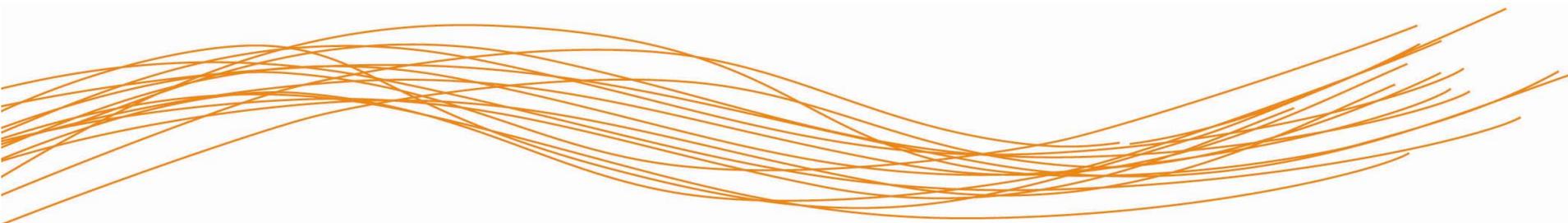


EC Research Priorities in the Area of Bio-based Products



Laurent Bochereau
Head of Science, Technology and Education Section
European Commission Delegation to the US

Minneapolis, 20 August 2007





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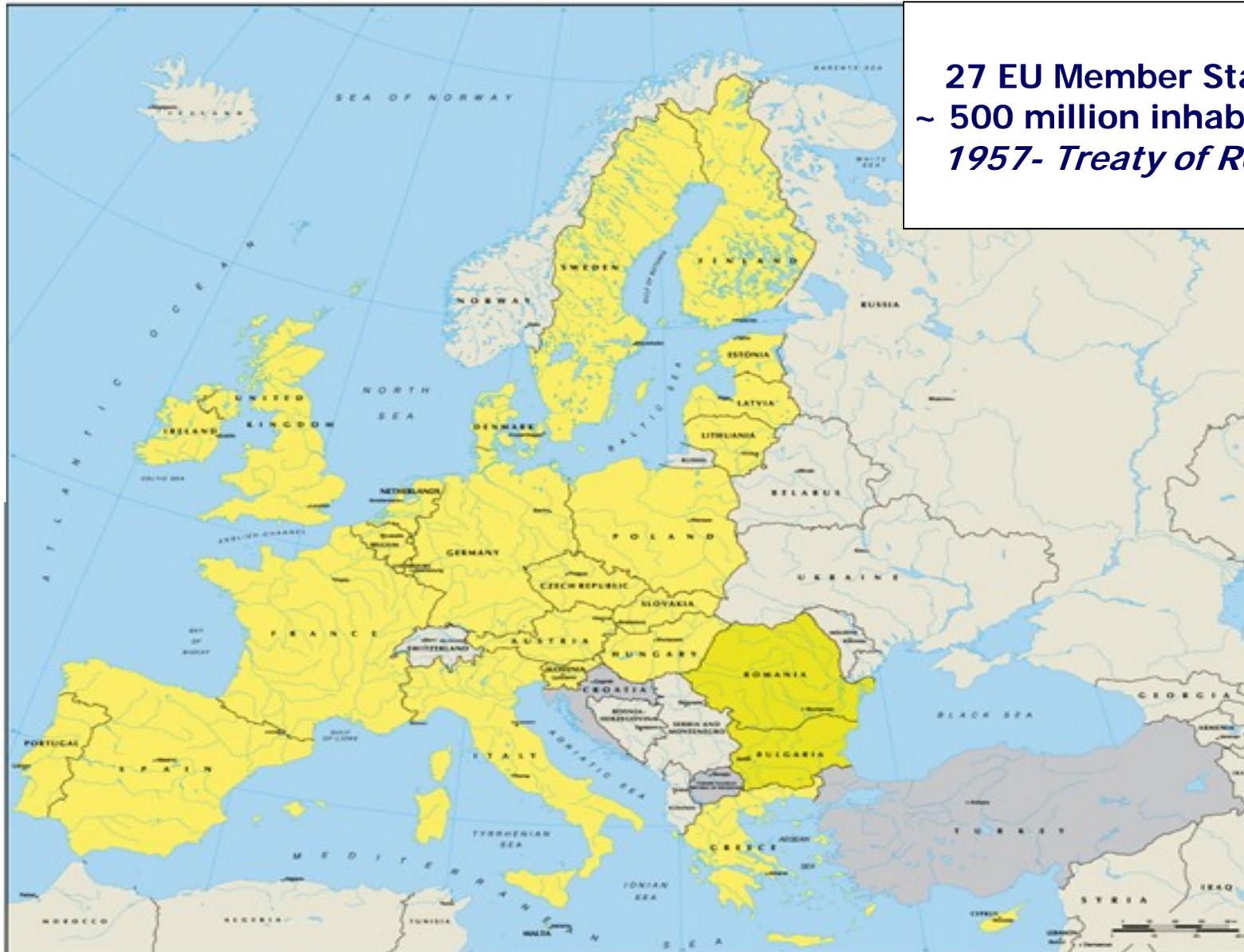
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Outline

