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Smart Agriculture in the 21st Century

# GLOBAL PERSPECTIVES ON THE GLOBAL BIOECONOMY

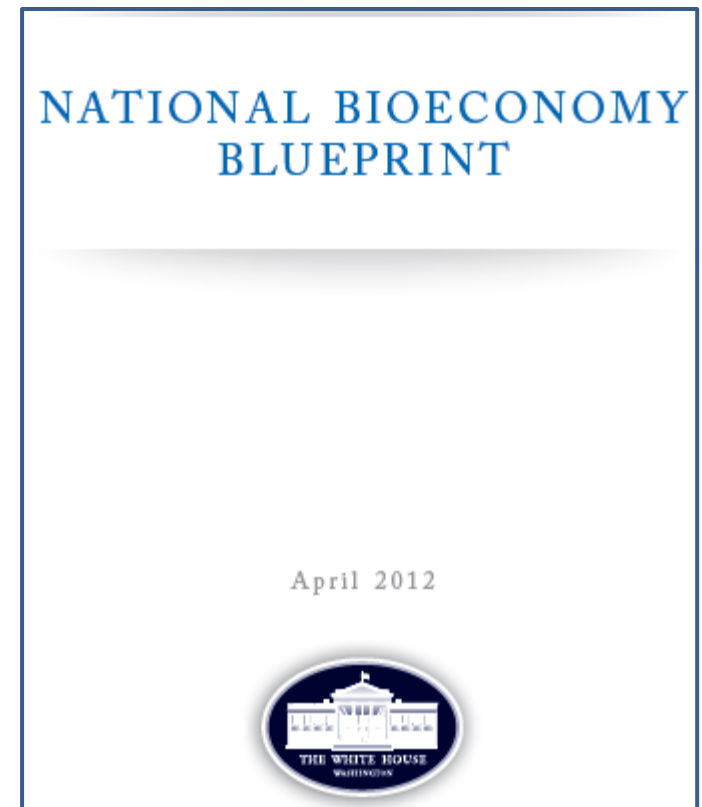
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# Early documents



[http://ec.europa.eu/research/bioeconomy/pdf/201202\\_innovating\\_sustainable\\_growth\\_en.pdf](http://ec.europa.eu/research/bioeconomy/pdf/201202_innovating_sustainable_growth_en.pdf)

[http://www.whitehouse.gov/sites/default/files/microsites/ostp/national\\_bioeconomy\\_blueprint\\_april\\_2012.pdf](http://www.whitehouse.gov/sites/default/files/microsites/ostp/national_bioeconomy_blueprint_april_2012.pdf)



# Why a bioeconomy ?

- Increasing population
- **Resource depletion**
- **Climate change**
- **Energy security**
- Food security

## *Three pillars of the **EU Bioeconomy Action Plan***

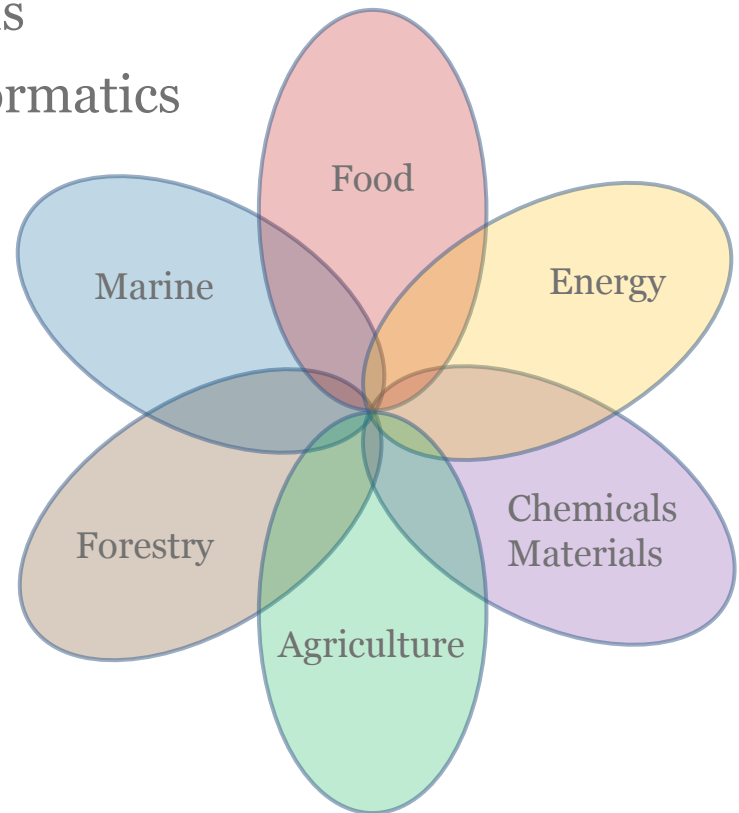
- Investing in science and skills
- Reinforcing policies and partnerships
- Boosting bioeconomy markets and their competitiveness





