

Renewable Energy

Photovoltaic Solar Electricity Biofuels

Dr. Heinz Ossenbrink

European Commission

DG Joint Research Centre - Institute for Energy

Petten - The Netherlands

Ispra - Italy

<http://ie.jrc.ec.europa.eu/>

<http://www.jrc.ec.europa.eu/>

The Directive 2020 The Renewable Mix Impact on Photovoltaic Impact on Biofuels

Remark:

Energy Unit used throughout the Presentation:

both for electrical & thermal energy

TWh

Divide by 10:

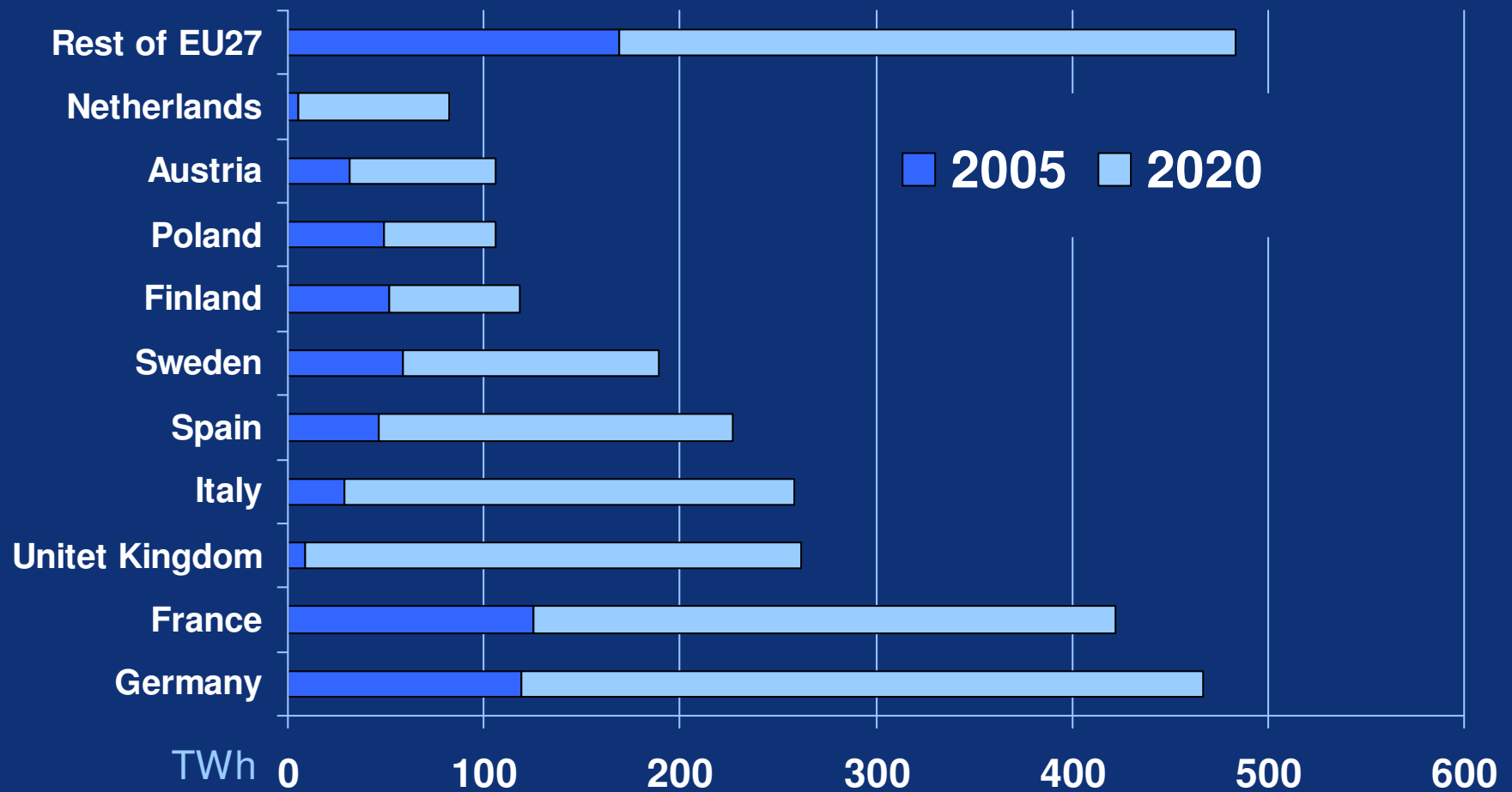
= Number of 1.3 GW Nuclear Reactors

= Bio.€ Revenue

