Atmospheric benefits of using wood products: How should we deal with time?

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Green Life of wood

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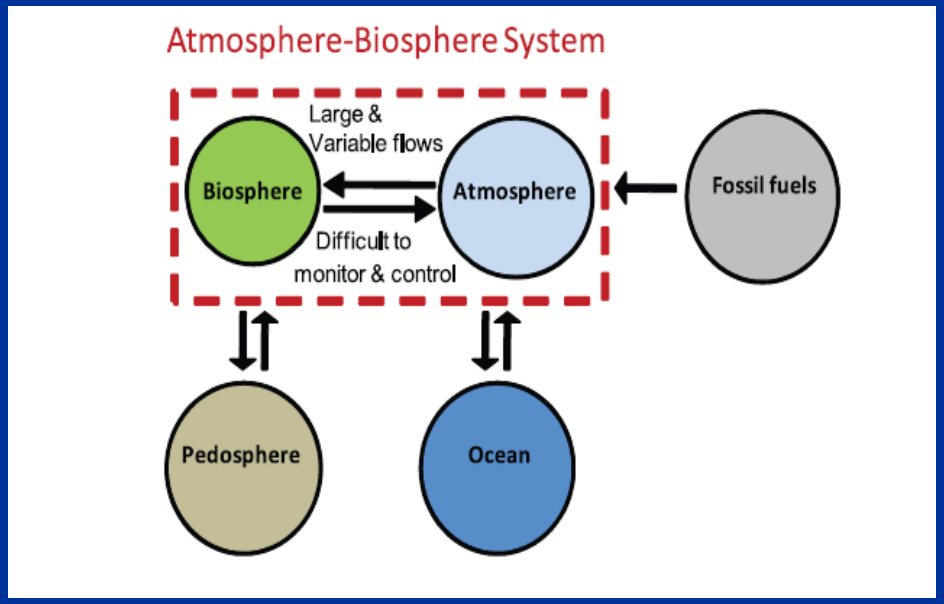
OUTLINE

- C neutrality and the carbon debt of wood energy
- Science-policy dialogue: some elements for moving forward

C neutrality and the carbon debt



Biomass is part of the atmosphere-biosphere system. But bioenergy is not automatically considered carbon neutral (IPCC 2012 FAQ):

1-Some emissions in production, processing, transport.
…usually very low figures for forest products e.g.:
4.5% of energy delivered (Pimentel and Pimentel 2008)
1.35% to 2.8% (Gautam et al. 2010)
6.75% (McKechnie et al. 2011)

