Bio-energy : pending issues

- resources

- sustainability

- GHG savings

J. Van de Velde
EP 10/11/11

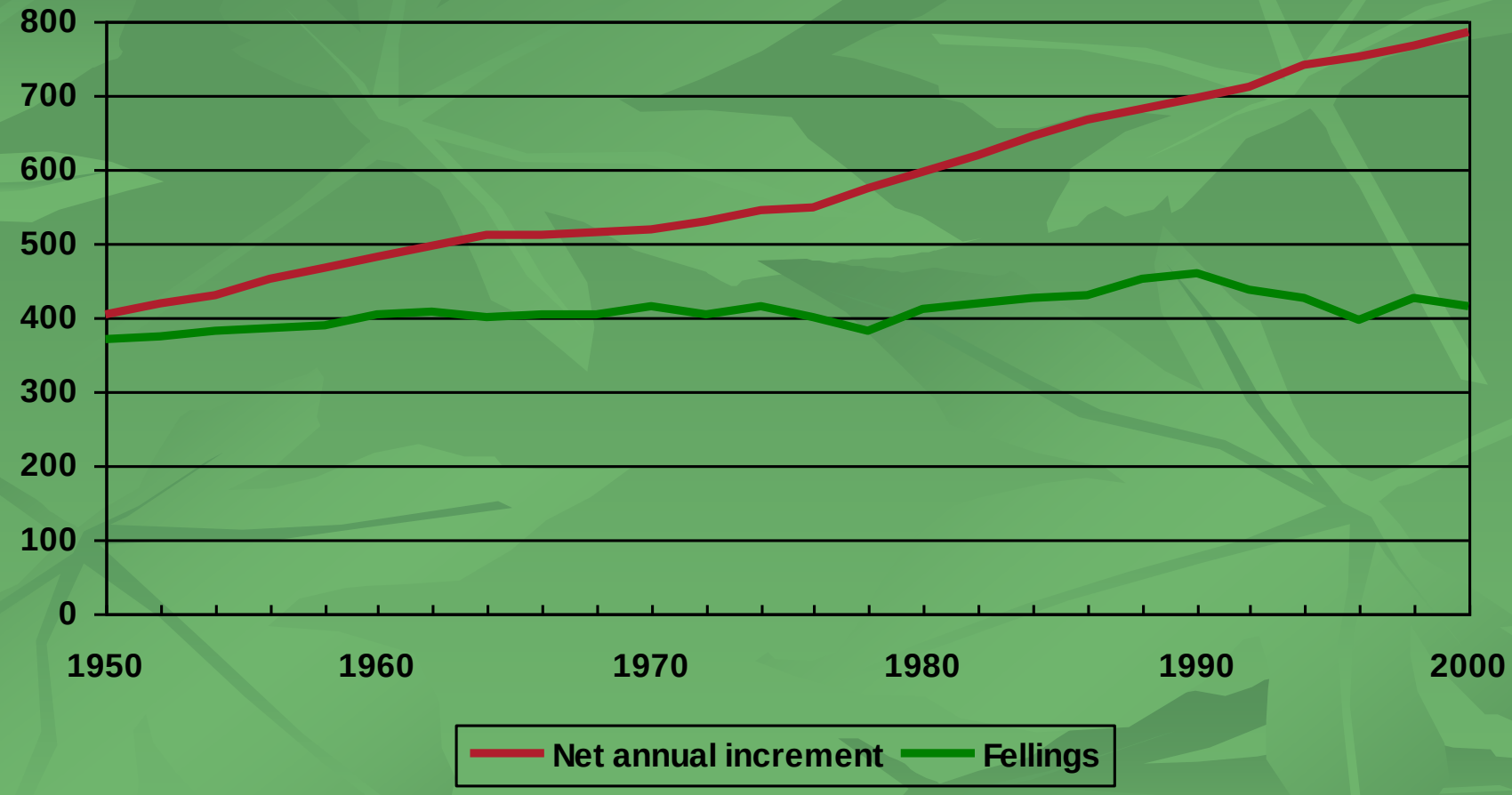
Biomass & RE objectives

- 20 % RES by 2020 , incl. 10 % of transport E
- BIOMASS :
  - Wood/ fiber/residue for heat and power
  - Much better ghg reduction potential , esp. In CHP
  - 60 % of actual RES ; of which 80-90 % wood + “residue”

- Making the 20 % in 2020 = biomass x 2-3
  (RE Roadmap 2008)

