



Status of biogas development in the European Union and opportunities for international cooperation

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3-5 November 2016, Beijing, China





DG JRC Role: facts & figures

- 6 locations in 5 Member States
- **1 500 core research staff**, out of around 3 000 total staff
- **83%** of core research staff with **PhDs**
- Research fellows and visiting scientists
- **42 large scale research facilities**, more than 110 online databases
- More than **100 economic, bio-physical and nuclear models**

Mission: *"As the science and knowledge service of the Commission our mission is to support EU policies with independent evidence throughout the whole policy cycle."*

Vision: *"To play a central role in creating, managing and making sense of the collective scientific knowledge for better EU policy."*

Energy and Climate Challenges



Keep global warming below 2° C – Paris Agreement

- reduce GHG emissions by 20% by 2020, in comparison with 1990
- reduce GHG emissions by 80 by 2050

The 2020 energy targets:

- 20% reduction in energy consumption
- 20% share of renewables in energy mix
 - 10% renewable energy in transport
- sustainability requirements for biofuels for transport
 - GHG emissions savings of 35% now (60% from 2018)
 - No-go areas for raw materials

Energy and climate targets for 2030

- 40% reduction in greenhouse gas emissions
- at least a 27% share of renewable energy consumption
- at least 27% energy savings compared with the business-as-usual

Low-carbon economy by 2050

- Several decarbonisation scenarios for the period until 2050
Energy Roadmap 2050



EU objective for 2050: GHG emissions 80% below 1990 levels

Explore routes towards a low-carbon energy system by 2050

Scenarios explore routes to decarbonisation of energy system

- ❖ Reference scenario
- ❖ Current Policy Initiatives

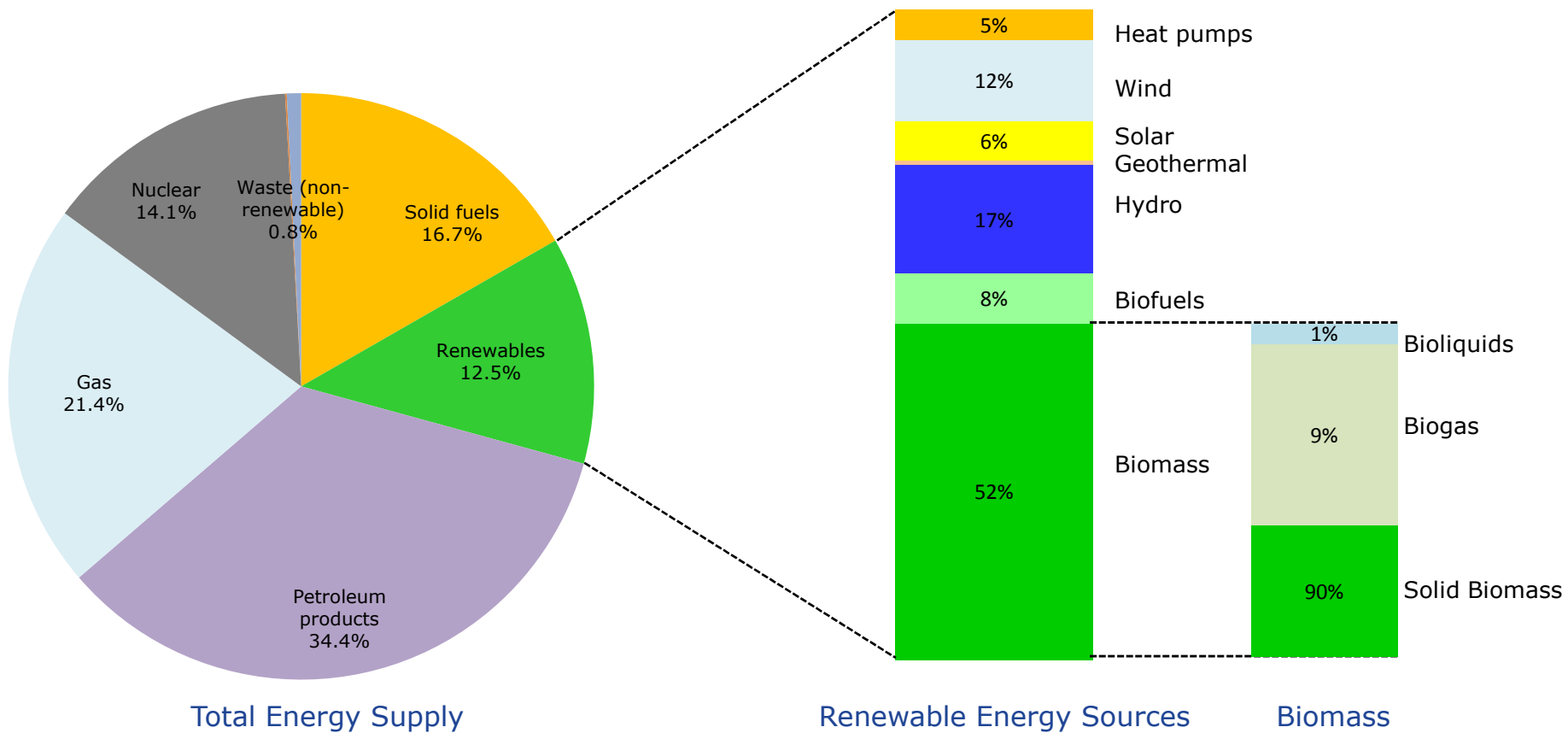
➡ 40% GHG reduction by 2030

- ❖ Energy Efficiency
- ❖ Diversified Supply Technologies
- ❖ High RES
- ❖ CCS
- ❖ Low Nuclear

