The International CHP/DHC Collaborative

Advancing Near-Term Low Carbon Technologies

CHP/DHC Country Scorecard: Germany

In Germany, high efficiency Combined Heat and Power (CHP) represented almost 13% of total electricity generation in 2005 and is seen as a strategic technology to aid in the government's Energy and Climate Policy, together with District Heating / Cooling (DHC), which represents about 14 % of the space heat market.

The 2002 CHP law has helped drive CHP with a premium payment for electricity from CHP plants being modernised and CHP plants < 2 MWe. However, a new CHP law, which aims to double CHP electricity generation by 2020, is expected to bring further benefits for all CHP ranges in 2009.

Other notable policy support for CHP in Germany includes the use of benchmarks under the EU Emissions Trading Scheme (ETS), a CHP/DHC-friendly building code, a natural gas and heating oil tax exemption for CHP and high feed-in tariffs for biogas CHP which make the German biogas CHP market one of the most active markets in the world. In addition, Germany offers important support for fuel cell CHP, making the country one of Europe's hot spots.

Energy Overview

Germany is the largest energy market in Europe and forms the backbone of the continent's electricity and gas networks. Electricity generation is largely based on coal and nuclear power plants, although this is changing. The use of natural gas is increasingly common; with an 11% share of total electricity generation in 2006,[1] renewable electricity is growing even more rapidly. This has created a more balanced energy supply, a trend that looks likely to continue. Households consume 29% of the final energy in Germany; of this, 89% is used for heating and hot water generation[2].

Four large utilities (EON, RWE, EnBW and Vattenfall) supply most of Germany's electricity, while local Stadtwerke (municipal utilities) provide electricity and heat to many cities, often using CHP in conjunction with district heating / cooling.

All of the main utilities are building new power plants, and many local CHP and DHC systems are being modernised. The most recent goal of the German government is to double CHP's share of electricity generation by 2020 up to 25 %[3]. This goal is dependent on the success of the new CHP law, which will be in effect from 2009.

Germany has become a leading market for renewables, primarily through strong government support using also a feed-in tariff[4]. Its PV and wind market is now the largest in the world, and biogas CHP capacity has grown from 180 MW in 2000 to over 1 GW in 2006[5].

1. *IEA Statistics – Electricity Information, 2007.*
2. Federal Ministry of Economics and Technology (BMWi), Endenergieverbrauch nach Anwendungsbereichen, 2007.
3. Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), Integrierte Energie- und Klimaprogramm, 2007.
4. Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), Erneuerbare-Energien Gesetz (EEG), 2000.
5. German Biogas Association, 2008.

Climate Change Context

As a signatory to the United Nations Framework Convention on Climate Change, Germany has the target of reducing its Greenhouse Gas GHG emissions from 2008 to 2012 by 21% from 1990 levels under the Kyoto Protocol. In December 2007, the government announced a range of measures in its Energy and Climate Programme to achieve this goal, including support for CHP and DHC.

Emissions trading is central to reducing energy-related GHG emissions in Germany[6]:

- The government aims to reduce CO_2 emissions from the energy sector from 532.5 Mt/yr to 495 Mt/yr in the period 2008 to 2012 through the emissions allocation of the EU ETS.
- Power-only plants will be responsible for the majority of the reductions, having to cut emissions by 15% relative to the 2000 – 2002 baseline (effectively 47.8 Mt/yr).
- Industry and CHP plants will only be required to make a 1.25% cut (effectively 2.7 Mt/yr).
- After the European Commission tightened the emissions allocation in Germany's second National Allocation Plan in February 2007, the country is now on track to meet this target.

CHP Status: Technology, Applications and Market Activity

In 2005, CHP qualifying as 'high efficiency' accounted for 21 GW of installed capacity and CHP in total amounted to 12.6% of total electricity generation[9]. Table 1 summarises the status of all CHP units in Germany in 2005.