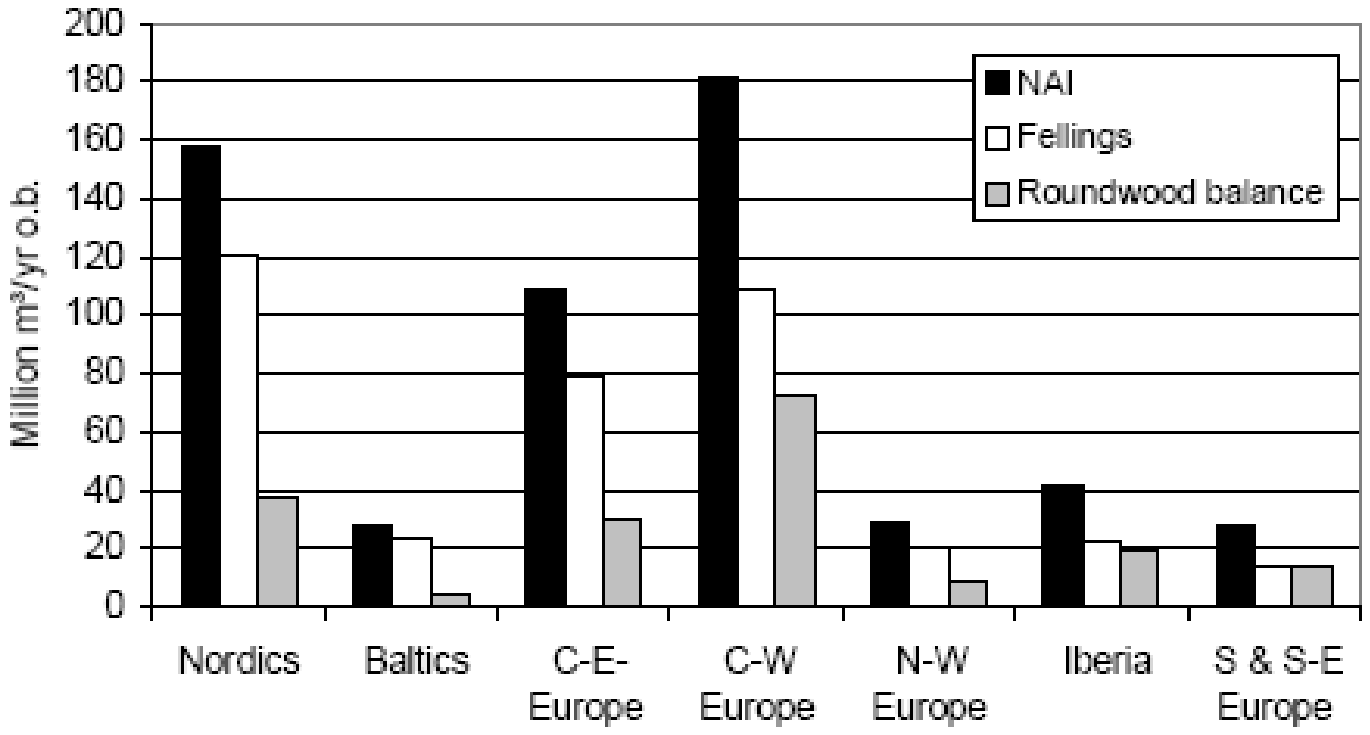
- Many sources of cellulosic biomass are being mentioned :
  - Existing forests (logging residue, compl. Fellings, whole tree harvesting, roots, stumps…)
  - Afforestation programmes (long term)
  - Short rotation coppice (willows/ poplars / alder)
  - Fiber crops (Miscanthus, Giant reeds , etc)
  - Peat (big resource but big emissions potential)
  - Agricultural residue (soil ?) and MSW (availability?)

Stora Enso 2000 : optimism



Source : Stora Enso presentation

METLA 2004 : more optimism



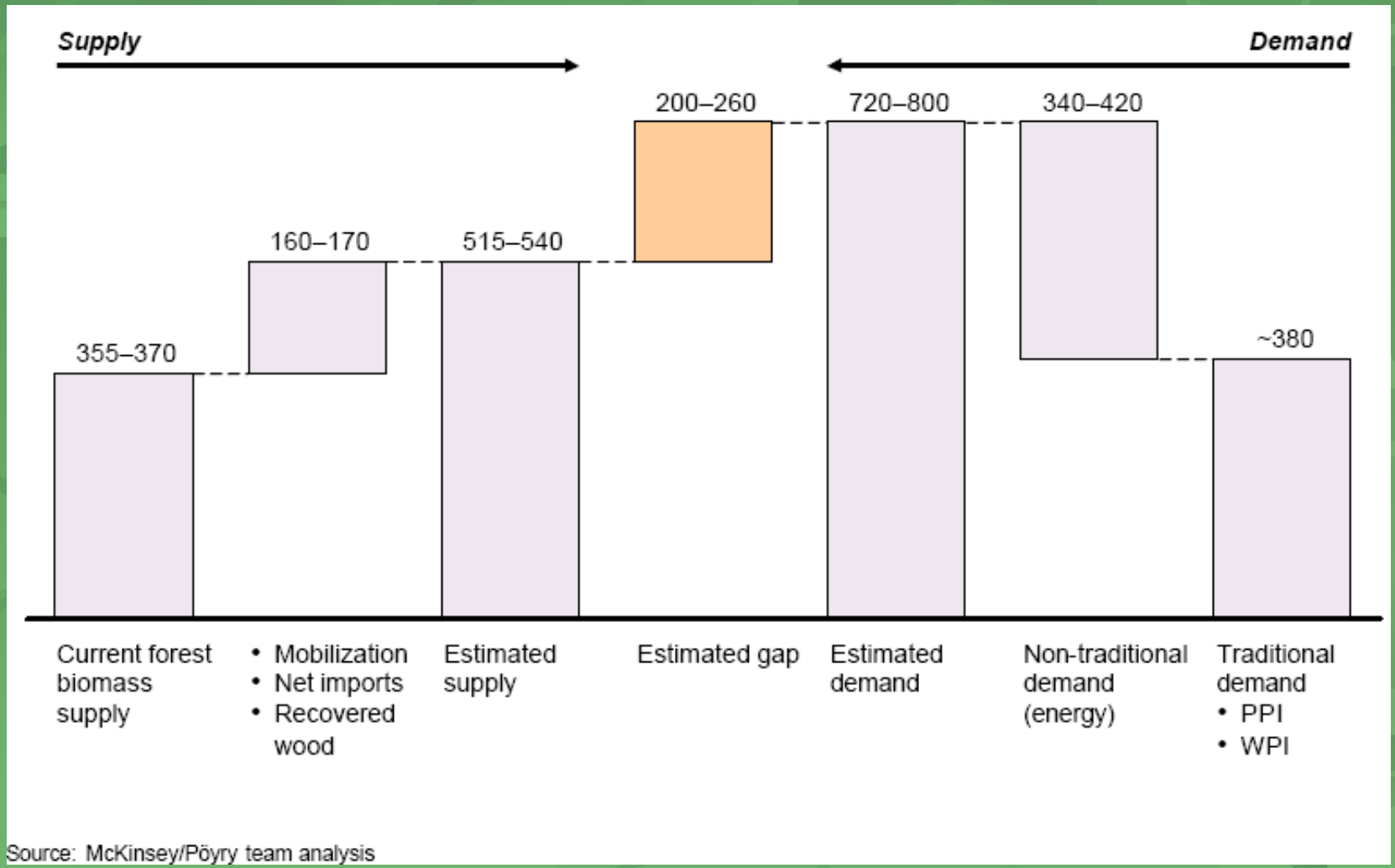
NAI, fellings and roundwood balance on forest available for wood supply in EU25 by country groups.

