Prospects for the International Bioenergy Market and Scientific Cooperation

Network of Expertise in Energy Technology – Integrated Approaches to Energy Technologies

Beijing, China – November 27, 2012

Jonathan L. Male – IEA Bioenergy

Content

- IEA Bioenergy: International bioenergy RD&D cooperation
- International biomass and bioenergy trade: past, present, future
- Current status of technology
- Promising developments in technology

IEA Bioenergy

IEA Bioenergy

IEA Bioenergy is an international collaboration set up in 1978 by the International Energy Agency (IEA) as one of more than 40 "Implementing Agreements" within IEA's Energy Technology Network

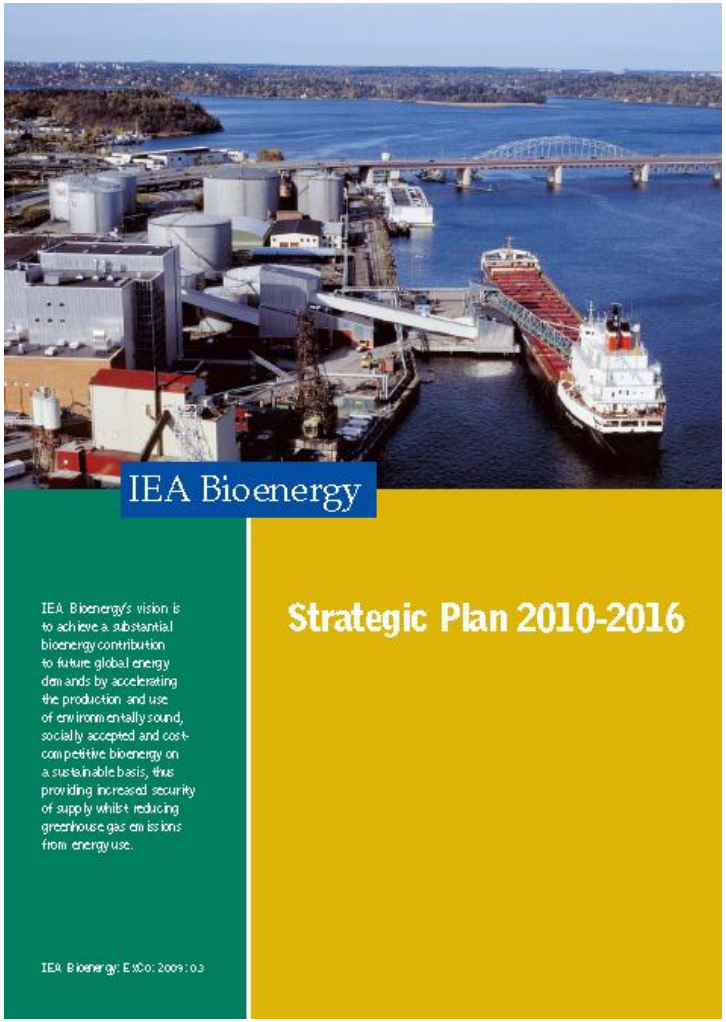
Bioenergy Implementing Agreement:

- ***24 Contracting parties,***
  12 Annexes/Tasks
- ***www.ieabioenergy.com***

Strategic Plan

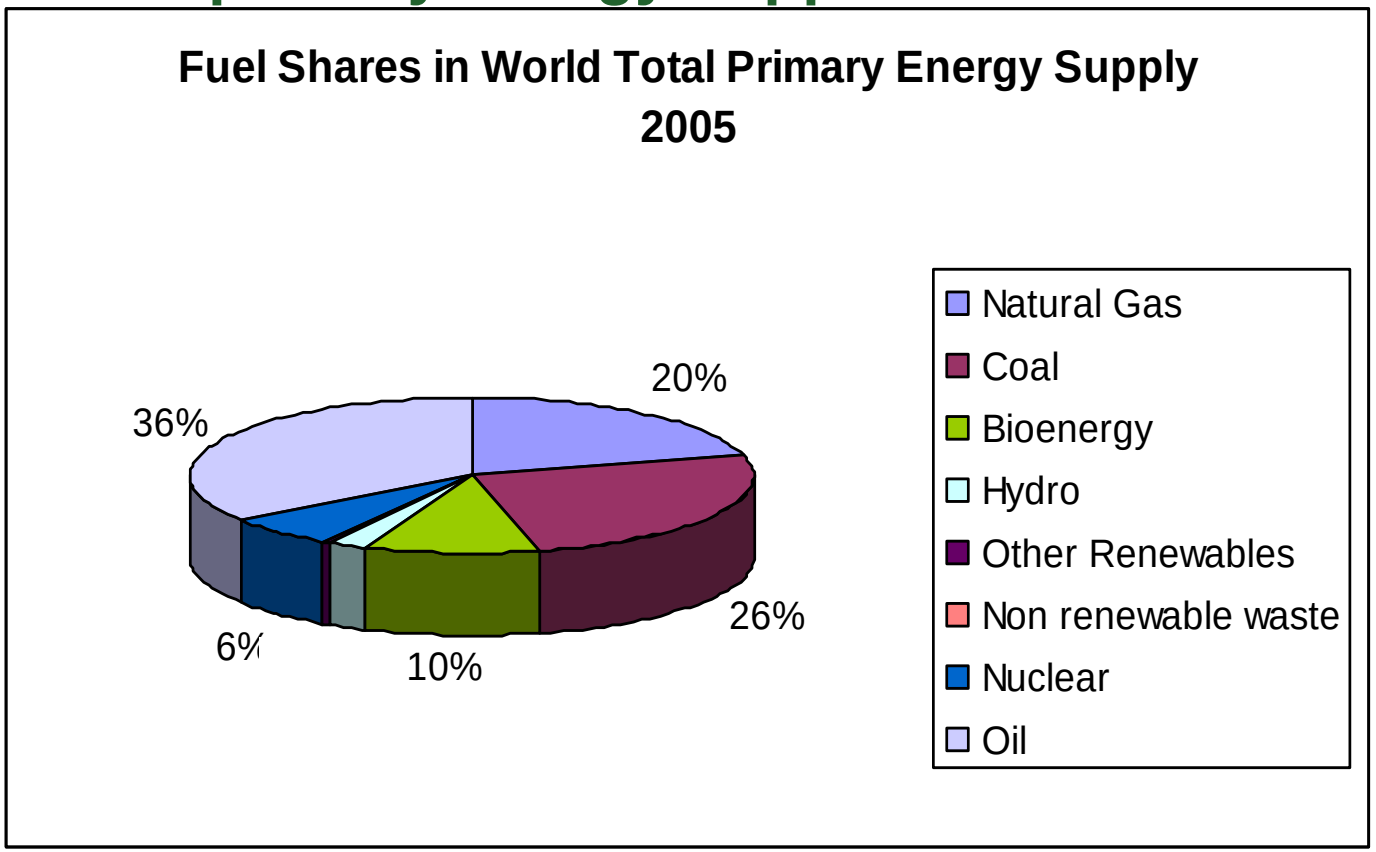
IEA Bioenergy

Vision: To achieve a substantial bioenergy contribution to future global energy supplies by accelerating the production and use of environmentally sound, socially accepted and cost-competitive bioenergy on a sustainable basis, thus providing increased security of supply whilst reducing greenhouse gas emissions from energy use.