TABLE 1

OVER 20 GW OF CHP CAPACITY WAS INSTALLED IN GERMANY IN 2005

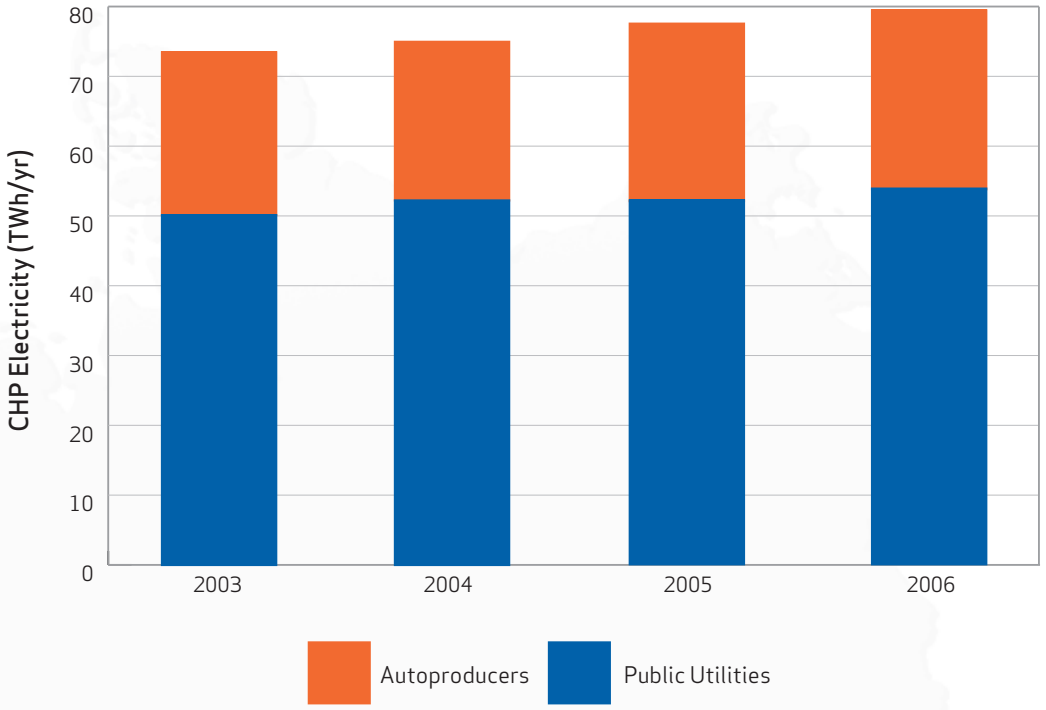
	Total	Autoproducers	Public Utilities
Maximum capacity (GW)	20 840	9 164	11 676
Electricity production (TWh net)	77 851	25 541	52 310
Number of units	2 938	836	2 102

SOURCE: FEDERAL STATISTICAL OFFICE, DATA FOR EUROSTAT.

6. Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), Emissions Trading, 2008.
7. Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), Integrierte Energie- und Klimaprogramm, 2007.
8. The IEA recommended this in its review of Germany's energy policy in 2007 (IEA, Energy Policies of IEA Countries – Germany, 2007).
9. *IEA, Combined Heat and Power – Evaluating the benefits of greater global investment, 2008.*

FIGURE 1
INCREASING ELECTRICITY PRODUCTION BY CHP UNITS IN GERMANY

SOURCE: FEDERAL STATISTICAL OFFICE (DESTATIS).



Industrial Applications

The German chemical and mining industries are the main users of CHP. Industrial CHP plants are often owned and operated by the industrial host, though some plants are outsourced to third-party contracting companies. The German market for industrial CHP has been quiet in recent years because long-term viability was uncertain and the CHP Law did not aim at promoting industrial CHP plants.

District Heating Applications

District heating CHP is widely applied in Germany; municipal authorities have developed DH CHP systems to provide heat and power to businesses and residents in many cities for more than 100 years. Many Stadtwerke have recently started to expand their CHP and DH investment, driven by strong government support and the attractive economic performance of such schemes (see box below).

The four major utilities also have significant CHP assets in DH, although large power plants remain their core business. E.ON and Vattenfall have developed CHP plants by connecting their conventional power plants to DH networks, while industrial applications dominate the portfolios of RWE and EnBW.

Stadtwerke have traditionally been important players in the German CHP market. Many have developed CHP plants as part of their local energy concepts.

Today, Stadtwerke are increasingly interested in further developing their DH / CHP assets because government support and rising gas prices are making these schemes economically attractive in comparison to alternative forms of heat supply. Many are therefore seeking to modernise their existing plants, or to develop new ones. 34 Stadtwerke are planning new plants (with a total capacity of 2 200 MWe) and 29 are looking to modernise existing ones for a total of 1 250 MWe installed capacity[10]. Most Stadtwerke are members of the German District Heating Association (www.agfw.de).

Small Commercial and Domestic Applications

Commercial CHP is a relatively minor segment in the German CHP market because many suitable office and public buildings are in areas already served by municipal district heating schemes. CHP is also increasingly being applied in buildings like hospitals and hotels; activity in this market has been steady. Support through the new CHP law is likely to ensure that this will continue, and perhaps accelerate.