Mantau 2006 : caution and ?

	million m³	%		%	million m³	
Supply from forest & woody biomass outside the forest:						
Industrial Roundwood - JFSQ	377	49%				Material use:
Industrial Roundwood*	26	3%		26%	214	Sawmill industry
Fuelwood - JFSQ	56	7%		11%	89	Panel industry
Fuelwood*	29	4%		19%	155	Pulp industry
Bark	12	2%		1%	6	Pellets, briquetts etc. ****
Used logging residues	17	2%		2%	14	Other physical utilization
Woody biomass outside the forest	13	2%				
Supply by-products:						
Chips, particles & wood residues	122	16%				
Pulp production co-products**	72	9%				Energy use:
Supply recovered wood				6%	49	Power and heat
Recovered wood***	42	5%		7%	61	Industrial internal
Supply processed wood fuel:				12%	96	Private households
Processed wood fuel	6	1%		17%	138	Undifferentiated energy use
SUPPLY TOTAL	775		Difference 47		821	TOTAL USE

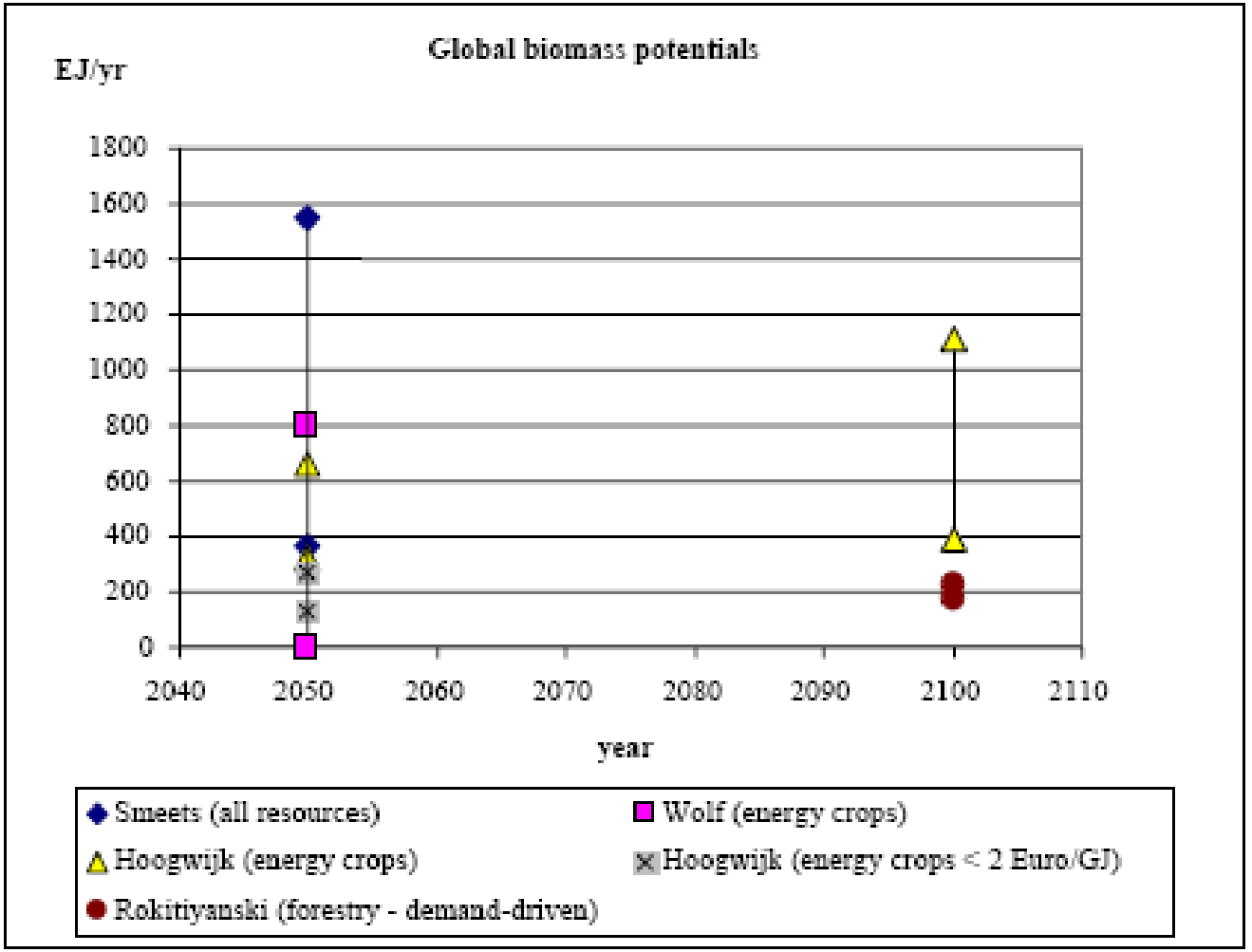
* maximum difference unreported to JFSQ
** black liquor, tall oil, etc.
*** for material & energy use
**** processed wood fuel industry

