

CODE2

**Cogeneration Observatory
and Dissemination Europe**



D2.1 CHP Awareness Case Study **GREECE**

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Chapter 1: Introduction

The development of CHP in a Member State is connected to the level of awareness in that state. Therefore, it is essential not only to analyze the present condition, but to ensure that we promote the deployment of CHP. Existing CHP installed capacity is limited in Greece; nevertheless, there is a lot of area for expansion. Sectors that already use CHP systems are mainly industries, sanitary landfill facilities, hospitals, greenhouses, educational facilities, apartment buildings and hotels. Greece holds an important geopolitical position and has shown a great interest in CHP technology and dissemination through HACHP. Greece was chosen for the awareness study, due to its low base of CHP, its extreme southerly location and the relatively high level of interest in cogeneration as witnessed by the recent supportive government legislation. Additionally, there has been an increase in CHP installed systems in the period 2000 to today.

Chapter 2: Awareness of CHP in Greece

Several important movements have been made by the Greek government in an effort to embody European legislation concerning CHP. Regulations and EU Laws have been, while both the new “General Regulation of Buildings” and “Regulations on Energy Assessments of Buildings” contain many references on CHP systems. In April 2012, the Technical Chamber of Greece has issued a Technical Directive for “the installation of micro and small CHP in Buildings”, which is offered as a guide to all engineers working on buildings. Industry, through the Hellenic Association for the promotion of Combined Heat and Power (HACHP), played a leading role in providing information and support to the government during these changes. Lately, there has been an effort to clarify and ensure the connection of micro-CHP systems to the electrical grid which could reduce the return on investment period for new projects to 1-2 years.

Under this regime, medium and large CHP systems have an adequate profit for investors. Limited finance from banks as well as insecurity among the investors makes subsidies almost necessary in order to install such CHP systems. Small and micro CHP systems seem to be sufficiently profitable under the current support schemes for investors to use their own funds. The flexibility and low total investment cost makes these CHP systems more favorable to a larger number of installations.

Interest groups concerning CHP are presented in the following table:

General public	For the ordinary citizen, CHP is an almost unknown technology. Although most of them are aware of terms such as “energy efficiency” and “green energy” they still are not familiarized with CHP technology. There are exceptions of well informed individuals, where many of them have already or are thinking about investing in micro-CHP systems. Small and micro-CHP systems are good means to raise awareness of the efficiency of a cogeneration approach since these systems could interest individuals, who with a relatively low cost would like to improve the energy efficiency of their houses.
Media	CHP technology is quite known among the specialized on energy media. Media generally hold a good image about CHP which is considered decentralized, environmentally friendly and close to the citizen. The daily papers and TV programs mention CHP infrequently. The problem could be that specific technology terms are difficult to process for ordinary journalists and there is a low level of interest by the general public.
Policy	Regulations such as “General Regulation of Buildings” and “Regulations on energy assessments of Buildings” contain many references on CHP systems. Also a Technical Directive titled “Installation of micro and small CHP in Buildings” is offered as a guide to all engineers working on buildings, provided by the Technical Chamber of Greece. There has been a successful campaign in the field of Energy Efficiency from devices to buildings which is also an essential market factor. Nevertheless, there have been few steps concerning CHP systems.
Energy industry	Increasing use of cogeneration, which holds a good image, particularly with the younger staff. CHP systems have been used for many years now by major energy industries.
Industry	CHP is well known in principle, but there is a lack of technical, economic and legal know-how to implement it despite a good business case. Due to today’s financial crisis in Greece most of the businessmen hesitate to invest even knowing that this could be to their benefit.
Other potential user groups (commercial, hotels, greenhouses, buildings, etc)	CHP is quite well known in some of these groups. Nevertheless there are only a few examples of completed CHP system installations. Due to lack of own funds subsidies are often necessary for such investments to be made. Small family-run companies or individuals are not well informed and with limited cash flow and without any assistant bank they don’t invest in energy efficiency.
Energy consultants	CHP is known in principle, but often the detailed know-how is missing. Additionally in the past few years there has been a great profit to be made in renewable energy sources such as photovoltaics and wind turbines, which were more attractive to energy consultants’ clients than CHP systems.
Planners	CHP is known in principle, but often detailed know-how is missing.

Installation companies	CHP is known in principle and detailed know-how is at a good level. Unfortunately due to the low level of interest among user groups there are only a few installation companies in Greece.
Architects, Mechanical and Structural engineers	CHP solutions are mostly known only superficially. The focus is on solar thermal, heat pumps and pellets. HACHP in an effort to increase awareness on CHP made several contacts to engineering offices and the Technical Directive for “the installation of micro and small CHP in Buildings” are offered as a guide to all engineers working on buildings. There also could be more informative activities towards construction companies and engineers.
Academic area	Only some of the polytechnic schools and universities and technical colleges deal with CHP. There is a good knowledge only in a few institutes.
Environment NGOs	Good image: decentralized, environmentally friendly, citizen close.
Banks, leasing, financing facilities	There are major problems for CHP financing. Although a few years ago financing of CHP systems was secured, nowadays due to economic crisis it is minimised.

