



The role of biomass in the future energy system

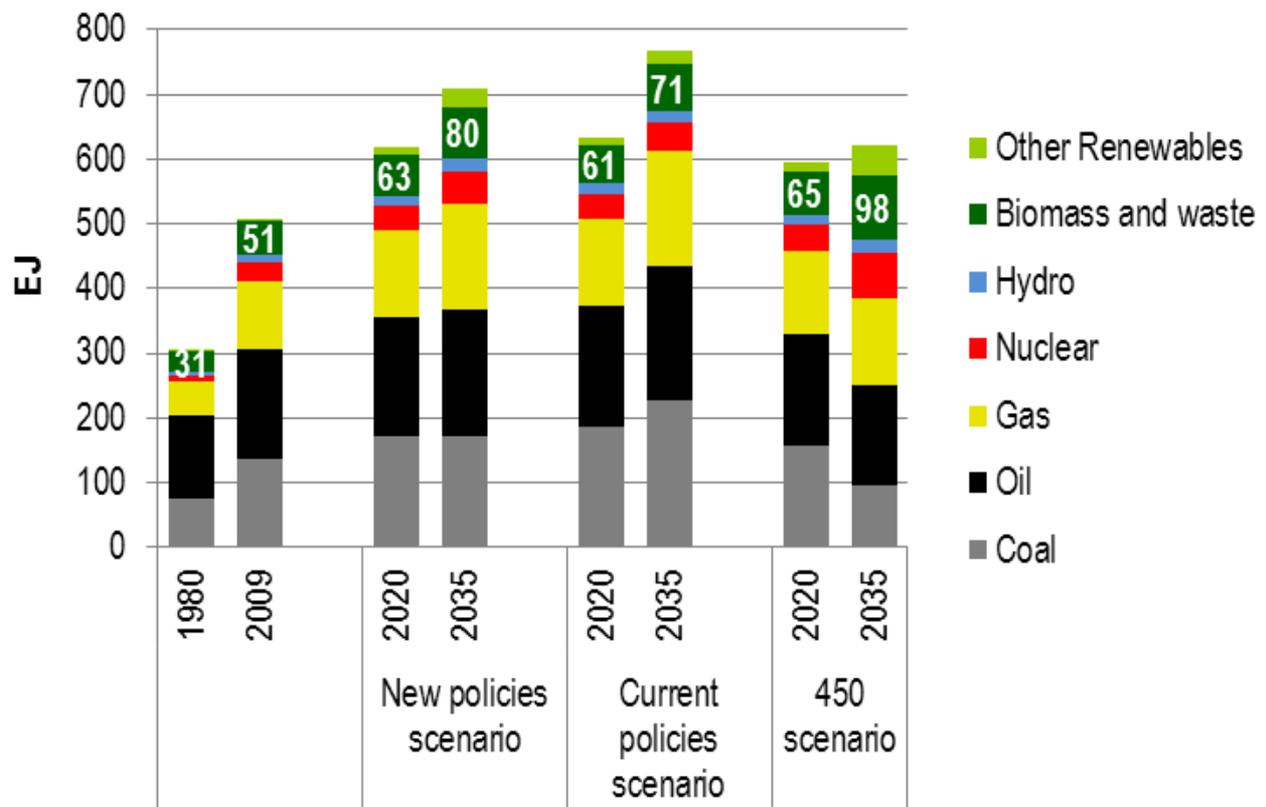
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IEA WEO 2011 scenarios



Content:

- 1. Introduction into bioenergy utilization*
- 2. Development of bioenergy in (Central) Europe*
- 3. Biomass potentials and aspects of competing utilization*
- 4. Bioenergy policies and sustainability criteria*

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Short rotation coppice on arable land

e.g. Willow, poplar



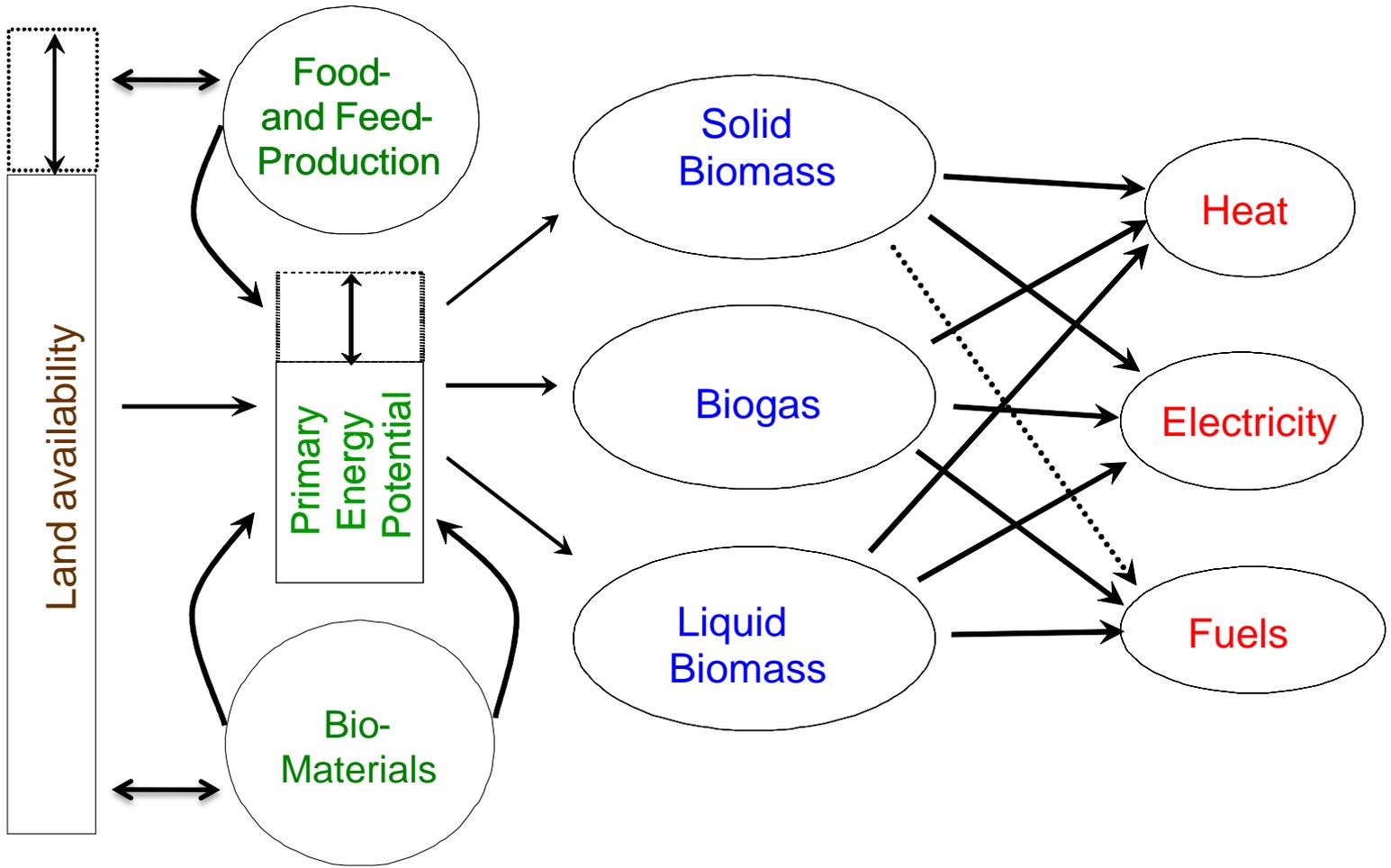
Bild: LTZ 2008

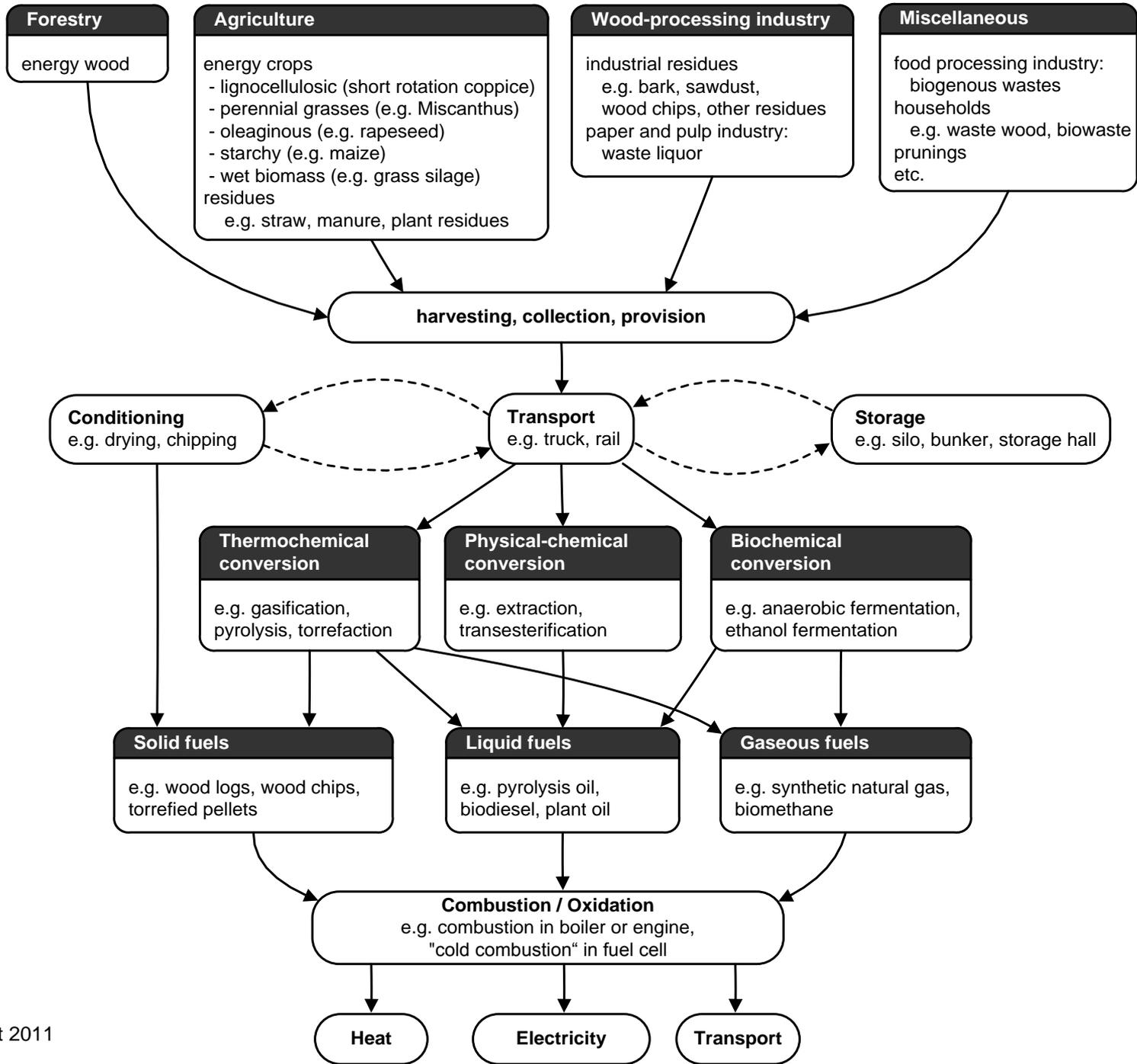
Miscanthus (Chinaschilf/Elefantengras):



