



Biogas for energy production

The state of the French situation & stakes

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French Agency for Environment and Energy Management (ADEME)

Public Body

with industrial and commercial nature

under the joint supervision of

- ✓ **Ministry of Ecology and Sustainable Development**
- ✓ **Ministry of Industry**
- ✓ **Ministry of Research**



A new charter agreement on objectives structuring relations between ADEME and the State

Objectives set for each of the agency's four types of activity

- ✓ **Acquire Knowledge**
By expanding the technology and innovation knowledge and covering industry branches and costs
- ✓ **Convince and mobilize**
Through communication, information, education and training
- ✓ **Advise**
By developing advisory services, disseminated directly or via relay structures
- ✓ **Help in decision-making and to achieve execution**
Through accompanying action and funding

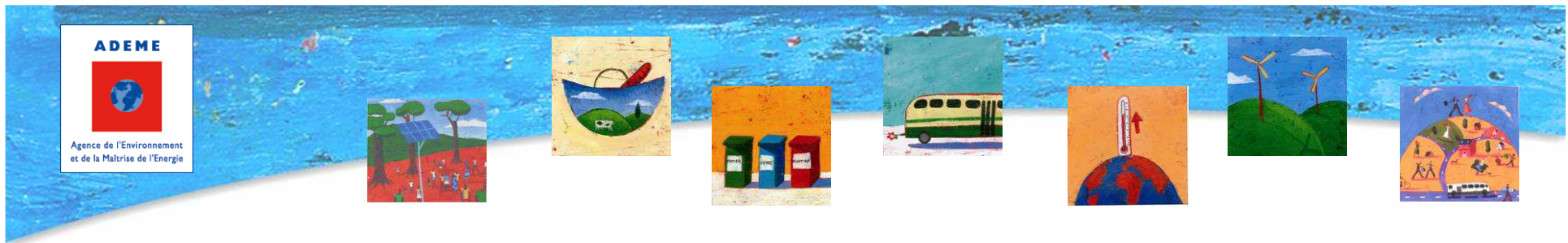


A new charter agreement on objectives structuring relations between ADEME and the State

Action and results to be reach in four domains

ADEME's mandate is to accompany and assist actors in the society and the economy in the process of reducing and eliminating their environmental impacts and managing energy, in the following domains:

- ✓ Waste and soil**
- ✓ Energy**
- ✓ Air quality and noise pollution**
- ✓ Cross-sectored action**



Since the end of 1999, ADEME give subsidies and have relationship with the French society for biogas (called Club Biogaz) with many objectives :

- **develop biogas industry in France**
- **develop a privileged bridgehead with the French State**
- **animate the relationship between French State and sectors concerned by the biogas technology (agriculture, industry or municipalities)**
- **make technical studies**
- **give technical and economical data to industries or manufacturers**



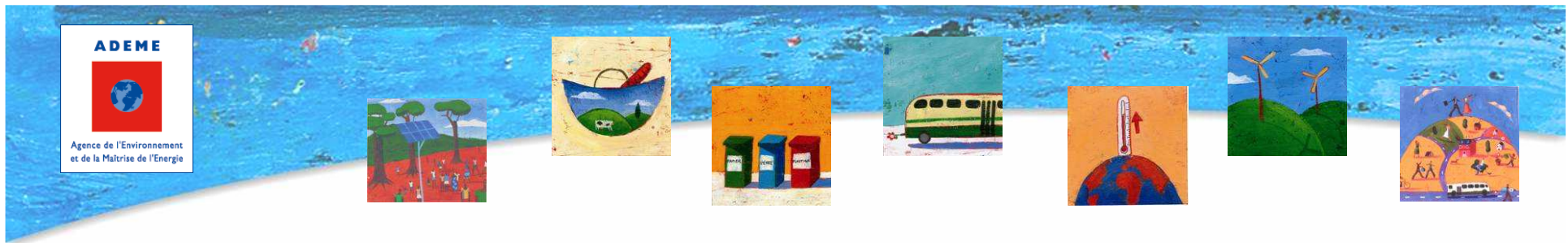
Plan

- **Governmental laws and regulations**
- **Incentives and development**
- **The state of the situation and its evolution**
- **Conclusion**