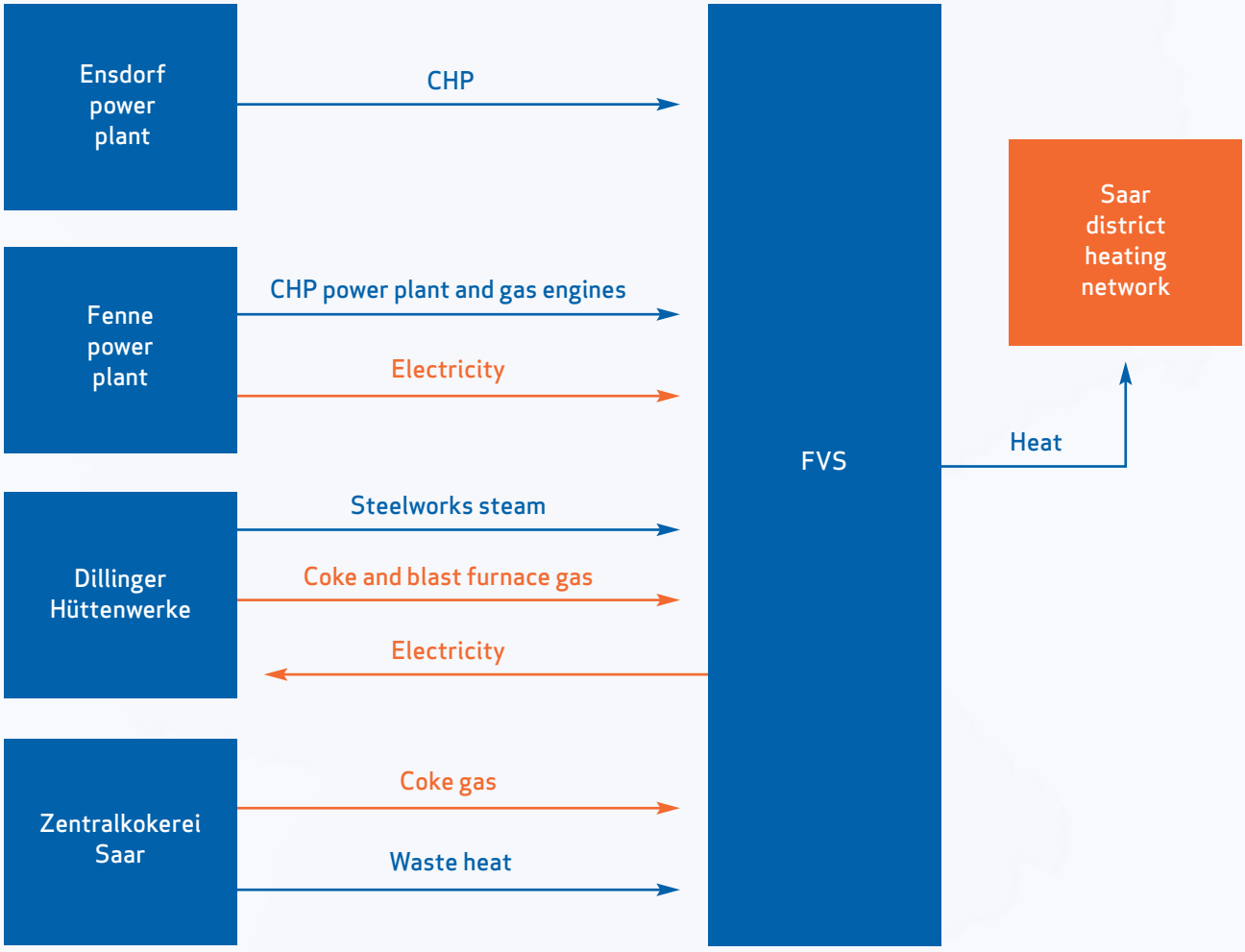
Germany is also aiming to become a strong market for domestic micro-CHP. Micro-CHP technologies are designed for single households, and typically smaller than 5 kWe. Various German CHP companies and boiler manufacturers offer micro-CHP products. Currently several thousand systems have been installed, mostly at demonstration projects; this market may emerge within the next few years[11].

10. German District Heating Association, 2008.
11 Delta Energy and Environment Micro-CHP Annual Roundup, 2007.

Case Study. The Saar District Heating System

The area of Saarbrücken is served by an extensive District Heating network, linking over 13 000 industrial, commercial and domestic customers to 680 MW of CHP capacity (Figure 2).
Construction of the first DH system started in 1976; the system has been extended over time, with over €252 million investment. The total system is estimated to save 160 000 tCO_2 per year.

FIGURE 2
ENERGY SUPPLY TO THE SAAR DISTRICT HEATING SYSTEM



SOURCE: EVONIK NEW ENERGIES GMBH, 2008.

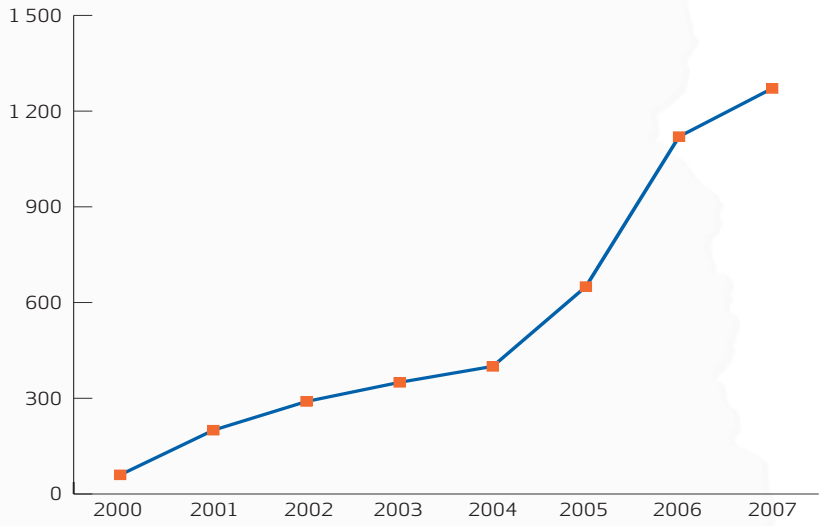
Biogas CHP

The number of biogas CHP plants in Germany has grown rapidly since 2000, with 335 MWe of new capacity in 2006. In 2007, over 3 700 units were operating, representing 1 271 MWe of capacity (Figure 3). The main sources of biogas are landfills, sewage gas, agricultural waste and manure. Landfill sources are showing saturation and the agricultural biogas sector has been growing rapidly. Most biogas systems are below 1 MWe, predominately gas engines. The potential for further growth is substantial, with a total estimated biogas potential of 110 PJ/yr, enough for 1 GWe. The government projects installed capacity to reach 2 768 MWe in 2020, at an estimated 30 000 sites[12].