Bioenergy

- **Already plays a major role supplying ~10% of world primary energy supplies**

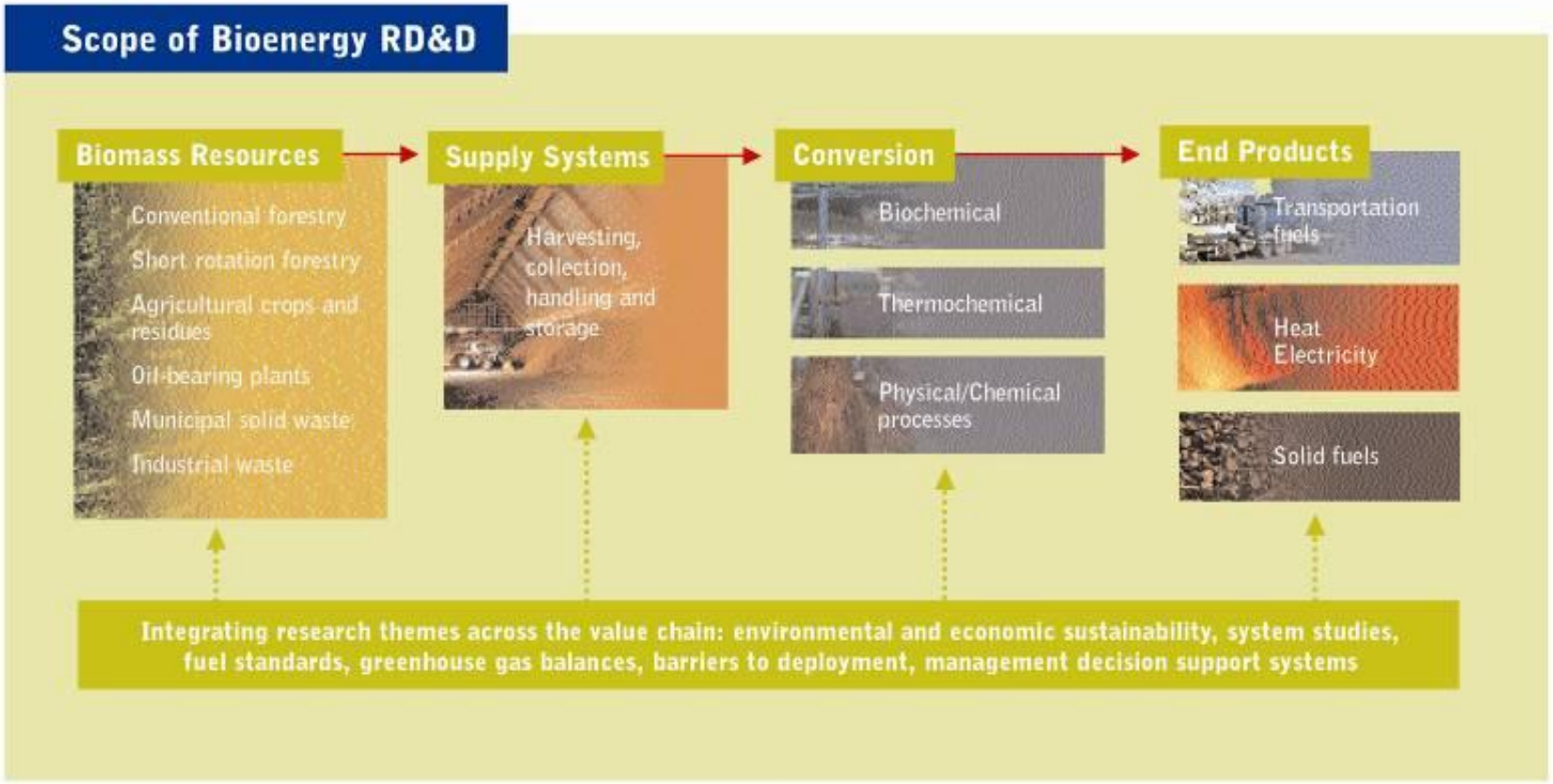


IEA Renewables Information 2007

- **Has significant scope to make a greater contribution to secure and sustainable energy provision**

Bioenergy

- **Involves a range of feedstocks and technology options that can produce heat, power and liquid fuels**



Agreement Activities

IEA Bioenergy

Executive Committee

- Bi-annual Executive Committee meetings, management of the IEA - Bioenergy
- Topical Workshops
- Annual report, newsletters, website
- Strategic Position Papers

Tasks

- Coordination of national RD&D programs, information exchange and joint projects
- Task meetings, study tours and workshops
- Publications, reports, newsletters, websites
- Networking with industrial and other stakeholders

12 Task in Three Areas

- **Feedstock**
  Forest and agricultural products, MSW and recovered fuels

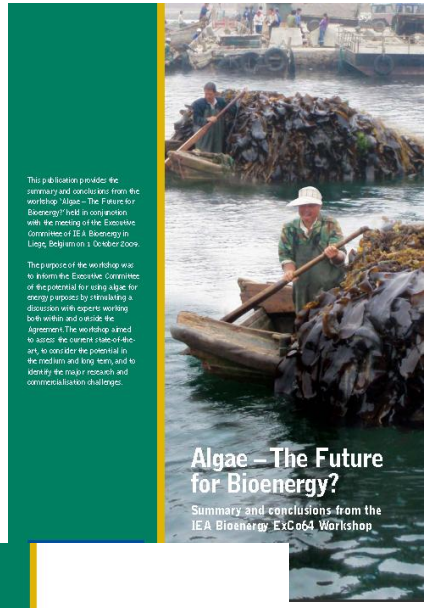
- **Conversion**
  Combustion, gasification, pyrolysis, anaerobic digestion, fermentation, biorefineries

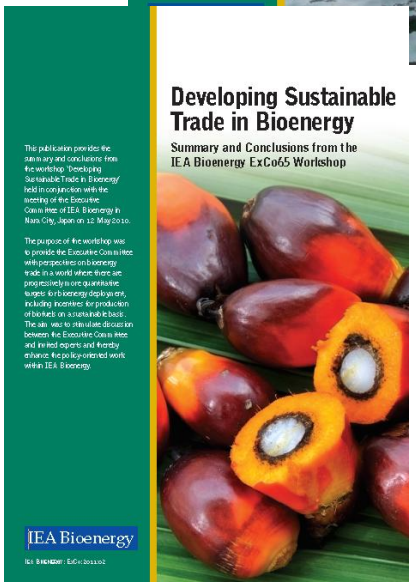
- **Integrating Research Issues**
  GHG balances, socio-economic drivers, international trade, systems analysis

Workshops

Held in conjunction with Executive Committee Meetings...

- **Integrated waste management and utilisation of the products for energy**
- **Availability of biomass resources**
- **The biorefinery concept**
- **Biofuels for transport - part of a sustainable future**
- **Bioenergy – the impact of indirect land use change**
- **Algae the future for bioenergy?**
- **Developing sustainable trade in bioenergy**