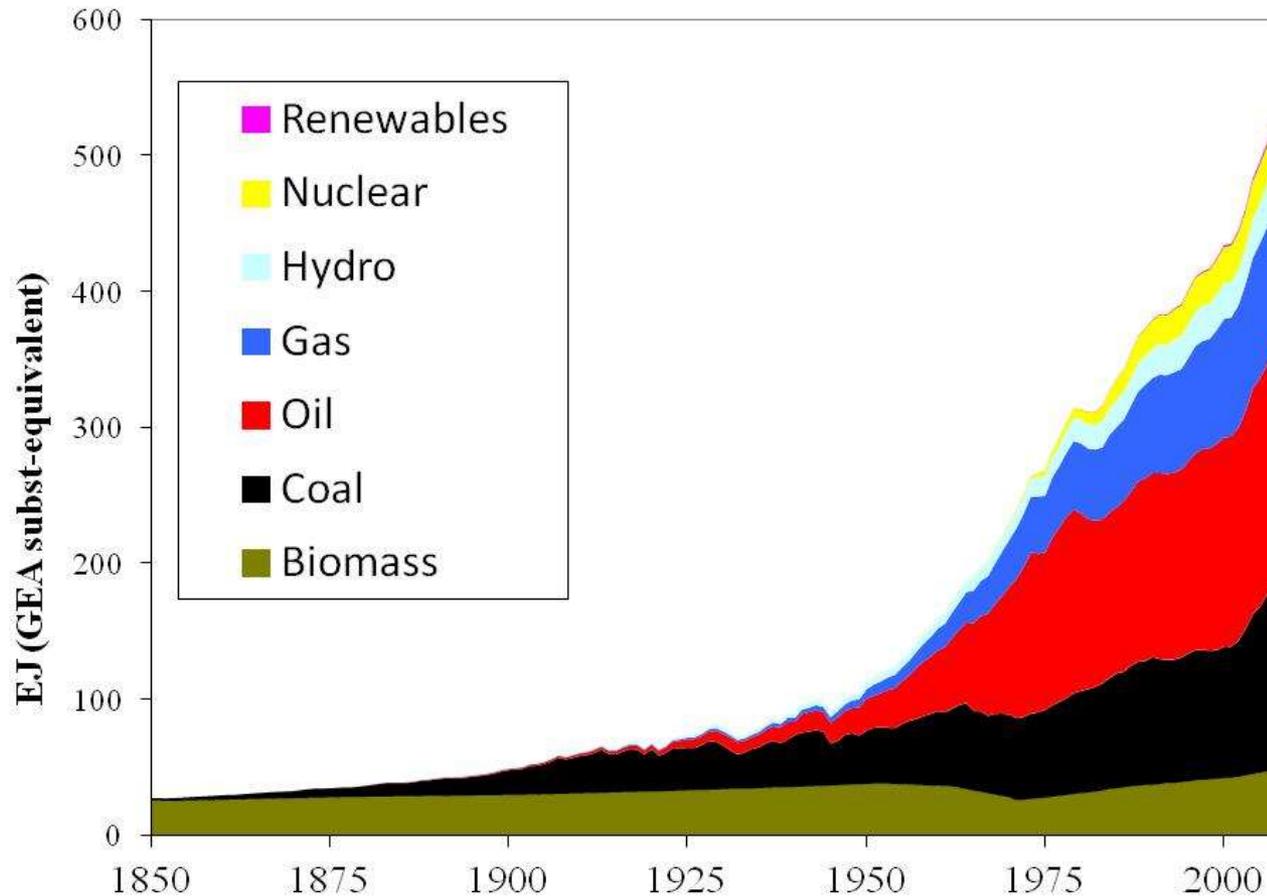
Bild: envplan240.pbwiki.com/f/miscanthus_harvesting.jpg

Introduction into bioenergy utilization



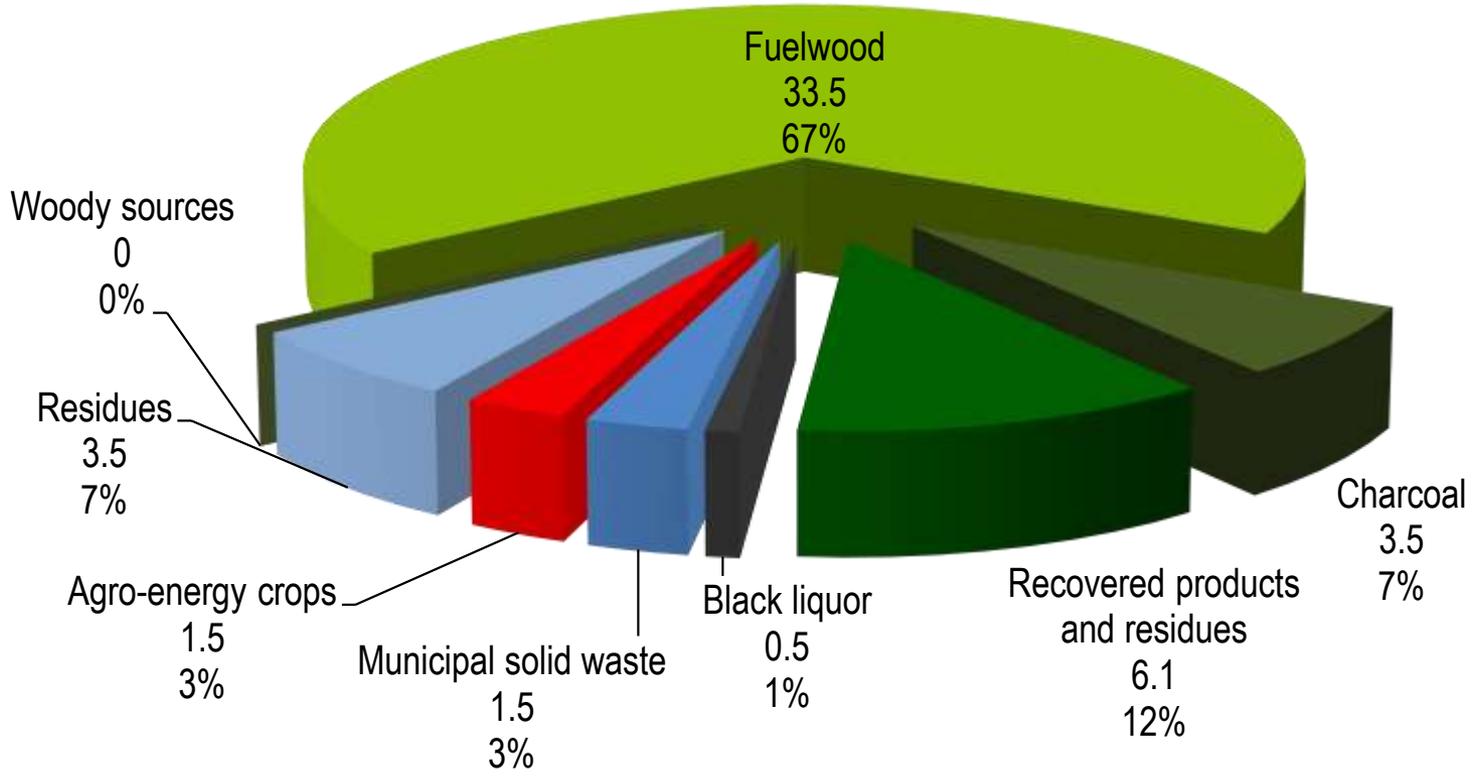


World Primary Energy Use EJ (GEA standard)



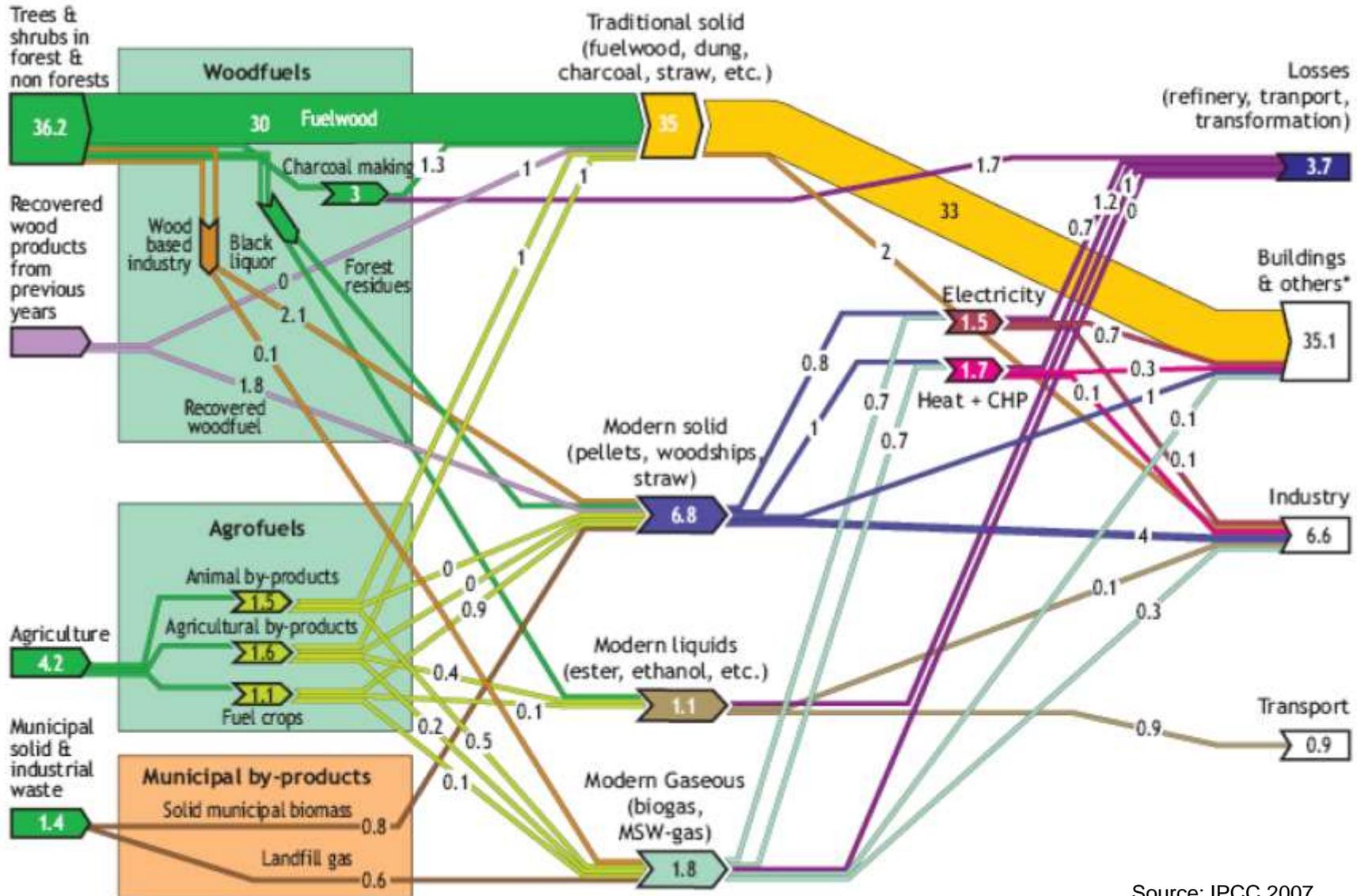
Source: Grubler, A., T.B. Johansson, L., Mundaca, N. Nakicenovic, S. Pachauri, K. Riahi, H.-H. Rogner, L. Strupeit. 2011: Energy Primer. In *Global Energy Assessment: Toward a Sustainable Future*. L. Gomez-Echeverri, T.B. Johansson, N. Nakicenovic, A. Patwardhan, (eds.), IIASA, Laxenburg, Austria and Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Global structure of bioenergy use, 2009