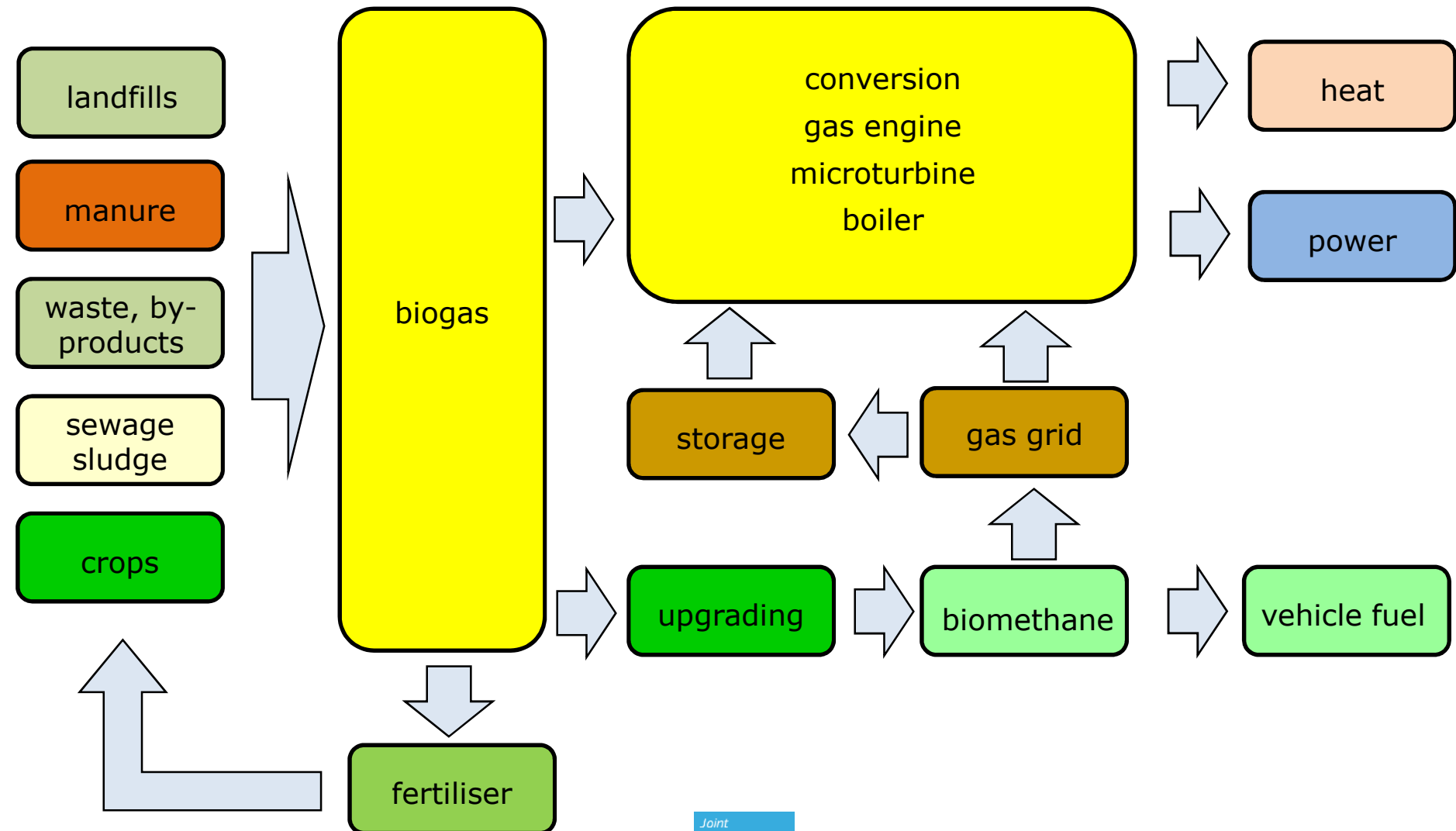
➡ 80% GHG reduction by 2050



EU energy mix in 2014



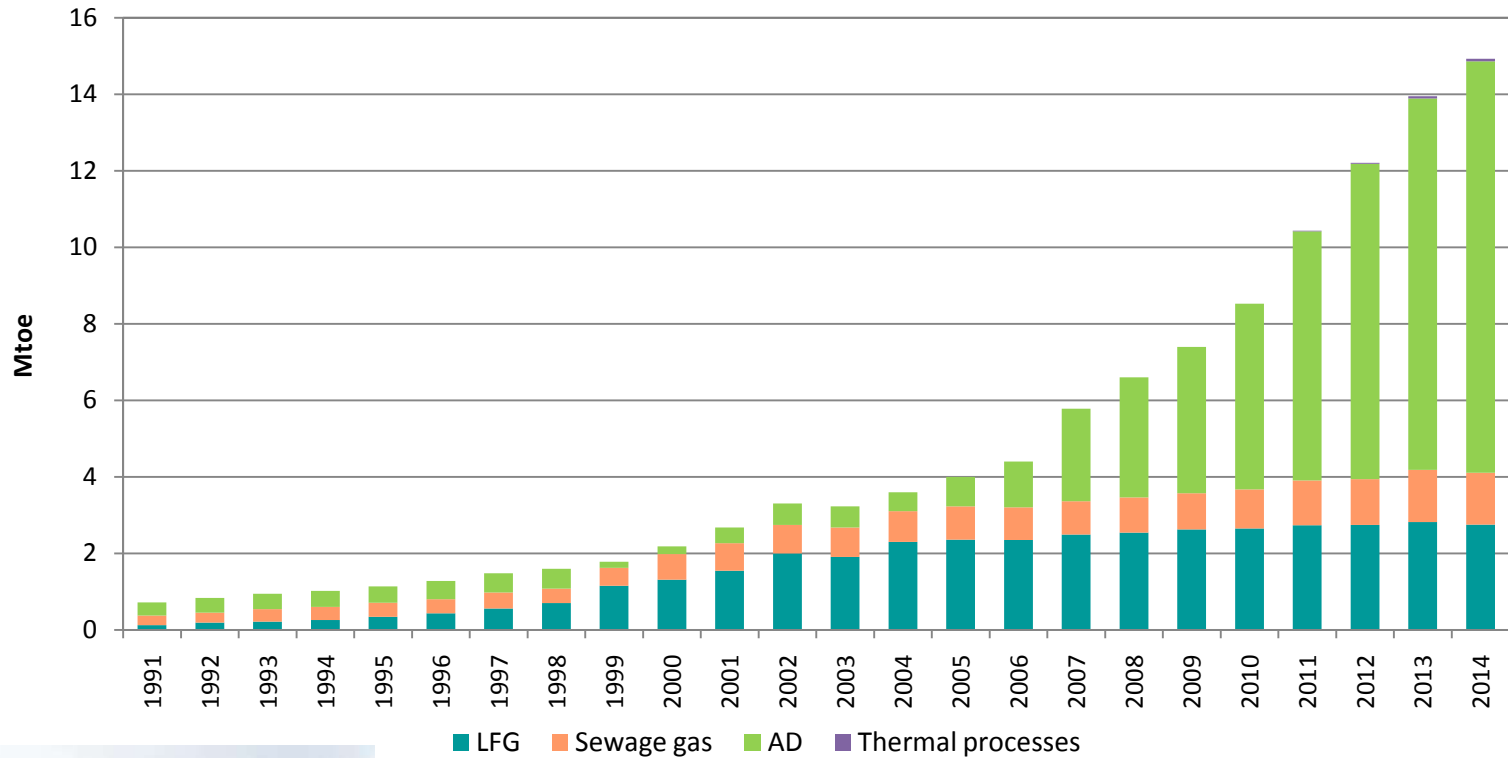
Biogas: technology options



Biogas uptake in Europe



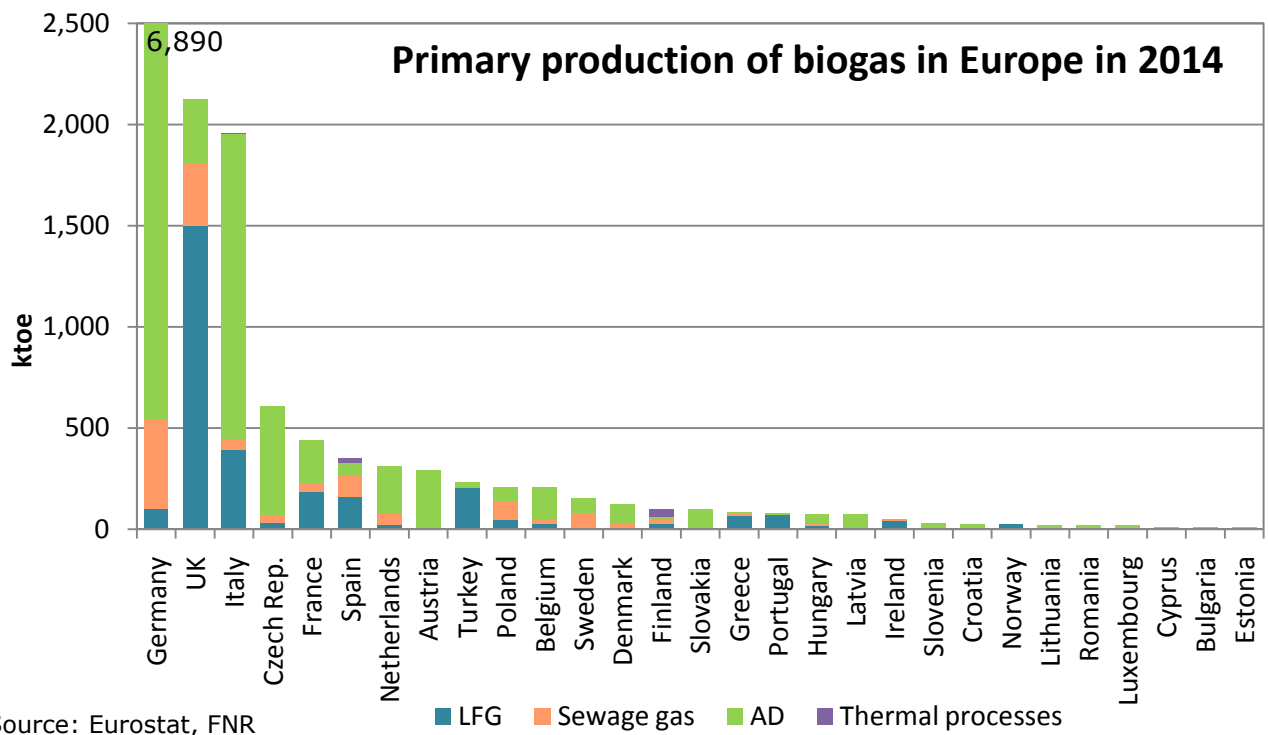
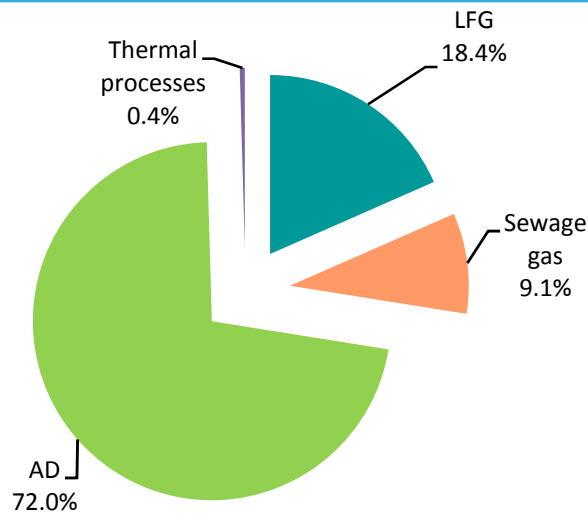
Evolution of primary energy biogas production in the EU