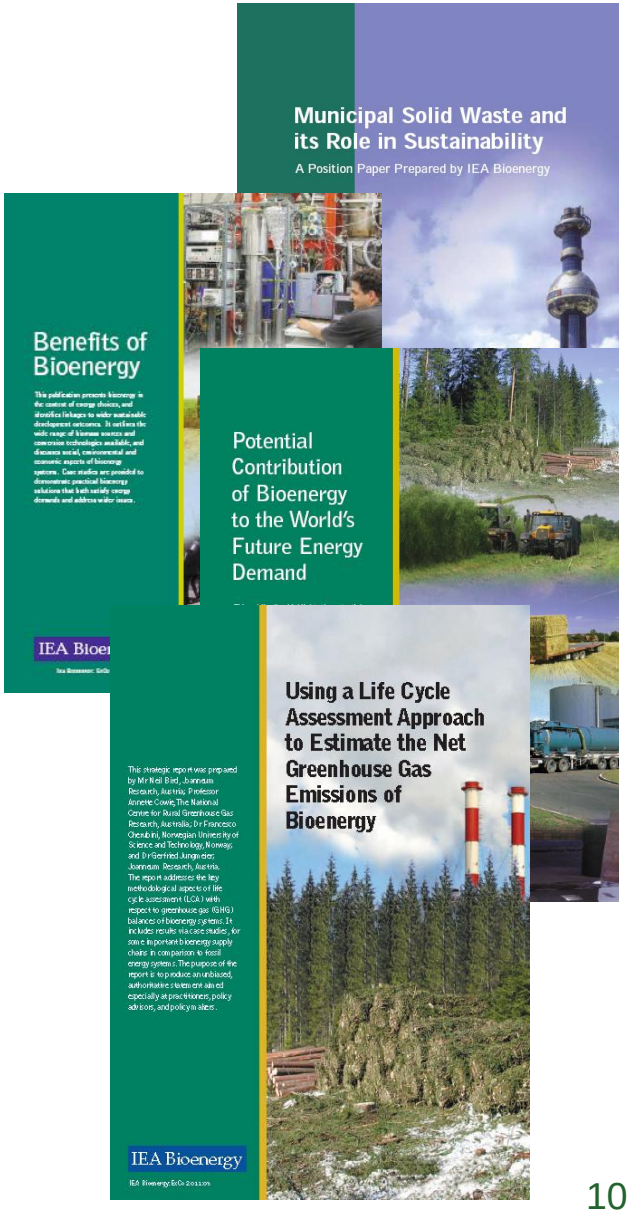




Strategic Position Papers

IEA Bioenergy

- Sustainable Production of Woody Biomass for Energy
- Municipal Solid Waste and Its Role in Sustainability
- Benefits of Bioenergy
- Potential Contribution of Bioenergy to Future World Energy Needs
- Using a Lifecycle Assessment Approach to Estimate the Greenhouse Gas Emissions of Bioenergy

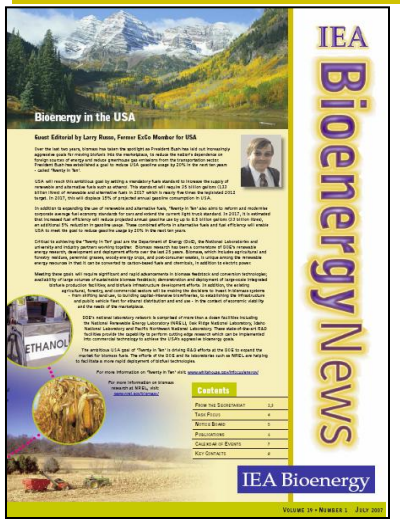


Annual Reports and Newsletters

- **Annual Report: Report from the Executive Committee, progress reports on each Task, feature article and information on budgets and participation**

- **IEA Bioenergy News: Report on ExCo meeting and workshop, editorial from a Member Country, news from the Tasks recent publications and upcoming events**

www.ieabioenergy.com



24 Contracting Parties

IEA Bioenergy

- Australia
- Austria
- Belgium
- Brazil
- Canada
- Croatia
- Denmark
- European Commission
- Finland
- France
- Germany
- Ireland
- Italy
- Japan
- Korea
- Netherlands
- New Zealand
- Norway
- South Africa
- Sweden
- Switzerland
- Turkey
- United Kingdom
- United States

Development of International Biofuels Production and Trade

IEA Bioenergy

Solid biofuels trade

- Total 2000 → 2010: 56 → 300 PJ
- Pellets 2000 → 2010: 8.5 → 120 PJ
- Combustion systems near competitiveness

Liquid biofuels production

- Biodiesel 2000 → 2009: 30 → 572 PJ
- Bioethanol 2000 → 2009 340 → 1540 PJ
- "Net trade" 2009: 120-130 PJ
- New technologies under development (cellulose fermentation, synthetic fuels)
- Not competitive without policy measures

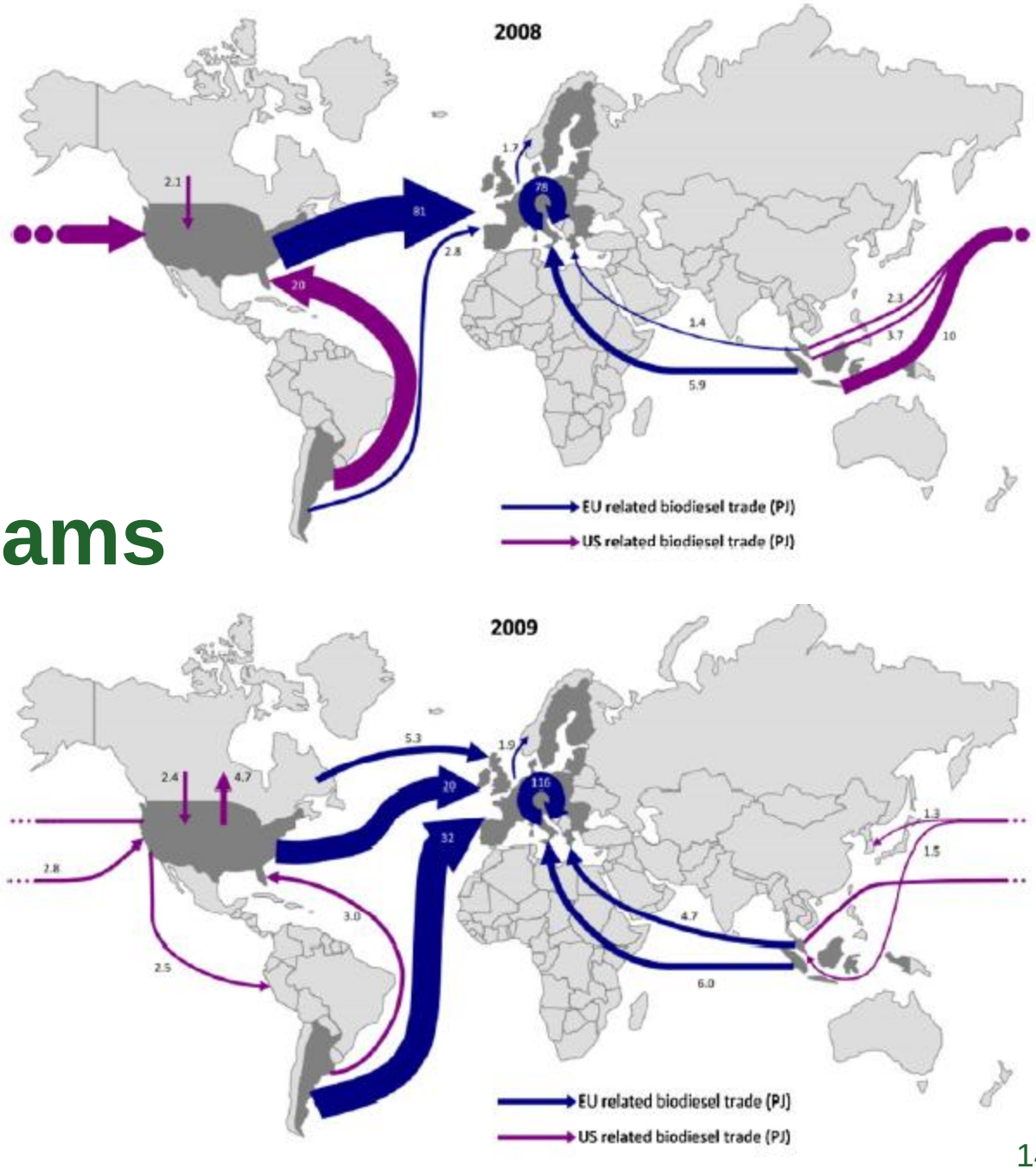
Role of policy

- Biofuel market targets, trade barriers
- Competition with food, feed and fiber uses
- Certification (sustainability)