Source: estimation according to FAO 2010

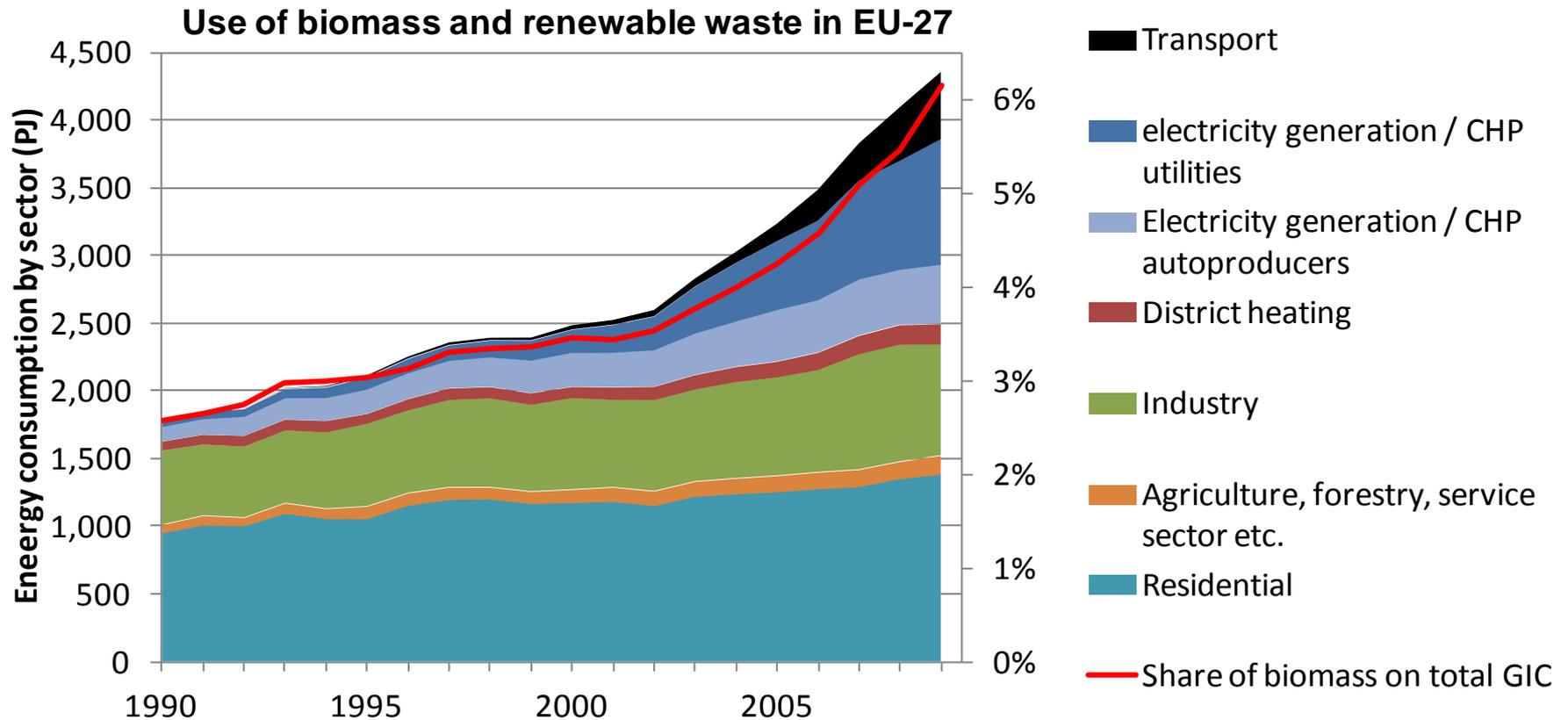
World biomass energy flows 2004, (EJ/yr)



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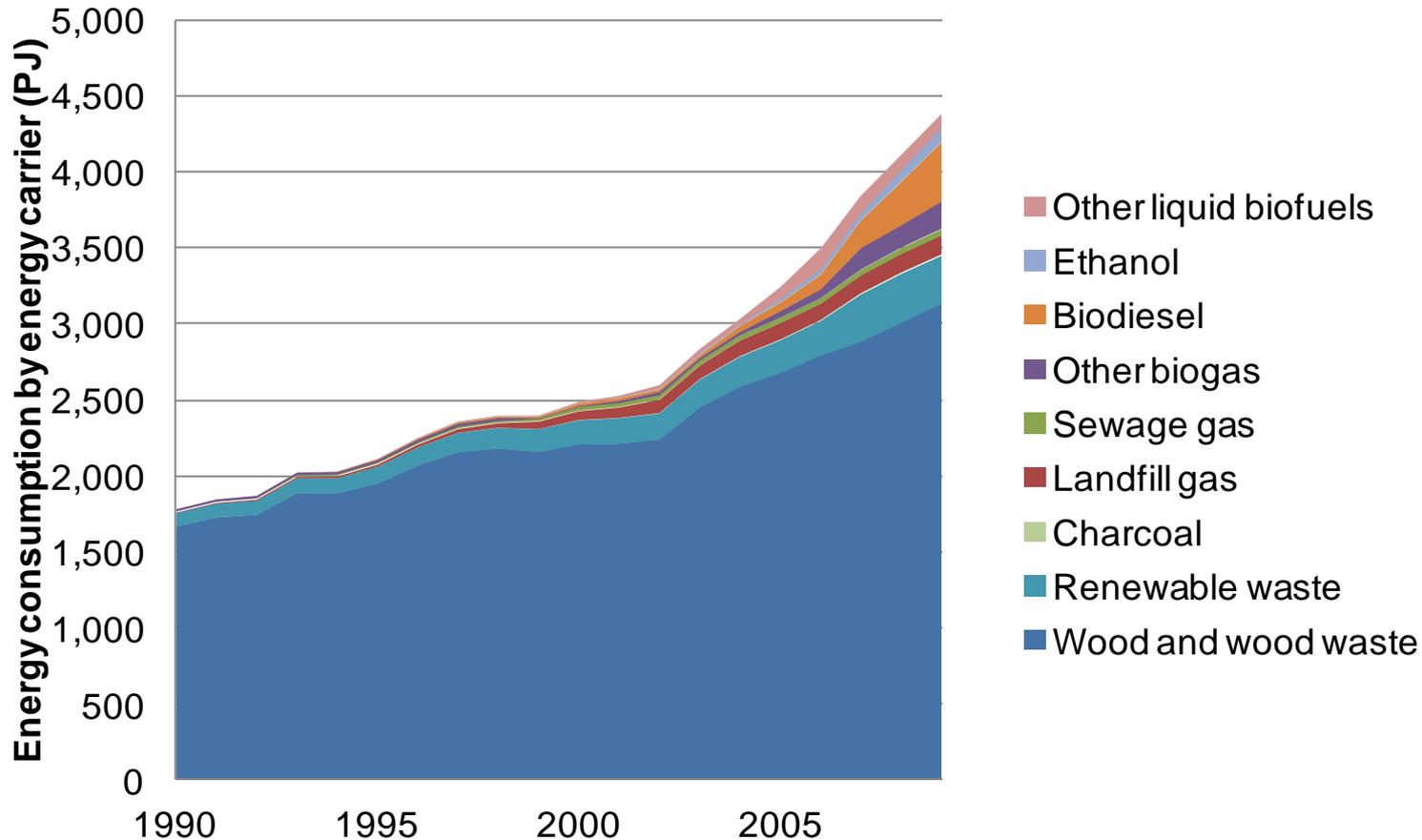
Historical overview bioenergy (EU-27)



Source: Eurostat 2011

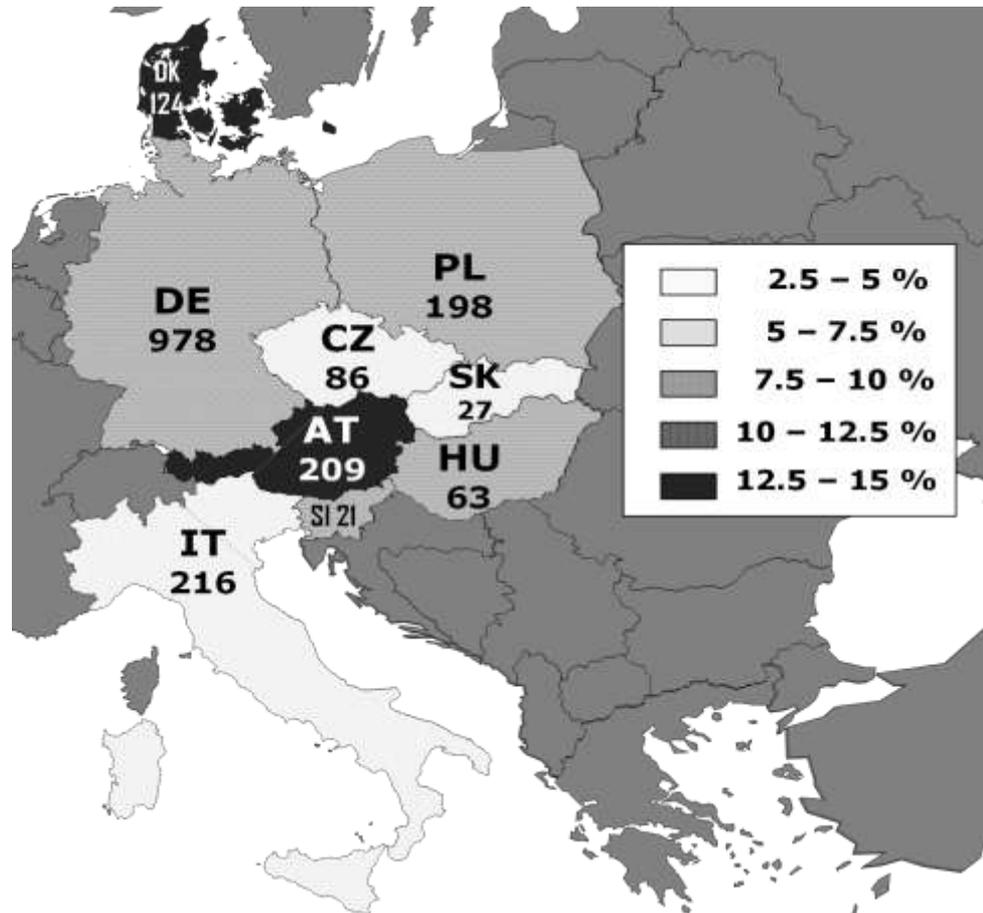
Historical overview bioenergy (EU-27)

Bioenergy by energy carrier in EU-27



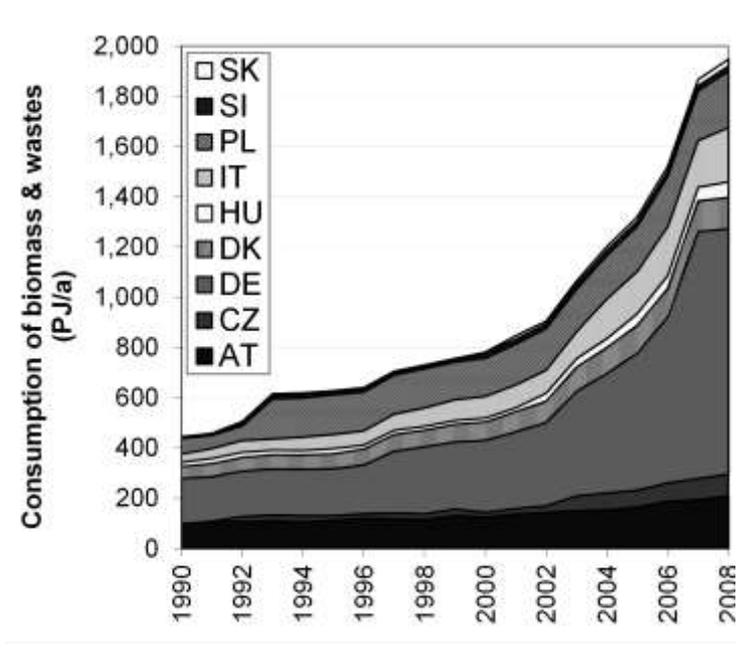
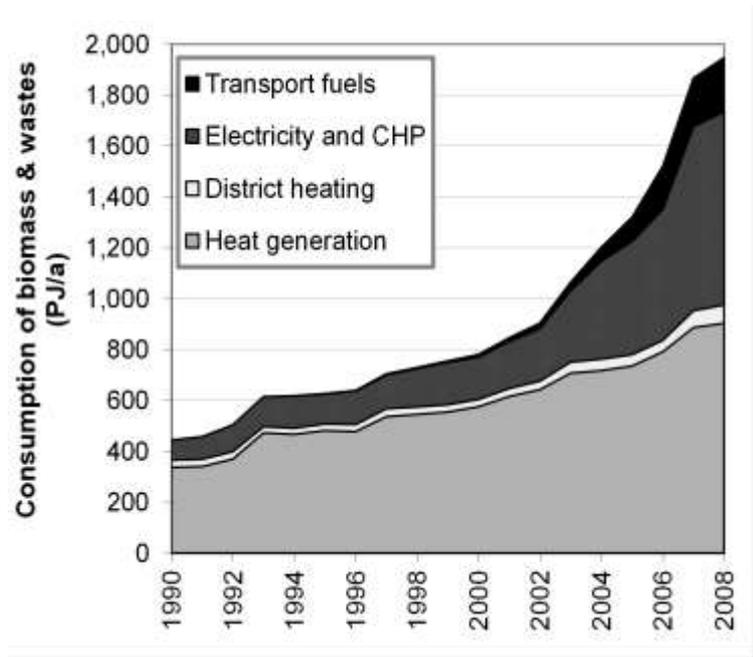
Source: Eurostat 2011