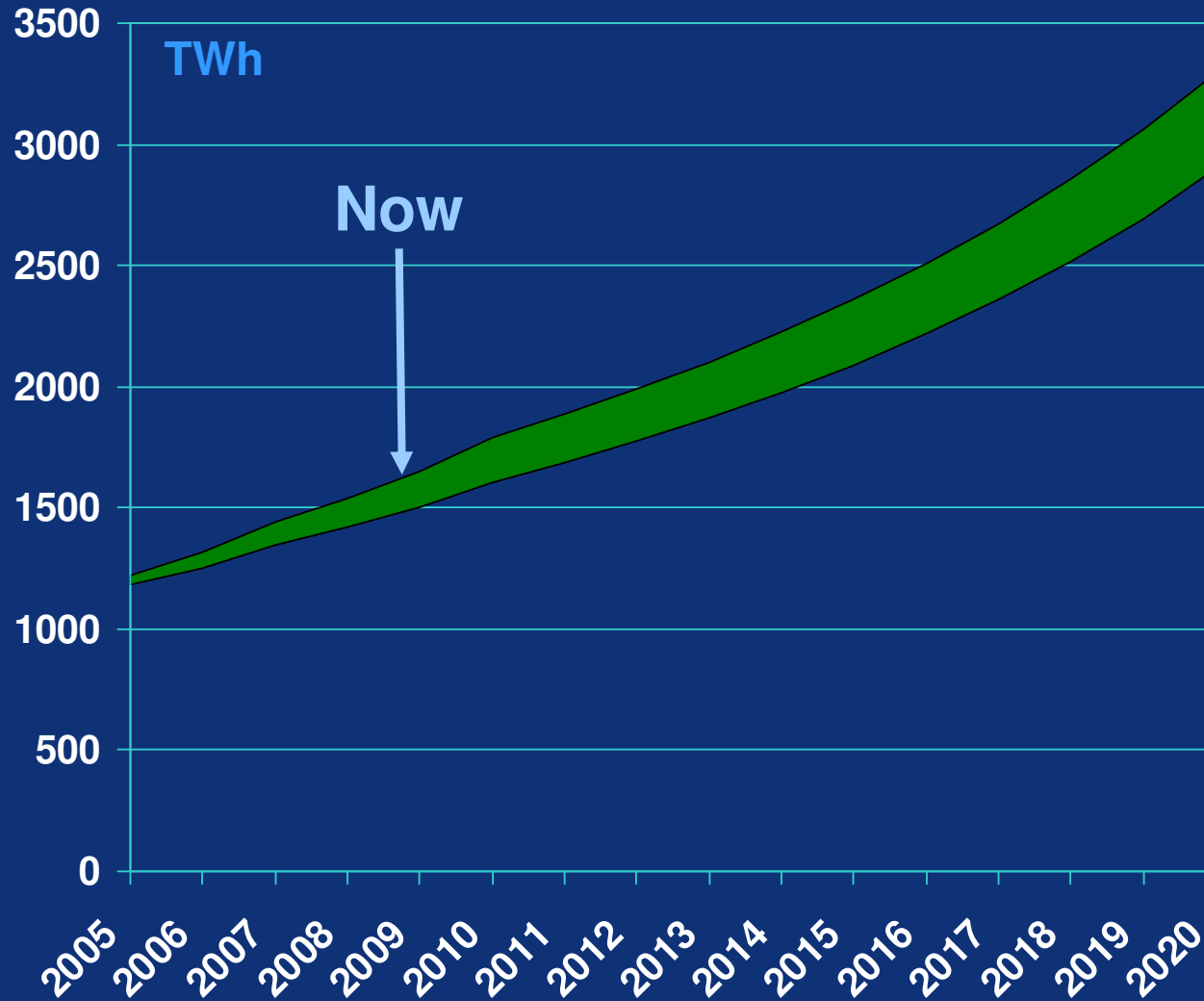
Major Content of Directive

- ✓ **Mandatory 2020 Targets for Memberstates**
- ✓ **“Burden Share” Possible**
- ✓ **Trajectory towards 2020**
- ✓ **Biofuels for Transport:**
 - Replaced proposed 10% Biofuel*
 - by 10% Renewable Sources**
 - Sustainability Certification
 - Land Use Change Assessment
 - GHG accounting
 - Other Renewables (Bio-gas, electric Drive trains)

Memberstates Contribution to 20% Renewables Total 3300 TWh



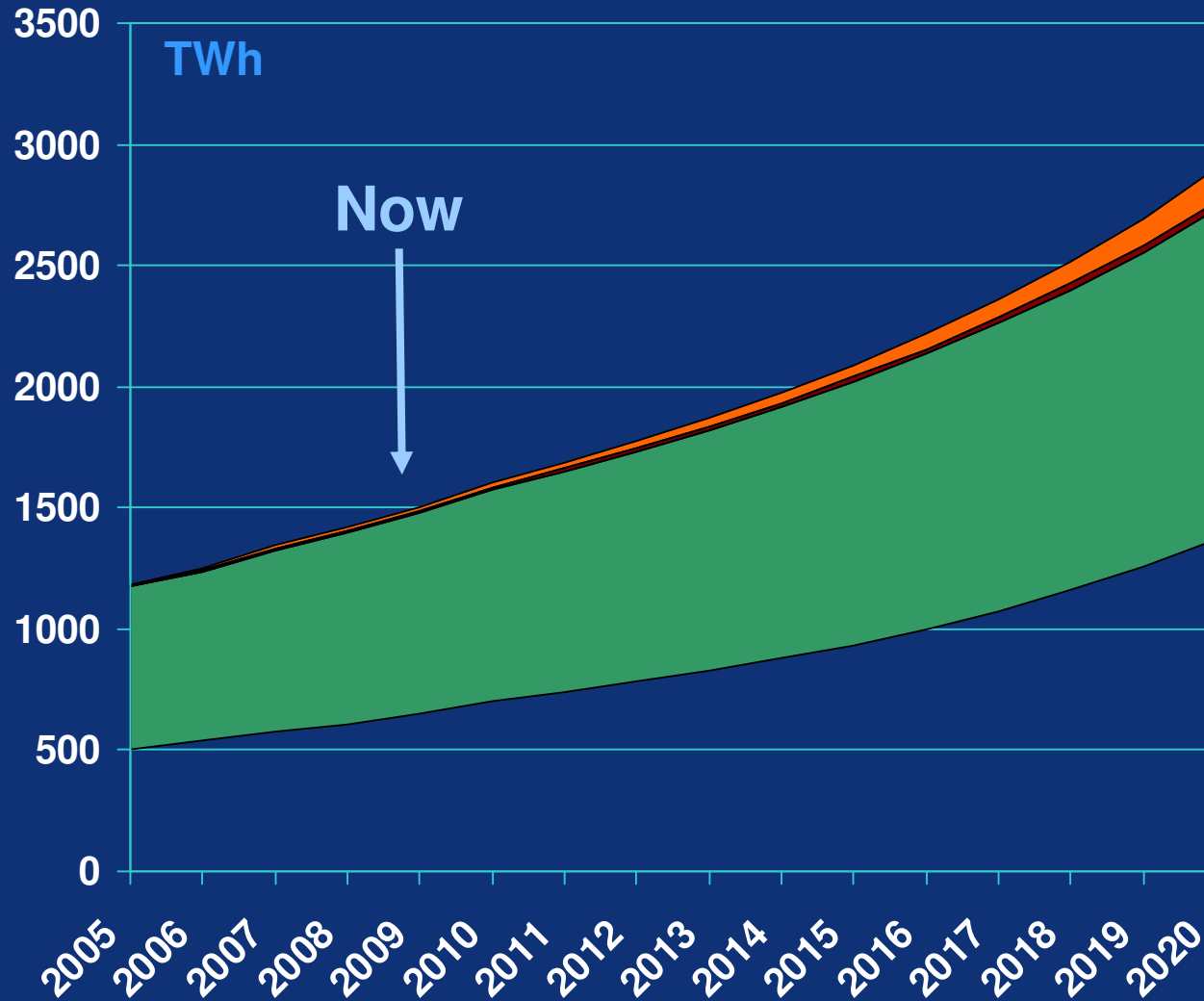
10% Share of Transport Fuel: **400 TWh**