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The new French regulation

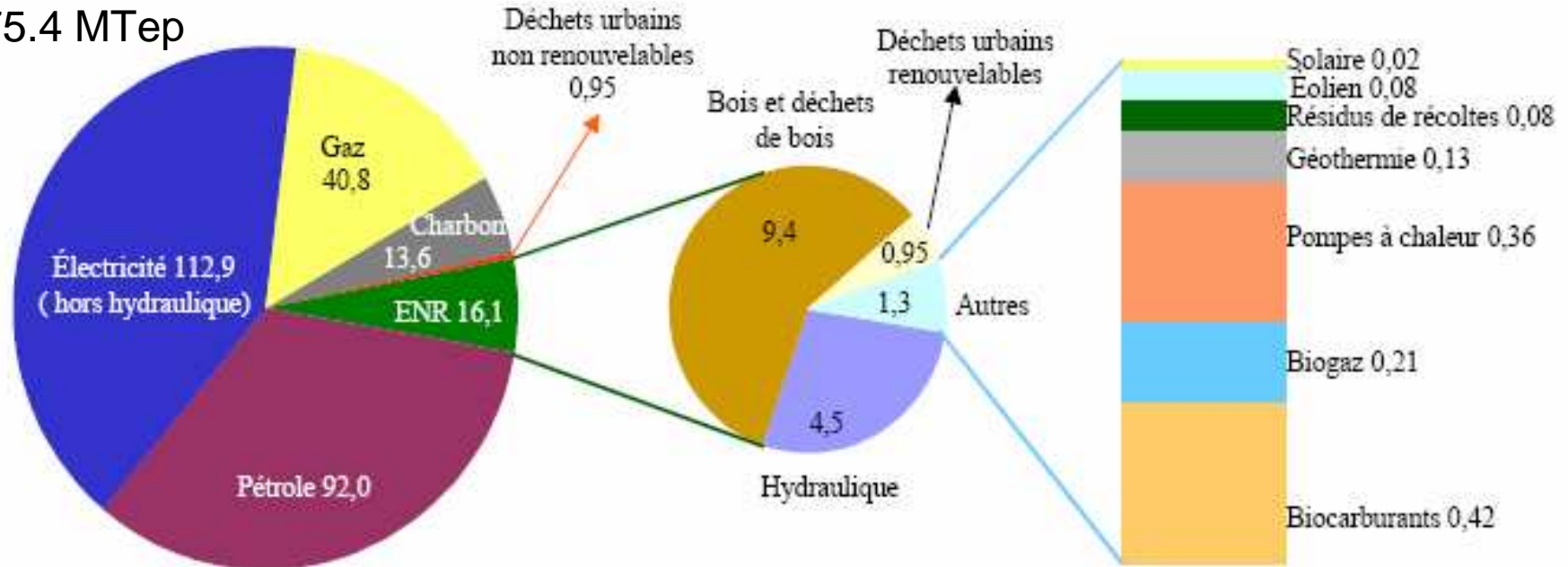
A French program law for orienting energetic policy called "POPE Law", instated the 13th of July 2005

- **RE : satisfy 10% of needs from RE resources in 2010**
- **RE-electricity : from 15% in 1997 to 21% in 2010**
[directive Electricité 27/09/2001]
- **RE-heat : increasing to 50 % in 2010**
- **Biofuels : to aim for 5.75 (and 7) % in 2010**
[directive Biocarburants 08/05/03]
- **Greenhouse gases : reducing emissions by 3%/yr in 2050**
[plan climat,04]
- **Energy autonomy : decreasing fossil fuel importation from 10 Mtep in 2010 and replacing with biomass for heat production & biofuels**



Waste & Biogas in final consumption of energy (2005, in Mtep)