- | **The European Knowledge-based Bioeconomy**
- | **Recent EC Policy Developments**
- | **EC Research Priorities within FP7 (2007-2013)**
- | **EC-US Research Cooperation Initiatives**
- | **Challenges and Open Questions**



THE EUROPEAN UNION



27 EU Member States
~ 500 million inhabitants
1957- *Treaty of Rome*





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The European Union

- **The first economic institutions were based on energy (such as coal and nuclear), industry (such as steel) and agriculture.**
- **Today, progress in Europe depends on knowledge and innovation (the Lisbon process) including the bio-sciences.**
- **The concept of an European Knowledge Based Bio-Economy is emerging.**





What is the Knowledge-Based Bio-Economy?

The knowledge base: Advances in Life Sciences and Biotechnologies in convergence with other technologies such as nanotechnologies, chemistry, information technologies...

The Bio-Economy: Includes all industries and economic sectors that produce, manage or otherwise make use of biological resources including bio-waste.

The European bio-economy has an approximate market size of over €1.5 trillion, employing more than 22 million people

Sector	Annual turn-over (billion €)	Employment (million)	Data source
Food	800	4.1	CIAA
Agriculture	210	15	COPA-COGECA
Paper/Pulp	400	0.3 direct (4 ind.)	CEPI
Forestry/Wood industry	150	2.7	CEI-BOIS
Industrial Biotech.	50 (est.)		McKinsey*
Total	1610	22.1	

* estimated to be 10 % of sales within the chemical industry accounting for €125 million by 2010



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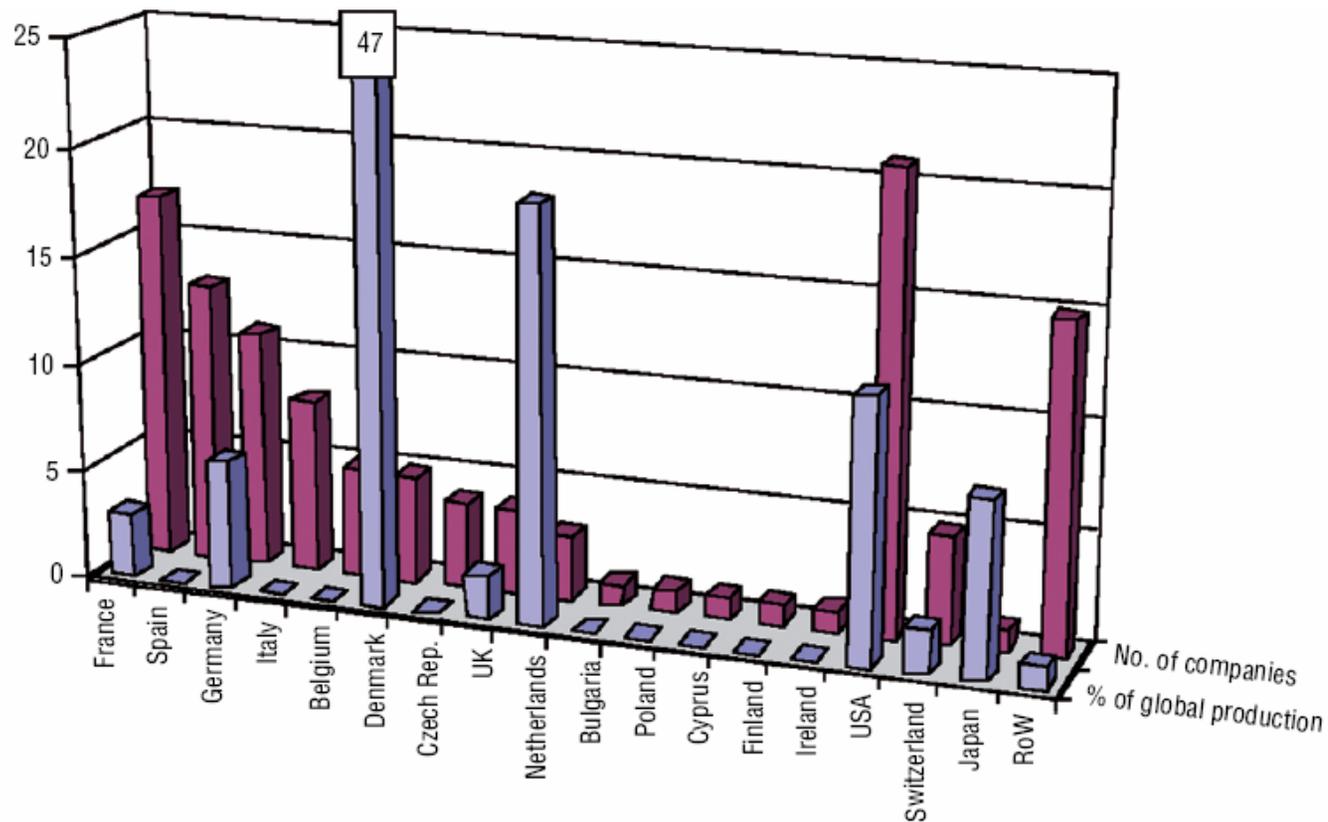
What are the drivers of a Knowledge-Based Bio-Economy?

