



## Seminar on the Production and Use of Biogas

### Production and Use of Biogas: EU Regulations and Research

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# Contents of Presentation

- Outline of EU Policies & Targets Related to Renewable Energy
- EU Biogas Production Data and Targets for the Future
- A Selection of EU IEA-Member Country Data & Scope of Legislation
- EU Research Projects
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- Useful Contact Details and References



## EU Policies and Targets: Energy (1)

- **RES White paper 1997:** increase share of RES from 6% to 12% of gross consumption by 2010
- **Action plan for Energy Efficiency target:** to reduce energy intensity by a further 1 % point per year until 2010
- **Comply with EU commitments under the 1997 Kyoto Protocol** on reducing greenhouse gas emissions
- Johannesburg “**coalition of the willing**” to work to increase the use of RES using targets and timetables



## EU Policies and Targets: Energy (2)

- **Directive 2001/77/EC of 27.09.01 on RES-e** : to establish a framework to increase the share of green electricity from 14% to 22% of gross electricity consumption by 2010
- **Directive 2002/91/EC of 04.01.03 on the energy performances of buildings**: saving potential of 22%.
- **Directive 2003/30/EC of 08.05.2003 on the promotion of liquid biofuels for transport**: targets: 2% by 2005; 5.75% by 2010
- **Directive 2004/8/EC on cogeneration of heat and power.**



## EU Policies and Targets: Energy (3)

- **Waste Incineration (2000/76/EC)**  
Limits on emissions from thermal treatment of Waste materials (effective 12/2005)
- **Landfill (1999/31/EC)**  
Reduced landfilling of biodegradable component of waste by 65% by 2016
- **Integrated Pollution Prevention and Control (96/61/EC):** special provision for RES



## EU Policies and Targets: Biogas

There is no particular policy on biogas, it is a component of the general bioenergy "cocktail" ...so it is covered by all policies related to RES and bioenergy.

Landfill gas is covered by the policies on waste management but its applications falls under the energy policies.



# The RES Directives & Energy from Waste

**Waste is a valuable resource!**

- The Biodegradable fraction of MSW is a RES.  
(e.g. classified as 50% in the NL)
- Energy and fuels from waste is thus covered by the Directives.

- One of the main problems is how to determine the biodegradable fraction of waste streams ?
- Need for Standards??

Kaiserslautern, DE





# EU Biogas Production Data and Targets for the Future





## Sources of European Biogas Production

Source	Installations	Production Share
Landfill	450	38%
Urban Sewage	1600-1700	33%
Industrial Sewage	420	24%
Agricultural Biogas	1600-1700	2%
Methanisation of Municipal Waste	65	2%
Collective Co-digestion	55	1%
<b>Total</b>	<b>~ 4250</b>	<b>100%</b>



## Crude Biogas Production (Units = ktoe)

Country	2002	2003*
UK	1076	1151
Germany	659	685
France	302	322
Spain	168	257
Italy	155	155
Netherlands	149	154
Sweden	147	147
Portugal	76	76
Denmark	62	62
Austria	59	64
Belgium	56	56
Greece	42	42
Ireland	28	28
Finland	18	18
Luxemburg	2	2
<b>Total</b>	<b>2999</b>	<b>3219</b>

\* estimated



# Energy Production from Biogas (Units = ktoe)

	2002			2003		
Land	Electricity	Heat	Total	Electricity	Heat	Total
Germany	251	168	419	258	168	426
UK	265	55	320	265	55	320
France	34	58	92	36	58	94
Netherlands	26	37	63	27	37	64
Italy	81	na	81	81	na	81
Spain	33	11	44	65	28	93
Denmark	18	19	36	18	19	37
Sweden	10	24	34	10	24	34
Austria	18	6	24	19	8	27
Belgium	19	5	24	19	5	24
Ireland	6	3	9	6	3	9
Finland	2	3	5	2	3	5
Greece	0	6	6	0	6	6
Luxemburg	1	2	3	1	2	3
Portugal	1	1	2	1	1	2
<b>TOTAL</b>	<b>766</b>	<b>397</b>	<b>1163</b>	<b>809</b>	<b>417</b>	<b>1226</b>