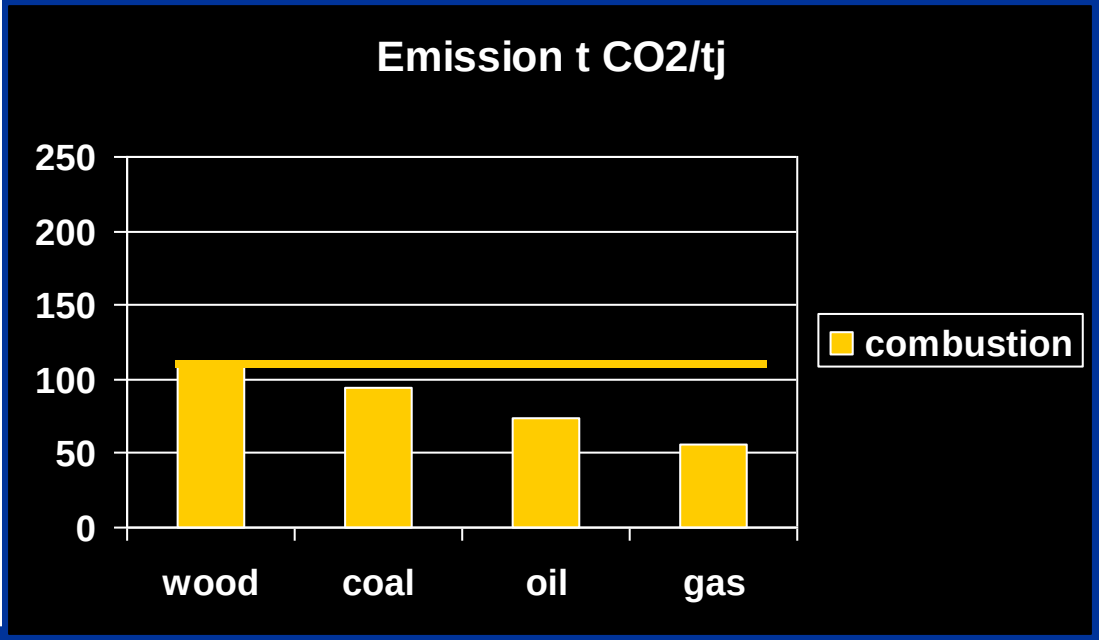
2-LUC and ILUC

3-temporal emissions>removal in harvesting and regrowth

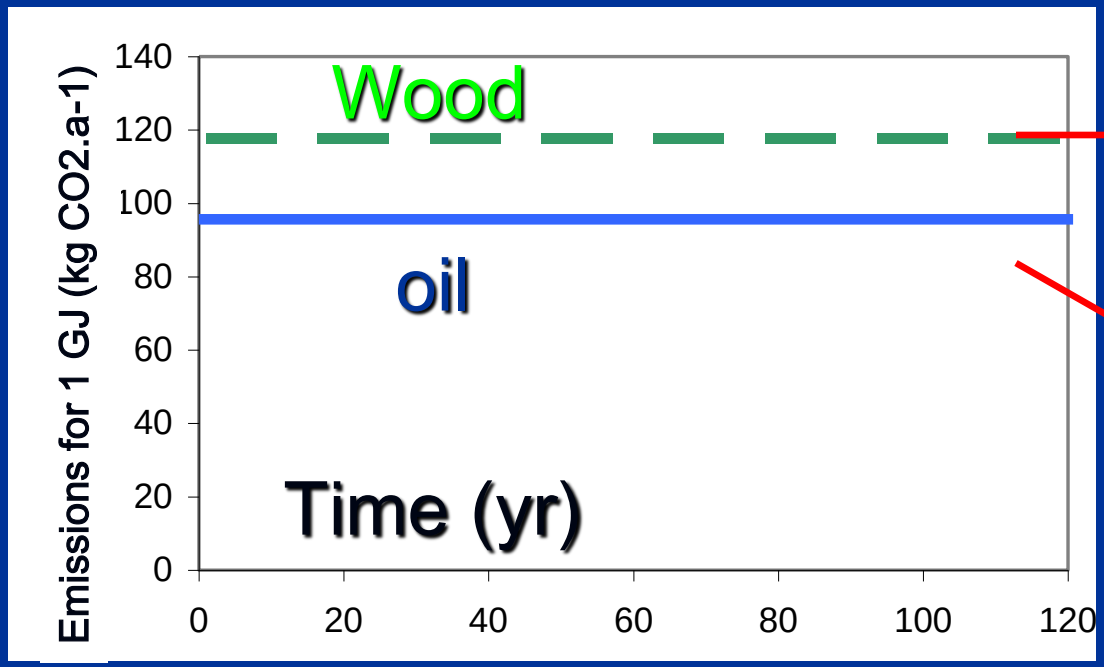
C neutrality and carbon debt

Emissions per energy delivered

Default emission factors IPCC (tCO2/tj)	
Coal	94.6
Oil	74.1
Gas	56.1
Wood	112



Emission per energy delivered