- Improved health
 - Food with improved nutritional value, increased food safety, new treatments, diagnosis and vaccines against human and animal diseases , improved animal feeds...
- Sustainability and a cleaner environment
 - Energy and water saving production and processes in agriculture and industry ; decrease dependency of fossil resources; reduced production of green-house gasses
- Support to rural development
 - Use of “set-aside” land; cultivation of new crops; decentralised production facilities
- Increased industrial competitiveness through innovative eco-efficient bio-based products





64% of the world's enzyme –producing companies are located in Europe. They produce about 75% of the global production of enzymes.



RoW: rest of the world

Source: ETEPS.³³⁸



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The European Knowledge-Based Bio-Economy and globalisation.

Old and new competitors are moving forward:

- US invest 3 times more than Europe in Biotech R&D
- BP will invest \$500m in a Energy Biosciences Institute at Uni. Of California over the next 10 years.
- China invested between 2001-2005 12 billion Yuan (1.1 billion Euro) in biotech R&D- and is expected to double the investment within the next 5 years.
- Brazilian government announced in 2006 a R\$7b11 (2.6billion Euro) Investments program to foster over the next 10 years the development of biotechnology.
- India tripled its research budget for biotech from the period 1997-2002 to 2002-2007.





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Mid term review of the European Strategy on Life Sciences and Biotechnology :

Actions promoting research and market development for a Knowledge-Based Bio-Economy

- **Generating knowledge** under the 7th Framework Programme (2007-2013) from basic research to applied research, research infrastructures, training and specific support to SMEs.
- **Mobilise public and private research funding** and reinforce coordination through Technology Platforms (eg biofuels)
- **Launching of Joint Technology Initiatives** among others on Innovative Medicine.
- **Promote pilot plants** to demonstrate the potential of bio-based applications
- **Stimulate lead markets initiatives** for eco-efficient bio-based products

