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‘Key Challenges of the Future Biomass Sector”.

Final Conference of the Global Biopact Project: “Socio-economic Impacts of Biofuels and Bio-products,
28 December 2013, Brussels - Belgium

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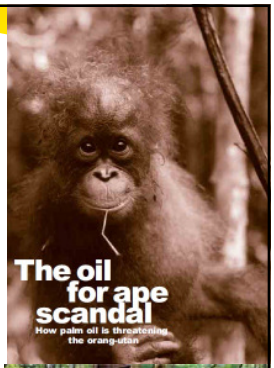
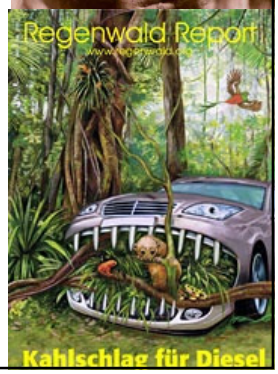
Biobased economy; friend or foe?

- Food vs. Fuel
- Biofuels a *crime against humanity*
- Threats for biodiversity, water, farmers…
- LUC & iLUC, Carbon Payback… result in poor GHG balances
- Large number of external damages.





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What to do?

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Despair or ….

Do something
IEA Task 40!

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Energy system transformation…

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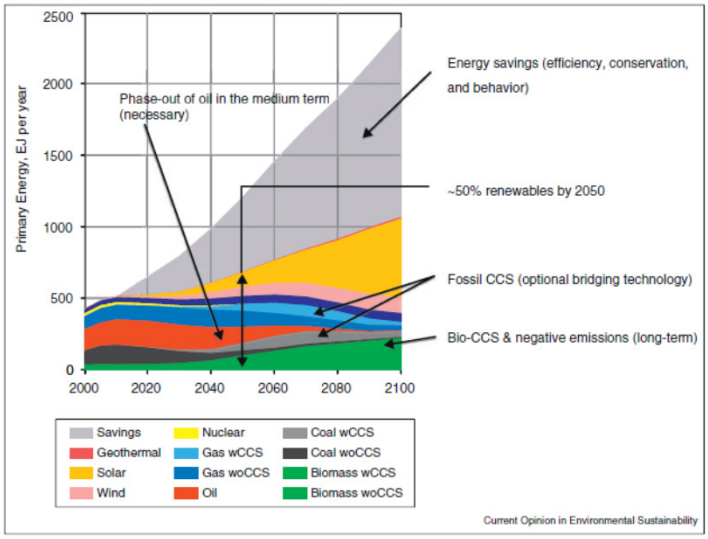

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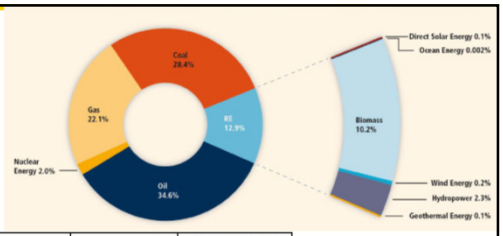
[GEA/van Vuuren et al CoSust, 2012]

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]

2050 Bioenergy Potentials & Deployment Levels

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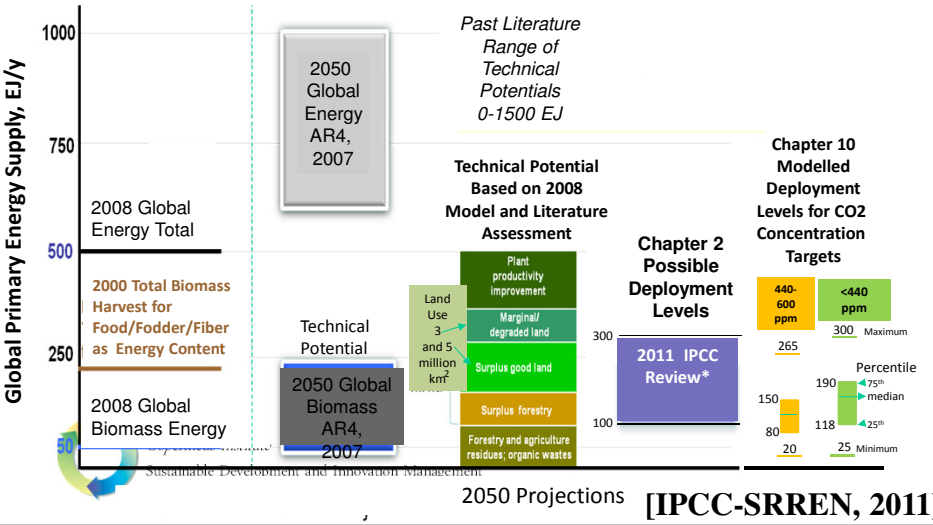