Lamers, P. *et al*. Renewable and Sustainable Energy Reviews *15* (2011) 2655– 2676

IEA Bioenergy

Global biodiesel trade streams



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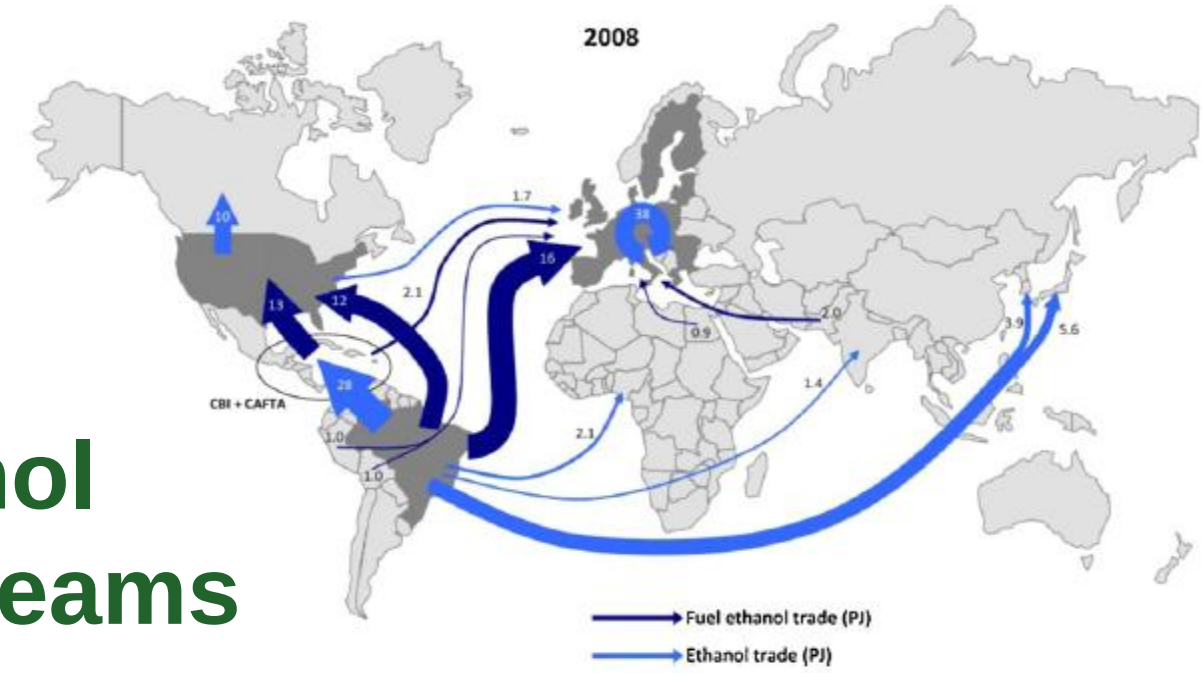
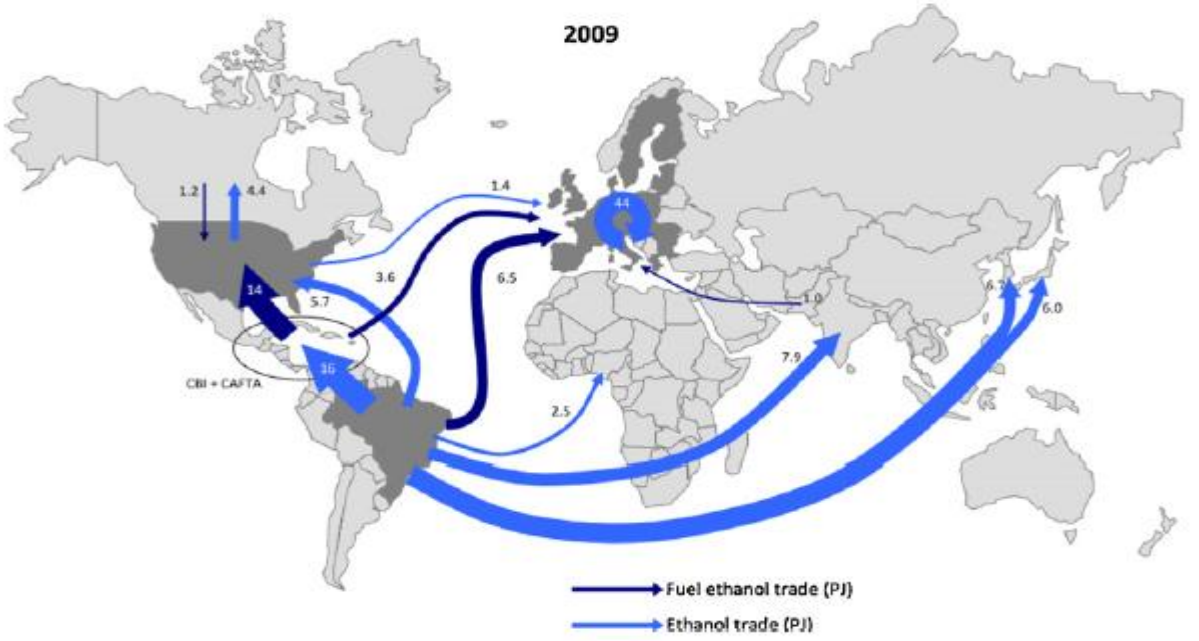
IEA Bioenergy

Global bioethanol trade streams





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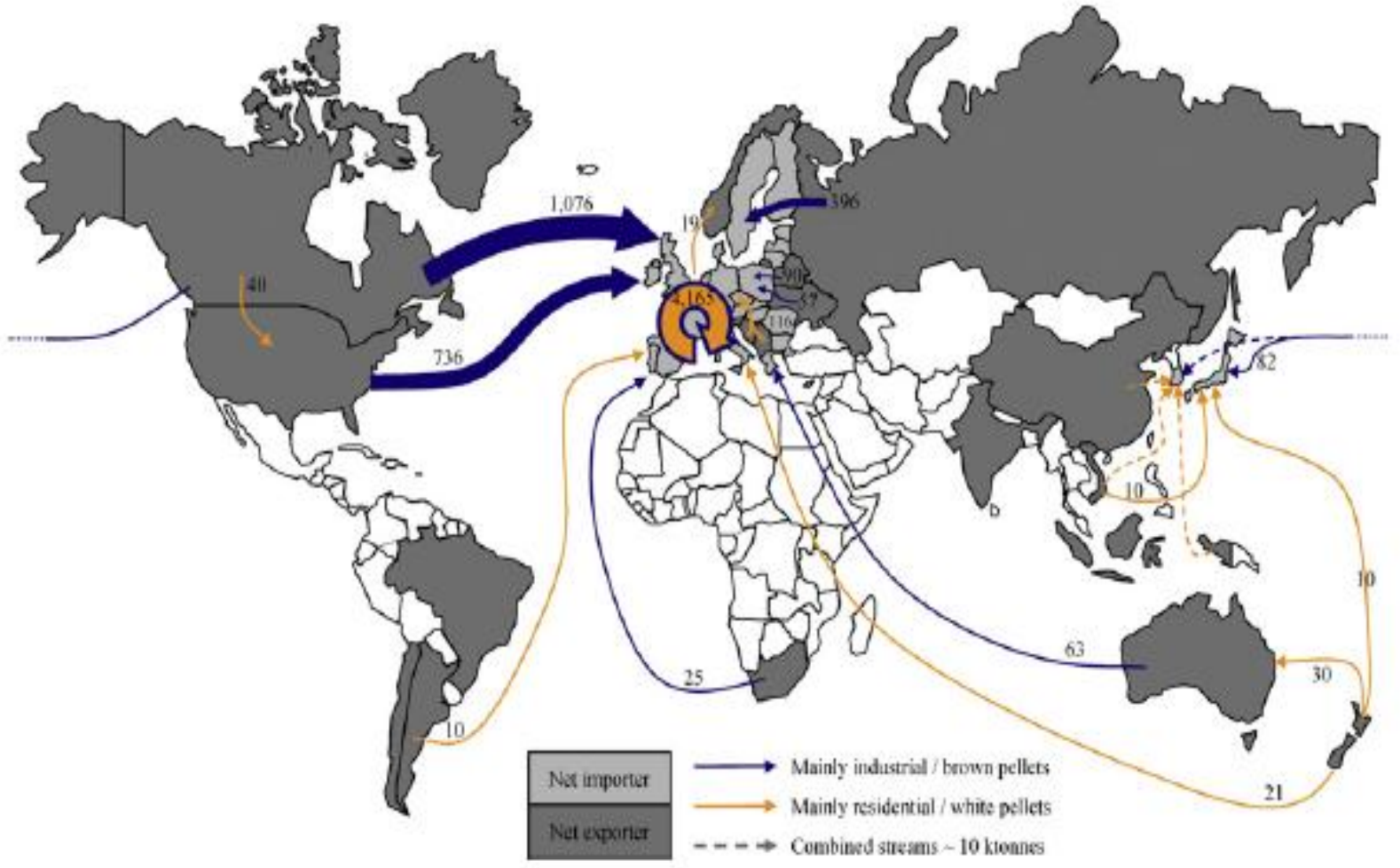
World Wood Pellet Trade Streams in 2010 (>10 ktonnes)