Cross-country comparative overview in Central Europe



Share of bioenergy in the gross inland consumption (2007), values in PJ/a
Source: Eurostat 2010, Kalt 2011

Dynamic historical developments in Central Europe (2)

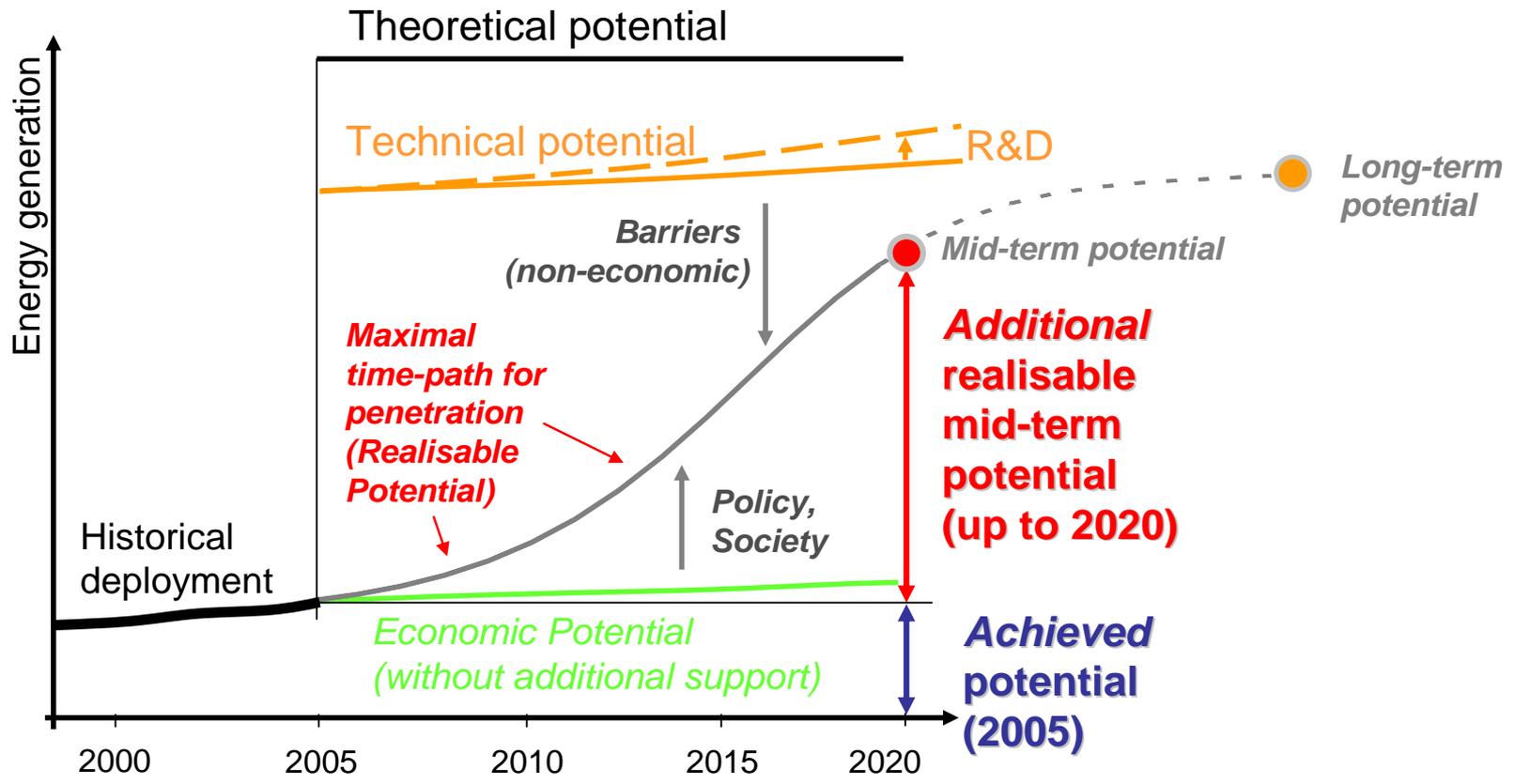


Source: Eurostat 2010, Kalt 2011

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Dynamic biomass potentials - methodology



Source: Resch 2009

Dynamic biomass potentials - methodology

Objective: Assessment of realizable potentials with respect to

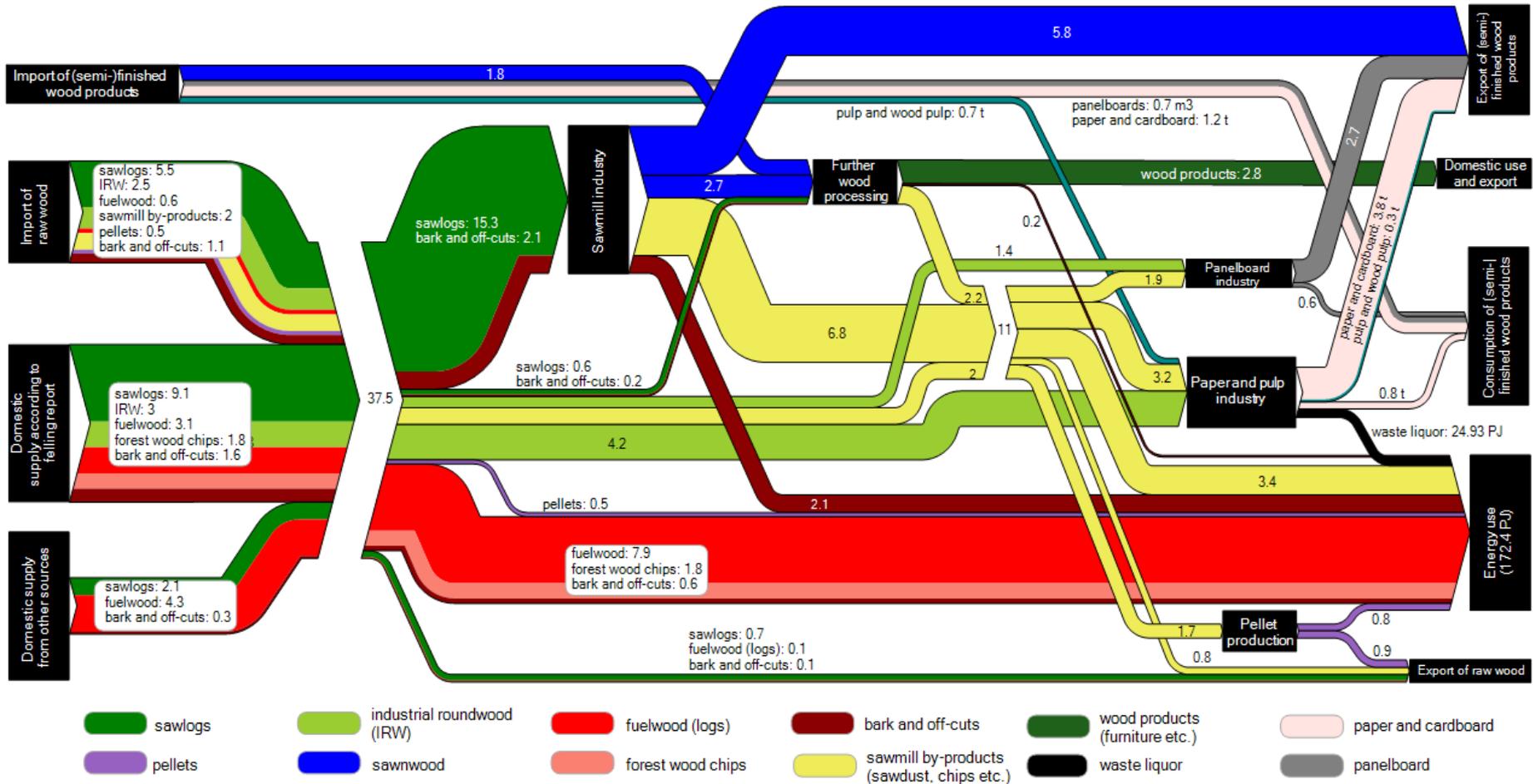
- *ecological restrictions and*
- *competing uses*

Methodology:

- *Estimation of currently unused resources (static potential assessment); example: Unused annual forest growth*
- *Identification of dynamic parameters*
Examples: Development of wood working industries, Dynamics in the distribution of agricultural land
- *Deriving scenarios for these dynamic parameters*
- *Assessment of the dynamic potentials*

Challenge: Complex dynamic interactions with SIGNIFICANT implications!

