Biofuels and Sustainable Chemistry

Just Meeting in Biorefineries or More Synergies?

Dirk Carrez

SusChem
European Technology Platform For
SUSTAINABLE CHEMISTRY

A European Technology Platform for Sustainable Chemistry

Structure of SusChem ETP

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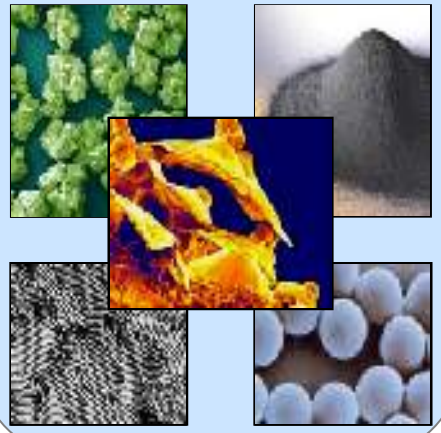
Member States Mirror Groups

Industrial Biotechnology

Materials Technology



Reaction & Process Design

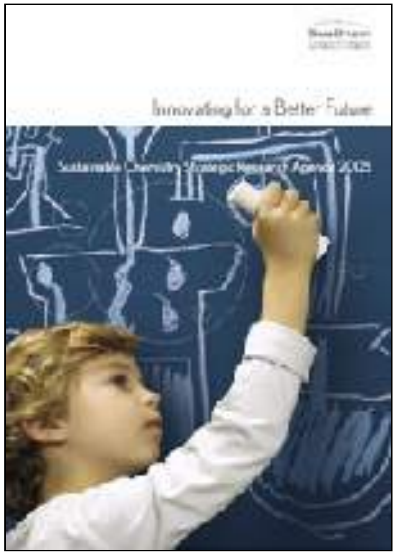
Horizontal Issues Group

Process

Vision

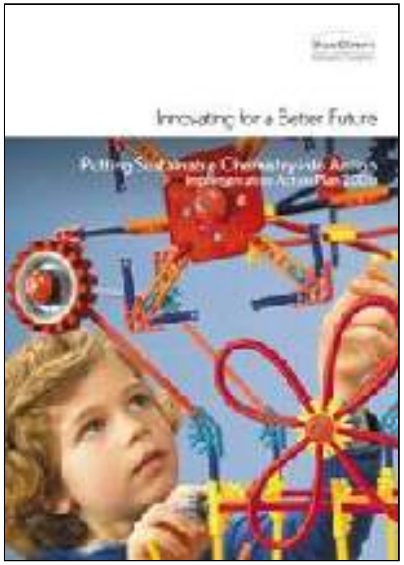
March 2005

Strategic Research Agenda



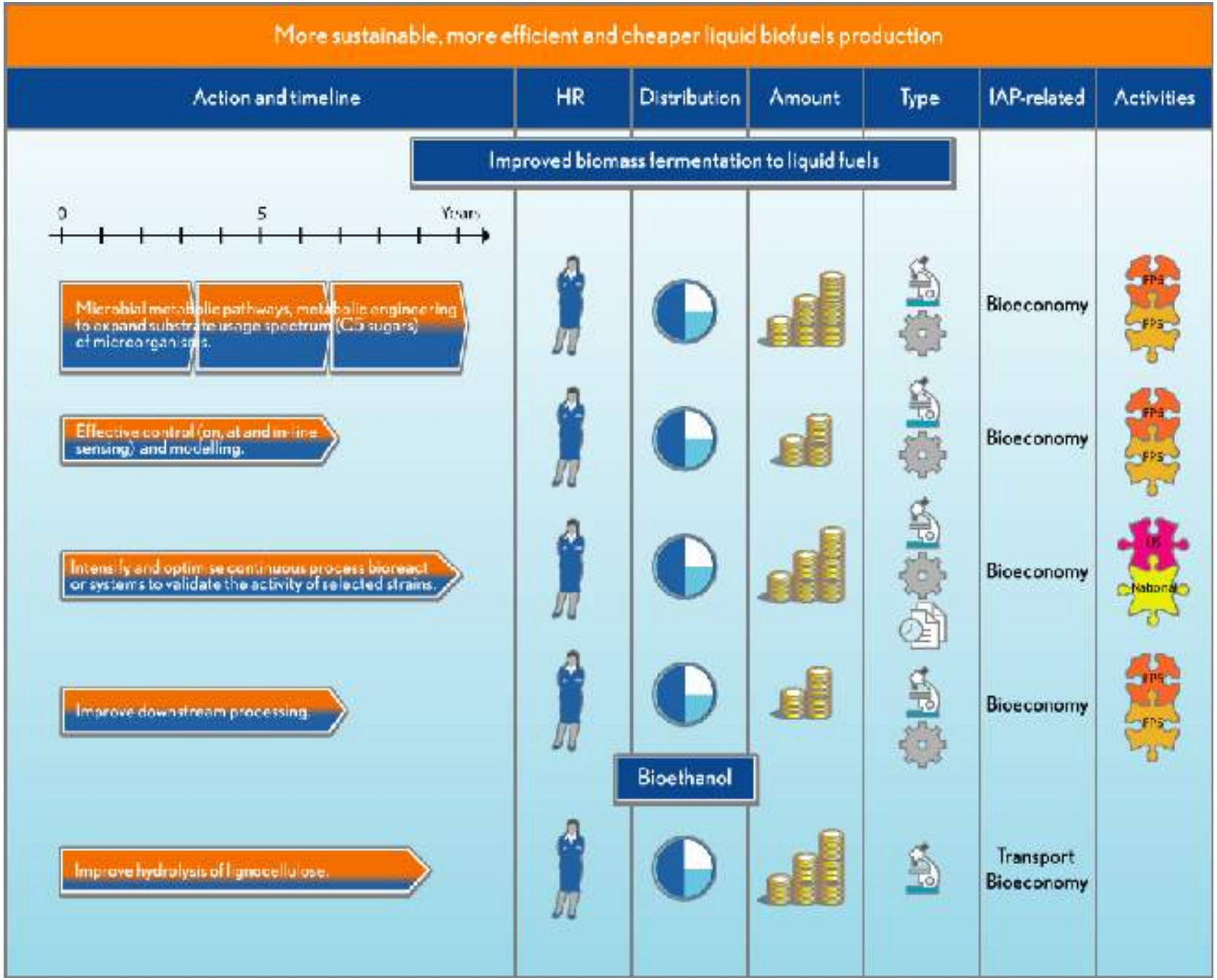
November 2005

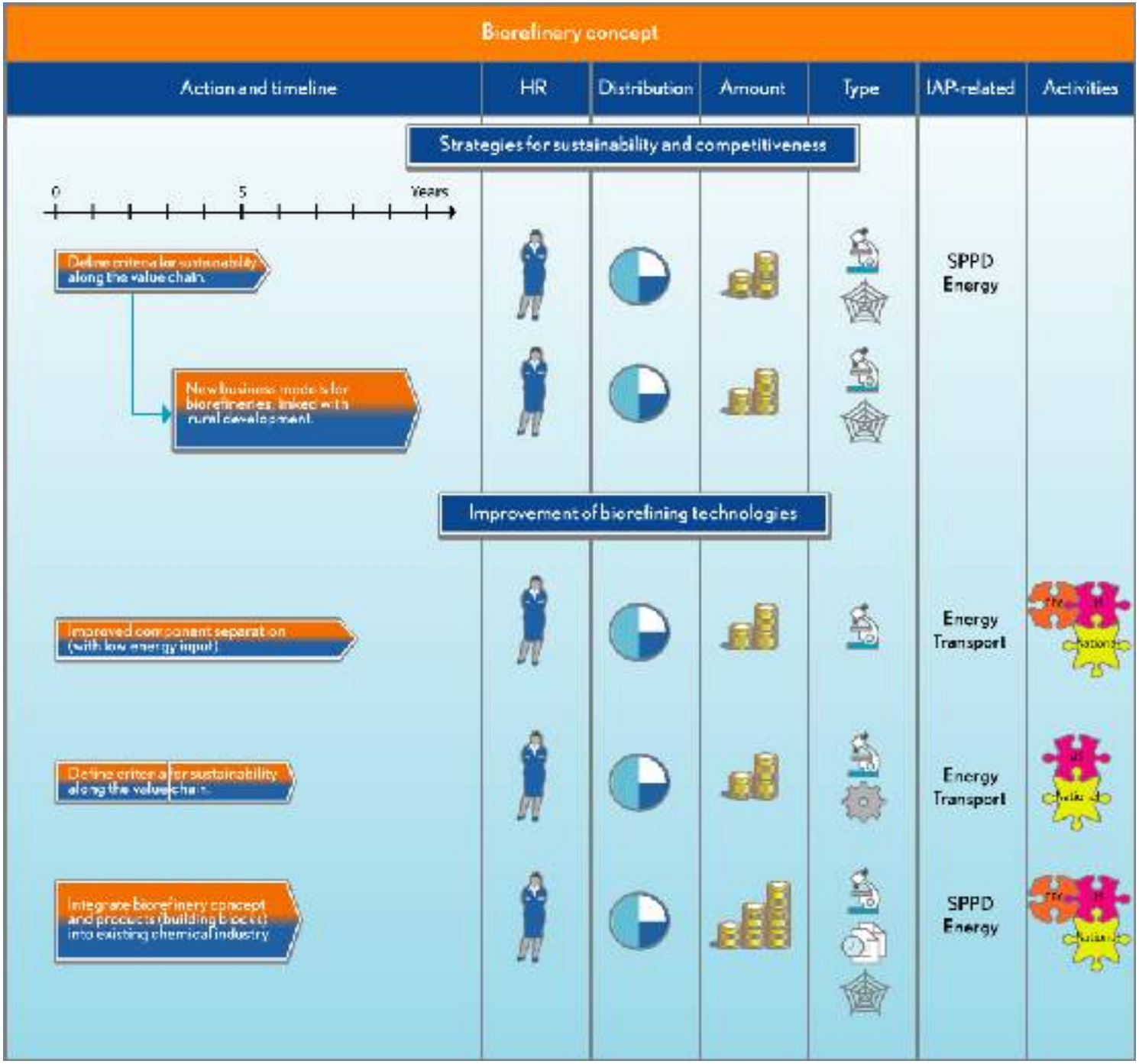
Implementation Action Plan



December 2006