The Renewable Energy Law (EEG) has been the driving factor on the successful development of the biogas CHP sector in Germany (see CHP Promotion Policies below).

FIGURE 3
BIOGAS CAPACITY IN GERMANY FROM 2000 TO 2007

SOURCE: GERMAN BIOGAS ASSOCIATION, 2008.



Case Study. Biogas CHP Plant in Kupferzell

Location:	Kupferzell
CHP technology:	Microturbine
Installed capacity:	130 kWe
Biogas substrate:	Food industry waste and corn silage
Special features:	The exhaust from the micro-turbine is used directly for drying the wet fermentation residue to produce mineral fertiliser
Support:	Guaranteed electricity price bonus for biogas is up to 19.5 €c per kWh[13]
Financial payback period:	3 to 5 years
CO_2 emissions avoided:	500 – 1160 kg CO_2 per MWh

SOURCE: GREENVIRONMENT, 2008.

12. German Biogas Association, 2008.
13. German Biogas Association, 2008.

Government CHP Promotion Policies

The government has introduced various incentive schemes to support CHP. In order of importance, these are:

1. The **Kraft-Wärme-Kopplungsgesetz**[14] **(the 2002 CHP Law).** The existing law is (described below) and the new law is (summarised in the Box on page 7).
2. Natural gas, as well as heating oil, used for CHP are **exempt from Ökosteuer** (Ecotax), creating an incentive for industry to replace heat-only boilers with CHP systems.
3. Biogas CHP receives favourable feed-in tariffs under the **Erneuerbare-Energie-Gesetz**[15] **(Renewable Energy Law).**
4. CHP/DHC is recognised as a compensation measure in the "EEWärme-G" (Renewable Heat Law).
5. The **German building code** targets primary (not final) energy consumption and therefore allows for proper reflection of efficiency advantages in energy conversion and delivery.
6. Larger CHP plants were carefully considered **Germany's implementation of the EU ETS** (see Emissions Trading Box).

Kraft-Wärme-Kopplungsgesetz (2002 CHP Law)

Targets and Budget

The Kraft-Wärme-Kopplungsgesetz provides the core of Germany's CHP policy, and supports CHP plants through bonus payments. It aims to achieve 23 Mt of CO_2 emissions reductions by 2010 (compared to 1998) by modernising existing CHP installations, promoting the operation of new small CHP plants, and commercialising fuel cell CHP. The CHP Law's total budget until 2010 is almost €4.5 billion, with €358 million earmarked for fuel cells[16].

Bonus Payments

Under the CHP Law, network operators are obliged to connect CHP plants to their system and to buy their electricity at a 'normal' price, unless agreed otherwise in a bilateral contract with the CHP plant operator. The normal price is defined as the average base-load electricity price of the EEX (European Energy Exchange) in Leipzig over the previous quarter.

CHP plants also receive a bonus on the electricity they supply to public electricity networks, as summarised in Table 3. In effect, since 1 April 2002, the only new plants eligible for support have been those smaller than 2 MWe (see Table 2)[17]. In addition, CHP is compensated for the avoided network costs for the electricity it uses on-site. Compensations are in the range of 0.4 to 1.5 €c / kWh, depending on the location. The calculation and payment methodology are described in the Stromnetzentgelt-verordnung[18] (Electricity network tariff regulation).

CHP plants are required to report the amount of electricity fed into the network to the network operator every month.

TABLE 2

ELECTRICITY PRICE BONUS OF 2002 CHP LAW IS LIMITED TO EXISTING PLANTS AND NEW PLANTS WITH LESS THAN 2 MWE

Category	2006 (€c/kWh)	2007 (€c/kWh)	2008 (€c/kWh)	2009 (€c/kWh)	2010 (€c/kWh)
Old plants (before 1990)	0.97	-	-	-	-
New plants (since 1990)	1.23	1.23	0.82	0.56	-
Modernised plants (modernised between April 2002 and December 2005)	1.69	1.64	1.64	1.59	1.59
New small plants (<2 MWe; after 2002)	2.25	2.25	2.10	2.10	1.94
New small plants (<50 kWe; 2002 to 2008)	5.10 (for 10 years after becoming operational)				
Fuel cells	5.10 (for 10 years after becoming operational)				

SOURCE: BHKW INFOZENTRUM, 2004.

14. Federal Ministry of Economics and Technology (BMWi), Kraft-Wärme-Kopplungsgesetz, 2002.
15. Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), Erneuerbare-Energie-Gesetz, 2004.
16. It is worth noting that data suggests that the law's goal can not be fully achieved by 2010.
17. 2002 German CHP Law.
18. Federal Ministry of Economics and Technology, Stromnetzentgeltverordnung, 2005.