[IPCC-SRREN, 2011]

Chapter 10 Bioenergy Scenario Results

Total biomass

Biofuels

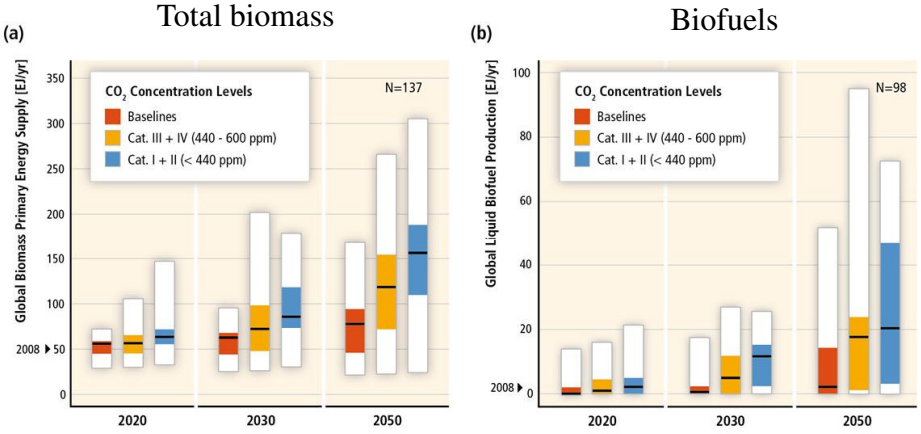

Figure 2.23 | (a) The global primary energy supply from biomass in long-term scenarios; (b) global biofuels production in long-term scenarios reported in secondary energy terms of the delivered product (median, 25th to 75th percentile range and full range of scenario results; colour coding is based on categories of atmospheric CO_2 concentration levels in 2100; the number of scenarios underlying the figure is indicated in the right upper corner) (adapted from Krey and Clarke, 2011). For comparison, the historic levels in 2008 are indicated by the small black arrows on the left axis.

[IPCC-SRREN, 2011]

