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CHP IN SE EUROPE – Roadmap for Greece

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Cogeneration Observatory for Distributed Energy -CODE2

- CODE2 is an EU-funded programme under Intelligence Energy Europe, started in July 2012 and for 30 months
- Partners: COGEN EUROPE, HACHP, Vlanders CHPA, Italian CHPA, BEA
- Scope: CHP Roadmaps for 27 M-S with major attention to 7 M-S and Best Cases of CHP installations

CHP statistics for Greece, based on Eurostat data and LAGIE

	Total installed electricity capacity (MW)	Total electricity generated (MWh)	Total heat supplied (MWh)	Total cogenerated electricity generated (MWh)	Total CHP share on electricity (%)
2008	9,517	63,749,000	no data available	1,211,231	1.9
2009	9,667	61,365,000	no data available	1,840,950	3.0
2010	10,075	57,392,000	no data available	2,467,856	4.3

Table 1

	Installed CHP capacity, MW	Cogenerated electricity, MWh	Contract-based HECHP, MW
2008	98,73	34.792	56,28
2009	133,07	144.122	97,07
2010	134,71	114.560	98,71

Table 2

Why this difference?

The difference between the two data is that the data in Table 2 deals only with cogenerated electricity from **High Efficiency CHP** units and does not take into account the cogenerated electricity by non-HECHP units or auto-producers.

Typical example is PPC's-operated district heating systems, which are supplying heat from coal-fired power stations to three near-by cities in Northern Greece and Peloponnese and of other CHP producers that they are not characterized as HECHP.

The Hellenic Association for CHP-HACHP-has conducted a detailed study, in 2011, on behalf of the Centre for Renewable Energy Sources, CRES, which is the national entity for the promotion of RES and Energy Efficiency, by recording all installed HECHP units, in or out of operation, High Efficiency or not, and above 50 kW_e and the results are shown in Table 3.

HECHP units above 50 kW_e	
Total installed Capacity	88.15 MW _e
Industrial sector capacity	77.67 MW _e
Tertiary, other	10.48 MW _e

Table 3: HECHP units above 50kW_e in Greece

Some important projects of HECHP installations in strategic sectors in Greece

	Area of installation	Capacity MW _e	Fuel	Sector	Status
Aluminium of Greece	Aspra spitia Viotia	110	NG	Industry	From 1/2008 to 12/2012 in monitoring phase until Jan 2013 when final the permit was given, but still no “premium” has been issued
Thessaloniki Refineries	Thessaloniki	5.9	Ref. gases	Industry	Operating
Psyttalia island – EYDAP	Psyttalia Athens	5X2.4=12	biogas	Athens Sewage & Water Co	Operating
Two greenhouses	Alexandria & Drama	2x4.9=9.8	NG	Agriculture	Operating
National University	Athens	2.7	NG	Tertiary	Operational problems
8 th floor apartment building	Thessaloniki	0.004	NG	Tertiary	Missing agreement for connection to the national electricity grid

Table 4: Notable Projects with HECHP units

DHS in Greece

- As for district heating, this sector in Greece is underdeveloped and not widespread.
- There are five (5) DH systems in total;
- 4 are operating by PPC – 3 in Northern Greece, 1 in Peloponnese of a total CHP installed capacity of 175 MW_{th} – and 1 by a private company in N. Greece, with 16 MW_e CHP units capacity, provide heating for 12900 households, operating from 2007.
- A new DH system, of a capacity of 70 MW_{th} is scheduled to be in operation by 2015, in Florina, a city in northern Greece with harsh winter conditions and will provide heating for 2300 households.

Municipality of Florina: <http://www.cityoflorina.gr>

Feed-in-Tariff for HECHP

- Regarding supporting HECHP investments, the key tool is ***guaranteed feed-in-tariffs*** for the cogenerated electricity fed into the System or Grid, including the Grid of the Non-Interconnected Islands, on the basis of a defined price, expressed in €/MWh of electricity of a definite time period
- The F-i-T for cogenerated electricity injected to the Network or Grid is 89.97 €/MWh for the Interconnected network and 101,85 €/MWh for Non-Interconnected Network (islands), using **all** fuels except natural gas and biomass.

F-i-T for HECHP with NG

- L.3851/2010 (Article 5) updated the tariffs for the electricity generated by HECHP plants by introducing a fuel clause coefficient (CC) used to adjust the price of electricity generated by HECHP plants in accordance with natural gas prices.
- The «**premium**» for electricity from HECHP plants, using NG, was set as:
89,97*CC, for the Interconnected System and
101,85*CC for the Non-Interconnected Islands.

- CC is set as 1 for all fuels except NG.
- The NG CC is calculated by the following equation:

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

where:

MNGP is the average monthly 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 YPEKA and communicated to LAGIE on a monthly 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.

