



# Biogas in Greece: Current situation and Perspectives

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- ✓ Current situation and potential resources
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# Greek energy balance

(Source: Ministry of Development)

Area	132,000 km <sup>2</sup>
Population	10.96 millions

Gross national energy consumption (2004)		30.7 MTOE
Sources	KTOE	%
Oil products	17,517	57.03
Solid fuels	9,441	30.72
Natural gas	2,028	6.60
RES and large-scale hydros	1,560	5.05
Solar	108	0.35
Wind	96	0.31
Biomass	917	2.99
Biogas	36	0.12
Small Hydro (<10 MW)	26	0.08
Large Hydro (>10 MW)	376	1.23
Power (imports)	184	0.60
Total		100.0

# Basics of the electrical system (Source: PPC)

Power consumption in 2006 55.5 TWh

Power Production in 2006 53.0 TWh

Total installed capacity (from PPC units) 12.695 MW  
+ 1400 MW

CO<sub>2</sub> emissions 53.658 kt

Sources for power production 2005 %

Lignite 55.9

Oil 13.5

Natural gas 12.9

Large scale hydros 9.1

RES 3.1

Imports-exports 5.5

Total 100.0



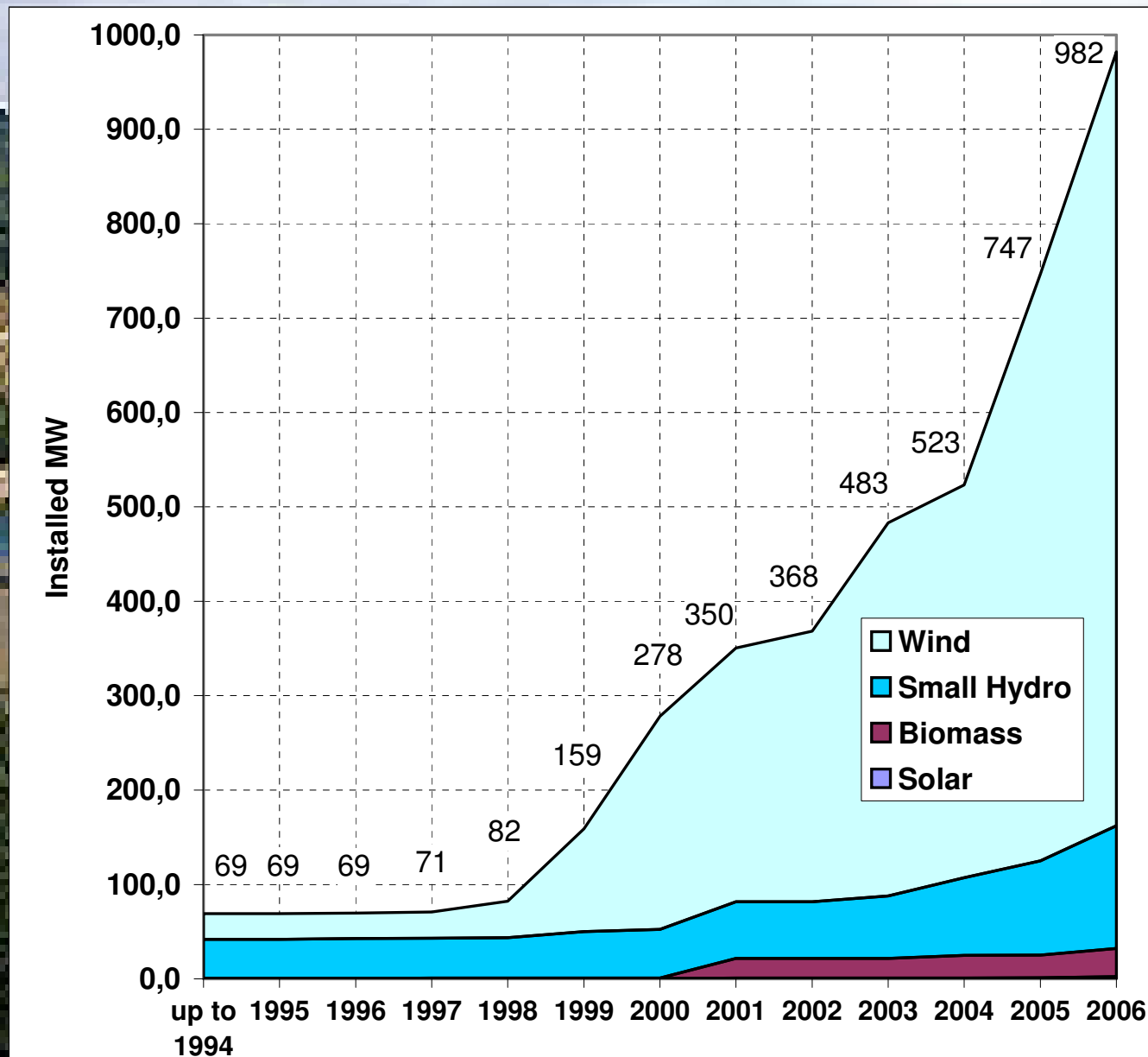
# RES and biogas deployment in Greece

- In 2005 the energy from RES amounted to 2.2 TWh.
  - 77.4% from wind farms,
  - 13.6% from small hydroelectric plants and
  - 9% from biogas.
- In 2006 the energy from RES amounted to 2.7 TWh.