Key factors biomass potentials

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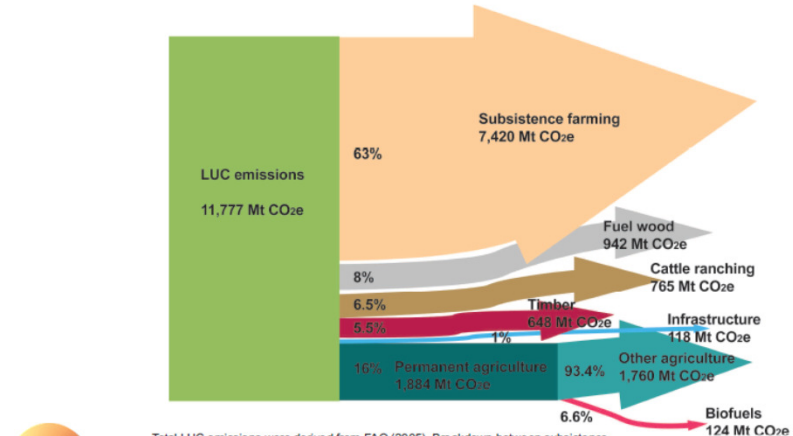
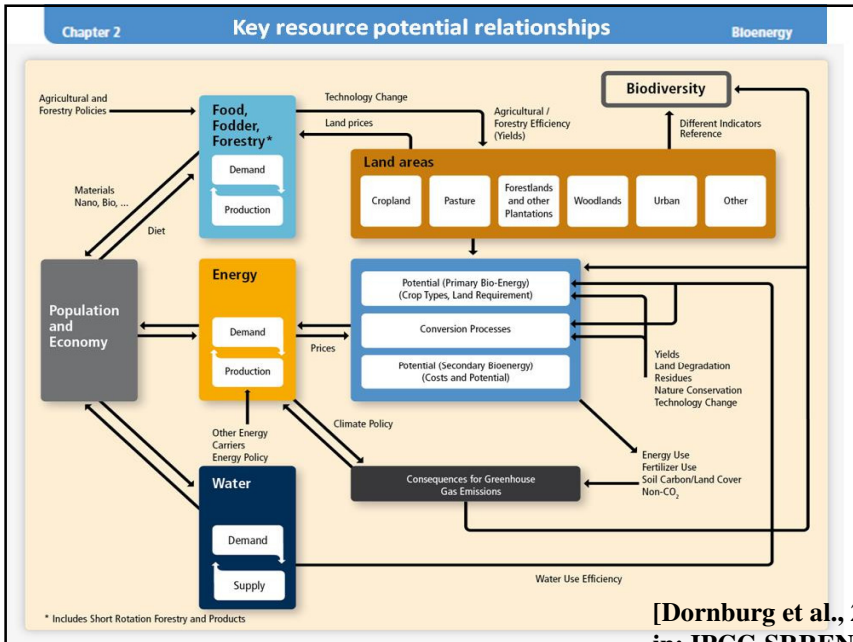
Issue/effect	Importance
Supply potential of biomass	
Improvement agricultural management	***
Choice of crops	***
Food demands and human diet	***
Use of degraded land	***
Competition for water	***
Use of agricultural/forestry by-products	**
Protected area expansion	**
Water use efficiency	**
Climate change	**
Alternative protein chains	**
Demand for biomaterials	*
Demand potential of biomass	
Bio-energy demand versus supply	**
Cost of biomass supply	**
Learning in energy conversion	**
Market mechanism food-feed-fuel	**

Dornburg et al., Energy & Environmental Science 2010

Contributors to land use change…



Total LUC emissions were derived from FAO (2005). Breakdown between subsistence farming, fuel wood, cattle ranching, timber and permanent agriculture were taken from FAO (1980). The contribution of biofuels was based on the proportion of commercial agricultural output allocated to biofuels over the period 2000 - 2005.



[Dornburg et al., 2010 in: IPCC-SRREN, 2011]

Figure 2.3 | Overview of key relationships relevant to assessment of biomass resource potentials (modified from Dornburg et al., 2010). Indirect land use and social issues are not displayed. Reproduced with permission from the Royal Society of Chemistry.

Wood pellet trade 2009; some 30% of wood pellets used traded internationally

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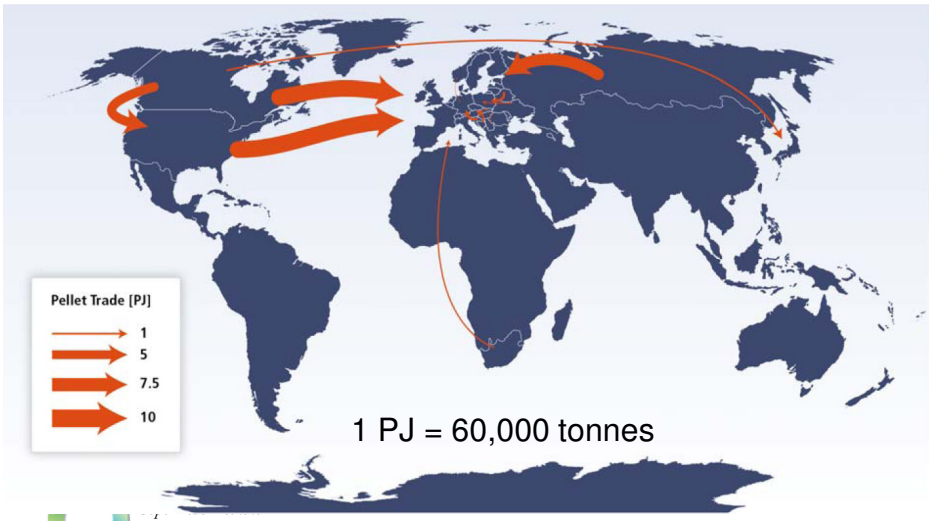

