HELLENIC REPUBLIC

MINISTRY OF ENVIRONMENT, ENERGY AND CLIMATE CHANGE

SECRETARIAT-GENERAL FOR ENERGY AND CLIMATE CHANGE

Athens, November 2011

NATIONAL REPORT

UNDER ARTICLES 6(3) AND 10(2) OF DIRECTIVE 2004/8/EC,

OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL,

ON THE

PROMOTION OF COGENERATION

BASED ON A USEFUL HEAT DEMAND

IN THE INTERNAL MARKET AND AMENDING DIRECTIVE 92/42/EEC

This national progress report

for high efficiency cogeneration

of heat and power (HECHP) was

based on the relevant template

proposed by the EU and developed

through cooperation between

the Directorate for Energy Policy and

the Directorate for Power Generation

of the Ministry for the Environment, Energy and Climate Change.

Contents

1. SUMMARY

In recent years, the institutional framework on energy in Greece has turned towards supporting Renewable Energy Sources (RES) and High Efficiency Combined Heat and Power (HECHP) applications, thus setting up an integrated context for attracting investments, and the recent changes made to the operation of the Energy Markets in Electricity and Natural Gas have contributed in this direction.

The development of Combined Heat and Power (CHP) applications in Greece is directly linked not only to the existence of the required authorisation and financing framework, but also to the demand for energy in certain branches of economic activity. That is why the progress made concerning the penetration of CHP in the Greek energy system must be looked into and analysed taking into account not only the institutional framework, but also the investment interest, the needs for thermal loads per branch of economic activity, as well as the overall financial context affecting both the establishment of new units and continued operation of existing ones.

In particular, given that due to the country's weather conditions thermal loads in specific end-consumer areas are needed only for a short period within a year and taking into account the limited development of district heating networks, the framework set up for the development of CHP is restricted and concerns only specific areas of application and specific geographical regions where there is both sufficient demand for thermal energy and potential for developing network infrastructures. Further development of CHP applications in Greece, using both conventional fuels and RES, depends, in addition to having appropriate regulatory and financing instruments in place, in particular on technological progress with a view to making commercially mature and exploitable new HECHP technologies capable of covering cooling loads.

As detailed in the following sections, the institutional framework for the promotion of HECHP applications has been adapted to, and developed in accordance with, relevant EU directives and decisions, and the financial instruments used for supporting these applications have been adjusted both with a view to meeting investment needs and promoting actions in sectors with increased potential for the development of HECHP applications. It should be noted, however, that the consequences of the current unfavourable investment environment caused by the economic recession tend to discourage new HECHP investments too, in particular where these applications are related to industrial or infrastructure/network development activities.

As explained in this report, the energy contribution of HECHP applications was constantly growing in the period 2006-2010, with internal fluctuations in their share mainly due to reduced industrial activity. There has also been increased volatility concerning the types of fuels used per period under examination, also depending on the development of fuel prices. In summary, positive results have already been observed due to the recent institutional changes, whereas past obstacles or weaknesses are now dealt with either by the regulatory framework or by using a streamlined approach and reinforcing market mechanisms. It should be pointed out, however, that these prospects for further penetration of HECHP units are not expected

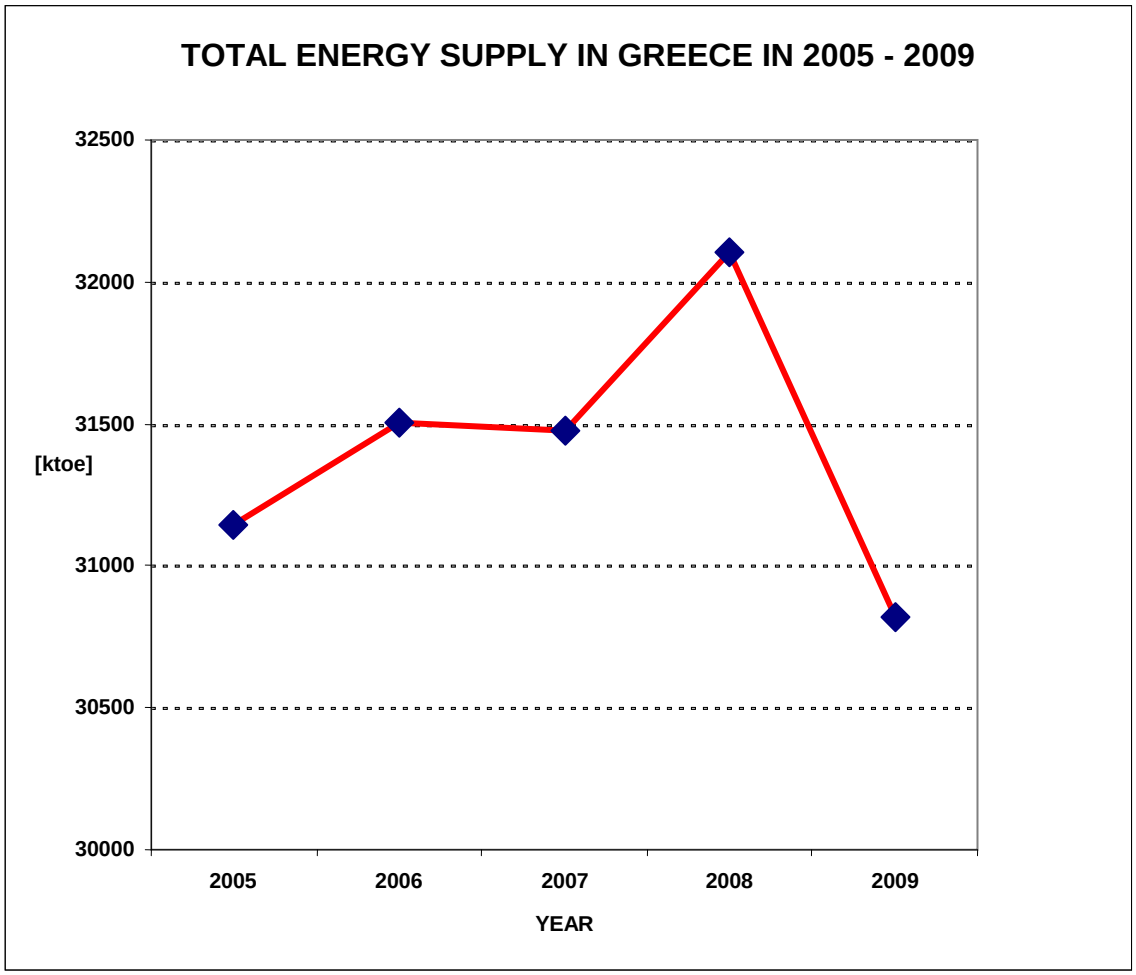
to modify their share ratios in the country's total needs for electricity and heat and their absolute penetration values in the midterm.

2. THE GREEK ENERGY SYSTEM

The effect of the economic crisis on Greece is reflected on the energy balance in the form of reduced demand for energy in most sectors. In particular, the total energy supply in Greece amounted approximately to 28 Mtoe in 2010, i.e. reduced by 8.2% as compared to 2009 or 11.1% as compared to 2008. Graph 1 presents the development of final energy supply in the period 2005-2009, reflecting the initial significant impacts of the economic recession and reduction in the demand for energy. On the contrary, the total energy supply in Greece tended to rise from 1990 to 2008 at an annual rate of 2%.

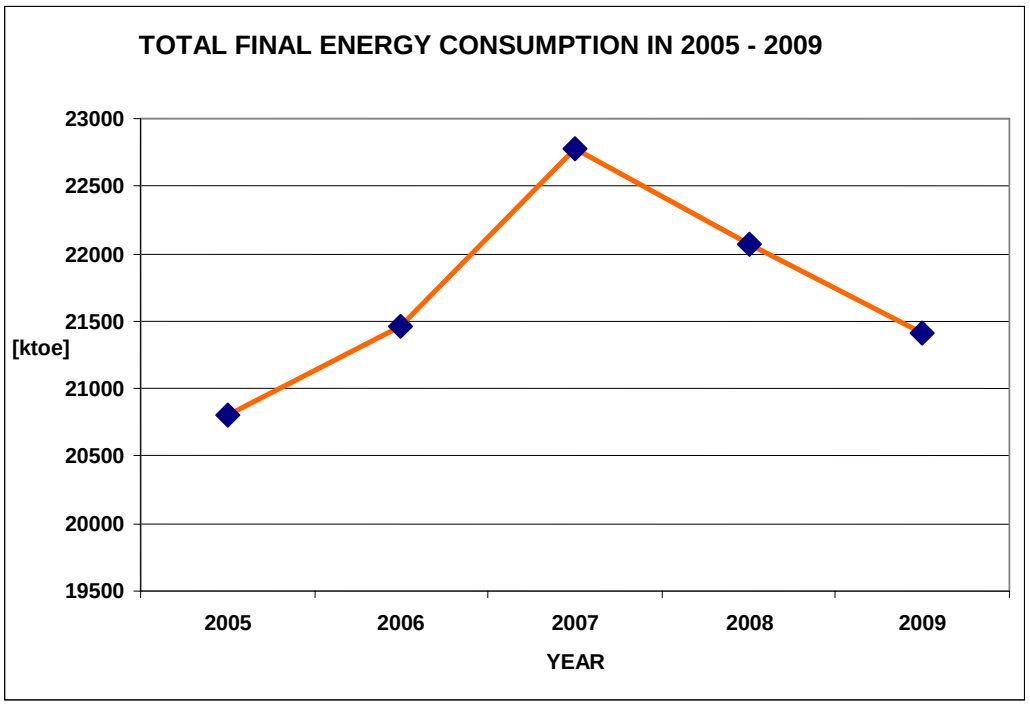
Amidst the above-described economic and energy environment, there was a reduction in final energy consumption, which approached in 2009 the price levels prevailing in the early five-year period 2005-2009 (Graph 2), whereas a further reduction was observed in 2010 leading to the levels prevailing at the beginning of the previous decade.

While total energy demand is dropping, we observe a rise both in its share and absolute value by 2009, and it is only in the recent period 2009-2010 that we see a significant drop in its values due to the economic environment. Final energy consumption in the industrial sector has dropped in recent years both in terms of absolute figures and share ratios in total final consumption. Graph 3 presents consumption levels in end use sectors in the period 2005-2009.



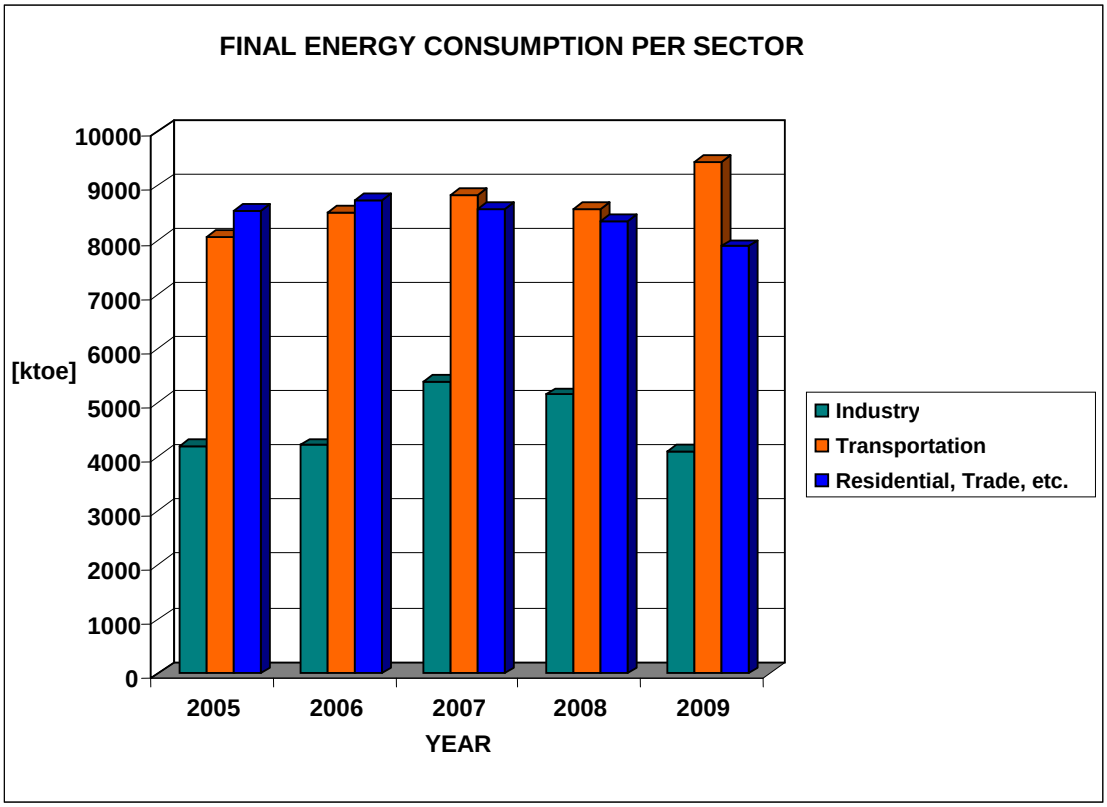
Graph 1. Total energy supply development in Greece in the period 2005-2009.