# RES and biogas deployment in Greece

- In 2005 the installed power from RES amounted to 747.2 MW, the 24 MW of these were from biogas (3.2%). This corresponded to primary biogas production of 1,507.2 TJ.
- In 2006 the installed power from RES amounted to 763.5 MW, the 36.39 MW of these were from biogas (4.7%). This corresponded to primary biogas production of 2,905.80 TJ.
- The biofuel is coming from the exploitation of biogas generated in Sanitary Landfills (SL) (2,268.84 TJ in 2006) and biogas generated in Municipal Wastewater Treatment Plants (MWTP) (636.97 TJ) mainly in the region of Attiki.

# Cumulative capacity of RES installed plants



Source:  
Greek  
Ministry of  
Development

# Biogas plants in Greece

Plant	Feedstock	Amount (m <sup>3</sup> /day)	Gas production (Nm <sup>3</sup> /day)	Primary production of biogas (TJ/y)	Installed Capacity (MW)	Power Production (MMWh <sub>e</sub> )	Heat Production (MMWh <sub>th</sub> )	Heat Production (TJ/y)	
1	MWTP of Chania	Sewage sludge	17,000	1,085	9.12	0.21	130	2.2	
2	MWTP of Heraklion	Sewage sludge	23,000	3,200	26.90	0,19	465	4.3	
3	MWTP of Volos	Sewage sludge	27,000	1,500	12.61	0,35	240	4.12	
4	MWTP of Psyttalia	Sewage sludge	760,000	70,000	588.34	7,14	28,000	40,300	145.22
5	SL of A.Liosia	Landfill gas		164,000	1,107.41	13,8	264,000	0	0
6	SL of A.Liosia (Expansion)	Landfill gas		112,000	756.28	9,7	190,000	84,500	304.49
7	SL of Tagarades	Landfill gas		60,000	405.15	5,0	95,600	0	0
<b>8</b>	<b>TOTAL</b>			<b>411,785</b>	<b>2,905.80</b>	<b>36,39</b>	<b>578,435</b>	<b>124,800</b>	<b>460.32</b>