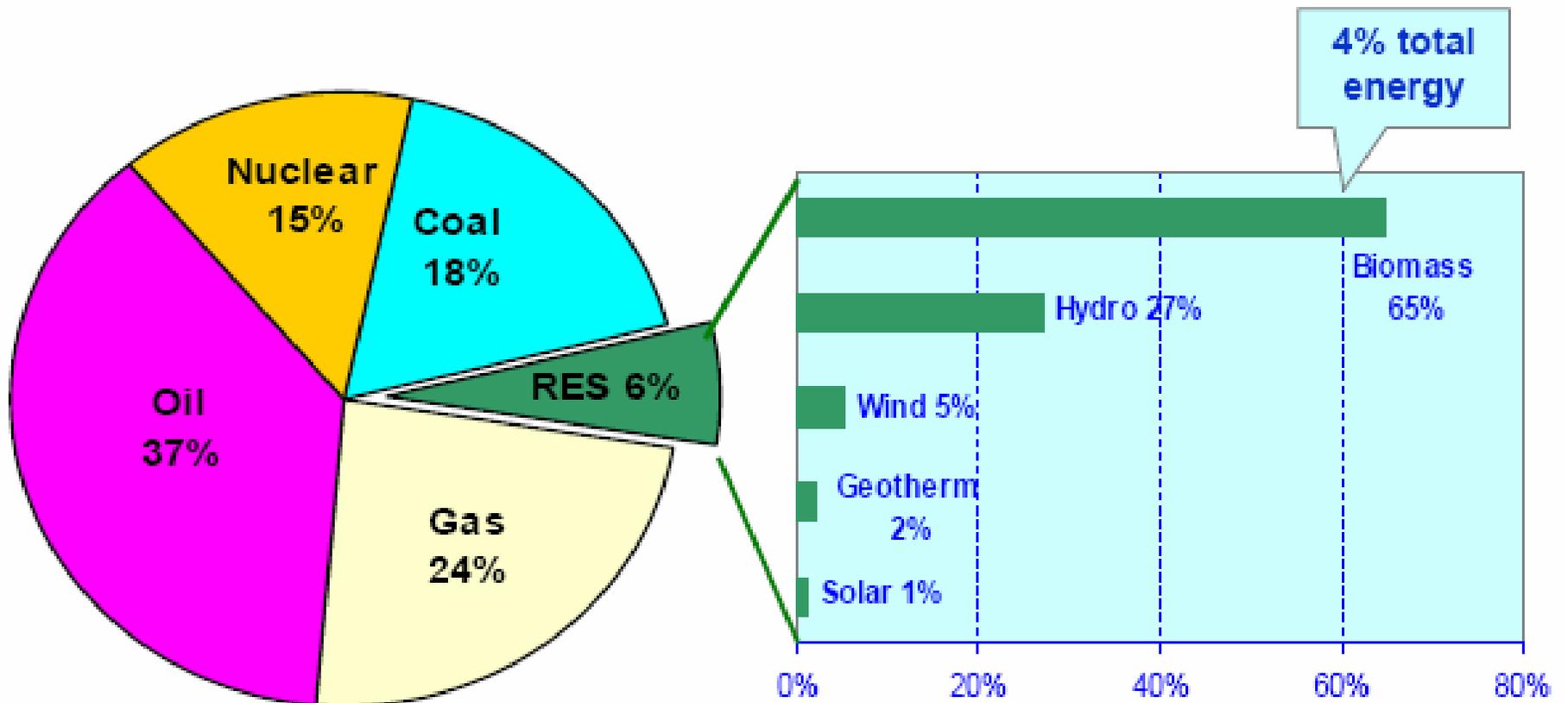




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Breakdown of EU-25 Gross Energy Consumption





2007 EU Renewable Energy Roadmap

- | **Part of integrated climate and energy policy**
- | **Renewable energy**: a binding target of **20%** share in the EU energy consumption by **2020**
- | **Biofuels**: a binding minimum target of **10%** of all road transport fuels by **2020**
- | **New EU legislation on the use of renewable energy in heating and cooling**
- | **National Action Plans** on how to achieve the targets (energy mix, tax reduction/exemption, ...)