Associations

HACHP is the association membership represents the broad base of those organisations involved commercial and academically in CHP. The Association has engaged with Greek policy makers raising awareness and assisting in interpreting the European Legislation. The Association also holds seminars and workshops on CHP and participates in energy sector events. Currently, the HACHP is increasing awareness of private companies and individuals to invest in CHP which are currently promoted by HACHP through suggestions concerning connectivity of small and micro CHP systems to electrical grid.

IENE, the Institute of Energy for South-East Europe, is an independent and non-profit organisation established in Athens in 2003 by a group of scientists and business executives active in energy sector. The key objectives of the Institute is to constitute a permanent forum where energy issues can be discussed, analyzed, to participate in the formulation of energy policies, both in national and international level, within the broader region of SE Europe and to contribute to the implementation of EU sustainable energy strategy. IENE’s efforts to open up and promote the discussion on energy issues is backed by an infrastructure designed to develop and exemplify its positions and to foster an exchange of views through publications, but also through the organization of public events such as debates, workshops, seminars, conferences and educational visits to energy-related sites. Regarding CHP, IENE is giving the floor in an annual basis to HACHP to present its views on cogeneration in its annual Conference on “Energy and Development”. Also, IENE organises annually a half-day workshop on CHP, where its advertisement and the promotion is through their channels, with the participation of young-mainly-engineers and technicians.

Barriers

There are also a lot of barriers that should be overcome:

- Legal issues and bureaucracy maximise the waiting time for permits and make it difficult for investors to proceed. But in this area a lot of progress was made and the remaining is under discussion for permanent solution.
- An important issue is the low level of information and social interest, especially in some of the interest groups. For example, the majority of architects and engineers in general, who are involved in the construction sector, do not have enough knowledge in this field. At the same time, the general public is unaware of the benefits of cogeneration.
- In the past years, there is a general tendency in all European member-states towards energy efficiency. Especially in Greece, there has been a successful campaign to that field. Greater energy efficiency in buildings is an essential market factor. Nevertheless, there have been few steps concerning CHP systems.
- Due to today's financial crisis in Greece most of the businessmen hesitate to invest even knowing that this could be to their benefit. On the other hand, small family-run companies or individuals are not well informed and with limited cash flow or any assistant bank they don't invest in energy efficiency.

Case studies

In the case studies, which HACHP presents for Greece, it is important to mention not only the economic and environmental data, but also the degree of awareness and the acceptance of the final users. The two case studies were successfully implemented because of the current national support scheme for CHP:

- In the case of the greenhouse the awareness which stimulated uptake of CHP came through a joint EU project.
- In the case of the residential building, the installation of the micro-CHP came mainly from the efforts of the local distributor/installer of the engine to install the product and the willingness of the apartment owners to move to greener technologies for heating and for domestic hot water.

In both cases the awareness of market players had only a small role. The most significant impact on the projects was their financial attractiveness and individual links between market operators and potential clients.

Chapter 3: Conclusions: Importance of Awareness in CHP success in Greece

It is critical to note that until now cogeneration has had a low penetration in the Greek market with that cogenerated electricity was minimal, between 2.5% to 1.4%, compared to the total electricity production. Hence, the Greek energy market is at an early stage of development. There has also been no attempt to develop awareness for CHP in Greece. The many other challenges of the energy market add to the difficulty of developing proper market awareness: the electricity market is still only partially liberalized; there are many distortions, in both

electricity and fuel markets and, there are many barriers, in both the legal and administrative area to overpass.

Now, it is clear, that due to the influence of the EU Directives, the target set by EU for Energy Efficiency by 20% compare to 1990's data and that the country should fulfil it, and due to the influence of HACHP in the Greek Ministry of Energy and Environment –YPEKA, the CHP position is clearer, stronger and more positive.

The importance of awareness in CHP is, now, an essential factor in the dissemination of CHP systems on a national level. Proper and thorough information produces well informed investors. At the same time a total rise of awareness may trigger an increase for companies to enter the market by selling and installing CHP systems.