New CHP Law (2008)

A new CHP law, as a part of an energy and climate protection package, was approved in June 2008 and amends the Kraft-Wärme-Kopplungsgesetz starting in January 2009. The box below summarises the main changes.

The New CHP Law

The Federal Ministry of Economics and Technology (BMWi) submitted a new CHP Law proposal[19] to the parliament in December 2007, which aims to double the total share of CHP electricity to 25% by 2020. This support was driven, in part, by recent studies, which show that CHP could deliver **CO_2 emissions savings of 54 million tonnes per year, if the economic potential is achieved**[20]. This is a significant share of the total CO_2 emissions from the energy sector in 2005 (816 Mt)[21], and equivalent to 13% of the 413 Mt reduction necessary to meet the government's target of a 40% cut in 2020, compared to 1990 levels.

The new CHP law will continue the support for CHP through a bonus tariff on the electricity price. It will also bring the CHP law into line with the EU CHP Directive (2004/8/EC) by introducing a Guarantee of Origin for CHP electricity, and incorporating the definition of high-efficiency CHP.

The proposal makes the following changes to the existing CHP law:

- The obligation for network operators to connect CHP plants and buy their electricity is complemented by a **dispatch priority**, equivalent to that for renewables.
- The **bonus** is extended to modernised and new CHP plants starting operation between 2007 and 2016, **without capacity limits**.
- **Electricity for own consumption becomes eligible for the bonus**, extending the arrangements for power exported to public networks.

The extension and new construction of heat networks become eligible for support, if at least 60% of the heat is supplied by CHP. The total budget for heat network support is €150 million, and developers can receive €1 / m of pipe / mm diameter, capped at 20% of total investment, or €5 million per project.

Other Support for CHP

Ökosteuer (Ecotax) Exemption

CHP plants are exempt from the Ecotax on fossil fuels if their load factor is over 70%[22]. However, the power sector is also exempt from the Ecotax, so the only benefit for CHP plants is for the avoided boiler fuel. The benefit of avoided tax on gas or heating oil for heat boilers can still be significant – up to €2 million per year for a 40 MWe CHP plant.

The Erneuerbare-Wärme-Gesetz (EEWärme-G)

The German renewable heat law requires owners of new buildings to ensure part of the heat demand of the building is supplied by renewable energies. To ensure coherence with energy efficiency policies, buildings that are supplied by DHC systems that are to a significant extent based on high-efficiency CHP and/or renewable are exempted from this obligation.

The Energieeinsparverordnung (EnEV)

The German building code consistently targets reduction of primary energy use (instead of final energy use). Heat supply options are rated by primary energy factors reflecting the respective fossil-fuel content. The default value used for CHP based DHC is 0.7, which has to be compared to a value of 1.3 for natural gas fired boilers and 3.0 for electricity.

Erneuerbare-Energie-Gesetz

The Erneuerbare-Energie-Gesetz (EEG) targets renewables rather than CHP, but small biogas CHP plants can take advantage of its benefits.

The EEG guarantees an electricity feed-in tariff of up to 19.5 €c / kWh for biogas CHP (see Table 4), making such plants profitable. It also obliges grid operators to give priority for grid connection to renewable energy sources, and to purchase and transmit all electricity generated.

A new EEG was approved in June 2008 and replaces the old EEG from January 1, 2009. As a result, the feed-in tariffs and the CHP-Bonus will change slightly (see Table 5).

The new law rewards the efficiency of CHP through a bonus of 3 €c / kWh for a 20-year period, which provides a reliable, long-term revenue stream.

19. Federal Ministry of Economics and Technology, Entwurf eines Gesetzes zur Förderung der Kraft-Wärme-Kopplung, 2007.
20. Hans-Joachim Ziesing, KWK-Potenziale in Deutschland und ihre Erschliessung, Energiewirtschaftliche Tagesfragen, Heft 3, 2008.
21. Umweltbundesamt, Nationaler Inventarbericht Deutschland, 2007.
22. Bundesministerium der Justiz, Gesetz zur Neuregelung der Besteuerung von Energieerzeugnissen und zur Änderung des Stromsteuergesetzes (Law for the new arrangements of taxation of energy generation and amendment of the electricity taxation), 2006.

TABLE 3

GUARANTEED ELECTRICITY PRICE BONUS FOR BIOGAS IN GERMANY

	Guaranteed electricity price (€c / kWh)			
Capacity range	Basic rate for electricity	Bonus for biomass	Bonus for CHP agricultural wastes and energy crops	Maximum price
0 - 150 kWe	11.5	6.0	2.0	19.5
150 - 500 kWe	9.9	6.0	2.0	17.9
500 - 5 000 kWe	8.9	6.0	2.0	16.9
> 5 000 kWe	8.4	6.0	2.0	16.4

SOURCE: GERMAN BIOGAS ASSOCIATION, 2006.