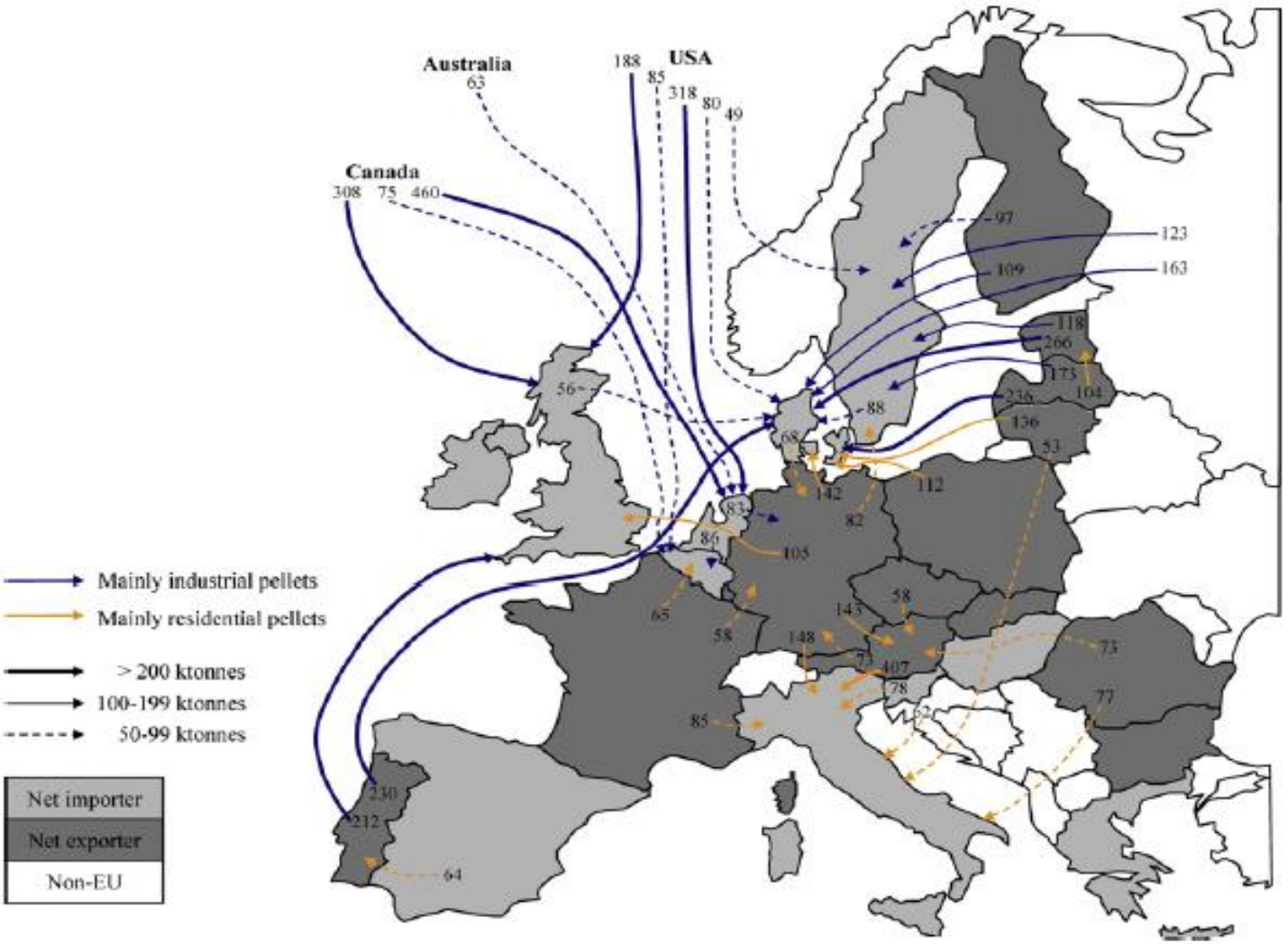
IEA Bioenergy



Lamers, P. *et al.* Renewable and Sustainable Energy Reviews *16* (2012) 3176– 3199

Wood Pellet Trade Streams in Europe 2010 (>10 ktonnes)