275.4 MTEp

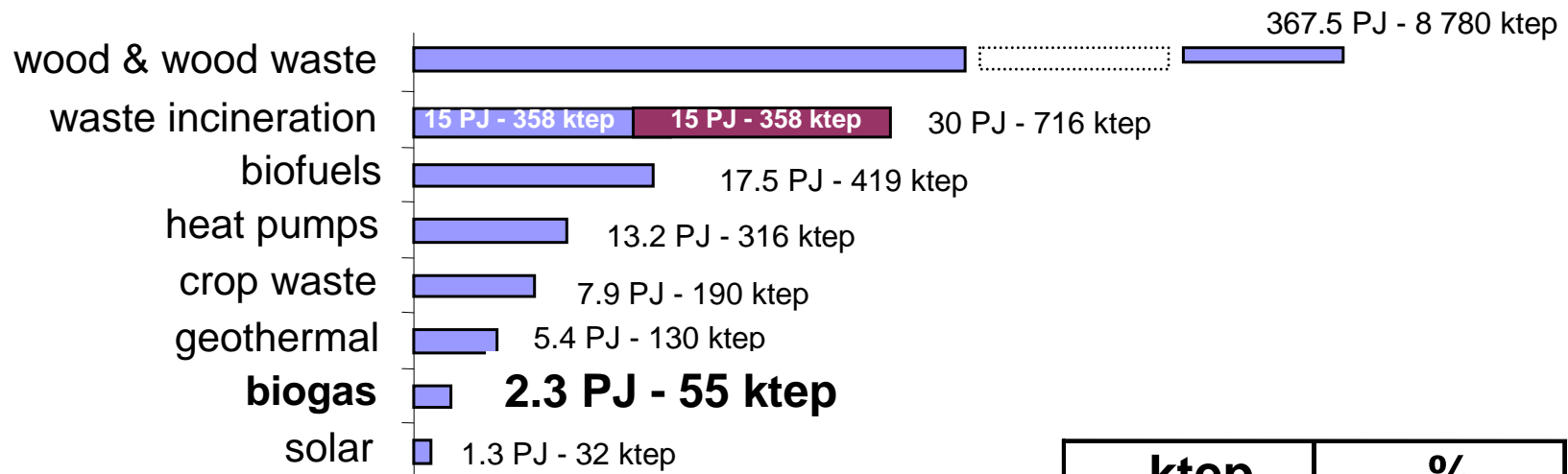


Biogas energetic valorisation : 8.8 TJ – 0.21 Mtep

- **1.3 % of RE (674 TJ – 16.1 Mtep)**
- **0.08 % of final consumption (11.5 PJ – 275.4 Mtep)**



Biogas in French RE-heat production (2004)