F-i-T for HECHP with NG

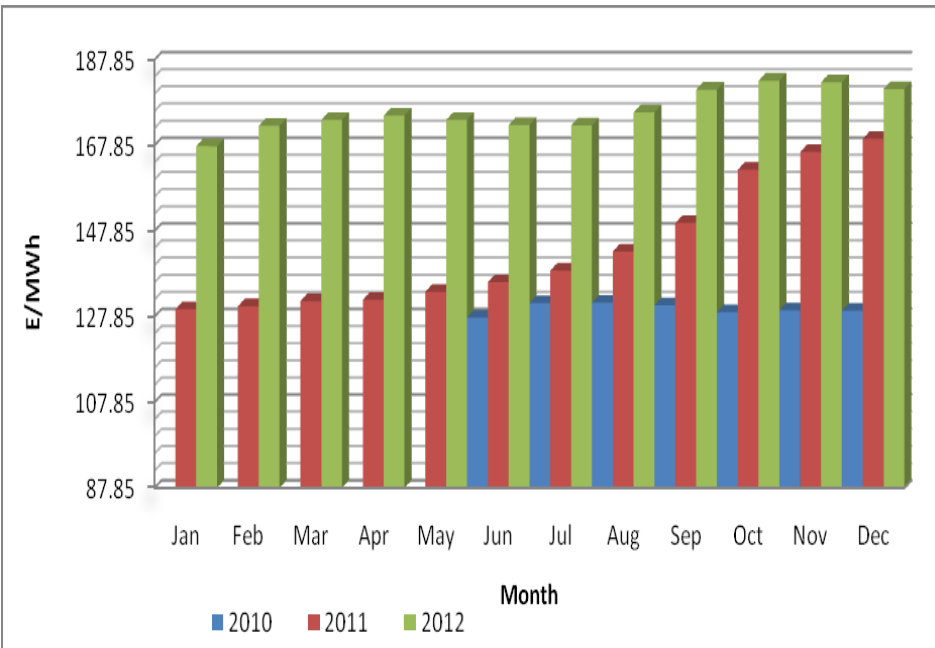


Figure 1: F-i-T for CHP units up to 1 MWe

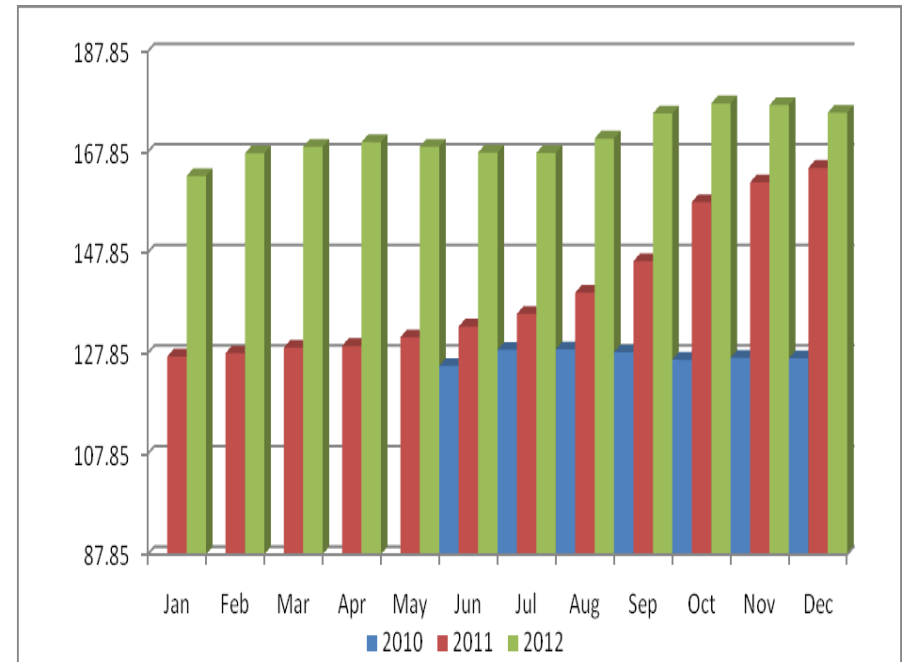


Figure 2: F-i-T for CHP units above 1 MWe

The economics of CHP in Greece

- The current Feed-in-Tariff/Premium support scheme provides a good economic environment for HECHP investments with a foreseen 11-13% return on investment mainly for those using NG fuel, in spite of unfavorable economic situation of Greece. It is important to mention that before the economic crisis in Greece (up to 2009) the return on investment for NG fuel was around 18-20%.
- On 2010, taxation on all fuels, including NG, was imposed as a requirement of the 1st MoU between Greek government and lenders (EC-ECB, IMF).
- A 10% “special contribution” on the gross profit from the F-i-T/premium monthly payment was imposed by the 2nd MoU, for 2+1 years, starting 6/2012 until 6/2015.

Analysis on electricity-NG prices and the calculated “spark power ratio”

Price/Year	Natural Gas, €/MWh			Electricity, €/MWh	
	Industry Above 1MW	Industry up to 1MW	Household	Industry	Household
2009	-	38	38	94	105
2010	-	43	45	85	97
2011	48,73	55	59	91	102
2012	48,56	63	68	100	106

Price/Year	Spark ratio		
	Industry Above 1MW	Industry Up to 1MW	Household
2009	-	2,47	2,76
2010	-	1,98	2,26
2011	1,87	1,65	1,85
2012	2,06	1,59	1,68

Conclusions

Greece	Micro		Small & Medium		Large		
	<i>up to 50kW</i>		<i>up to 10 MW</i>		<i>more than 10 MW</i>		
	NG	RES	NG	RES	NG	Coal	RES
SME/Industry							
District heating/cooling							
Services							
Households							



“normal”

CHP Investment has **good economic benefits**, return on investment acceptable (8-10%) for the investors, **interest for new investment exists**; there are no significant economic barriers for the implementation.



“modest”

CHP Investment has **modest/limited economic benefits** and return on investment (5-7%), **limited interest for new investments**.



“poor”

CHP Investment has **poor or negative return on investment or is not possible due to other limitations**, no interest/possibilities for new investments.



Not applicable for the sector

NG

Natural Gas or appropriate fossil fuel

RES

Renewable energy sources (wood biomass, biogas, etc.)