IEA Bioenergy



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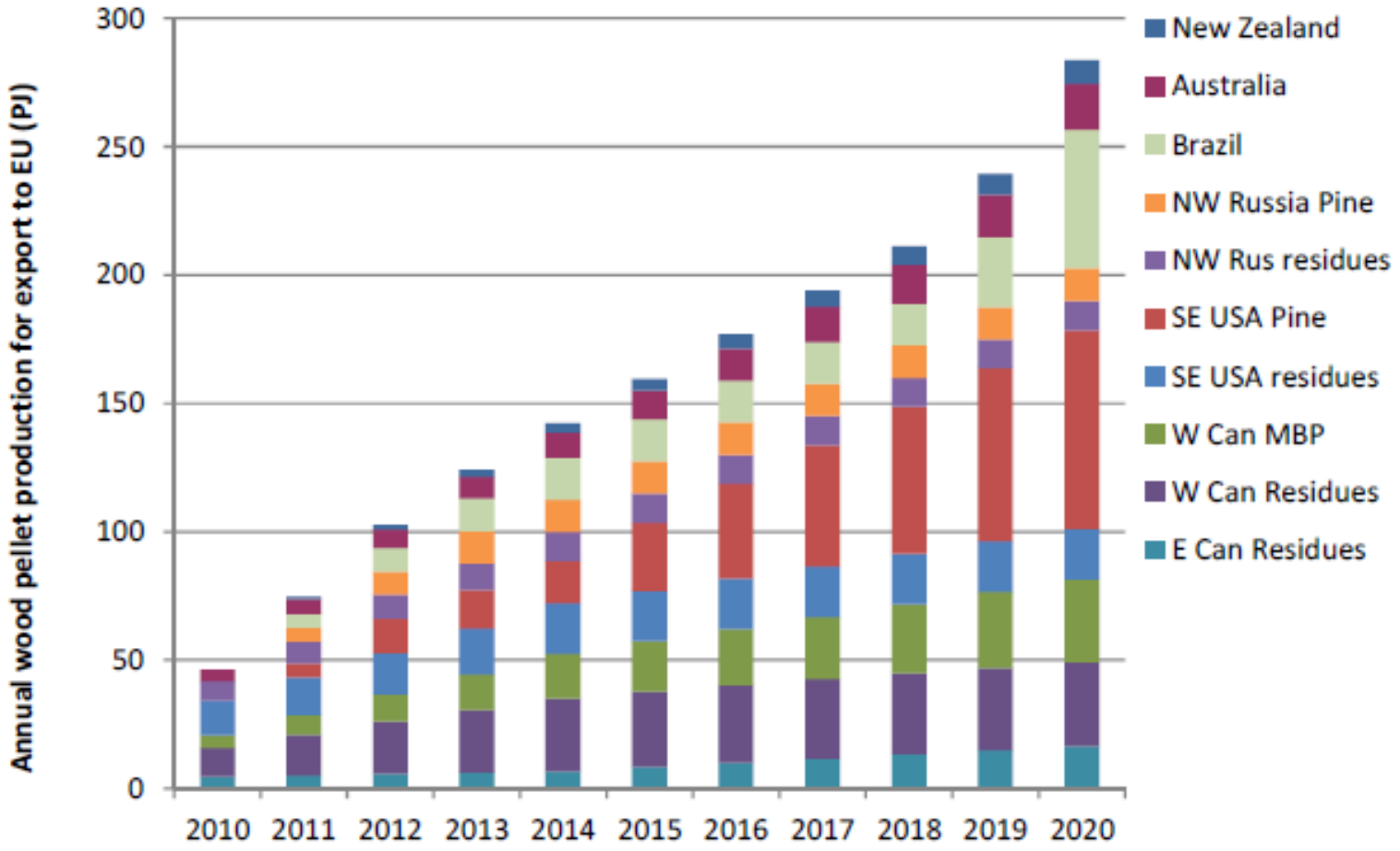
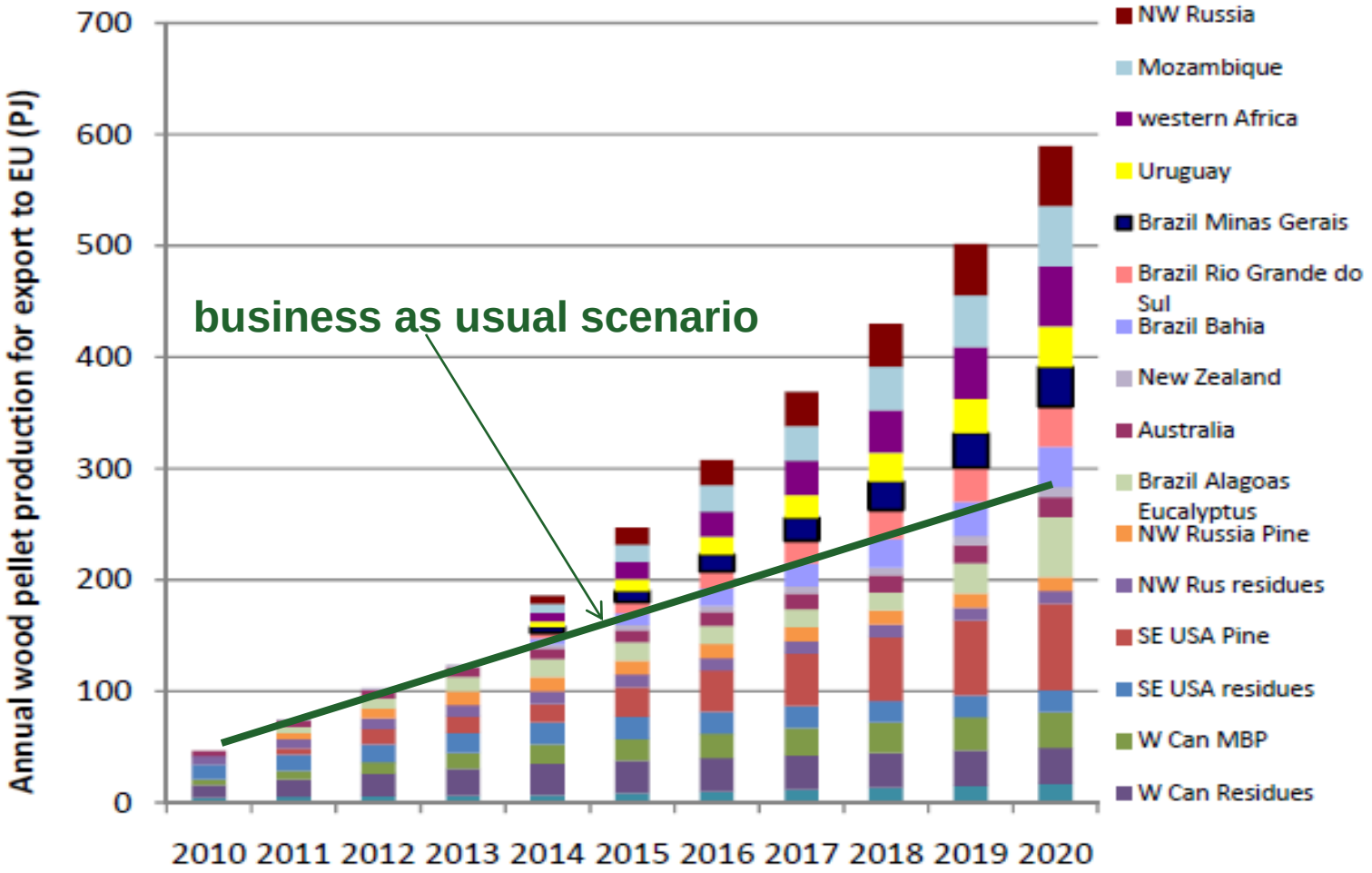
Future Development of International Pellets Trade

(business as usual scenario)



Future development of international pellets trade

(high import scenario)



Source: M. Junginger, IEA Bioenergy Task 40, 2 Feb 2012

Current Status (1)