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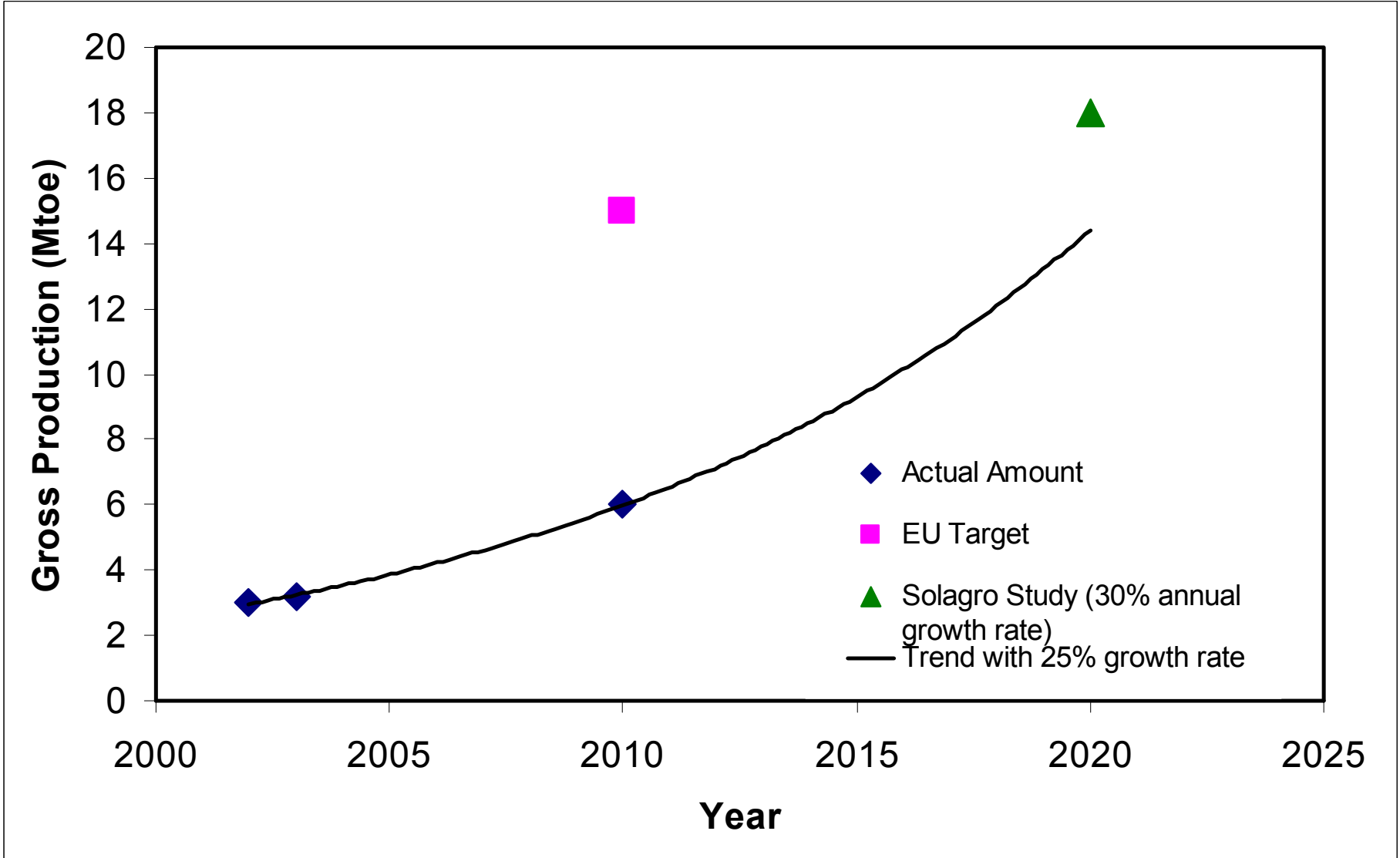
## Biogas Production Potential by the Year 2020 (Units = ktoe)

Country	Potential in 2020
France	3682
Germany	3419
UK	2271
Italy	1626
Spain	1578
Netherlands	1172
Ireland	1028
Belgium	765
Denmark	765
Austria	526
Sweden	383
Portugal	311
Finland	263
Greece	167
Luxemburg	31
<b>Total</b>	<b>17987</b>



# Trends in Growth of Biogas Production

Joint Research Centre





## A Selection of EU IEA-Member Country Data & Scope of Legislation



## Individual Country Positions: Netherlands

### Output: 2002

Gross production - 149 ktoe (inclusive 14 ktoe flared) (data from *NOVEM*)

→  
37 ktoe heat  
304 GWh electricity (= 27 ktoe)  
38 million m<sup>3</sup> injected into natural gas network