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(Source: Sikkema et al.,Bio FPR 2011 in IPCC, 2011)

Global biofuels production and main international trade 2009; some 30% of biodiesel & vegetal oil trade internationally

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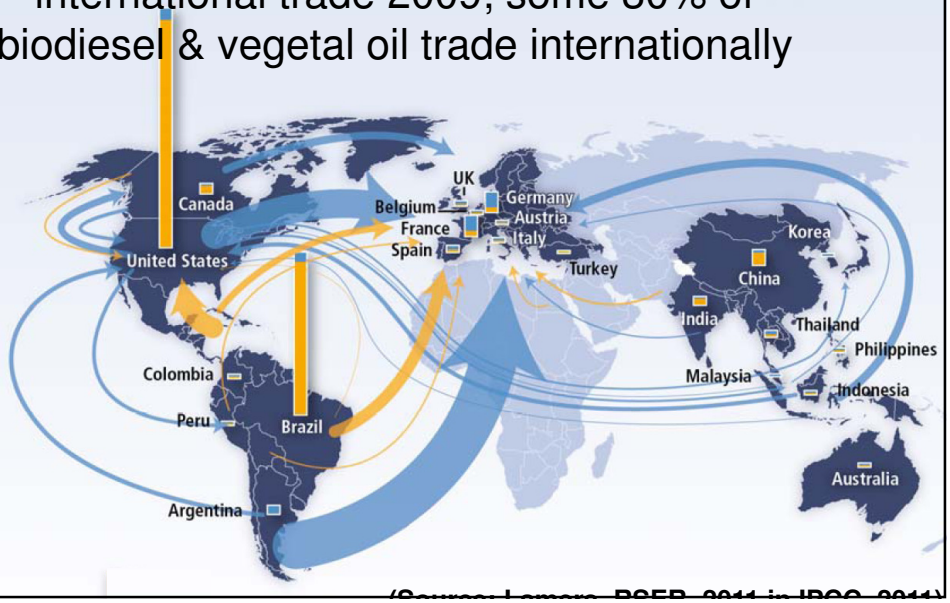

Simulated Biomass trade flows 2020

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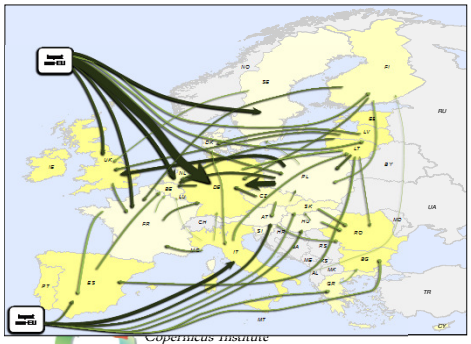
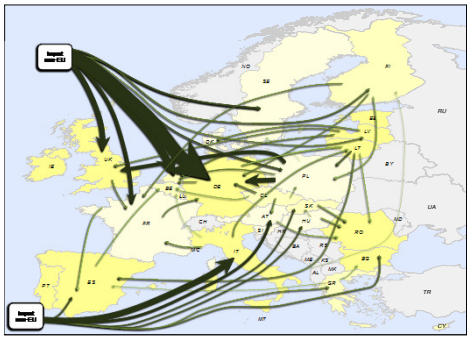
	2009 (pellets)	2015 Low Import	2015 High Import	2020 Low Import	2020 High Import
Total trade (Mtoe)	1.6	5.4	6.2	12.6	17.4
Total trade (Mt wood pellet eq.)*	3.8	12	14	29	40
Of which Intra-EU	55%	38%	32%	52%	32%
Of which Inter-EU	45%	62%	68%	48%	68%

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

Low Import scenario



High Import scenario



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Year: 2020

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

Advancing markets…pushed by technological progress and pulled by high oil prices

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- 2nd generation biofuels…
- Biorefining, biochemicals, biomaterials…
- Aviation and shipping…

- Likely to compete for the same resources…
- Should meet the same sustainability criteria…(but that is not the case today!)
- Competition or synergy?