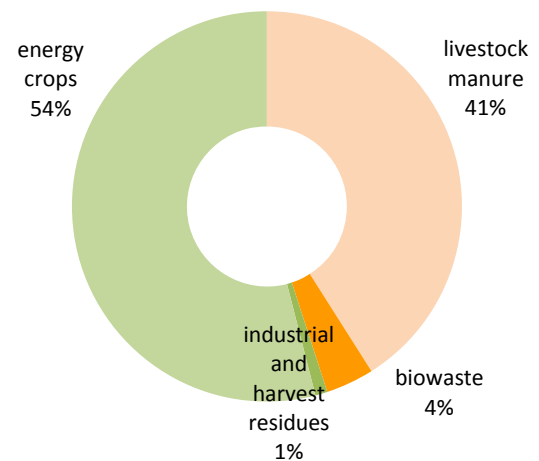
Biogas uptake in Europe



- Landfill Gas Recovery –collection of the landfill gas
- Anaerobic Digestion
- Waste Water Treatment Plants (WWTP) - sewage sludge
- Agriculture – manure and energy crops (e.g. energy grasses, silage maize)
- Biowaste – food waste and other types of biowaste
- Industrial waste streams (e.g. food industries)



Feedstock use in biogas plants in 2012 in Germany

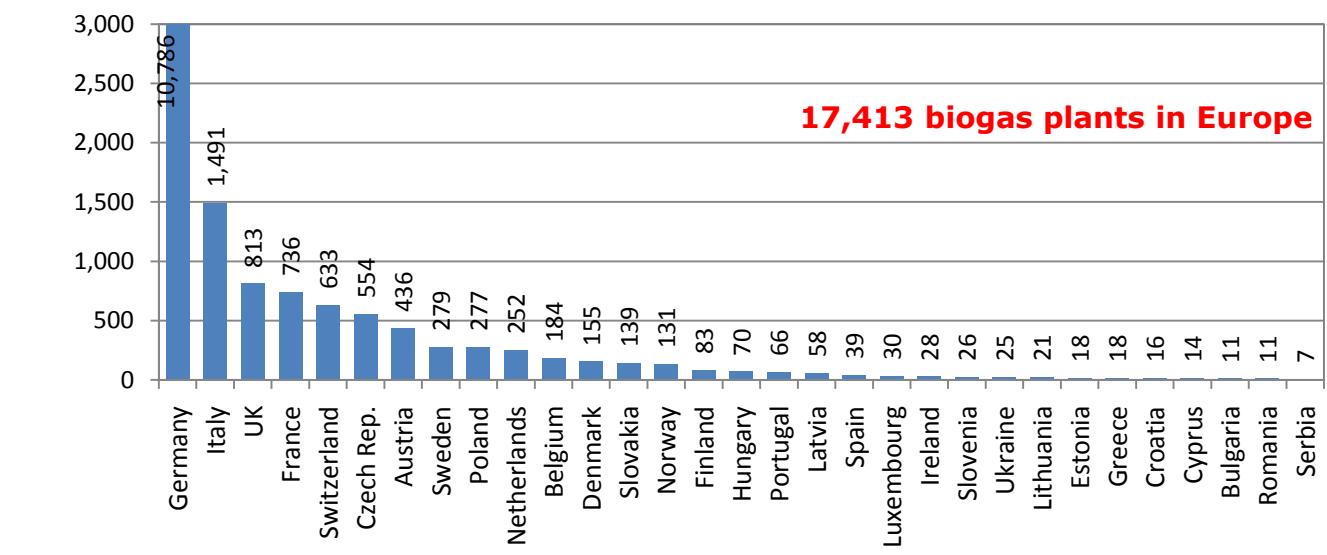
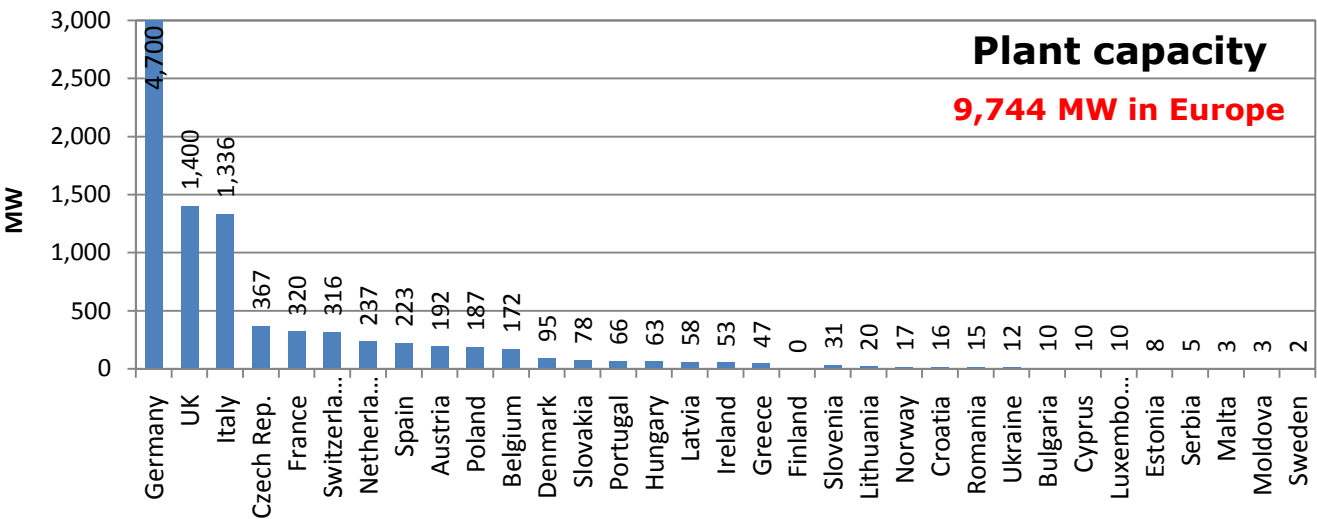