CEPI 2007 : shortage by 2020



Source: McKinsey/Pöyry team analysis

NL govmt. 2008 : don't know



Source : Comparison of 8 mayor biomass availability studies, consortium led by Utrecht univ.

UN-ECE 2008 : more wood needed

Demand pull as a result of energy policy

Development of wood consumption for energy use if EU targets (RES) are realized as planned

349 M m^3 ***2005***

591 M m^3 [1] ***2010***

768 M m^3 [2] ***2020***

EU-RES-targets:

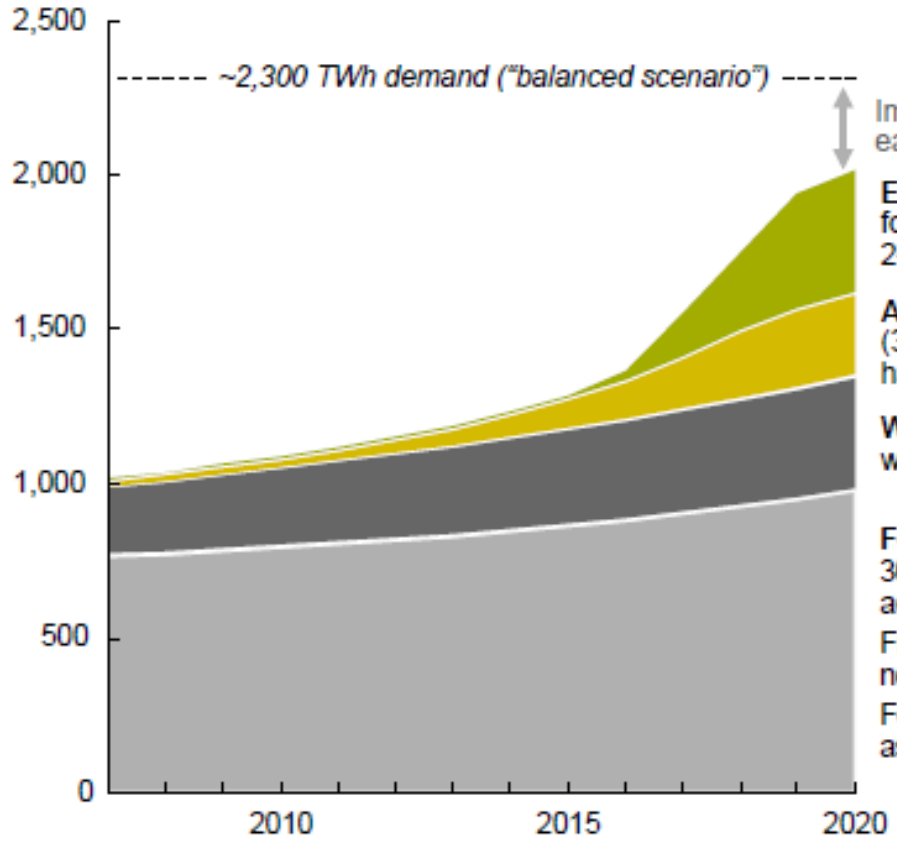
[1] 2010: 12%
[2] 2020: 20%

Source: Hetsch / Steierer / Prins (2008) UNECE/FAO

Vattenfall 2010 : no limits

Aggressive EU supply mobilization scenario

TWh, primary energy



Imports from 120 pellet mills, each producing 500 kton p.a.

Energy crops 5 million hectares of land used for energy crops (less than for biofuels today, 2-3% of total crop and pasture land in EU)

Agri residue Denmark's extraction rate (30-50% of residues) implemented across half of Europe

Waste Mobilization of 60% of renewable waste excluding recycling (35% in 2007)

Forestry (direct and indirect)
30% of all forest residues extracted across Europe (today ~3%)

From 83% to 87% of roundwood annual net growth harvested

Forest products industry by-products assumed not to increase

SOURCE: AEBIOM; EEA (2006); IEA; Capros et al (2008): Model-based Analysis of the 2008 EU Policy Package on Climate Change and Renewables; McKinsey biomass model (2009)

EU Wood 2011 : yes we can !