# Fields covered in the EU Bioeconomy

- Canada and US include:
  - Health sector, incl. pharmaceuticals
  - Innovation services such as bioinformatics
- EU does not include Health
- EU focuses on
  - Reducing fossil fuels and GHGs
  - New products from biomass for technology advantage



# Finnish bioeconomy strategy

## Finnish strategy: 4 priority areas

1. A competitive **operating environment** for bioeconomy growth
2. **New business** by risk financing, bold experiments and crossing of sectoral boundaries
3. A strong **competence base** through education, training and research
4. **Secured biomass** accessibility and **sustainable** use of biomass



TYÖ- JA ELINKEINOMINISTERIÖ  
ARBETS- OCH NÄRINGSMINISTERIET  
MINISTRY OF EMPLOYMENT AND THE ECONOMY



# South African bioeconomy strategy

**Health:** Support and strengthen R&D and innovation capabilities to make: active pharma ingredients, vaccines, biopharmaceuticals, diagnostics and medical devices

**Agriculture:** Ensure **food security**, enhance nutrition and enable job creation through expansion and intensification of sustainable agricultural production and processing

**Industry and Environment:** Support R&D and innovation in biological processes for the production of **goods and services**, while enhancing water and waste-management practices to **support green economy**



science  
& technology

Department:  
Science and Technology  
REPUBLIC OF SOUTH AFRICA



# “Bioeconomy’s contribution towards Malaysia’s GDP is targeted at 8%-10%”

By 2020 BTP aims to :

- Contribute \$14.3 billion to Malaysia’s GNI
- Attract investments of \$15 billion into Malaysia’s biotechnology industry
- Create 170,000 new job opportunities
- Agriculture, health, industry



The banner features the Bioeconomy Malaysia logo at the top, which includes a stylized DNA helix. Below the logo, the text reads "BIOECONOMY MALAYSIA". The main title of the event is "BIOECONOMY TRANSFORMATION PROGRAMME (BTP) BIOCENTRAL WORKSHOP", with the dates "8-9 September 2014" underneath. The banner also lists the supporting and organizing bodies: MOSTI (Ministry of Science, Technology and Innovation), PKNM (National Science Foundation), BIOTECHCORP (Malaysian Biotechnology Corporation), and the Malaysian Biotechnology Commission. The slogan "Enriching the Nation, Securing the Future" is displayed at the bottom.

**BIOECONOMY MALAYSIA**

**BIOECONOMY TRANSFORMATION PROGRAMME (BTP) BIOCENTRAL WORKSHOP**

8-9 September 2014

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**Enriching the Nation, Securing the Future**