Key relationships: e.g. wood flow chart Austria, 2009

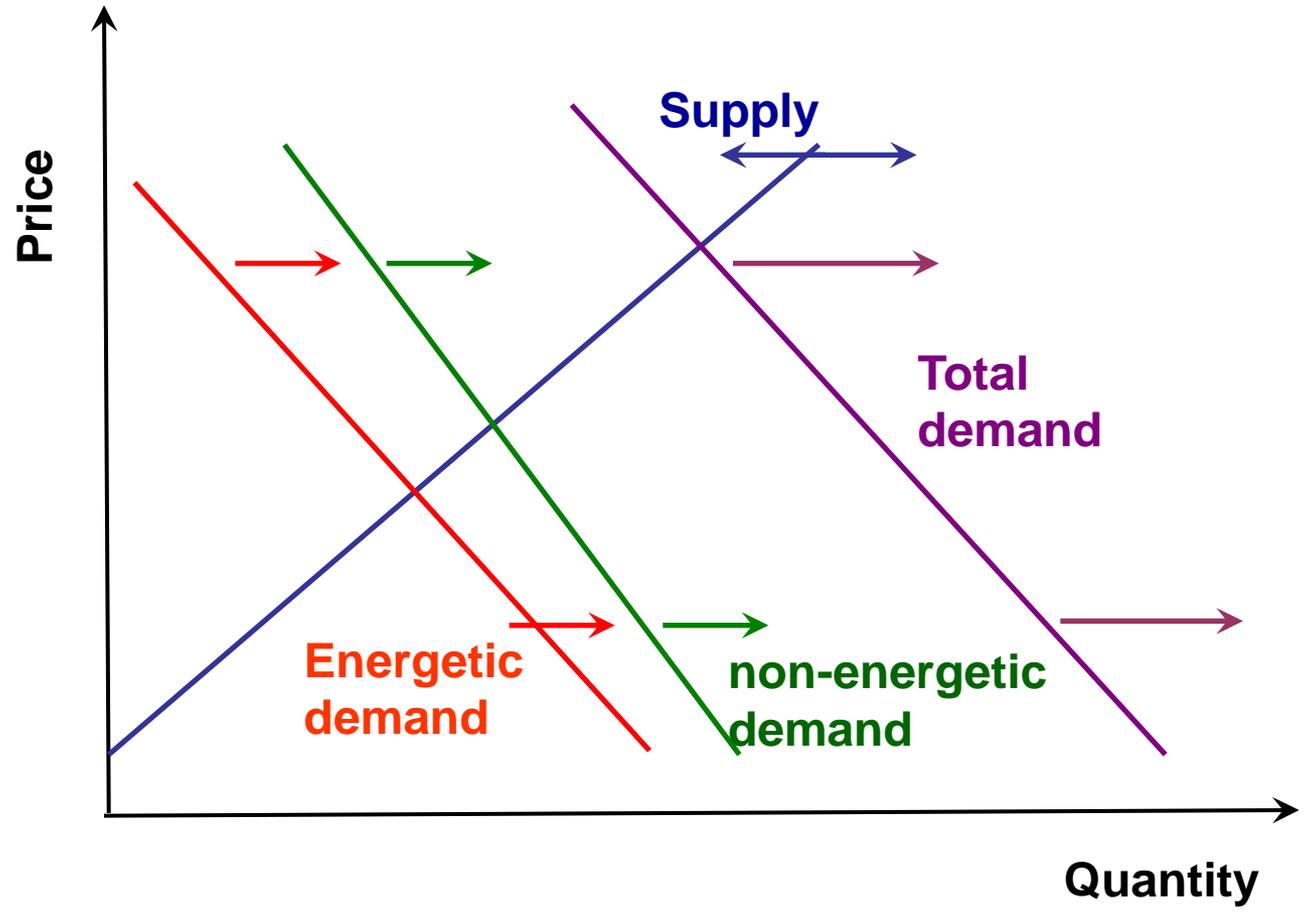


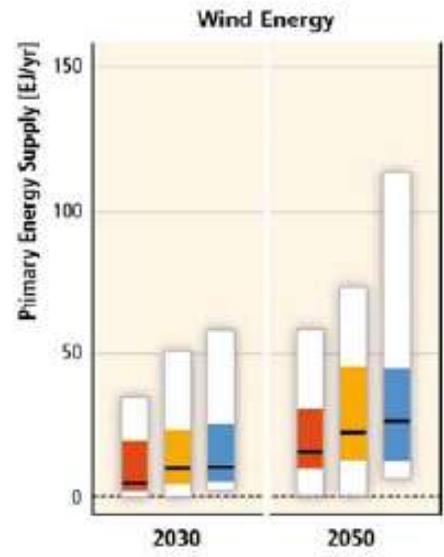
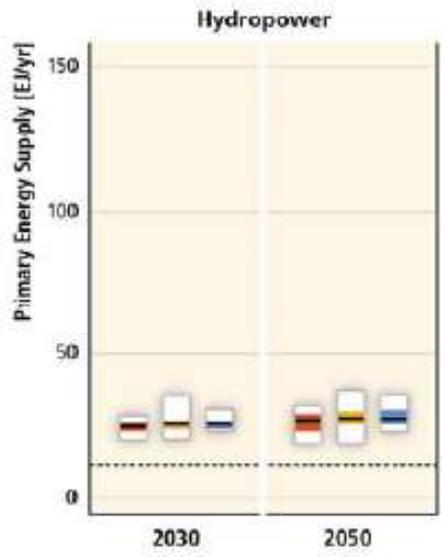
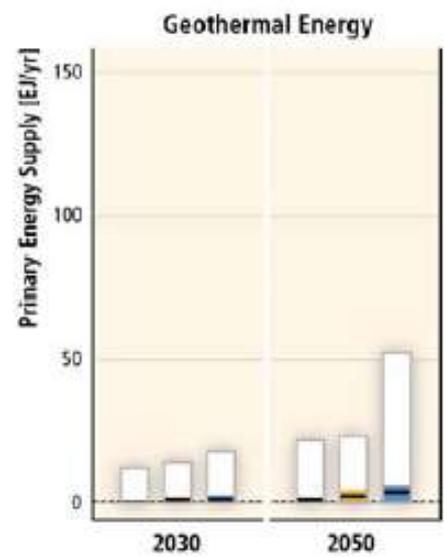
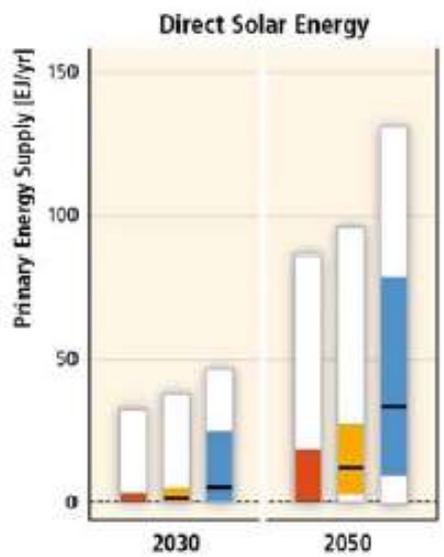
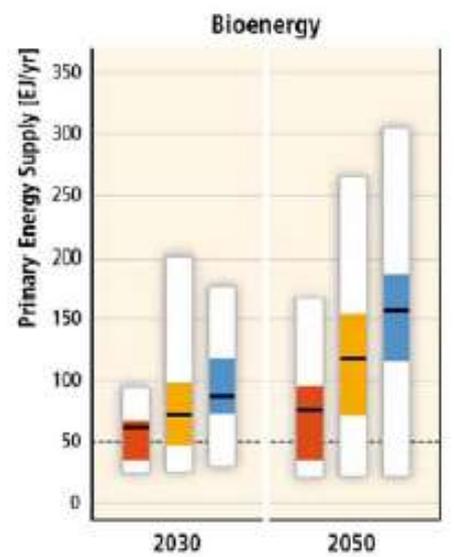
Source: Kalt 2011

energetic and non-energetic demand for biomass:

- *Transition to "bio-based" economy will lead to a strong global increase in demand for biomass resources.*
 - *Change in diets (global demand in agricultural area)*
 - *New bio-based products, biorefineries*
 - *Energy*
 - *Paper, pulp, board and other wood-processing industries*

Energetic and non-energetic demand for biomass





- Maximum
- 75th
- Median
- 25th
- Minimum
- Deployment Level 2008

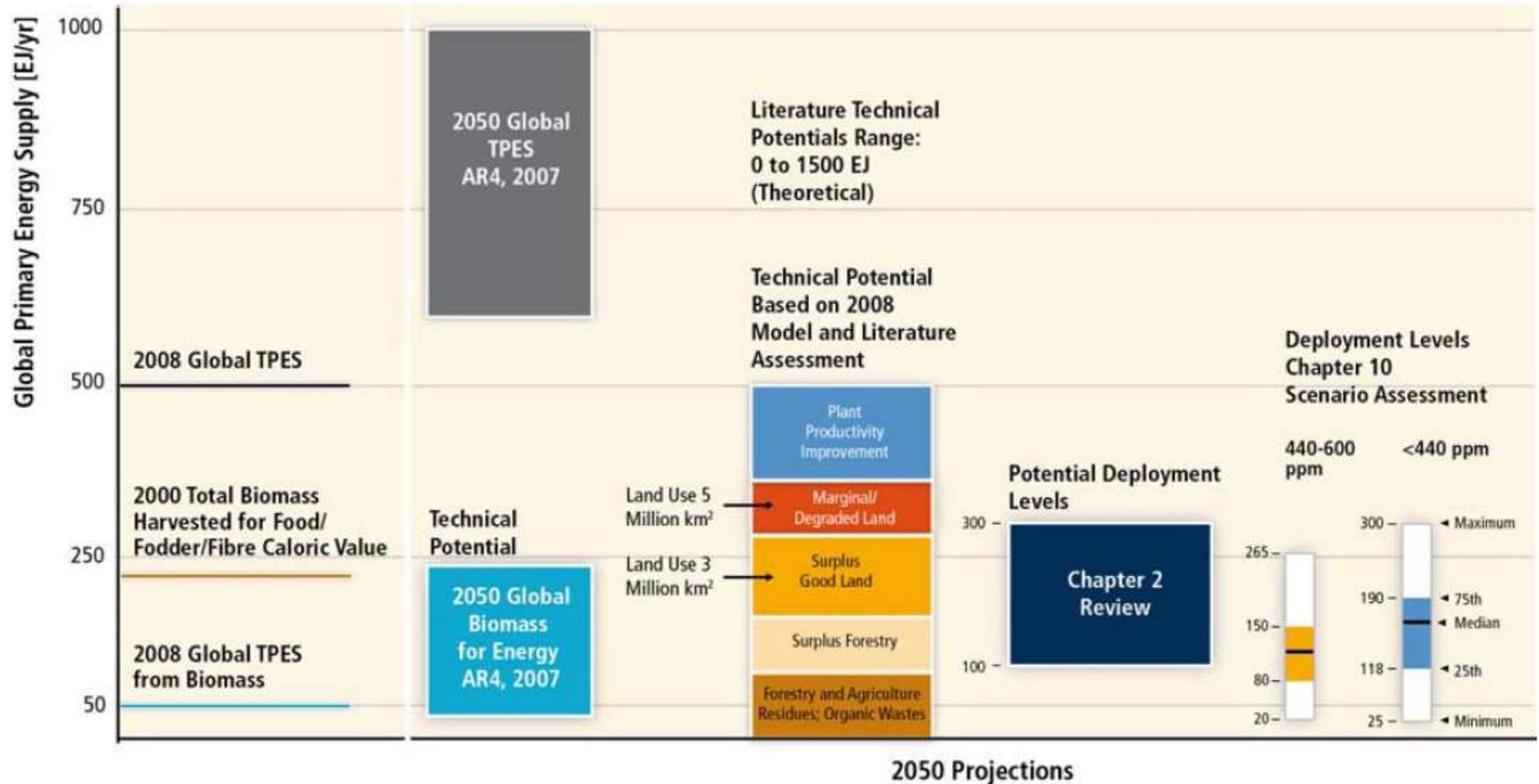
CO₂ Concentration Levels

- Baselines
- Cat. III + IV (440 - 600 ppm)
- Cat. I + II (<440 ppm)

Bioenergy Supply is Accounted for Prior to Conversion

Primary Energy Supply is Accounted for Based on Secondary Energy Produced

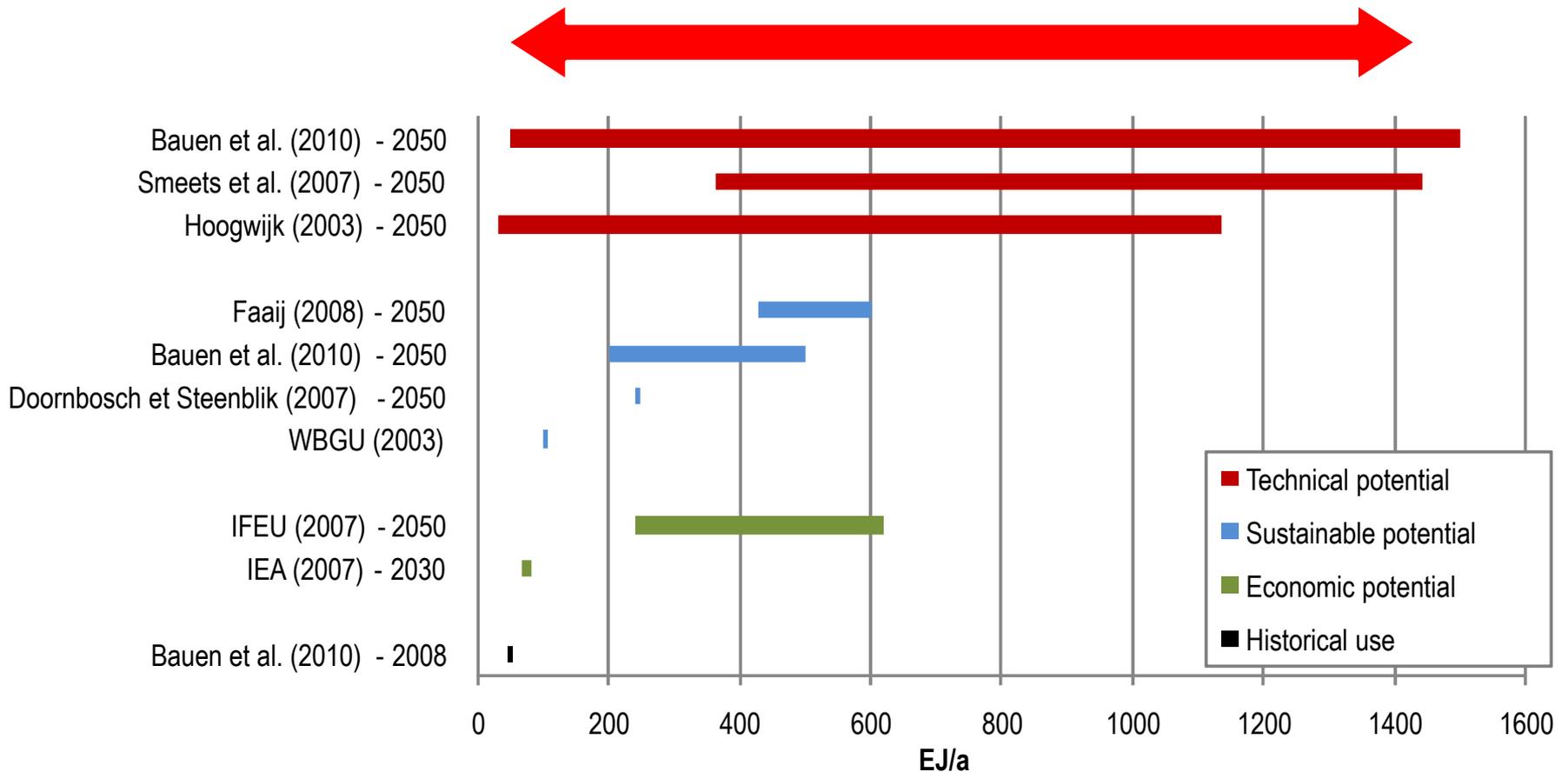
Global biomass supply, potentials, scenarios