Source: Eurostat, FNR

Biogas uptake in Europe



Biogas plants: very large to very small

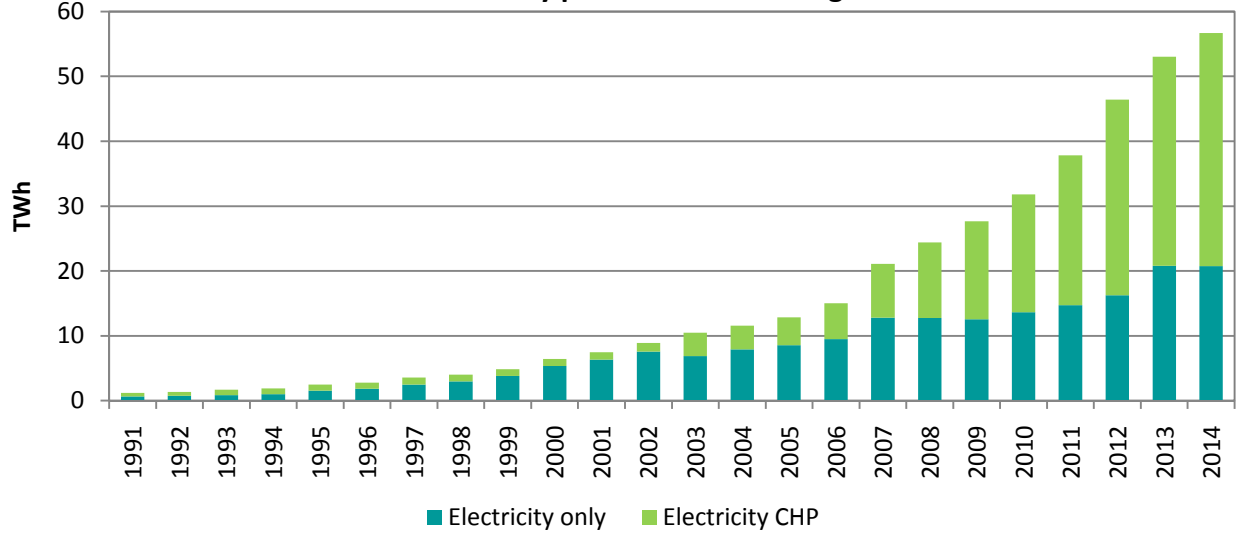


Source: Eurostat

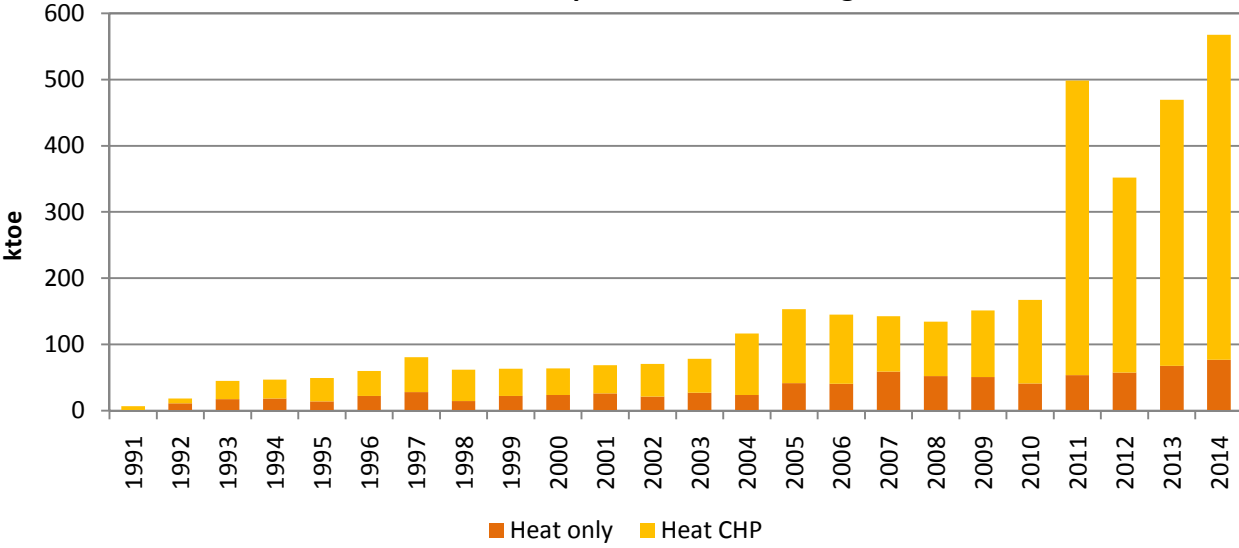
Biogas uptake in Europe



Evolution of electricity production from biogas in the EU



Evolution of derived heat production from biogas in the EU



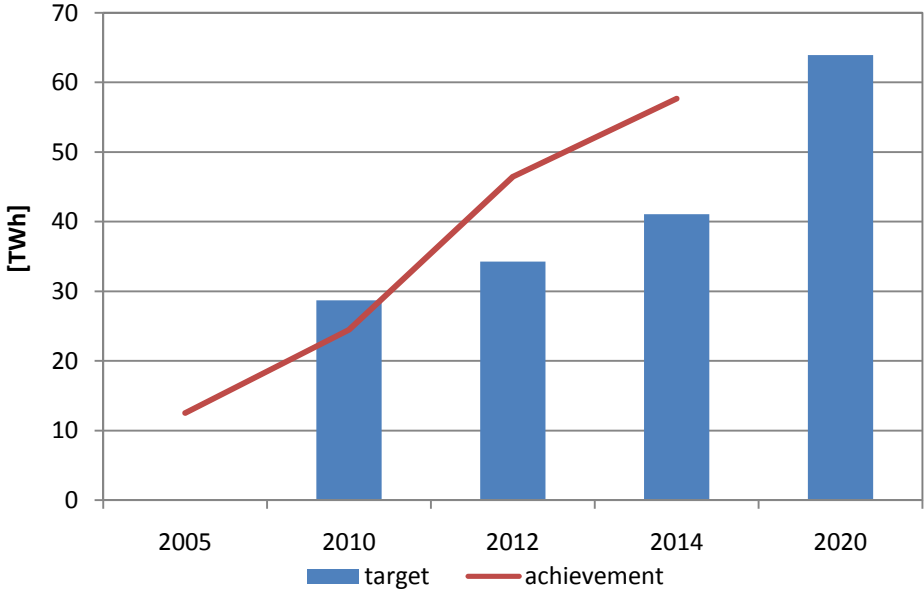
Source: www.eu-agrobiogas.net

Biogas uptake in Europe

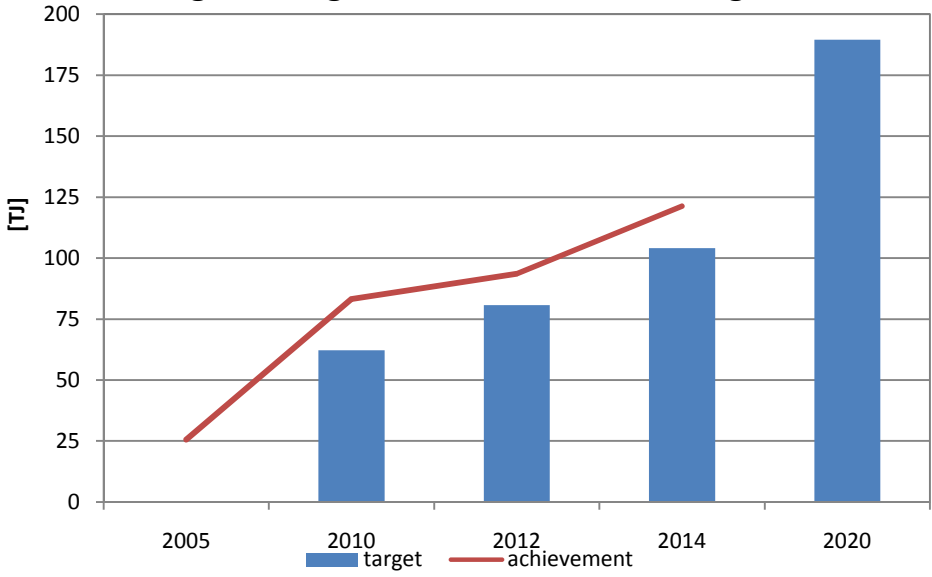


Progress in biogas electricity and heat production in the EU above the National Renewable Energy targets

Biogas electricity and NREAP targets



Biogas heat generation and NREAP targets

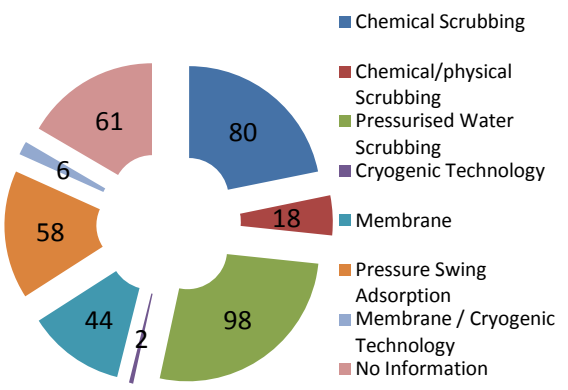


Biogas upgrade

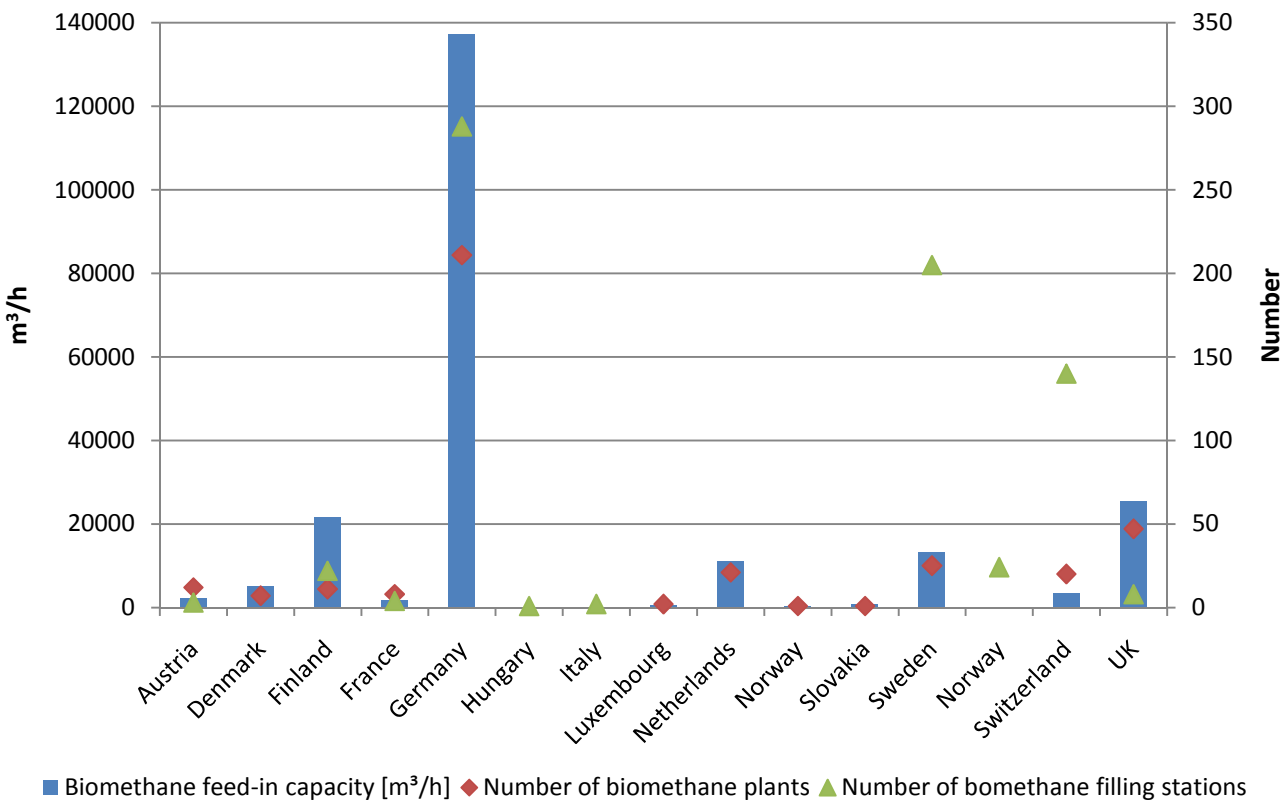


Biomethane upgrading technologies

- Chemical/physical scrubbing
- Pressurised Water Scrubbing
- Pressure Swing Adsorption
- Cryogenic
- Membrane



