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Prospects for Developing Sustainable Bioenergy Markets and Trade.

IEA Bioenergy ExCo workshop (part of Bioenergy Australia),
Twin Waters - Australia, 23th November 2011

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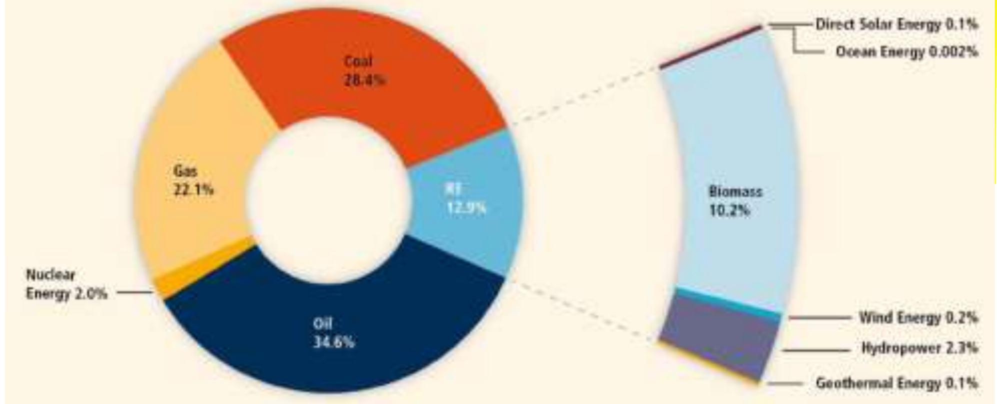
IPCC publishes Special Report on Renewable Energy Sources and Climate Change Mitigation

Potsdam, 11 May 2011 - By 2050, a maximum of 77 percent of the world's energy supply could be provided from renewable energy sources. The share of renewable energy in the future global energy mix differs substantially among scientific scenarios....A comprehensive review by the IPCC outlines the large potential of renewable energy sources to mitigate emissions of greenhouse gases and anthropogenic climate change. Special Report on Renewable Energy Sources and Climate Change Mitigation' (SRREN) has been approved by government representatives for IPCC member countries at the **11th Session of Working Group III** in Abu Dhabi, United Arab Emirates.

Coordinating Lead Authors Meeting with
PCC WGIII cochairs and TSU – Potsdam, Jan. 2011

★ Bioenergy CLAs

Biomass & bioenergy flows according to IEA + other refs (2008)



Type	Primary Energy, EJ/y	~Average Efficiency, %	Secondary Energy Carrier, EJ/y
Traditional Biomass			
Accounted by IEA, 2010	*30.7**	10 to 20	3 to 6
Unaccounted - informal sectors	6 to 12		0.6 to 2.4
Total Traditional Biomass	*37-42*		*3.6 to 8.4*
Modern Biomass (IEA, 2010)			
Power sector: Electricity *(0.82 EJ*)*, Heat, and CHP from biomass, MSW *(0.58 EJ*)*, biogas	5.2	60	3.1
Residential and Others :Total residential heat *(33.7 EJ*)* minus IEA traditional biomass; biogas heating, public/commercial buildings heating	*4.1**	60 to 80	2.4-3.2
Road **Transport** Fuels (ethanol, biodiesel, ETBE)	3.1	65	*1.9**
Total Modern Bioenergy (as accounted by IEA , 11.4 EJ for values)*	*12.4*	*60-65*	*7.4 to 8.3*

Note: (*) Direct data from 2010 IEA Energy Balances Statistics for 2008. Others derive from combinations of data across biomass sources and sectors of the IEA publication.

[IPCC-SRREN, 2011]

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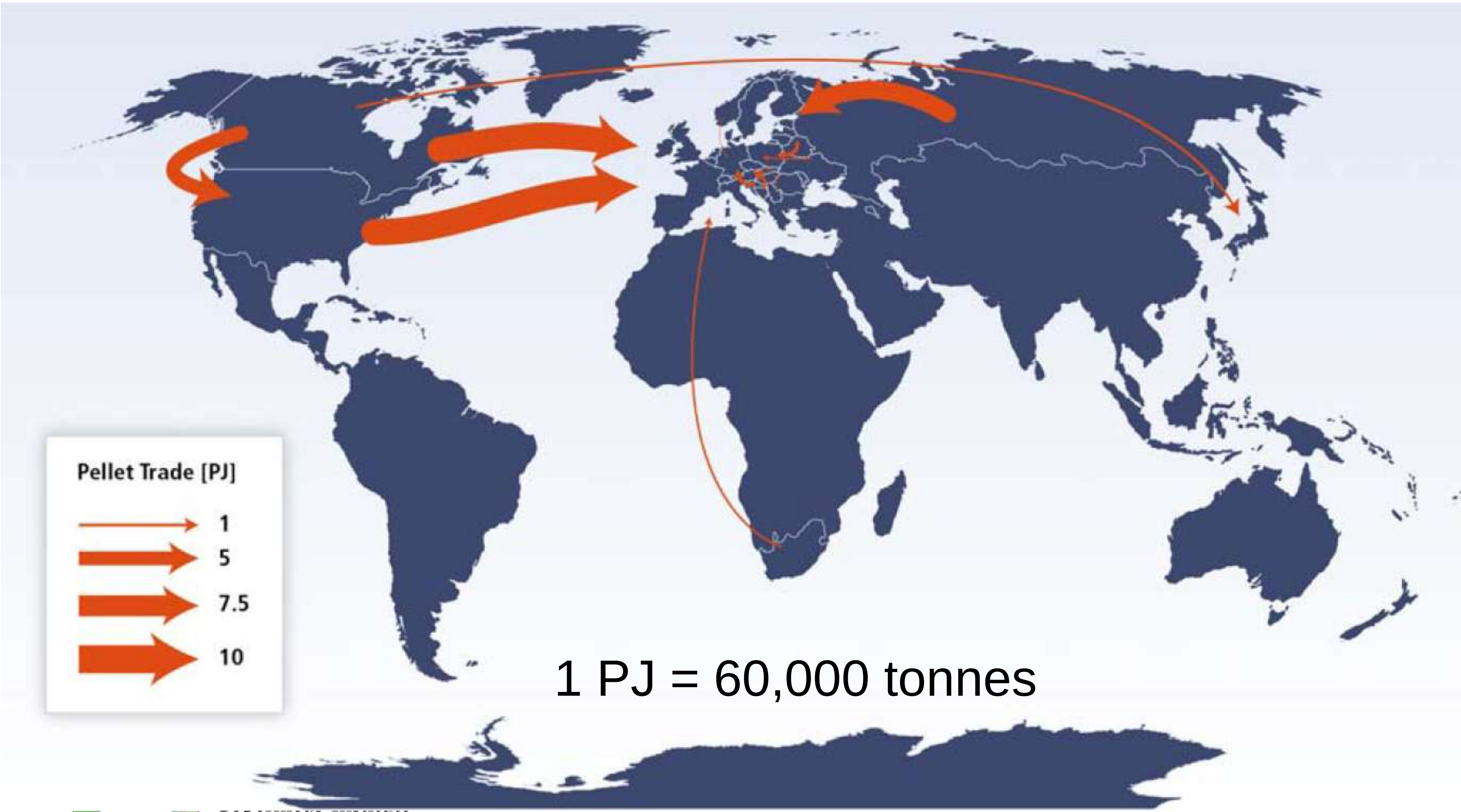
Global wood pellet trade 2009



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(Source: Sikkema et al.,Bio FPR 2011 in IPCC, 2011)

Global biofuels production and main international trade 2009

(Source: Lamers, RSER, 2011 in IPCC, 2011)

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Global production and trade of the major biomass commodities (2008)

Mton in 2008	Bioethanol	Biodiesel	Wood pellets
Global production	52.9	10.6	11.5
Global net trade	3.72 (*)	2.92	Approx. 4
Main exporters	Brazil	US, Argentina, Indonesia Malaysia	Canada,USA, Baltic countries, Finland, Russia
Main importers	USA, Japan, EU	EU	Belgium, Netherlands, Sweden, Italy

(*) An estimated 75% of the traded bioethanol is used as transport fuel.

[Heinimö & Junginger, Biomass & Bioenergy, 2009]

2050 Bioenergy Potentials & Deployment Levels

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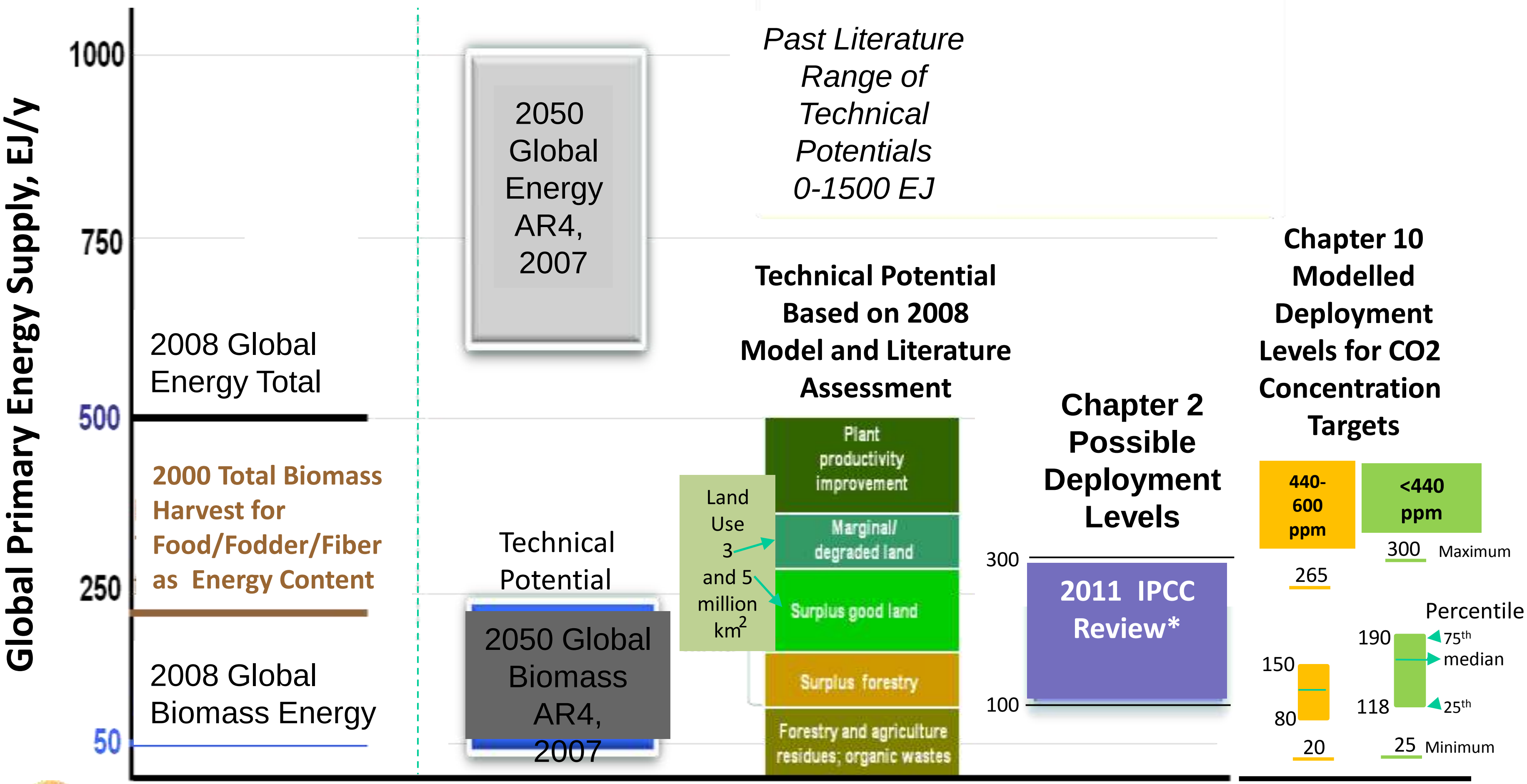
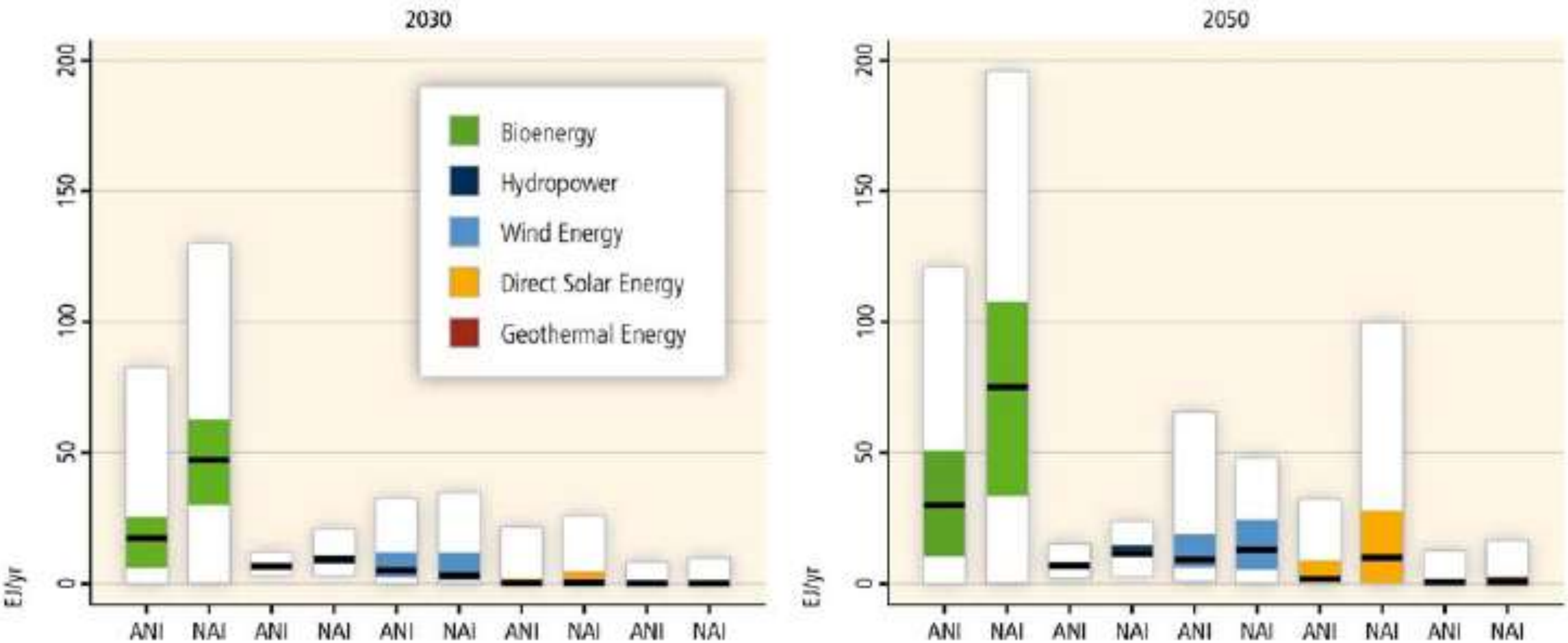