■ biomass fraction
■ non biomass fraction

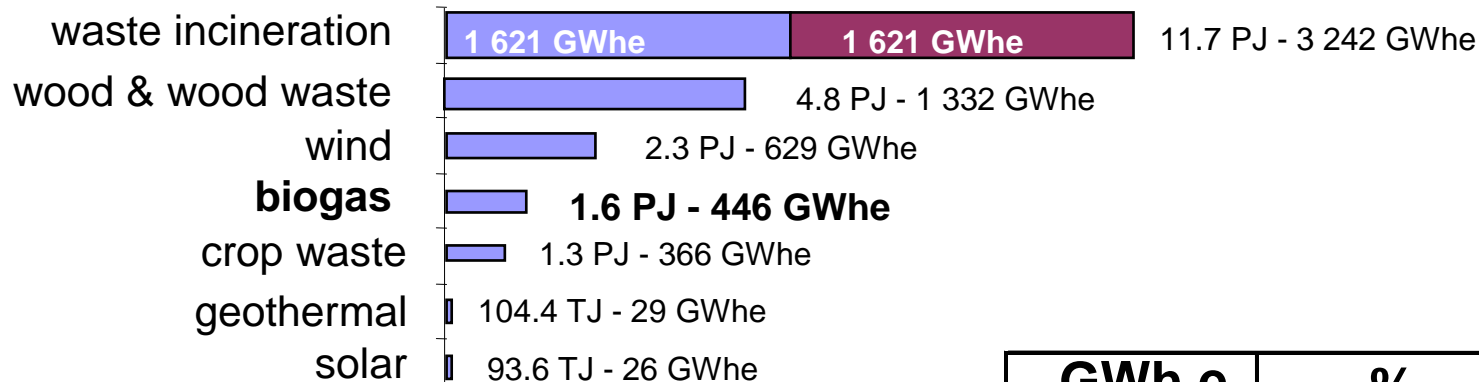
1 kTep = 41.86 TJ

	ktep	%
Landfill	6	11%
m. sludge	30	55%
Agriculture	2	4%
Industry	17	31%
Total	55	100%



Biogas in French RE-electricity production (2004)

excepting hydraulic production (242 PJ - 67 369 GWhe)



■ biomass fraction
■ non biomass fraction

1 GWh = 3.6 TJ

	GWh e	%
Landfill	380	85,2%
M. sludge	60	13,5%
Agriculture	2	0,4%
Industry	4	0,9%
Total	446	100%



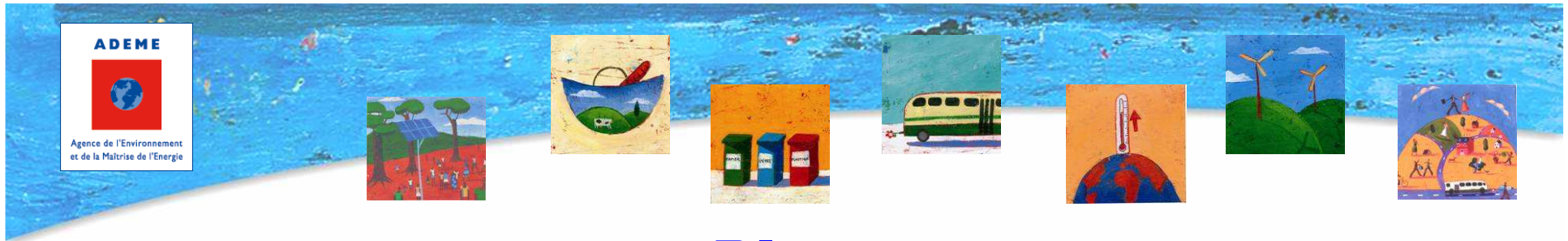
Objectives of electricity power installation [instated 07 /07/06]

RE	2010 (MWe)	2015 (MWe)
biogas	100	250
biomass	1000	2000
MSW	200	300
geothermal	90	200



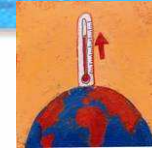
Potential objectives of heat production

RE	2005	2010	2015
geothermal	180 kTep	260 kTep	500 kTep
biogas	56 kTep	90 kTep	160 kTep
MSW	351 kTep	450 kTep	700 kTep
biomass	8,93 MTep	11,5 MTep	15,7 MTep
TOTAL	9,69 MTep	12,8 MTep	18,4 MTep



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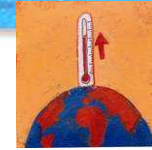
Device implementation

- **New conditions for buying RE electricity from biogas [instated 10/07/06]**
- **New call for tender from the National Committee of Electricity Regulation [response in July 07]**
- **New regulations :**
 - “white certificates”
 - PNAQ
 - Energy management (POPE law instated July 05)
 - “green certificates”