Source: IPCC Special report on renewable energy

Global biomass potentials in the literature

Main impact parameter: Land required for food production (diets, land availability, land use management, water availability, sustainability issues, ...)



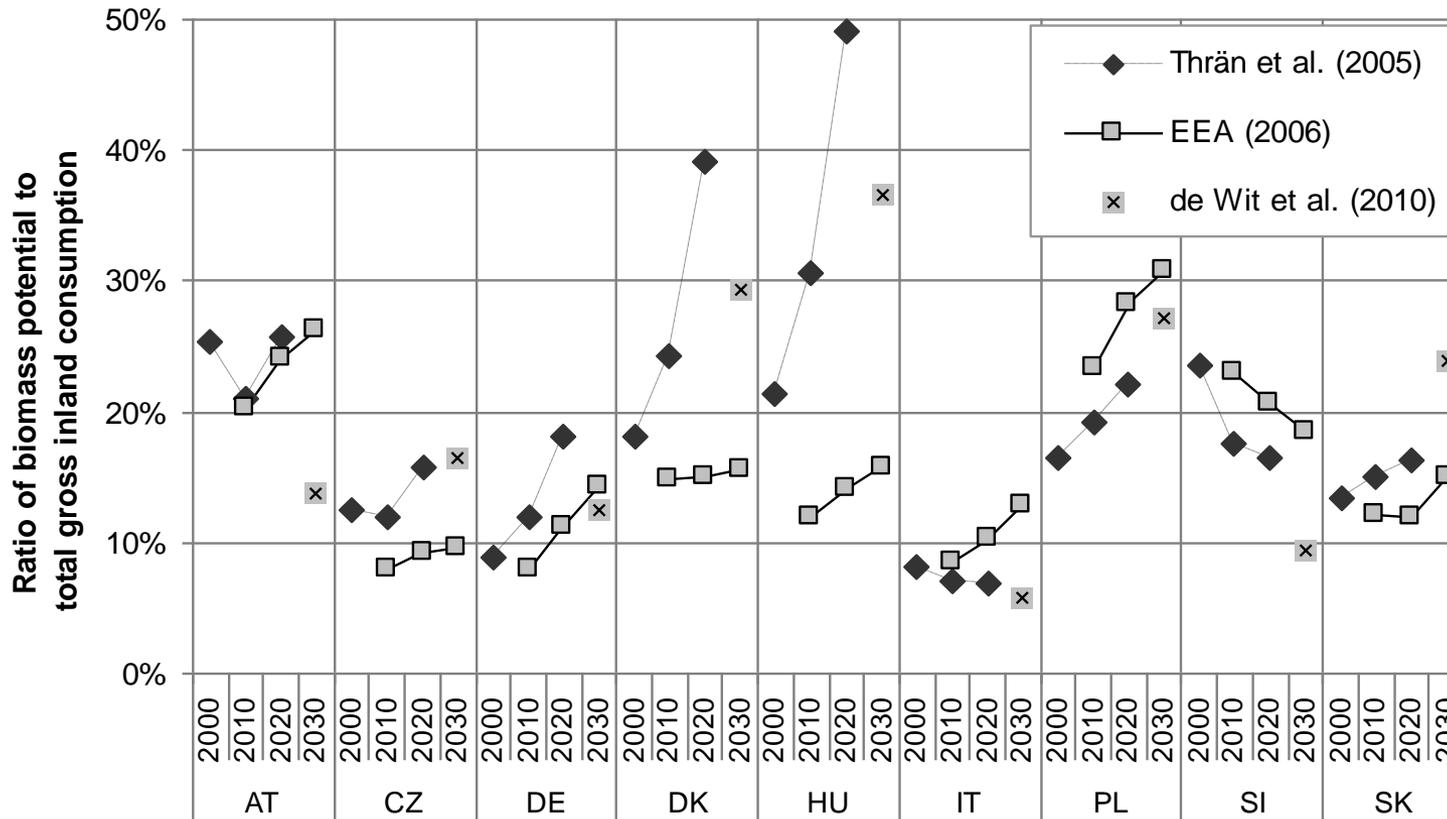
Implications of high bioenergy demand/supply?

- ↑ Ensure a secure, stable supply of biomass
 - ↑ Enable the further replacement of fossil energy
 - ↑ Make use of the key benefits of bioenergy in a future sustainable society: tradeability, energy storage, ...
 - ↑ ...
- All these issues have to be put on the top of the political agenda!

And: this does not primarily depend on the further development of bioenergy!
- ↓ Additional pressure on the agricultural production with implications on resource use, intensification ...
 - ↓ Additional pressure on land use change
 - Subsistence agriculture
 - Marginal land => „marginalised people“?
 - GHG-emissions due to (indirect) land use change
 - ↓ Additional pressure on biodiversity
 - ↓ Additional pressure on scarce water resources
 - ↓ Additional pressure on social standards
 - ↓ ...

Strong policy framework!

Potentials and outlook in Central European Countries

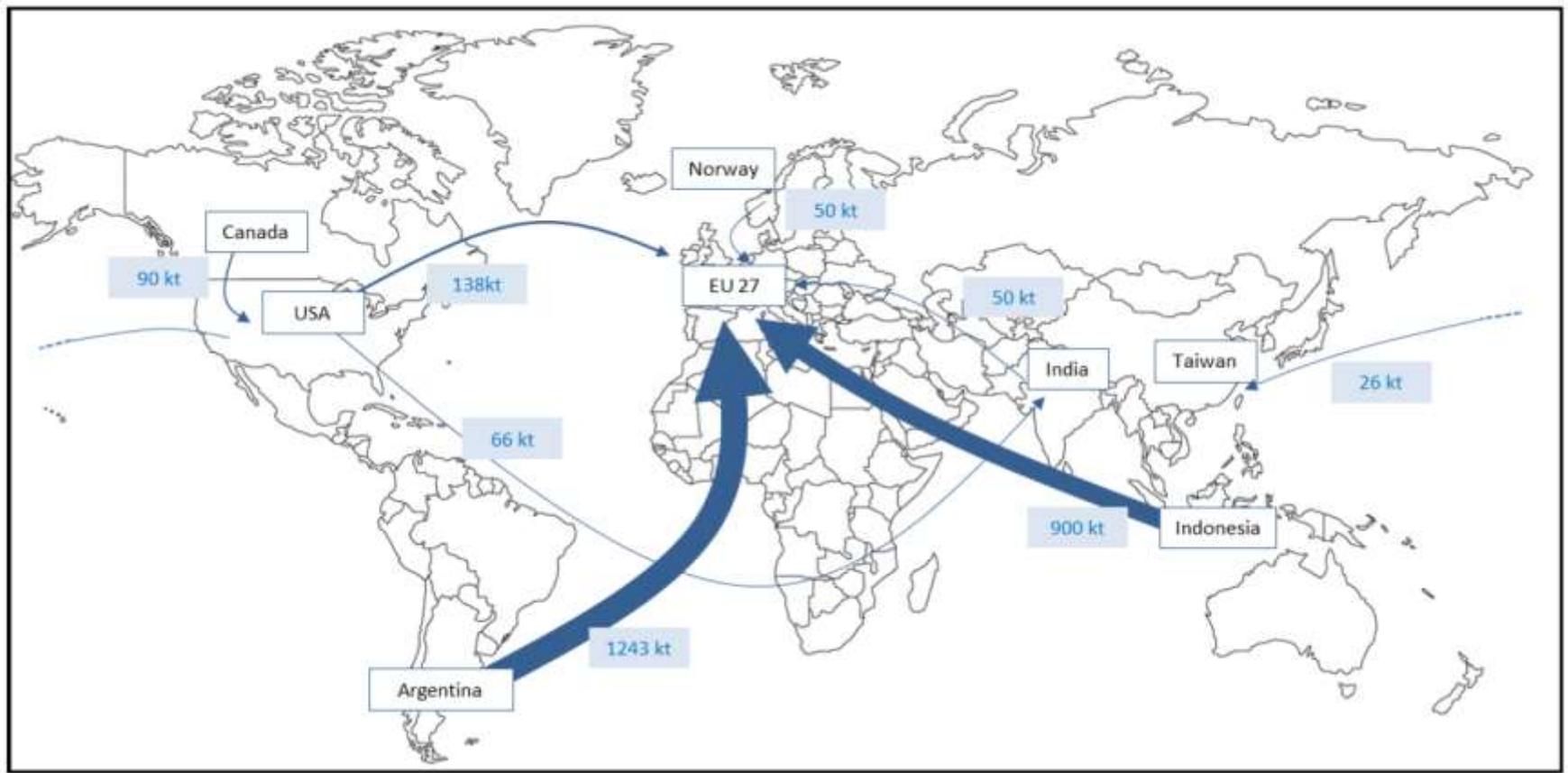


Sources: Thrän et al. (2005), EEA (2006) and de Wit and Faaij (2010) to total gross inland energy consumption (scenario according to Capros et al., 2008; "PRIMES target case")