# G7 bioeconomy actions

Country	Name of strategy	Main actors	Key funding areas
Canada	Growing forward	M. of Agriculture	R&D renewable resources, bio-based materials, bioenergy
France	BE-relevant policies	M. for Ecology M. for Research	Bioenergy, green chems, clusters, circular econ.
Germany	R&D strategy BE Policy strategies BE	M. for Research M. for Agriculture	R&D food security, sust. agric., ind. process, bioenergy
Italy	No specific BE policy	---	EU Programmes
Japan	Biomass utilisation and Industrial strategies	Cabinet, National Biomass Policy Council	R&I, circular econ., regional devel.
UK	BE-relevant policies	Parliament, Energy & Climate, Env, Transport, Business	Bioenergy, agri-science and technology
US	Bioeconomy Blueprint Farm Bill	White House, USDA	Life sciences (biomed.) Agriculture (multiple areas)
EU	Innovation for sust. growth	DG Science, Research, Innovation	Horizon 2020, PPPs



# G7 differences in approach

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- **“Top-down”**: Germany, Japan, US and EU
  - Driven by political sector that develops visions, strategies and action plans
- **“Bottom-up”**: Canada, France, Italy
  - Industry driving, policy sector restricting to funding R&D
- **Mixed**: UK has a mixture of political and industrial activity
  
- **Canada & US** – both have **abundant** biomass capacities
  - Bioeconomy strategies focused on natural assets
  - Both include health: pharma and innovation services



# G7 differences in approach

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- **France, Germany, Italy, Japan, UK:** **few** natural resources
  - Focus on innovation potential and industrial renaissance
  - Establishing international technology and resource partnerships with emerging economies to gain access to biomass
  - “Alternative biomass”: CO<sub>2</sub>, waste, other residues
  - Capitalise on R&D strengths to develop science-based, high-value industries
- **EU:** does not classify medical biotech as bioeconomy
  - Focus on replacing fossil fuels and GHG emissions savings
  - Focus on technological advantage in new biomass processing methods to make new products



## Smart Agriculture in the 21st Century

# WHAT PROGRESS DO WE SEE ?

*“Greater use of renewable resources is no longer just an option, **it is a necessity**. We must drive the transition from a fossil-based to a bio-based society, with research and innovation as the motor.”*

A Bioeconomy Strategy for Europe, 2013.



# Burden of hope rests on cellulosic

The Abengoa cellulosic ethanol plant near Hugoton, Kansas, will start production this year



- **Project LIBERTY:** US DoE grants to support engineering and construction, and biomass collection and infrastructure
- **The Abengoa plant** in Kansas: federal loan guarantee from the US DoE Loan Programs Office.
- **DuPont plant**, Nevada, Iowa: USDA and DuPont PPP to set voluntary standards for the sustainable harvesting of agricultural residues for cellulosic fuel



# Lessons from cellulosic flagships: unusual and complex projects, many stakeholders

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- High CapEx
  - Simultaneous commitment by many actors:
    - Technology providers, R&D partners
    - Customers (e.g. equity investors)
    - Banks/financial institutions
    - Funding bodies (EU/Regions)
    - Local authorities
- Sustained investment
  - Investors (many ongoing negotiations)
  - Grants (PPP, DG RTD, Regional funds)
  - **Debt (main difficulty)**
- Flagships are not easily bankable (**not for technical risk**)



Cellulosic biorefinery, Crescentino, Italy.





## Crescentino: essential numbers

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- **Investment** value: EUR 150 million
- **Location:** **abandoned industrial area** (consistent with brownfield policy)
- **Capacity:** 40,000 tons ethanol per annum
- **Power generation:** 13 MW entirely from **lignin** – electricity powers the plant and extra **sold back to the grid**
- **Water:** 100% recycle, **no river water** use, zero water discharge
- **Employment:** ~100 direct jobs at capacity, and up to 400 indirect (e.g. local logistics)





# Two PPP firsts for Canada

- **Sarnia:** BioAmber bio-succinic acid plant supported by a \$ 12 million investment from the Harper Government
- Due to open early in 2015
- First of its kind in the world
- **Edmonton:** Enerkem's first in the world commercial Waste-to-Biofuels plant
- Converts Edmonton's municipal garbage to methanol (ethanol later)
- Opened June 04, 2014
- "The mill that kills landfill"