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Biofuels; they are not going away.

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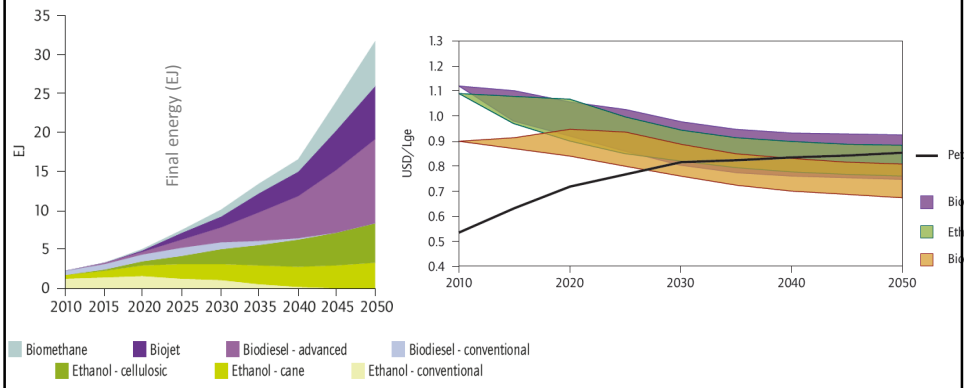

- Large-scale deployment of advanced biofuels vital to meet the roadmap targets
- **Advanced biofuels reach cost parity around 2030 in an optimistic case**

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[IEA Biofuels Roadmap]

A future vision on global bioenergy markets (2050…)

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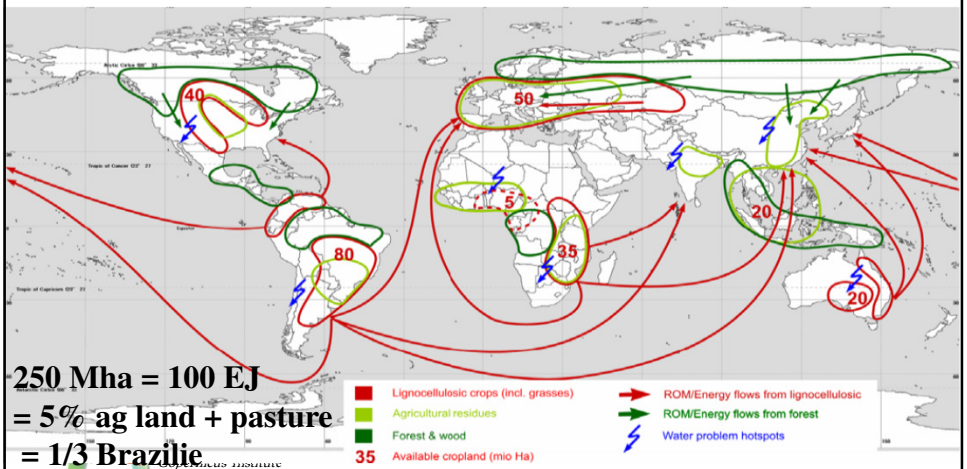

250 Mha = 100 EJ
= 5% ag land + pasture
= 1/3 Brazilie

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[GIRACT FFF Scenario project; Faaij, 2008]