(Source: Directorate for Energy Policy of the Ministry of the Environment, Energy and Climate Change - National Energy Balances)



Graph 2. Final energy consumption development in Greece in the period 2005-2009.

(Source: Directorate for Energy Policy of the Ministry of the Environment, Energy and Climate Change - National Energy Balances)

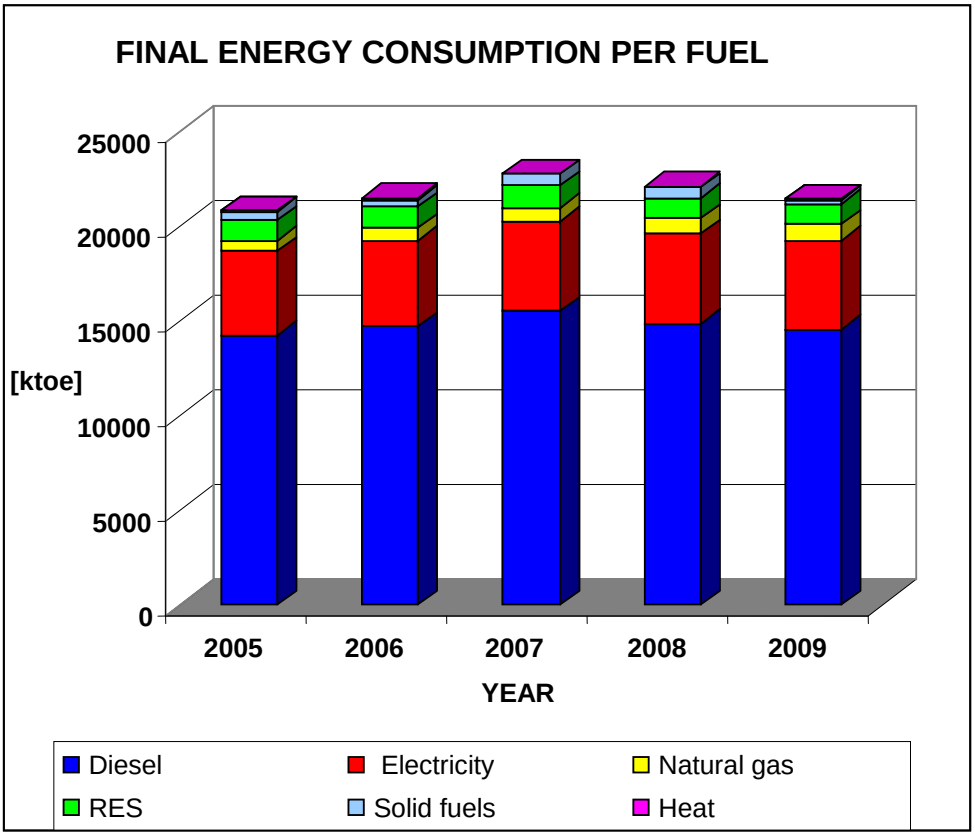


Graph 3. Final energy consumption development in Greece in the period 2005-2009 per sector.

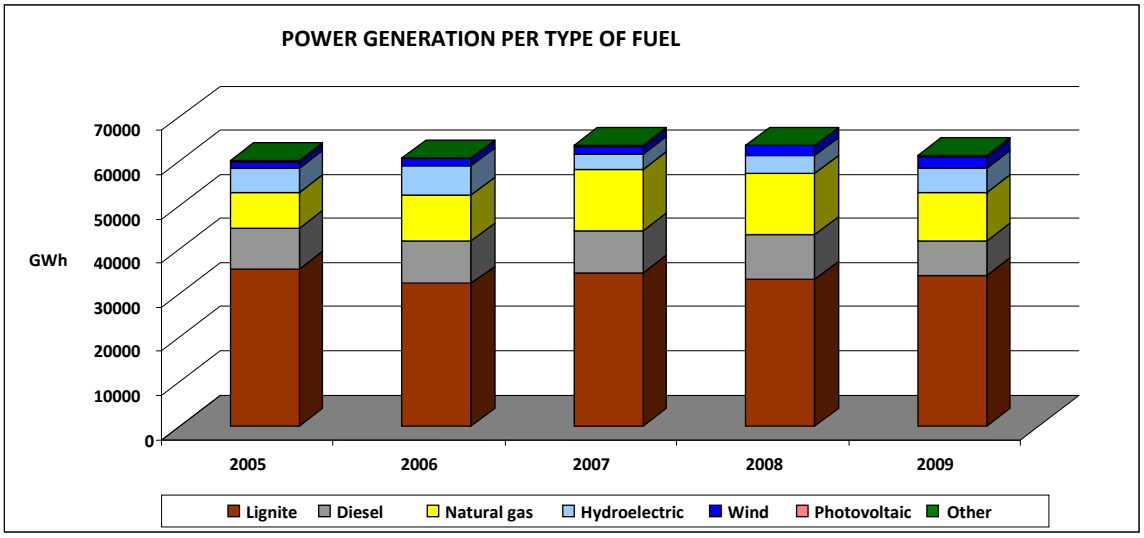
(Source: Directorate for Energy Policy of the Ministry of the Environment, Energy and Climate Change - National Energy Balances)

Concerning direct uses and coverage of the needs for heat, significant change and progress has been made in the energy supply sector by introducing natural gas, where it is gradually occupying higher and higher shares both in the industrial and the residential and tertiary sectors, with thermal RES (biomass and thermal heat collectors and, at considerably lower levels, geothermal applications), whose shares are still on the rise, as well as with oil products, which are still dominant both in the industrial and the residential, tertiary and agricultural sectors when it comes to meeting the needs for heat (Graph 4).

The power generation sector, however, varies strongly as there has been a significant increase in the share of RES and natural gas technologies, but lignite plants still hold the largest share in power generation (Graph 5). The use of oil products has actually been limited to the independent power systems of non-interconnected islands, whereas efforts are being made for gradually interconnecting these islands to the mainland system.



Graph 4. Final energy consumption development in Greece in the period 2005-2009 per fuel. (Source: Directorate for Energy Policy of the Ministry of the Environment, Energy and Climate Change - National Energy Balances)



Graph 5. Power generation development in Greece in the period 2005-2009 per fuel. (Source: National Energy Balances)

Penetration of CHP facilities has been rather limited in Greece so far; the largest part of the installed capacity of CHP units is at refineries, large power plants and food industries. Moreover, PPC's power units have been properly modified to meet the needs of urban areas for heat by means of district heating networks. CHP applications using biogas are in the relatively early stages of development, mainly in waste water

and organic waste treatment units, where the institutional and financial possibilities provided for RES are put to use.

Table 1 below presents a summary of the penetration of CHP applications per branch of economic activity. It should be noted that the authorisation procedure for 29 applications for CHP units of an installed power of more than 1 MW_e, of a total thermal capacity of 779.4 MW_{th}, has progressed (at least generation authorisations have been obtained), also including extensions of district heating networks at PPC power units (of a total capacity of 230 MW_{th}). Applications have also been filed at the respective stages of the authorisation procedure for CHP units of an installed capacity of less than 1 MW_e, relating to a total of 8 units of a total thermal capacity of 9.1 MW_{th}.

The main financing instruments for supporting HECHP plant investments, in addition to the subsidy granted for the electricity generated by such units, include the Law on Development now in force, the Operational Programmes on Competitiveness and tax exemption incentives.

Table 1. Installed capacity of CHP units in Greece.
(source: Ministry of the Environment, Energy and Climate Change, Directorate for Power Generation, October 2011)

Category of activity	*Number of units*	*Electric capacity*		*Net thermal capacity (MW_{th})*
		CHP (MW_e)	*Mixed (MW_e)*	
Supply of electricity, natural gas, steam and hot water	8	62,51	1.739,00	364,27
Production of refined oil products	5	129,27	139,27	212,50
Food, drink and tobacco industries	6	18,00	44,50	194,90
Textile, clothing and leather industries	1	1,20	1,20	1,47
Hospital activities	1	0,73	0,73	0,89
Education	1	2,72	2,72	3,09
Cultivation of vegetables and horticultural products in greenhouses	2	9,70	9,70	11
Manufacture of non-structural products, manufacture of fireproof ceramic products	1	1,13	1,13	2,74
Hotels	1	0,07	0,07	0,11
Production of aluminium	1	2,08	2,72	3,60
Production of steel strip and packaging plastic materials	1	2,10	2,10	2,91
Production of chemical substances and products	2	21,22	21,22	53,40
Waste water collection and treatment	4	3,19	3,19	8,67
Collection, treatment and supply of water	2	17,90	23,70	34,50

TOTAL	**36**	**269,7**	**1.991,3**	**892,6**

3. TRANSPOSITION/IMPLEMENTATION OF THE LEGAL TEXT OF DIRECTIVE 2004/8/EC

Q1: *What is the level of transposition of the Directive in Greece? What is the timeline for the remaining parts of the transposition of the Directive, if any?*

The first legal text in Greece making reference to HECHP was **Law 3468/2006 "Generation of electricity from Renewable Energy Sources and High-Efficiency Cogeneration of Heat and Power, and other provisions"** which defined HECHP as cogeneration which ensures at least 10% of primary energy savings as compared to the thermal power and electricity generated by separate procedures. Furthermore, Law 3468/2006 defined "Small Scale Cogeneration Unit" as a cogeneration unit of an installed electric capacity of less than 1 MW_e and "Micro Cogeneration Unit" as a cogeneration unit of an installed electric capacity of less than 50 kW_e.

In accordance with Law 3468/2006, "HECHP producer" means a HECHP producer generating electricity by the use of HECHP plants, and "HECHP autoproducer" means a producer generating electricity by the use of HECHP units mainly for its own use and feeding any surplus electricity into the System or Grid.

Law 3468/2006 also laid down the authorisation procedure to be followed for HECHP projects (in particular, the requirements for obtaining generation, installation and operating authorisations, and exemptions), the conditions for giving priority to HECHP plants within the System or the Interconnected Grid, the prices for electricity from HECHP plants, and the mechanisms to be used for promoting large scale HECHP investment plans.

In accordance with the Law in question, the competent System or Grid Administrator should, in allocating the load, give priority to:

- HECHP plants using RES or RES in conjunction with gaseous fuels, irrespective of their installed capacity;
- HECHP plants of an installed capacity of up to 35 MW_e generating electricity by the use of a method other than that described under the preceding indent;
- the surplus electricity from autoproducers, on condition that the surplus electricity is generated by HECHP plants of a maximum installed capacity of 35MW_e and for the part of the power generated which does not exceed, annually, 20% of the total electricity generated, which may not be more than 50 000 MWh in any event.