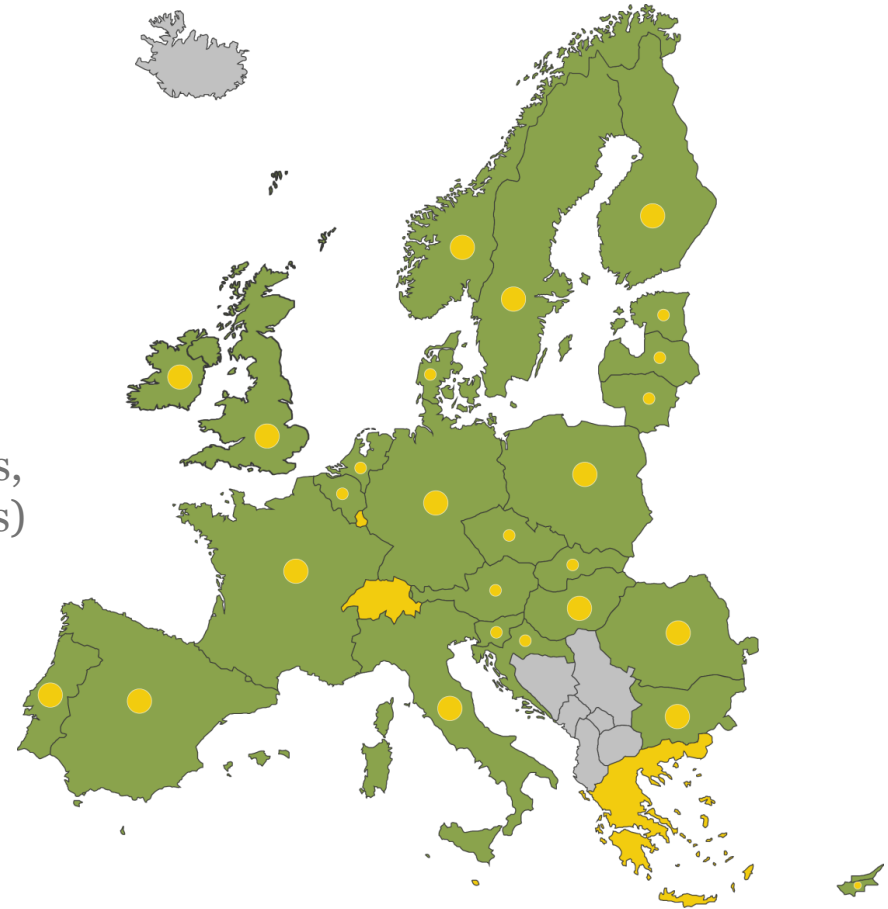


# The BBI public-private partnership

<http://biconsortium.eu/>



- 80 Full members
  - 46 Large industries
  - 20 SMEs
  - 14 Clusters
- 140 Associated members
  - Universities, RTOs, Trade Associations, European Technology Platforms (ETPs)



## Sectors covered to date

- Agriculture
- Agri-food
- Forestry / Pulp and Paper
- Technology providers
- Chemicals
- Energy



# Biorefineries in Italy: facts and figures

**Private investments: more than €1.0 billion; 1600 people employed.**

## PIEMONTE

## LOMBARDIA

R&D CENTRE BIOPLASTICS AND BIOCHEMICALS FROM RRM (NOVARA)  
R&D CENTRE CHEMISTRY FROM RENEWABLES (NOVARA)

R&D CENTRE GREEN CHEMISTRY PROCESS ENGINEERING AND BIOLUBRICANTS (MANTOVA)

R&D CENTRE BIOLUBRICANTS (SAN DONATO MILANESE - MI)  
PILOT PLANT FOR BIOBASED BUTADIENE (SAN DONATO MILANESE - MI)

R&D CENTRE BIOCHEMICALS PROCESSES AND TECHNOLOGIES (RIVALTA SCRIVIA - AL)

PILOT PLANT FATTY ALCOHOL (RIVALTA SCRIVIA - AL)

## VENETO

FLAGSHIP 1,4 BDO FROM RRM (ADRIA - RO)