# Biogas plant in Ano Liossia



Source: HELECTOR



# Biogas plant in Ano Liossia - Cogeneration unit



Source: HELECTOR



# Biogas plant in Psyttalia

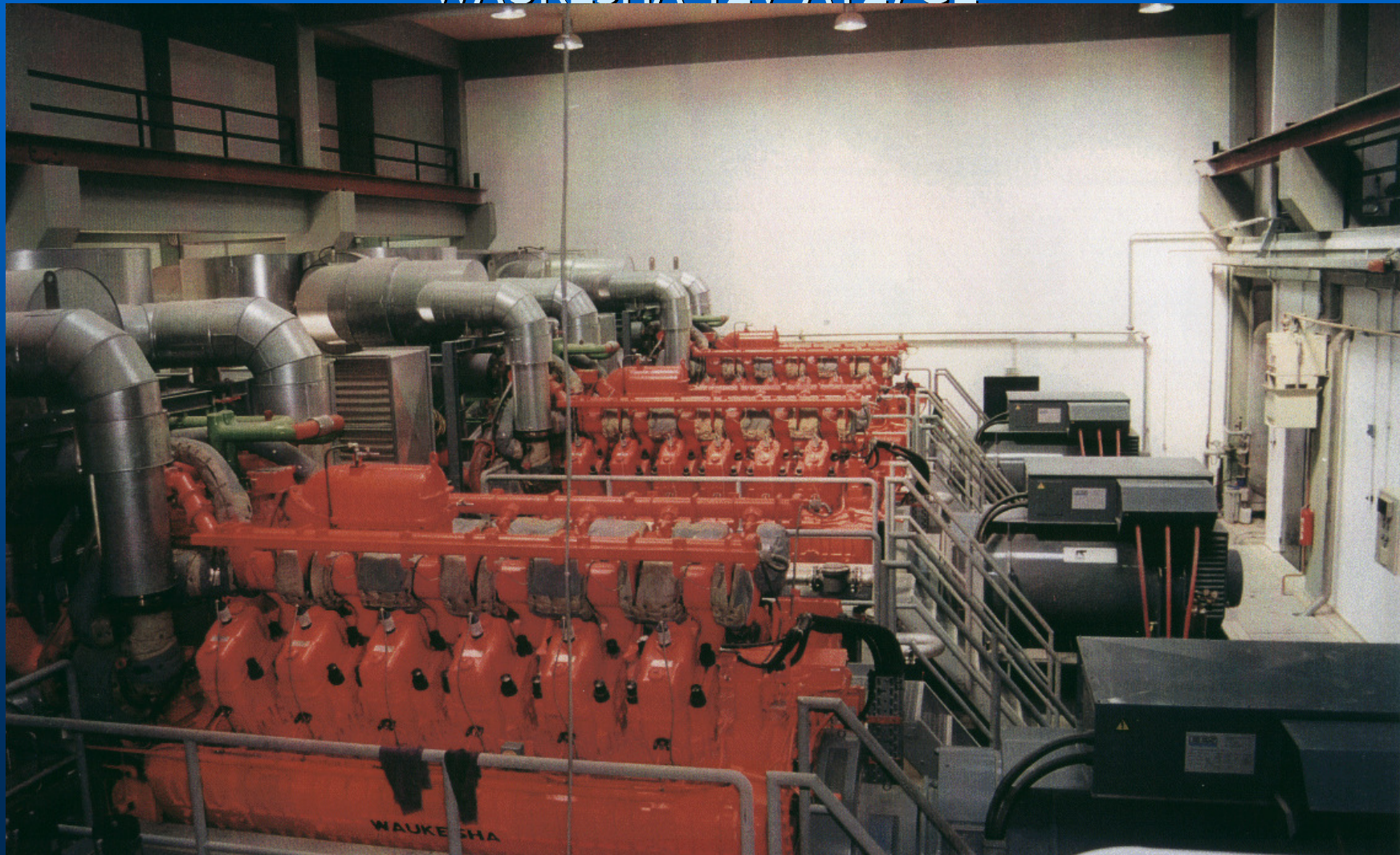


Source: EYDAP



# Biogas plant in Psyttalia - Biogas motor

WAUKESHA 12V-AT27GL



Source: EYDAP



# Biogas plant in Heraklion-Crete



Source: EDRASIS S.A

# Biomass potential (of the main organic wastes) in Greece

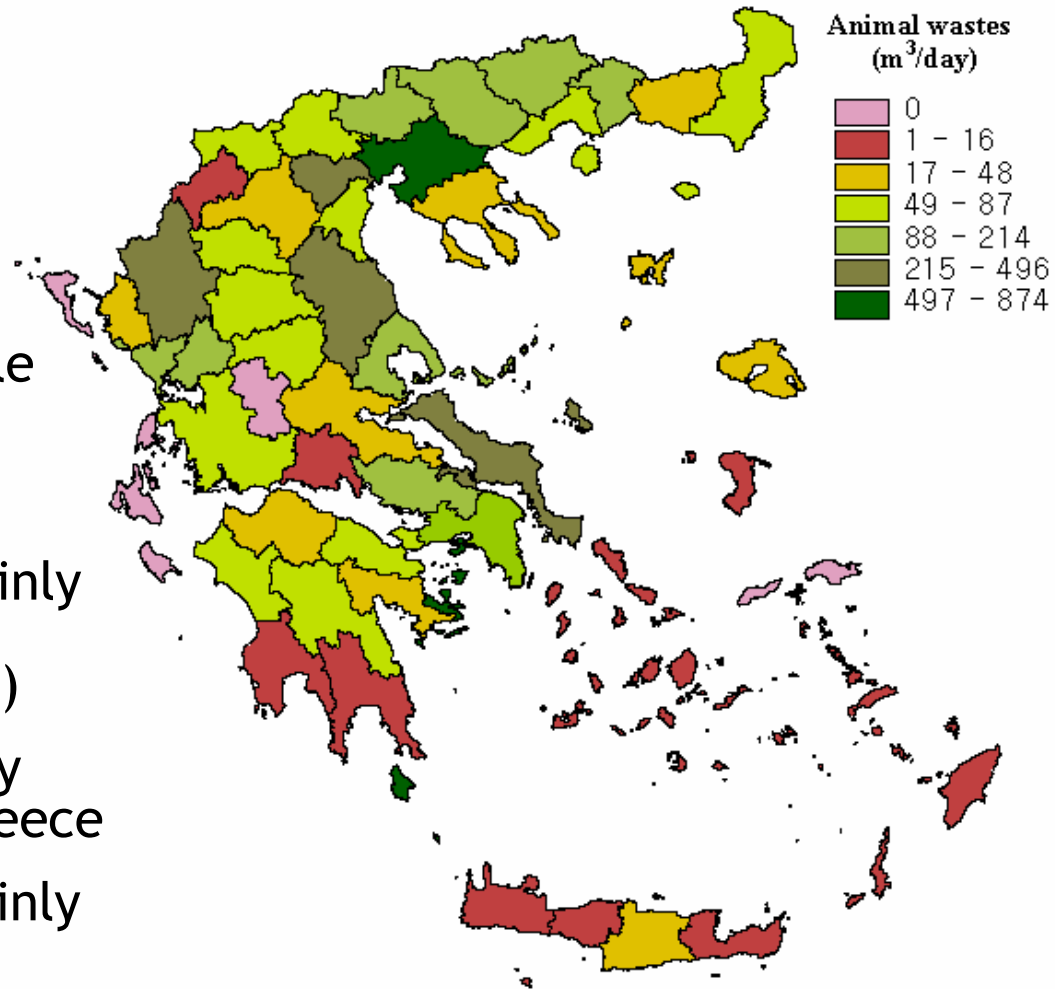
Category	Units *	Capacity *	Organic wastes (t/y)	Installed capacity (MW)
Cattle	32.875	727,040 cattle	14,540,800	278
Sows	36.593	140,645 sows	2,268,220	37
Slaughterhouses	101	77,242 t/y (Cat 2) 127,690 t/y (Cat 3)	204,932	28
Milk factories (milk processing for cheese production)	548	160,362.4 t/y goat milk 447,705.2 t/y sheep milk	425,647	7.21
<b>Σύνολο</b>			<b>17,439,599</b>	<b>350.21</b>