For more information: www.suschem.org


More sustainable, more efficient and cheaper liquid biofuels production
Action and timeline
HR
Distribution
Amount
Type
IAP-related
Activities
Improved biomass fermentation to liquid fuels
0
5
Years
Microbial metabolic pathways, metabolic engineering to expand substrate usage spectrum (C5 sugars) of microorganisms.
Effective control (on, at and in-line sensing) and modelling.
Intensify and optimise continuous process bioreactor systems to validate the activity of selected strains.
Improve downstream processing.
Bioethanol
Improve hydrolysis of lignocellulose.
Bioeconomy
Bioeconomy
Bioeconomy
Bioeconomy
Transport Bioeconomy
FPS
FPS
FPS
FPS
FPS
FPS
National


Biorefinery concept
Action and timeline
HR
Distribution
Amount
Type
IAP-related
Activities
Strategies for sustainability and competitiveness
0
5
Years
Define criteria for sustainability along the value chain
New business models for biorefineries linked with rural development
SPPD
Energy
Improvement of biorefining technologies
Improved component separation (with low energy input)
Energy
Transport
Define criteria for sustainability along the value chain
Energy
Transport
Integrate biorefinery concept and products (building blocks) into existing chemical industry
SPPD
Energy

Alignment with Framework Programme 7

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"Knowledge based bio-economy"

→ DG Research, Directorate E "Food, Agriculture and Biotechnology"

"Renewable fuel production"

→ DG Research, Directorate J "Energy"