### Legislation

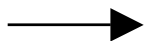
- Manure Regulation (1977) - list of types of manure
  - restricted allowance for co-digestion
- Amendment of 1977 Regulation (2004)
  - digestate from co-digestion allowed to be used or sold for land improvement
- Target of 10% for renewable energy in 2010: 7% of electricity from renewable fuel (13% electricity now consumed is green, but only 3.3% generated in NL - expected that NL will purchase "green certificates" from outside EU)
- Green electricity free from ECO-tax applied to fossil fuels
- Liberalisation of energy market from 01.07.2004



## Individual Country Positions: Sweden (1)

### Output: 2003

Gross production - 147 ktoe (data from *STEM*)



?? ktoe heat

120 GWh electricity (= 10.3ktoe)

?? million m<sup>3</sup> injected into natural gas network

110 GWh (9.5 ktoe) vehicle fuel

### Policy/Legislation

- Targets: 7.4% renewable electricity (2003); 16.9% (2010)
- Biogas for heat production is not taxed
- Green certificates for electricity production (from 2004): 27 €/MWh (market price for electricity ~ 20 €/MWh)
- Biogas for vehicles not taxed; natural gas is taxed - difference is equal to upgrading cost of biogas to pipeline quality
- For EC Biofuels Directive, approximately 2/3 supplied by ethanol, 1/3 biogas (mainly for buses and local distribution); on target for 3% in 2005, but growth rate too low to meet 5.75% by 2010





## Individual Country Positions: Sweden (2)

### Effects of Policy

Market price for biogas as transport fuel ~ 60 €/MWh (attractive !!)  
Biogas mainly from sewage sludge, but large interest in plants for digestion of MSW (due to landfill restrictions)  
Interest in agricultural biogas limited due to low electricity price and uneven demand for heat on farms - but green certificate system could change this situation.

### Research

**Government-funded, 3-year project (1.65 MEuro) started in 2004:**

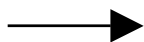
Objective: improvement in cooperation between regions with a view to facilitating more widespread use of biogas as a vehicle fuel.  
The Swedish Association for Biogas (SBGF) will administer the project.



## Individual Country Positions: Austria

### Output: 2003

Gross production - 64 ktoe (data from *EurObserver*)



8 ktoe heat  
221 GWh electricity ( = 19 ktoe)

### Legislation

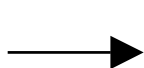
- Eco-electricity law (BGB1 I 149/2002): defines conditions, inputs etc.
- Regulation (BGB1 II 508/2002): sets prices for eco-electricity from biogas plants for export to grid  
Plants must be commissioned by 31.12.2004 and in operation by 31.12.2006  
Prices guaranteed for accepted plants for 13 years (~ 120 plants in operation; ~40 plants under construction)
- Biogas carries ECO-label, but digestate disposal is a problem



## Individual Country Positions: UK

### Output: 2002

Gross production - 1076 ktoe (data from *DTI*)



?? ktoe heat

3076 GWh electricity ( = 265 ktoe)

Most electricity production from landfill (2679 GWh)

### Legislation

- The Renewables Obligation Order (SI 2002/914: 01.04.2002)  
Covering biogas (landfill and sewage), wind, geothermal, hydro, biomass (including energy crops and co-firing), tidal, wave, PV, ...  
Target: to provide 10% of UK's electricity from renewables by 2010 (this means building 1.25 GW extra capacity/year !!)  
Control: by "Renewable Obligation Certificates" (ROCs) which can be traded  
Possible to "buy out" obligation at current price of £30.51 per MW/h.
- No tax advantage for biogas over NG, but 25% investment support for biogas production/recovery plants



## Individual Country Positions: Finland

### Output: 2002

Gross production - 18 ktoe (No expansion forecast for 2003)

→ 3 ktoe heat  
23.3 GWh electricity (= 2 ktoe)

### Legislation

- National Climate Change Strategy (2001)
- Action Plan for Renewable Energy Sources (1999) plays important role
  - Biogas production supported by grants for investment + tax relief for electricity
  - Small projects (0.2 - 2M €) get 20% of investment costs: > € 2M grants and projects employing new technology get up to 40%
  - New tax system (2003) provides support of 0.42 € cents/kWh for electricity to grid from plant with capacity >2 MVA (<2 MVA, no support)
  - Access to grid granted by Electricity Market Law No 386/1995
  - Fuel Tax Law No. 1280/2003: biogas for transport exempt from taxation.