\* Source: Ministry of Agricultural Development and Food

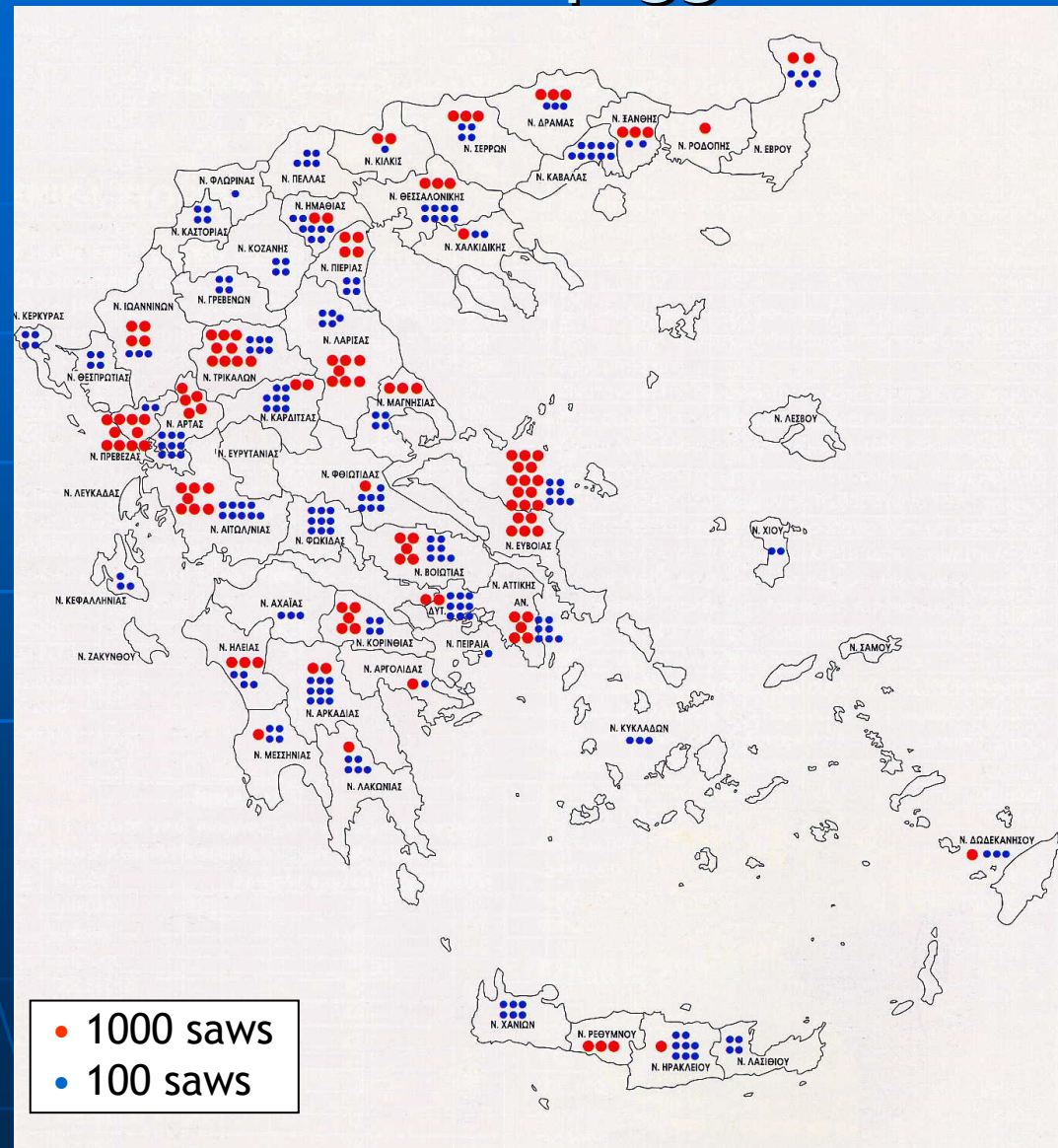


# Potential daily production of animal wastes

- ✓ 17 Mtons/year cattle and pig slurries
- ✓ 315 MW
- ✓ Cattle breeding mainly northern Greece (Thessaloniki, Pella)
- ✓ Pig breeding equally distributed over Greece
- ✓ Poultry farming mainly in three regions

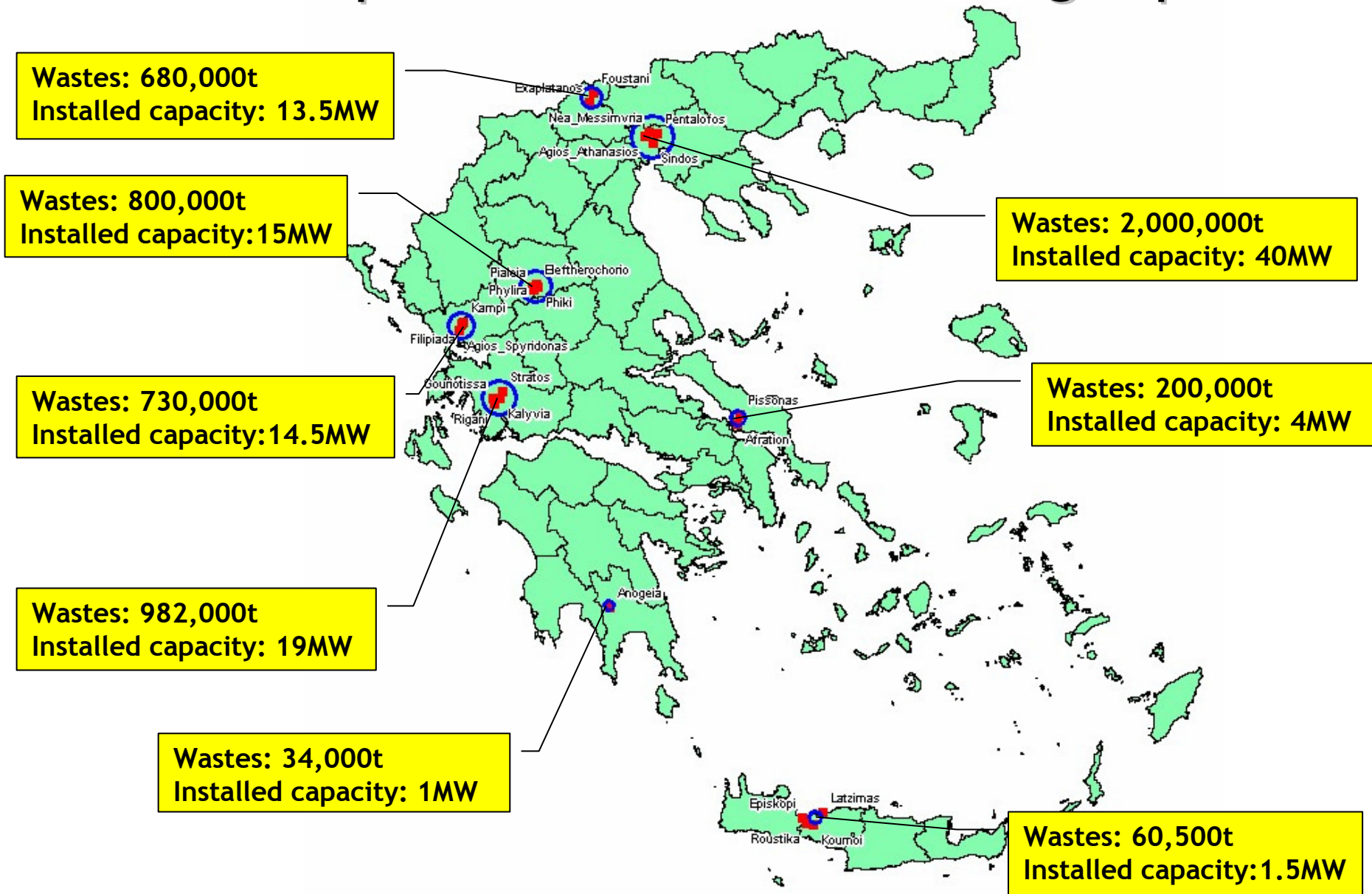


# Spatial distribution of piggeries in Greece



Source: Union of pig breeders in Greece.