Biomethane plants



- ❑ 367 biomethane plants in Europe
- ❑ 697 biomethane filling stations
- ❑ 1,953 mil m³ biomethane/year capacity

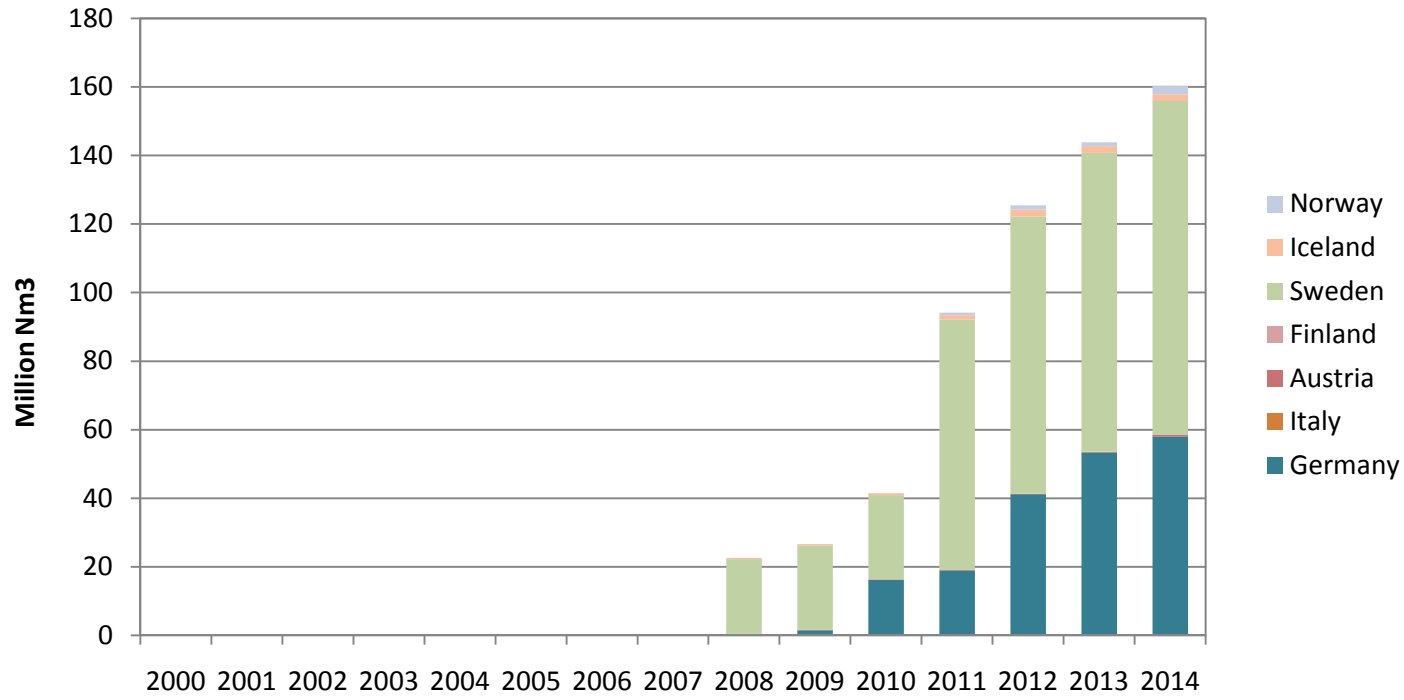
- ❑ 1.2 million NGV in Europe
 - 885,000 NGV in Italy
 - 98,000 NGV in Germany
 - 47,000 NGV in Sweden
- ❑ 3500 LNG and CNG stations

Biomethane as vehicle fuel



- Biomethane is compressed to 200 bars for on-site storage or transport by road
- Biomethane can be used in vehicles operated with natural gas without any engine modification
- Bi-fuel vehicles use gas and gasoline
- Biomethane is distributed through on-site fuelling stations

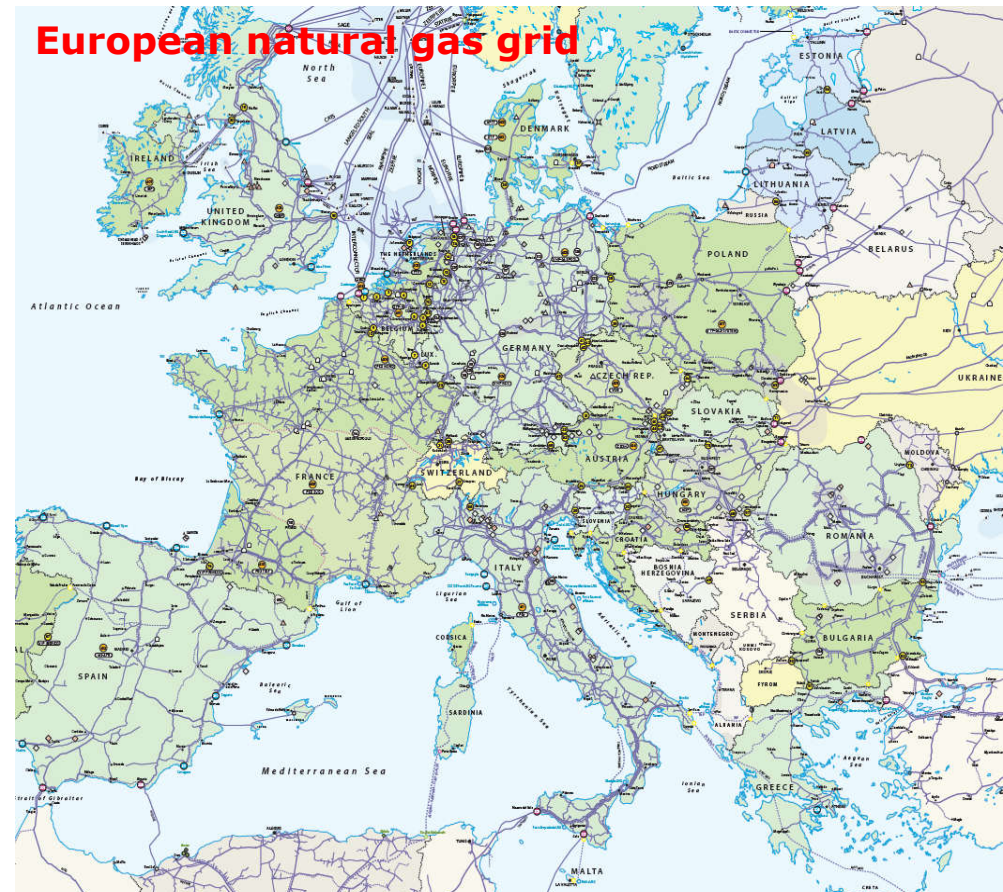
Biomethane use in transport in European countries



Biogas injection into natural gas grid



- Biogas plants usually locate in rural areas
- Biogas can be distributed via natural gas grid
- Biogas needs to be upgraded before gas grid injection to natural gas quality
- Grid connects the production site with more densely populated areas
- Used at the place where needed
- Improves the local security of supply
- Standards for gas injection to grid
 - Low and High Heating Value, methane, carbon dioxide, sulphur compounds, moisture, siloxanes...



