The Success of Cogeneration in Europe

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Cogeneration, the utilization of heat created while producing electricity from fossil fuels, is by no means a new technology. Shortly after the gas and diesel engines were invented, engineers started researching ways to utilize the heat instead of wasting it. Cogeneration has existed in Europe for at least 70 years.

The Awareness Stage

Despite the fact that cogeneration—as a technology —has been around for a long time, it took half a century and the second so-called "oil crisis" in the 1970's for societies to become aware of limited energy resources. The limitation of oil also meant, in general, an extreme rise in energy prices. This in turn created a heightened interest in developing energy-saving strategies.

Energy pricing was an even more important factor in the 1980's and 1990's, when the electricity rates almost doubled in 15 years, whereas the gas prices stayed at the same level (Figure 1, Figure 2).

Cogeneration was given an additional boost by environmental groups in the 1980's. These groups fueled protests against nuclear power plants and large high-polluting coal-fired plants. They also promoted all aspects of low emission energy production processes and primary fuel saving conversion technologies, including cogeneration.

The Boom

Additionally some governments in Western European nations attracted cogeneration investors by not only providing subsidies and tax breaks but also by regulating electricity prices and by creating other regulatory laws. These subsidies and laws caused the number of cogen-

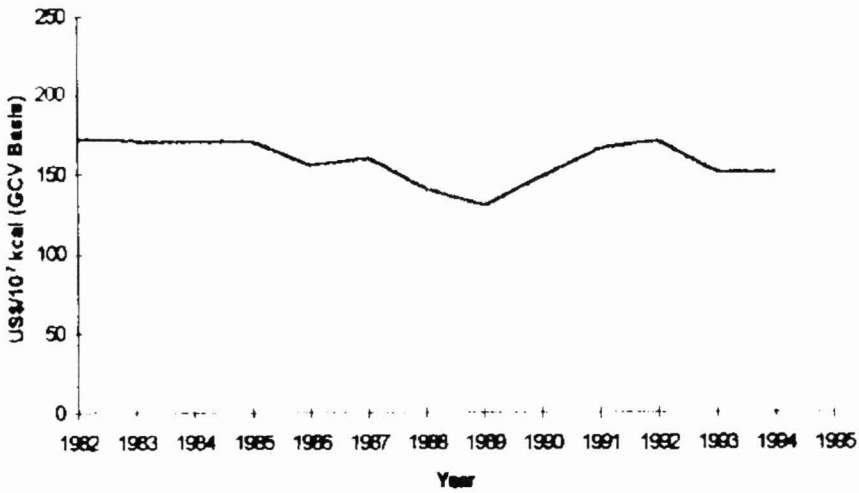


Figure 1. Gas Prices (OECD Europe)

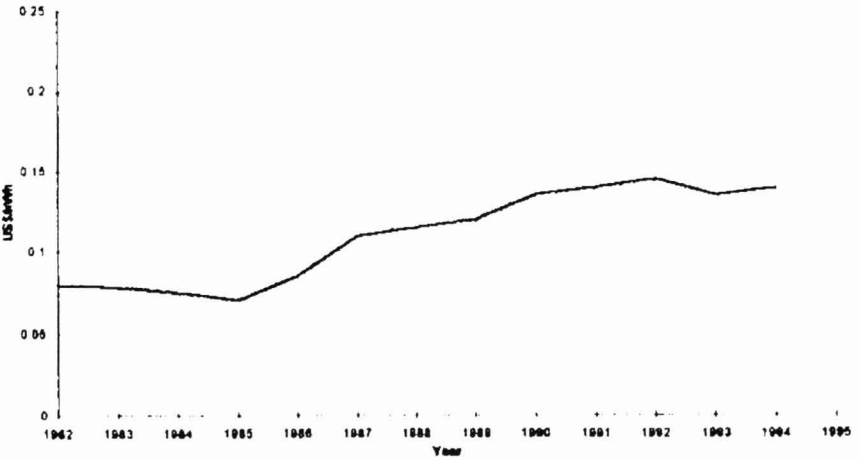


Figure 2. Electricity Prices for Domestic Customers (OECD Europe)

eration installations to increase. This in turn led to cogeneration technology becoming more advanced and less expensive. All these major factors (Figure 3) started a cogeneration boom in the late 1980's early 1990's in certain Western European Nations.

