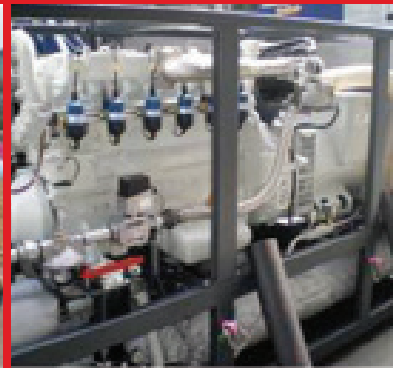


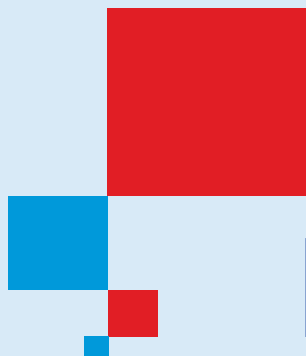


Cogeneration
Observatory and
Dissemination
Europe



COGENERATION THE SMART DECISION!



Why and how
cogeneration
can make your
company
more profitable
and energy
efficient?



Co-funded by the Intelligent Energy Europe
Programme of the European Union

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COGENERATION – THE SMART DECISION!

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Date: July 2014

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1 WHY COGENERATION IS AN EFFICIENT AND PROFITABLE SOLUTION FOR SMEs

Cogeneration (CHP) is a proven state of the art technology which can reduce energy costs and improve the competitiveness of your company: stop wasting money by burning fuel in an on-site boiler to produce heat and purchasing electricity from unpredictable energy markets. A CHP system provides both types of energy in one energy efficient step. Supported by different economic incentives, CHP is a sound economic investment for your own secure and sustainable supply of energy. Additional benefits to your company include:

- **Increase the resource efficiency** of your company: CHP is the most efficient energy conversion technology of a primary fuel to electricity and heat achieving up to 30% primary energy savings or even more compared to separate production of heat and electricity.
- **Reduce your carbon footprint:** CHP is a low-carbon technology reducing GHG emissions by up to 30% for fossil fuels

or completely decarbonisation by high efficiently using renewable energy sources (biomass, biogas, solar etc.).

- **Solution compatible with PV:** Flexible CHP electricity generation fits very well with the intermittent PV electricity generation (stable CHP generation also in winter and night period is complementary to the PV).
- **Security of supply:** CHP is a well-proven concept with a long track record in various types of applications. CHP may also be used as a source of back-up power and can thus improve the security of supply. Note: this requires some additional system components as well as operating standards.
- **Plug & play:** CHP is one of the few energy savings technologies that can deliver high-temperature heat (> 80 °C) efficiently. This makes it an easy retrofit option for existing, high temperature heating systems. Most CHP installations can be installed plug & play.

Benefits and advantages of cogeneration have been widely recognised all over the world.

CO-GENERATION OR COMBINED HEAT AND POWER (CHP)

Co-generation or Combined Heat and Power (CHP) is the simultaneous generation of thermal energy and electricity or mechanical energy by using fossil or renewable fuels, most often natural gas, coal or wood biomass and biogas. CHP saves energy due to the simultaneous production of electricity and heat on-site and thereby preventing major losses that occur at most central electricity production facilities nowadays.

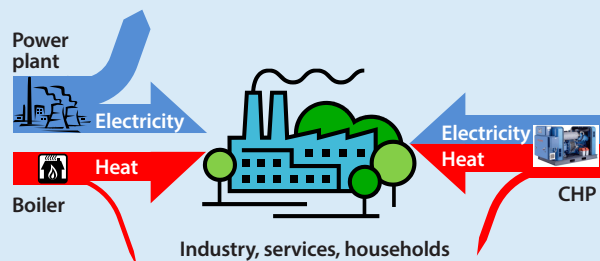
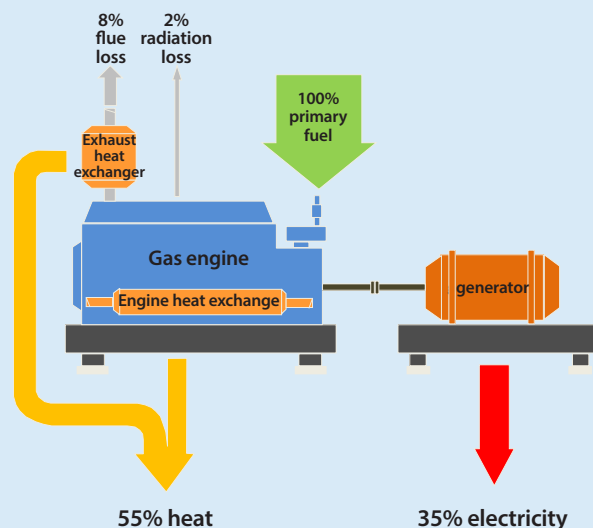