TABLE 4

GUARANTEED ELECTRICITY PRICE BONUS FOR BIOGAS IN GERMANY UNDER THE EEG 2009

	Guaranteed electricity price (€c / kWh)			
Capacity range	Basic rate for biomass	Bonus for agricultural wastes and energy crops	Bonus for CHP	Maximum price
0 - 150 kWe	11.67	11.0/9.0	3.0	25.67
150 - 500 kWe	9.18	9.0	3.0	21.18
500 - 5 000 kWe	8.25	4.0	3.0	15.25
5 000 kWe - 20 000 kWe	7,79	0	3.0	10,79

SOURCE: GERMAN FEDERAL ENVIRONMENT MINISTRY, 2008.

Government support for biogas CHP has made German biogas CHP companies among the most experienced and active in the world. Many are now building on their expertise to enter markets in other European countries, North America and Asia.

The government is aware of the importance of its support for biogas CHP to ensure continuing development of the sector. It is increasing the efficiency bonus for CHP to 3 €c/kWh in 2009. It has also drafted legislation to allow plants to feed biogas into the natural gas network for use in other CHP applications elsewhere.

Emissions Trading Scheme

The German government has recognised that addressing the unique features of CHP under its emissions trading is important to foster CHP (see box below).

CHP and Emissions Trading in Germany

Allowance Allocation

The National Allocation Plan 2 allocates emission allowances to CHP for both heat and power outputs (double benchmarking) based on the emissions from separate generation of heat and power. This approach takes into account of the overall emissions savings of CHP compared to separate generation.

Existing CHP plants receive allowances based on the product of historic emissions and a compliance factor. New entrants receive allowances according to benchmarking with the Best-Available-Technology (BAT) electricity and heat technologies.

Compliance Factor

The compliance factor for high-efficiency CHP is 0.9875, compared to 0.85 for power-only generation. This means that CHP plants only have to reduce emissions by 1.25% from their baseline, while power-only plants have to achieve cuts of 15%. CHP plants not qualifying as 'high efficiency' are treated as power-only plants.

Reference Values

The reference operating hours for new-entrant CHP plants are 8 000 hours per year for the paper, chemical and refining sector, and 7 500 hours for other CHP plants. 8 000 hours represents a load factor of 91%, which may normally be sufficient but some CHP plants in continuous-processing industries may still exceed this[23].

23. German EU ETS National Allocation Plan 2 (2008 - 2012), 2008.

Micro-CHP and Fuel Cell Strategy

Germany has taken a strategic decision to position itself as a leader in fuel cell and micro-CHP. As such, it enjoys by far the most supportive policy and subsidy structure for fuel cell development in Europe, and a significant majority of European fuel cell development and demonstration is taking place in Germany.

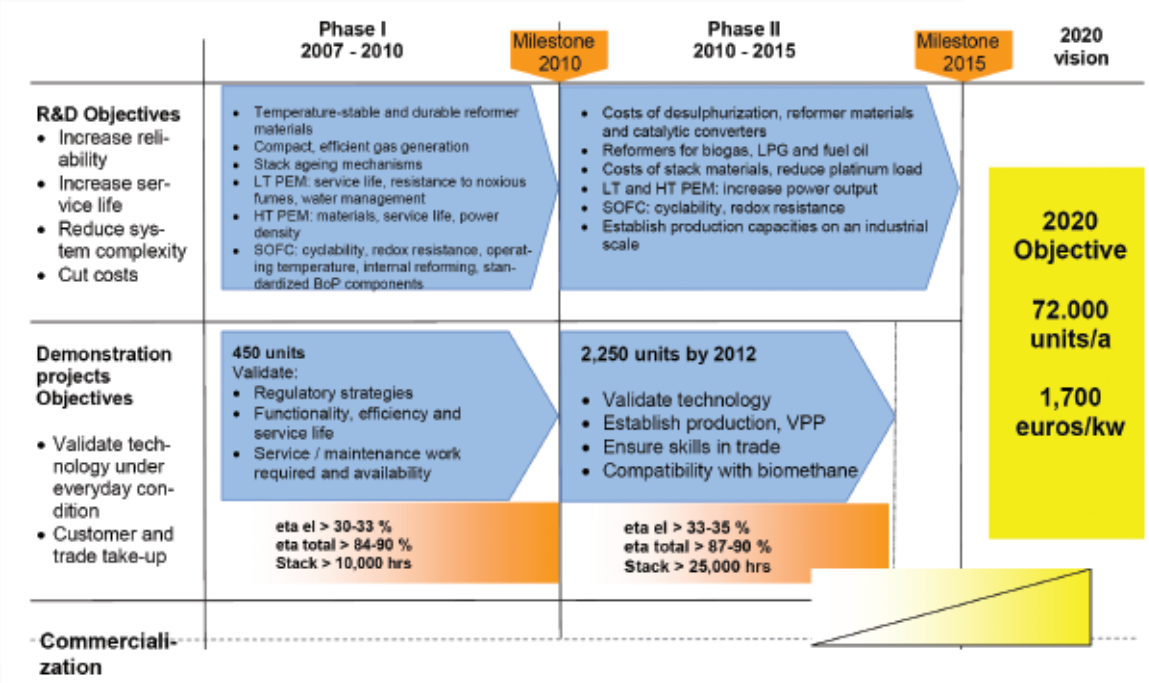
The government recently established a €500 million National Innovation Programme for hydrogen and fuel cells, developed in partnership with the fuel cell industry, energy companies and research institutes. Fuel cell applications are divided into four segments: transport, portable, industrial (>100 kW) and "house energy" (1-10 kW). €125-150 million of project funding is earmarked for stationary applications (including CHP).