PILOT PLANT BIOMONOMERS (NOVARA)

DEMO PLANT GREEN GLYCOL (RIVALTA SCRIVIA - AL)

## EMILIA ROMAGNA

R&D CENTRE BIOELASTOMERS (RAVENNA)

INDUSTRIAL PLANT LIGNOCELLULOSIC BIOETHANOL (CRESCENTINO - VC)

FLAGSHIP SUCCINIC ACID (CASSANO SPINOLA - AL)

## UMBRIA

R&D CENTRE, PILOT AND DEMO PLANTS ON OLEAGINOUS CROPS AND BIOLUBRICANTS FROM LOCAL CROPS (TERNI)

INDUSTRIAL PLANT BIOPLASTICS BASED ON STARCH AND POLYESTERS FROM VEGETABLE OILS (TERNI)

## SARDEGNA

1 FLAGSHIP AZELAIC ACID AND PELARGONIC ACID (PORTO TORRES - SS)

1 FLAGSHIP BASIS FOR BIOLUBRICANTS AND BIOADDITIVES FOR RUBBER

R&D CENTRE

## LAZIO

INDUSTRIAL PLANT BIODEGRADABLE POLYESTERS (PATRICA - FR)

## CAMPANIA


BIOTECHNOLOGICAL R&D CENTRE (PIANA DI MONTE VERNA - CE)

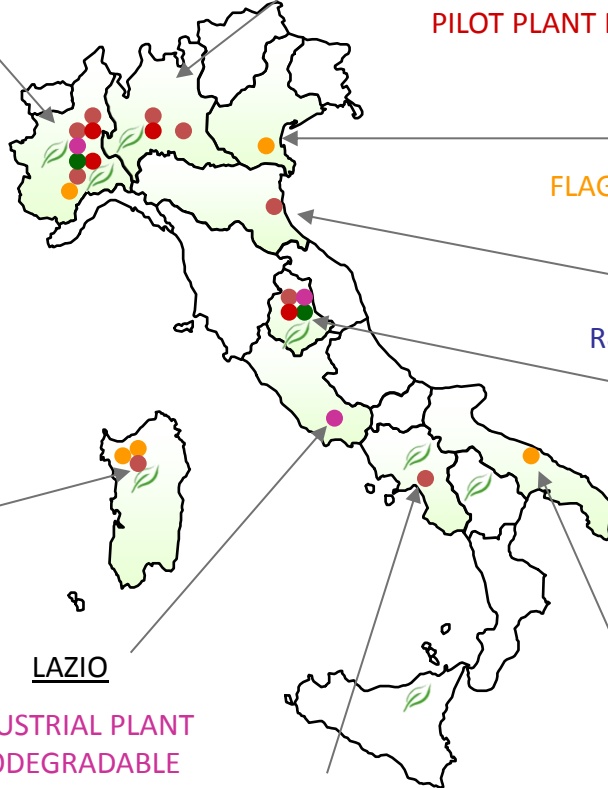
## PUGLIA

FLAGSHIP AVIATION FUEL (MODUGNO - BA)

## LOCATION TBD

EXPERIMENTAL CROPS AND DEMO PLANTS FOR EXTRACTION OF NATURAL RUBBER AND OTHER VALUABLE PRODUCTS (RESINS ETC.)

-  EXPERIMENTAL FIELDS 8
-  R&D CENTRES (9)
-  PILOT PLANTS (4)
-  DEMO PLANTS (2)
-  INDUSTRIAL SITES (3)
-  FLAGSHIPS (5)