Regional supply (potentials) <> regional demand

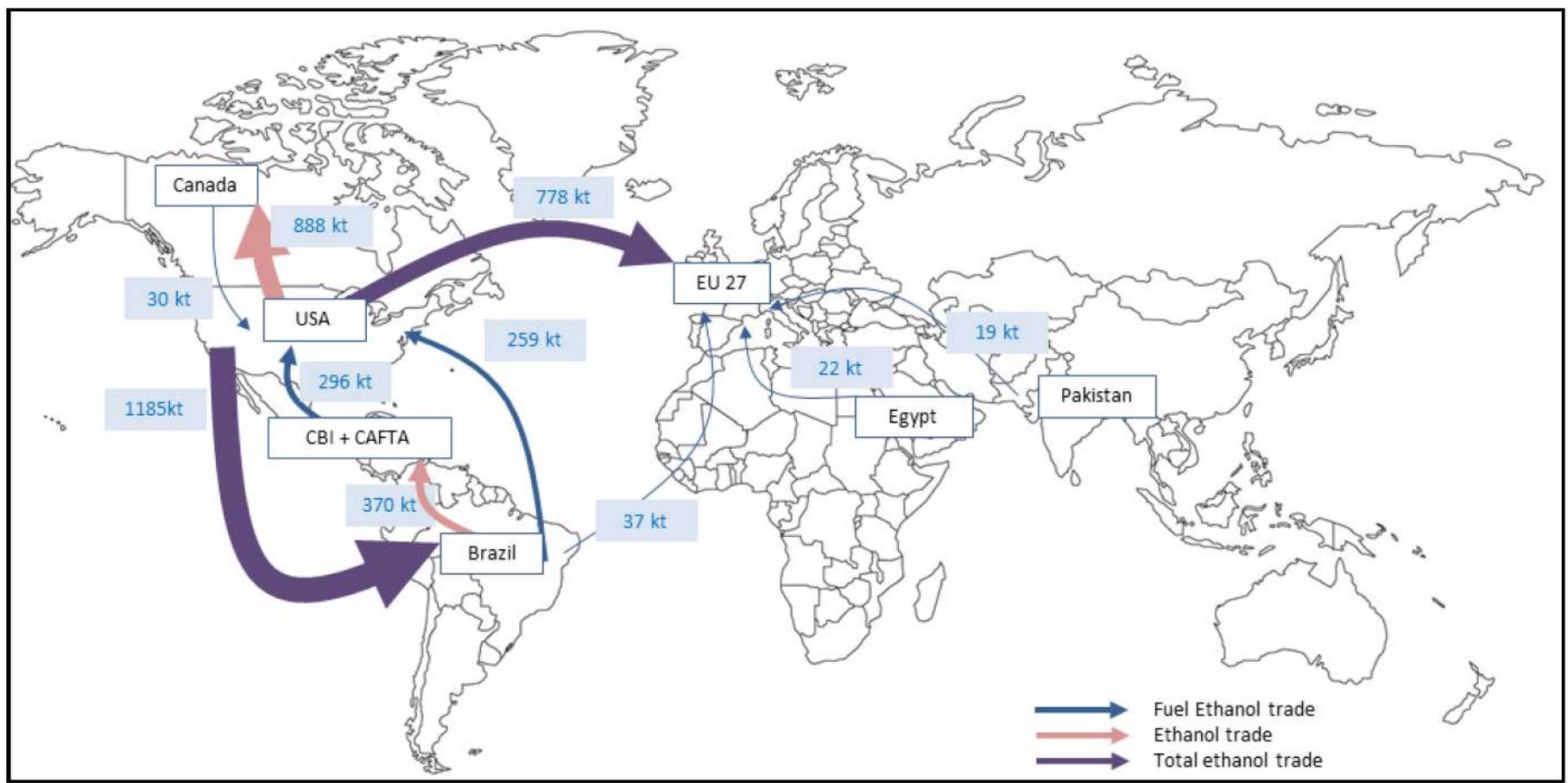
=> bioenergy trade

Global biodiesel trade 2011



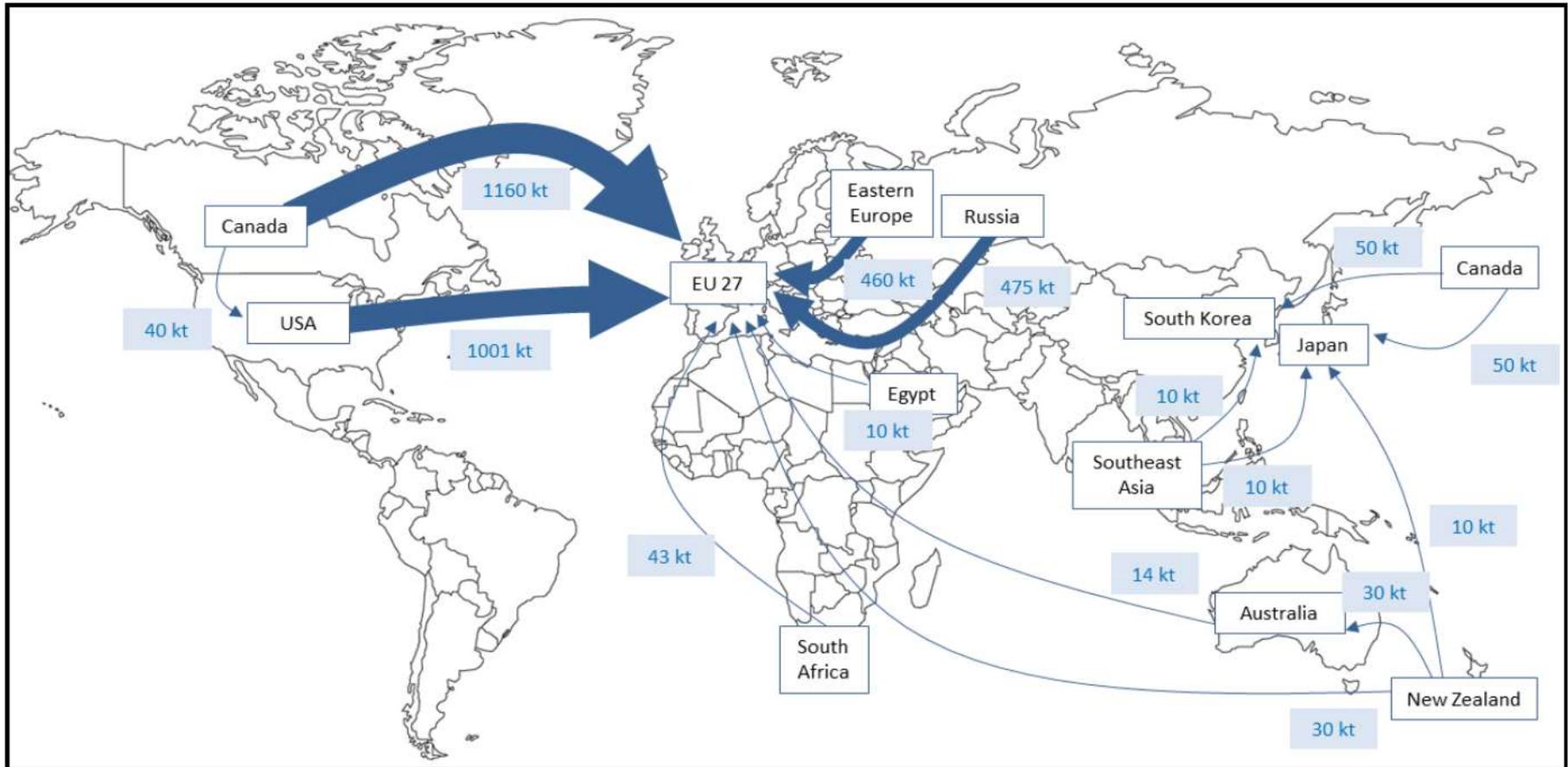
Source: Lamers 2012

Global bioethanol trade 2011



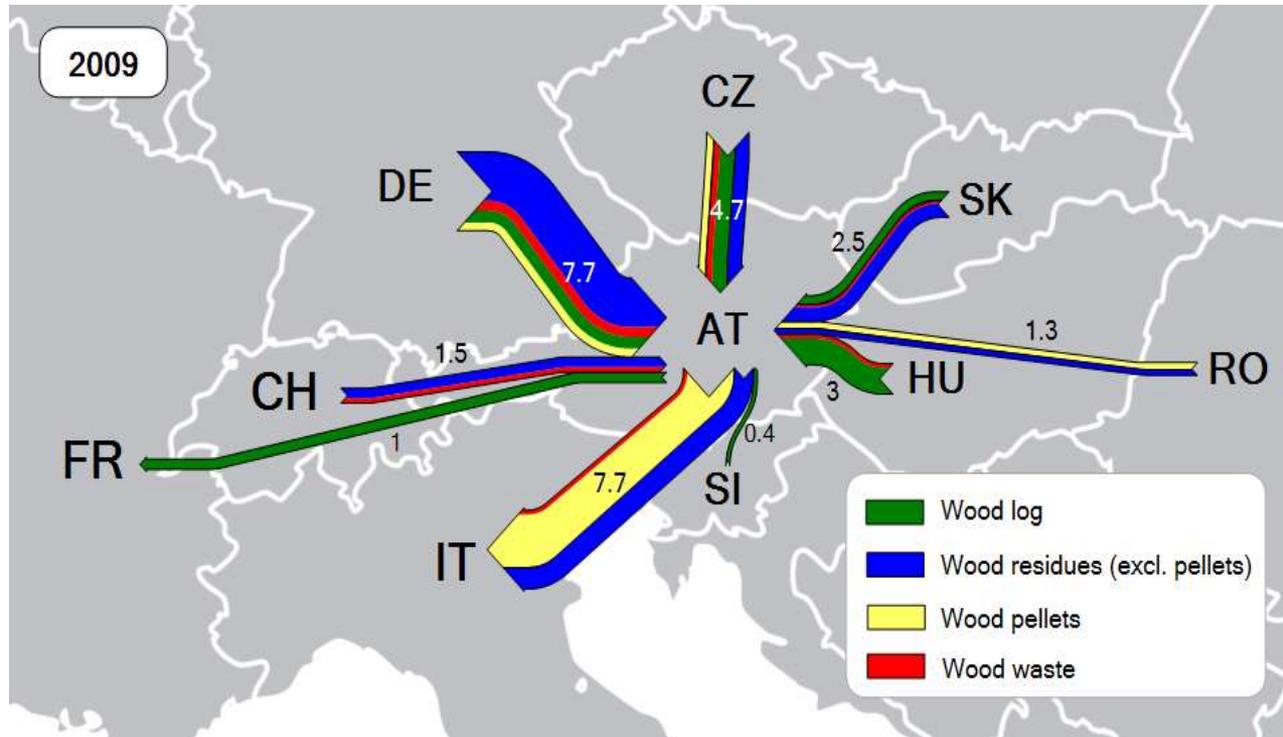
Source: Lamers 2012

Global wood pellets trade 2011



Source: Lamers 2012

International trade of woody bioenergy related to Austria, 2009 (PJ)



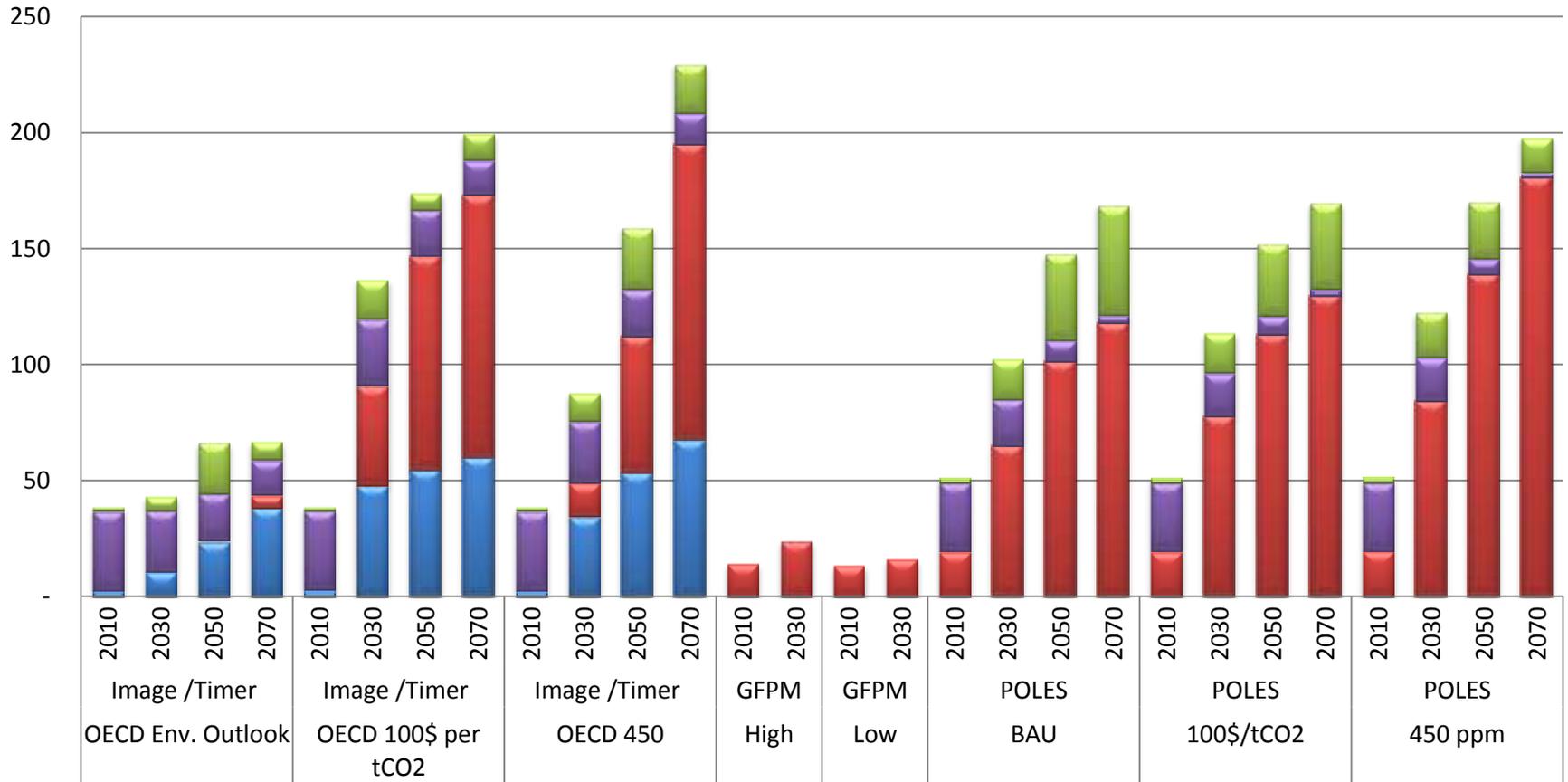
Net trade streams with wood log, wood residues, pellets and wood waste in 2009 (values in PJ, only streams above 0.3 PJ are not shown)