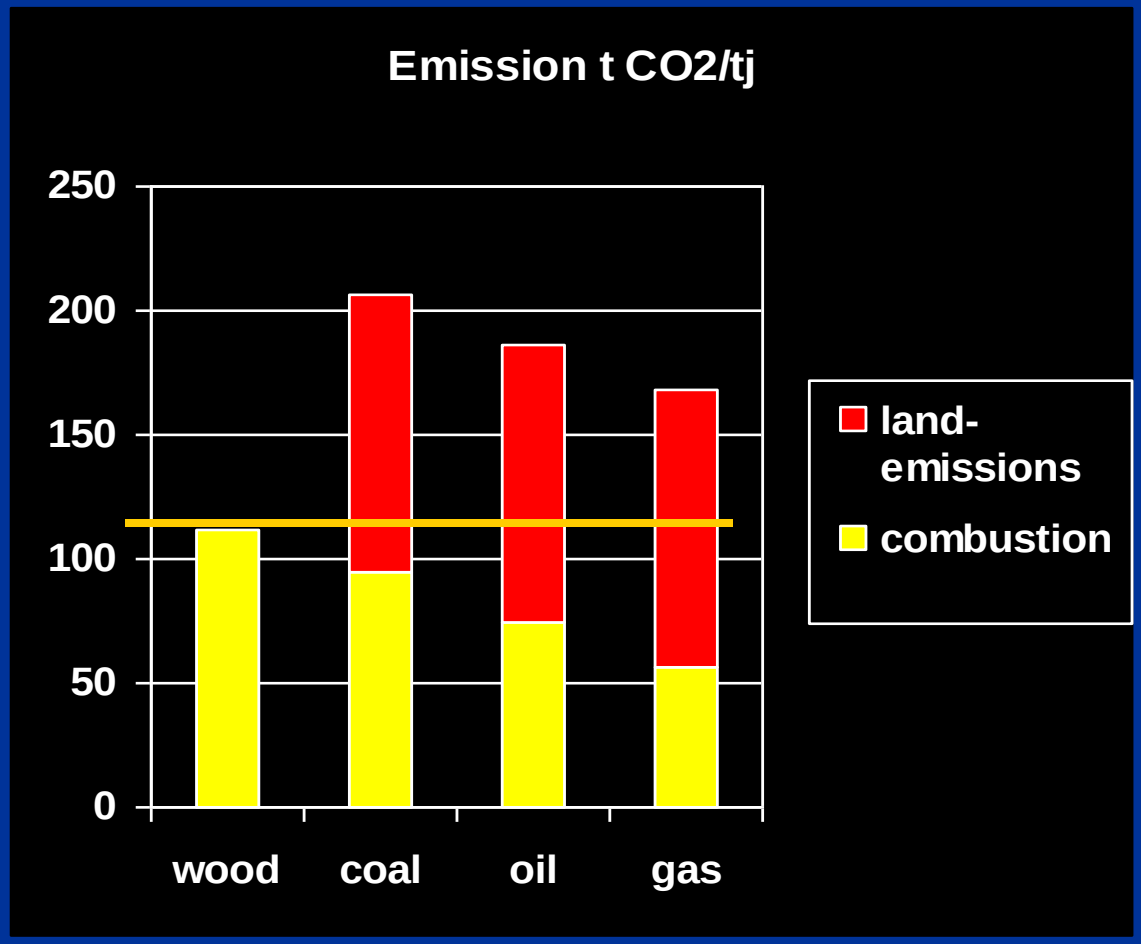


… in the reference scenario, unused C will eventually be emitted by the decomposition process (biogenic emissions). Bioenergy always win and the benefits from the substitution of f.f. to bioenergy are permanent and cumulative.

Q: how long before bioenergy contributes to reducing net GHG emission?