Actually, the Law that transposed Directive 2004/8/EC into Greek legislation and laid the regulatory foundation for promoting the cogeneration of heat and power (CHP) is **Law 3734/2009 "Promotion of the cogeneration of two or more useful forms of energy, regulating issues relating to the Mesochora Hydroelectric Project and other provisions".**

In particular, Law 3734/2009:

- Lays down the key principles for determining two important operating characteristics of CHP units, which are: (a) electricity generated in conjunction with useful thermal energy, and (b) primary energy savings achieved thanks to cogeneration. The primary energy savings are calculated in accordance with harmonised efficiency reference values for separate production of electricity and heat, as already published by the European Commission (Decision 2007/74/EC).

- Lays down the requirements to be met for defining a cogeneration as "high-efficiency cogeneration" (HECHP).

- Sets out definitions relating to the installation and operation of cogeneration units, in harmony with the definitions proposed in the relevant Community Directive for all EU Member States.

- Ensures that it is possible to guarantee the origin of the electricity generated by HECHP units.

- Establishes the procedure for drawing up regular technical reports on the national potential for CHP and HECHP.

In more detail, it lays down the key principles for calculating the electricity generated by cogeneration units. This calculation must be based on values from the actual operation of the plant. In the event that these values are impossible to measure due to any reason whatsoever, indicative values can be used for the calculation, in accordance with the Directive. On the basis of the calculation of the electricity generated by cogeneration units, the amounts of electricity from HECHP units sold to the System Administrator are determined.

Moreover, in July 2009, **Ministerial Decision D5−IL/G/F 1/off.15641 laying down the details of the method used for calculating the electricity from cogeneration units and the efficiency of cogeneration** was adopted in accordance with Commission Decision of 19 November 2008 establishing detailed guidelines for the implementation and application of Annex II to Directive 2004/8/EC.

Ministerial Decision D5−IL/G/F1/off.15641 includes a detailed presentation of the procedure for calculating electricity from cogeneration units and primary energy savings both from the cogeneration and non-cogeneration parts. It also sets out in detail the measurement and reporting procedure and the proposed approach for data relating to complementary provisions. Finally, in accordance with the Ministerial Decision, the heat used in biomass burning cogeneration units for biomass-drying purposes is not deemed to be useful cogeneration heat. On the contrary, the heat offered by cogeneration units to a biomass processing system is deemed to be useful cogeneration heat.

Law 3734/2009 also sets out the values that qualify the efficiency of cogeneration (efficiency points, primary energy savings) and provides the key equations used for calculating these values. The electricity and heat generated by cogeneration units are used in making the calculations, along with the efficiency reference values for separate

production of electricity and heat, taking into account the European Union's harmonised values.

In particular, the efficiency reference values, the requirements for application relating to the year of construction, the possibility of renovating HECHP and the composition of the fuels used were laid down in July 2009 by **Ministerial Decision D5−IL/G/F 1/off.15606 laying down harmonised efficiency reference values for separate production of electricity and heat,** also taking into account Commission Decision of 21 December 2006 establishing harmonised efficiency reference values for separate production of electricity and heat in application of Directive 2004/8/EC.

In particular, where the calculations concerning the cogeneration unit under examination include condensate return, steam production efficiency must be reduced by 5 absolute percentage points. It also sets out the procedure for adjusting the harmonised efficiency reference values for separate production of electricity and heat to the average weather conditions prevailing in the country and to the losses avoided, thanks to cogeneration, in the interconnected electric system. It should be noted that correction factors for the average climatic situation do not apply to fuel cell-based cogeneration technology.

The provisions of Law 3734/2009 also stipulate that the decisions on the Regulation on issuing authorisations for the generation of electricity from HECHP as provided for in Article 5(3) of Law 3468/2006 and laying down the supporting documents required for HECHP units as provided for in Article 8(10) of Law 3468/2006 may be amended and complemented by virtue of decisions to be taken by the Minister for the Environment, Energy and Climate Change.

It is also stipulated that, with a view to ensuring the transmission and distribution of electricity generated by HECHP units, the relevant provisions of **Law 2773/99 "Liberalisation of the market in electricity – Regulation of energy policy issues and other provisions"** and Law 3468/06, as well as the System Management and Electric Power Exchange Code shall apply mutatis mutandis. Law 2773/1999, as amended by Law 3426/2005, Law 3175/2003 and Law 2837/2000, stipulated that HTSO should give priority access to the electricity generated from RES and cogeneration systems.

In addition, Law 3734/2009 introduced in domestic legislation the concept of guarantees of origin of electricity generated by legally operating high efficiency cogeneration facilities. The necessary regulatory framework is regulated by a decision taken by the Minister for the Environment, Energy and Climate Change, following an opinion from the Regulatory Authority for Energy (RAE). In particular, the implementation of the system for Guarantees of Origin of Electricity from HECHP was adopted in May 2010 by virtue of **Ministerial Decision Δ6/Φ1/off.8786 on the implementation of the System for Guarantees of Origin of Electricity from RES and HECHP and the mechanism used for securing the system.** This Ministerial Decision lays down the details concerning the keeping of a register and the organisation of the system for guarantees of origin, the conditions and procedure for registering a plant in the Register of Units, the content and duration of the guarantees of origin, the procedure for issue thereof, the method used for calculating the electricity generated and the mechanism used for control thereof, as well as other matters relating to the resolution of disputes, cooperation between organisations, transparency, etc.

The provisions of Law 3734/2009 set out the conditions and procedure for issuing production, installation and operating authorisations for CHP facilities using conventional fuels, which are not classified as HECHP facilities. The provisions of Law 3468/2006 apply to HECHP plants from RES. With a view to facilitating the procedure followed for evaluating applications for generation authorisations for cogeneration projects of an installed capacity of no more than 35 MW_e, RAE issued an evaluation guide concerning their energy efficiency.

It also describes the procedure followed for the type approval of a compact small scale or micro cogeneration unit. By decision of the Minister for Development the procedure for obtaining type approval for a cogeneration unit is set out, which shall be issued by a certified organisation. Small scale cogeneration units having obtained type approval are exempted from the obligation to obtain a generation, installation and operating authorisation.

Within the framework of complying with Directive 2004/8/EC, certain matters are regulated relating to the drawing up of the national report on the cogeneration potential and the progress made in the diffusion of cogeneration in Greece, including small scale and micro cogeneration. This report includes a separate analysis of, and reference to, HECHP.

Finally, reference is made to the obligation to submit statistics on the operation of cogeneration units to the European Commission. Cogeneration unit owners are required to submit such statistics to the Ministry of Environment, Energy and Climate Change. It should be noted that the statistics provided by cogeneration unit owners are confidential. This data is used for the calculation of the electricity and heat produced by cogeneration units, as well as the primary energy savings achieved thanks to the use of cogeneration on an annual basis. These statistics are submitted by the Ministry of Environment, Energy and Climate Change to the European Commission.

The Law in question, in conjunction with Law 3468/2006, Law 2773/1999 on the liberalisation of the market in electricity, Law 3175/2003 regulating the operation of heat networks, and Law 2941/2001, constitute an appropriate framework for an attractive investment environment for investing in CHP units.

Recent developments in the institutional framework

Law 3851/2010 "Speeding up the development of Renewable Energy Sources with a view to dealing with climate change, and other provisions falling within the scope of responsibility of the Ministry of the Environment, Energy and Climate Change" was adopted in 4 June 2010 providing for the simplification and speeding up of the authorisation procedure for HECHP plants, while at the same time including a specific framework for streamlining HECHP-linked energy tariffs in the financial support system for electricity generation from RES, as envisaged by Law 3468/2006.

In particular, Law 3851/2010 stipulates that HECHP plants of an installed capacity of less than 1 MW_e or 5 MW_e which are set up by educational or research organisations in the public or private sector are exempted from the obligation to obtain a generation authorisation or any other certification decision (the exemption applies for as long as

the plants are operated only for educational or research purposes and also includes plants set up by the Centre for Renewable Energy Sources and Saving for as long as these plants are operated for issuing certifications or taking measurements).

As far as the tariffs of the electricity generated from HECHP units are concerned, Law 3851/2010 also takes into account the fluctuations in natural gas prices for HECHP units using this type of fuel. The said provision stipulates that the offered price shall be proportionate to the mean quarterly unit price of natural gas without taking into account the price offered to power generation customers, as laid down by the Public Gas Corporation (DEPA). This type of tariffs applies to plants to which priority is given under Law 3468/2006, as referred to above.

It should be noted that, in the case of HECHP plants using RES or HECHP plants using RES in conjunction with gaseous fuels, tariffs are determined on the basis of applicable tariffs for each form of RES.

In August 2011, Law 4001/2011 **"Operation of markets in energy and natural gas, for hydrocarbon research, production and transmission networks, and other provisions"** brought about certain changes concerning the inclusion of HECHP plants and the tariffs of the energy generated from HECHP. In particular, the competent System or Grid Operator shall, in allocating the load, give priority to HECHP units irrespective of their installed capacity, which also applies to the surplus (up to 20% annually) electricity generated by autoproducers, thus lifting the 35 MW limit that applied previously.

Concerning the tariffs of electricity from HECHP, Law 4001/2011 has modified the method used for calculating the guaranteed price in such a way that, on the one hand, the average monthly selling unit price of natural gas is taken into account and, on the other hand, the price amount is different for autoproducers of an installed capacity of less than 35 MW from that applicable in other cases (autoproducers of an installed capacity of more than 35 MW and all main producers).

In conclusion, as also envisaged by Law 3734/09 on modifying and complementing the decisions on the Regulation on issuing authorisations for the generation of electricity from HECHP, the procedure for approving the Regulation on issuing authorisations for the generation of electricity was completed in October 2011 by virtue of Ministerial Decision YAPE/F1/14810/2011 **"Regulation on issuing authorisations for the generation of electricity by the use of renewable energy sources and through high efficiency cogeneration of heat and power".**

This Ministerial Decision (Article 3) lays down the procedure to be followed for submitting applications for the issue generation authorisations for HECHP plants, as well as the accompanying documents and information required. Moreover, special conditions are laid down to ensure that the holder of a generation authorisation shall, during each year, ensure maximum efficiency of the facility and reliable measurement of the energy generated and consumed, and shall submit the relevant information to the competent department of the Ministry of the Environment, Energy and Climate Change and REA by the use of the relevant monitoring form.

Q2: *What is the timeline for implementing measures based on the Commission Decision of 19.11.2008 establishing detailed guidelines? Please indicate how this has taken place (revision of a general energy law, a specific law, decree, regulation, etc.).*

Detailed guidelines on the implementation and application of the methodology used to calculate the quantity of electricity from cogeneration, as described in Annex II to Directive 2004/8/EC, were laid down in July 2009 by adopting **Ministerial Decision Δ5−ΗΛ/Γ/Φ 1/off.15641 laying down details on the method used for calculating the electricity from cogeneration and the efficiency of cogeneration.**

Q3: *To what extent do you consider your country to have already significantly implemented the Directive?*

Directive 2004/8/EC has already been implemented in its entirety, and as described in previous sections, certain matters relating to application thereof have been updated and re-regulated by virtue of new legislative and regulatory acts with a view to facilitating the promotion and penetration of HECHP technologies. Table 2 presents a summary of the main Articles of the Directive which have been transposed and applied.

Table 2. Transposing Directive 2004/8/EC into Greek legislation.