# EU Research Projects



## RESEARCH at EU LEVEL

### On-going projects (1):

- AMONCO (Advanced Prediction, Monitoring and Controlling of Anaerobic Digestion Process Behaviour Towards Biogas Usage in Fuel Cells)
  - identify harmful species in raw gas
  - feedstock composition control (primary measure)
  - advanced process control to maximise CH<sub>4</sub> production
  - cost effective gas cleaning to FC specification
  - assessment of effect of biogas in FC (single cell tests)
  - implementation strategy

Impact: Overcome problems with contaminants in biogas used for FC/CHP

Contact Point : Profactor, Austria  
Reference: ENK6-CT-2001-00518



## RESEARCH at EU LEVEL

### On-going projects (2):

- 3A-BIOGAS (Three-Step Fermentation of Solid State Biowaste for Biogas Production and Sanitation)
  - assessment of end-user requirements
  - optimise 3A (aerobic + anaerobic + aerobic) process at prototype scale
  - series production of modular batch system for dry fermentation with percolation
  - optimised process control system
  - socio-economic assessment
  - preparation for exploitation

Impact: Availability of digestion process to complement common wet processes, particularly in agriculture

Contact Point : Muller Abfallprojekte, Austria

Reference: ENK6-CT-2002-30026



## RESEARCH at EU LEVEL

### On-going projects (3):

- DIPROWASTE (Enhanced Production of Methane from Anaerobic Digestion with Pre-processed Solid Waste for Renewable Energy)
  - evaluation of waste pretreatment methods
  - assessment of anaerobic digestion of selected wastes
  - quality evaluation of digester products
  - establish digester design criteria
  - system evaluation for large-scale plant
  - economic assessment

Impact: Demonstrated cost effective pre-treatments for enhanced biogas recovery

Contact Point: ABIRER Systems, Germany  
Reference: CRAFT-71485-1999





## RESEARCH at EU LEVEL

### On-going projects (4):

- ENERGATTERT (Agricultural Biogas as Green Energy Supply)
  - evaluation of other, existing installation
  - assessment of different waste mixes for effective digestion
  - use of demonstration plant on 350-unit bovine farm
  - study and optimisation of biomethanisation process
  - assessment of biogas production
  - dissemination and public awareness

Impact: Enabling biomethanisation to be properly assessed as means for energy recovery

Contact Point: Emmanuel Hannick, Belgium

Reference: NNE5-227-2001



## RESEARCH at EU LEVEL

### On-going projects (5):

- EROB (Development of an Improved Energy Recovery of Biogas by Cooling and Removal of Harmful Substances)
  - analysis of cleaning efficiencies of existing systems
  - verification of cleaning at landfill site
  - design of standard modular cleaning system
  - manufacture, installation and commissioning at landfill site
  - process reliability assessment and plant optimisation
  - Dissemination of results and launch of system on the market