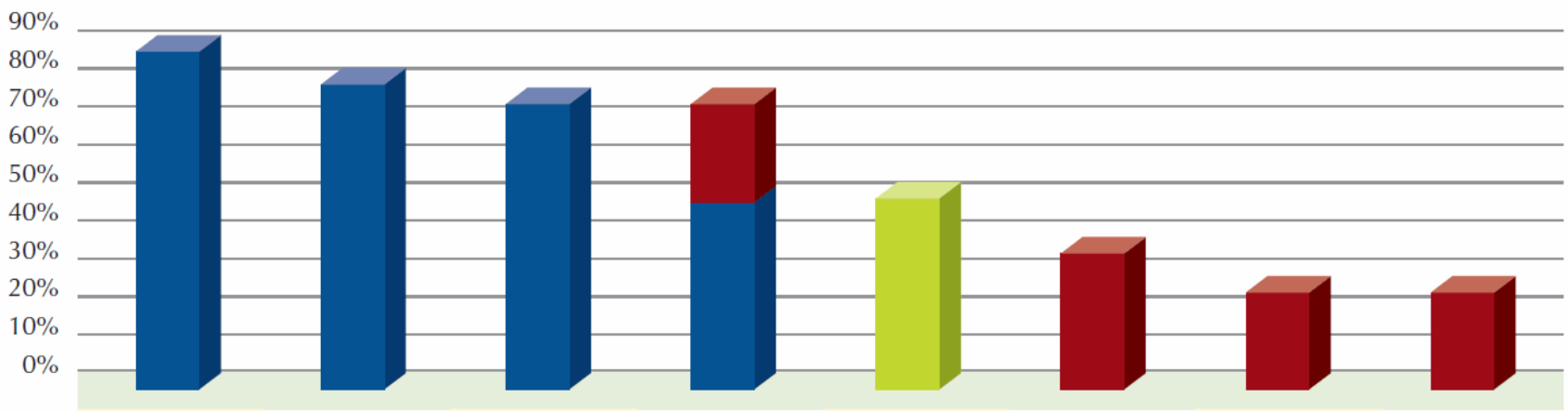
3-factors

- Feedstock and ecosystem C dynamics
- E-efficiency
- Fossil Fuel substituted



An important factor for time to C debt repayment: Relative biomass conversion efficiency of bioenergy technologies

Figure 7. Relative biomass conversion efficiency of bioenergy technologies.



	AWC (Europe)	Building Heat (U.S.)	Industrial Process Heat	5 MW CHP	Cellulosic Ethanol	Co-Firing @ 20% of Fuel Mix	50 MW Biopower Plant	20 MW Biopower Plant
Biofuel					50%			
Electricity				25%		35%	25%	25%
Thermal	89%	80%	75%	50%				

Source: Biomass Energy Resource Center; Richter et al. 2009.

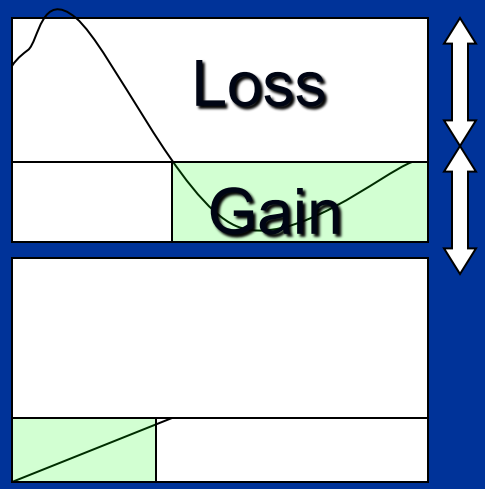
Another important factor: ecosystem carbon cycling in the baseline scenario (role of feedstock type)