# Potential spatial distribution of biogas plants



# Biomass Plans

Ministry of Development





# Legislation on electricity production from RES and CHP

- ✓ The Directive 2001/77 on electricity from RES has been adopted by the Greek government in June 2005, as **Law 3468/06**. The main scope of this new law is to simplify the permitting system for the RES investments in Greece (i.e. licensing procedures).
- ✓ A point of strong interest is the new electricity feed-in-tariffs system, applicable for the sales of RES-produced electricity to the grid. Electricity produced by biomass is set at 73 euro/MWh (while for photovoltaics is 400 euro/MWh).



## Electricity from RES (Directive 2001/77, Law 3468/06)

2010 Target: 20.1% RES contribution incl. large-scale hydro

Basic-scenario	Requirements in installed capacity by 2010, in MW	Energy generated in 2010 in Twh	Share of every renewable energy source in 2010 (%)
Wind parks	3,372	7.09	10.42
Small-scale hydro	364	1.09	1.60
Large-scale hydro	3,325	4.58	6.74
<b>Biomass</b>	<b>103</b>	<b>0.81</b>	<b>1.19</b>
Geothermal	12	0.09	0.13
Photovoltaics	18	0.02	0.03
<b>Total</b>	<b>7,193</b>	<b>13.67</b>	<b>20.10</b>



## Electricity from RES (Directive 2001/77, Law 3468/06)

2010 Target: 20.1% RES contribution incl. large-scale hydro

Conservative-scenario	Requirements in installed capacity by 2010, in MW	Energy generated in 2010 in Twh	Share of every renewable energy source in 2010 (%)
Wind parks	2,104	4.42	6.50
Small-scale hydro	211	0.63	0.93
Large-scale hydro	3,325	4.58	6.74
<b>Biomass</b>	<b>59</b>	<b>0.46</b>	<b>0.68</b>
Geothermal	5	0.04	0.06
Photovoltaics	7	0.01	0.01
<b>Total</b>	<b>5,711</b>	<b>10.15</b>	<b>14.92</b>

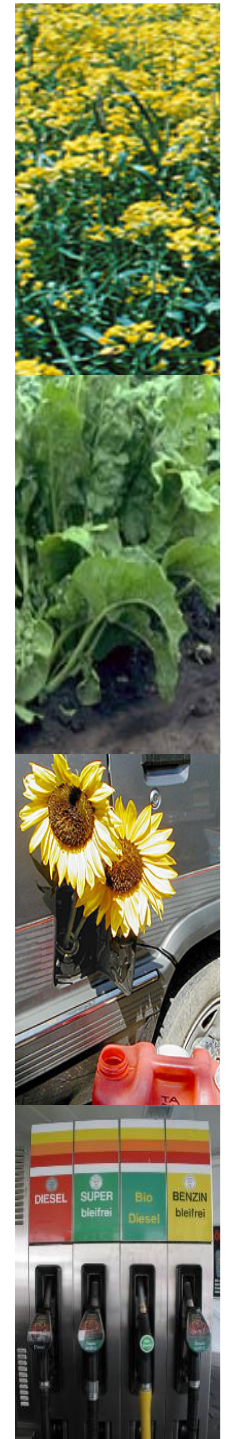
# Bio energy in the heat market

- The concept of district heating is not widespread and the lack of regulated heat prices and infrastructure hinders the development in this sector. The only district heating schemes that exist in Greece are the ones using the waste heat from lignite thermal plants.
- Bioenergy in 2005 accounted for 1 Mtoe.
  - 73% (0.7 Mtoe) wood consumed directly in the domestic/residential sector
  - 27% (0.26 Mtoe) biogas from sanitary landfills and wastewater treatment plants, wood/agricultural/food industries' residues.



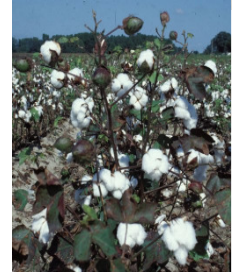
# Liquid biofuels

- ✓ The Biofuels directive 2003/30 has been adopted as Law 3423/05.
- ✓ Biodiesel will be the main biofuel for the Greek transport sector with bioethanol playing a less important role until 2008.
- ✓ Obligatory use of all detaxed biodiesel in the existing refineries (in an up to 5% blend). Detaxed quantities are decided on an annual basis under a quota scheme.
- ✓ For 2006 14 investors have applied for detaxed biodiesel production amounting to the 91,000 m<sup>3</sup> set for 2006 and 13 investors applied for 114,000 m<sup>3</sup> for 2007.
- ✓ For 2007 the 30% of the 3 final months (Oct, Nov, Dec) has to be supplied by locally produced seed oils.
- ✓ The market for pure biodiesel does not exist yet.