[IPCC-SRREN, 2011]

Global RE supply by source in Annex I (ANI) and Non-Annex I (NAI) countries in 164 long-term scenarios (2030 and 2050).



Thick black line = median,
Coloured box = 25th-75th percentile,
Whiskers = total range across all reviewed scenarios.

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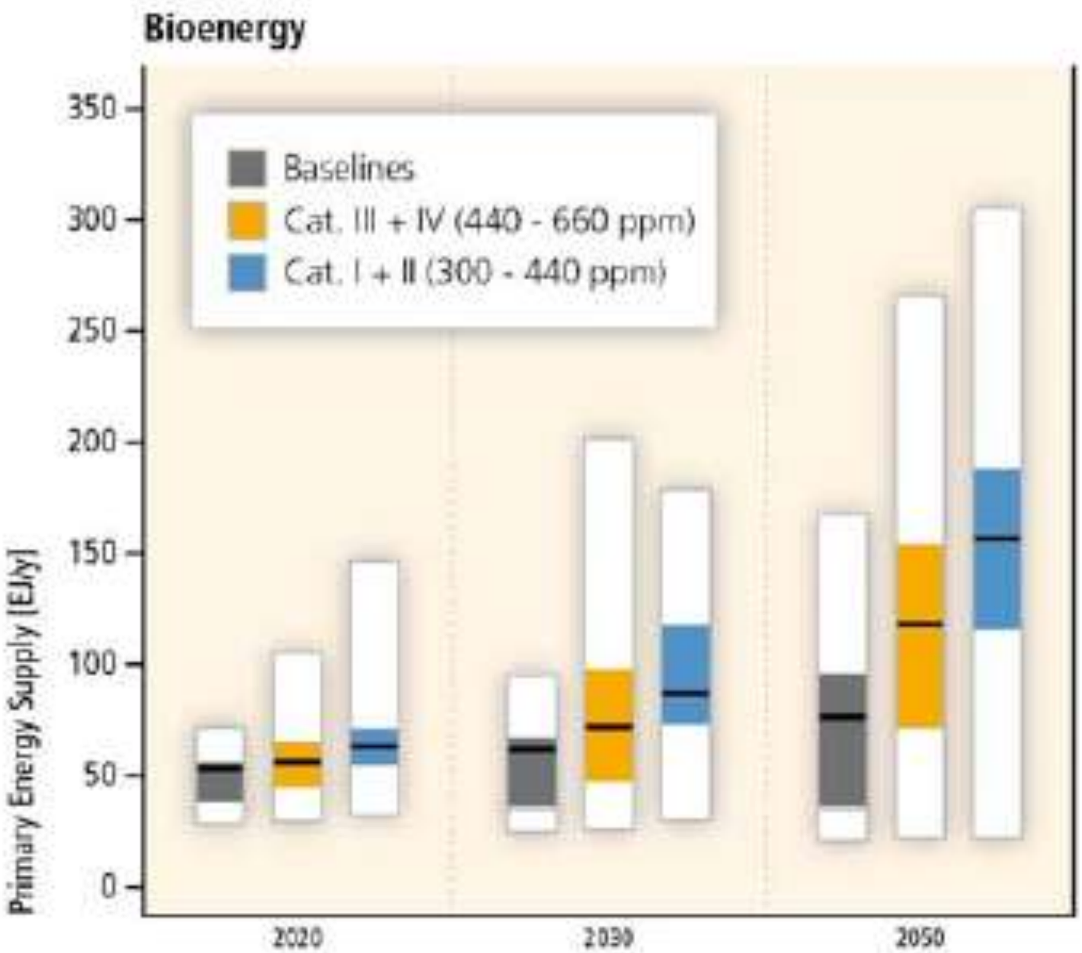
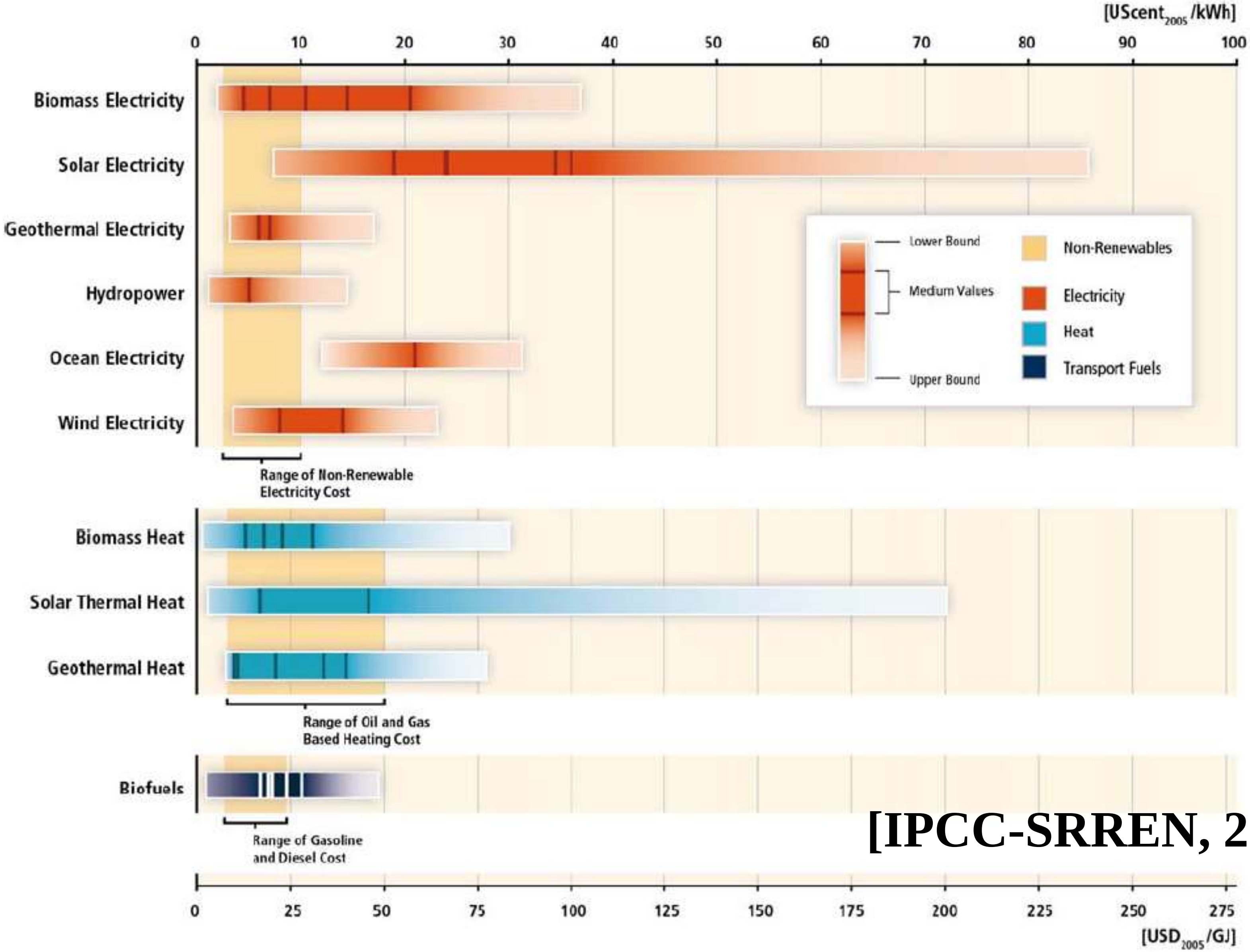
[IPCC-SRREN, 2011]

Global primary energy supply of biomass in 164 long-term scenarios in 2020, 2030 and 2050, grouped by different categories of atmospheric CO2 concentration level in 2100