Figure 3. Major Factors for Cogen Investment

Social and Political Factors
- Public pressure against large power plants
- Emissions regulations
- Energy-saving strategies
- Deregulation and liberalization

Economic Factors
- General high energy prices
- Attractive gaps between electricity prices and primary fuels
- Decreasing investment and operations costs

Different approach

The European engineers take a different approach to designing cogeneration plants. Instead of building large gas turbines or combined cycle plants whose main target is to produce electricity and then trying to utilize as much heat as possible, European engineers target the replacement of the base heat supply of certain, small scale entities. By focusing on the annual heat demand graph, the basic layout for maximum utilization is determined. If a plant can use all or a majority of the electricity, the "by-product," produced in this combined process, the perfect requirements are a given.

Producing heat and electricity at the point of need—that means creating an end of the pipe solution—is a very effective way to ensure engineering keeps the optimization of the relation between demand and production as its main target.

STATE OF THE ART

Acknowledged Technology

Today cogeneration is one of the prime technologies available to achieve two valuable goals:

- efficient usage of limited resources and
- air pollution reduction.

In every major European country there is a non-profit organization promoting the usage of cogeneration and acting as a platform for the various interests involved. These national institutions are members of Cogen Europe, a non-profit organization based in Brussels, Belgium, whose main focus is to promote cogeneration to a multinational level (Figure 4).

Some Impressive Numbers

- Denmark, Finland and The Netherlands are the European leaders in the ratio of cogeneration to total national power production. In these countries between 30% to 40% of their total power production is provided by cogeneration (Figure 5). In the European Union an average of 10% of total power production is done through cogeneration systems [2].

- In the last 10 years Germany and The Netherlands installed approximately 10,000 cogeneration units based on gas engines and turbines.

- In Germany in 10 years, from 1985 to 1995, the engine- and turbine-based cogeneration systems grew from 500 plants to over 3,300

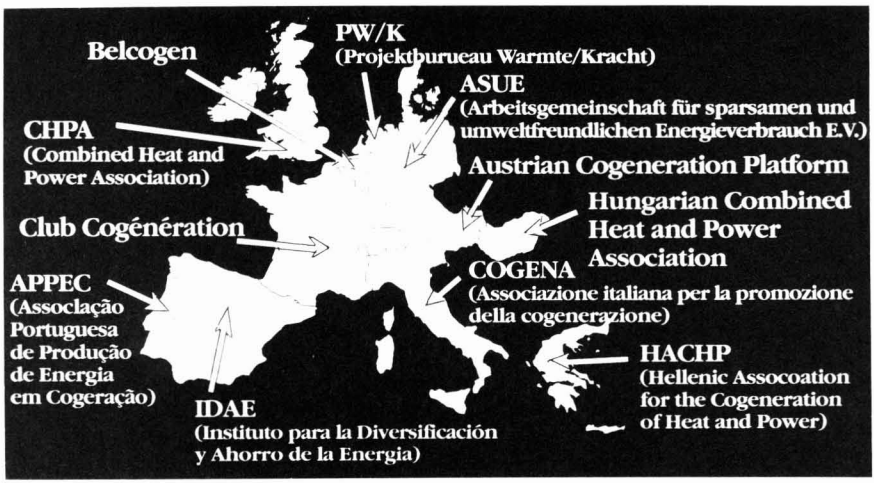
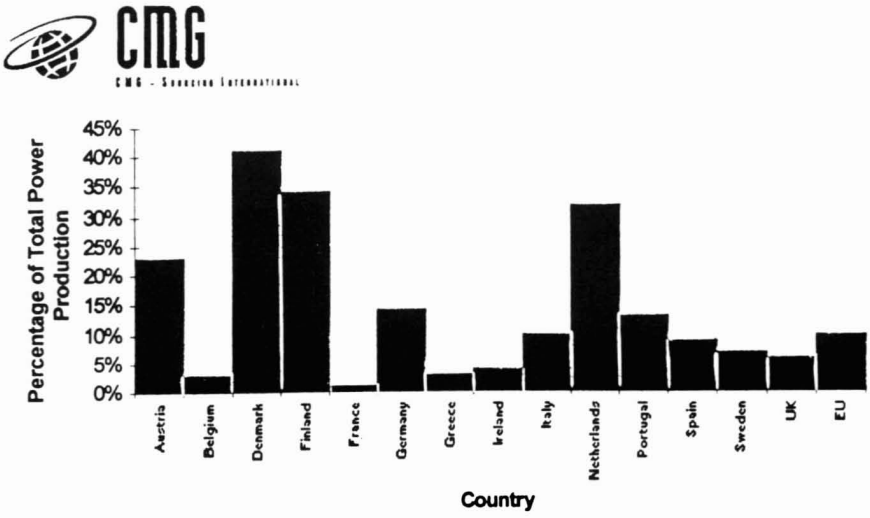


Figure 4. National Members of Cogen Europe



Source: Cogen Europe

Figure 5. Cogeneration as a Share of National Power Production (%)

plants. In these 10 years, almost 6 times as many installations were made than existed before 1985 [3].