Renewable Sources

- Bio-fuel Tsp
- Solar Thermal
- Geothermal
- Biomass-Heat
- Biomass-E
- Ocean
- Geothermal-E
- Solarthermdyn.
- Photovoltaic
- Wind
- Hydro

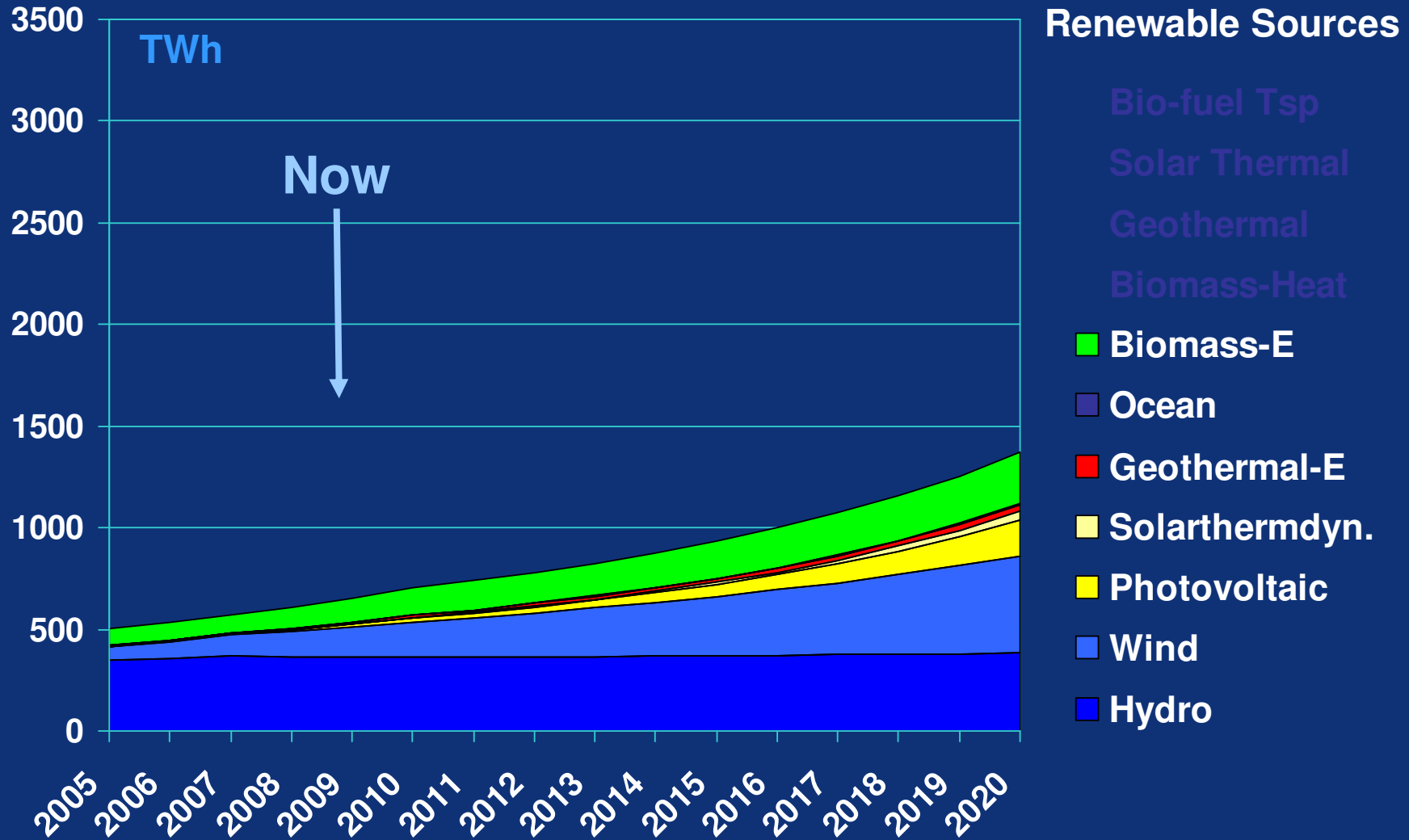
24% Share of Heating & Cooling: **1600 TWh**