Table 1-2: Wood Resource Balance by all sectors

Wood Resource Balance							
Region	EU27			IPCC Scenario:			A1
potential	2010	2020	2030	2010	2020	2030	demand
		M m³			M m³		
stemwood C, ME	361.8	356.8	355.7	196.4	218.5	246.7	sawmill industry
stemwood NC, ME	182.3	178.1	181.0	11.4	14.2	17.3	veneer plywood
forest residues C+NC, ME	118.0	119.8	120.3	143.3	168.4	200.3	pulp industry
bark, C+NC, ME	23.7	23.3	23.4	92.3	110.1	135.7	panel industry
landsc. care wood (USE) ME	58.5	66.0	73.5	14.8	17.6	19.8	other material uses
				20.9	43.5	53.6	producer of wood fuels
sawmill by-products (POT)	86.6	96.0	107.8	85.5	98.3	113.9	forest sect. intern. use
other ind. res. reduced (POT)	29.7	34.9	41.7	83.2	242.0	377.1	biomass power plants
black liquor (POT)	60.4	71.3	84.9	23.2	68.8	81.5	households (pellets)
solid wood fuels (POT)	20.9	43.5	53.6	154.5	163.2	150.6	households (other)
post-consumer wood (POT)	52.0	58.7	67.3	0.0	0.8	29.0	liquid biofuels
total	**993.9**	**1,048.4**	**1,109.4**	**825.5**	**1,145.4**	**1,425.4**	**total**

HI	High – refers to high mobilisation scenario
ME	Medium – refers to medium mobilisation scenario
LO	Low – refers to low mobilisation scenario
TH	Theoretical – refers to theoretical availability
POT	Potential – refers to "real" availability under given constraints
DEM	Demand – refers to modelled or assumed demand
DIS	Disposed – refers to potential that is currently disposed
USE	Use – refers to potential that is or will be used
C	Coniferous - softwood
NC	Non-coniferous - hardwood

Source: Mantau, Wood Resource Balance, EUwood 2010

Real potential ?

- Information about biomass feedstock sources remains scattered, dispersed, incomplete and difficult to compare
- What is clear :
  - Other wood use will come under severe pressure, so will related industry
  - Competition for resources will be fierce,driving up prices, causing policy changes…
  - Heavy reliance on imports is a likely option, leading to indirect effects (“ILUC”)

Pls. look at ALL biotic outputs

- Traditional agro – cereals, veg. oil, sugar,
- Traditional livestock – wool, cotton, meat, tallow
- Traditional forestry – wood, paper, panels
- Or, the new competitors:
  - Biofuels (Renewable Energy Directive – 10 %)
  - Biomass (Biomass strategy – 2/3 of 20 % RE)
  - Advanced bio-materials (wood-based > how much ?)
  - Green Chemistry (biorefineries)

  (Bio-economy = more of all of the abov > how much ?)

<u>But remember</u> : ecosystem stability is the basis for all biological production and land is a limited resource

Sustainability issues

Applying RED crit. for biofuel to biomass ?

- Biodiv. No go :
  - biofuel : Y — biomass : Y
- Carbon No go :
  - biofuel : Y — biomass : N

  (avoid LUC) — (if no LUC anyway)

- Cultivation requirements
  - biofuel : Y (= CAP or similar) — biomass : N (time/spatial scale)
- GHG savings standards
  - Biofuel : Y — biomass : ?

  (default or actual) — (diff. applications / LULUCF)

GHG emissions from biomass ?

- Sinks or production from forests, that is the question.
- “Additional “ biomass is required (Searchinger)

- Bio-E is only “Conventionally” carbon neutral (IPCC)
  - Emissions not counted under the energy sector
    should be accounted for under LULUCF regime
  - What the atmosphere “sees” is more GHG if bio-energy comes from intensification, land use change, underground biomass
  - No LULUCF acc. = blank check for drawing down terrestrial C-stocks for bio-energy

- Change from forest to other land use/ pasture to arable always means additional emissions from vegetation and soil. None of the studies so far look at soil emissions
- Burning imported biomass may mean big “leakage” of carbon if no accounting at all e.g.when from non A I c.

Reducing emissions ?

- GHG “savings” / Fossil fuel “substitution”
- GHG “efficiency” / “Green fuels”

- All this CAN make sense if an amount of fossil carbon corresponding with the carbon content of an equal unit of alternative energy is effectively NOT mined or pumped up.
- ONLY effective after depreciation period of carbon debt at start

- In the current scenario of rising energy global use, the main effect of alternative fuels is more energy on the market
- Only with effective capping of energy use will real substitution be possible, but no policy about this
- Current perfomance of RE should be intepreted as POTENTIAL only

What else ?

