each year in the Netherlands alone) and the associated energy and emissions savings are comparable to those achieved through the introduction of condensing boiler in the EU in the late 1980s.

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About COGEN Europe:
COGEN Europe is Europe's umbrella organisation representing the interests of the cogeneration industry, users of the technology and promoting its benefits in the EU and the wider Europe. The association is backed by the key players in the industry including gas and electricity companies, ESCOs, equipment suppliers, consultancies, national promotion organisations, financial and other service companies.