Figure 1: Gas engine CHP



2 WHERE AND HOW

Intensive recent CHP technology development offers a wide range of efficient technology solutions for economic applications of CHP and business opportunities in all economic sectors:

- **Industry:** CHP units can provide a significant share of steam, hot water and hot air in process industry for process use, heating and cooling and a large share of electricity demand by use of gas and steam turbines, internal combustion engines, ORC etc. Biomass and biogas CHP applications using renewable industrial waste products offer optimal resource efficiency and economic benefits for the company.
- **Services:** Gas turbines and engines (small and micro) are key CHP technologies for sustainable supply of electricity, heat and optional cooling (trigeneration or CCHP) in buildings and other process use in services, especially in health, tourism, education, agriculture etc. Emerging fuel cell technology with even higher electrical efficiency could boost the potential for CHP application to unexpected limits.
- **Households:** Fast recent development of micro CHP technologies like gas and Stirling engines, as well as fuel cells, enables the use of cogeneration for efficient heating and electricity supply of single and multi-family buildings in accordance with the close to zero energy building concept (active building).

EFFICIENT FULL HEAT CHP SUPPLY

The company Riedl is an internationally competitive provider of comprehensive and high-quality solutions in the field of mechanical treatment of complex products.



A 50 kWe gas engine CHP on natural gas with heat storage, installed in 2011, is the heating source covering the entire heat demand for the company's industrial hall in Maribor. All produced electricity is entirely used on-site, grid electricity supplying the remaining demand.



The investment of 85.000 EUR will be recovered in 4 to 6 years, as the company is eligible for a feed-in premium on all produced electricity.

CHECKLIST FOR CONSIDERING CHP

- **Stable and predictable heat or/and cooling demand** for heating or process use on site of at least 4,000 hours per year.
- **Appropriate energy market conditions** – higher electricity price compared to the fuel price (ratio of at least 2:1).
- **Support mechanisms in place**, if energy market conditions request additional support: feed-in, certificates, tax relief, subsidies etc.
- **Availability of fuel on the location:** natural gas, wood biomass, biogas, LPG etc.
- **Proper place for installation of CHP unit:** room, connections, chimney etc.
- **Financial resources:** own, loans, energy contracting, subsidies etc.

3 ABC OF CHP ECONOMICS – EFFICIENT, SUSTAINABLE, FLEXIBLE & ECONOMIC

Why CHP can bring economic benefits?

CHP is an attractive solution, depending on local and national circumstances, as well as the specific characteristics of businesses. To take advantage of the process, your business needs to be using a considerable amount of heat (particularly as part of a production process), which usually requires at least 4,000 running hours per year (threshold depends on market conditions). The utilisation of useful waste heat from on-site CHP electricity generation is the key advantage which results in economic benefits of high efficiency cogeneration units.

Adopting cogeneration instead of your current boiler brings:

- **Lower electricity purchase costs** (reduced electricity purchase, exemption of payment network costs and other taxes on electricity, market price risk mitigation, DSM etc.).
- **Additional income from CHP support instruments** (premium, fixed purchase price, certificates, tax relief, investment subsidies, free ETS allowances etc.). Check CHP support in your country!

- **Opportunity for energy system services delivery to electricity system operator** (system balancing by flexible CHP operation in relation to fast growing RES electricity generation, reserve services etc.).
- **Improved company image by sustainable energy supply and CO₂ reduction** (primary energy savings, use of RES, reduced carbon footprint by GHG mitigation, reduced environmental pollution etc.).
- **Economic benefits for the company by lower total energy costs.**

These benefits then need to be offset against higher CHP investment, fuel¹ and maintenance costs compared to the simple heat only boiler solution.