Renewable Sources

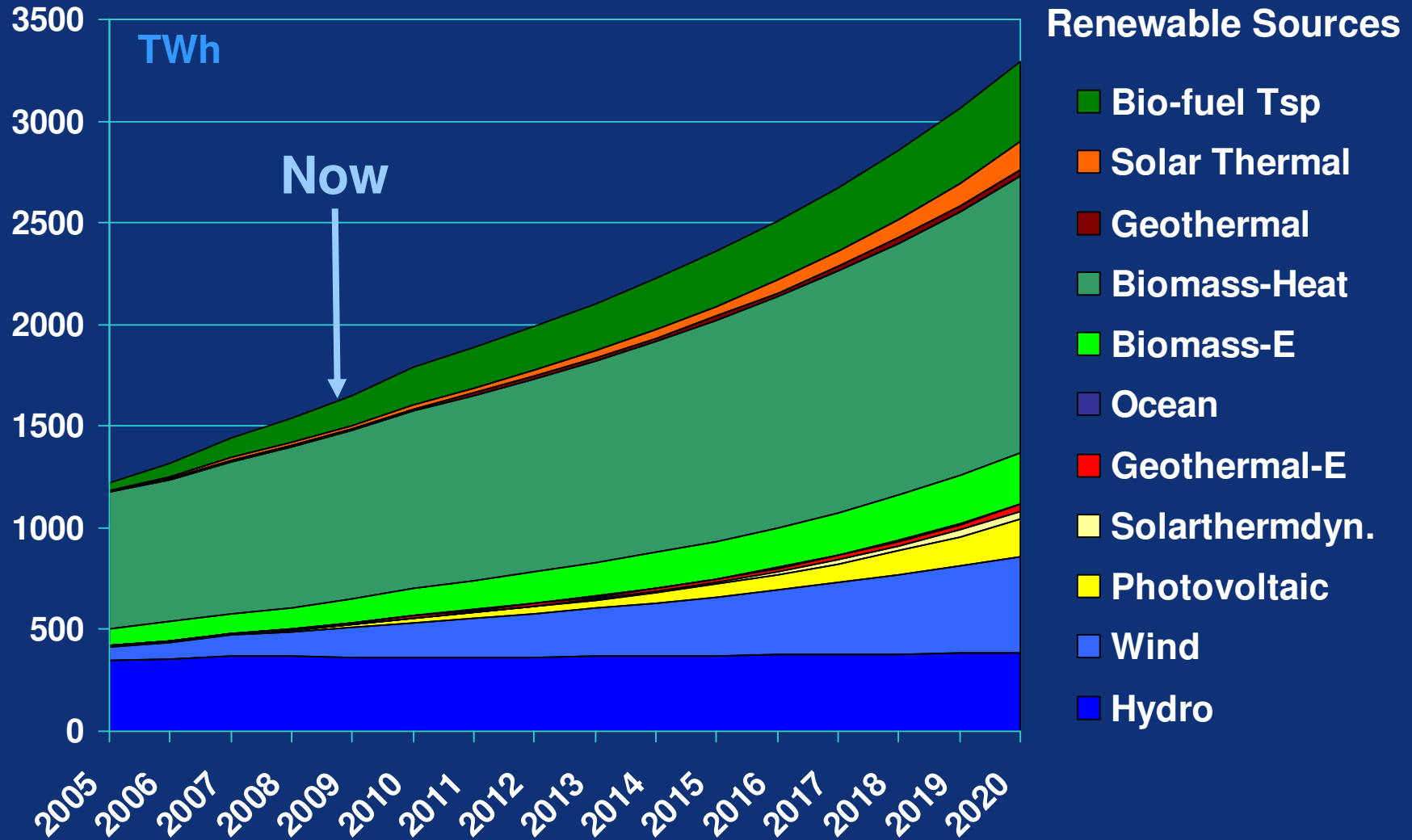
-  Bio-fuel Tsp
-  Solar Thermal
-  Geothermal
-  Biomass-Heat
-  Biomass-E
-  Ocean
-  Geothermal-E
-  Solarthermdyn.
-  Photovoltaic
-  Wind
-  Hydro

34% Share of Electricity: **1350 TWh**

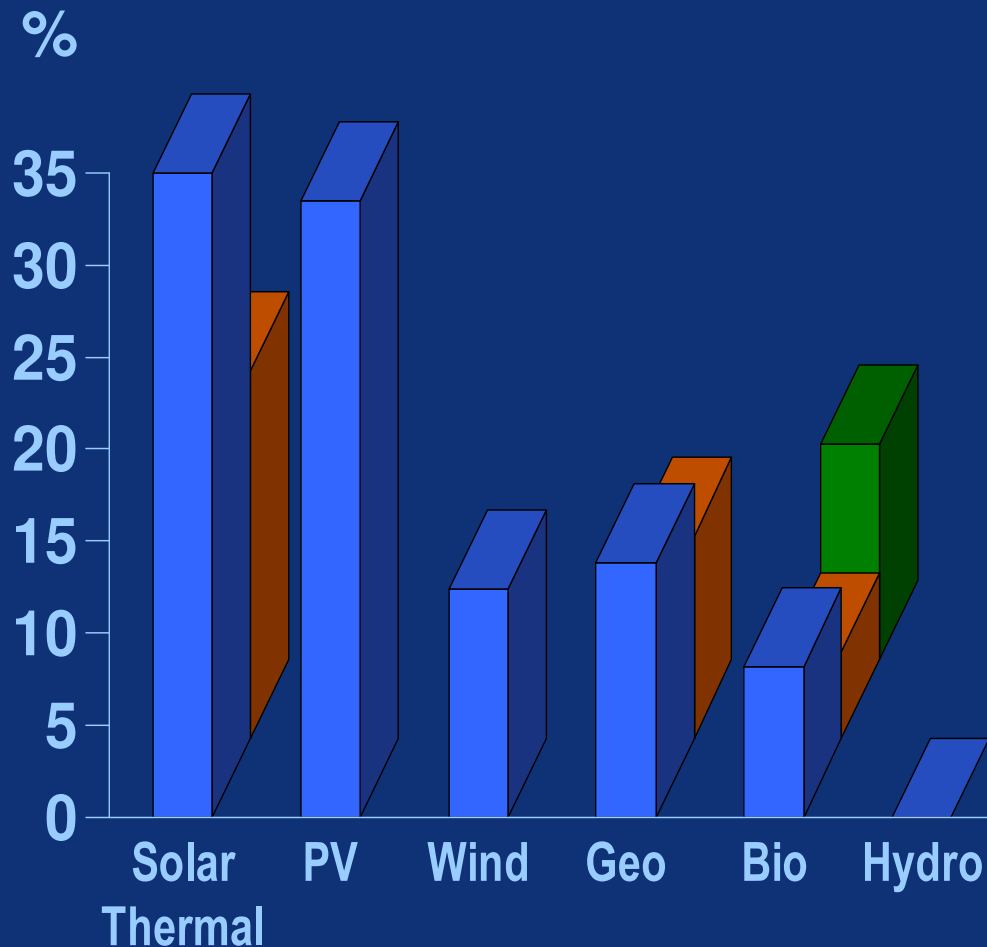


Source based on EREC 2008

20% Share of Renewable Sources: **3300 TWh**



Average Required Growth Rate per year



2007-2020 by
Technology

Transport
Heat and Cooling
Electricity

It can be done!