Directive 2004/8/EC	***Transposition into national legislation and implementing provisions***
Article 4	*Law 3734/2009, Article 5: Calculating the efficiency of cogeneration* *Ministerial Decision Δ5-ΗΛ/Γ/Φ 1/off.15606, laying down harmonised efficiency reference values for separate production of electricity and heat*
Article 5	*Law 3734/2009, Article 8: Guarantee of origin of electricity from high-efficiency cogeneration* *Ministerial Decision Δ6/Φ1/off.8786, on the implementation of the System for Guarantees of Origin of Electricity from RES and HECHP and the mechanism used for securing the system*
Article 6	*Law 3734/2009, Article 11: National cogeneration potential*
Article 7	*Law 3908/2011 on Development, Law 3842/2010:* *Operational Programmes on Competitiveness*
Article 8	*Law 3468/2006, Article 13: Tariffs of electricity generated by RES or HECHP plants and hybrid plants* *Law 3734/2009, Article 7: Measures for promoting cogeneration and high efficiency cogeneration* *Law 3851/2010, Article 5: Streamlining the tariffs of energy generated by*

	RES and HECHP plants *Law 4001/2011, Article 197: Other provisions*
Article 9	*Law 3468/2006, Law 3734/2009, Law 3851/2010:* *RAE, A guide to evaluate the energy efficiency of heat and power cogeneration projects*
Article 10	*Law 3734/2009, Article 11: National cogeneration potential*

***Q4**: Is Greece using the alternative calculation method according to Article 12(2)?*

Greece uses no alternative electricity calculation method other than that described in Law 3734/09 (Articles 5 and 6); actually, Greece has adopted a calculation method in accordance with the stipulations laid down in Annexes II & III to Directive 2004/8/EC.

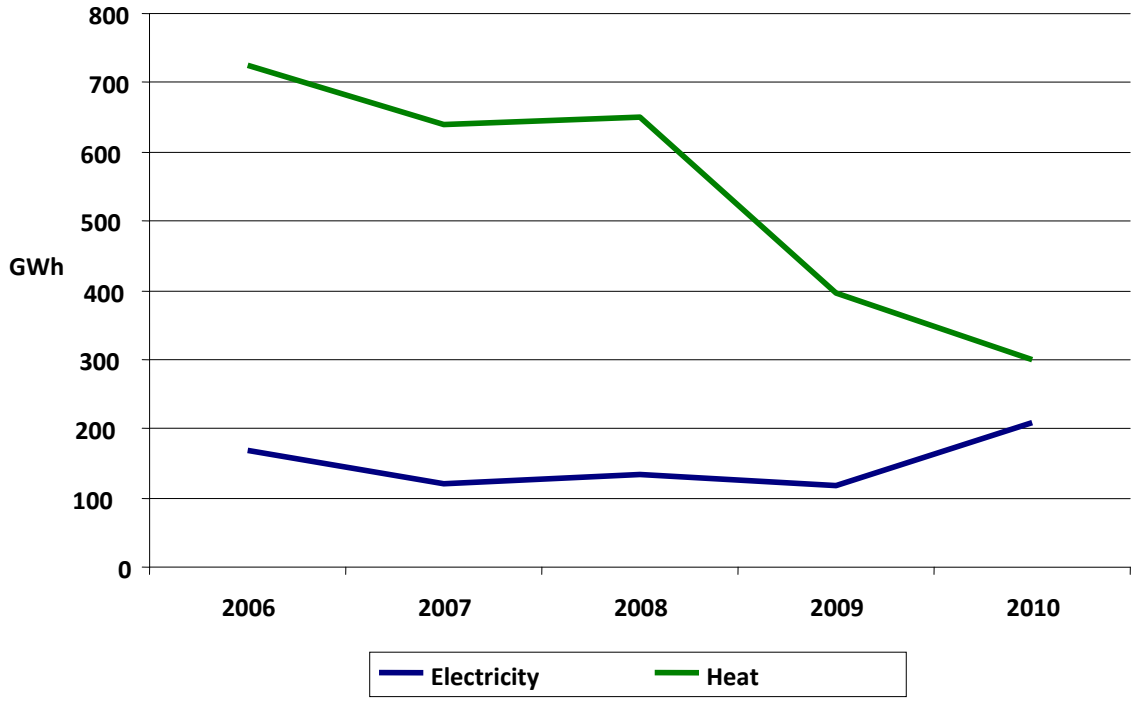
***Q5:** Is there any need for Greece to review in accordance with Article 13 the threshold values used for calculation of electricity from cogeneration and/or the threshold values used for calculation of efficiency of cogeneration production and primary energy savings?*

Greece feels that it is not necessary to review the threshold values used for calculation of electricity from cogeneration and/or the threshold values used for calculation of efficiency of cogeneration production and primary energy savings.

4. NATIONAL POTENTIAL TO INCREASE THE SHARE OF HIGH-EFFICIENCY COGENERATION

***Q6:** Can Greece already show progress in high-efficiency cogeneration since the last report on national potential which can be ascribed to either EU or national legislation and support schemes?*

Graph 6 presents the development of the electricity and heat generated by HECHP plants.



Graph 6. Development of the electricity and heat generated by HECHP plants.

The above graph clearly presents a relatively steady increasing trend in electricity production in 2010, in contrast with heat production, which is marked with more intense fluctuations. In particular, following a small drop in heat production in 2007 and steady production levels in 2008, there was a significant drop in 2009, which went on in 2010. The drop was mainly due to fluctuations in the production activity of units and was influenced by a number of factors, the most important one being an increase in fuel prices which made the operation of some units inexpedient. The effect of fuel prices can also be seen in the change of the fuel mix used by HECHP units. Natural gas was the basic fuel used by HECHP units in 2006; however, there was a significant reduction in its use in 2007, followed by an increase. Increased penetration of diesel was observed in 2007 and 2008, but its use dropped significantly in the following years.

Finally, the penetration of HECHP units using biogas is deemed to be of particular importance. As an indication, it should be noted that 7 units of a total installed electric and thermal capacity of 8.9 MW_e and 27.0 MW_{th}, respectively, operated in 2010.

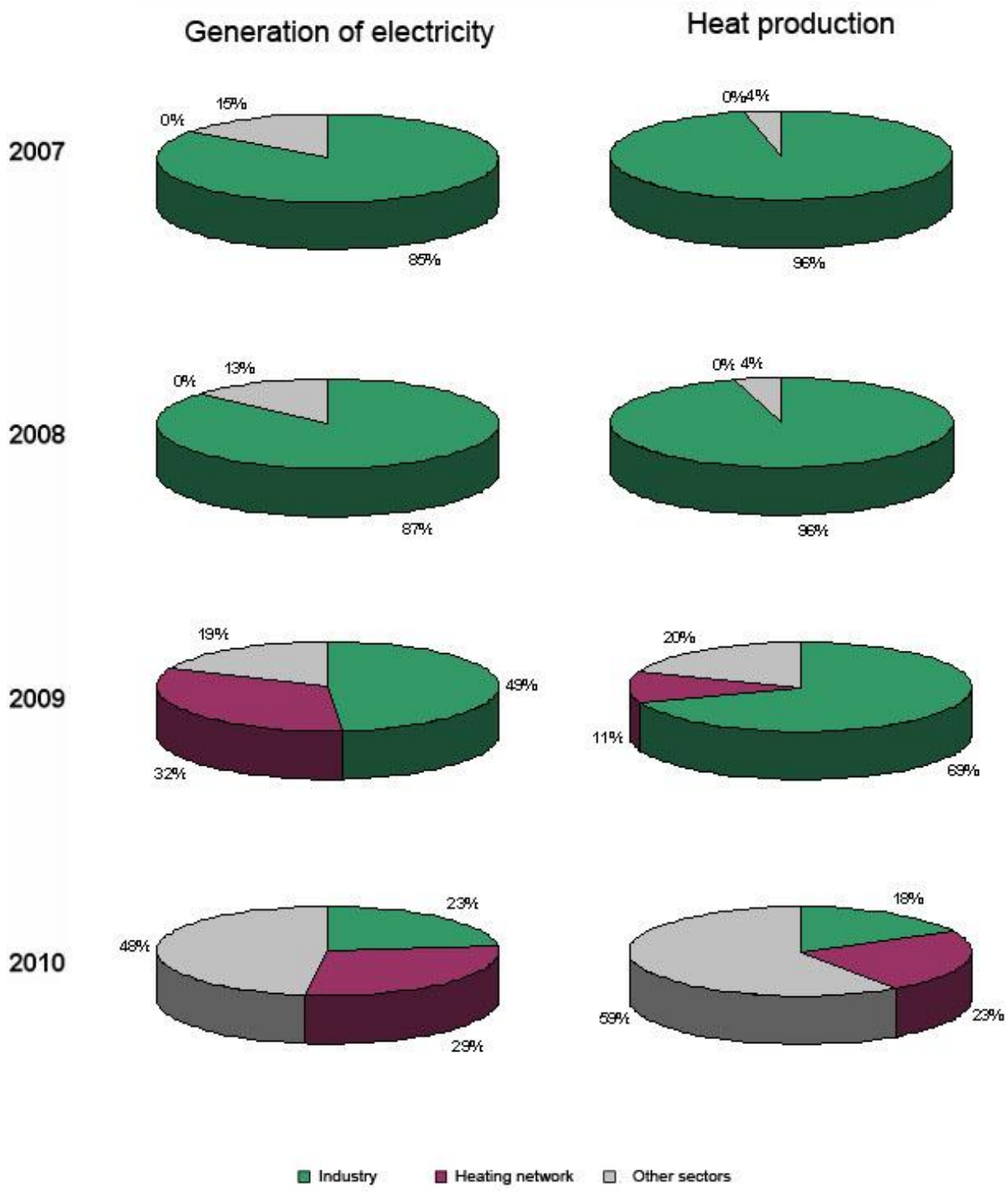
Important findings are derived from the above graph for the period after 2009, during which, despite continued and increased consequences from the economic recession, the institutional changes and adjustments made from 2009 onwards within the context of transposing the Directive appear to be boosting and reinforcing the share of HECHP units, which is expected to be further increased due to the recent changes in the supporting financial instruments and the simplification and speeding up of the authorisation procedure.

***Q7:** What is your evaluation of the progress towards increasing the share of high-efficiency cogeneration in your country? Your assessment should be based on the*

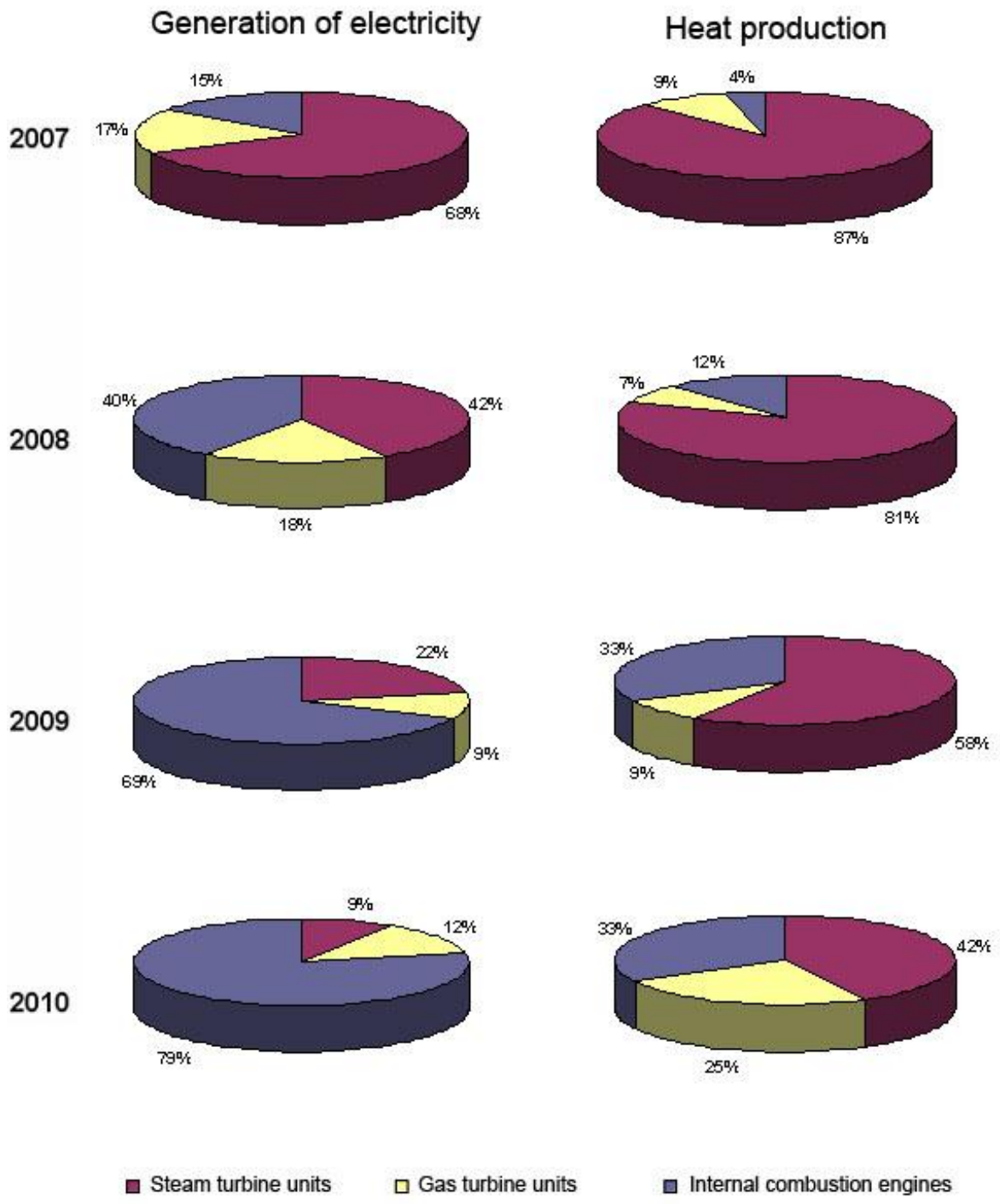
specific figures to be included in the attached spreadsheet (Excel file) designed to facilitate the submission of your data.