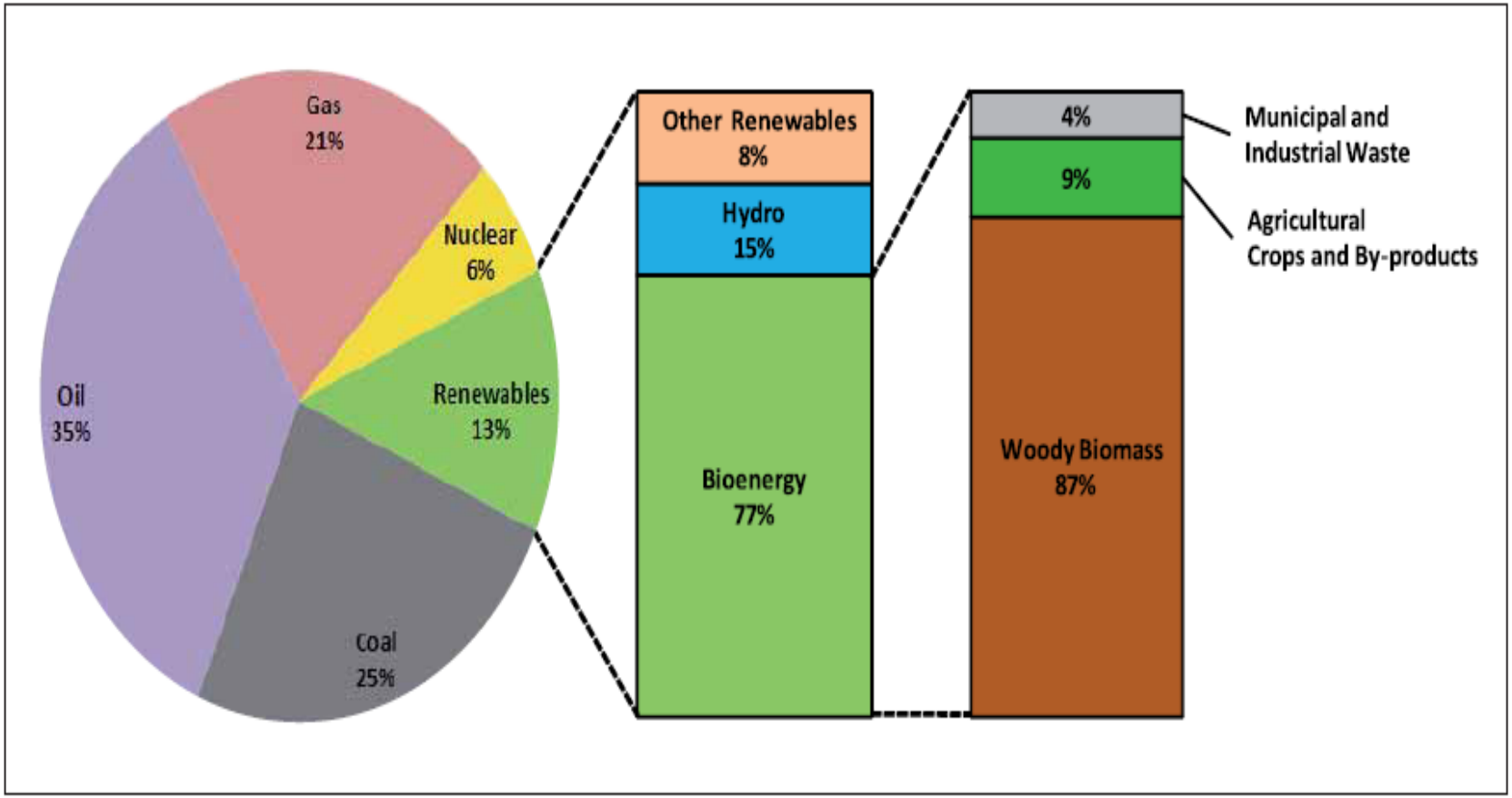


Figure 1. Share of bioenergy in the world primary energy mix. Source: based on IEA, 2006; and IPCC, 2007.

Source: Bioenergy – a Sustainable and Reliable Energy Source, IEA Bioenergy 2009

Current Status (2)

- Conditions for deployment (completed R&D, proven practical operation, economic competitiveness) are fulfilled by only few applications (small scale heat, large scale co-firing)
- Broad spectrum of technologies under development, need for concentration
- Feedstock availability likely to be overestimated; competition with food, feed, and fiber uses
- Feedstock competition, sustainability discussion and lacking competitiveness tend to block industrial engagement
- Lack of a reliable political framework

Promising Developments

- Gasification and direct liquefaction as biomass pretreatment for heat, power, and transport fuel production
- Improvements of components and systems for efficient conversion in an “integrated” approach
- Development of feedstock options not competing with other uses (waste biomass, degraded land)
- International cooperation on standardization and on defining and introducing “sustainability criteria”
- Development of realistic estimates of total global feedstock potential

Conclusions

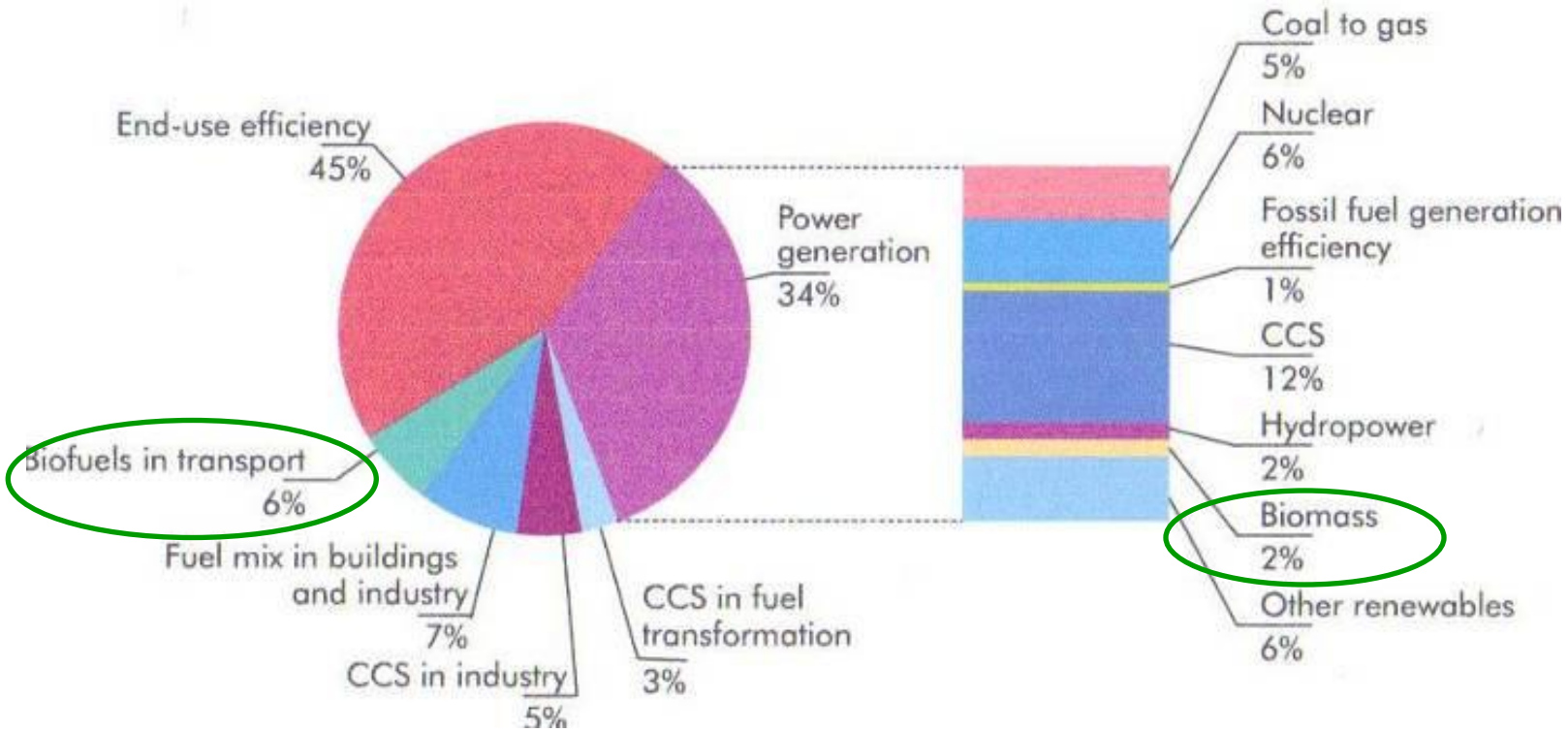
- The challenge is to recognize that we have a cost problem and not so much a technology problem
- Some Technology Roadmaps identify policy actions (taxation, quotas) as necessary for creating a “level playing field“ at the consumer level (e.g. “Clean Energy Progress Report”, IEA 2011)
- However, most of the roadmap activities are of technological and institutional nature
- As soon as competitiveness is achieved, industry will step in, and respond to the market pull
- Feedstock competition, and environmental restrictions will ultimately limit the volume