Biogas potential from manure



livestock

biogas potential

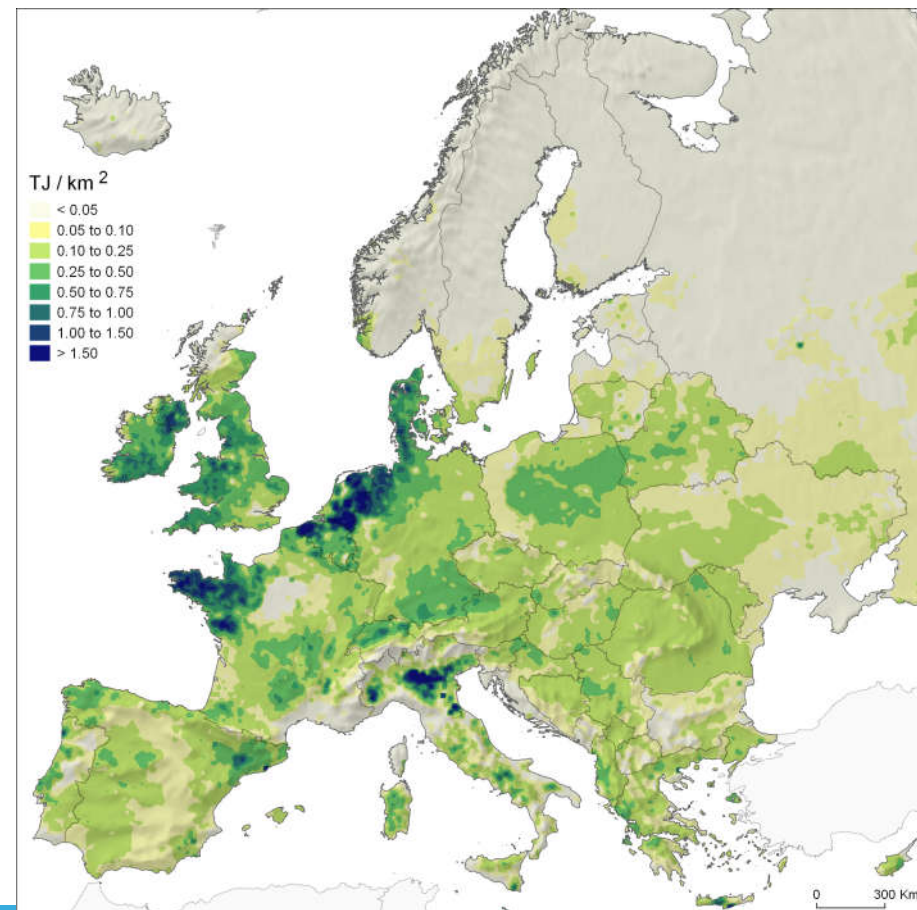
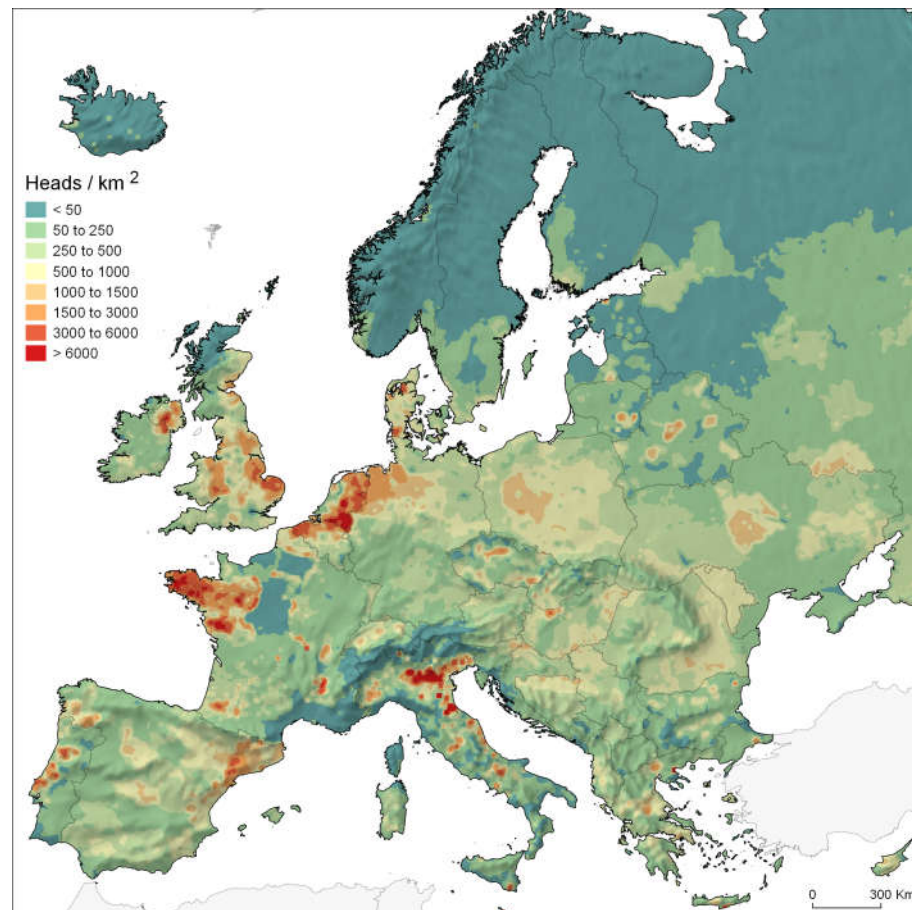
suitable plant location

Livestock information

- statistical data on livestock type, population
- geo-referenced data

Spatial distribution of biogas

- feedstock composition (DM, OM)
- biogas yields
- Total and realistic potential



Biogas potential from manure



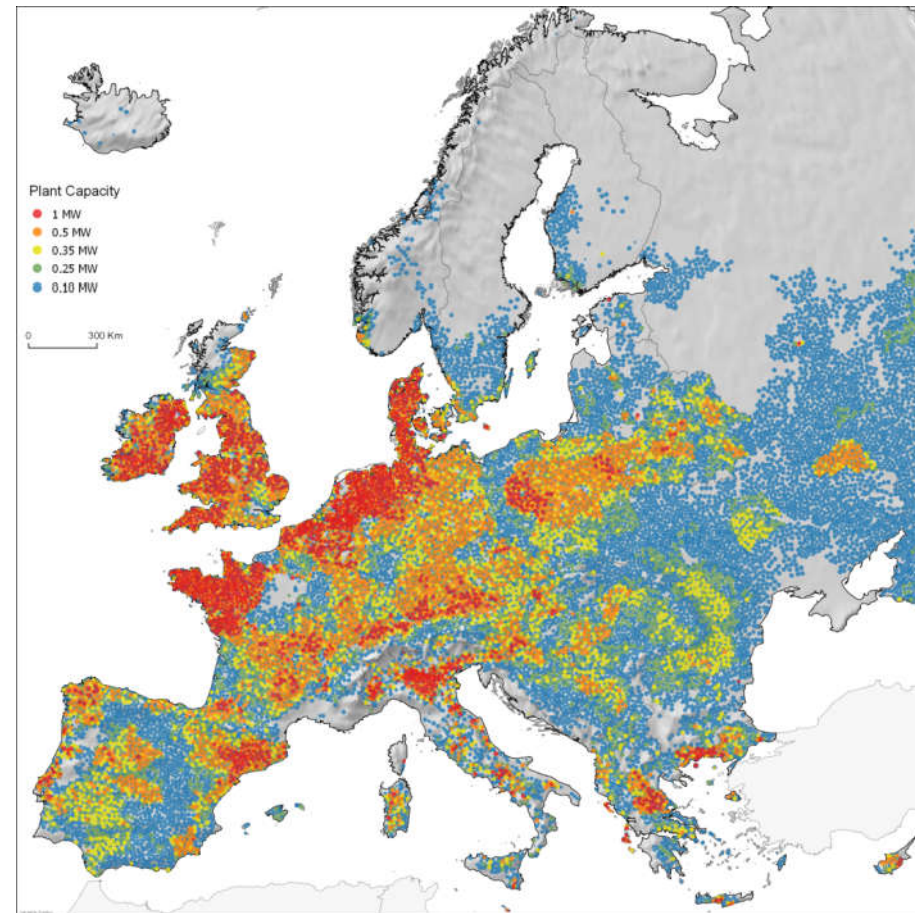
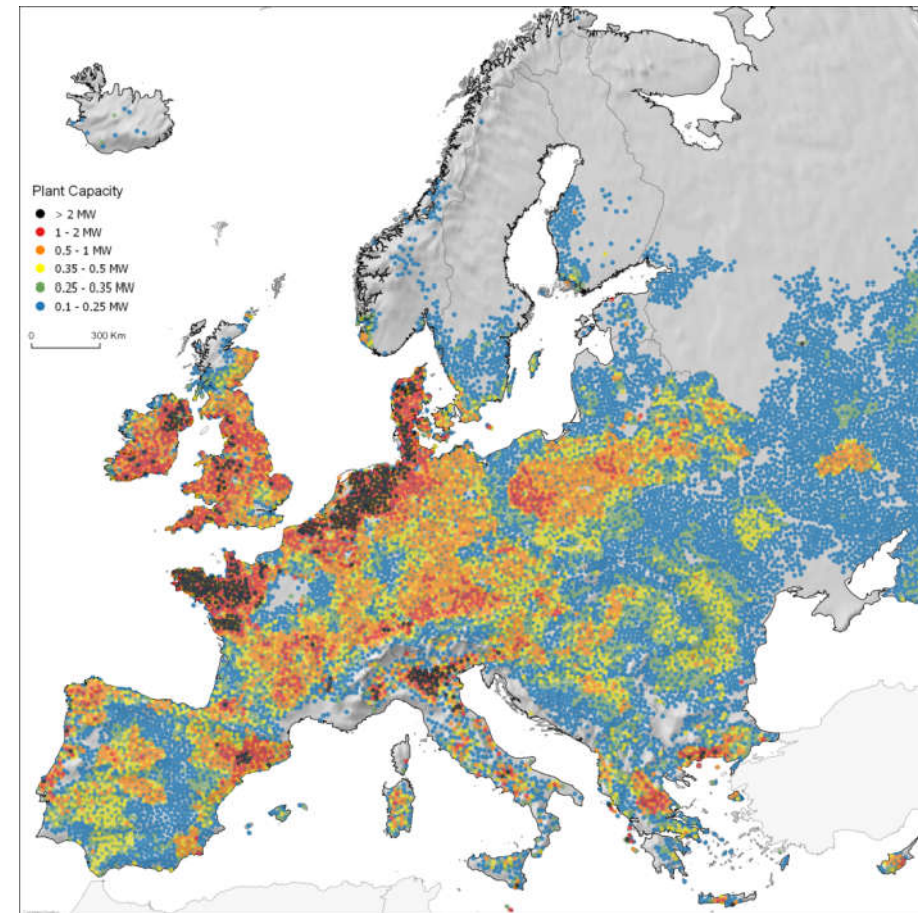
livestock