Detailed data about HECHP units in period 2006-2010 are included in the Annex. They are presented on annual basis for all units, per plant operating sector and per technology used.

Graph 7 presents a breakdown of the electricity and heat generated by HECHP units per operating sector for the years 2007 to 2010. The largest percentage of the electricity generated was observed in the industrial sector by 2008, whereas district heating gradually occupied a significant share from 2009 onwards, finally reaching 23% of the heat generated by HECHP units. This, however, is caused to a large extent by the drop in the heat generated by HECHP units in industry, which was reduced by 81% in absolute figures. The contribution to the generation of electricity from other sectors, despite being steady by 2009, doubled in 2010, but their contribution to the generation of heat rose more rapidly as far as the relevant share was concerned, reaching almost 60% of the heat generated by HECHP units in 2010. Graph 8 presents a breakdown of the electricity and heat generated by HECHP units per technology. Steam turbine units were used in electricity generation mainly in 2007, while at the same time the share of internal combustion engines was rising thus making them the key technology in 2009 and 2010. The share of gas turbine units remained steady in the period under examination and tended to drop in 2009 and 2010. The same trend was observed in connection with heat generation, where the operation of steam turbine units was gradually replaced by internal combustion engines, whereas the share of gas turbine units was particularly high in 2010 as compared to previous years.



Graph 7. Development of the electricity and heat generated by HECHP plants.



Graph 8. Development of the electricity and heat generated by HECHP plants.

Taking into account the above behaviours, the recent changes made in support of natural gas-fuelled CECHP and the development of new financing instruments and reinforcement/activation of existing ones are expected to contribute towards the growth of HECHP units, in particular in sectors ("other sectors" category in the above graphs) including applications mainly in the tertiary sector. Moreover, the expansion of the natural gas network may support the prospect of developing district heating applications, which has resulted in the appearance of relevant units since 2009.

5. BARRIERS TO HIGH-EFFICIENCY COGENERATION

Q8: *Please give your views on the current barriers to high-efficiency cogeneration in Greece:*

- barriers in relation to administrative procedures (authorization, coordination among competent authorities, streamlined simplified procedures, etc);

- barriers in relation to electricity grid system and tariff issues (including specific measures for small scale and micro cogeneration units);

- other barriers (internalisation of external costs, energy prices, financial & technical barriers, etc) in accordance with Articles 9 and 6 of the cogeneration Directive 2004/8/EC.

Indicate the measures to overcome them.

The key barriers delaying further penetration of HECHP plants are summarised below, along with the measures implemented or proposed to overcome them.

- ***Authorisation procedure***

The authorisation framework has always been a key barrier to HECHP and RES facilities.

Law 3468/2006 laid the foundation for streamlining the authorisation procedure with a view to speeding up the issue of the required generation, installation and operating authorisations for the implementation of RES and HECHP projects.

Through Law 3851/2010, an effort was made to lift all authorisation-related barriers and further simplify the different authorisation procedure stages by reducing authorisation issuance deadlines substantially. As far as HECHP systems were concerned, it relieved plants of an installed capacity of less than 1 MW_e of the obligation to obtain a generation, installation and operating authorisation, thus making things easier for interested investors.

The table below sets out the milestones of the authorisation procedure, as currently in force under the provisions of Law 3851/2010.

Table 3. Milestones of the authorisation procedure for HECHP plants under the provisions of Law 3851/2010.

HECHP plants of an installed capacity of ≤ 1MW_e	**HECHP plants of an installed capacity of > 1MW_e**
No Generation Authorisation or other certification decision is required (Art. 4 of Law 3468/2006, as replaced by Art. 2(12) of Law 3851/2010).	A Generation Authorisation is required.
An application for formulating the Connection Offer must be filed with the competent Operator, who shall ratify the topographic diagrams depicting the connection method.	

<table>
<tr><td colspan="2">A Connection Offer is issued, which is non-binding initially. Then it becomes finalised and binding upon completion of environmental licensing.

Applications must be filed to secure the right to use the location, where necessary.</td></tr>
<tr><td colspan="2">Approval of Environmental Conditions (AEC) is required. It is issued after filing a relevant application accompanied by an Environmental Impact Assessment (EIA), in accordance with the type of the project.</td></tr>
<tr><td>No Installation Authorisation is required.</td><td>An Installation Authorisation is required.</td></tr>
<tr><td colspan="2">A Building Permit is required, where structural works are to be carried out.

A Connection Authorisation is required.

A Purchase & Sale Contract is required.</td></tr>
<tr><td>No Trial Operation is required.

No Operating Authorisation is required (Art. 8 of Law 3468/2006, as replaced by Art. 3(2) of Law 3851/2010).</td><td>A Temporary Connection is required for the Trial Operation, which is granted after an application is filed with the competent Operator. Where the plant has operated for 15 days without any problems, the Operator shall issue a certificate of successful testing (Ministerial Decision 13310/2007, Government Gazette B/1153, Art. 14).

An Operating Authorisation is required.</td></tr>
</table>

- ***Connecting HECHP plants to the Grid***

The same procedure as that used for RES plants apply to matters relating to the connection of HECHP plants to the System or Grid. Certain opinions from RAE have laid down the terms and conditions for connecting users (**RAE opinion 1/2007 "Approval of the terms and conditions for connecting users to the Transmission System"**) and determined the fees to be charged for connecting them to the transmission system (**RAE opinion 2/2007 "Approval of the tariffs charged for connecting users to the Transmission System"**). Moreover, certain matters relating to connecting RES/HECHP power plants to the System or Grid had been regulated initially by Law 3468/2006 (Art. 11), before being replaced by Law 3851/2010 (Art. 4).

- ***Undeveloped market in heat energy***

The undeveloped Greek market in heat energy together with the low and irregular demand for heat and cooling energy are also barriers to a higher penetration of HECHP systems.

The above are problems are coupled with the special climatic situation prevailing in Greece. In particular, due to the Mediterranean climate and the intense fluctuations in the relief of the territory and successive alternate strips of land and sea, the demand for heat and cooling energy is irregular depending on the time period. Furthermore, the fluctuating demand for heat and cooling energy observed in the industrial and tertiary sectors due to such factors as reduced activity resulting from the economic recession or seasonal operation thereof, in the tourist sector in particular, tends to affect the financial sustainability of possible investments in HECHP systems. Promoting triple generation could be a solution.

It should also be noted that HECHP units have to compete with other technological applications, such as heat pumps, which appear to be more attractive investments solutions.

- ***Difficulty in investment financing***

Due to the current economic recession it is hard to secure funds from banks, which tends to hinder the implementation of investments in the energy sector, including cogeneration projects. Concerning cogeneration systems in particular, financing is getting harder not only due to reduced available funds and business insecurity, but also due to the low levels of acceptance of the technology in question by would-be investors. Cogeneration technologies are not deemed to be so attractive as compared to RES investments, which attract most investments' interest.

Leverage of investment funds by mobilising new funding channels, in particular through development of the market in energy services in Greece by Energy Service Companies (ESCs), is expected to boost the development of HECHP too for specific applications, and the new Law on development has made possible the initial financing of such investments. An alternative financing mechanism, concerning public HECHP projects (e.g. district heating networks) in particular, could be the implementation of projects through public-private partnerships (PPPs); where it is established that there is a potential for the penetration of cogeneration and district heating systems, the relevant projects could be implemented by securing funds from third parties and concluding long term contracts for the sale of heat.

- ***Limited district heating network***

The existing district heating networks are limited and are set up only in areas where PPC SA operates thermal power plants. The construction of new district heating infrastructures may lead both to further penetration of cogeneration technologies and laying the foundation for ensuring steady demand levels for heat and cooling energy on an annual basis.

6. GUARANTEES OF ORIGIN AND SUPPORT SCHEMES

Q9: *Article 5 of the Directive requires Member States to ensure that accurate and reliable guarantees of origin are issued according to objective, transparent and non-discriminatory criteria. Please indicate what is the situation concerning the implementation of this measure in Greece (information on primary energy savings, type of registration system)?*

Directive 2004/8/EC concerning guarantees of origin of electricity generated by HECHP plants was transposed into Greek legislation initially by adopting Law 3734/2009. In particular, under Article 8, the origin of electricity from HECHP may be proven to third parties by the issuance of a relevant guarantee of origin.

Ministerial Decision Δ6/Φ1/off.8786/14-05-2010 provided a more detailed framework for the implementation of the system of guarantees of origin generated by HECHP plants and the mechanism used for securing the system. Moreover, the system of guarantees of origin and the mechanism used for securing the system applies only to the amount of energy generated by HECHP plants and is calculated in accordance with the provisions of Law 3734/2009 (Article 1 of Ministerial Decision Δ6/Φ1/off.8786/14-05-2010).

The organisations responsible for issuing the guarantees of origin where a HECHP plant which does not use RES for the generation of electricity are the Hellenic Transmission System Operator (HTSO) where the plant is established in a geographical area served by the interconnected system (either connected to the System directly or through the Grid, or in the case of an independent facility), and the Non-Interconnected Islands Operator (PPC) where the plant is established on an non-interconnected island (either connected to the island's network or in the case of an independent facility).

In the case of HECHP plants using RES for the generation of electricity, HTSO is responsible for issuing guarantees of origin where the electricity generated is fed into the System directly or via the Grid, PPC is responsible where the electricity is fed into the Grid of non-interconnected islands, and CRES is responsible in the case of independent plants (Article 1 of Ministerial Decision Δ6/Φ1/off.8786/14-05-2010 and Article 16 of Law 3468/2006).

Keeping a Register and organising an Information System of Guarantees of Origin (Article 3 of Ministerial Decision Δ6/Φ1/off.8786/14-05-2010)

To ensure the operation of the system of guarantees of origin and secure it, the competent issuing organisation keeps an electronic register and takes all required care to make it secure and tamper-proof. The electronic register is comprised of the Register of Installations and the Register of Guarantees of Origin. The Information System of Guarantees of Origin is the same for all issuing organisations, and its specifications are determined by HTSO, which is responsible for the operation, maintenance and upgrading thereof, and are subject to the approval of RAE, the controlling body. The Register of Installations is used to register the technical details of each plant, and the Register of Guarantees of Origin is used to register all relevant information concerning

guarantees of origin, including the details of their holders and any possible information relating to the transfer, modification or revocation thereof.