# Bazancourt-Pomacle, Northern France

**Chamtor**

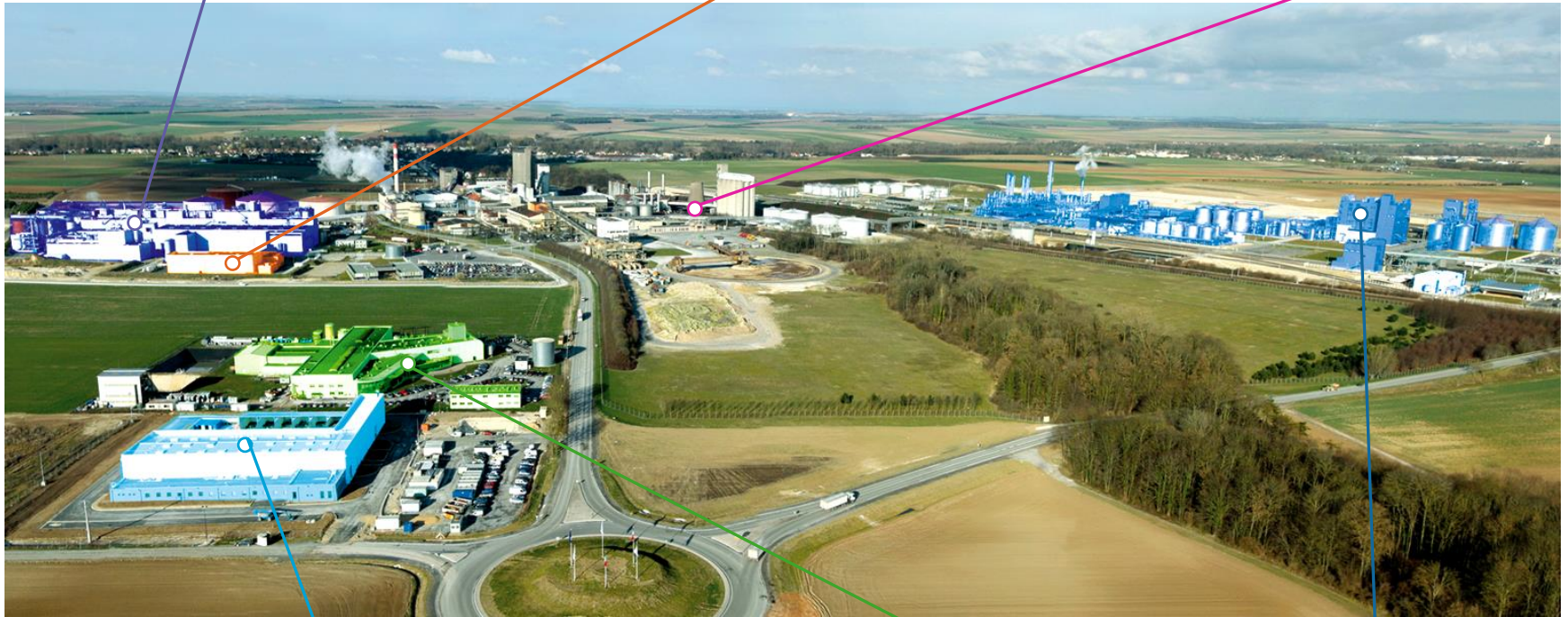
Wheat transformation

**BioDémo**

Industrial demonstration

**Cristal Union**

Sugar producer



**Procéthol 2G**

FUTUROL project- 2<sup>nd</sup> generation ethanol

**ARD – Research centre  
Soliance**






**Cristanol**

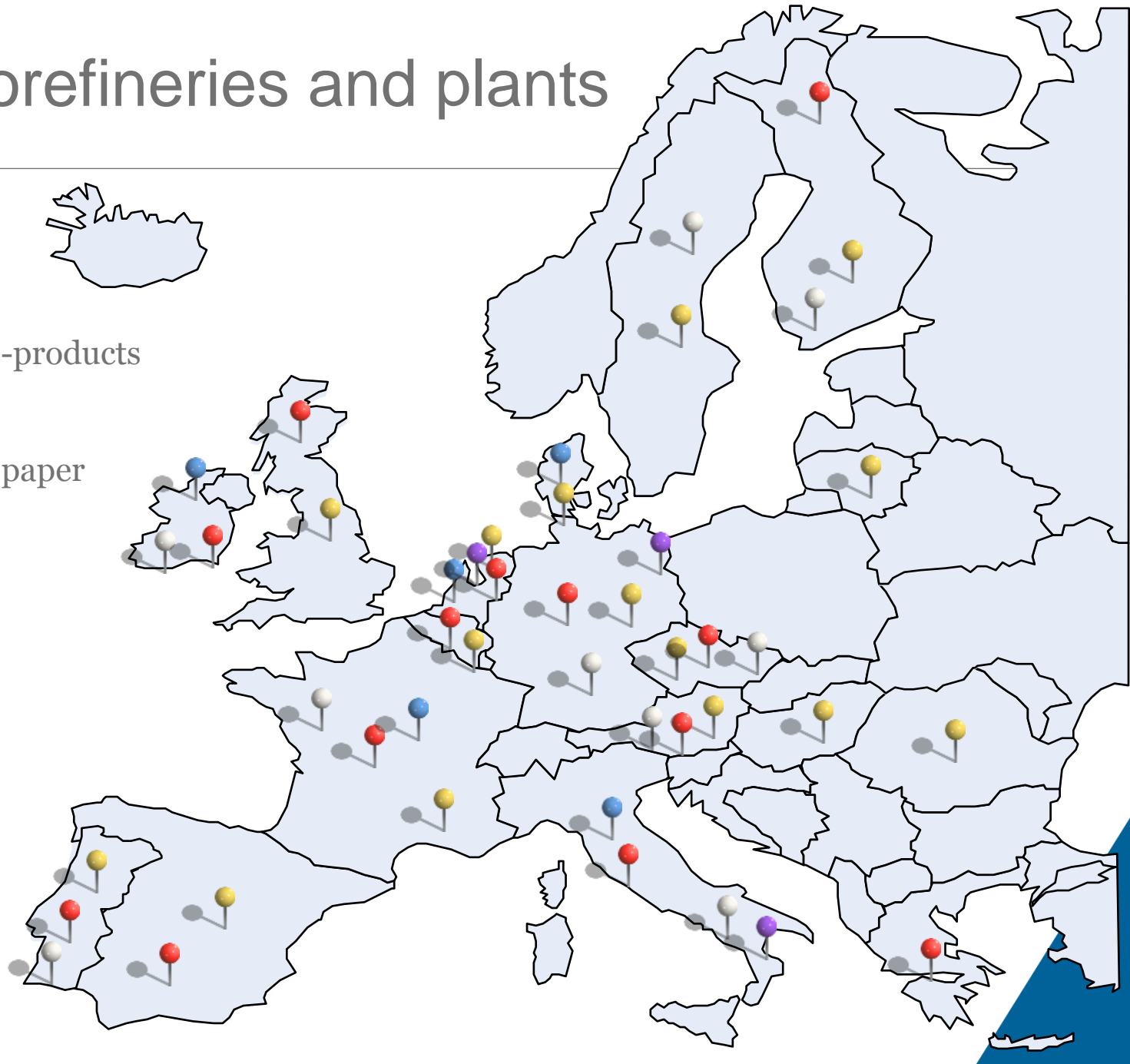
1<sup>st</sup> generation ethanol





# EU biorefineries and plants

-  Other bio-products
-  Biofuel
-  Pulp and paper