biogas potential

suitable plant location

➤ two scenarios investigated:

- constant collection radius of 10 km
- variable collection area (max 10 km radius) for 1 MWe, 500 kW_e, 350 kW_e, 250 kW_e, 100 kW_e



between 13,866 and 19,482 manure-based biogas plants could be built in Europe

biogas plant capacity: 6,144- 7145 MWe
average capacity: 365-440 kW_e

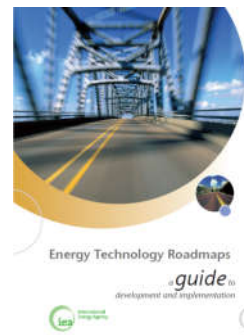
Challenges for biogas development for Europe



- improvements in economic performance, monitoring and control, upgrading technologies
- maximising heat use
- use of residues and wastes - what about energy crops ?
- new and difficult feedstock - lignocellulosic biomass, algae ...
- compatible regulations for grid injection
- availability of financial support schemes
- social acceptance

Technical Networking in the field of bioenergy:

- ❖ **IEA Technology roadmaps**
to advance global development and uptake of key technologies to reach a 50% reduction in energy-related CO₂ emissions by 2050
- ❖ **IEA - Bioenergy How2Guide Initiative**
specific guidance for bioenergy technology roadmap development and implementation at national/regional level
- ❖ **IEA Bioenergy Task 37: Energy from Biogas**
addresses the whole production chain from collection and pretreatment to biogas upgrading, fertiliser application and process chain sustainability
- ❖ **IEA Bioenergy Task 43: Biomass Feedstocks for Energy Markets**
analyses related to biomass feedstock, including biomass markets and the socioeconomic and environmental consequences of feedstock production
- ❖ **Global Bioenergy Partnership (GBEP)**
WG on Bioenergy and Water
- ❖ **International Civil Aviation Organisation (ICAO)**
Alternative Fuel Task Force (AFTF)



International cooperation



European Commission

EC is supporting the UNEP-SETAC Life Cycle Initiative



<h3>Starting Life Cycle Thinking</h3> <p>The Life Cycle Initiative aims to foster the concept of Life Cycle Thinking (LCT). Learn more about the idea behind LCT and existing methodologies.</p>	<h3>Activities</h3> <p>The activities of the Life Cycle Initiative are divided into 5-year phases. Learn about the work areas, objectives and deliverables of our current phase of activities.</p>	<h3>Resources</h3> <p>Knowledge generation on approaches and methodologies is a core element of our work. Browse our broad variety of resources, training materials, and publications.</p>	<h3>Events</h3> <p>Find out about interesting international events, conferences and workshops related to the field of Life Cycle Approaches, including both upcoming and past events.</p>
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Life Cycle Assessment activities worldwide are mapped, including public and private initiatives as well as research groups.





China-EU Panel on Land and Soil

MANDATE

- China-EU Panel on Land and Soil (SEPLS) scientific body with goal to provide decision makers in
- Europe and China with a clear scientific view on current state of land and soil resources and potential
- environmental and socio-economic consequences of their utilization patterns

FUNCTIONS

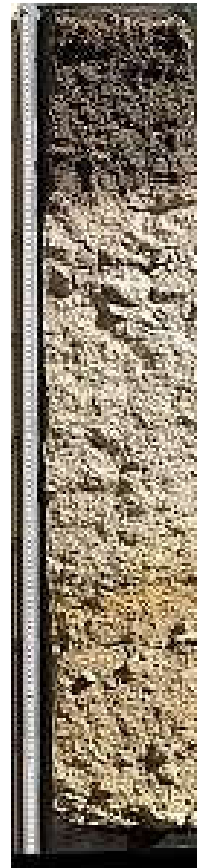
- Evaluate and Report Scientific results for policy support
- Propose Priority issues for research projects
- Policy Evaluation and Advice
- Awareness Raising (Public, Across sectors)

DELIVERABLES

- Policy support summary documents
- Identification of knowledge gaps
- Proposals for research projects

SECRETARIAT

- **In Europe: Joint Research Centre**
- **In China: Chinese Academy of Sciences**

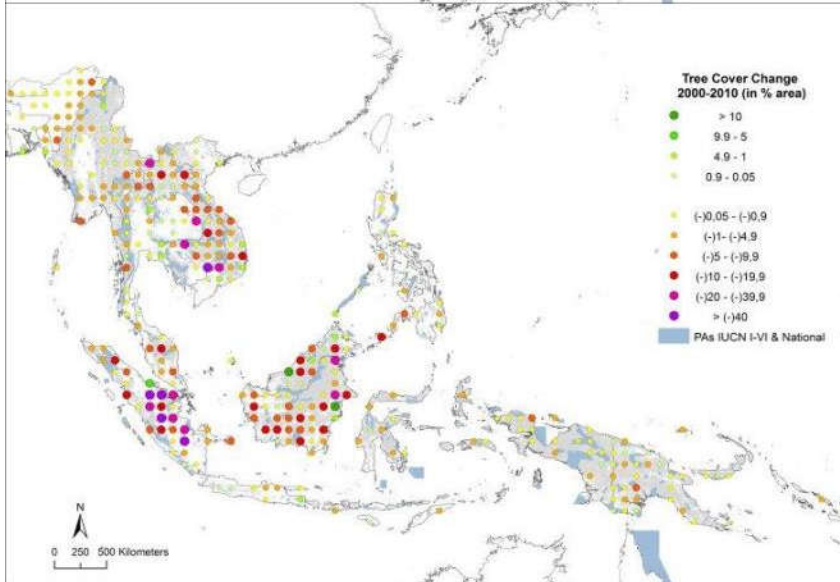
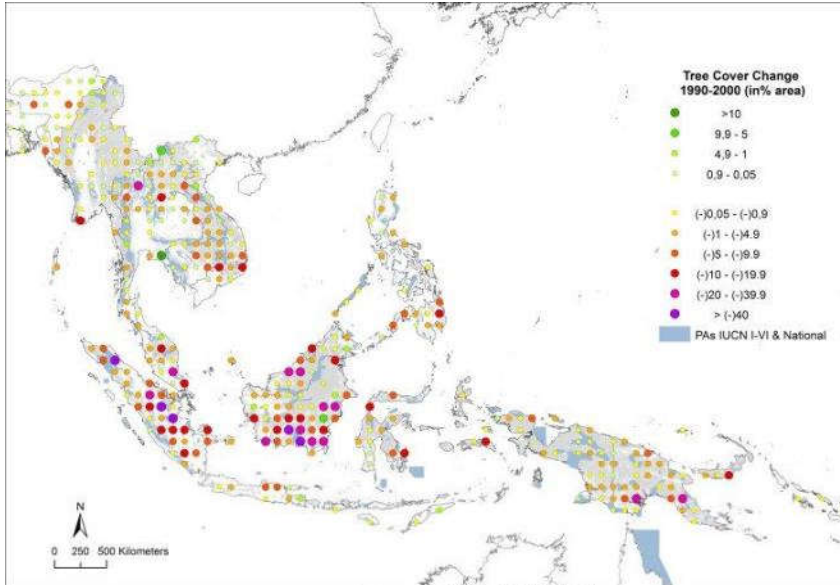




Tropical Deforestation Monitoring with Remote Sensing

Spatial distribution of forest cover change in Southeast Asia: change in forest cover per sample site (in % of land area, clouds excluded).