The Information System of Guarantees of Origin is used for keeping, under the competent issuing organisation's care, the required information for which the organisation is responsible; the information relating to each guarantee of origin are kept for at least 10 years of revocation thereof. RAE, as a controlling body, has the right to access and modify the entire electronic register, and the issuing organisations have the right to access only the part of the electronic register kept by them. Finally, every holder of an account of guarantee of origin has the right to access the information relating to him.

Registration in the Register of Installers (Article 4 of Ministerial Decision Δ6/Φ1/off.8786/14-05-2010)

Every interested producer desiring the issue of guarantees of origin for the electricity generated by his power plant files an application for opening an account in the Register of Guarantees of Origin, fills out the Installation Details Statement for registering in the Register of Installations and having his plant recognised as an installation, in accordance with the stipulations of Article 4, where the procedures required for registering an HECHP plant in the Register of Installations are described, and submits his operating authorisation. In the case of HECHP plants for which no operating authorisation is required, a certificate issued by the competent Operator is filed to the effect that the plant connection has been activated. Moreover, complete details are filed, as required by the issuing organisation, concerning the plant measurement devices which are subject to the producer's responsibility. In the case of independent power plants, only the complete details are filed for the measurement devices installed, as required by the issuing organisation.

Moreover, in the case of HECHP plants using a form of RES and conventional fuels, the producer files a certificate issued by a certified body to the effect that the measurement devices other than those installed within the boundaries of the Grid or System, which may have been installed subject to the producer's responsibility and whose measurements are taken into account in calculating the energy generated, are compliant with the specifications set out by the issuing body in accordance with applicable standards.

The issuing organisations submit to RAE for approval the specifications of the measurement and logging devices and telecommunications equipment used for gathering and transmitting the required data, with which the installations must comply, and RAE must approve the above specifications within three months. RAE has issued a decision (Decision 545/2011) laying down in detail the specifications for meters and measurements concerning the issue of guarantees of origin. Then the issuing organisations verify that the power plant meets the application requirements of the Ministerial Decision in question, that the Installation Details Statement is complete and accurate, as well as that the measurement devices have actually been installed within the boundaries of the Grid or System, or that they function in a reliable fashion in the case of independent plants.

The decision on whether to register, or not to register, a power plant which is interconnected to the Grid or System in the Register of Installations is communicated to the applicant within 10 business days from the date of submission of the Installation Details Statement, on condition that all required documentation has been submitted. In the case of independent power plants, the decision is communicated within one month. Finally, the issuing organisation updates the Register of Installations whenever a producer notifies a change to the details of his plant kept in the Register.

Content, duration, issue and calculation method of guarantees of 0rigin (Articles 5-7 of Ministerial Decision Δ6/Φ1/off.8786/14-05-2010)

The electronic certificate issued by the competent issuing organisation certifies the origin of 1 MWh of electricity generated by a HECHP plant for a specific period of time. The issue of guarantees of origin of electricity generated by HECHP plants may be requested for a period of one year.

To have guarantees of origin issued, a producer files an application with the issuing organisation electronically 10 days after the expiry date of the period for which it requests issue of guarantees of origin and no later than 60 days from the same date. The application is accompanied by official measurements of the plant's electricity input and output taken by the competent Operator. In the case of independent power plants, the required measurements are submitted by the producer, in accordance with such specifications as laid down by the issuing organisation.

The producer shall file a report issued by a certified body, including a certificate on the accuracy of the measurements and the information referred to in the Statement of Consumptions, as referred to in the same Ministerial Decision. Plants of a capacity of less than 1 MW_e are exempted of the obligation to file a report issued by a certified body in the first two years of operation of the system of guarantees of origin. Following lapse of two years and after taking into account the opinions of participants, the reports of issuing organisations, as well as all other information as deemed relevant, at discretion, RAE shall assess the effectiveness of the mechanism used to control and certify the data submitted and shall make recommendations on whether it is appropriate to change the capacity and other technical characteristics of the plants exempted of the obligation to submit a report issued by a certified body.

The guarantees of origin are issued within 10 business days from the date of receipt of the relevant application and compliance with all relevant requirements, following checking by the issuing organisation. The issuing organisation, in a reasoned decision communicated to RAE, may extend the above deadline once for an equal amount of time.

Concerning the method used to calculate the electricity generated by an HECHP plant, the electricity generated from high efficiency cogeneration is taken into account and is calculated in accordance with the provisions of Law 3734/2009. Where a HECHP plant uses RES too, it is possible to issue guarantees of origin both for the electricity generated from RES and that generated from a conventional source of energy.

Control mechanism and obligations of producers and account holders (Articles 10 and 11 of Ministerial Decision Δ6/Φ1/off.8786/14-05-2010)

Concerning the control mechanism used to verify that the requirements for the issue of guarantees of origin are met and the information used as a basis for issue thereof is accurate, the issuing organisation and its authorised agents have free access to the plant, as well as to all necessary details or information. The producer shall have to facilitate the work of the issuing organisation or its authorised agents. Inspections may be performed periodically, at any time, even without warning, and the time between two successive inspections may not be longer than 5 years.

The producer is required to state accurate information about the plant and the energy generated by the plant, to provide the issuing organisation, its authorised agents and RAE with access so that they can inspect the plant and check the files kept, as well as to inform the issuing organisation in advance about any scheduled or unscheduled change. He is also required to install, in accordance with the requirements set out by the issuing organisation, the required devices for measuring the electricity, fuel consumed, amounts of heat transmitted, as well as all other figures necessary for calculating the energy generated which is taken into account in issuing guarantees of origin, as well as to take all appropriate measures with a view to ensuring the continuous and accurate operation of the plant, including mainly calibration, maintenance and immediate remedy of failures.

Q10: Does your country have support schemes for cogeneration/CHP based on Directive 2004/8/EC (operational and/or investment aid); What kind of support is provided (feed-in tariffs, certificates and quota, priority access to the grid, etc.); Are they designed to provide stable long-term investment conditions? Which sectors will be targeted (agricultural and/or industrial and/or heating cogeneration)?

- ***Priority to HECHP plants***

Law 2244/1994 "Regulating matters relating to the generation of electricity from renewable energy sources and conventional fuels, and other provisions" required PPC to purchase the electricity generated by RES and cogeneration plants and prohibited the provision of the electricity generated by autoproducers and independent producers to third parties. *Law 2773/1999, as amended by Law 3426/2005, Law 3175/2003 and Law 2837/2000, stipulated that the System or Grid Operator should give priority access to the electricity generated from RES and cogeneration systems.*

Law 3468/2006 stipulated that the competent System or Grid Operator should, in allocating the load, give priority to HECHP plants using RES or a combination of RES and gaseous fuels, irrespective of installed capacity, as well as to HECHP plants of an installed capacity of up to 35 MW_e. The priority also applied to the surplus electricity from autoproducers operating HECHP plants of ain installed capacity of up to 35 MW_e, on condition that the surplus electricity generated did not exceed, annually, 20% of the total electricity generated, which might not be more than 50 000 MWh in any event. On Non-Interconnected Islands, the competent Operator is required to purchase the

surplus electricity generated by autoproducers operating HECHP plants after having purchased the electricity generated from RES plants operated by producers or autoproducers and hybrid plant RES units first. The terms and conditions, procedure and all necessary details concerning the purchase of electricity from power plants by the Operator of Non-Interconnected Islands are laid down in the Operating Code for Non-Interconnected Islands.

Moreover, Law 4001/2011 (Article 197) has, since 01/09/2011, stipulated that the respective Operator shall, in allocating the load, give priority to all HECHP units irrespective of installed capacity, i.e. lifting the 35 MW_e installed capacity restriction. It shall also give priority to the surplus electricity from autoproducers, on condition that the surplus electricity is generated from HECHP and for the part of the energy generated which does not exceed, annually, 20% of the total electricity generated, i.e. lifting the 35 MWe installed capacity and 50 000 MWh maximum surplus production restrictions.

- ***Tariffs for electricity from HECHP plants***

The key tool for supporting investments in HECHP plants is guaranteed tariffs for the generated electricity fed into the System or Grid, including the Grid of the Non-Interconnected Islands, on the basis of a defined price expressed in Euro per MWh of electricity for a definite period of time. Application of this mechanism provides stable long-term investment conditions.

Recent Law 3851/2010 (Article 5) updated the tariffs for the electricity generated by HECHP plants by introducing a fuel clause coefficient used to adjust the price of electricity generated by HECHP plants in accordance with natural gas prices. In particular, the tariffs for electricity from HECHP plants were set as follows:

- **87.85*CC** €/MWh for the Interconnected System; and
- **99.45*CC** €/MWh for the Non-Interconnected Islands.

The natural gas clause coefficient (CC) pertains to HECHP plants using natural gas. This coefficient (CC) is calculated by the use of the following equation:

$$CC = 1+(MNGP-26)/(100 \times n_{el}) \quad (1)$$

where:

- MNGP is the mean quarterly unit price of natural gas for cogeneration, in €/MWh of gross calorific value, sold to natural gas users in Greece, exclusive of power generation customers. The price is set by DEPA and communicated to HTSO on a quarterly basis.
- n_{el} is the electrical efficiency of an HECHP system in accordance with the gross calorific value of natural gas, which is set to 0.33 for HECHP units of an installed capacity of less than or equal to 1 MW_e, and 0.35 for HECHP units of an installed capacity of more than 1 MW_e. The value of the clause coefficient may not be lower than one.

Where HECHP plants using natural gas utilise the flue gases for agricultural purposes, the clause coefficient may be increased in accordance with a decision taken by RAE up to 20%. RAE took a decision (Decision 435/2011) stipulating that the clause coefficient (CC) used to set the price of electricity from HECHP for producers who have realised, or will realise, investments in flue gas treatment and utilisation installations for CO_2 enrichment of crops in greenhouses must be modified in accordance with the following equation:

$$CC = 1.18 + (MNGP-26)/(100 \times n_{el}) \quad (2)$$

The tariffs for the electricity from a producer's or autoproducer's HECHP power plant are determined on a monthly basis in accordance with the MNGP of the previous quarter.

The adjusted prices applied to the electricity generated by HECHP plants to which priority has been given by the respective Operator in allocating the load.

The electricity sale contract executed between a producer and the System Operator is valid for a period of 20 years and may be extended in accordance with the terms and conditions laid down in the relevant authorisation, following a written agreement reached between the parties, provided that the relevant generation authorisation is in effect.

Law 4001/2011 (Article 197) re-updated the procedure for setting the tariffs for the generated electricity by stipulating that the prices for natural gas using HECHP plants of an installed capacity of up to 35 MW_e which are not power generation customers shall be increased in accordance with the natural gas clause coefficient, as calculated by the use of equation (1), using, however, the mean monthly unit price of natural gas sold for cogeneration (expressed in €/MWh of gross calorific value) to natural gas users, exclusive of power generation customers. This price is set by the Directorate for Oil Policy of the Ministry of the Environment, Energy and Climate Change and is communicated to HTSO on a monthly basis.

In all other cases of natural gas using HECHP plants, the prices are increased, at the maximum, in accordance with the clause coefficient, using the mean monthly unit price of natural gas sold (expressed in €/MWh of gross calorific value) to natural gas users who are power generation customers. This price is set by the Directorate for Oil Policy of the Ministry of the Environment, Energy and Climate Change and is communicated to HTSO on a monthly basis.

In the case of electricity autoproducers, the prices apply to HECHP plants only for the surplus electricity fed into the System or Grid, which may reach up to 20% of the total electricity generated annually, irrespective of the installed capacity of the plants. Finally, the tariffs for the electricity from a producer's or autoproducer's HECHP power plant are determined on a monthly basis in accordance with the respective MNGP of the previous month.

The table below (Table 4) describes the tariff-related modifications made to Law 4001/2011.

Table 4. Modifications to Law 4001/2011 concerning the tariffs of electricity from HECHP plants.