Driving forces, dimensions, scales…

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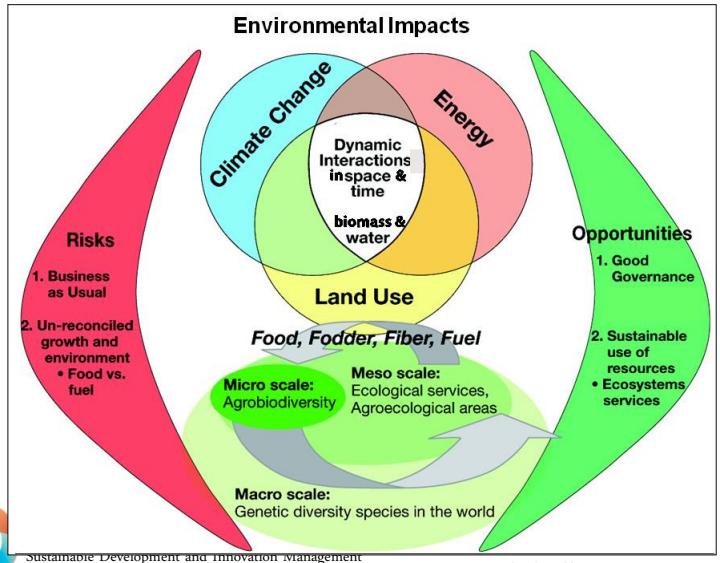

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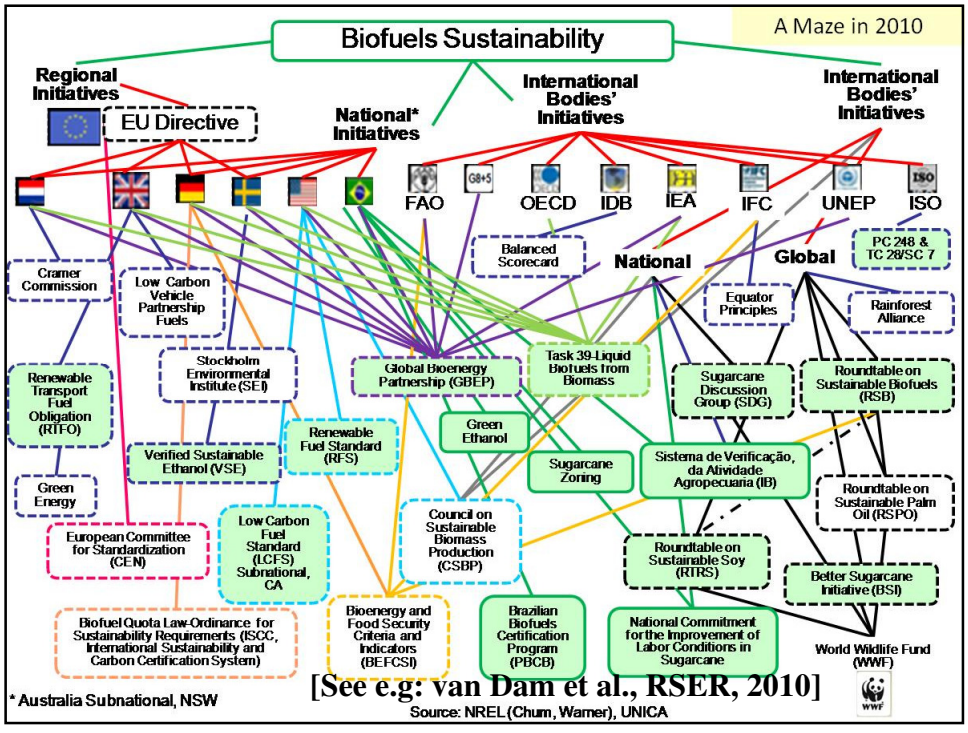
[IPCC-SRREN, 2011]



[See e.g: van Dam et al., RSER, 2010]