Proper planning and implementation of the CHP investment, considering all aspects of the location and quality management of CHP unit operation, are key factors for profitable CHP investment usually managed by proficient CHP installers.

CHP IN HOTEL ZUR BRÜCKE



In March 2009, in the small hotel additionally to a gas boiler a CHP plant with 15 kW of electric power was taken in operation after one week of installation time. Thanks to government support and 7,270 full operation hours per year, the system pays for itself in 3.5 years. The annual saving of CO₂ emissions is 76 tons and of primary energy 142 MWh (39%).

CHP gas engine unit parameters:

- Heat capacity: 17 – 30 kW
- Electrical capacity: 6 – 15.2 kW
- Yearly generation: 109 MWh_{el}, 216 MWh_H
- Dimension: 1,250 x 750 x 1,110 mm
- Weight: 700 kg
- Service interval: 8,500 hours of operation
- SPL : < 49 dB (A)
- Total investment costs: 37,352 EUR

AVAILABLE SUPPORT FOR CHP IN EU

- Feed-in tariffs, green certificates, investment subsidies, tax allowances etc., depending on the individual Member State
- Further information:
EUROPEAN COMMISSION, DG ENERGY
(http://ec.europa.eu/energy/efficiency/cogeneration/cogeneration_en.htm)
COGEN EUROPE
(<http://www.cogeneurope.eu/>)

¹ Use of renewable fuels or waste products could even reduce the fuel costs.

4 HOW TO TAKE PROPER ACTION

If you would like to know whether your business is suitable for the application of CHP, you can make use of the “Smart CHP” tool which is developed to provide you with first insights in the economic potential of CHP for small scale CHP applications in industry, services and households. This is how it works:

The use of the Smart CHP tool is simple and fast and is accompanied by a “quick guide” available on-line in the tool. It enables a rapid analysis of the key project technical and economic variables giving a first estimate of the profitability of the CHP application.

If you find that the project looks potentially attractive in Smart CHP, then follow through the main steps shown in the flow

diagram. Usually technology provider could offer majority of services needed although proper expert support could be very important for the quality design of more complex units that would optimally fit to your company energy needs.

You don't have the necessary financial resources or knowledge for the implementation of CHP investment? Procurement can even be done more simple. How? Make use of an energy service company or ESCO for short. You can transfer implementation risks and financing of CHP unit to the ESCO experts by energy contracting. An ESCO will provide the know-how, design and finance of the CHP unit and take responsibility for the successful operation during the contract period, providing incentive prices for heat and electricity supply to your company.