Alignment with MS: ERA-net IB

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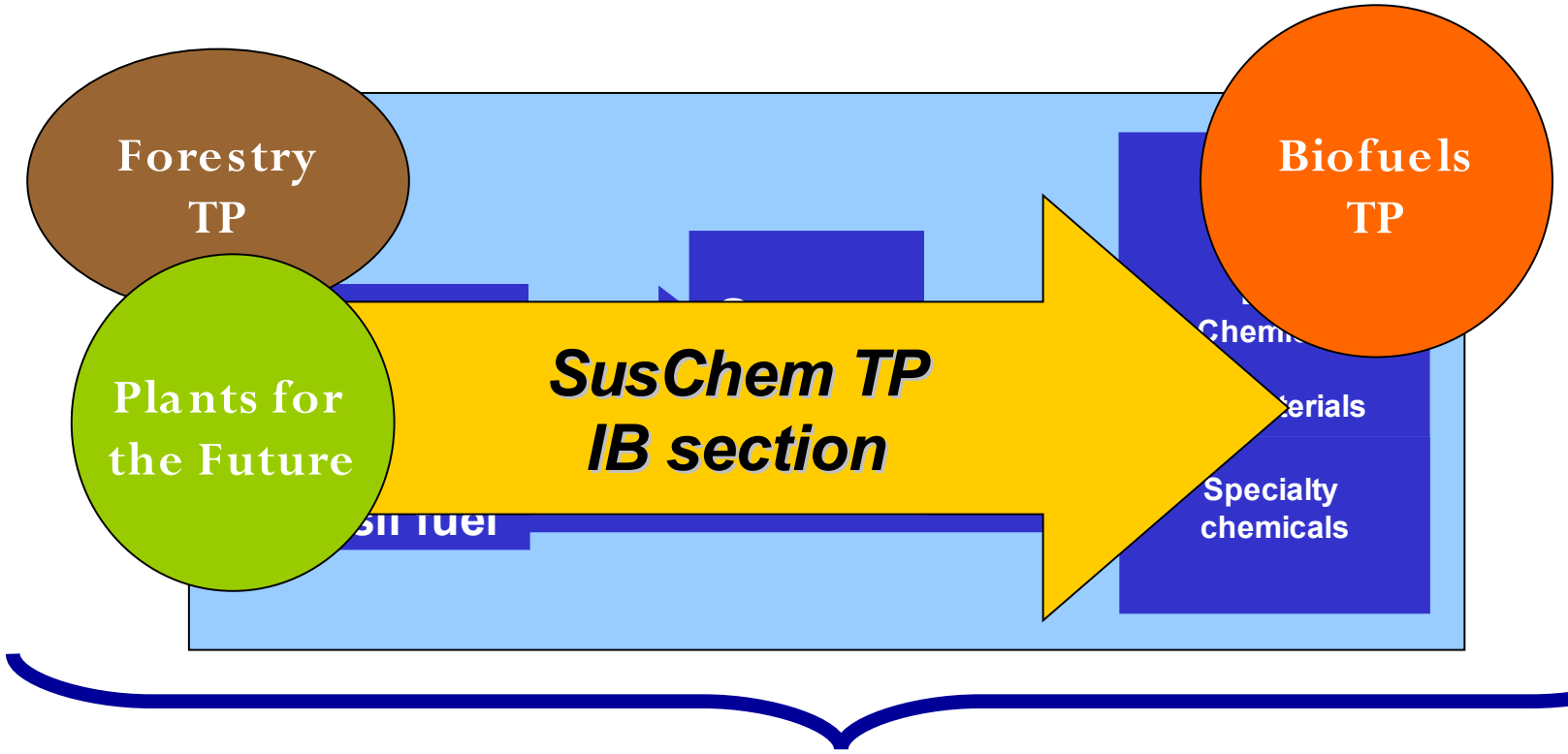
ERA IB
European Research Area
Industrial Biotechnology