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

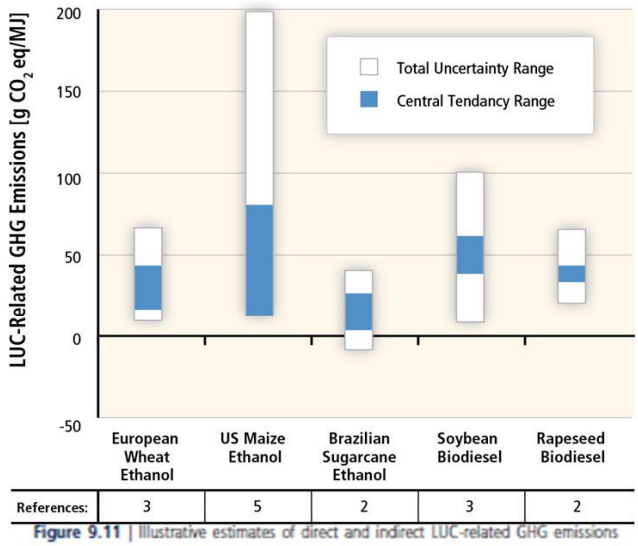


Figure 9.11 | Illustrative estimates of direct and indirect LUC-related GHG emissions induced by several first-generation biofuel pathways, reported here as ranges in central tendency and total reported uncertainty. Estimates reported here combine several different uncertainty calculation methods and 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

Confrontation bottom-up vs. top down iLUC modelling

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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, verification of 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.

[IEA Bioenergy 38/40/43, 2011]

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Example: Corn ethanol
Results from PE & CGE models

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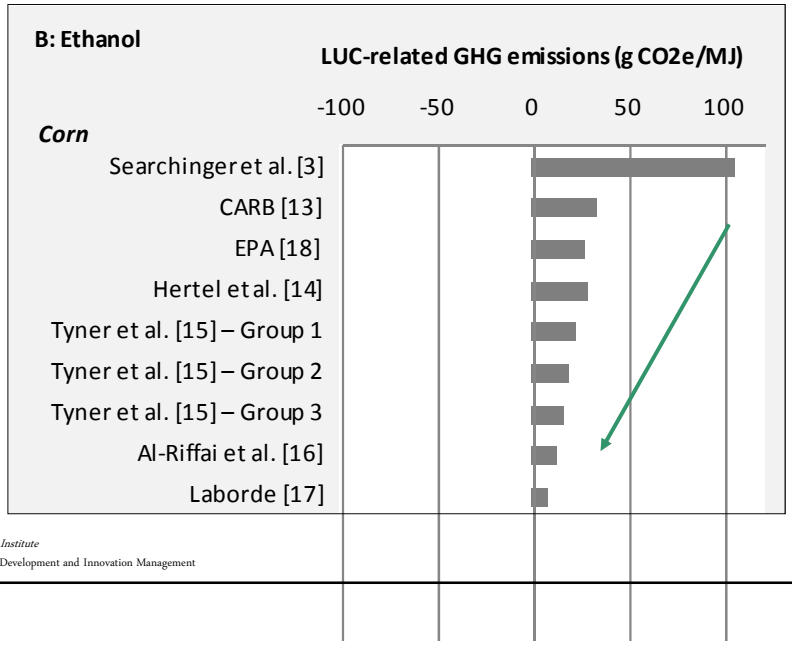

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Final remarks

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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; many barriers to be addressed and efficiency gained.
- Rapid growth very likely to continue; cultivated wood is becoming more important, so is advanced pre-treatment.
- More markets for lignocellulosic biomass emerge: 2nd gen biofuels, biochemicals, bio-CCS…
- Only a future when done sustainably…
- …while at the same time RE and GHG mitigation targets cannot be met without large scale bioenergy deployment

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Priorities IEA T40 2013-2050

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- Mobilisation of sustainable biomass resources across the globle
- New market demand for biomass from the broader biobased economy perspective.
- Sustainability and certification
- Business models for biomass supply and value chains
- Advanced analysis tools to understand potential future market developments, implications and impacts of policies.
- Outreach and dissemination **www.bioenergytrade.org**

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Scientific challenges

- Land & natural resources (local – global)
  - Integral land use strategies (agriculture, BBE, nature, rural development)
  - Full impact analyses and optimization
  - Governance…
- Drive down the learning curves
  - Technologies (fuels, biomaterials, power, carbon management (CCS)
  - Cropping systems
  - Logistics, markets, CoC
  - Business models & investment.

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Thanks for your attention

For more information, see:

- www.bioenergytrade.org
- **Sciencedirect/Scopus**
- **http://srren.ipcc-wg3.de/report**

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