34% of Electricity

Wind 13%, PV 5%, Bio-Electricity 6%, Hydro 11%

10% of Transport Fuels

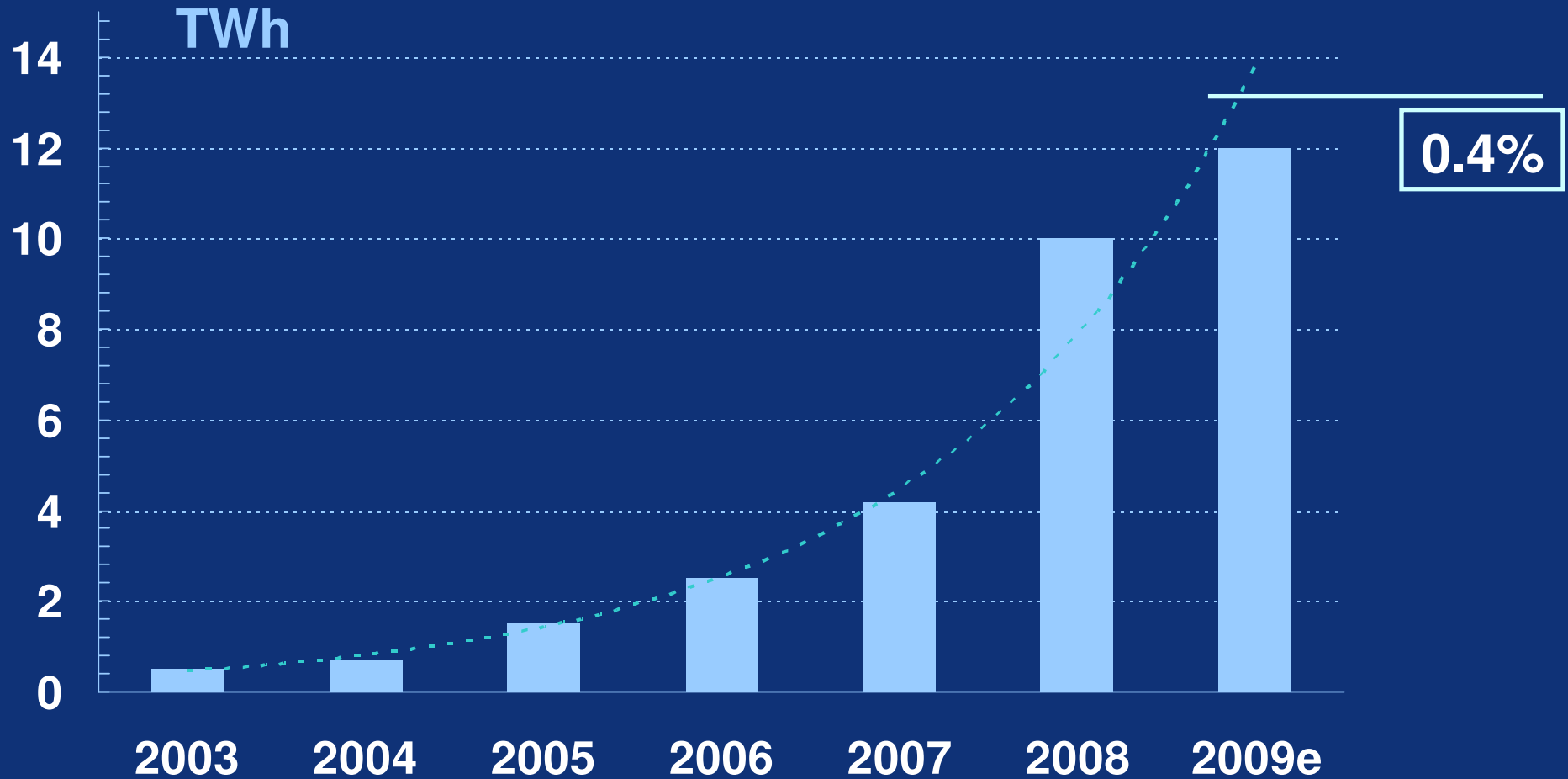
Biofuels 9%, for Electric Cars 1%

24% of Heating & Cooling

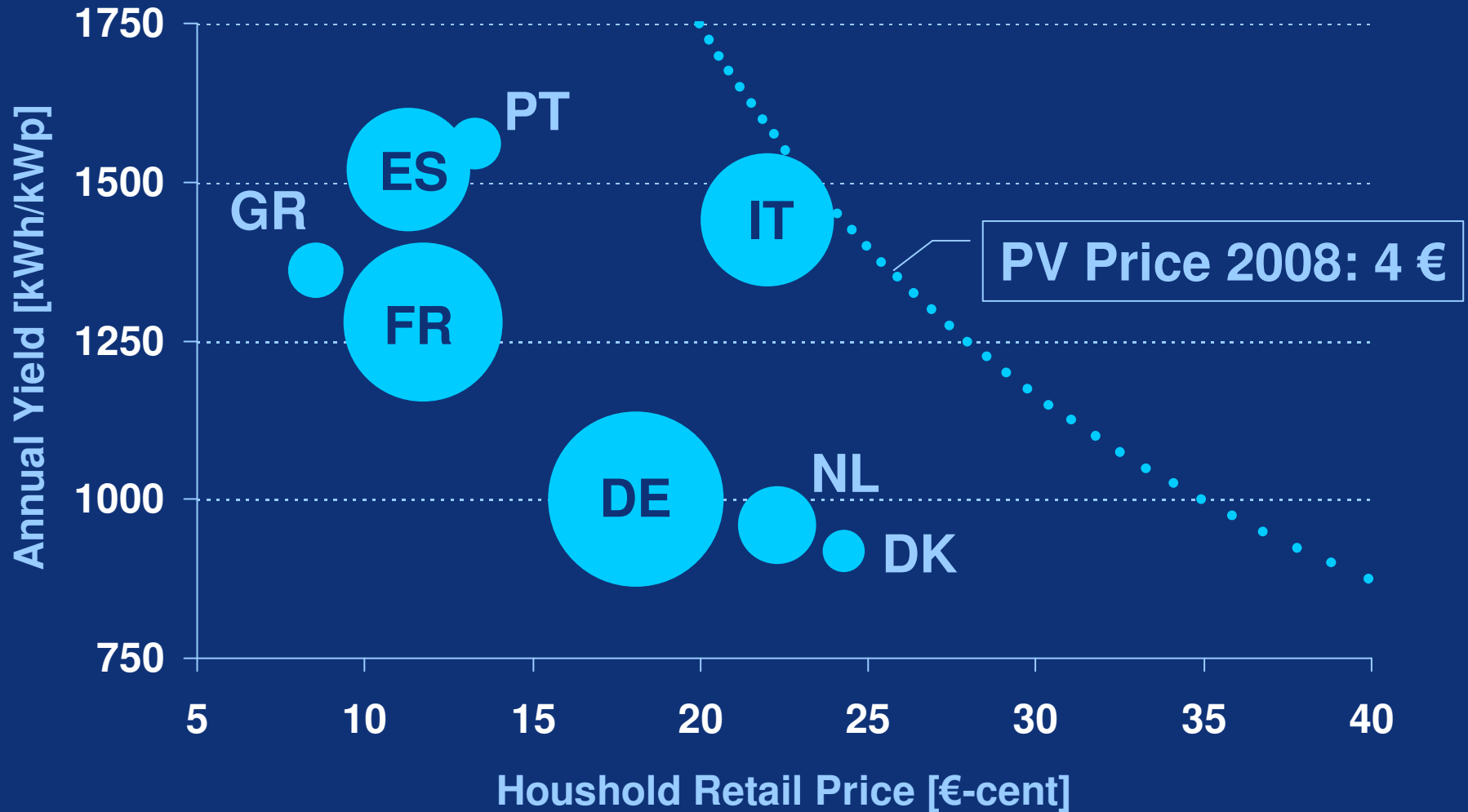
Biomass 21%, Solar 2%, Geothermal 1%

= 20% of Final Consumption

Photovoltaic Electricity EU-27



PV Grid Parity with Household Retail Prices (2008)



National PV Electricity Production 2020



2020 **5%** Electricity Target **180** TWh

European Initiatives

5% Share is feasible, Sunny Countries up to 15%

European Strategic Energy Technology (SET) Plan:

Industrial Initiative “SET for 2020” :

Goal: **12%** Share of PV Electricity

~400 TWh / year

Requires Major Grid Investments

PV price reduction of 30% within last 12 months

Thin film technologies take the price lead

Biofuels Consumption

1997: 5 TWh / 0.4 Mtoe

2005: 36 TWh / 3.1 Mtoe

2006: 63 TWh / 5.4 Mtoe

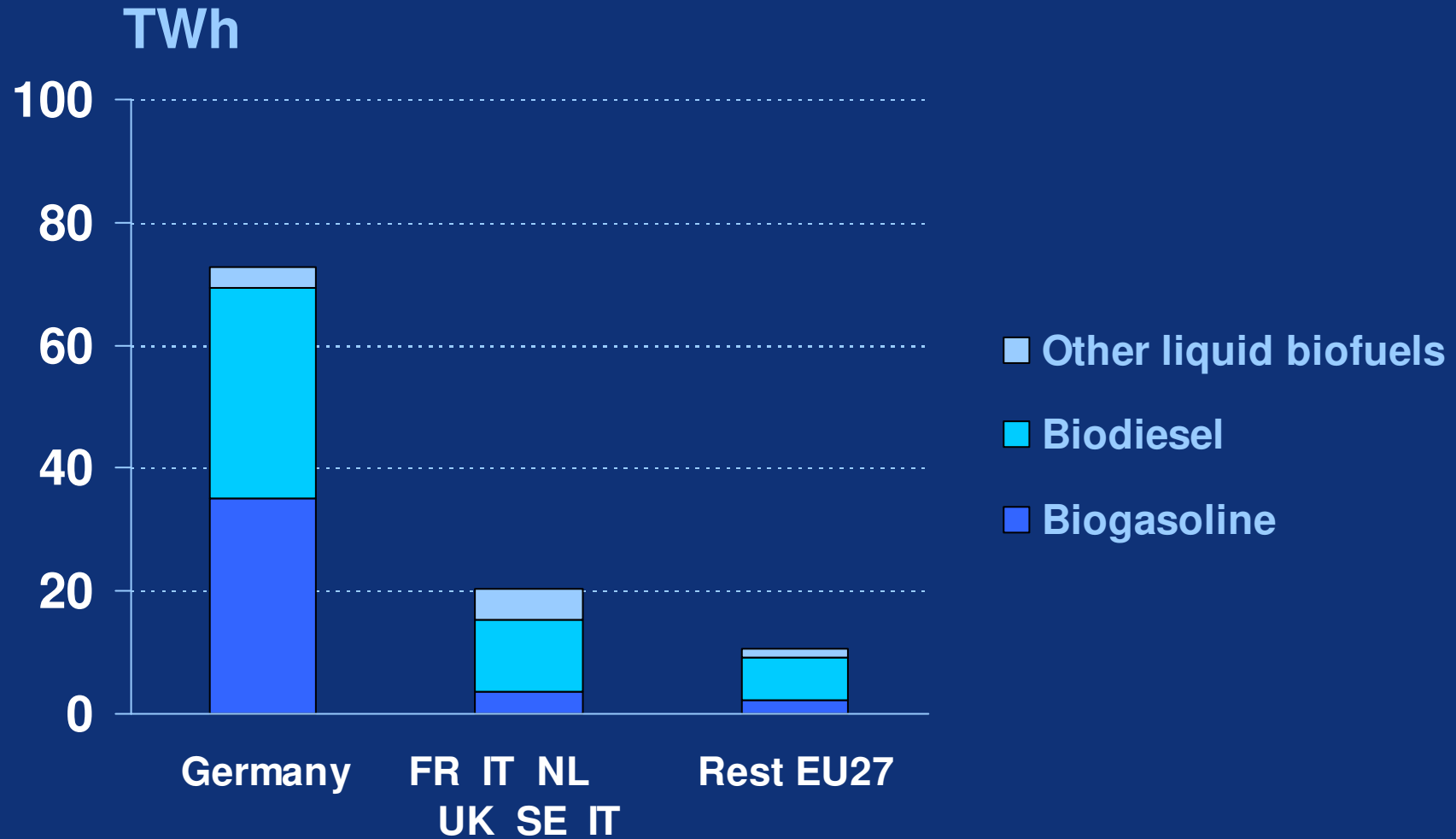
(1.8% of EU27 Transport Fuel Consumption)

2010e: 185 TWh / 16 Mtoe

2020e: 400 TWh / 34 Mtoe

(10 % of EU27 Transport Fuel Consumption)

Bio Fuels EU27 (2006)



2020 Target 390 TWh

Sustainability of Biofuels

Land Use...