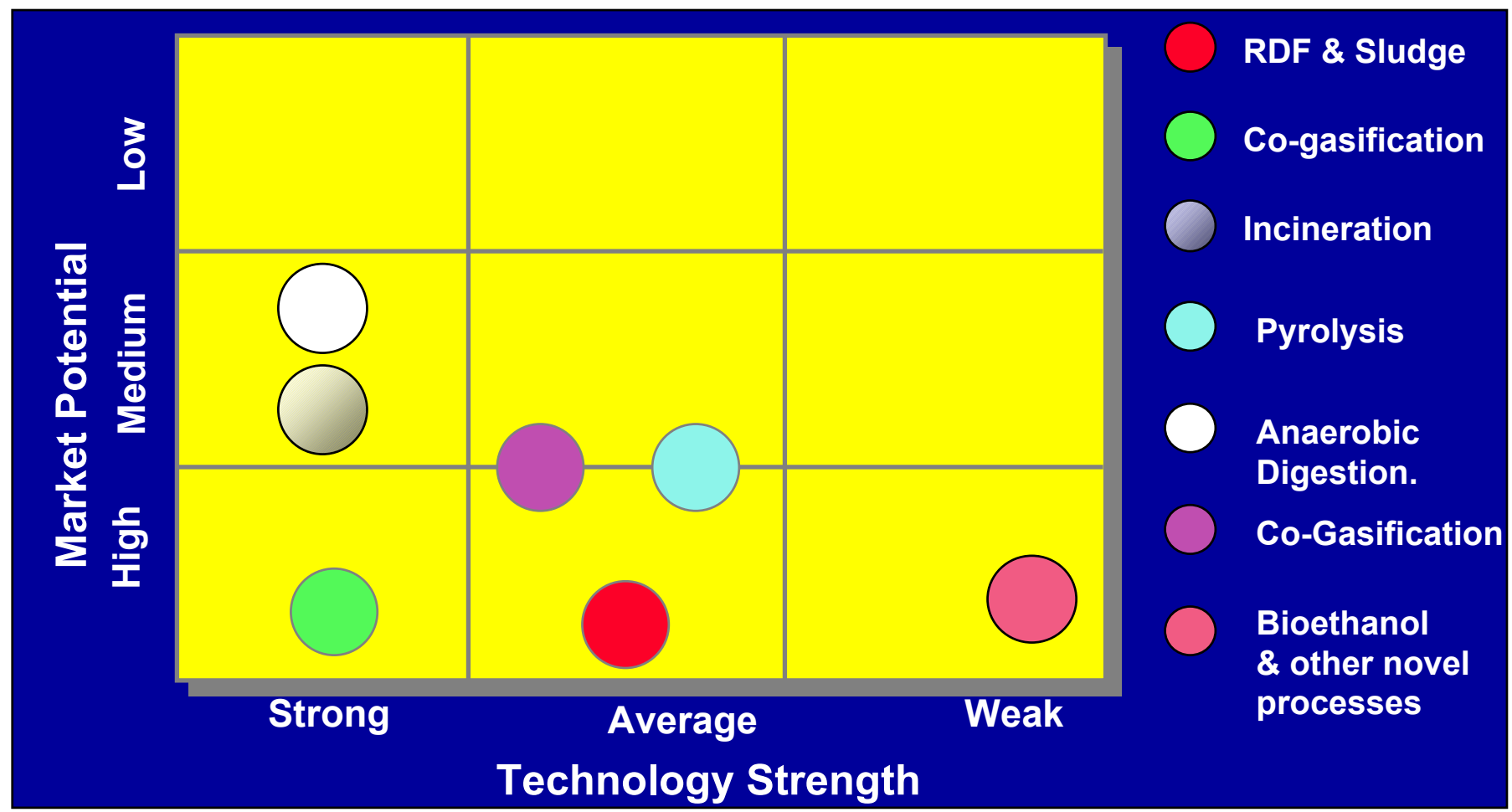
Impact: Increased exploitation of landfill gas for energy recovery

Contact Point: Pro2 Anlagentechnik GmbH, Germany

Reference: ENK5-CT-2000-30004

# STATUS OF PROCESSES & APPLICATIONS

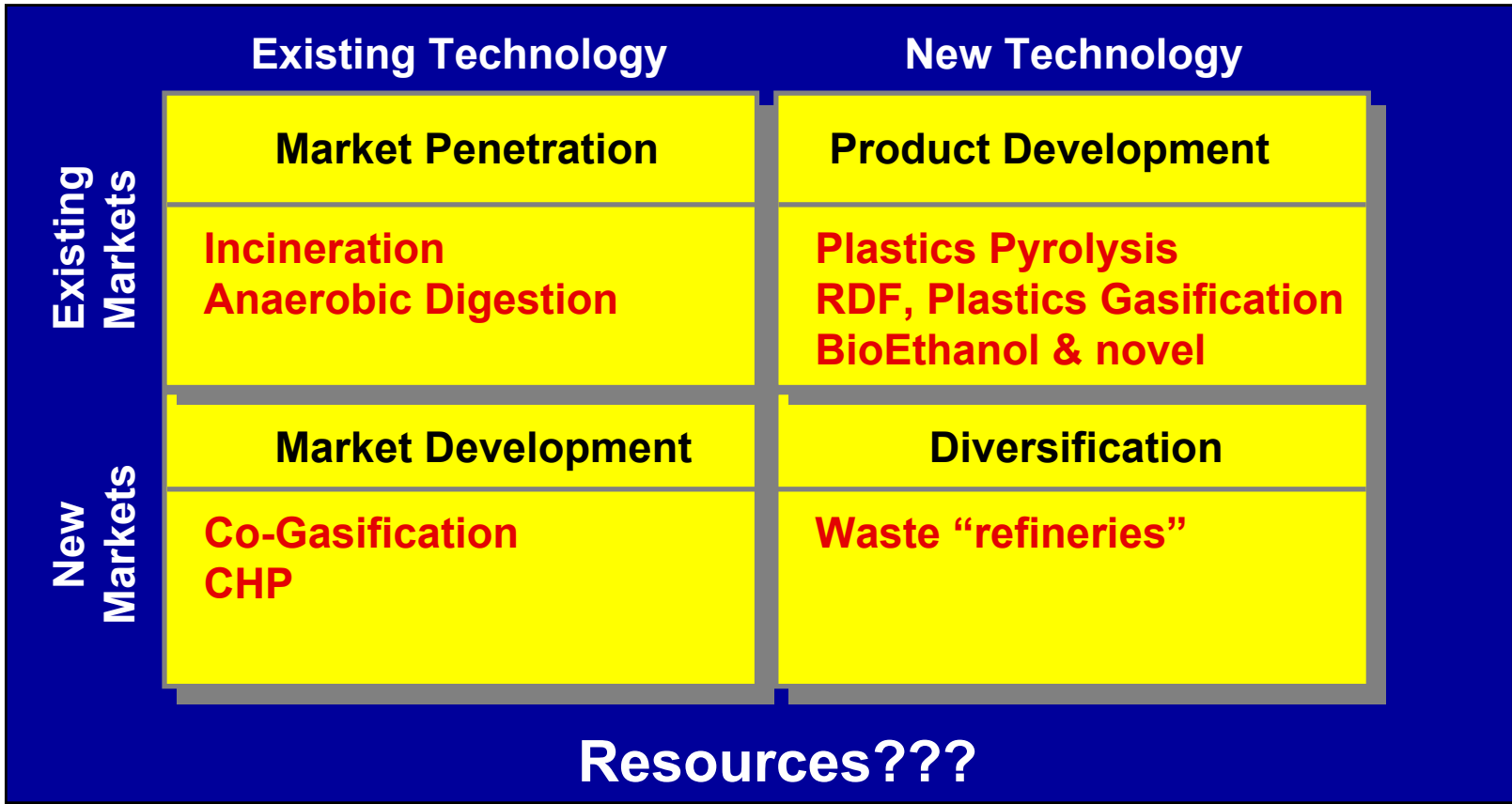
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# MARKET OPPORTUNITIES