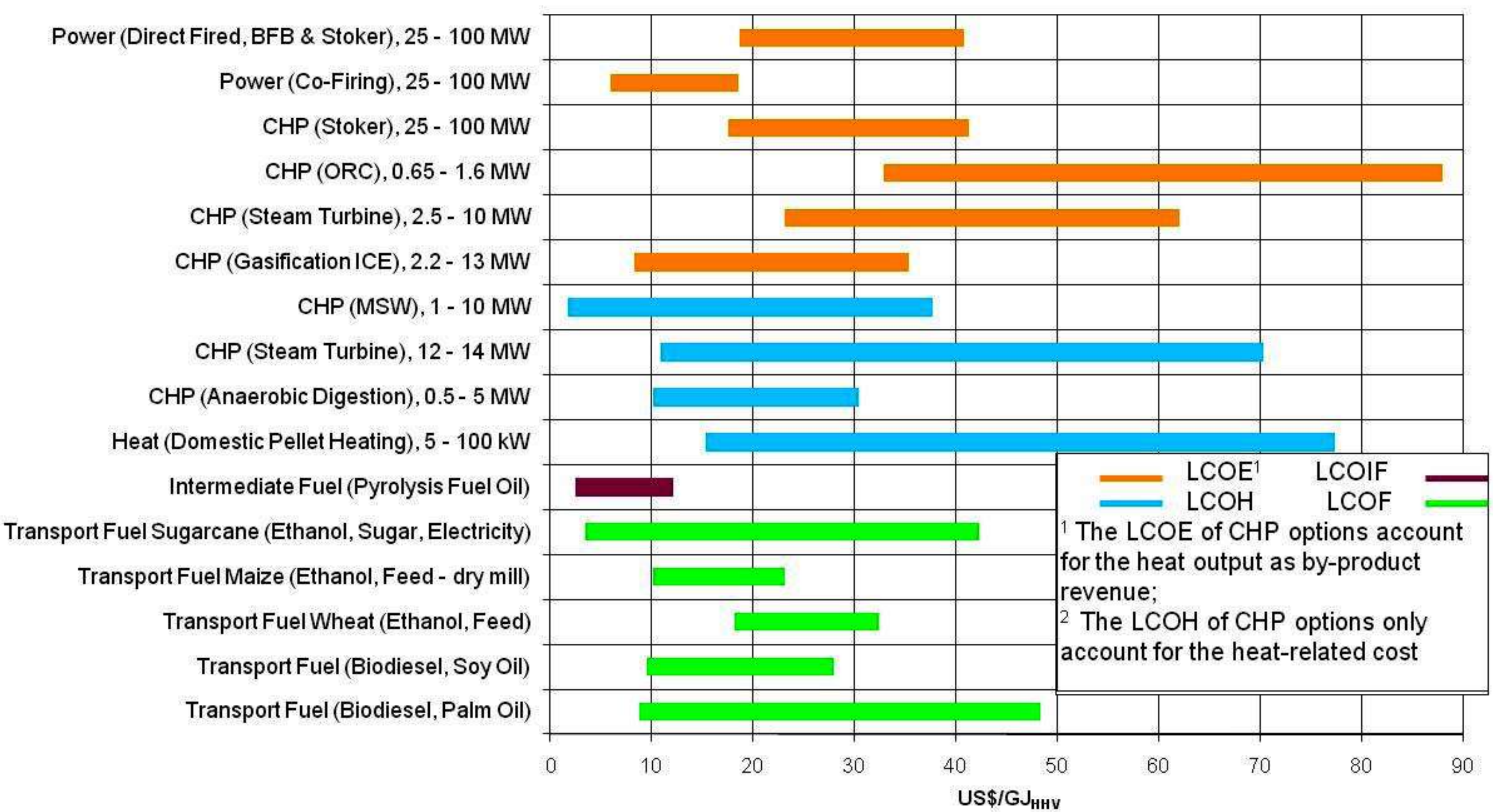
[IPCC-SRREN, 2011]

Range of LCOE for selected commercially available RE technologies compared to recent non-RE costs.



[IPCC-SRREN, 2011]

Cost ranges various current bioenergy systems.



[IPCC-SRREN, 2011]

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Projected production costs estimated for selected *developing* technologies

Select Bioenergy Technology	Energy Sector (Electricity, Thermal, Transport)*	2020-2030 Projected Production Costs US$(2005)/GJ
Integrated Gasification Combined Cycle (IGCC)[1.]	Electricity and/or Transport	12.8-19.1 (4.6-6.9 cents/kWh)
Renewable diesel & jet fuel	Transport and electricity	15-30
Lignocellulose sugar-based biofuels[2]	Transport	6-30
Lignocellulose syngas-based biofuels[3]	Transport	12 -25
Lignocellulose pyrolysis-based biofuels[4]	Transport	14-24 (blendstock)
Gaseous biofuels[5]	Thermal and Transport	6-12
Aquatic plant derived fuels, chemicals	Transport	30-140

[1]Feed cost $3.1/GJ, IGCC (future) 30-300 MW, 20 yr life, 10% Discount Rate; [2]ethanol, butanols, microbial hydrocarbons and microbial hydrocarbons from sugar or starch crops; [3] syndiesel, methanol and gasoline, etc.; syngas fermentation routes to ethanol; [4] biomass pyrolysis (or other thermal treatment) and catalytic upgrading to gasoline and diesel blendstocks or to jet fuels; [5] synfuel to SNG, methane, dimethylether, hydrogen from biomass thermochemical and anaerobic digestion (larger scale)

[IPCC-SRREN, 2011]

Direct and indirect land use GHG emissions – Take II (Chapter 9)

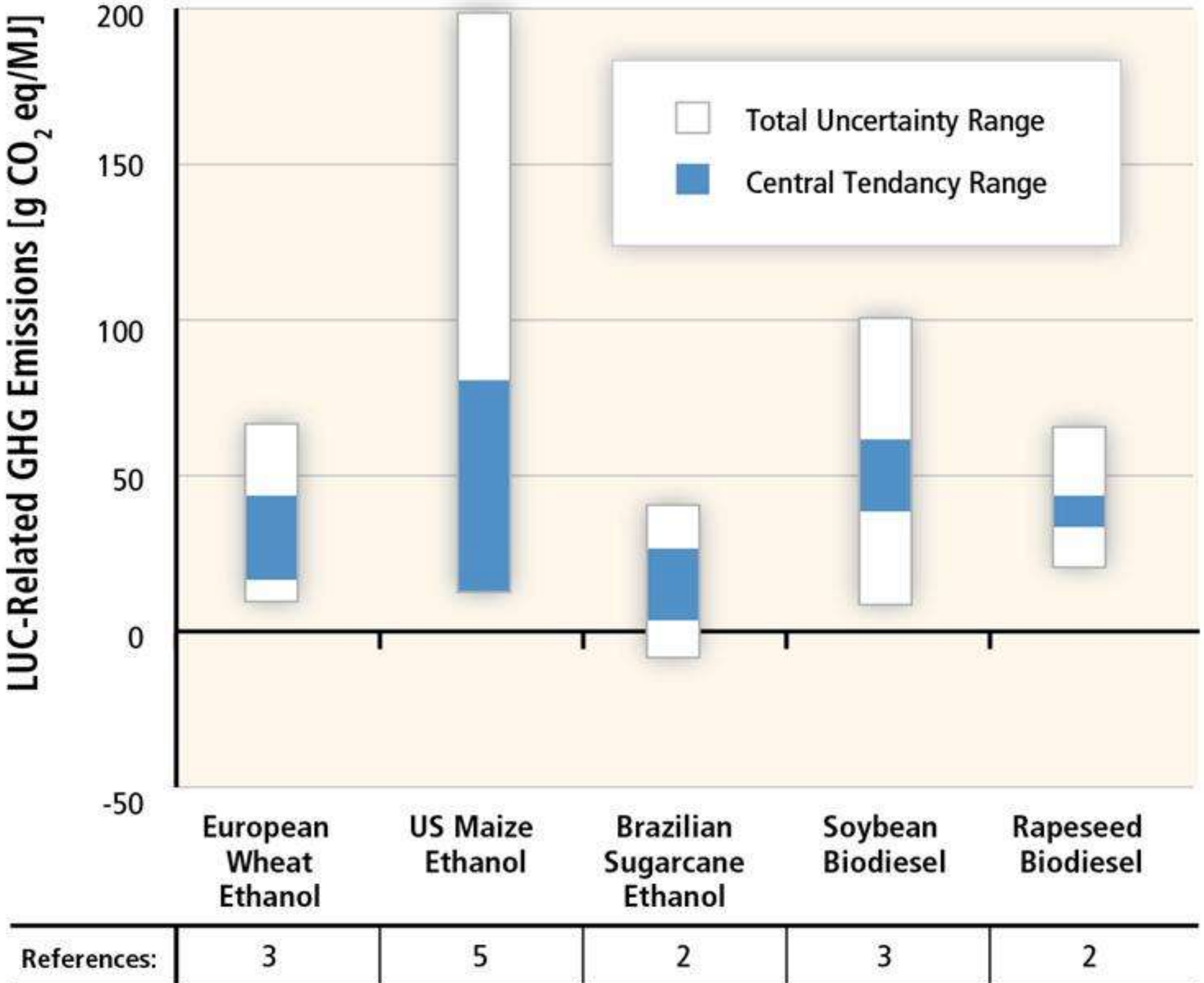

Figure 9.11 | Illustrative estimates of direct and indirect LUC-related GHG emissions induced by several first-generation biofuel pathways, reported here as ranges in central tendency and total reported uncertainty. Estimates reported here combine several different uncertainty calculation methods and central tendency measures and assume a 30-year time frame. Reported under the x-axis is the number of references with results falling within these ranges (Sources: Searchinger et al., 2008; Al-Riffai et al., 2010; EPA, 2010b; Fritsche et al., 2010; Hertel et al., 2010; Tyner et al., 2010).

[IPCC-SRREN, 2011]

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Status iLUC (an opinion)

- Diverging outcomes; more sophisticated approaches; from 0.8 to later analyses: 0.3 -> 0.2.
- More detailed regional studies: depends highly (Fully…) on rate of improvement in agricultural and livestock management.
- CGE: extrapolates past developments, very sensitive to input data, poor in tackling technological change…

- iLUC is a **reactive** concept while we actually want to be **proactive** in avoiding it altogether…
- defining iLUC factors has received most attention versus very limited focus on mitigation of iLUC **[Faaij, 2011]**

Confrontation of bottom-up vs. top down

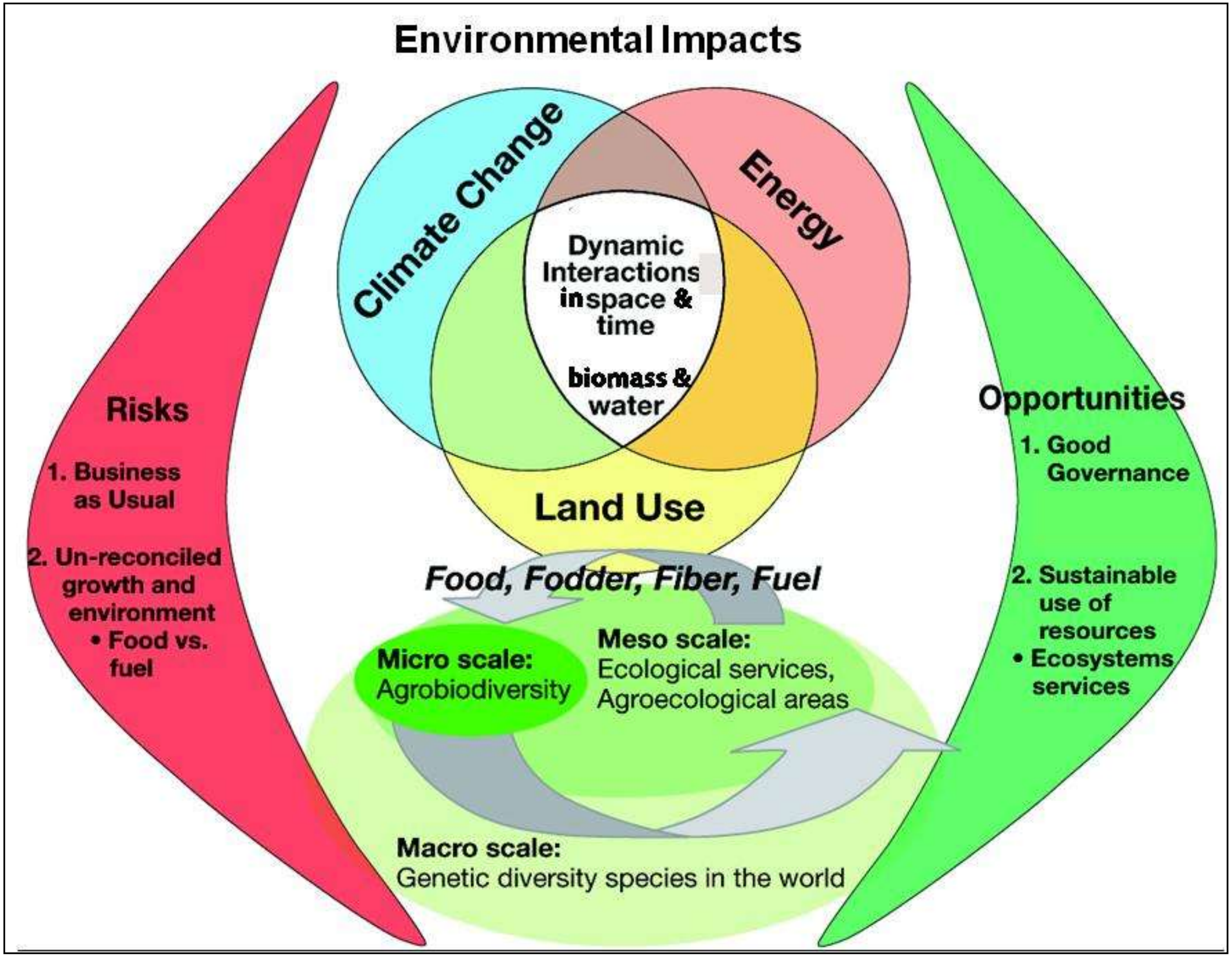
Key steps iLUC modelling efforts:

- CGE; historic data basis
- Model shock, short term, BAU, current technology.
- Quantify LUC
- Quantify GHG implications (carbon stocks)

Bottom-up insights:

- Coverage of BBE options, advancements in agriculture, verify changes (land, production)
- Gradual, sustainability driven, longer term, technological change (BBE, Agriculture)
- LUC depends on zoning, productivity, socio-economic drivers
- Governing of forest, agriculture, identification of ''best'' lands.