GHG emissions...

Deforestation...

Water Consumption...

Availability

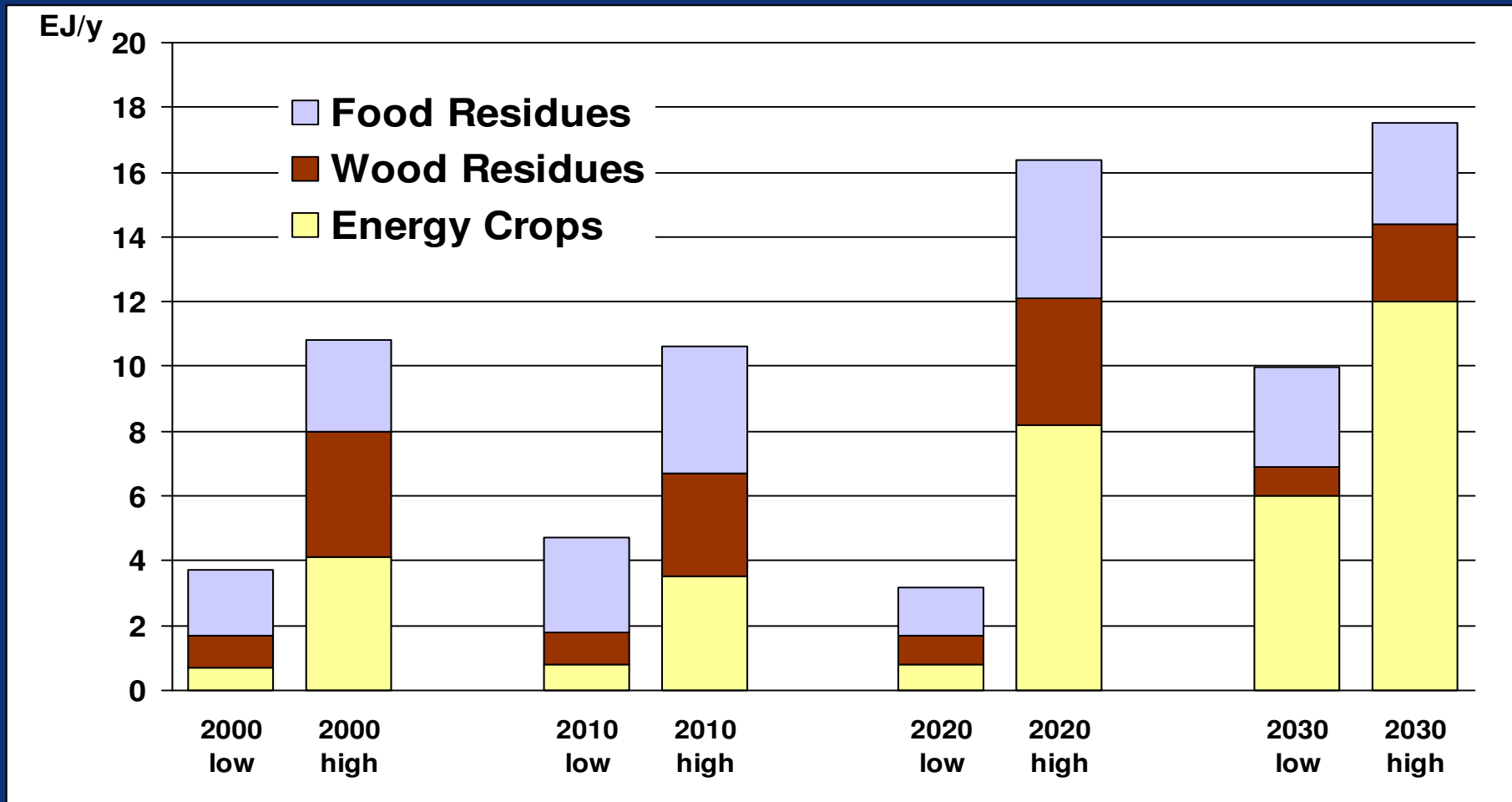
CO₂, CH₄, N₂O

Land Use Change

Competition with Food

How can we make sure that we don't make it worse?

Total Biomass Potential EU25 (144 studies)



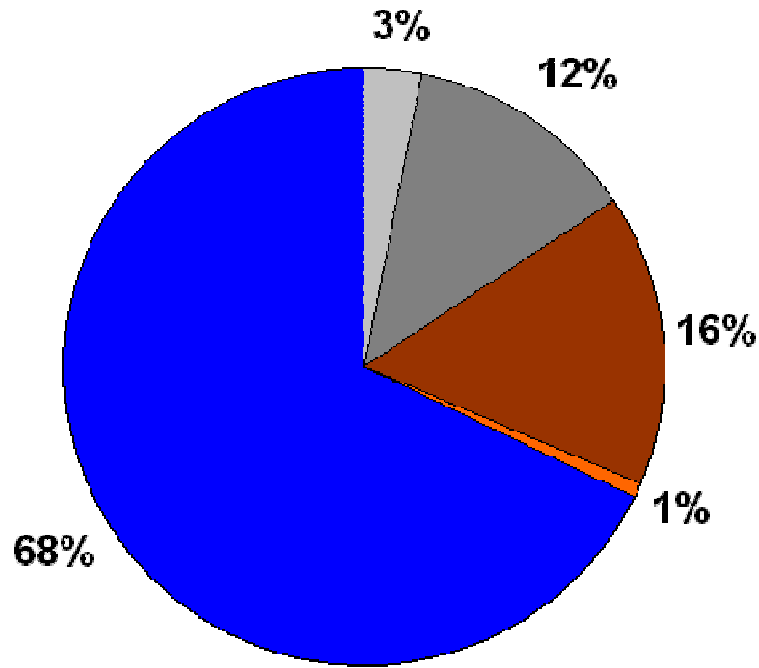
**Large variability and uncertainty of the results....
And what about the costs ?**