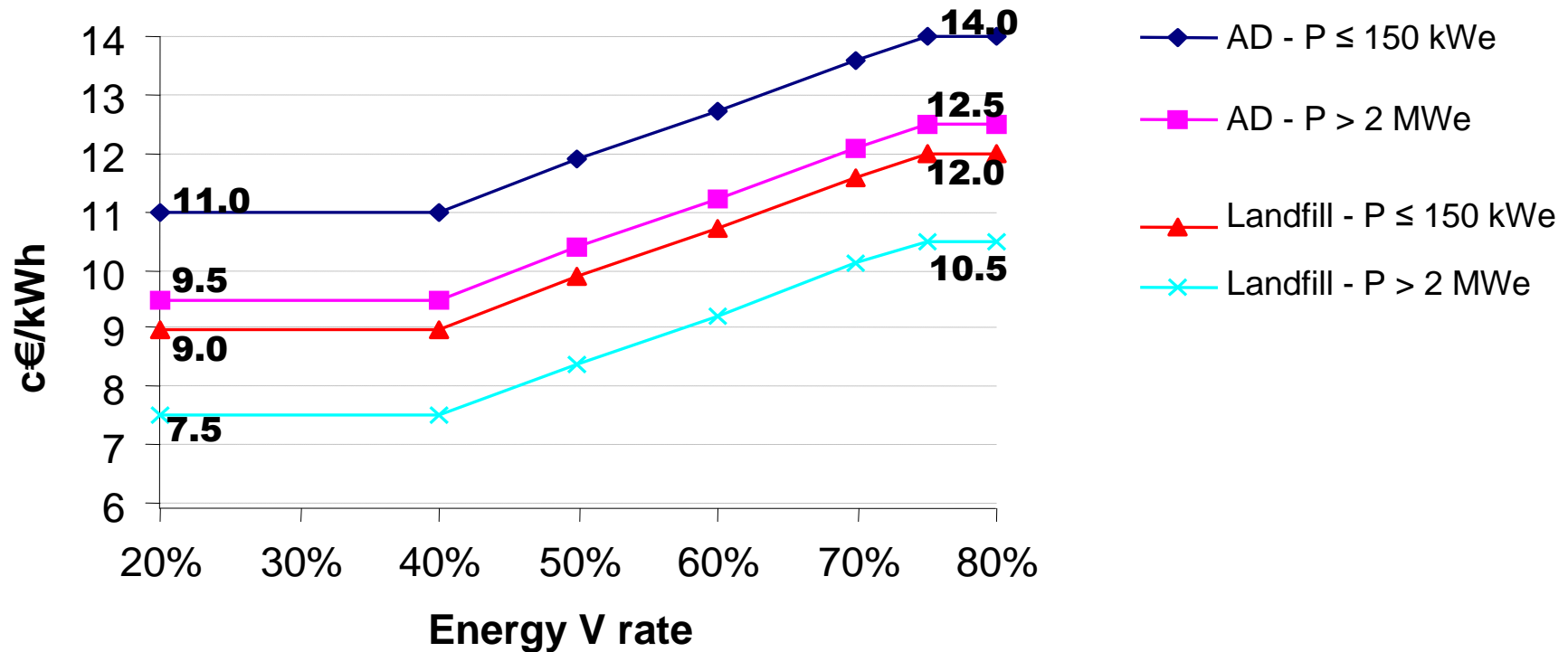


New fixed prices for buying RE electricity from biogas

- **Estimation of the over costs for energy valorization**
- **Base price**
 - Increasing price for low powers
 - AD bonus = +2 c€/kWhe
- **Combined heat and electricity production**
 - Bonus for combined heat and electricity production, from 0 to 3 c€/kWh_e
 - Depending of the V rate
 - $V = (\text{sell or consumed electricity \& heat}) / \text{primary energy entering in the energy production unit}$



New fixed prices for buying RE electricity from biogas (10/07/06)





Others buying prices for electricity from RE

- **wind [10/07/06] :**
 - on land : 8.2 c€/kWh lasting 10 yrs & 2.8 c€/kWh lasting 5 yrs
 - offshore : 13 c€/kWh lasting 10 yrs & from 3 to 13 c€/kWh lasting 10 yrs depending on locations
- **photovoltaic [10/07/06] :**
 - 30c€ to 40 c€/kWh depending on locations + bonus for good building integration 25c€/kWh
- **geothermal [10/07/06] :**
 - 12 c€/kWh + bonus from 0 to 3 c€/kWh
 - island territories : 10 c€/kWh + bonus from 0 to 3 c€/kWh
- **biomass except biogas [16/04/02] :**
 - 4.9 c€/kWh + bonus from 0 et 1.2 c€/kWh