-  Starch
-  Algae





# Bio-based olefins would really help to replace the oil barrel



Today : *Fossil resources*



Tomorrow : *Renewable resources*

1

Ethylene



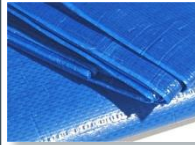
2

Propylene



3

N-Butenes



4

Butadiene



5

Isoprene



6

Isobutene



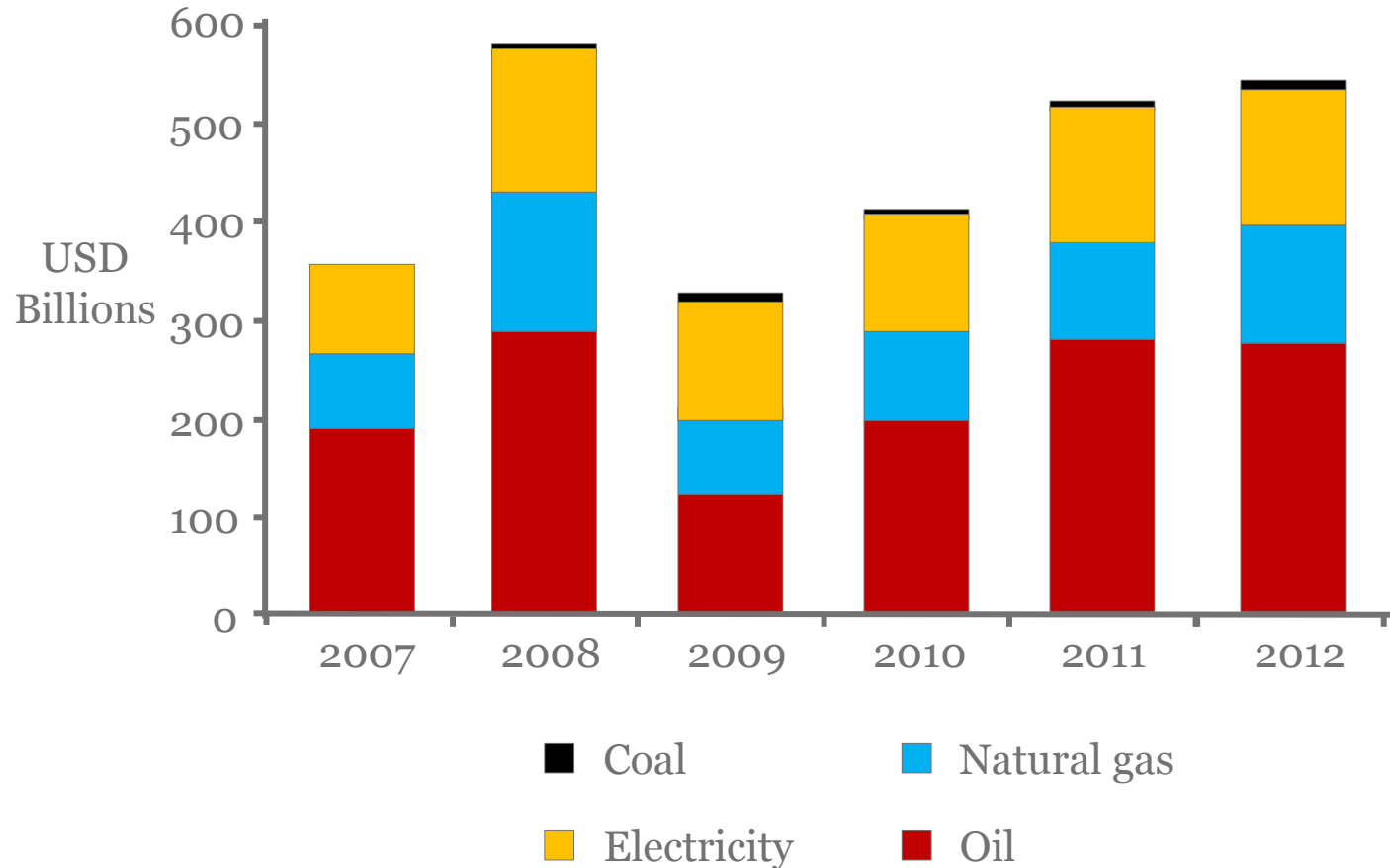
BUT

- Petro-olefins benefit from huge economies of scale, amortised plants and long periods of innovation, so very cost-competitive
- *How to make new bio-based olefins compete ?*

<http://www.youtube.com/watch?v=BYBrXTs6Nm8>



# Fossil fuel consumption subsidies



- Global financial support to renewable energy, 2011: **USD 88 billion**

International Energy Agency (2012). World Energy Outlook 2012. Paris: IEA Publishing.  
International Energy Agency (2013). Market Trends and Projections to 2018. Paris: IEA Publishing.





# Thank you for your time

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