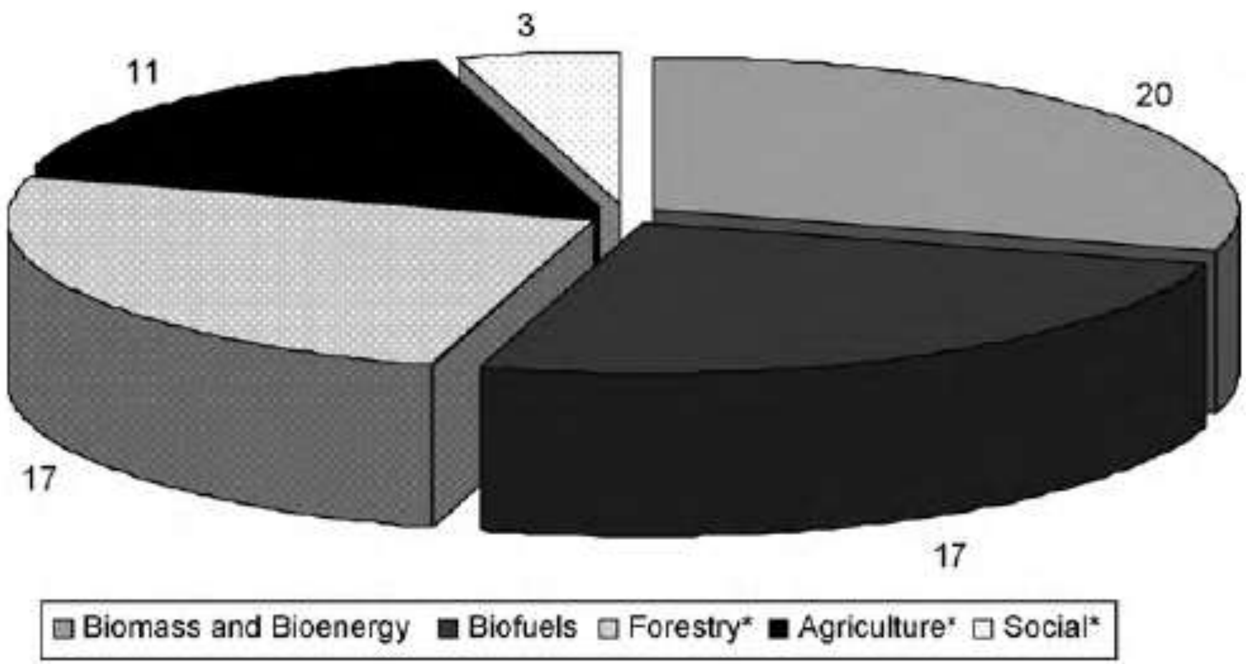
Driving forces, dimensions, scales…



[IPCC-SRREN, 2011]

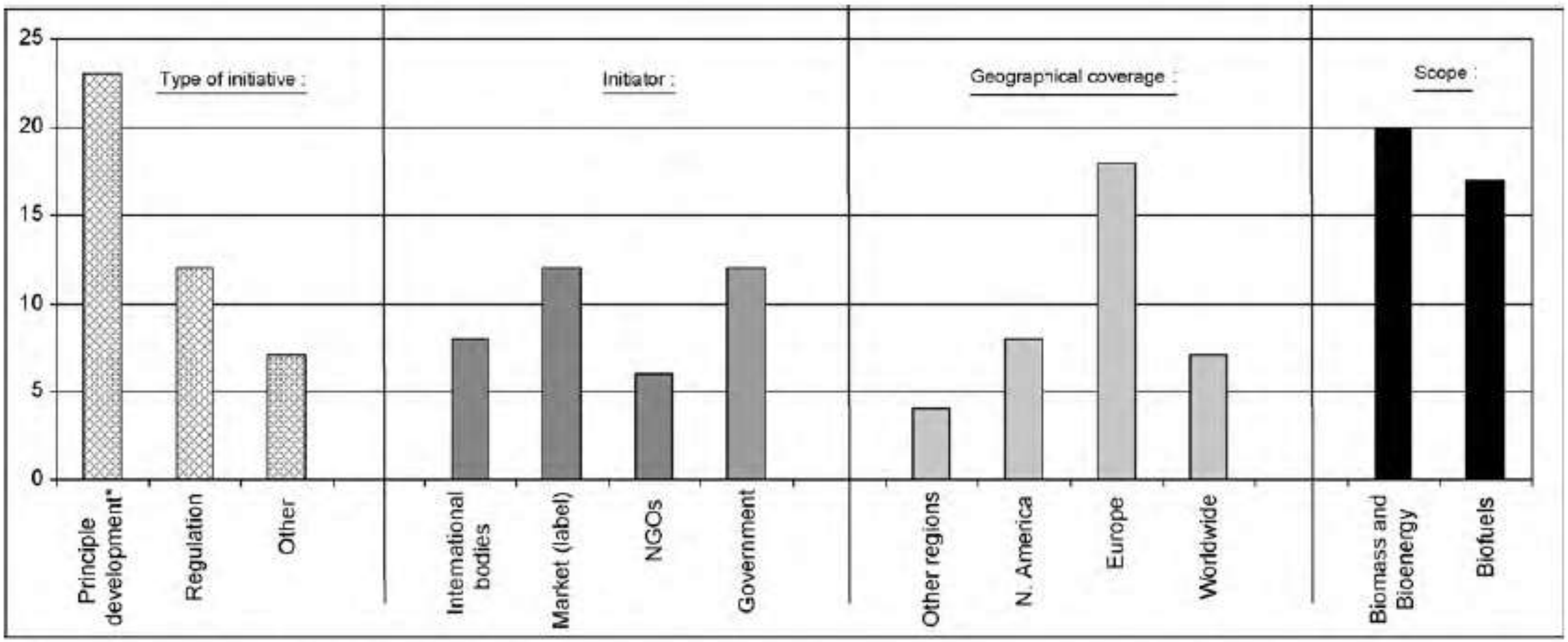
Initiatives and certification systems on biomass and bioenergy certification

(substantially more systems exist)



[van Dam et al., RSER, 2010]

Key characteristics of initiatives and systems on biomass and bioenergy certification



* Several initiatives (NTA 8080, UK-RTFO) focus their initiatives on regulation as well as principle development.

[van Dam et al., RSER, 2010]

Operationalisation of sustainability criteria

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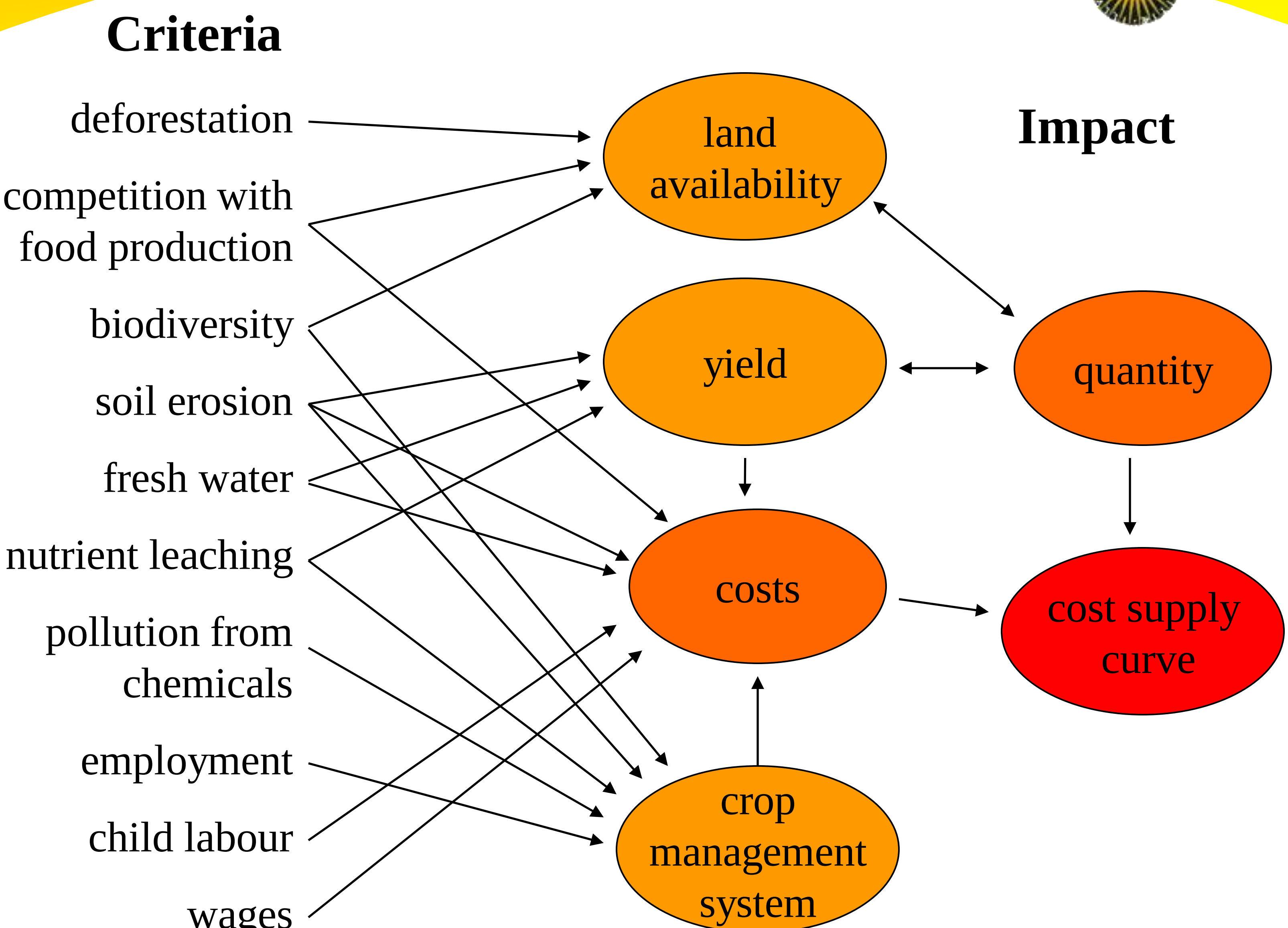
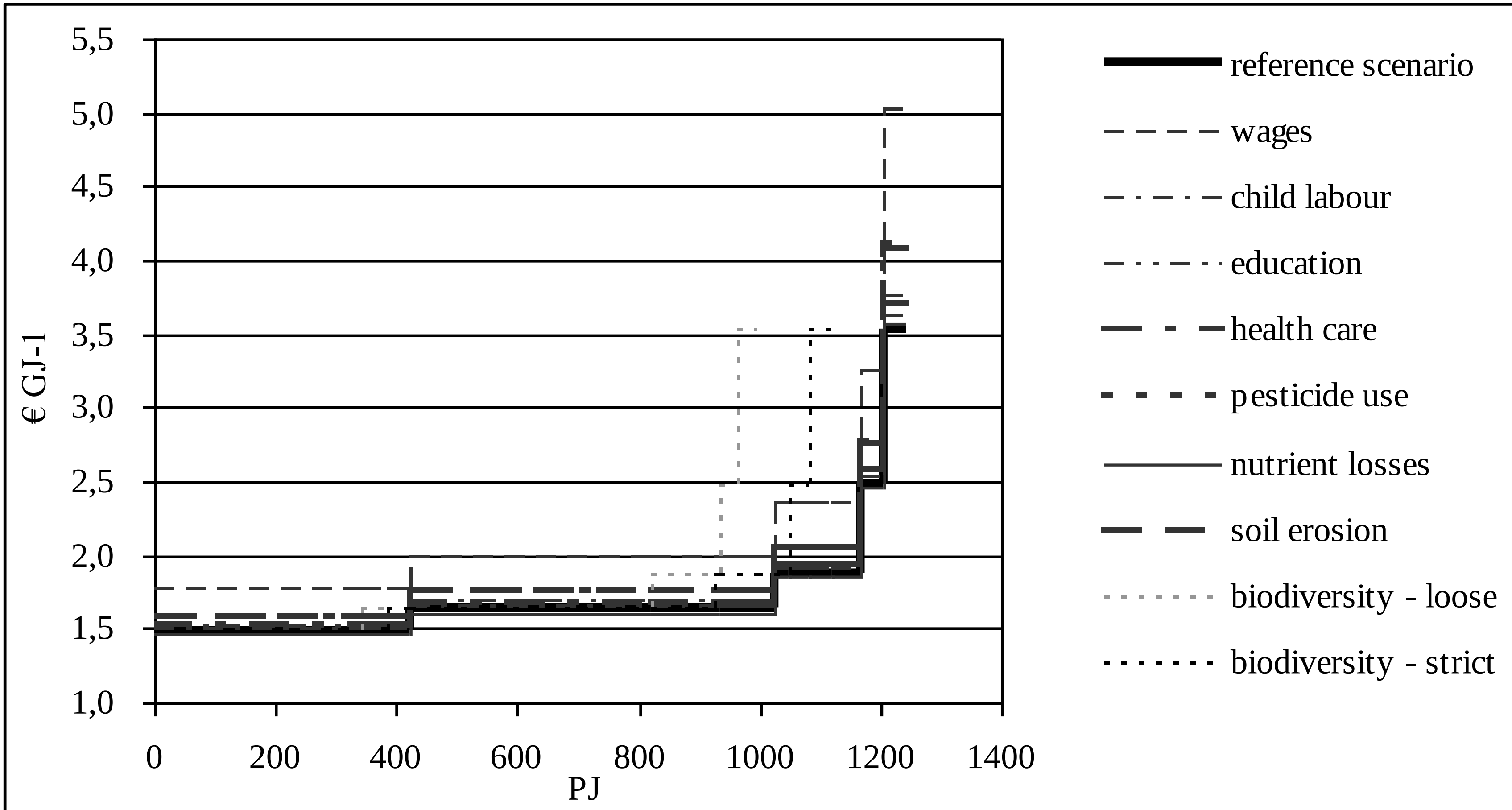