New call for tender from the National Committee of Electricity Regulation

- **First call in 2003, December – aimed for 250 MWe**
 - Aim : 200 MWe for biomass and 50 MWe for biogas
 - Results biogas : **1 landfill gas of 16 MWe** (86 €/MWh)

- **Second call 2007, Aug. - aimed for 300 MWe**
 - 220 MWe for power units > 9MWe
 - 80 MWe for power units included between 5 and 9 MWe
 - **Starting before the 1st of July 09**
 - **Cogeneration unit only (with a V rate \geq 50%)**



New regulations

- **PNAQ Directive and C quotas for units P > 20 MW**
- **Domestic Projects (around 10 €/T CO₂ ?)**
 - Units P < 20 MW
 - Sectors concerned
 - **On-farm AD**
 - **New systems of landfill gas canalization**
 - **Production or saving of heat energy to decrease the consumption of fossil fuels in a new or existing unit from biogas or biomass**
- **White certificates : Energy management for house heat valorization (around 2c€/kWh ?)**



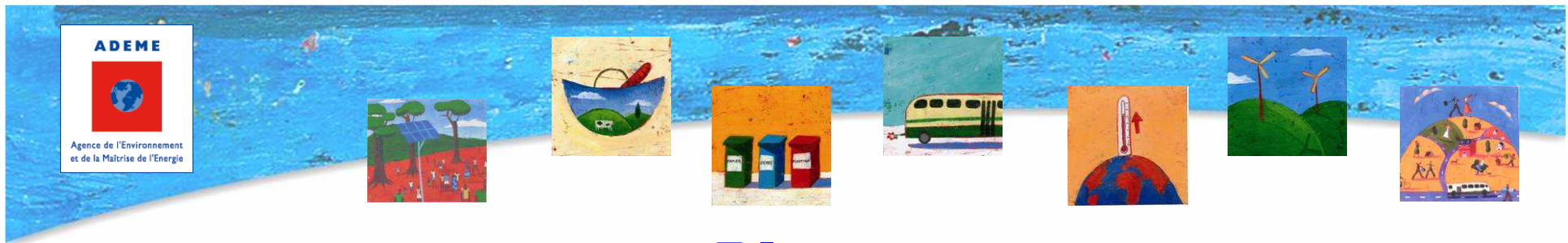
Aids of ADEME

- **Financial aid for decision-making**
- **Direct subsidies for project realization**
 - **Demonstration plants**
 - **Best conception practices ?**
 - To define
 - Maximizing energy valorization : $V \text{ rate} > 65 \%$?
 - Including energy crop in few quantity : 15 % of total dry matter ?
 - Including territorial waste management
 - Economic aspects



Conclusion (1/2)

- **New stakes**
- **Incentive prices for buying RE-electricity**
- **Opportunity for the new call for tender**
- **New experimental instruments**
 - **Green and White certificates**
 - **Domestic projects**
- **Governmental (and regional) and UE aids**



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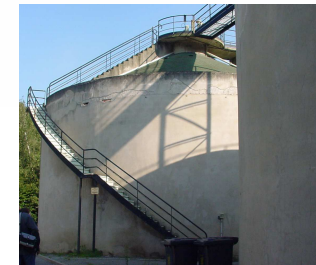


Food industry

- **103 industrial sites (127 digesters)**
- **Treatment capacity : 853 T DCO/d**
- **Energy Production (auto-consumption on site)**
 - Heat : 196 GWh
 - Electricity : 4 GWh
- **Tendency : + 3 to 5 units/yr [AND,04]**
- **Vital numbers**
 - Investment costs : 2,500 €/T DCO
 - Treatment costs : 170 €/T DCO
 - Company support :
 - France : Ondéo-Degrémont, OTV-Véolia, Proserpol, Naskéo
 - Other countries: Biothane, Biotim, ENTEC, GWE, LINDE KCA, Paques