Partners ERA-IB

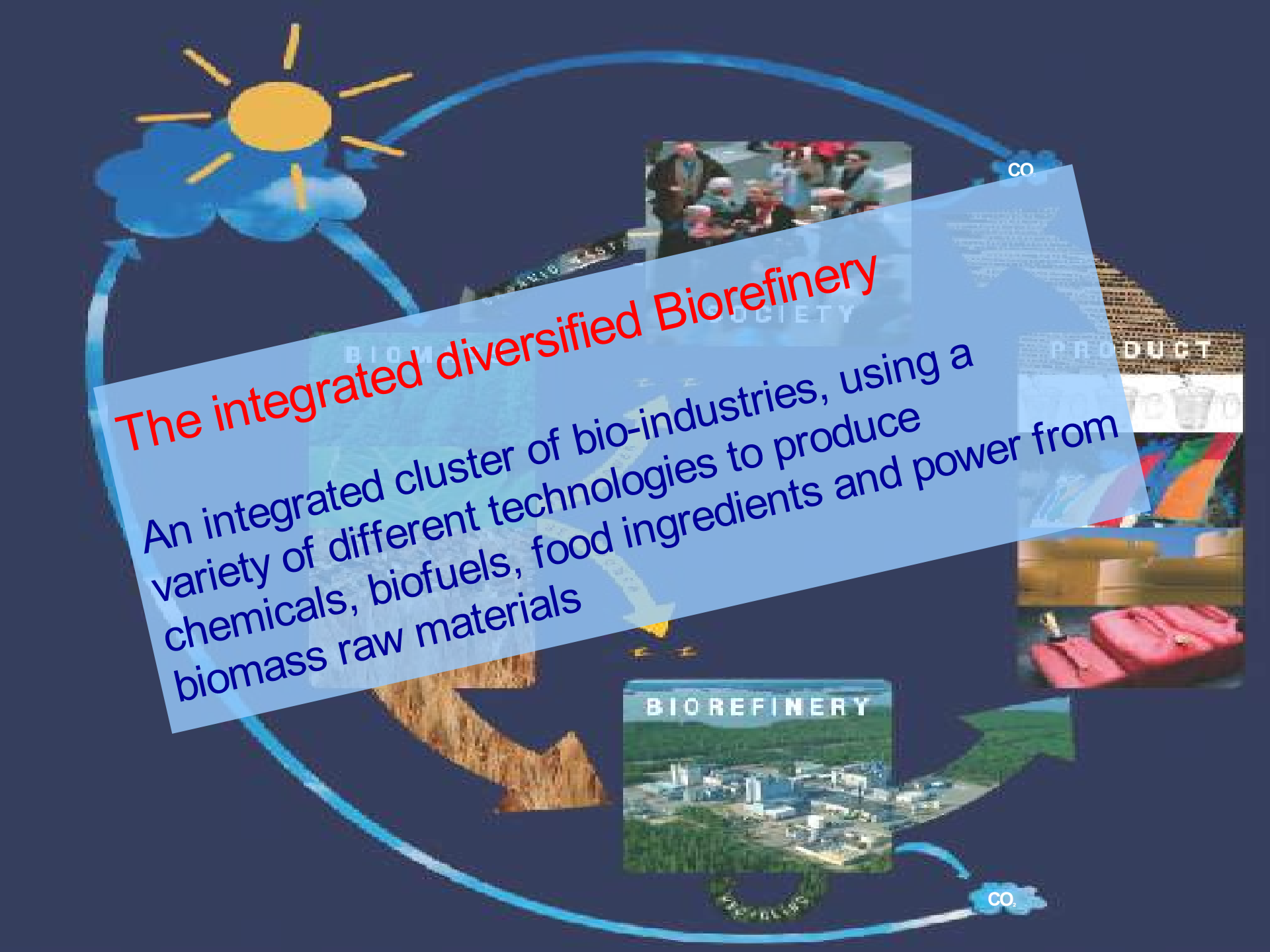
NWO – The Netherlands	BMBF / PTJ - Germany
MEC / FECyT - Spain	SCO-MOH / MOST - Israel
ADEME -France	DTI - UK
CNMP - Romania	MES / TUL - Poland
FCT - Portugal	DRA - Denmark
MSES - Croatia	BelSPO - Belgium

Observers: Slovenia, Norway, Finland, Sweden

Alignment with other ETPs: KBBE-ETP network



- « Integrated Biorefinery » concept (research, pilot plants, demonstration projects, …)
- Lead Market Initiative for Biobased Products


The integrated diversified Biorefinery
An integrated cluster of bio-industries, using a variety of different technologies to produce chemicals, biofuels, food ingredients and power from biomass raw materials
BIOREFINERY
CO
CO2

Beyond bioethanol.....