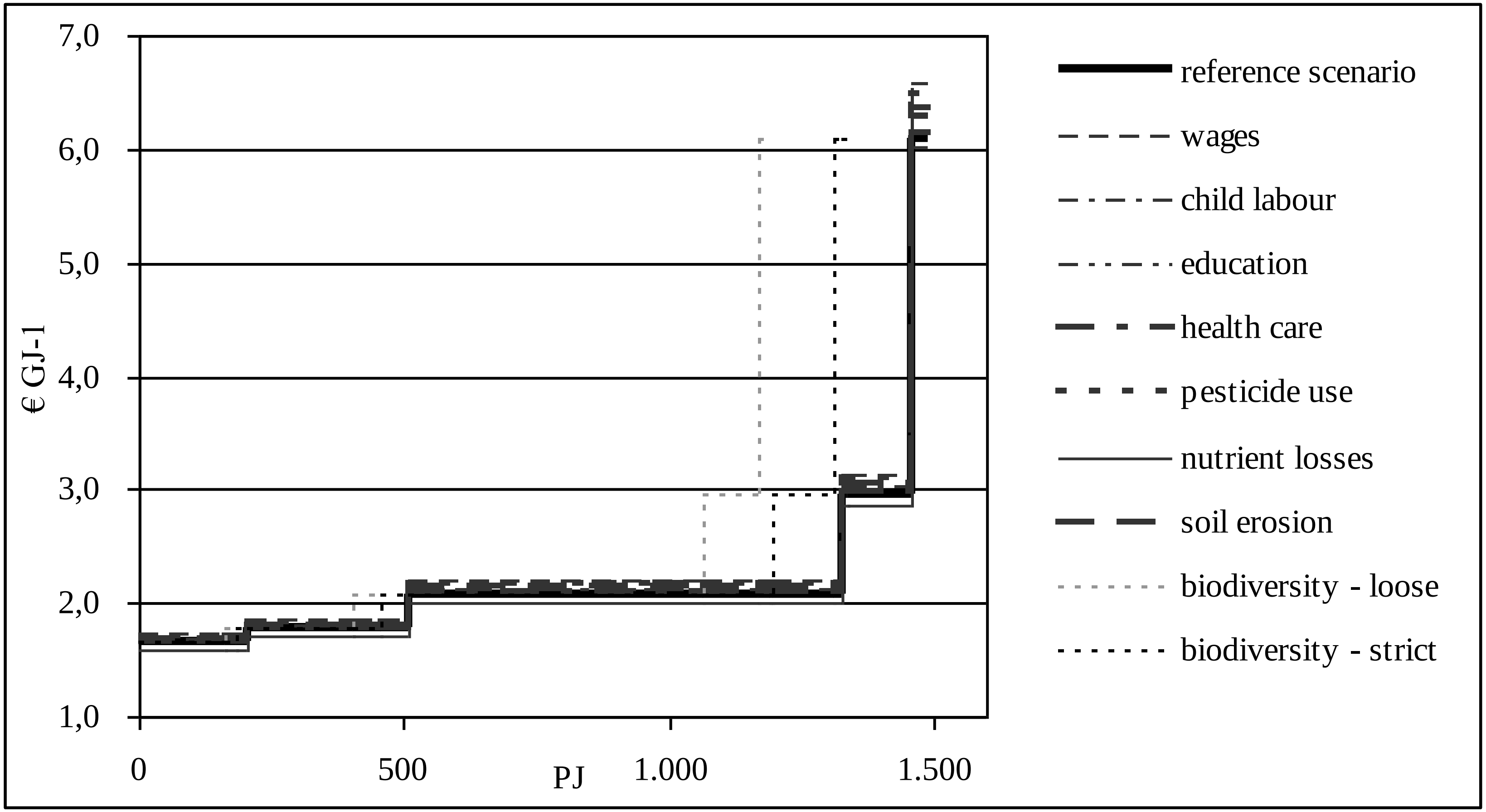
[Smeets et al., Biomass & Bioenergy, 2010]

Cost supply curve Brazil with sustainability demands



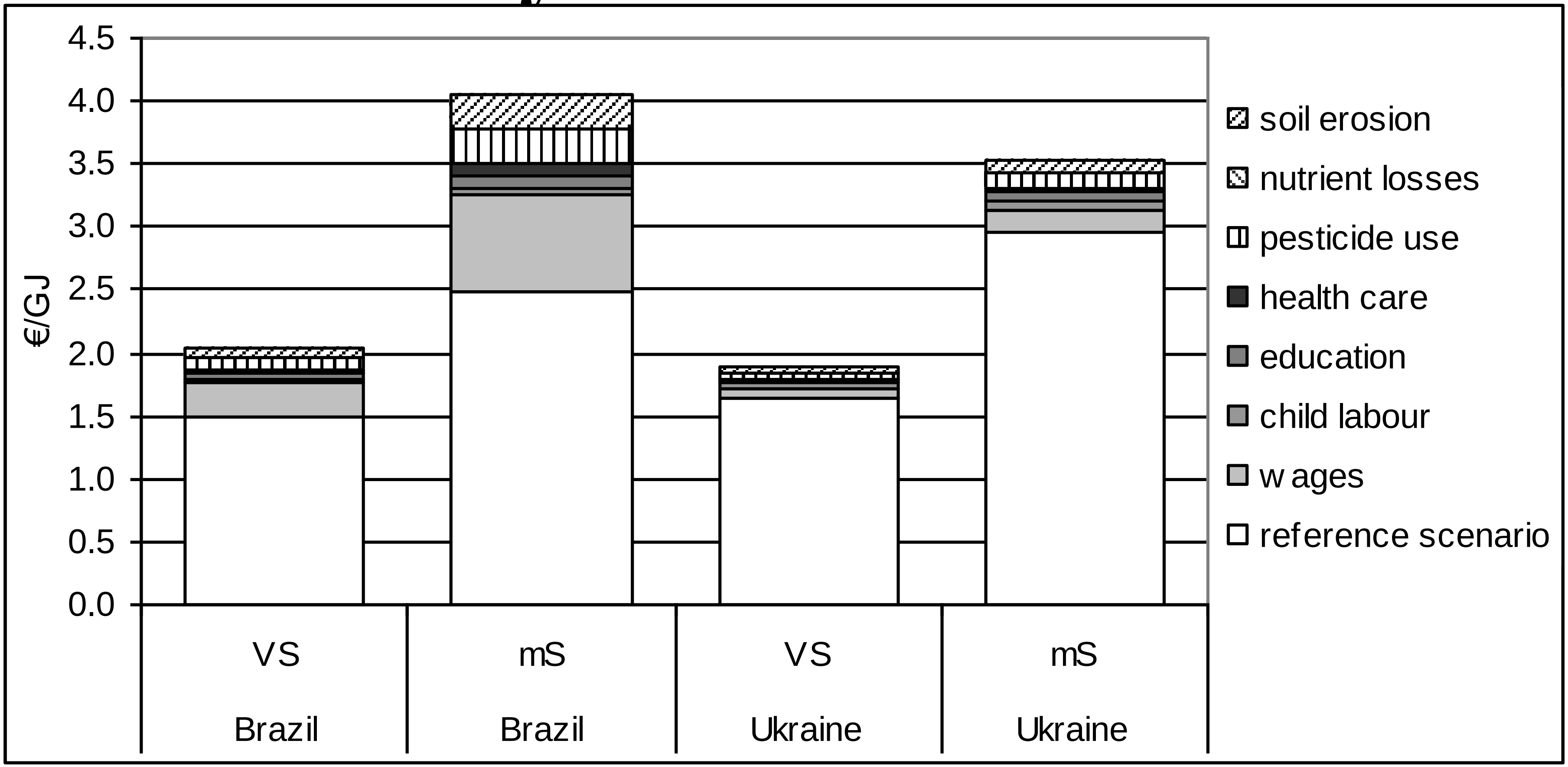
[Biomass & Bioenergy, Smeets et al., 2010]