Urban sludge



- **68 treatment units**
- **treatment capacity : 17.7 Mécq habitants**
- **Energy Production**
 - Heat : 345 GWh
 - Electricity : 45 GWh
- **Tendency : - 3 to 5 units/yr** [French Ministry for Energy, 2006]
- **Aim 2014 : + 60 units** [AND, 2004]
 - Electricity & Heat : + 4 to 19 MWe, + 28 to 140 GWhe, +111 to 223 GWth
- **Vital numbers**
 - Investment costs : 500 to 3,000 €/T de MS
 - Treatment costs : 300 to 400 €/T de MS
 - Company support : Degrémont-Lyonnaise des Eaux, OTV-Véolia, SOGEA-Vinci, Stéreau-SAUR-Bouygues



On-farm AD and co-digestion

- **5 on-farm units**
- **Many projects of AD co-digestion**
- **Treatment capacity (2006) : 27,000 T/an**
- **Energy Production**
 - Heat : 3300 MWh
 - Electricity : 1300 MWh

- **Tendency : + 10 on-farm units/yr**
 - electricity & Heat : : +7 MWe/an, + 22 GWhe/an, +22 GWhth/an

- **Vital numbers**
 - Investment costs : 3,000 to 8,000 €/kWe
 - Company support : from a few enterprises





MSW-AD



- **3 units : Amiens, Varennes-Jarcy , Le Robert (Martinique, besides sea)**
- **Treatment capacity : 195 000 T/an - (161 000 T treated)**
- **Energy Production :**
 - **Heat : 32 000 MWh**
 - **Electricity (aim) : 30 500 MWh**
- **Tendency 2007-2012 : + 2 units/yr**
- **2012 : + 15 units of which 6 will start up between 2007 and 2009**
1,366 Mt in total capacity (258 000 T/yr of biowaste)
Electricity : 150 GWh (20 MWe)
Heat/Biogas as vehicle fuel : 250 GWh
- **Vital numbers :**
 - **Investment costs : 600 € HT/T (ε: 7,000 – 9,000 €/kWe)**
 - **Treatment costs : 80 €/T**
 - **Company support : Vinci, Valorga, LINDE KCA - OWS, etc.**



Landfill Biogas

- **26 biogas valorization units (2003)**
- **Energy Production :**
 - **Heat : 69 GWh**
 - **Electricity : 350 GWh**
- **Tendency before new price : stagnation**
- **Aim 2014 - electricity : 800 GWh (P : 100 MWe)**
- **Vital numbers**
 - **Investment costs : 1,320 – 1,700 €/kWe**
depending on power



Recent studies of ADEME (1/2)

- **R & D studies to increase knowledge about AD technologies**
- **R & D studies to increase knowledge about AD and aerobic mixed technologies**
- **Economical & technical study on AD in UE for little and large scale units (2003 & 2004)**
- **Potential market of AD in France (2004)**
- **Overview on bacterial components in biogas (2005)**



Current studies of ADEME (2/2)

- **LCA for biogas as vehicle fuel**
- **Economical & technical study on biogas as vehicle fuel**
- **UE Biogasmax Project (Lille city)**
- **Biogas upgrading : expertise by the French Agency for Work, Health and Environment (AFFSET)**
 - Missing a biogas screening of xenobiotic and bacterial components
- **Siloxanes : reference methodology for analysis in biogas and treatment systems + test (Veolia Co.)**
- **Energy crops in France : interest of LCA ?**



CONCLUSION (2/2)

- **AD : Important sector which should not be neglected that permits :**
 - Energy substitution
 - Decreasing greenhouse gases emissions

- **In France : Biogas & AD, 2 news sectors,**
 - Building knowledge
 - Developing know-how

- **Incentives in building**