Figure 4 shows the roadmap to achieve the 2020 goal of 72 000 1-10 kW systems/year. The programme aims to install 450 units up to 2010, with installations ramping up to add a further 2 250 in the following two years. Demonstration funding will continue until 2015, with an aim to install 72 000 units a year by 2020.

Energy companies, together with fuel cell developers, believe there is an attractive market for 1-10 kW fuel cell systems installed in single family and multi-family houses. Over 150 fuel cells have been installed in German homes, with energy companies investing considerable resources in such projects. German boiler manufacturers Vaillant and Viessmann, and Baxi subsidiary Baxi Innotech all have major fuel cell development programmes.

FIGURE 4 GERMANY'S FUEL CELL ROADMAP FOR 1 TO 10 KW FUEL CELL CHP SYSTEMS

SOURCE: "NATIONAL INNOVATION PROGRAM HYDROGEN AND FUEL CELL TECHNOLOGY" (NIP), FEDERAL GOVERNMENT, 2007.



Stakeholders

Government

German Federal government responsibilities for CHP includes different departments.

- The **Bundesministerium für Wirtschaft, und Technologie** (BMWi, the Federal Ministry for Economics and Technology), is responsible for CHP and has overall responsibility for energy.
- The **Bundesministerium für Umwelt, Naturschutz und Reactorsicherheit** (BMU, the Federal Ministry for the Environment, Natural Protection and Reactor Safety), is responsible for climate protection and renewables.
- The **Bundesamt für Wirtschaft und Ausfuhrkontrolle** (BAFA, the Federal Office of Economics and Export Control), implements the CHP law and promotes CHP projects.
- The **Umweltbundesamt**, the scientific advisor of the BMU, is responsible for regulation on CO_2 and pollutant emissions.
- The **Bundesnetzagentur**, the energy market regulator, is responsible for creating competitive energy markets.

Industry

- **Stadtwerke** – own and operate CHP plants.
- **Verband kommunaler Unternehmen** e.V. (VKU), the association of municipal utilities, including many which own and operate CHP plants.
- **Verband der Industriellen Energie- und Kraftwirtschaft** e.V. (VIK), the association of industrial energy producers, including many CHP owners and operators.

Stakeholders (cont.)

Non-governmental Organizations

- **Bundesverband Kraft-Wärme-Kopplung** (B.KWK), the German CHP association.
- **AGFW eV**, the German District Heating association.
- **Fachverband Biogas**, the German biogas association.

Barriers to Increased Use of CHP

Energy security is central to Germany's energy policy and determines much of the market framework within which CHP plants operate. The German CHP sector mostly uses natural gas, but internal supplies are decreasing while gas consumption is growing, raising concerns about a growing dependence on imported gas. Concerns about energy security could have both positive and negative implications for CHP:

- Natural gas prices for CHP are likely to rise, but alternative fuels, such a biogas, become increasingly attractive.
- Government policy measures to diversify the fuel mix may try to limit the growth in natural gas consumption, affecting CHP.
- The existing CHP law limits feed-in support to new installations smaller than 2 MWe and did not provide incentives for the expansion of the DHC infrastructure. The 2008 CHP law addresses these limitations.

CHP Potential

The technical potential for CHP in Germany is large; according to a study for the Federal Ministry of Economics and Technology (BMWi), CHP plants could provide as much as 357 TWh electricity per year, 57% of generation[24].

The government expects that only part of this full technical potential will be realised. Its energy projections suggest that 2.1 GWe of new industrial CHP capacity and 1.3 GWe of new DH / CHP capacity will become operational by 2010[25]. The new CHP law aims to double the amount of CHP electricity by 2020 to 25% of electricity supply.

Studies by The Bremer Energie Institut (BEI) and the Institut für Energiewirtschaft und Rationelle Energieanwendung[26] (IER) of the University of Stuttgart estimate that the economic potential for CHP in Germany is between 300 and 350 TWh per year, enough to meet around 37% of the country's electricity demand[27]. This translates into 35 to 35 GWe CHP capacity, and could reduce CO_2 emissions by 54 to 80 million tonnes per year[28]. Most of the potential is in DHC applications.

The IEA CHP / DHC Collaborative estimates that CHP can generate 250 TWh per year in 2030, if supported by a strong policy framework[29]. According to that report, which analysed the benefits of increased CHP use in the G8 and 5 other large economies, countries that invest in accelerated policies for CHP should realise the following benefits:

- a 3-7% decrease in energy investment costs between now and 2030;
- a slight decrease in consumer electricity costs; and
- up to 10% reductions in CO_2 emissions by 2030.

Achieving the Potential

If Germany takes advantage of its full potential, CHP could provide a much larger share of German electricity demand than the current 12.6%. The government is aware of this and has considerably raised the profile of CHP in the recent Energy and Climate Programme. This recognition has the potential to improve the German framework for CHP significantly. The IEA recommendations in the Box are designed to help Germany achieve its CHP goals.