Source: Eurostat (2011), Kalt 2011

Bioenergy production in selected scenarios

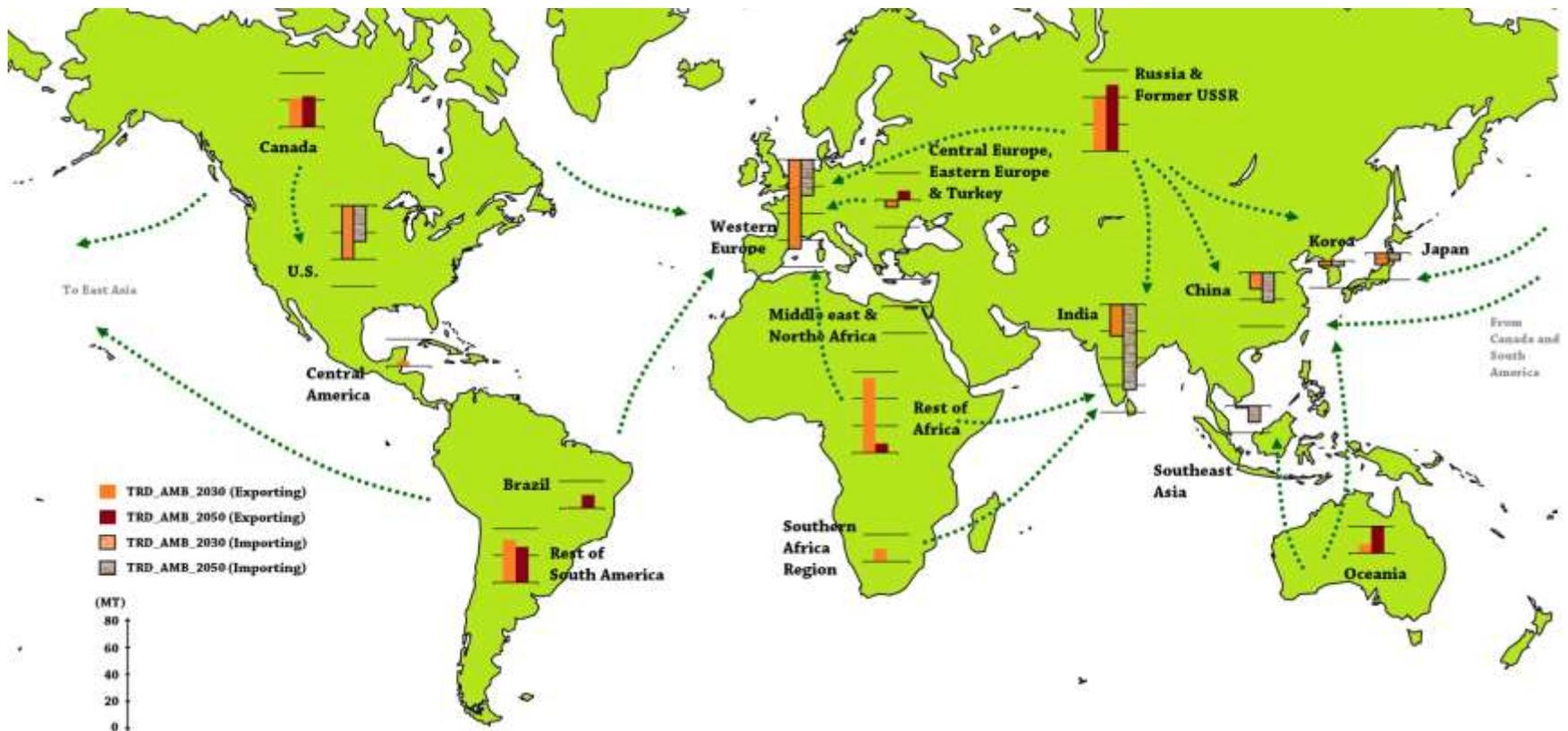
EJ Biomass

World Biomass Production



■ Solid biomass residues and waste
 ■ Solid biomass primary energy products
 ■ Solid biomass, traditional biomass
 ■ Liquid Biomass

Bioenergy demand and trade in scenarios up to 2050 (liquid biomass)



Bioenergy demand and trade in scenarios up to 2050 (solid biomass)



Bioenergy trade scenarios => implications?!

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Bioenergy policies and sustainability criteria

- *Relevant policy framework*
- *The RES-directive and sustainability criteria*

(Selected) historic bioenergy related policies:

EU-policies / documents

- *RES-E directive (not relevant anymore)*
- *Biofuel directive (not relevant anymore)*
- *Related progress reports (2007)*
- *Renewables-Directive (2009)*
- *...*

National policies

- *Implementation of RES-E and biofuel directives (not relevant anymore)*
- *National renewable energy action plans*
- *...*

EU RED (Renewable energy directive)

- *Share of renewable energy in the EU in 2020: 20% of gross final energy consumption*
- *Until 2010 Member States have to provide action plans with targets and interim targets for renewables in the electricity, heating and transport sector*
- *Renewables in transport: target of 10% in 2020, sustainability criteria and minimum GHG reduction requirements*

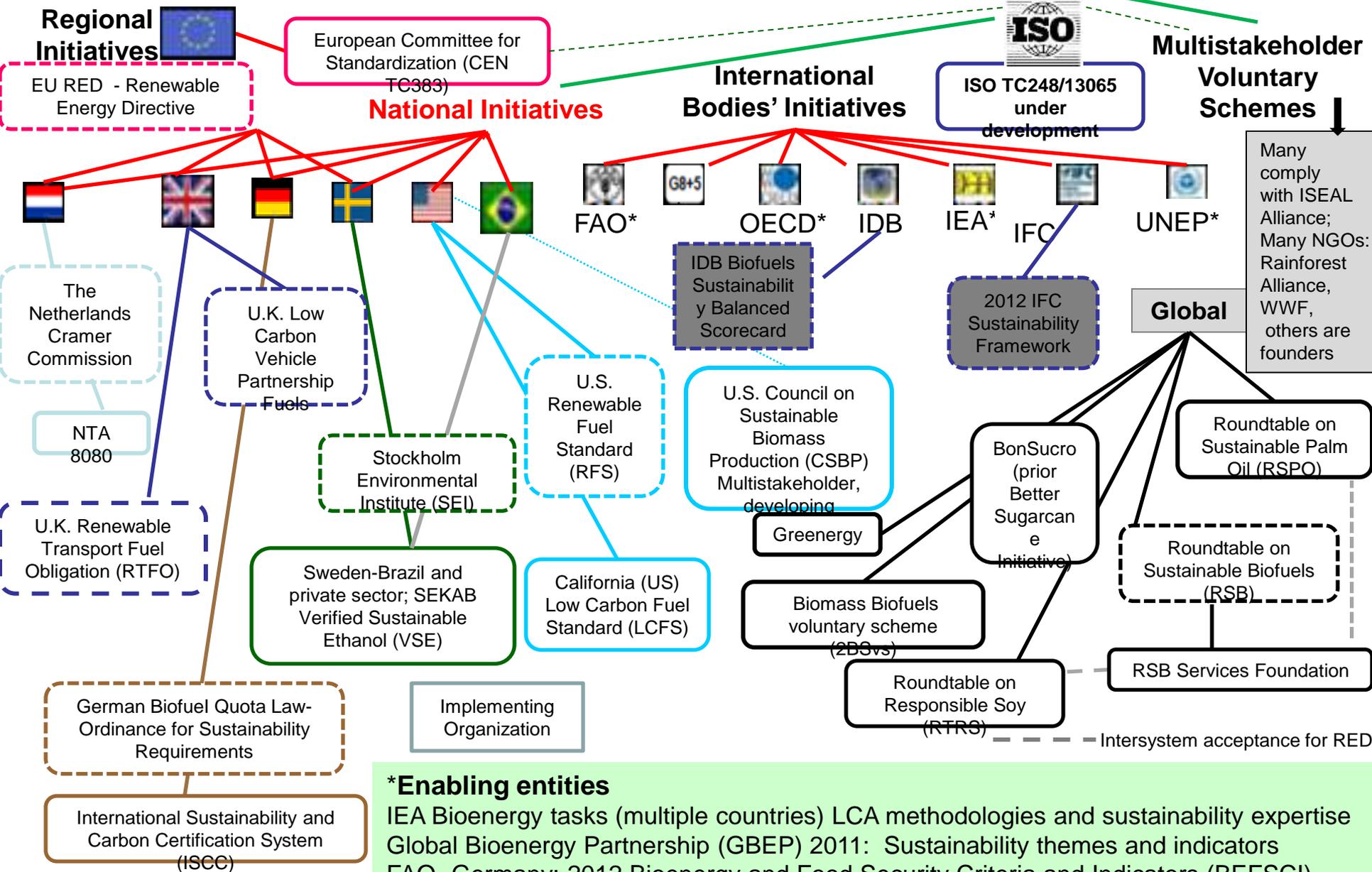
EU RES directive & sustainability criteria (1)

- *Sustainability criteria refer to „biofuels and bioliquids“*
- *GHG savings*
 - *>35% (for plants operating before 2008 this is valid from 2013)*
 - *From 2017: >50%*
 - *From 2018: 60% for all plants that started operation in or after 2017*
- *Not from land with high biodiversity value*
- *Not from land with high carbon stock*
- *Not from land that was peatland in 2008*
- *In accordance with environmental regulation of CAP (if produced in the EU)*

EU RES directive & sustainability criteria (2)

- *Commission shall, every two years, report on social sustainability, impact on food markets, land-use rights.*
- *Ongoing activities of the European Commission to define sustainability criteria for other forms of biomass (to be published possibly early 2013):*

Biofuels Sustainability



* Australia has a Subnational, NSW

Sustainability criteria and certification

- *A lot of different initiatives with different standards, aspects, objectives are currently existing.*
- *Most of them are dealing with liquid biofuels.*
- *Most of them are focusing on environmental principles.*
- *Concerns with respect to food security and socio-economic impacts are generally not included!
(Some voluntary schemes include socio-economic issues such as labour and employment conditions.)*
- *Wide variety of standards, methodologies => risk of confusion in the market, abuse and „shopping“ of standards.*
- *In spite of current limitations certification has the potential to influence direct, local impacts related to environmental and social effects.*
- *=> further development and strengthening of standards and methodological frameworks!*