Baseline

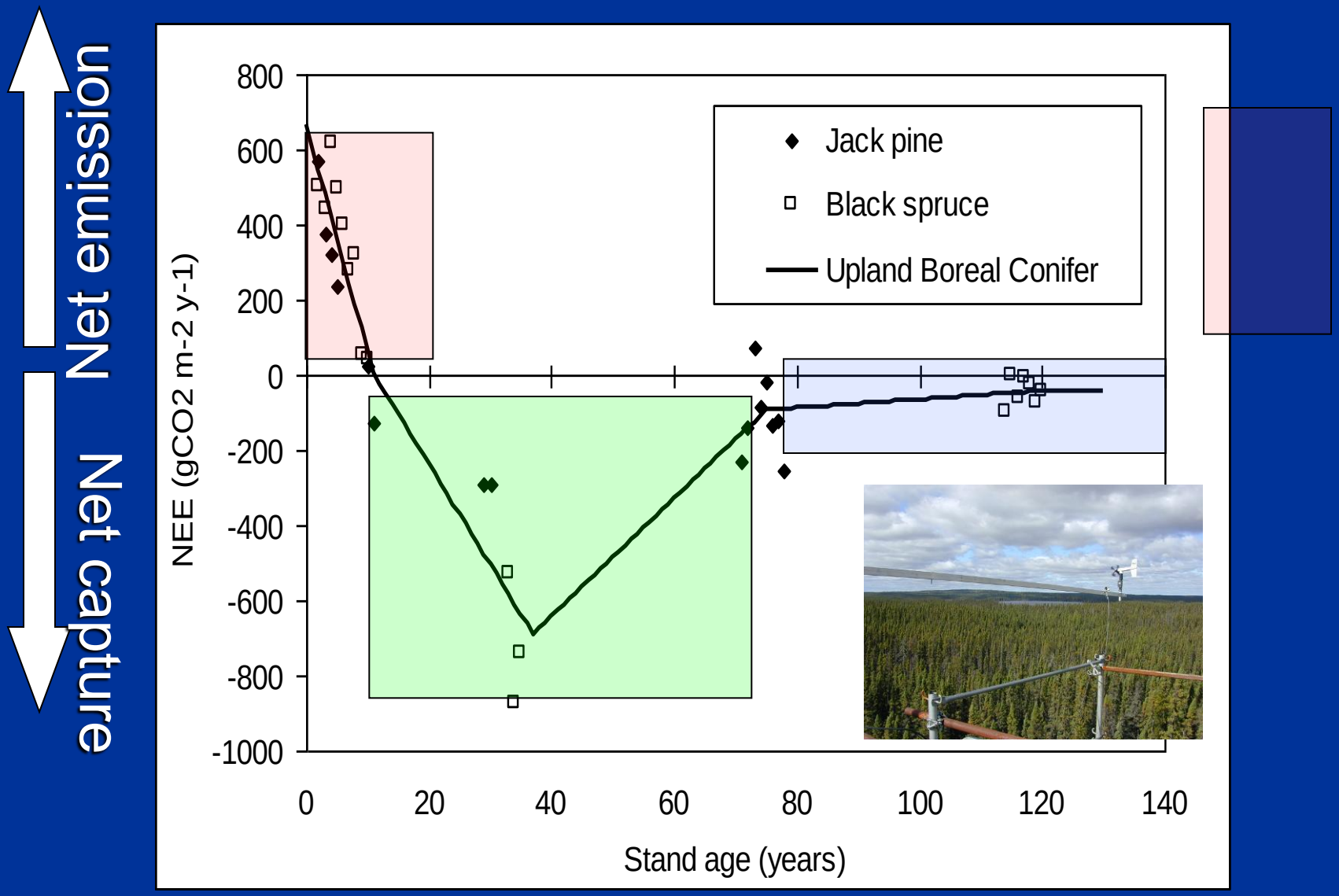
Bioenergy

Whole tree

Harvest residues



Following forest harvesting: first a loss of C then a gain



(Empirical data encompassing all fluxes) Bernier & Paré (Global Change Biology-Bioenergy 2012)

Time to C debt repayment of different forest bioenergy options

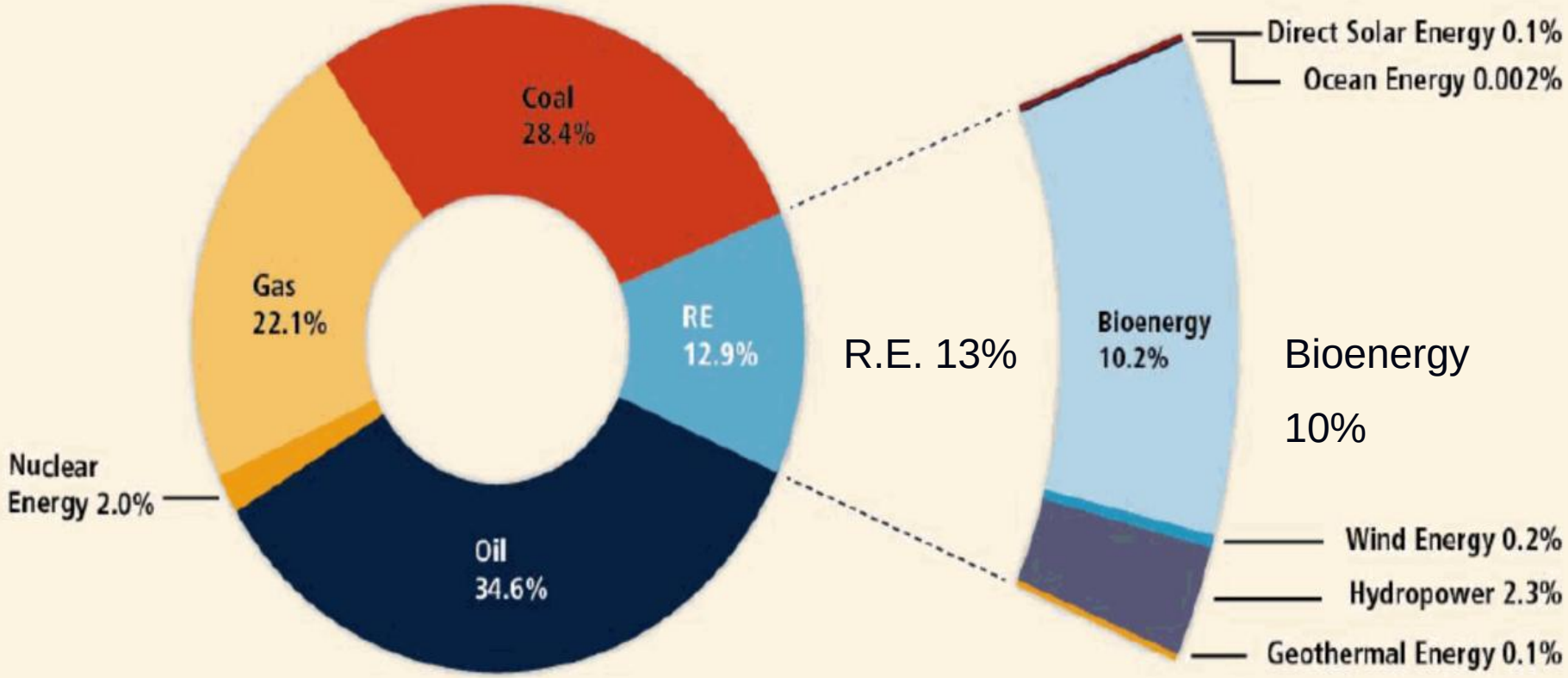
Reference	TDR (yr)	Feedstock	Use	Subs.
McKechnie et al. 2011	16	Harvest residues	Eletricity	Coal
McKechnie et al. 2011	38	Green tree	Eletricity	Coal
Manomet 2010	5	Harvest residues	CHP	Oil
Manomet 2010	90	Green tree	Eletricity	Oil
Bernier & Paré 2012	7	Harvest residues	Heat	Oil
Bernier & Paré 2012	80+	Green tree	Heat	Oil
Repo et al. 2010	4	Harvest residues	Heat	Gaz
	22	Stump	Heat	Gaz
S-E USA 2012	35-50	Mixed	Electricity	Coal