## Other Directives adopted

- **Renewable Energy Directive (2001/77/EC).** Adopted in Law 2773 (ΦΕΚ 286/A/22.12.1999).
- **CO2 Emission Trading Directive 2003/87/EC.** Adopted in Joint Cabinet Decision 54409/2632 (ΦΕΚ 1931/B/27-12-04).
- **Nitrates Directive (91/676/EC).** Adopted in Joint Cabinet Decision 16190/1335/97 of 25 June 1997.





# Biomass Plans

Ministry of Environment,  
Physical Planning and  
Public Works



# Specific Spatial Planning Framework for RES

According to this plan:

- For biomass and biogas exploitation, favorable areas are considered these located in near proximity to agricultural lands where biomass is produced, waste treatment plants, food industries, animal breeding farms. Minimum distances from the nearby land uses are set.
- The plan is under public consultation.





# Other Directives adopted

- **Landfill Directive (99/31/EC)**. Adopted in CMD 29407/3508/2002 (ΦΕΚ 1572/B/16.12.02).
- **LCP Directive (2001/80/EC)**. Adopted in the MD 58751/2370/93 (ΦΕΚ 264/B/15.4.93).
- **Waste Incineration Directive (2000/76/EC)**. Adopted MD 922/77 (ΦΕΚ 315/A/14.10.77)
- **IPPC Directive (1996/61/EC)**. Adopted in Law 3010/02.



# Biomass Plans

## Ministry of Finance



# Support measures

- ✓ The “National Development Law” (Law 3299/2004). Subsidies vary from 40- 55% according to region and the type of the enterprise (in case of SMEs and specific regions they can reach up to 55%)
- ✓ The **Greek Operational Programme for Competitiveness**, active until the end of 2006 with a total budget of about 777.6 MEURO (public funding of about 268.4 MEURO). Biomass share was 60.7 MEURO, out of which the 31.4 MEURO were spent on biogas projects. Support on capital cost (up to 40%) for biogas plants was included in the 3rd Community Support Framework (Energy).

The 4th Framework is under development and respective provisions are expected to be put forth.





# Identified barriers (1/2)

- Cognitive barriers, which relate the low level of awareness and understanding of the financing schemes and risk management infrastructures
- Political barriers, associated with regulatory and policy issues (lack of gate fees, lack of regulatory price for heat)
- The small-scale of projects
- Resource availability and supply risk, either in terms of assessing the resource or contracting the supply (reduction of gas quantity and quality due to changes in organic feedstock)
- High investment costs
- Planning opposition associated with odor problems

## Identified barriers (2/2)

- Large plants owners are not properly aware of the technologies for manure treatment and potential biogas-to-energy applications.
- Small plants cannot in general effectively combine forces with other producers to form clusters of enterprises and create viable biogas plants.
- Liberalisation of the energy market is proceeding very slowly in Greece and PPC retains the leading position in power generation and supply.
- The “polluter pays” principle is not applied practically.

# Perspectives and success conditions (1/3)

- Strict adherence to the deadlines set for the various RES applications which are rarely respected by the public electricity company, by the relevant departments of the Ministry of Development and the Ministry of Environment, Civil Planning and Public Works, by the regional and prefecture authorities, etc.
- Substantial reduction in the number of public-sector entities (departments, committees, agencies, etc.) required to approve environmental licensing of RES installations, so as to initiate investments.
- Detailed examination of the possibility to incorporate all RES -licensing procedures into a 'one-stop shop' mechanism, under the supervision of the Ministry of Development.