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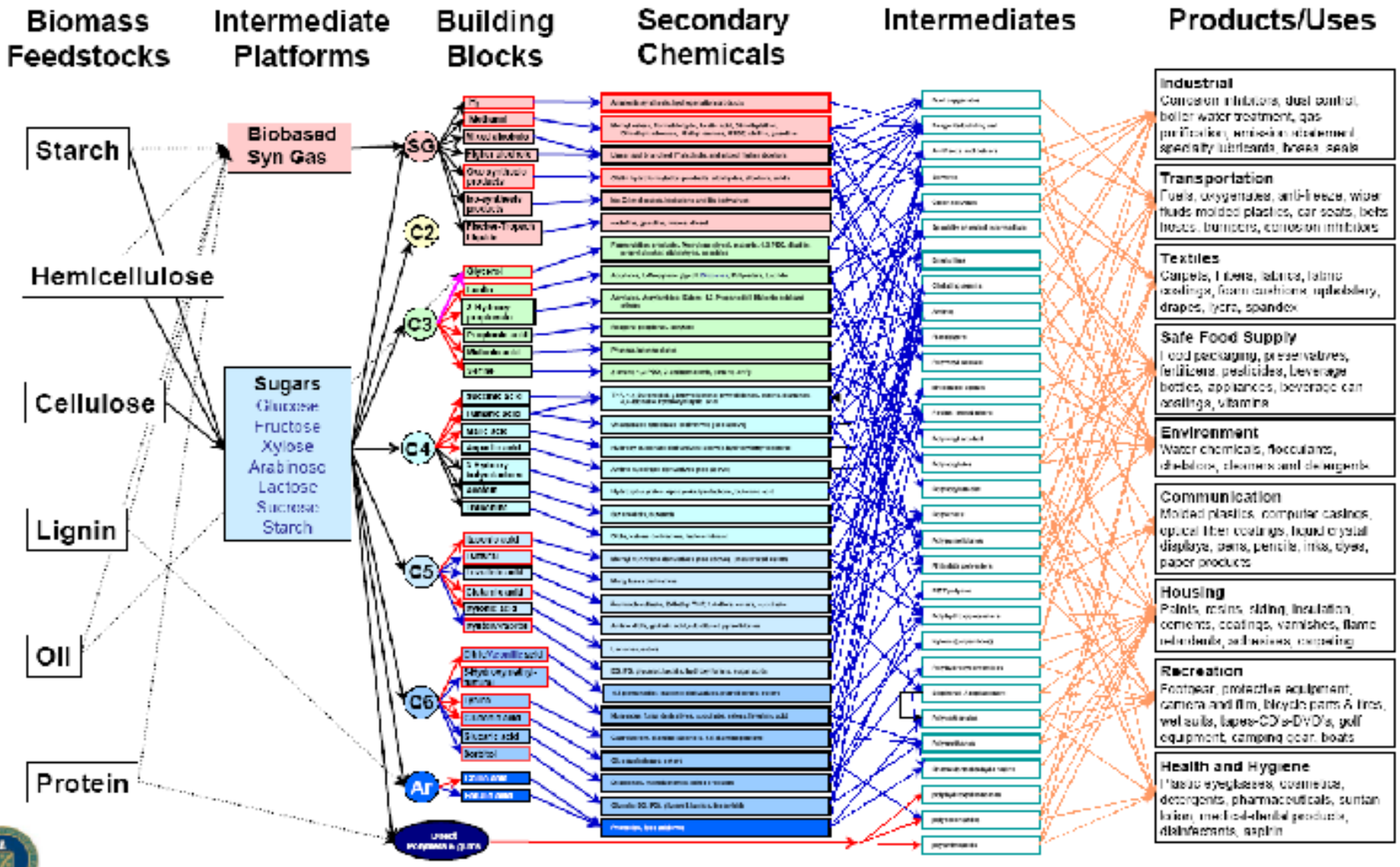
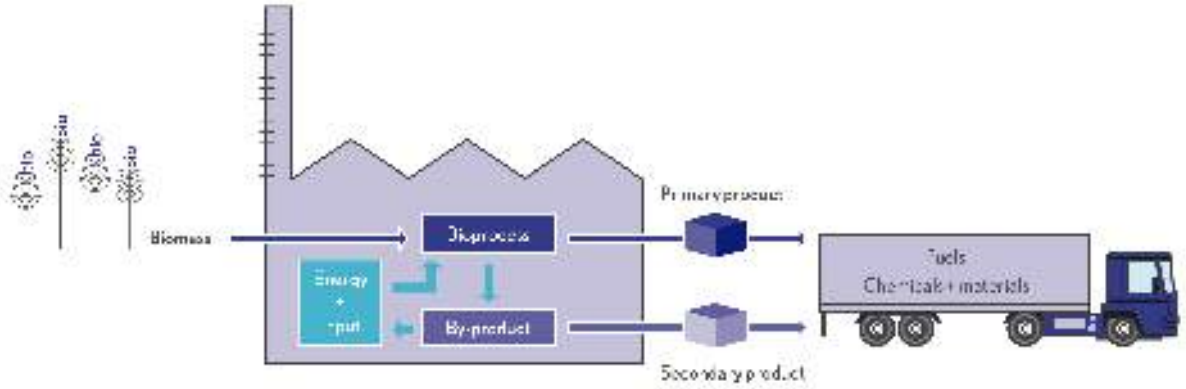