FUTURE OUTLOOK

Massive Changes

The only consistent factor in the European industrial power market is rapid change, which can be viewed both positively and negatively for equipment manufacturers. The key areas of change, which can have dual effects on the markets are [4]:

- Industrial production cost reduction
- EU liberalization of power markets
- Gas prices and infrastructure
- The rise of contract energy management
- Technical advantages
- Environmental policy

Optimistic Forecast

Despite all the possible negative influences most experts see a bright future for the Independent Power Producer market.

The existing prognoses state that the European Union will triple their power production from IPPs by the year 2005 to 2010. This means that within 8-13 years approximately an average of 30% of power production in Europe will be generated by Cogeneration[8]. Presently, of all the power plants built today, more than 30% are IPPs [5].

The main reasons for that growth are:

Based on the recommendation by Cogen Europe, the European Community is promoting cogeneration to account for at least 20% of total European power generation [6].

The EU Environment Ministers agreed on March 3, 1997 that a collective 15% reduction (based on the 1990 emissions) of the "Greenhouse Gas Emission" should be achieved by 2010. In order to achieve this reduction in admissions, the ministers set up a recommendation list for a wide range of policies and measures which can be used at a community-wide level to help achieve these targets. Cogeneration is ranked highly on this list of recommended policies and measures (Figure 6) [7].

Better Technologies—improving the specific investment costs and operating costs dramatically—guarantee much better ROI and therefore attract more and more investors. For example, in 1990, the investment cost of a gas-engine driven cogeneration plant in the 5 MW range was approximately DM 1,700 ($1,000) per kWel installed. Today a similar plant would cost approximately DM 1,200($706) per kWel installed (Figure 7). Thus a 30% reduction in investment costs over a 7-year time period, i.e., an annual reduction in investment costs by an average of 4.28%.

In cooperation with various manufacturers, a German utility developed a standard cogeneration plant with 1 MW el. output. This plant cost DM 1,500 ($882) per kWel including building, back-up boiler, stack, etc. By using one or more of these standard 1 MW el. modules to make up larger plants, one can optimize the installation for the specific requirements [8].

In addition to having lower investment costs, today's systems have better efficiency and lower maintenance costs (and therefore lower operating costs) than those systems installed just 5 years ago (Figure 8) and turbine technology has made tremendous developments in the recent years showing that these technologies are both ecologically and eco-

Figure 6.

Member States	% Greenhouse gas emission reductions in 2010 for CO_2, CH_4 and N_2O together (GWP 100 weighted), compared to 1990
Belgium	–10
Denmark	–25
Germany	–25
Greece	+30
Spain	+17
France	0
Ireland	+15
Italy	–7
Luxembourg	–30
Netherlands	–10
Austria	–25
Portugal	+40
Finland	0
Sweden	+5
UK	–10

Source: Cogen Europe

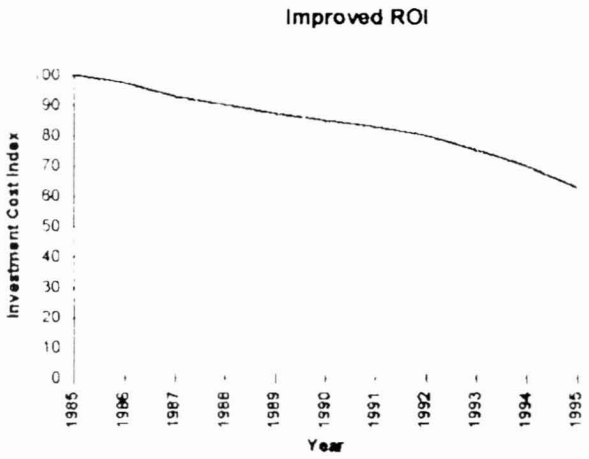


Figure 7.

nomically the prime choice for power generation if the right conditions exist [9].

A risk analysis considering all the factors that the deregulation of the electricity-markets will affect, shows that the clear winners of such a scenario are

- IPPs,
- Renewable power producer and
- Energy-brokers [10].