Cost supply curve Ukraine with sustainability demands



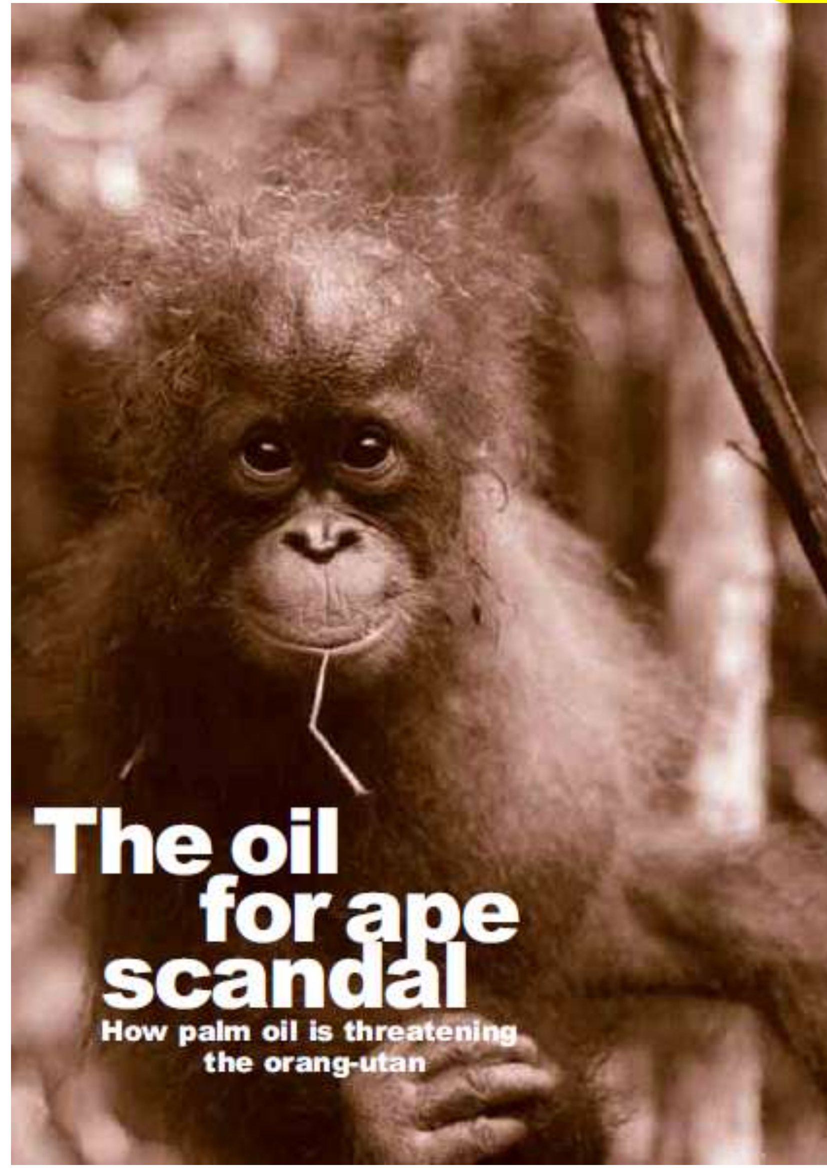
[Biomass & Bioenergy, Smeets et al., 2010]

Indicative cost impacts of applying sustainability criteria…

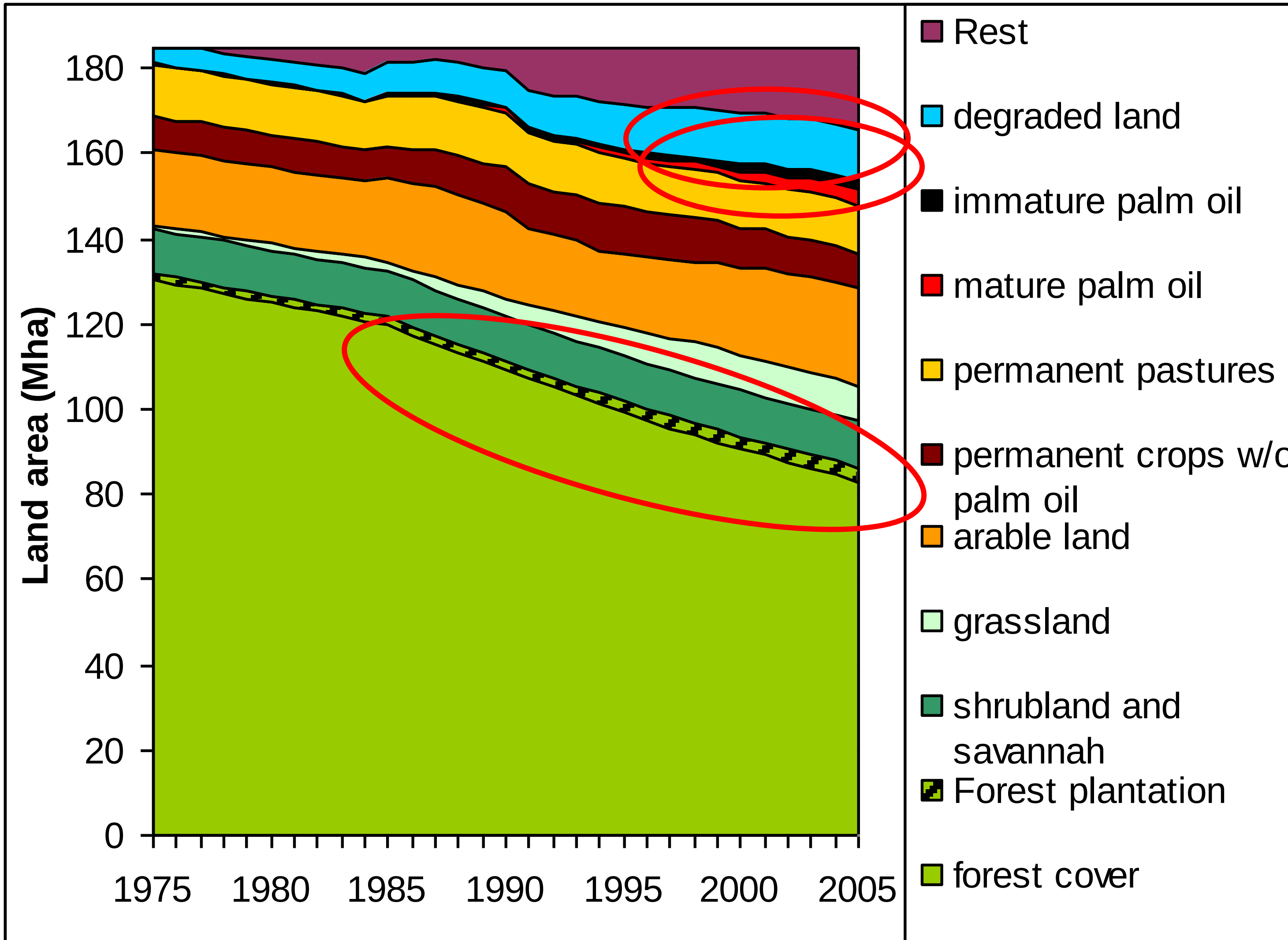


[Biomass & Bioenergy, Smeets et al., 20010]


Regenwald Report
Kahlschlag für Diesel


The oil for ape scandal
How palm oil is threatening the orang-utan

LUC in Indonesia



[Wicke, et al., 2011, Land use policy]

LUC until 2020 Indonesia

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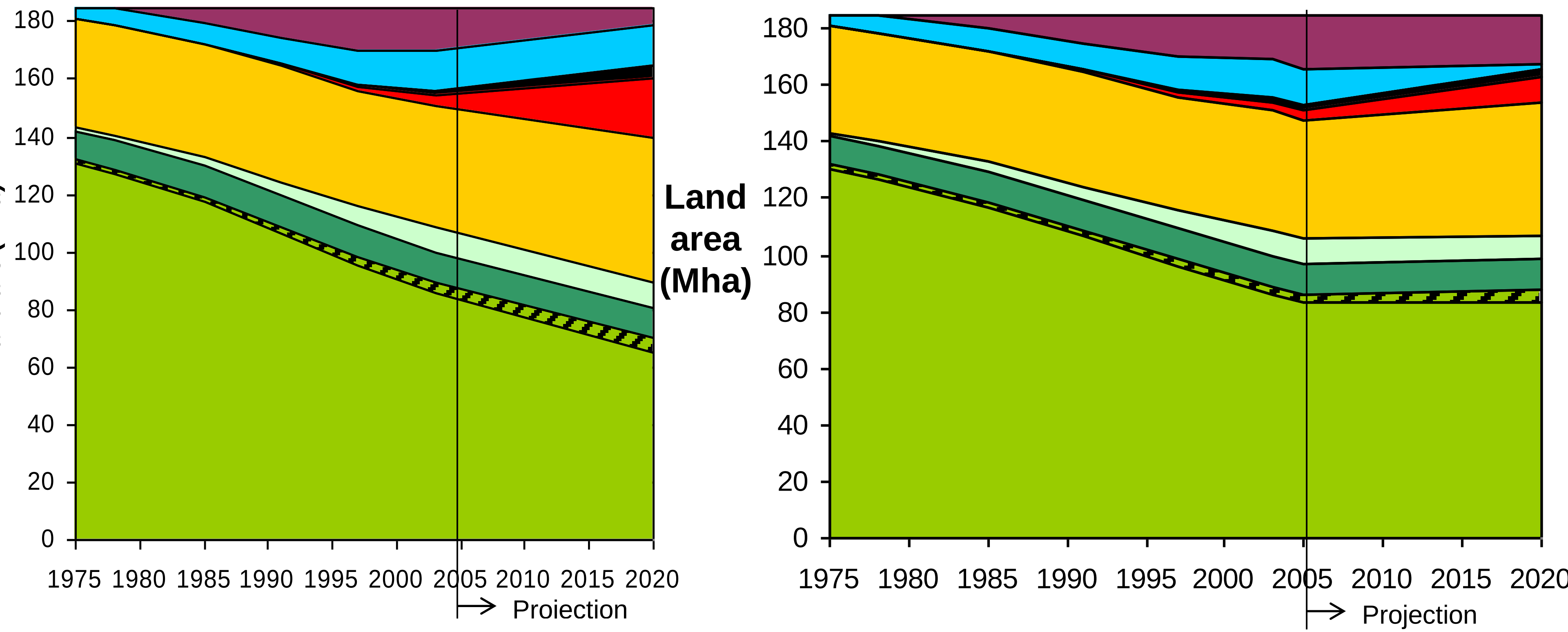
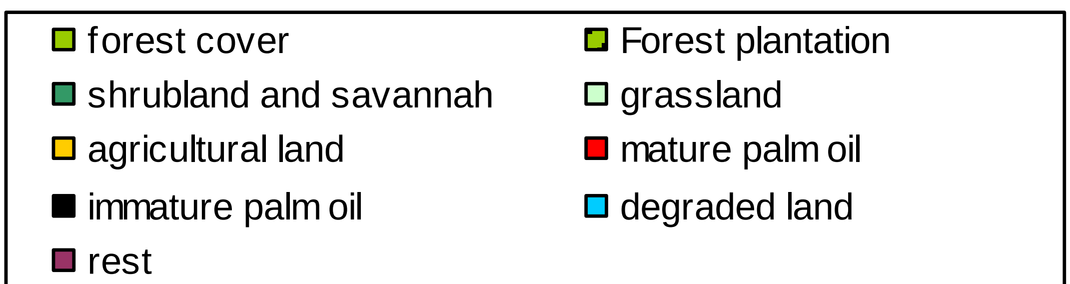
Business as Usual – Provincial plans (base)