IUCN I-VI and National Protected Areas from IUCN and UNEP (2009). Background map (grey): Forest Cover 2000.



Forest cover and change from 1990 to 2010 in South-east Asia (Areas in Mha, se), 1990-2000 & 2000-2010

Forest cover 1990 268.0 (6.6)

Forest cover 2000b 250.6 (6.7)

Forest cover 2010 236.3 (6.7)

Gross forest cover loss 20.4 (1.9) 17.7 (1.9)

Gross forest cover gain 2.9 (0.5) 3.2 (0.7)

**Net change forest cover -17.5 (2.6) -14.5 (2.5)
approx. 6 and 7%**

Net change OWLc +10.6 (1.8) +7.1 (1.6)

a incl. PNG & Solomon Isl., b average from two period estimates, c OWL = Other Wooded Land.

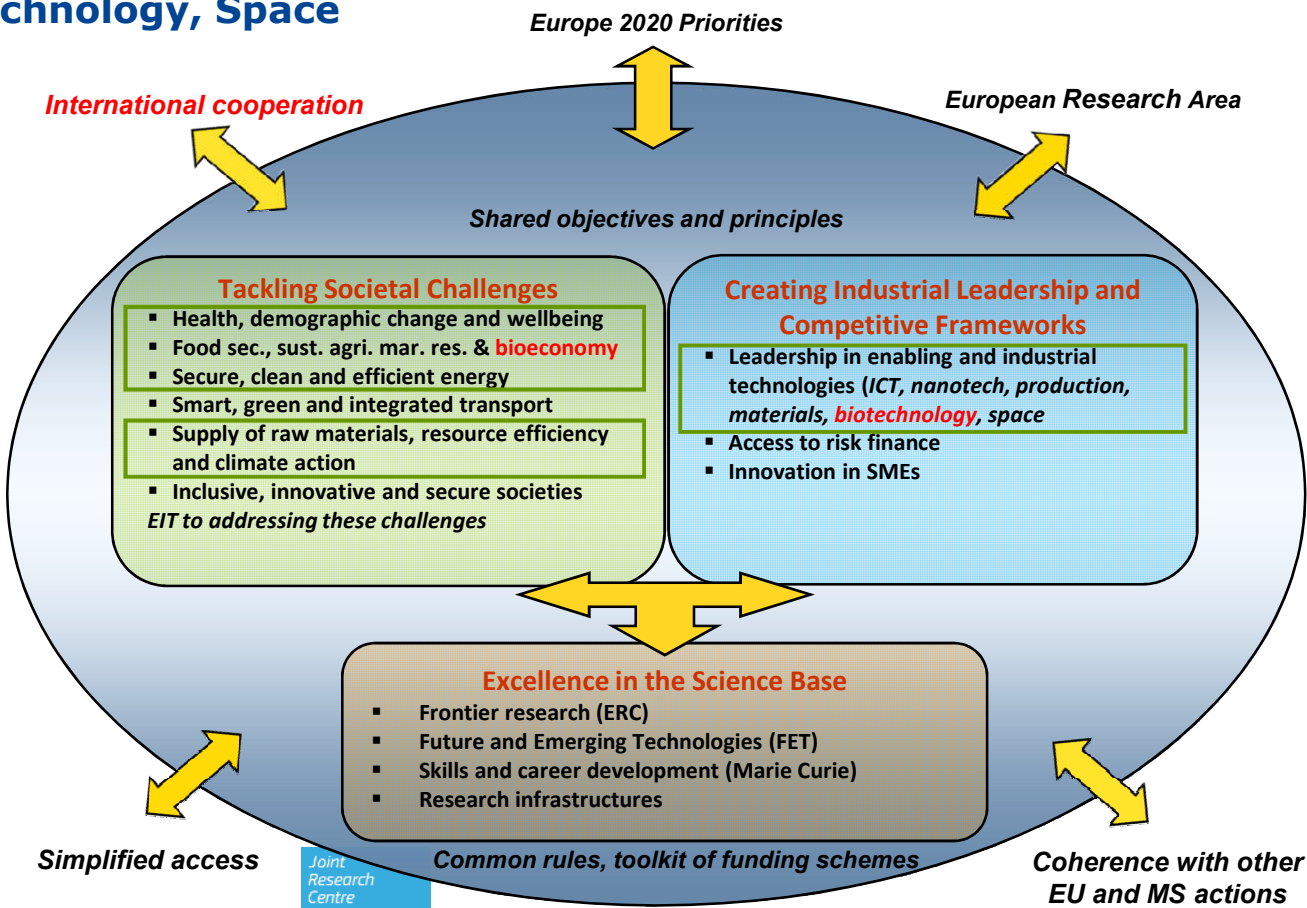
Horizon 2020

Framework Programme for Research and Innovation



China can participate in all Calls for Proposals of the EU Horizon 2020

Several topics are specifically flagged for targeted cooperation with China including the fields of **Food, Agriculture and Biotechnology, Water, Energy, ICT, Nanotechnology, Space and Polar research.**





The EC2 project



- ◆ Europe-China Clean Energy Centre
- ◆ Promoted by European Commission, National Energy Administration (PRC), Ministry of Commerce (PRC)
- ◆ 2010-2015
- ◆ Total budget: € 12.4 M
- ◆ 14 partners



EC2 activities



- ◆ **Objective:** To support Chinese Government's efforts to shape a more sustainable, environment-friendly and efficient energy sector

through access to

European policies, regulatory frameworks, technologies, relevant know-how and best practices

- Technological Platform for EU-China cooperation on clean energies
- Policy Advisory and Capacity Building
- Awareness Raising (project results and updates on focus areas)

Bioenergy Scientific / Technical Networking

European
Commission

Bioenergy & Bioeconomy, Status & Perspectives

Hagoshrim Israel JRC, MIGAL, 2015

Use of agricultural residues for bioenergy

SECB, UABIO, Kiev, Ukraine, 2014

EUROCLIMA Workshop on International Cooperation in the field of Bioenergy & Technology

Santiago de Chile, 2013 - JRC, CER.

Cereals straw and agricultural residues for bioenergy in New Member States and Candidate Countries,, 2007 Novi Sad Serbia.

Sustainable Bioenergy Cropping Systems for the Mediterranean, Madrid 2006 - JRC, EEA, CENER, CIEMAT.

Cereal straw resources for bioenergy in the European Union, 2006, Pamplona, CENER, Spain.

Extending RES sustainability criteria to solid and gaseous biomass The Hague, Uppsala, 2012 - JRC, IEA, INAS, NL Agency

The effects of increased demand for biofuel feedstocks on the world agricultural markets and areas, Ispra, 2010.

Review and inter-comparison of modelling land use change effects of bioenergy, OECD/EEA, Paris, 2009.

Direct and indirect impact of biofuel policies on tropical deforestation in Malaysia, MPOC, Kuala Lumpur, Malaysia 2008

Agro-environmental impact of biofuels and bioenergy, UNICAMP/CTBE Campinas, Brazil, 2011.

Greenhouse gas emissions from biofuels and bioenergy INTA, Buenos Aires, Argentina, 2011.



Biomass resource assessment for biofuels/bioenergy and competition with other biomass uses, Eberswalde University/EEA, Germany, 2009.

SRF, SRC and Energy Grass in the European Union: Agro-environmental component, present use and perspectives, 2007, Harpenden-EEA, Rothamsted, UK.

EU Forest-based biomass for energy: cost supply relations and constraints, Metla/EFI, 2007, Joensuu, FI

Opportunities for international cooperation on biogas



- ❖ Biogas potential largely untapped
- ❖ Resource assessment, taking into account various sustainability constraints
- ❖ Operational experience for biogas generation – small to large scale
- ❖ Available and new emerging technologies for electricity, heating and biogas upgrading to natural gas quality
- ❖ New business opportunities – for rural development, equipment manufacturers, and operators
- ❖ Contribute to climate change mitigation – large greenhouse gas emission reduction potential
- ❖ Opportunities for local use v.s. natural gas grid injection and biogas use as fuel

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