Annexes: Two Case study factsheets on micro-CHP unit in an apartment house and CCHP unit in a hi-tech greenhouse

MICRO-CHP UNIT IN AN APARTMENT HOUSE

Residential/Building

Main CHP project indicators

Heat capacity (total)	kW	12
Electrical capacity (total)	kW	4,5
Technology	Internal Combustion engine	
No. of units	1	
Manufacturer	ECOPOWER	
Type of Fuel	Natural gas	
Heat: yearly generation	MWh	38,5
Electricity: yearly generation	MWh	14,5
Year of construction	2010	
Total investment costs	EUR	25,000
Financing	Own funds	
State support	none	
Location	Thessaloniki, Greece www.moumtzis.gr	

Picture



General description of the case

The case study is dealing with the total replacement of the central heating system of an apartment building, which was erected in 1964, with 9 level and 18 apartments. The old heating system was a dual pipe central heating system, which used heating oil. The total power of the old system was 250kW_{th} and it was over-dimensioned, as this was a common practice in most of the apartment buildings in Greece, constructed the

previous decades. The old system was replaced by a micro-CHP system, producing electrical power of 4,5 kW_e and thermal power of 12kW_{th} and the heating fuel is, now, natural gas. A boiler of 50 kW_{th} was connected to the CHP system and is used as “back-up”, as well as two thermal storage tanks of 1.000 liters each, connected in parallel. So during its operation the CHP unit was heating up the water, stored in the two thermal tanks and from these tanks the heated water was circulating in the piping and the radiators.

Success factors

Regarding legislation and pricing, the Greek Law for the promotion of CHP (L.3734/09) is favourable for micro-CHP units, giving priority to the cogenerated electricity to the network. Also, the local natural gas companies are providing favourably prices for natural gas for micro-CHP systems. Regarding the project itself, the annual consumption before the investment, was 14.000 liters of heating oil for the heating period 2009-2010. Then, the annual consumption of CHP system is 12.200 m³ of natural gas, while it also produces 14.5 MWh/year, electricity that was injected in LV network system, for the heating period 2010-11. The annual costs for 2009-10 were 17.000€ with the previous system, which were reduced to 8.655€, if you take under consideration the economic benefit from electricity produced. The annual working costs of the system were decreased by 51%, and the return on investment period is calculated to 3 years.

Main barriers

The main barrier for the promotion of micro-CHP, for both the tertiary and residential sectors, is the absence of an agreement between cogenerator and the DSO.

Conclusions

All the owners of the apartment building are very satisfied with their investment and are willing to suggest such systems to others. This is due to the fact that beyond the lower heating expenses, the indoor thermal comfort was increased, as the heating system is now operating continuously, due to the fact that the micro-CHP unit is heating up the two thermal storage tanks and not directly the apartments. If the above-mentioned barrier is solved, then there is a great possibility of similar projects in all areas where Natural Gas is provided.

CCHP UNIT IN A HI-TECH GREENHOUSE

Agriculture

Main CHP project indicators

Heat capacity (total)	kW	6000
Electrical capacity (total)	kW	4800
Technology	Internal Combustion engine	
No. of units	3	
Manufacturer	CATERPILLAR	
Type of Fuel	Natural gas	
Heat: yearly generation	MWh	32000
Electricity: yearly generation	MWh	25000
Year of construction	2007	
Total investment costs	EUR	20,5 million
Financing	EU Community Supporting Funds	
State support	Feed-in tariff	
Location	AGRITEX s.a. Alexandria, Imathia W. Macedonia, Greece www.agritex.gr	

- The greenhouse is equipped with the necessary equipment for hydroponic cultivation, harvesting and pest.
- Energy Management Unit that includes a CHP unit of 4,8 MW_e, gas boilers of 18,6 MW_{th} and an absorption chiller of 550 kW_c
- Processing Unit of an 1,5 tn CO₂ production/hour
- Organic cleaning, disinfection system and water recycling and irrigation facilities for collecting and managing the rainwater
- 2100 m² packing machine sorting and packing of 5 positions with a machine of "flow-pack"
- Coolant chamber of 276 m² and 1000 m² of storage space.

Success factors

The investment was funded by the EU-funded CSF "Operational Programme-Competitiveness". The cogenerated electricity is purchased by the HTSO and supplies the national grid.

Due to the fact that CCHP units cover the heating and cooling needs of the greenhouse, an extra F-i-T, of 18% is given by the State, as a bonus, for the process of CO₂, which is added to the specified F-I-T for cogenerated electricity with NG.

Picture



General description of the case

The facilities include:

- Glass-made greenhouse, of 100 acres, with all heating, cooling, irrigation, fertilisation, shading, ventilation and enrichment with CO₂, linked to a central control unit.

Main barriers

The Greek electricity market is liberalised according to the Law, but there are many distortions that delay the full liberalisation. In the area of CHP in Greece, due to numerous distortions, there is no continuous payment of the F-i-Ts to the cogenerators, creating serious financial problems in the cash flow of the enterprise. This has the lowering of the CCHP operation.

Conclusions

In general, this hi-tech greenhouse with the CHP unit, the absorption chiller and the processing unit of the exhausts from the engines, producing clean CO₂ for the indoor plants, is a success story and there is a great potential to be multiplied in Greece, especially in this period of economic crisis, where the local primary production should be significantly increased.