Figure 3 – Analogous Model of a Biobased Product Flow-chart for Biomass Feedstocks

Visionary Project: The integrated biorefinery

- The focus of the visionary project 'Integrated biorefinery' is:
  - providing access to industrial facilities for research and demonstration stage
  - reducing both lead time and investment for product development
  - using all fractions of biomass to produce the highest value possible in an eco-efficient way



Visionary Project: The integrated biorefinery

- Joint working group on biorefinery is being created with experts from 4 ETPs: SusChem, Plant for the Future, Forestry and Biofuels

- First experts' workshop on 7 June 2007 :
  - Develop a common strategy for the development of biorefineries in Europe
  - Improve access to funding for research & "proof of concept" to pilot scale facilities
  - Need for research infrastructures & demonstration plar

Conclusions (1)

PHASE

Differentiate between pilot plants & demonstration plants

Commercial production

Pre-commercial demonstration

- Dedicated plants, have to be built. Total costs >10 000 k€/project)
- Complete commercial (integrated) production process, but on a smaller scale. Dedicated plants using equipment identical to the real factory. Multi-process and/or multi-company.
- Owner: private (but often with public financial support)
- Output: Data for factory planning and final investment decision

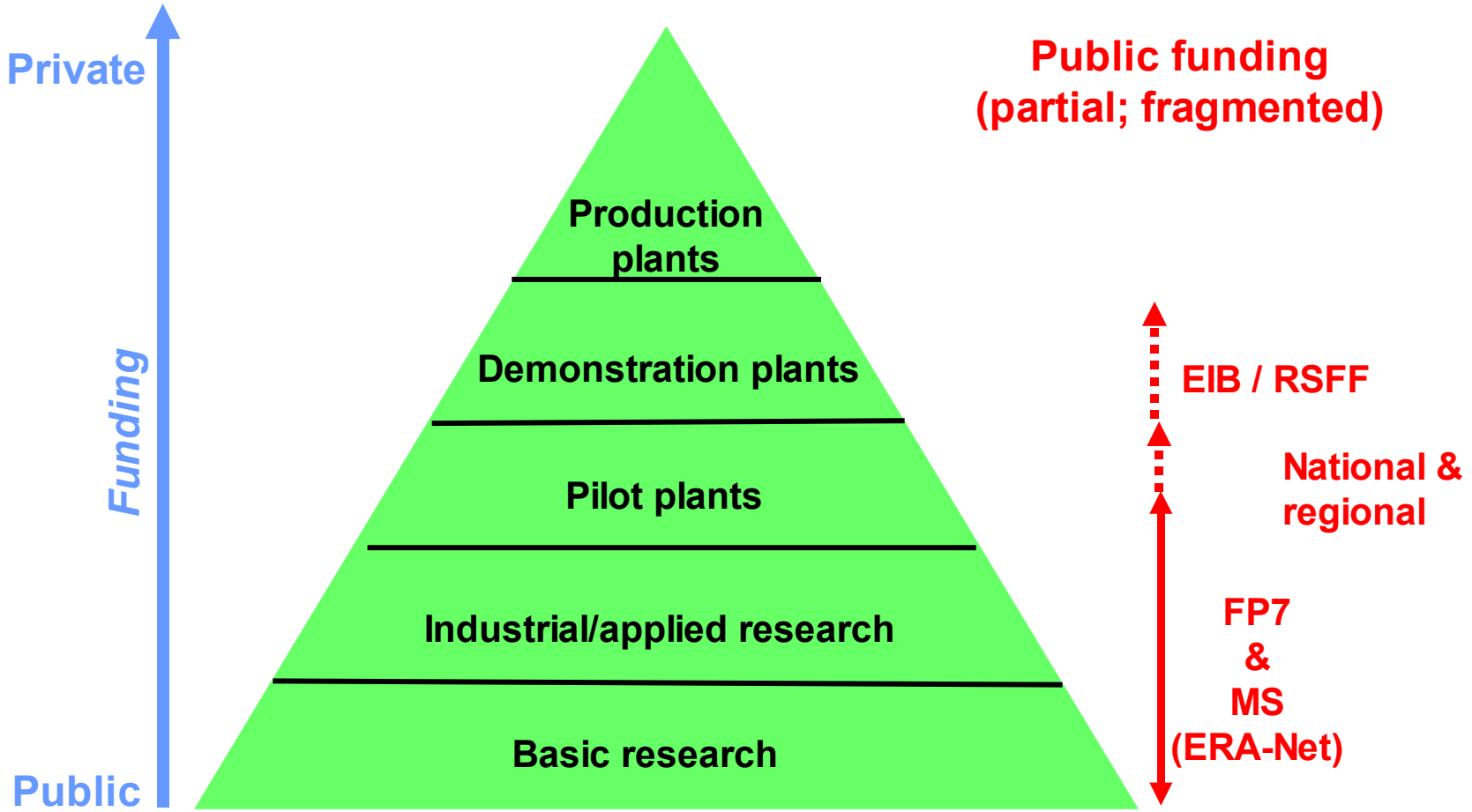
Piloting

- Aim: scaling up a specific process
- Multipurpose equipment that mimic industrial equipment. Mainly public (equipment can be "donated" by local companies). Multi-process facilities that can be rented. Owned by universities and R&D organizations
- Output: Functionality with industrially applicable equipment, proof-of-concept, scaling up, economic feasibility

Lab-scale R&D

Idea, concept or hypothesis

Public funding for biorefineries



EuropaBio: supporting biorefinery development

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Set up EU-wide demonstration project(s)

→ **Integrated, diversified and zero-waste biorefinery**

- Support the development of flexible research-oriented pilot plants
- Develop funding schemes in Europe for “multiple company consortia” to build small scale “first of a kind” plants