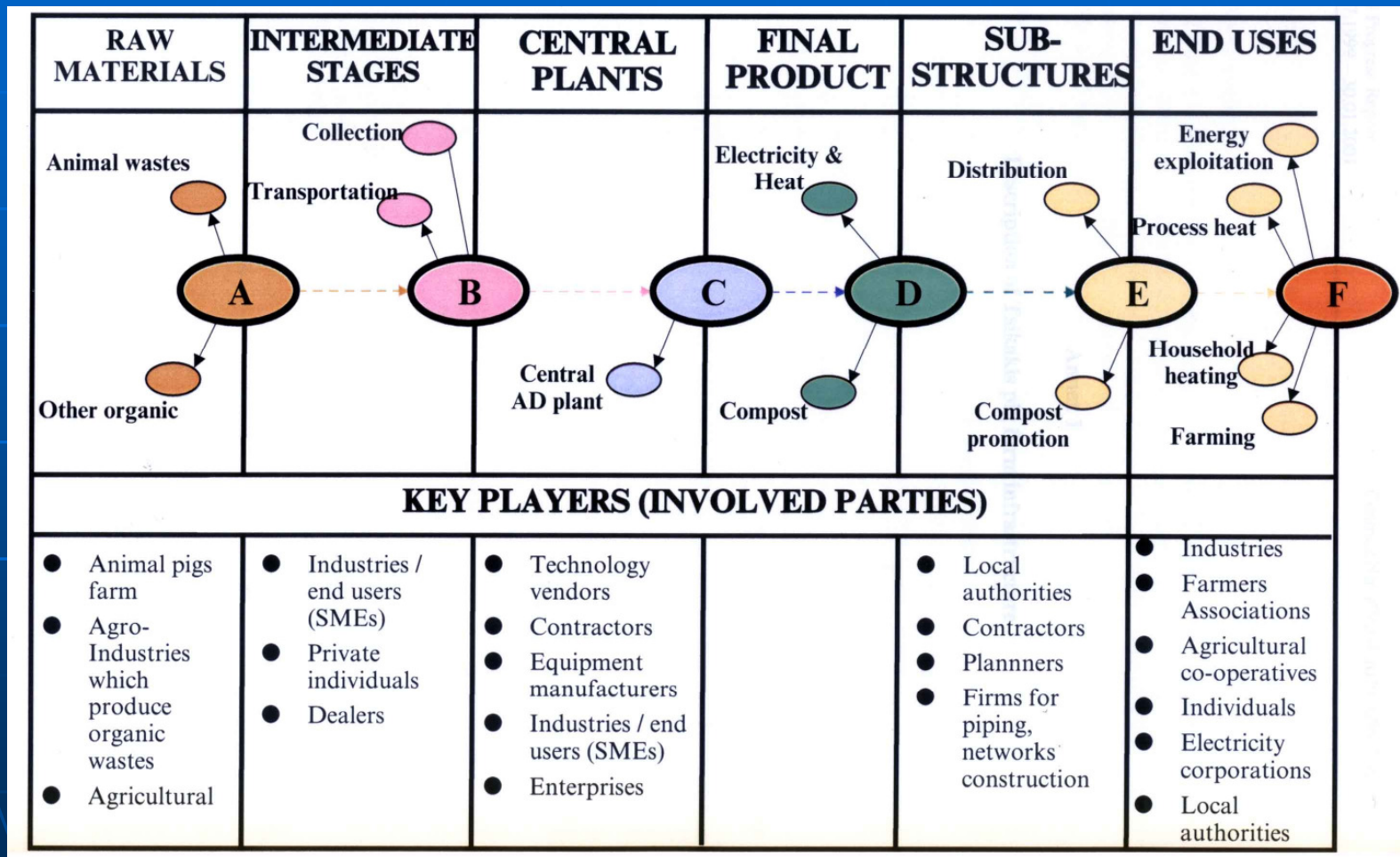


## Perspectives and success conditions (2/3)

- Creation of national clusters consisted of representatives from SMEs, technology suppliers, specialized contractors, equipment manufactures, financing providers, policy makers (Ministries, Local Authorities) etc. that would assure constant and efficient linking between different policies - on energy, environment, etc - and marketing activities on biogas deployment.

The aim of such clusters would be to determine synergies, dependencies and interactions between the involved key players for each stage of a biogas plant life cycle and find out which productive systems can be derived.

# Biogas networking scheme



# Perspectives and success conditions (3/3)

- Increase of the percentage of the public funding on the investment capital costs from the 40% that is now to 50%, mainly for the advanced bioconversion technologies.
- Improvement of the biogas market conditions (increases of demand and thus increases of the selling price of the energy products). This could be achieved through the increase of the amount of the de-taxed biofuels and the price of the biogas-produced electricity to the grid (73 euro/MWh set at present to the 150 euro/MWh).

# Conclusions

- Biogas currently exploited is mainly in the form of landfill gas and sewage sludge generated gas.
- Greece has a high organic waste potential 17 Mtons that currently is not exploited.
- 8 CAD plants could be constructed, with a total installed capacity of 350 MW, in areas of high organic waste potential.





# Conclusions

- The legislative framework and financing mechanisms are constantly being improved, but
- the still high investment costs
- the lack of public awareness
- the lack of implementation of a ‘gate-fee’,
- the lack of socio-economic costs and environmental benefits (external costs) reflected in economic analysis of a CAD plant hinder the biogas deployment in Greece





Thank you for your attention!

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