24. Federal Ministry of Economics and Technology (BMWi), Potenzialstudie BEI/DLR, 2006 and B. Eikmeier et al.: Analyse des nationalen Potenzials für den Einsatz hocheffizienter Kraft-Wärme-Kopplung, Bremer Energie Institut + DLR Stuttgart, Bremen 2005.
25. Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), Leitstudie 2007 „Ausbaustrategie Erneuerbare Energien", 2007.
26. KWK – Potenziale, 2007.
27. KWK-Potenziale in Deutschland und ihre Erschliessung, 2008.
28. Potenziale und Chancen der Kraft-Wärme-Kopplung in Deutschland, 2006.
29. *IEA, Combined Heat and Power – Evaluating the Benefits of Greater Global Investment*, 2008.

Main Policy Recommendations

- **District heating and cooling should be more actively considered as a key part of urban development schemes.**
- **Stimulate the use of natural gas for high-efficiency CHP by extending the Ecotax to power generation, while exempting CHP plants.**
- **Continue the support for biogas CHP through the Renewable Energy Law.**
- **Pursue export opportunities for German technical and policy leadership in biogas CHP.**

DHC with CHP should be considered in Urban Development

Local governments are increasingly planning the future development of their cities with a local city development concept. Technical infrastructure like DHC with CHP should be a part of this planning.

Difficulties in securing Natural Gas for CHP

Energy policy can also help ensure that CHP plants have access to natural gas at competitive prices. This can be achieved by introducing incentives to use gas in the most efficient way, including in CHP applications. Introducing an Ecotax for power generation, while exempting CHP plants, would be a good way of doing this.

Continue to support Biogas CHP

Existing policies, including the Renewable Energy Law, already create a positive framework for biogas. The feed-in tariff support encourages potential biogas producers to enter the market and the CHP bonus promotes the efficient use of biogas. The decision to allow biogas feed-in into the natural gas network will help extend this support to a much wider market.

Export the Expertise and Leadership of the German Biogas Industry

German biogas companies are among the most advanced and experienced in the world. The strong growth of the sector and effective government support have enabled the biogas industry to cover a wide range of technology applications. Exporting this technology and policy expertise would allow other countries wishing to support renewable energy to learn from German expertise, while creating new business opportunities for German companies.

CHP / DHC Scorecard

To aid in comparing amongst countries, the IEA has developed a scorecard of national CHP/DHC policy efforts that takes into account three criteria:
- The effectiveness of past policies in developing the CHP/DHC market over the last 5 years;
- Statements and commitments of intent in respect of future CHP/DHC policy, for example through the creation of national growth targets; and
- The existence today of meaningful policy incentives that are already causing significant market growth or that are likely to do so in the near future.

Each country is given a scorecard rating as follows:

No material policy effort or intent to promote CHP/DHC. The market is not expected to grow for the foreseeable future. ★☆☆☆☆

Some minor recognition of the role of CHP/DHC, but policies are not fully effective or are otherwise insufficient to influence market development. ★★☆☆☆

There is a clear recognition of the role of CHP/DHC, accompanied by the introduction of some measures to accelerate the market, but CHP/DHC are not high priorities compared to other energy solutions. In addition, the country lacks an integrated CHP/DHC strategy. As a result, market growth is likely to be modest. ★★★☆☆

CHP/DHC is at or close to the top of the list of energy policy priorities and a series of effective policies are being implemented as part of a coherent strategy. Important growth is expected in CHP / DHC markets. ★★★★☆

A world leader in prioritising CHP/DHC, with a clear and proven strategy for bringing about significant market development and the implementation of at least one global best-practice policy measure. ★★★★★

Germany Rating: ★★★★☆

The International CHP/DHC Collaborative

The **International CHP/DHC Collaborative** was launched in March 2007 to help evaluate global lessons learned and guide the G8 leaders and other policy makers as they attempt to assess the potential of CHP as an energy technology solution.

The Collaborative includes the following activities:
- collecting global data on current CHP installations;
- assessing growth potentials for key markets;
- developing country scorecards with data and relevant policies;
- documenting best practice policies for CHP and DHC; and
- convening an international CHP/DHC network, to share experiences and ideas.

Participants in the Collaborative include public and private Partner organisations and other government, industry and non-governmental organizations that provide expertise and support. The Collaborative Network, the larger group that is informed about meetings, publications and outreach, has over 350 participants.

If you are interested in participating in the Collaborative, please visit www.iea.org/G8/CHP/chp.asp.

The **IEA District Heating and Cooling Programme** (IEA DHC) is the major international research and development programme for district heating and cooling. It functions within the IEA's Framework for International Energy Technology Co-operation. The programme conducts highly effective Research and Development as well as policy analysis of District Heating and Cooling systems with low environmental impact through international collaboration. Established in 1983, IEA DHC currently has nine participant countries: Canada, Denmark, Finland, Korea, Netherlands, Norway, Sweden, UK and USA. For more information, visit www.iea-dhc.org.

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Questions and comments about this document should be sent to:

Tom Kerr
International Energy Agency
9, rue de la Fédération
75739 Paris Cedex 15
France

Email: tom.kerr@iea.org