	Type of producer	Tariffs until August 2011 (under Law 3851/2010)	Tariffs after August 2011 (under Law 4001/2011)
(a)	For small plants (up to 35 MW) which are not power generation customers	Proportionate to the mean ***quarterly*** unit price of natural gas without taking into account the price offered to power generation customers. The price is set by **DEPA.**	Proportionate to the mean ***monthly*** price of natural gas without taking into account the price offered to power generation customers. The price is set by the **Directorate for Oil Policy of the Ministry of the Environment, Energy and Climate Change.**
(b)	For large plants (more than 35 MW) which are not power generation customers	On the basis of an offer.	Proportionate to the mean monthly price of natural gas offered to power generation customers.
(c)	For small producers' plants (up to 35 MW) generating electricity from HECHP	See point (a)	See point (b)
(d)	For large producers' plants (more than 35 MW) generating electricity from HECHP	See point (b)	See point (b)

❖ ***Support mechanisms***

Promotion of HECHP plants has been supported all these years by several support mechanisms, including investment subsidies granted within the framework of the Operational Programmes on Competitiveness and Entrepreneurship and national laws on investment, or tax exemptions. The same actions aimed at providing financial aid are still in effect, with assistance from the activity of Energy Service Companies (ESCs).

The previous **Development Law 3299/2004 "Private investment incentives for economic growth and regional convergence"** provided for the following types of aid for HECHP plant construction investment plans:

(a) financial lease subsidy and/or aid;

(b) tax exemption;

(c) subsidy for the cost of the jobs created.

The new **Development Law 3908/2011 "Private investment aid for economic growth, entrepreneurship and regional convergence"** has provided for supporting investment plans, including construction of HECHP plants, by offering the following individual or combined types of aid:

(a) income tax exemption;

(b) subsidy consisting in payment by the State of an amount of money, free of charge, for covering part of the subsidised expenditures;

(c) financial lease subsidy consisting in coverage by the State of part of the instalments paid for the acquisition of mechanical and other equipment.

Opportunities for financing the construction of HECHP plants were also granted by the Operational Programme on Competitiveness (2000-2006), which has been completed. In particular, as part of Measure 6.5 "Promoting RES, cogeneration systems in the energy system of Greece – Energy Savings", 3 CHP investment plans were financed, of a total budget of EUR 12.5 million, with State expenditure amounting to EUR 4.4 million. In addition, as part of Measure 2.1.3 "Economic incentives for supporting individual private energy investments", 12 CHP investment plans were financed, of a total capacity of 278.6 MW and a total budget of EUR 1071.9 million, with State expenditure amounting to EUR 352.9 million.

Currently, the Operational Programmes "Environment and Sustainable Development" and "Competitiveness and Entrepreneurship", as included in the National Strategic Reference Framework (NSRF) 2007-2013, are financing several investment aid programmes including the installation of cogeneration systems as eligible expenditures. Following are some of the programmes:

- **Programme "High efficiency cogeneration of heat and power in hospitals".** This programme is aimed at installing HECHP units in conjunction with cooling systems using natural gas in hospitals; it is financed with EUR 15 million from the Operational Programme "Environment and Sustainable Development".

- **Programme "Green Tourism".** This programme is aimed at supporting tourist establishments with a view to improving their operating infrastructures and operational procedures, in a greener direction, by utilising specific local, geographic and quality characteristics; its actions include the installation of CHP systems with a view to meeting own needs, under an "autoproducer" regime. The funds offered are approximately EUR 30 million. Financing is realised by the Operational Programme "Competitiveness and Entrepreneurship".

- **Programme "Alternative Tourism".** This programme is aimed at supporting investment plans including the development of one or more specific and/or alternative forms of tourism, and its actions include the installation of energy saving, cogeneration and generation systems from RES (of a total capacity of up to 20 kW only for meeting own needs), under an "autoproducer" regime. The funds provided for are approximately EUR 20 million. Financing is realised by the Operational Programme "Competitiveness and Entrepreneurship".

Furthermore, a call for proposals for operations has been published with a view to including and financing district heating actions either through new projects or by expanding existing networks as part of the Operational Programme "Environment and Sustainable Development", of a total budget of EUR 50 million.

Concerning granting tax exemptions, **Law 3522/2006 "Income tax changes and simplification of the Code of Books and Records, and other provisions"** provided for reactivating the tax exemption system which applied under Law 2364/1995, however with lower financial benefits. In particular, the market in decentralised electricity generating systems based on the cogeneration of electricity and cooling-heat by the use of natural gas or RES was eligible for a 20% tax exemption subject to a maximum limit of EUR 700.00 per system. **Law 3842/2010 "Restoring tax justice, fighting tax evasion and other provisions"** reformed the provisions relating to tax exemptions and provided, for natural persons, a 10% reduction in the tax charged on the expenditure incurred for the purchase and installation of decentralised electricity generating systems based on the cogeneration of electricity and cooling-heat by the use of natural gas or RES. The expenditure amount used for calculating the reduction may not exceed EUR 6 000.00.

The market in energy services can play a very important role in promoting and financing cogeneration investments. As far as the institutional framework is concerned, the market in energy services in Greece is regulated by **Law 3855/2010 "Measures for improving end-use energy efficiency, energy services, and other provisions"** which first introduced the concept of Energy Service Companies (ESCs) and described the framework of operation, obligations and instruments to be used for promoting and developing the market in question on the basis of wholesome structures. A critical element for the successful development of the market in energy services are the Energy Efficiency Contracts, laying down in detail the energy service processing framework which should include certain parameters relating to the planning and management of the energy service provided, the methodology used for determining energy savings and assessing the total financial benefit, the rules applicable to purchasing, operating and maintaining the energy equipment, a determination of the total cost of the intervention, as well as the manner and time of full payment of that cost.

Finally, Law 3851/2010 (Article 10) requires that, by 31/12/2019 at the latest, all new buildings should meet all their needs for primary energy from energy supplying systems based on RES, CHP plants, district or block heating systems, as well as heat pumps. This obligation shall apply to new buildings housing services of the public and wider public sector by 31/12/2014 at the latest. This legal regulation is expected to increase the prospects for the penetration of cogeneration systems in the residential and tertiary sectors.

***Q11** How much money on a yearly basis has been provided in this way in the past years to the promotion of high-efficiency cogeneration in particular? And how much money is expected to be made available on a yearly basis to the promotion of high-efficiency cogeneration in the coming years?*

The amount of money spent on purchasing electricity from HECHP plants in the period 2006-2010 is presented in Table 5.

Table 5. Amount of money spent on purchasing electricity from HECHP plants.

Year	Market price (€/MWh)	Electricity (GWh)	Cost (€ thousand)

2006	73	9.1	665
2007	73	34.0	2 482
2008	73	34.8	2 540
2009-2010(5/2010)	73	203.9	14 885
2010 (6/2010-12/2010)	*87.85*CC*	54.8	6 972

The information concerning electricity generation, as published in HTSO's monthly bulletins, the market prices of electricity set out in relevant laws for the interconnected system and a value of 1.45 for the clause coefficient were used in calculating the electricity generated by HECHP plants. This calculated value resulted from the respective equation referred to above by using the mean MNGP value for the period in question (January-May 2010) and a value of 0.35 for the electrical efficiency of the HECHP system in accordance with the gross calorific value of natural gas, as most of the plants considered are of an installed capacity of more than 1 MW_e.

The tariffs for the electricity from HECHP plants using biogas are determined in accordance with current tariffs applicable to biogas units. The amount of money payable was calculated on the basis of the price that applied in accordance with Law 3468/2006 until May 2010, whereas the relevant tariffs were determined in accordance with Law 3851/2010 from June 2010 onwards (a value of 200 €/MWh was assumed, as almost the entire amount of electricity generated was from biogas units of an installed capacity of more than 3 MW). The results are presented in Table 6.

Table 6. Amount of money spent on purchasing electricity from HECHP plants using biogas.

Year	Market price (€/MWh)	Electricity (GWh)	Cost (€ thousand)
2006	73	28.4	2 071
2007	73	23.4	1 711
2008	73	20.3	1 481
2009-2010(5/2010)	73	46.0	3 357
2010 (6/2010-12/2010)	200	16.8	3 357

7. CONCLUSIONS

Undoubtedly, penetration of HECHP units, despite its significant increase as compared to 2007, i.e. the first year when such units were classified as an integrated category, has not achieved high shares in the demand for heat and electricity, whereas even at a cogeneration level, non-high efficiency cogeneration units are still dominant.

The institutional framework for the promotion of HECHP applications in Greece has been adapted to, and developed in accordance with, relevant EU directives and decisions, thus contributing towards the development and completion of HECHP projects, while at the same time offering an integrated support framework by having

appropriate financing mechanisms in place for promoting investments. Specific reference should be made to the fact that the regulatory framework was amended at short intervals in past years, in an effort to tackle identified barriers. The first positive results of such institutional changes have already been observed as there has been immediate response in terms of investment interest.

It should be noted once more, however, that notwithstanding the progress and functionality achieved concerning the regulatory framework, market needs and conditions are ultimately the dominant parameters affecting further development of at HECHP in Greece. In particular, given the weather conditions, i.e. limited need for thermal loads, seasonal consumption levels in tertiary sector applications, and volatile production activity in industrial applications due to the financial environment, will continue to be the main restrictions limiting substantial development of HECHP applications in Greece.

However, a further development of network infrastructures (either district heating or supply of natural gas) and utilisation of new financial mechanisms can create significant prospects for development in specific areas of economic activity. In addition, technological progress, which will make new HECHP technologies commercially mature and exploitable (e.g. triple cogeneration, small and micro cogeneration), will create the prospects for the commercial exploitation of such systems.

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3. Law 2941/2001 (Government Gazette, Series I, No 201, 12.09.2001) “Simplifying company establishment and Renewable Energy Source authorisation procedure, regulating matters relating to “HELLENIC SHIPYARDS SA”, and other provisions”.

4. Law 3175/2003 (Government Gazette, Series I, No 207, 29.08.03) “Utilising the geothermal potential, district heating, and other provisions”.

5. Law 3299/2004 (Government Gazette No 261, 23.12.2004) “Private investment incentives for economic growth and regional convergence”.

6. Law 3468/2006 (Government Gazette No 129, 27.06.2006) “Generation of electricity from Renewable Energy Sources and High-Efficiency Cogeneration of Heat and Power, and other provisions”.

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13. Law 4001/2011 (Government Gazette, 22.08.2011) “Operation of markets in energy and natural gas, for hydrocarbon research, production and transmission networks, and other provisions”.

Ministerial Decisions

1. Ministerial Decision Δ5−ΗΛ/Γ/Φ 1/off.15641 (Government Gazette 1420 15.07.2009) “Laying down the details of the method used for calculating the electricity from cogeneration units and the efficiency of cogeneration”.

2. Ministerial Decision Δ5−ΗΛ/Γ/Φ 1/off.15606 (Government Gazette No 1420, 15.07.2009) “Laying down harmonised efficiency reference values for separate production of electricity and heat”.

3. Ministerial Decision ΥΑΠΕ/Φ1/14810/2011 (Government Gazette, Series II, No 2373, 25.10.2011) “Regulation on issuing authorisations for the generation of electricity by the use of renewable energy sources and through high efficiency cogeneration of heat and power”

4. Ministerial Decision Δ6/Φ1/off.8786/2010 (Government Gazette No 646, 14.05.2010) “Implementation of the System for Guarantees of Origin of Electricity from RES and HECHP and the mechanism used for securing the system”.

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1. Opinion No 1/2007 from RAE “Approving the terms and conditions for connecting users to the Transmission System”.

2. Opinion No 2/2007 from RAE “Approving the tariffs charged for connecting users to the Transmission System”.

3. RAE, “A guide to evaluate the energy efficiency of heat and power cogeneration projects”, Version 2.0, 2009.

4. RAE Decision 545/2011 “Specifications for meters and measurements as required by Ministerial Decision Δ6/Φ1/off.8786/6-5-2010 ‘Implementation of the system for guarantees of origin of electricity from RES and HECHP and the mechanism used for securing the system’”.