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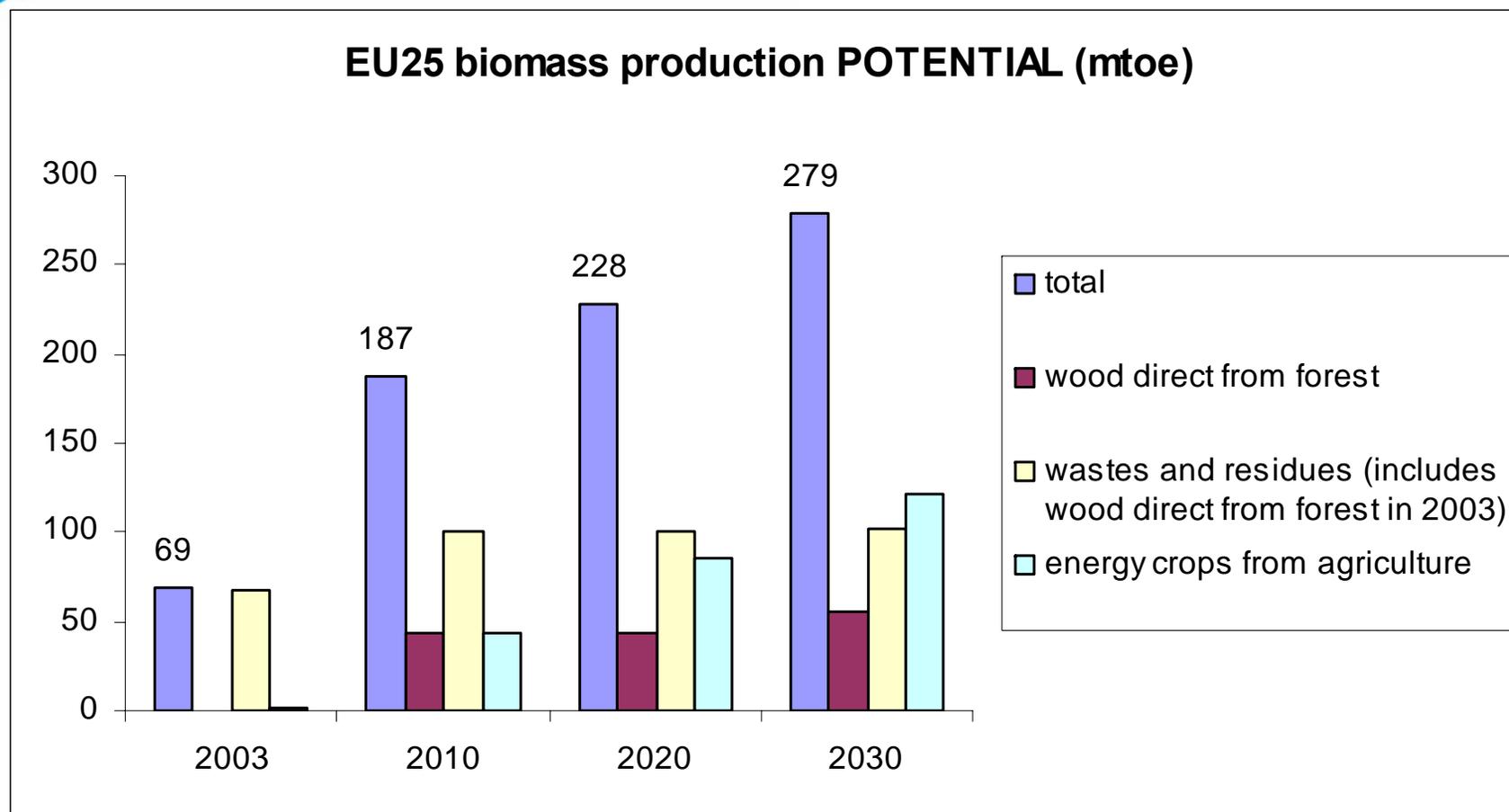
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Support from Common Agricultural Policy

- | **Decoupled income support**
 - Production decisions based on market signals
- | **Set-aside obligation**
 - Possibility to grow non-food crops
- | **Energy crops premium (45 €/ha)**
- | **Rural development (2007-2013)**
 - Measures supporting investments, environmental objectives and diversification of rural economies e.g. biofuels processing capacity on/near the farm



EU-25 biomass production potential



Sources: Eurostat (2003) / European Environmental Agency (projections)



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Impact on EU agriculture of the 10% biofuel target

Scenario with 30% of second generation in 2020:

- EU production UE: 80%; import: 20%
- Cereal prices: increase 3-6% ; Oilseeds prices: increase 8-15%
- About 15% of EU-27 arable land
- Slower decline of agricultural employment until 2020
- Less land abandonment in marginal regions
- Positive impact on farm income