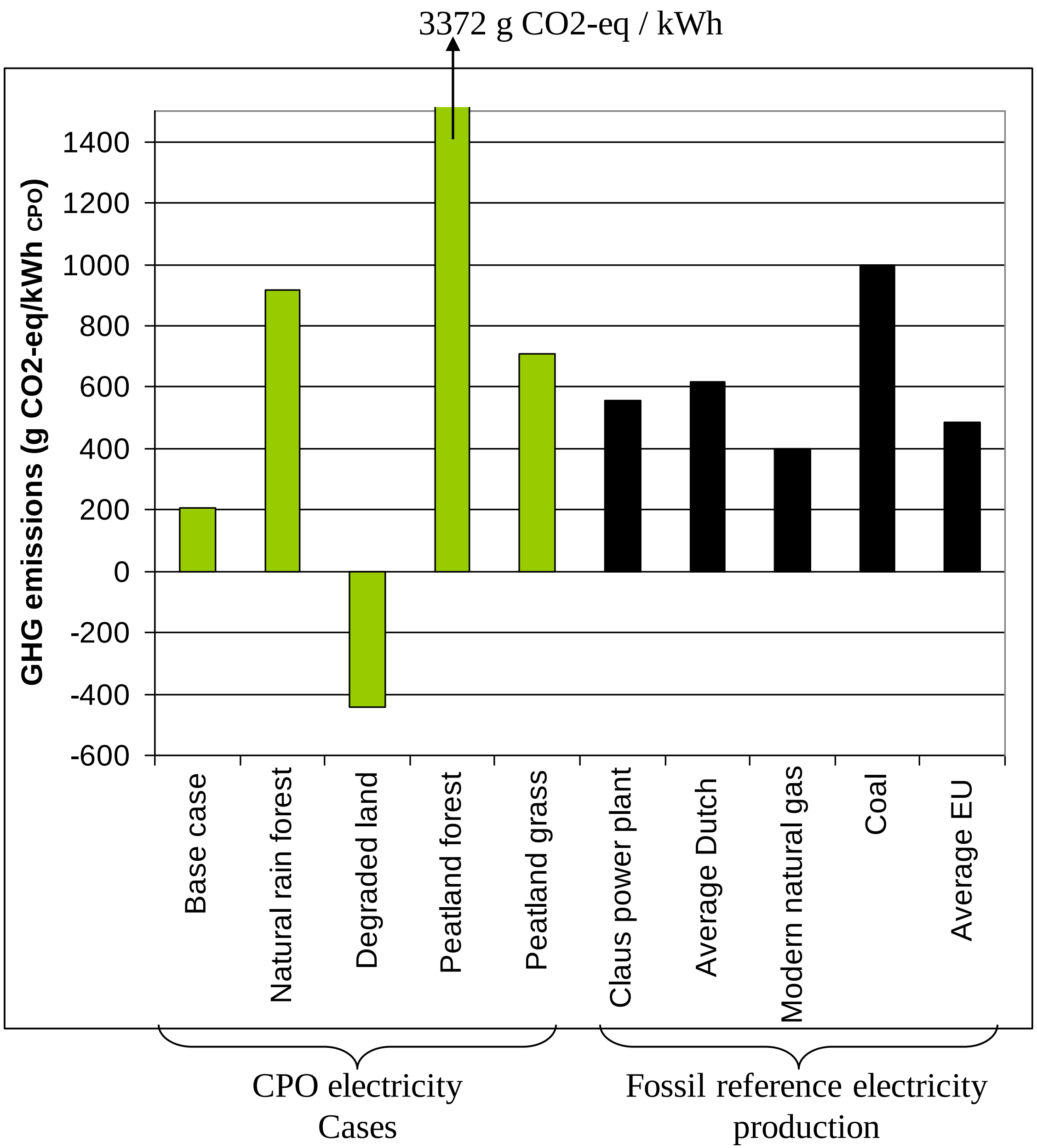
Sustainability – Past trends (improved)





[Wicke, et al., 2011 (land use policy)]

GHG Balances and land conversion issues



Forested peatland: extremely high emissions

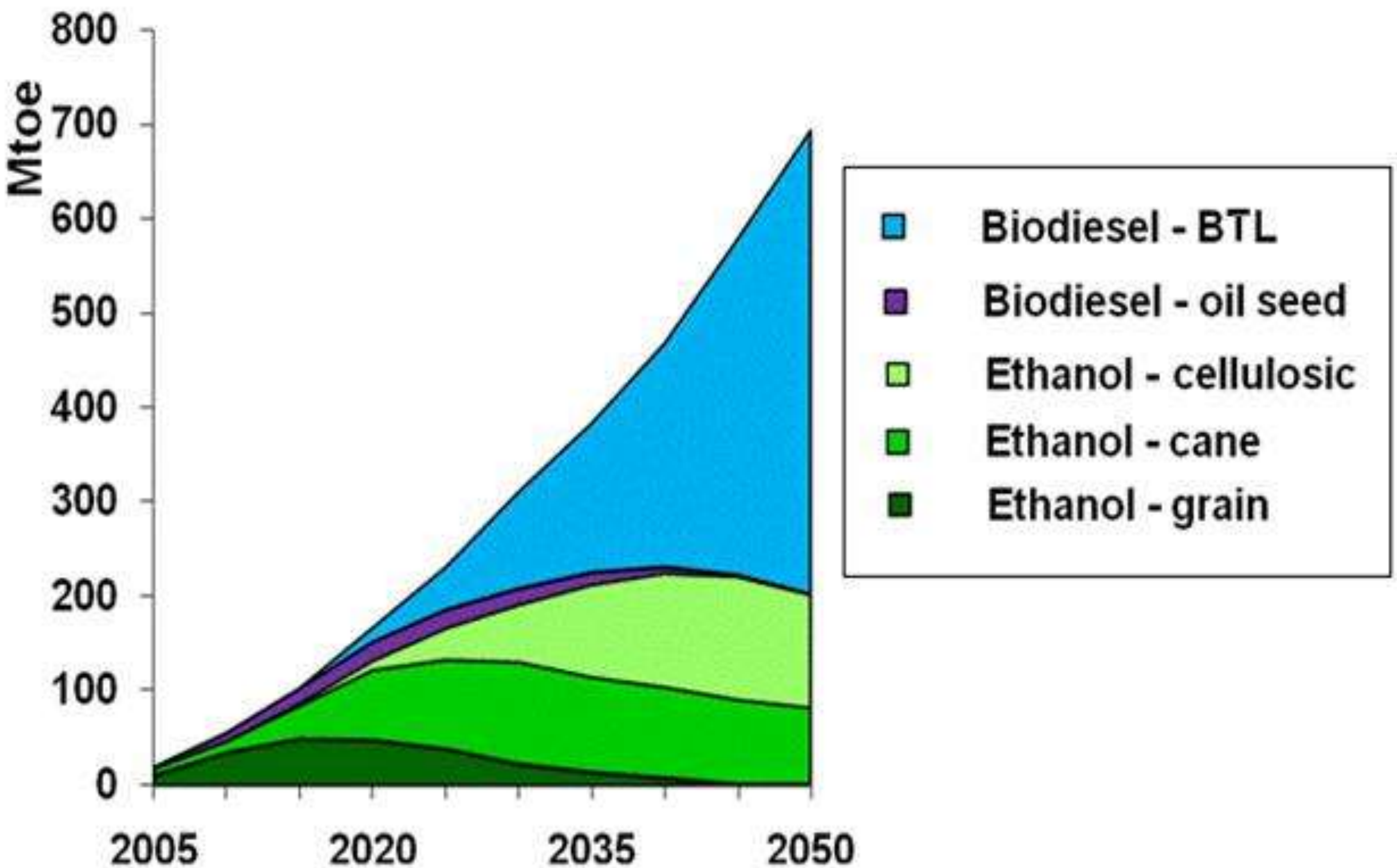
Natural rainforest: high emissions

Base case - Logged over forest: emissions about half of modern natural gas power

Degraded land: CO2 uptake

[Wicke, et al., Biomass & Bioenergy, 2008

The IEA on biofuels…



IEA-ETP, 2008

Biomass supply and demand in 2020

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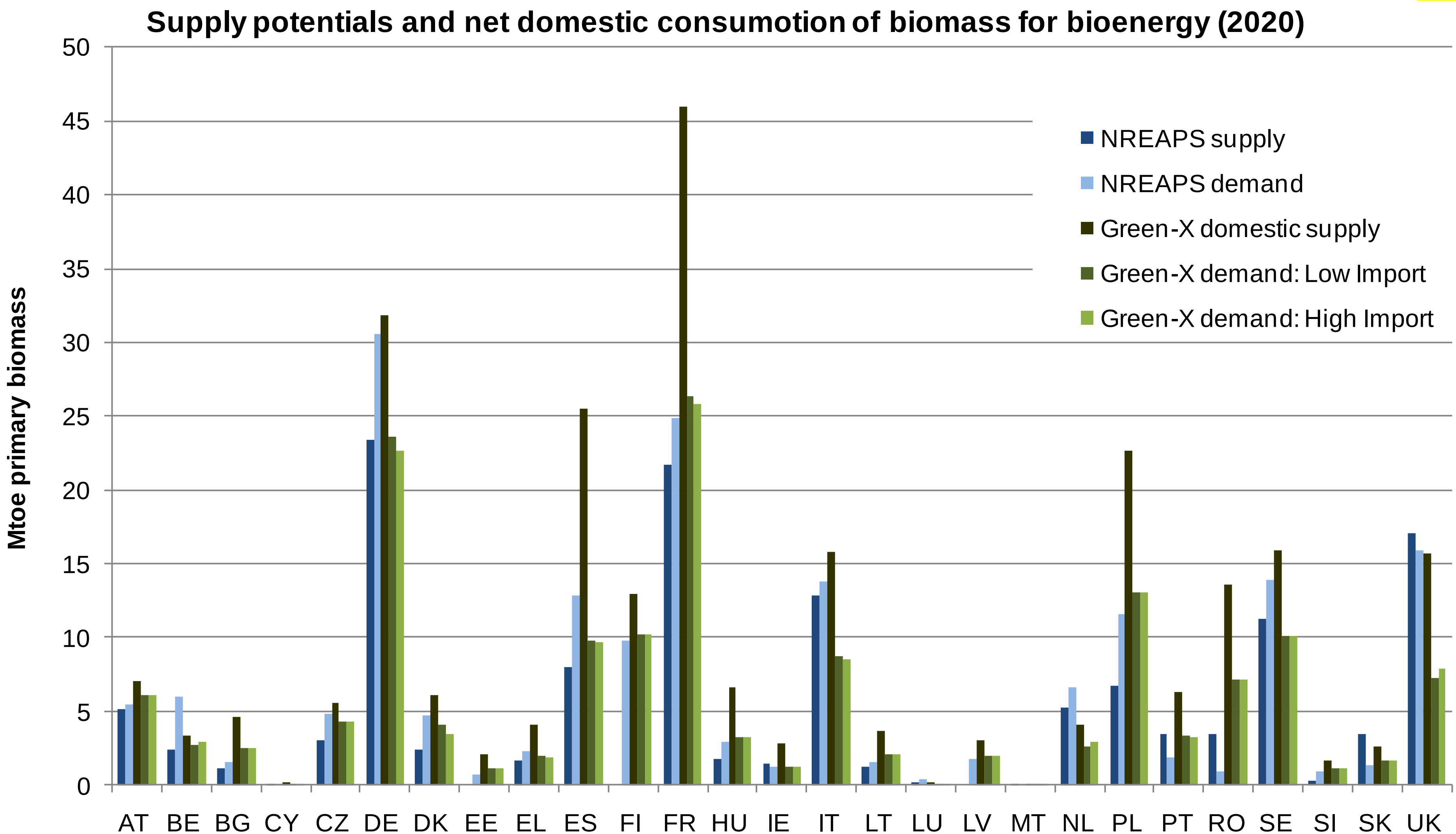

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[Hoefnagels et al, UU/Task 40, 2011]