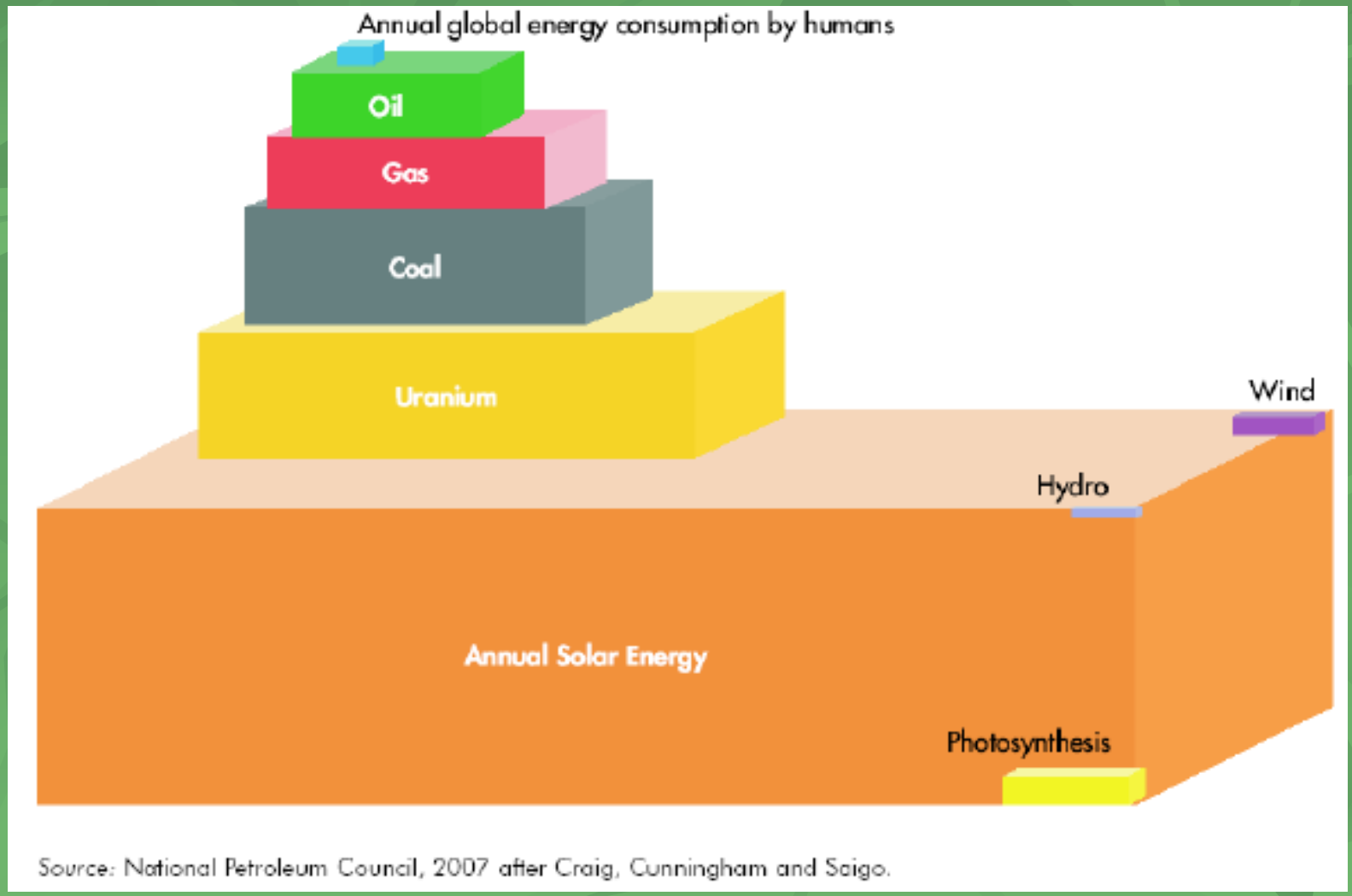
- Other RES (GHG subst. Rating)
  - Wind power
  - Solar (H & E)
  - Geothermal
  - Tidal & Wave
  - Hydro (decentralized)
  - [CCS & Nuclear]
  - [Agrofuel]

(source : M.Jacobson – Stanford)

- "Cosmic" RES have much lower total ecological footprint according to LCA analysis and better E return on investment ("EROI" scaling)