Estimated Market Figures

Based on the numbers of 1995 and 1996 as well as on the forecast of installations for the next 15 years, the cogeneration market in Europe appears to have impressive potential. Major participants will be the power equipment manufacturers (Figure 9). It is very likely that within the next few years we will see a consolidation wave among power equipment manufacturers with many mergers and acquisitions.

Not included in these market numbers, but the group of companies which most likely will see a tremendous business forced by the cogeneration market development are the gas companies. The forecast for Germany only shows that the existing gas consumption for power-production will double by the year 2010 (1995 - 16 billion m^3 - 20%; 2010 32 billion m^3 - 29%) (Figure 10) [11]. The growth from 1980 to 1995 was only 60% [12].

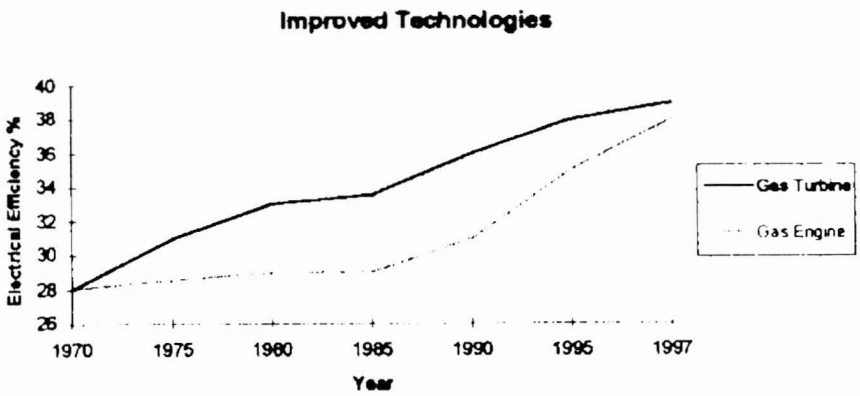


Figure 8.

Figure 9.

	Approximate Sales per Year
Power Equipment Manufacturers (engines)	US $1.8-2.5 billion
Power Equipment Manufacturers (turbines)	US $8.0-12.5 billion
Accessory Equipment	US $2.0-4.5 billion
Maintenance and Parts	US $1.0-1.5 billion
Engineering and Consulting	US $0.7-1.4 billion

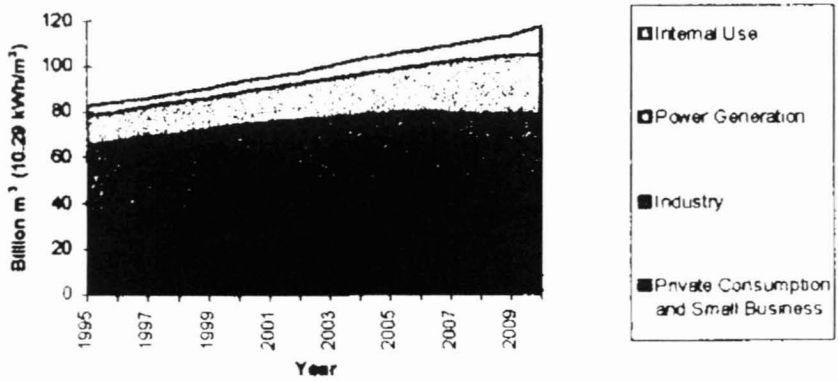


Figure 10. German Natural Gas Consumption Forecast

There are several groups of companies and organizations, such as financial institutions, lawyers, oil companies (lube oil), contractors, etc., who will additionally participate in this multi-billion dollar market.

10 Rules for US Companies

1. Choose entry strategy carefully
2. Perfect time for acquisitions and joint ventures
3. Partners provide easier access to European markets
4. UK and The Netherlands as prime markets for cogeneration

5. Seek professional assistance
6. Utilize free sources of information
7. Avoid tight budgets
8. Have dedicated area manager in charge specific region
9. Control flow of information
10. Do not underestimate the different ways of doing business abroad

If your company is offering services and products in this market this is the time to start or empower your activities in Europe.

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Hannes Hunschofsky oversees CMG-Sourcing International's business development activities, as well as the formation and management of various strategic alliances. Prior to this position he served as VP of sales and marketing worldwide for Jenbacher Energiesysteme AG, and as the president of their US subsidiary. Mr. Hunschofsky has also lectured at the marketing institute of the University of Innsbruck. In addition, he serves as a member of the board of directors at the August Storm company as well as the S&L Energie Projekte Company in Germany and as a consultant for a variety of international companies.

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