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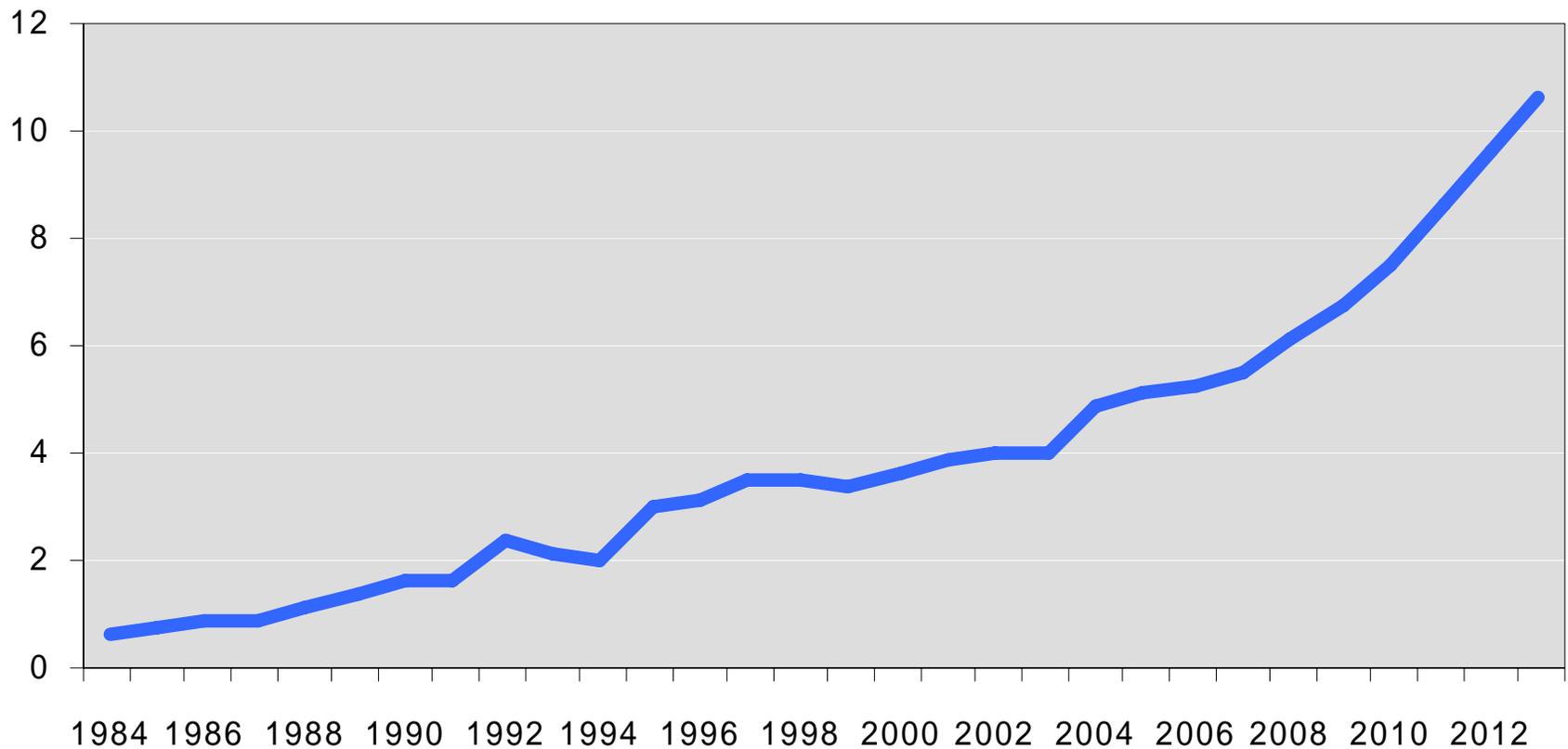
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EU Research Framework Programmes

Annual Budgets between 1984 and 2013

€ billion



NB: budgets in current prices. Source: Annual Report 2003, plus FP7 revised proposal





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Cooperation – Collaborative research

10 Thematic Priorities

	€ M *
1. Health	6.050
2. Food, Agriculture, Fisheries and Biotechnology	1.935
3. Information and Communication Technologies	9.110
4. Nanosciences, Nanotechnologies, Materials and new Production Technologies	3.500
5. Energy	2.300
6. Environment (including Climate Change)	1.900
7. Transport (including Aeronautics)	4.180
8. Socio-Economic Sciences and the Humanities	610
9. Space	1.430
10. Security	1.350

* Council's agreement of July 2006





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FP7

Collaborative research in Framework programme 7 **Food, Agriculture & Biotechnology**

Activities in 3 main areas

- Sustainable production and management of biological resources from land, forest and aquatic environments
- “Fork to farm”: food, health and well being
- Life sciences and biotechnology for sustainable non-food products and processes

Budget:

€1.9 billion over 7 years (2007-2013)

See WORKPROGRAMME and GUIDELINES for FP7 KBBE Calls:
<http://cordis.europa.eu/fp7>





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Call FP7-KBBE- 2007-2A

(publication: June 2007,
deadline 1° Stage: September 2007,
deadline 2° Stage: January 2008)