The SET plan

- Key EU technology challenges for the next 10 years to **meet the 2020 targets:**
  - Make second generation biofuels competitive alternatives to fossil fuels, while respecting the sustainability of their production

- Key EU technology challenges for the next 10 years to **meet the 2050 vision**:
  - Bring the next generation of renewable energy technologies to market competitiveness;

The SET plan

TECHNOLOGY AVENUE	DESCRIPTION	POTENTIAL	ADDITIONAL IMPACT				BARRIERS	NEEDS
	1) Sector 2) Current market share 3) State of the Art	1) Baseline scenario 2) Potential penetration 3) Potential breakthroughs	Environment		SES	Competitiveness		
			CO_2 avoided (Mt)	Mitigation cost (€/t CO_2)	Fossil fuel savings (Mtoe)	Additional cost of energy (%)		
BIOFUELS	1) Transport 2) 5.9 Mt of biofuels in 2005 3) 1st generation: Commercialised 2nd generation: pilot scale demonstrated	1) 2020: 7.5% of transport petrol & diesel demand 2030: 9.5% of transport petrol & diesel demand 2) 2020: 10-14% of transport petrol & diesel demand 2030: 15-20% of transport petrol & diesel demand 3) 2nd generation large scale demonstration by 2015	15÷40 (2020) 45÷75 (2030) 335÷810 (2010-2030)	130÷160 (2020) 90 (2030) 110÷135 (2010-2030)	10÷25 (2020) 20÷40 (2030) 150÷450 (2010-2030)	1.5÷3.5 (2020) 2.0÷3.5 (2030)	No structural barriers Biomass availability and sustainability (including allocation between energy sectors and competition with non energy sector)	Reinforced and focused public support for R&D at national and EU levels Funding mechanisms for large scale demonstration initiatives Harmonisation of market regulations and policies at EU levels

Example from the US

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Feedstock Transport

JOHN DEERE

Feedstock Harvest

JOHN DEERE

Feedstock Production

PIONEER
A DUPONT COMPANY

Feedstock Conversion

DIVERSA

NREL

Fermentation Production

Ethanol & Chemicals

Separation

DUPONT

+

DUPONT

Downstream Markets

DOE 1435-04-03-CA-70224

U.S. Department of Energy
Energy Efficiency and Renewable Energy

DUPONT
The miracles of science

Thank you

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EUROPABIO
The European Association for Bioindustries

A European Technology Platform for Sustainable Chemistry