Figure 2: Smart CHP tool – Input and output data for fast CHP check

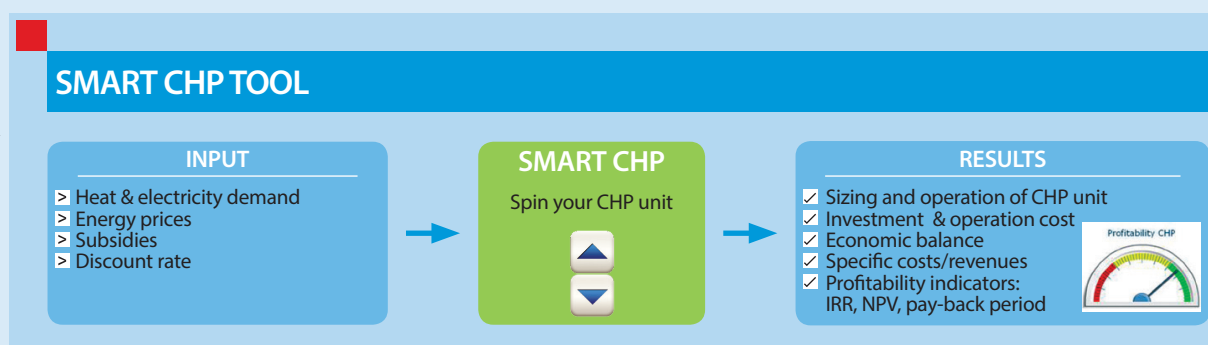
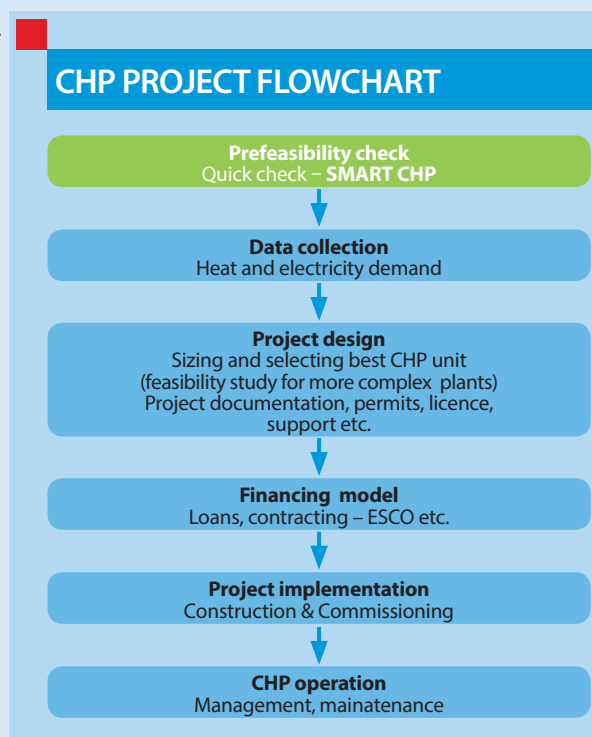


Figure 3: Flowchart of necessary steps for successful installation and commissioning of the CHP unit



CHP IN WARSTEINER BREWERY

Energy Master 2010 awarded CHP plant in Warsteiner brewery provides economic benefits for company by reduction of expenses for energy as well as reducing CO₂ emissions.

2 CHP gas engine units parameters:
Capacity: 2,3 MW_{el}, 3 MW_H
Yearly generation: 15 GWh_{el}, 15 GWh_H
Total investment costs: 3 million EUR



5 SOURCES OF INFORMATION

- www.european-energy-service-initiative.net/ec.europa.eu/energy/efficiency/cogeneration/cogeneration_en.htm
- www.cogeneurope.eu
- www.iea.org/chp
- www.chpassociation.org
- www.european-energy-service-initiative.net



DIRECTIVE ON ENERGY EFFICIENCY, 2012/27/EU

High-efficiency cogeneration and district heating and cooling has significant potential for saving primary energy, which is largely untapped in the Union.

Member states should carry out a comprehensive assessment of the potential for high-efficiency cogeneration and district

heating and cooling. These assessments should be updated, at the request of the Commission, to provide investors with information concerning national development plans and contribute to a stable and supportive investment environment.



BARACK OBAMA, The White House, August 30, 2012

US EXECUTIVE ORDER ACCELERATING INVESTMENT IN INDUSTRIAL ENERGY EFFICIENCY

Instead of burning fuel in an on site boiler to produce thermal energy and also purchasing electricity from the grid, a manufacturing facility can use a CHP system to provide both types of energy in one energy efficient step. Accelerating these investments in our Nation's factories can improve the competitiveness of United States manufacturing, lower

energy costs, free up future capital for businesses to invest, reduce air pollution, and create jobs.

US institutions will coordinate and strongly encourage efforts to achieve a national goal of deploying 40 gigawatts of new, cost effective industrial CHP in the United States by the end of 2020.



CO-GENERATION AND RENEWABLES: SOLUTIONS FOR A LOW-CARBON ENERGY FUTURE, IEA 2011

Renewable energy is one of the key solutions to our energy challenges. However, transitions take time, especially when they are on the scale needed to re-invent our energy system. Even though in the coming decades the share of renewables will rise, fossil and other alternative fuels will still play a major role. For that reason, it is important to use these

fuels as efficiently as possible. Co-generation offers the best of both worlds:

- Co-generation is a proven energy-efficient technology.
- Co-generation can accelerate the integration of renewable energy technologies.

More information about
the CODE2 project is available at:
www.code2-project.eu

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