Tension between two schools of thought in evaluating how we should deal with the temporal aspects of bioenergy:

GROUP 1: The next 20-30 years are critical	GROUP 2: Focussing on long-term cumulative atmospheric carbon levels
Permanent losses: Biodiversity losses, shoreline erosion,…	**Once positive, GHG mitigation of bioenergy are cumulative and permanent**
Stabilizing atmospheric CO_2 below 450 ppm prevents major perturbation in the atmospheric system	**The sooner we start, the sooner the benefits**
Respecting short term Policy objectives: (2°C) by 2050 with objectives for 2012, 2020, 2050	**We need bioenergy both to mitigate climate change and for fulfilling E demand (availability, costs, deployment of other RE difficult and more costly within 20-30 years)**

Bioenergy is the most abundant renewable energy source (by far)

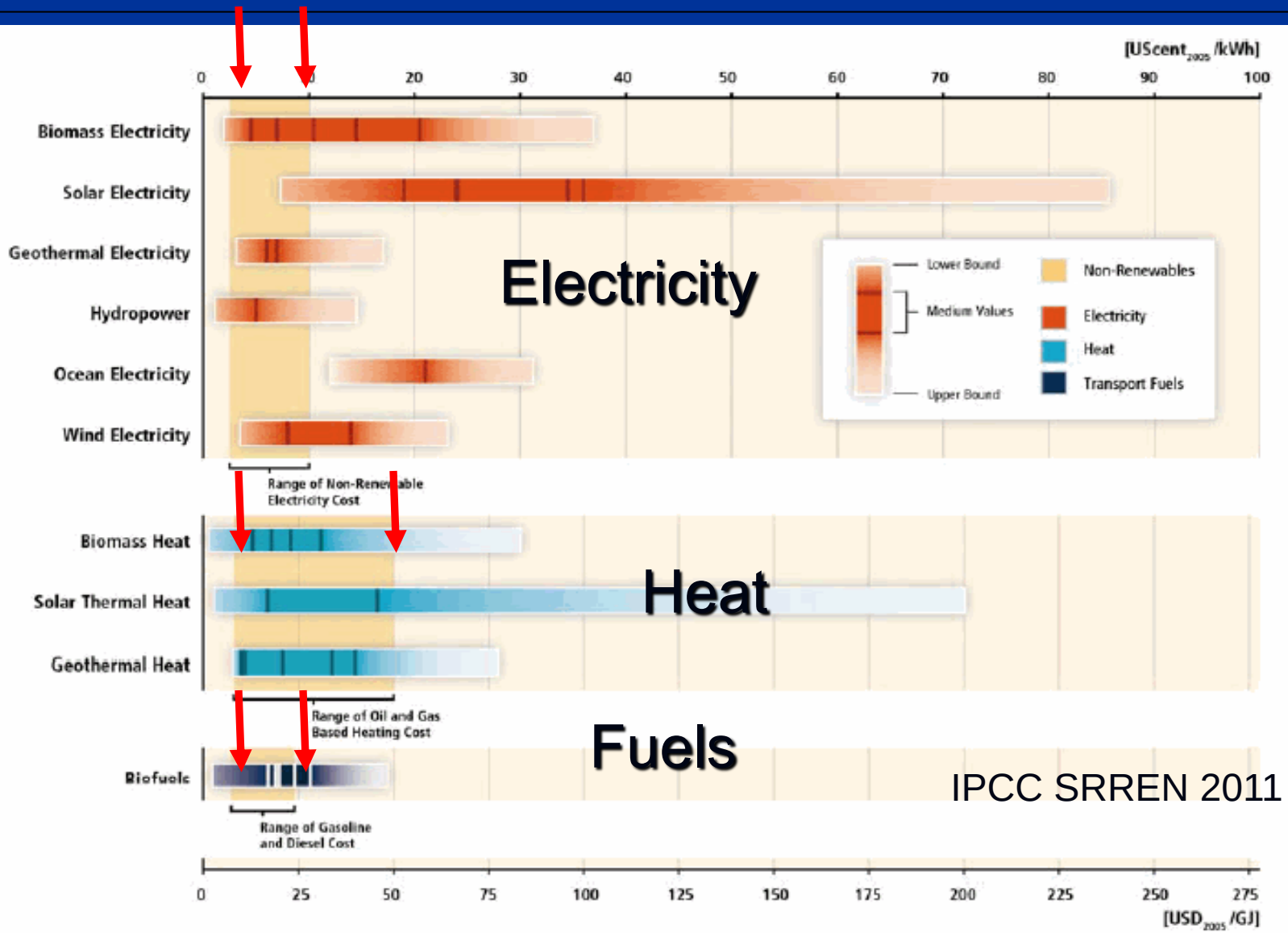
The global energy use is dominated by fossil fuel energy



... But bioenergy represents the lion's share of R.E.

Source: IPCC 2011 SRREN report on renewable energies

Several bioenergy pathways are already competitive from an economical standpoint



IPCC SRREN 2011

What forms consensus:

- The deployment of bioenergy has a different impact on atmospheric GHG given the time period considered;
- Times counts: emissions today has more value (detrimental) than emissions in the future;
- LCA methodologies can be used to estimate impacts of bioenergy on emissions as well as payback time;
- Promoting the use of bioenergy showing high energy efficiency;
- Promoting the substitution of fossil energy with low E efficiency;
- Promoting feedstocks generating short payback time:

-additional biomass, mill residues, harvest residues, recycled wood, wood from natural disturbances,…

- Predicting outcomes far in the future becomes uncertain due to baseline and scale considerations.

Policy choices	Needs and consequences
No acknowledgement of time : **Up to recently the majority of LCA case studies:** -ignored the CO_2 flux within a bioenergy system, assuming that CO_2 absorbed equals CO_2 emitted (Cherubini 2011GCB Bioenergy 3:413-426); GWP=0	Atmospheric benefits questioned Risks of not being able to demonstrate expected atmospheric benefits
Acknowledgement of time: **1- thresholds** (e.g. Liquid biofuel certification processes- 10-20 years; *Reviewed in Van Dam et al. 2010*); EU 2020	Need for LCA Standardisation of baseline and boundary A go no go threshold approach may cause loss of opportunities that are both important for the planet and for E security in the future
2- discounting (yet to develop)	Need for LCA Standardisation of baseline and boundary Need for agreement on discount rate

Final thoughts

"The only reason for time is so that everything doesn't happen at once." **Albert Einstein**

We need to deal with the time question. There are no easy solutions but forest bioenergy should remain an important source of renewable energy beyond 2020.

A winning solution on all fronts:

More wood from sustainable forestry in construction=more wood for cascading use into bioenergy and more feedstock from sources with short term atmospheric benefits such as mill and harvest residues.