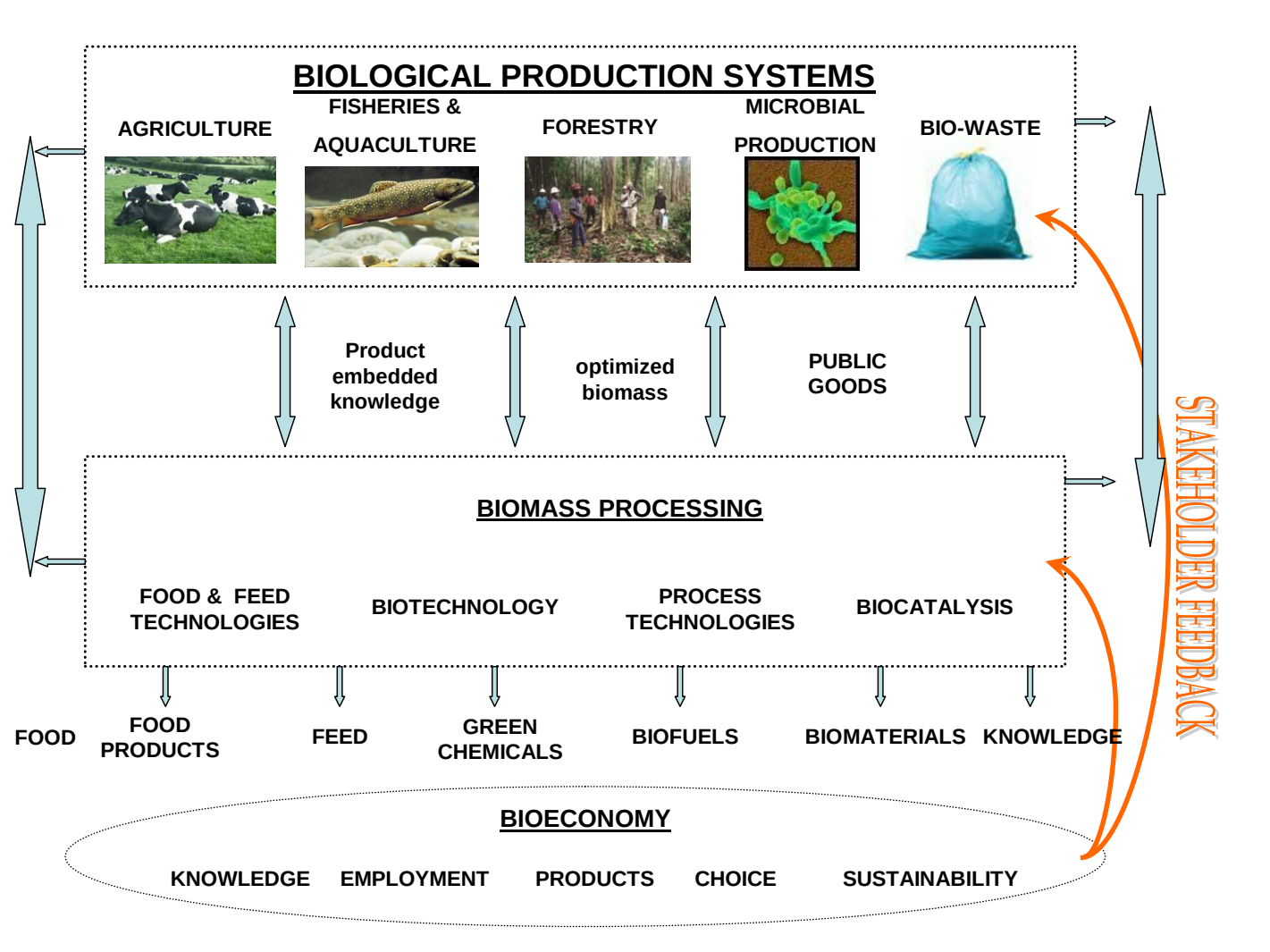
  It looks increasingly obvious that bio-E is a poor option if we want to do something about global change…

Looking at all energy sources :



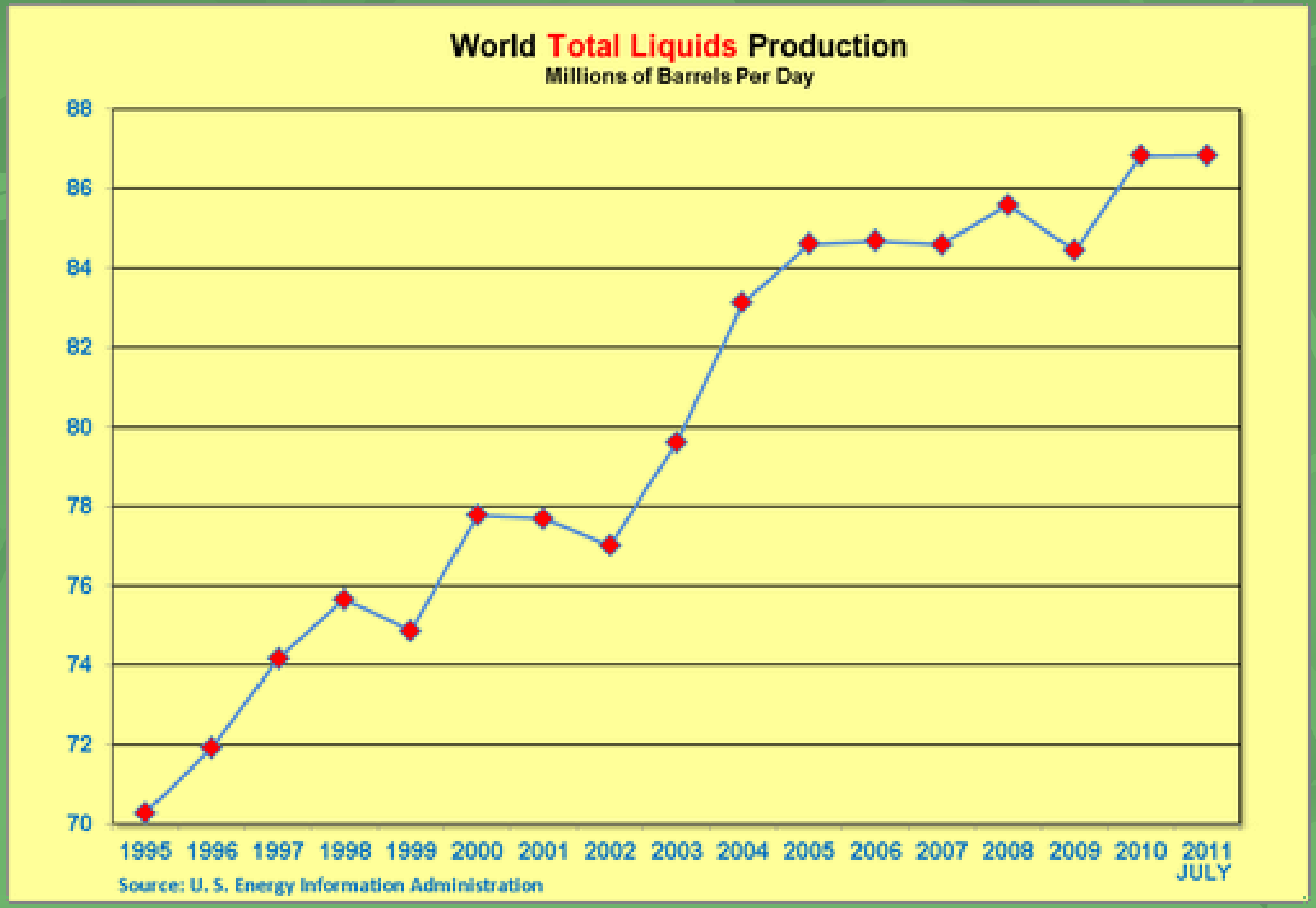
Biomass potential is only a tiny fraction of total RES potential