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2. Decision 2007/74/EC of the European Parliament and of the Council, of 21 December 2006 establishing harmonised efficiency reference values for separate production of electricity and heat.

3. Decision 2008/952/EC of the European Parliament and of the Council of 19 November 2008 **establishing detailed guidelines for the implementation and application of Annex II to Directive 2004/8/EC of the European Parliament and of the Council.**

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2. The Code Project (Cogeneration Observatory and Dissemination Europe), “European potential for cogeneration - Progress against the Directive’s objectives at European Level - South Eastern Europe Region», of the programme “Intelligent Energy Europe programme”, 2009.

3. “National Action Plan for Renewable Energy Sources, Ministry of the Environment, Energy and Climate Change, Athens, 2010.

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ANNEX

The tables below present the detailed data that must be entered in accordance with the configuration of the proposed Excel file, which is meant to facilitate the submission of data.

The amount of CO_2 emissions avoided was calculated by determining a weighted factor based on the fuel mix consumed by HECHP units annually. The values of the CO_2 emissions factor used are presented in Table 7.

Table 7. CO_2 emissions factor value (ktn CO_2/PJ)

Year	Emissions factor value
2006	89,7
2007	93,2
2008	74,6
2009	71,3
2010	65,4

Table 1: 2006 summary				HECHP Electricity	Producers of primary activity[1]	Autoproducers[1]	Percentage of HECHP from the total electricity	HECHP Heat	Producers of primary activity[2]	Autoproducers[2]	Percentage of HECHP from the total heat	New HECHP units	Modernised HECHP units	Total units	Primary energy savings[3]	CO_2 emissions avoided[4]
2006	Electricity	Capacity	GW	0.085	13.329	0.242	0.28%							13.57	1032.2	92588.6
		Production	TWh	0.169	59.759	1.003								60.76		
	Heat	Capacity	GW					0.286	0.379	0.390	31.59%			8.60		
		Production	TWh					0.725	0.646	1.648				75.37		
	Fuel	Total	PJ	3.548	493.441	12.545			6.546	9.553				853.44		
		Natural gas	PJ	2.059	74.760	2.943				2.436						
		Hard coal	PJ													
		Lignite	PJ	0.736	334.021				6.084							
		RES	PJ													
		Diesel and other products	PJ	0.592	83.691	9.208			0.462	6.824						
		Biomass	PJ													
		Biogas	PJ	0.161		0.161				0.121						
		Waste incineration	PJ													
		Landfill gas	PJ		0.969											
		Other fuels	PJ			0.233				0.172						

[1] Date relating to the total electricity generated by all units

[2] Data relating to the heat generated only by CHP units

[3] Units: PJ

[4] Units: ktn CO_2

Table 1: 2007 summary				HECHP Electricity	Producers of primary activity[1]	Autoproducers[1]	Percentage of HECHP from the total electricity	HECHP Heat	Producers of primary activity[2]	Autoproducers[2]	Percentage of HECHP from the total heat	New HECHP units	Modernised HECHP units	Total units	Primary energy savings[3]	CO_2 emissions avoided[4]
2007	Electricity	Capacity	GW	0.052	13.526	0.183	0.19%					0.03		13.71	511.7	47691.8
		Production	TWh	0.121	62.598	0.898						0.06		63.50		
	Heat	Capacity	GW					0.238	0.379	0.319	24.57%	0.04		8.62		
		Production	TWh					0.639	0.475	2.125		0.09		75.50		
	Fuel	Total	PJ	3.440	550.087	10.178			5.742	8.227		0.60		909.10		
		Natural gas	PJ	0.912	107.241	1.491				1.052						
		Hard coal	PJ													
		Lignite	PJ	0.647	356.704				4.448							
		RES	PJ													
		Diesel and other products	PJ	1.658	84.903	8.228			1.294	6.836						
		Biomass	PJ													
		Biogas	PJ	0.223		0.226				0.167						
		Waste incineration	PJ													
		Landfill gas	PJ		1.239											
		Other fuels	PJ			0.233				0.172						

[1] Date relating to the total electricity generated by all units

[2] Data relating to the heat generated only by CHP units

[3] Units: PJ

[4] Units: ktn CO_2

Table 1: 2008 summary				HECHP Electricity	Producers of primary activity[1]	Autoproducers[1]	Percentage of HECHP from the total electricity	HECHP Heat	Producers of primary activity[2]	Autoproducers[2]	Percentage of HECHP from the total heat	New HECHP units	Modernised HECHP units	Total units	Primary energy savings[3]	CO_2 emissions avoided[4]
2008	Electricity	Capacity	GW	0.095	13.727	0.526	0.21%					0.01		14.25	589.8	44000.3
		Production	TWh	0.134	62.438	1.311						0.02		63.75		
	Heat	Capacity	GW					0.409	0.380	0.431	28.50%	0.01		8.04		
		Production	TWh					0.650	0.486	1.795		0.02		70.44		
	Fuel	Total	PJ	3.453	541.242	14.855			5.985	13.528		0.18		879.69		
		Natural gas	PJ	1.381	112.666	3.412				2.285						
		Hard coal	PJ													
		Lignite	PJ	0.322	341.512				4.835							
		RES	PJ													
		Diesel and other products	PJ	1.474	85.879	10.999			1.150	10.912						
		Biomass	PJ													
		Biogas	PJ	0.276		0.276				0.207						
		Waste incineration	PJ													
		Landfill gas	PJ		1.185											
		Other fuels	PJ			0.168				0.124						

[1] Date relating to the total electricity generated by all units

[2] Data relating to the heat generated only by CHP units

[3] Units: PJ

[4] Units: ktn CO_2

Table 1: 2009 summary				HECHP Electricity	Producers of primary activity[1]	Autoproducers[1]	Percentage of HECHP from the total electricity	HECHP Heat	Producers of primary activity[2]	Autoproducers[2]	Percentage of HECHP from the total heat	New HECHP units	Modernised HECHP units	Total units	Primary energy savings[3]	CO_2 emissions avoided[4]
2009	Electricity	Capacity	GW	0.097	13.681	0.542	0.19%					0.04		14.22	577.9	41201.8
		Production	TWh	0.117	59.407	1.958						0.09		61.37		
	Heat	Capacity	GW					0.163	0.413	0.355	13.30%	0.12		6.82		
		Production	TWh					0.396	0.857	2.122		0.14		59.73		
	Fuel	Total	PJ	2.132	491.203	18.653			5.280	11.012		0.95		781.10		
		Natural gas	PJ	1.414	76.900	8.171				6.260						
		Hard coal	PJ													
		Lignite	PJ	0.339	345.774				5.258							
		RES	PJ													
		Diesel and other products	PJ	0.028	66.592	9.962			0.022	4.344						
		Biomass	PJ													
		Biogas	PJ	0.351		0.351				0.283						
		Waste incineration	PJ													
		Landfill gas	PJ		1.937											
		Other fuels	PJ			0.169				0.125						

[1] Date relating to the total electricity generated by all units

[2] Data relating to the heat generated only by CHP units

[3] Units: PJ

[4] Units: ktn CO_2

Table 1: 2010 summary				HECHP Electricity	Producers of primary activity[1]	Autoproducers[1]	Percentage of HECHP from the total electricity	HECHP Heat	Producers of primary activity[2]	Autoproducers[2]	Percentage of HECHP from the total heat	New HECHP units	Modernised HECHP units	Total units	Primary energy savings[3]	CO_2 emissions avoided[4]
2010	Electricity	Capacity	GW	0.099	13.564	0.522	0.36%					0.02		14.09	513.6	33590.7
		Production	TWh	0.209	56.076	2.492						0.01		58.57		
	Heat	Capacity	GW					0.337	0.406	0.487	8.49%	0.03		5.07		
		Production	TWh					0.299	2.139	1.383		0.05		44.43		
	Fuel	Total	PJ	2.477	458.019	26.571			5.461	15.391		0.04		682.36		
		Natural gas	PJ	1.886	88.265	15.277				8.607						
		Hard coal	PJ													
		Lignite	PJ	0.274	316.335				5.437							
		RES	PJ													
		Diesel and other products	PJ	0.031	51.724	9.667			0.024	5.620						
		Biomass	PJ													
		Biogas	PJ	0.286		0.286				0.171						
		Waste incineration	PJ													
		Landfill gas	PJ		1.695											
		Other fuels	PJ			1.341				0.993						

[1] Date relating to the total electricity generated by all units

[2] Data relating to the heat generated only by CHP units

[3] Units: PJ

[4] Units: ktn CO_2

Table 2: Sectors				Total	Industrial sector	Residential and tertiary sectors, and services	Other sectors
						District heating	
2006	Electricity	Capacity	GW	0,085	0.075		0.010
		Production	TWh	0,169	0.146		0.023
	Heat	Capacity	GW	0,286	0.268		0.018
		Production	TWh	0,725	0.702		0.023
	Fuel	Consumption	PJ	3,548	3,387		0,161
2007	Electricity	Capacity	GW	0,052	0,045		0,007
		Production	TWh	0.121	0.103		0.018
	Heat	Capacity	GW	0.238	0.228		0.010
		Production	TWh	0.639	0.616		0.023
	Fuel	Consumption	PJ	3.440	3.217		0.223
2008	Electricity	Capacity	GW	0.095	0.087		0.008
		Production	TWh	0.134	0.116		0.018
	Heat	Capacity	GW	0.409	0.407		0.002
		Production	TWh	0.650	0.621		0.029
	Fuel	Consumption	PJ	3.453	3.177		0.276
2009	Electricity	Capacity	GW	0.097	0.057	0.016	0.024
		Production	TWh	0.117	0.057	0.038	0.022
	Heat	Capacity	GW	0.163	0.127	0.005	0.031
		Production	TWh	0.396	0.274	0.043	0.079
	Fuel	Consumption	PJ	2.132	1.375	0.353	0.404
2010	Electricity	Capacity	GW	0.099	0.045	0.016	0.038
		Production	TWh	0.209	0.049	0.060	0.100
	Heat	Capacity	GW	0.337	0.285	0.004	0.048
		Production	TWh	0.299	0.053	0.069	0.178
	Fuel	Consumption	PJ	2.477	0.902	0.533	1.042

Table 3: Technologies				Total	Steam back pressure turbines	Gas turbines with heat recovery	Internal combustion engines
2006	Electricity	Capacity	GW	0.085	0.078	0.004	0.003
		Production	TWh	0.169	0.124	0.027	0.018
	Heat	Capacity	GW	0.286	0.273	0.009	0.004
		Production	TWh	0.725	0.643	0.057	0.025
	Fuel	Consumption	PJ	3.548	2.986	0.369	0.193
2007	Electricity	Capacity	GW	0.052	0.045	0.004	0.003
		Production	TWh	0.121	0.082	0.021	0.018
	Heat	Capacity	GW	0.238	0.223	0.011	0.004
		Production	TWh	0.639	0.557	0.057	0.025
	Fuel	Consumption	PJ	3.440	2.896	0.351	0.193
2008	Electricity	Capacity	GW	0.095	0.038	0.040	0.017
		Production	TWh	0.134	0.056	0.024	0.054
	Heat	Capacity	GW	0.409	0.390	0.011	0.008
		Production	TWh	0.650	0.527	0.047	0.076
	Fuel	Consumption	PJ	3.453	2.562	0.274	0.617
2009	Electricity	Capacity	GW	0.097	0.046	0.013	0.038
		Production	TWh	0.117	0.026	0.011	0.080
	Heat	Capacity	GW	0.163	0.122	0.018	0.023
		Production	TWh	0.396	0.233	0.034	0.129
	Fuel	Consumption	PJ	2.132	1.082	0.202	0.848
2010	Electricity	Capacity	GW	0.099	0.033	0.013	0.053
		Production	TWh	0.209	0.019	0.026	0.164
	Heat	Capacity	GW	0.337	0.236	0.011	0.090
		Production	TWh	0.299	0.126	0.074	0.099
	Fuel	Consumption	PJ	2.477	0.605	0.369	1.503