Simulated Biomass trade flows 2020

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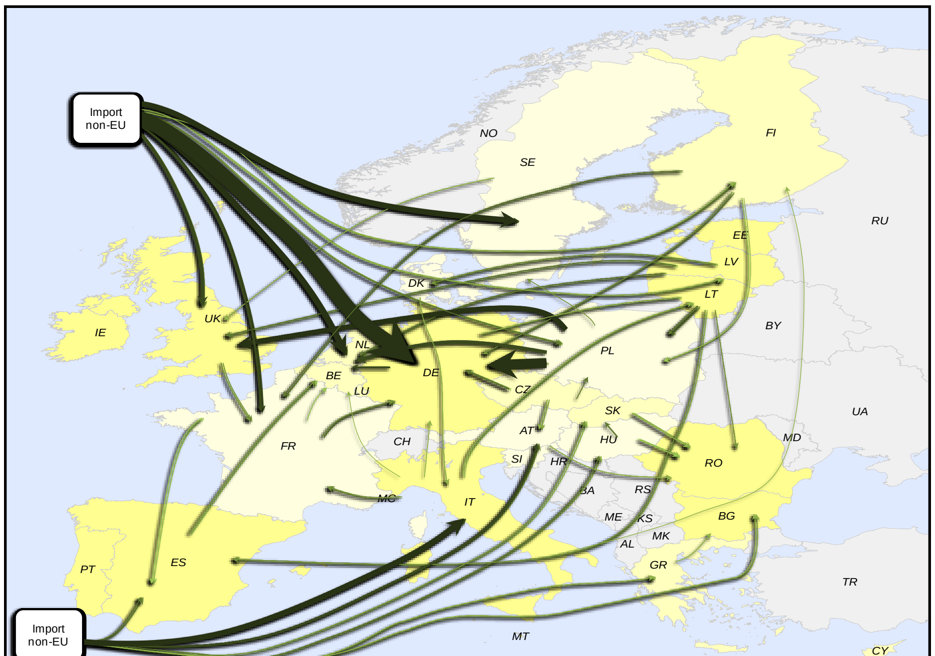
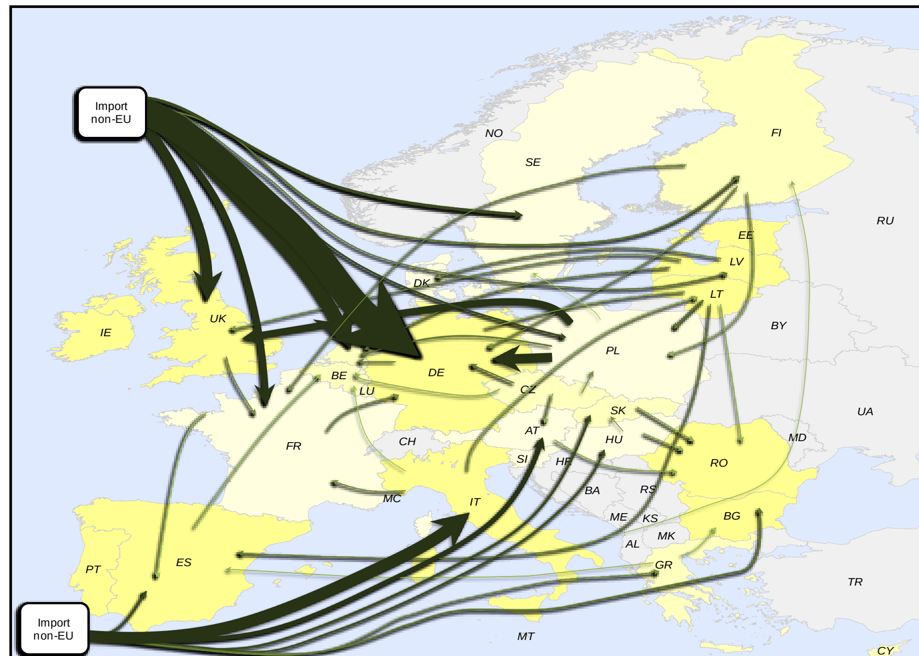
	2009 (pellets)	2015		2020	
		Low Import	High Import	Low Import	High Import
Total trade (Mtoe)	1.6	5.4	6.2	12.6	17.4
Total trade (Mt wood pellet eq.)*	3.8	12	14	29	40
Of which Intra-EU	55%	38%	32%	52%	32%
Of which Inter-EU	45%	62%	68%	48%	68%

) Mt eq. = million metric tonne pellet equivalent (18 MJ/kg)

Low Import scenario



High Import scenario



Year: 2020

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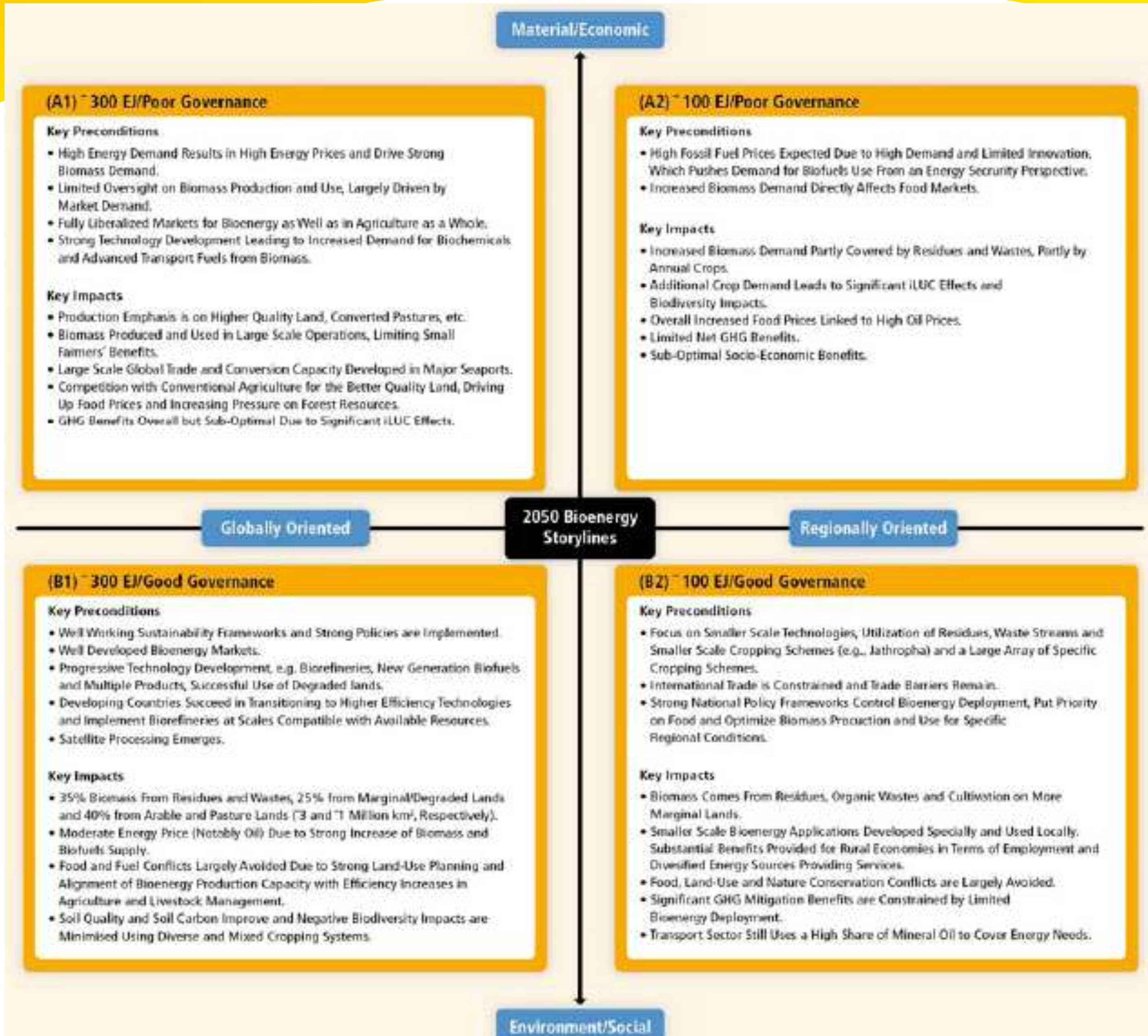
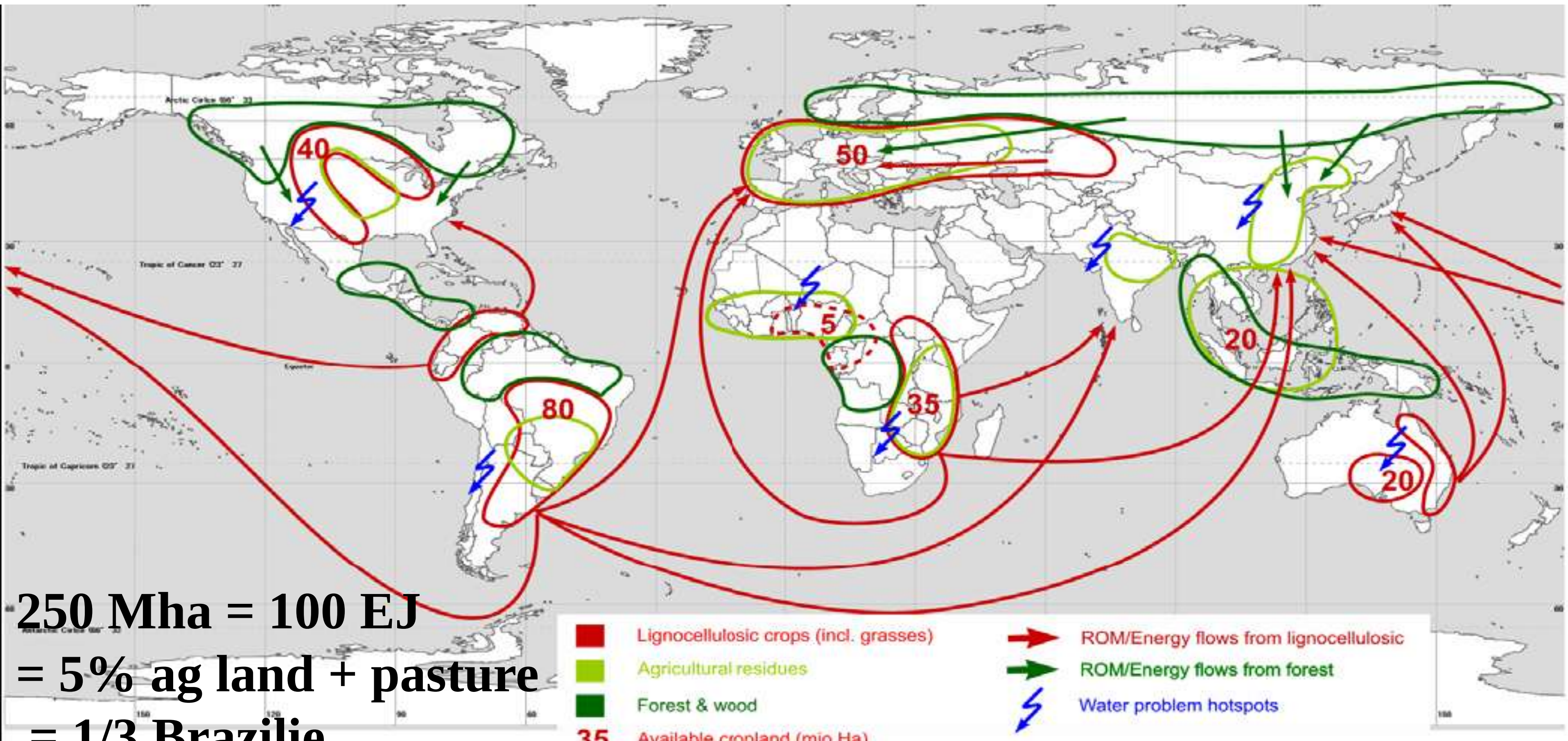
[Hoefnagels et al, UU/Task 40, 2011]

Opposing sketches for the scenario preconditions, technological challenges, and impacts for bioenergy deployment on long term following Typical IPCC SRES.



[IPCC-SRREN, 2011]

A future vision on global bioenergy markets (2050…)



250 Mha = 100 EJ
= 5% ag land + pasture
= 1/3 Brazilie

[GIRACT FFF Scenario project; Faaij, 2008]

Final remarks

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- Bioenergy trade has rapidly become more important in total biomass supplies (for pellets in particular).
- Plays major role in balancing out fluctuations in demand (policy!) & supply (variable at large).
- Markets still immature; ethanol closest to commodity trading.
- Rapid growth very likely to continue; in particular ('advanced'') pellets (torrefaction); cultivated wood is becoming more important.
- More markets for lignocellulosic biomass emerge: 2nd gen biofuels, biochemicals…
- Only a future when done sustainably…
- …while at the same time RE and GHG mitigation targets cannot be met without large scale bioenergy deployment

Thanks for your attention

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For more information, see:

www.bioenergytrade.org

- Detailed activities
- Background information
- Results
- Events
- Subscribe to the newsletter (2x per year).

And:

- Sciencedirect/Scopus
- http://srren.ipcc-wg3.de/report

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