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## A Summary of FP6 Funding



# 6th Framework Programme

## Sustainable development, global change and ecosystems

- Sustainable energy systems (810 M€)
  - *Short and medium term impact (DG TREN)*
  - *Medium and long term impact (DG RTD)*
- Sustainable surface transport (610 M€)
- Global change and ecosystems (700 M€)





# Intelligent Energy Europe

Total budget 215 M€

## Vertical key actions: to tackle non-technological barriers

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<b>SAVE</b>	<b>ALTENER</b>	<b>STEER</b>	<b>COOPENER</b>
<ul style="list-style-type: none"> <li>▪ Multiplying success in buildings</li> <li>▪ Retrofitting of social houses</li> <li>▪ Innovative approaches in industry</li> <li>▪ Transforming the market: Energy Efficient Equipment and Products</li> </ul>	<ul style="list-style-type: none"> <li>▪ RES-Electricity</li> <li>▪ RES-Heat</li> <li>▪ Small Scale RES Applications</li> <li>▪ Alternative fuels and vehicles</li> </ul>	<ul style="list-style-type: none"> <li>▪ Alternative fuels and vehicles</li> <li>▪ Policy measures for and efficient use of energy in transport</li> <li>▪ Strengthening the knowledge of local management agencies in the transport field</li> </ul>	<ul style="list-style-type: none"> <li>▪ Create an enabling policy and legislative environment for energy services in developing countries</li> <li>▪ Strengthen local energy expertise and build human capital in the developing countries</li> </ul>

Slide Courtesy of K.Maniatis: EC-DG TREN



## Useful Contact Details and References

- **CORDIS:**  
<http://www.cordis.lu/rtd2002/>
- **EUROPA:**  
[http://www.europa.eu.int/comm/dgs/research/index\\_en.html](http://www.europa.eu.int/comm/dgs/research/index_en.html)  
([http://europa.eu.int/comm/energy/res/documents/country\\_profiles/2004\\_0547\\_sec\\_country\\_profiles\\_en.pdf](http://europa.eu.int/comm/energy/res/documents/country_profiles/2004_0547_sec_country_profiles_en.pdf) for “Country Profiles”)
- **Energy research web site:**  
[http://europa.eu.int/comm/research/energy/index\\_en.html](http://europa.eu.int/comm/research/energy/index_en.html)
- **DG Energy and Transport web site:**  
[http://europa.eu.int/comm/energy/index\\_en.html](http://europa.eu.int/comm/energy/index_en.html)

• **Contact Point for Waste and Biomass Related Activities at JRC-Institute for Energy:** <http://ie.jrc.cec.eu.int/>

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Thank you