New demand : Green Economy



Source: DG RTD

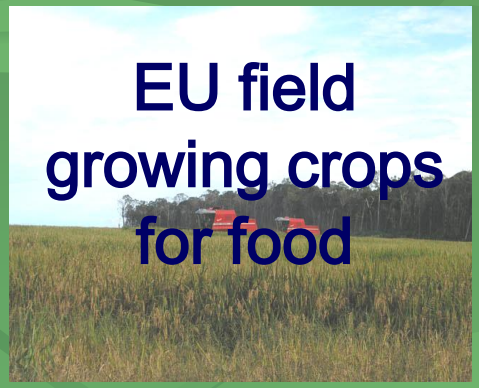
1 Bn Barrels = 12 days



Impossible to separate EU actions and international impacts (direct and indirect)

Indirect Land Use Change (ILUC) is caused by crop displacement:

NO BIOFUELS



WITH BIOFUELS

+

Diverting 1 ton EU wheat from food to bioethanol will not change emissions from that EU farm

…increased emissions to fill in the gap in the food market due to:

- Land expansion (into natural vegetation or set-aside land)
- Emissions from intensification

The losing end

LULUCF emissions

TABLE 1. LULUCF fluxes, CAIT (2005).

	1995 GHG emissions with LULUCF (MtC eq)[1]	LULUCF (MtC eq)	Percent LULUCF
USA	1,621.60	-110.0	6.8%
EU (25)	1,308.70	-6.1	0.5%
China	1303.7	31.1	2.4%
Indonesia	807.8	692.7	85.8%
Brazil	618.8	411.2	66.5%
Russia	589	15.5	2.6%
India	415.2	-10.9	2.6%
Japan	351.5	1.2	0.3%
Germany	294.8	0.0	0.0%
Malaysia	225.2	188.9	83.9%
UK	187.8	-0.5	0.3%
Canada	185.9	19.4	10.4%
Ukraine2	170.9	0.0	0.0%
Mexico	152	29.0	19.1%
France	141.1	-1.7	1.2%
Italy	139	-0.8	0.6%
Myanmar	135.9	115.0	84.6%
South Korea	119.7	0.3	0.3%
Poland	118.5	-0.5	0.4%
Australia	117.4	1.2	1.0%
South Africa	109.4	0.5	0.5%
Venezuela	102.3	43.1	42.1%
Iran	102.1	2.3	2.3%
Congo	98.4	84.0	85.4%

	2000 GHG emissions with LULUCF (MtC eq)[1]	LULUCF (MtC eq)	Percent LULUCF
USA	1779.7	-110.0	6.2%
China	1336	-12.9	1.0%
EU (25)	1280.8	-5.7	0.4%
Indonesia	834.5	699.5	83.8%
Brazil	604.4	374.5	62.0%
Russia	538.4	14.7	2.7%
India	490.5	-11.0	2.2%
Japan	365.1	1.2	0.3%
Germany	269.9	0.0	0.0%
Malaysia	237	190.8	80.5%
Canada	201.9	17.6	8.7%
UK	179.8	-0.4	0.2%
Mexico	165.8	26.4	15.9%
Italy	144.2	-0.8	0.6%
South Korea	143.7	0.4	0.3%
Ukraine[2]	141	0.0	0.0%
Myanmar	138.6	116.1	83.8%
France	138.1	-1.6	1.2%
Australia	135.3	1.2	0.9%
Iran	122	2.3	1.9%
South Africa	113.1	0.5	0.4%
Venezuela	104	39.3	37.8%
Poland	103.8	-0.5	0.5%
Turkey	102.8	5.7	5.5%

[1] "MtC eq" - million tons of carbon equivalent

EU Wood policy points

- **SUPPLY :** Mobilise more wood from existing forests
  - Raise harvest levels
  - Use more parts of the tree (above ground and below ground biomass)
  - Increase supply of wood from outside the forestIndustry residues
  - Landscape care wood, trees outside the forest
  - Post consumer recovered wood
  - Expand forest area (short rotation coppice)
  - Increase imports from other regions
- **DEMAND**
  - Promote energy efficiency
  - Promote use of renewables other than wood
  - Use wood more efficiently, in industry and for energy