Appendix

Bioenergy

- **Has significant scope to make a greater contribution to secure and sustainable energy provision**

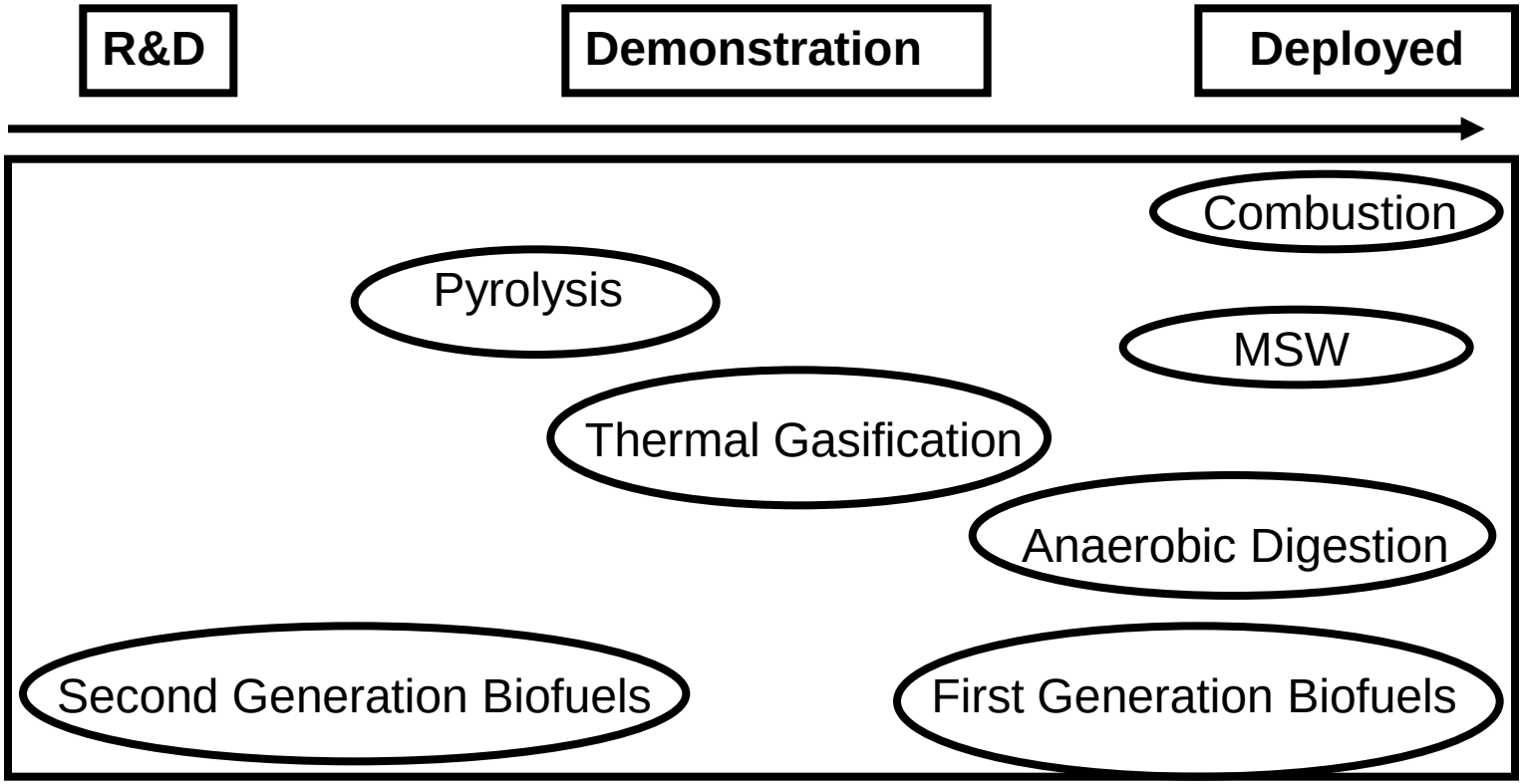
Figure 2.3 ▶ **Reduction in CO_2 emissions in the Map scenario by technology area**
(share of reduction below Baseline Scenario in 2050)



IEA Bioenergy

Bioenergy

- **Involves a number of technologies which range from fully commercially mature through to those at R&D stage**



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- Korea
- Netherlands
- New Zealand
- Norway
- South Africa
- Sweden
- Switzerland
- Turkey
- United Kingdom
- United States

IEA Bioenergy

IEA Bioenergy Conference 2012

Tuesday 13th to Thursday 15th of November 2012 – Vienna, Austria

JOANNEUM RESEARCH

TU WIEN TECHNISCHE UNIVERSITÄT WIEN Vienna University of Technology

www.ieabioenergy2012.org

The future of bioenergy

- "Will biofuels be good enough to challenge fossil fuels?"
  - Technology: YES, resources: NO, economy: NOT YET
- "What are the prospects for bioenergy to expand its market share and to become attractive for consumers?"
  - Without strong policy measures (taxes, quotas) limited prospects because of lack of current competitiveness
- "What technologies will create the basis for a breakthrough?"
  - Pretreatment technologies (gasification, pyrolysis, fermentation, oxygenation, torrefaction) to be able to apply conventional conversion technologies (combustion systems for heat and power production, liquid fuel production)

Products of IEA Bioenergy Recent Publications

- Bio-based Chemicals – Value Added Products from Biorefineries (2012)
- LCA Approach to Estimate the Net GHG Emissions of Bioenergy (2011)
- Algae as a Feedstock for Biofuels (2011)
- Thermal Pre-Treatment of Biomass for Large-scale Applications (2011)
- Developing Sustainable Trade in Bioenergy (2011)
- Bioenergy, Land-use Change and Climate Change Mitigation (2010)
- Bioenergy – a Sustainable and Reliable Energy Source (2009)

Task 29: Socio-Economic Drivers in Implementing Bioenergy Projects

IEA Bioenergy

Aims to:

Improve understanding of the drivers and impacts of establishing bioenergy markets at the local, regional, national and international level.

Synthesise and transfer critical knowledge to stakeholders.

Improve the assessment of impacts of biomass production and utilisation to provide guidance to policy makers.

Task 29: Key Activities and Achievements

IEA Bioenergy

- Increased understanding of the non-technical and socio-economic barriers to the uptake of bioenergy.
- position papers, brochures, scientific papers, presentations, and posters
- an educational website www.aboutbioenergy.info.
- a series of case studies highlighting the socio-economic dimension including validation activities – workshops, seminars, site visits.
- Integrating activities within the wider context of IEA Bioenergy.

Task 40: Sustainable International Bioenergy Trade

IEA Bioenergy

Focus on:
Supporting development of a sustainable international bioenergy trading system while recognising the diversity of resources and applications.

Aims to:
Review the development of biomass markets in various parts of the world and existing trade experiences.

Analyse the effects of existing markets (e.g., pulpwood) on bioenergy trade.

Review the barriers hampering development of a global commodity market and identify strategies to overcome them.

Identify sustainability criteria and their local influence on the biomass market.

Task 40: Key Activities and Achievements

IEA Bioenergy

- Analysis of trade, markets and market experience, e.g., ethanol.
- Case studies of biomass production and supply chains.
- Modelling and scenario analysis.
- Studies of sustainability quality and certification/ standardisation.
- Development of best practice guidelines.