Activity 1

- | The expression and accumulation of valuable industrial compounds in plants

Activity 2

- | Novel enzymes and microorganisms for biomass conversion to bioethanol
- | The search of novel enzymes and microorganisms for different bioprocesses
- | Microbial genomics and bio-informatics
- | Biotechnology for the conversion of biomass and waste into value-added products

Activity 3

- | Novel biotechnology approaches for utilizing wastes, including aquaculture wastes, to make high added value products
- | Exploring molecular microbial diversity in aquatic environment or the soil





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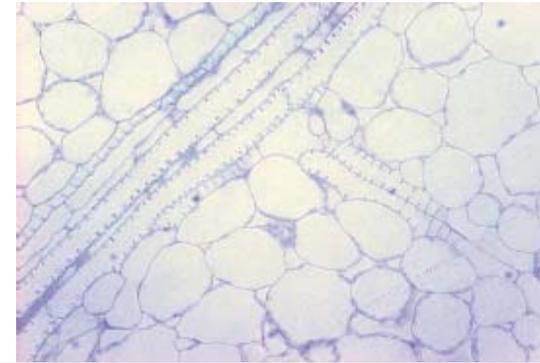
EC-US Research Cooperation on Bio-based Products

Bio-based product working group established 2004

- | **First workshop, April 2004, Albany, CA**
 - Developed draft Strategic Vision Paper
 - Identified Two Flagship Programs (user benefits, S&T challenge, private sector involvement, risk analysis)
 - **Plant cell walls**
 - **Plant oils**
- | **Second Workshop, March 2005, Beltsville, MD**
 - Identification and adoption of third flagship; **Biopolymers**
 - Strong endorsement of Strategic Vision Paper
- | **EPOBIO Initiative (2005-2007)**
 - Further identification of transatlantic cooperation opportunities

Plant Cell Wall flagship Project: raw material quality and utilization for biorefinering

Objective: to investigate plant cell walls in relation to their utility in biorefining



Targets are optimised plant cell walls for biorefinering

- ligno-cellulosic relationships
- source of cheap subunits
- potential novel functionality
- sinks of novel products to store and process

Emphasis on use of the whole crop and energy/env balance

Interest from a wide range of industries
(chemical, oil, food, ...)



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Oilseed flagship project: production of industrial oils in crop plants

Objective: to replace non-renewable oleochemicals derived from petroleum



Targets include:

- improved/novel oil crops as industrial feedstock
- increased yield (eg disease resistance) and characteristics (eg tailor-made fatty acid composition)

Examples of market potential include wax esters, hydroxy fatty acids and conjugated fatty acids

Interest of many US and EU private companies





Biopolymer flagship project: development of cost effective, high-performance materials

Objective: to replace non-renewable materials derived from petroleum



Groups of biopolymers to be considered are:

- Starch-based biopolymers (eg Mater.Bi)
- Protein-based biopolymers (eg gluten)
- Rubber from guayule
- Microbial Plastics (PHA, PHB, PLA, 1-3 PD)

Other biopolymers (isoprenes, gums) could be included

Interest goes from small companies (guayule) to multi-nationals (starch)





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EPOBIO Consortium Partners

- * **University of York – UK - (Prof Dianna Bowles)**
- Plant Research International – Netherlands**
- Max Planck Institute – Golm – Germany**
- * **National Hellenic Research Foundation – Greece**
- CPL Publishing – UK**
- Hamburg University – Germany**
- Swedish University of Agricultural Science – Sweden**
- University of Lausanne – Switzerland**
- Metabolic Explorer – France**
- Novamont – Italy**
- British Sugar – UK**
- * **Plant Gene Expression Centre – USA**
- * **USDA Albany - USA**

International Consortium Advisory Board

DSM, BASF, Biogemma, EUROPABIO, Metabolic Explorer, Cargill, BIO, DoE, ...

<http://www.epobio.net>





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Challenges and Open Questions

- **Sustainable** provision of agricultural raw materials, taking into account
 - potential of European agriculture and forestry (land availability)
 - impacts on food and feed markets - EU and globally
 - impact on biodiversity (monoculture, crop rotation, ...)
 - environmental balance of different raw materials (water, GHG ...)
- **Research** and **technological** development
 - optimised production and mix of raw materials
 - advanced, more cost-effective conversion processes
 - diversified feedstocks – not only food crops
- **Stable environment** for industries to develop
- **Public acceptance**

http://ec.europa.eu/energy/res/consultation/biofuels_en.htm