Source: IFEU, Heidelberg, BEE Project

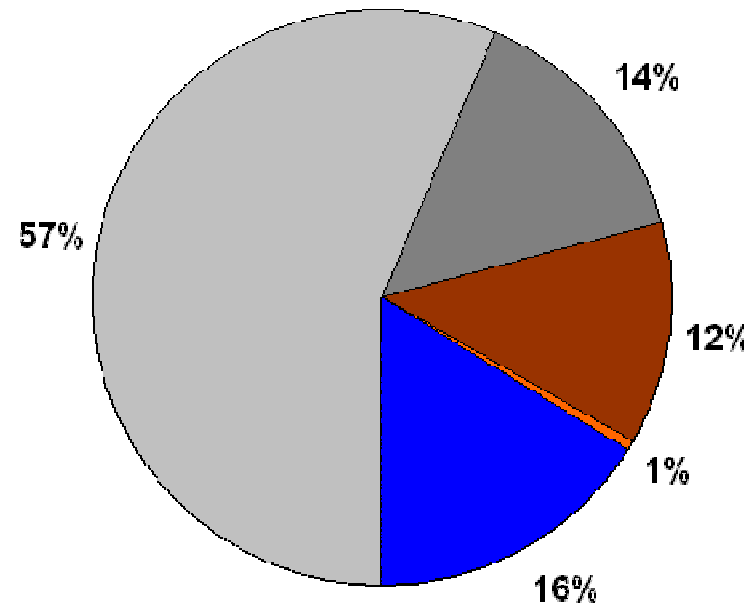
- ⊕ Avoided CO₂ emissions from fuel burning
- ⊕ Avoided CO₂ energy input fossil fuel
- ⊖ Energy input processing
- ⊕ Credits from by-products

- ⊖ N₂O emissions
- ⊖ Fertiliser production – N₂O
- ⊖ Fertiliser production – energy
- ⊖ Energy input farming
- ⊖ Carbon losses from arable fields
- ⊕ Enhanced Carbon sink

Rapeseed: total 2.6 kg CO₂-eq/kg C_{yield}



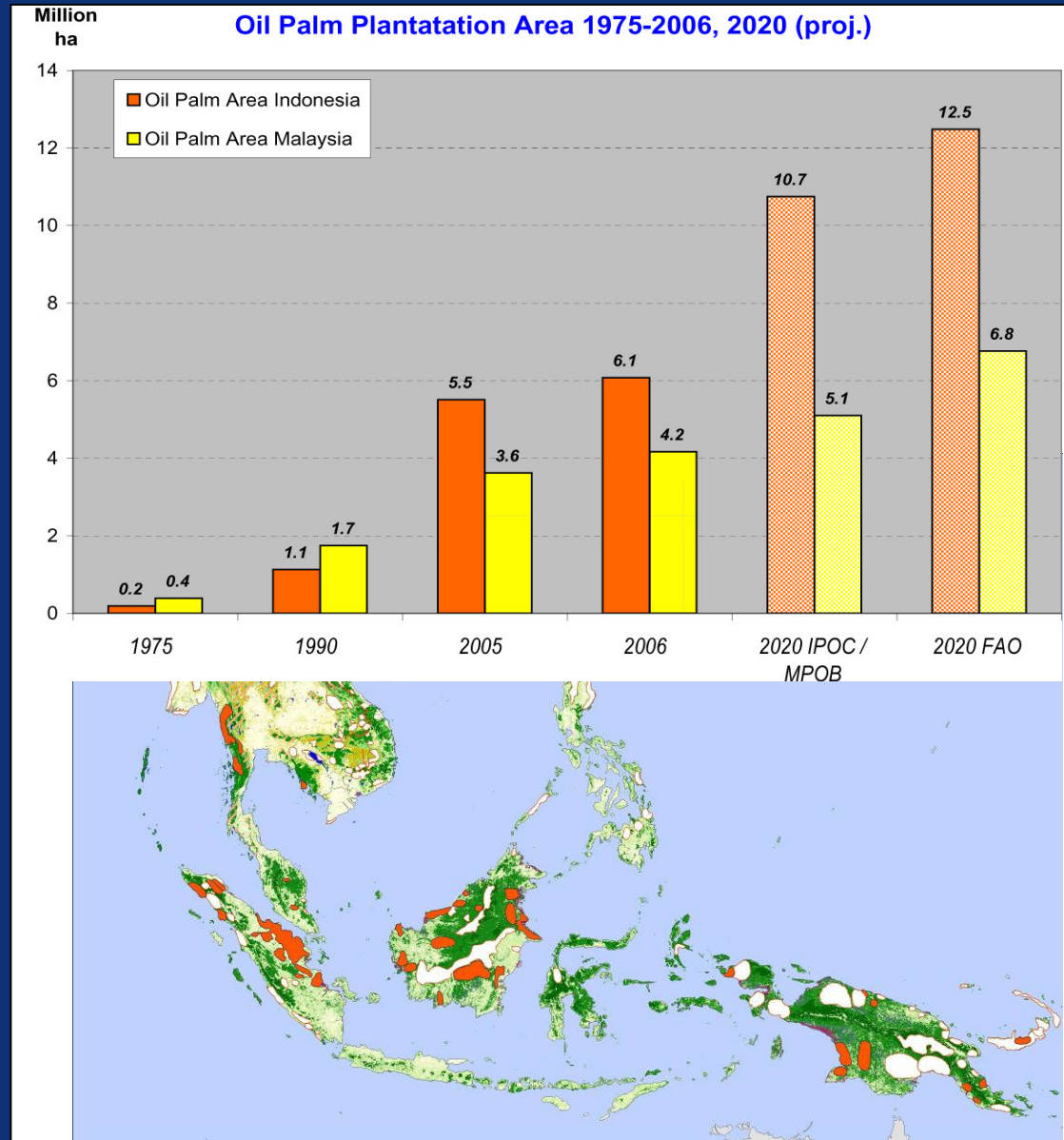
Sugar beet: total 0.73 kg CO₂-eq/kg C_{yield}

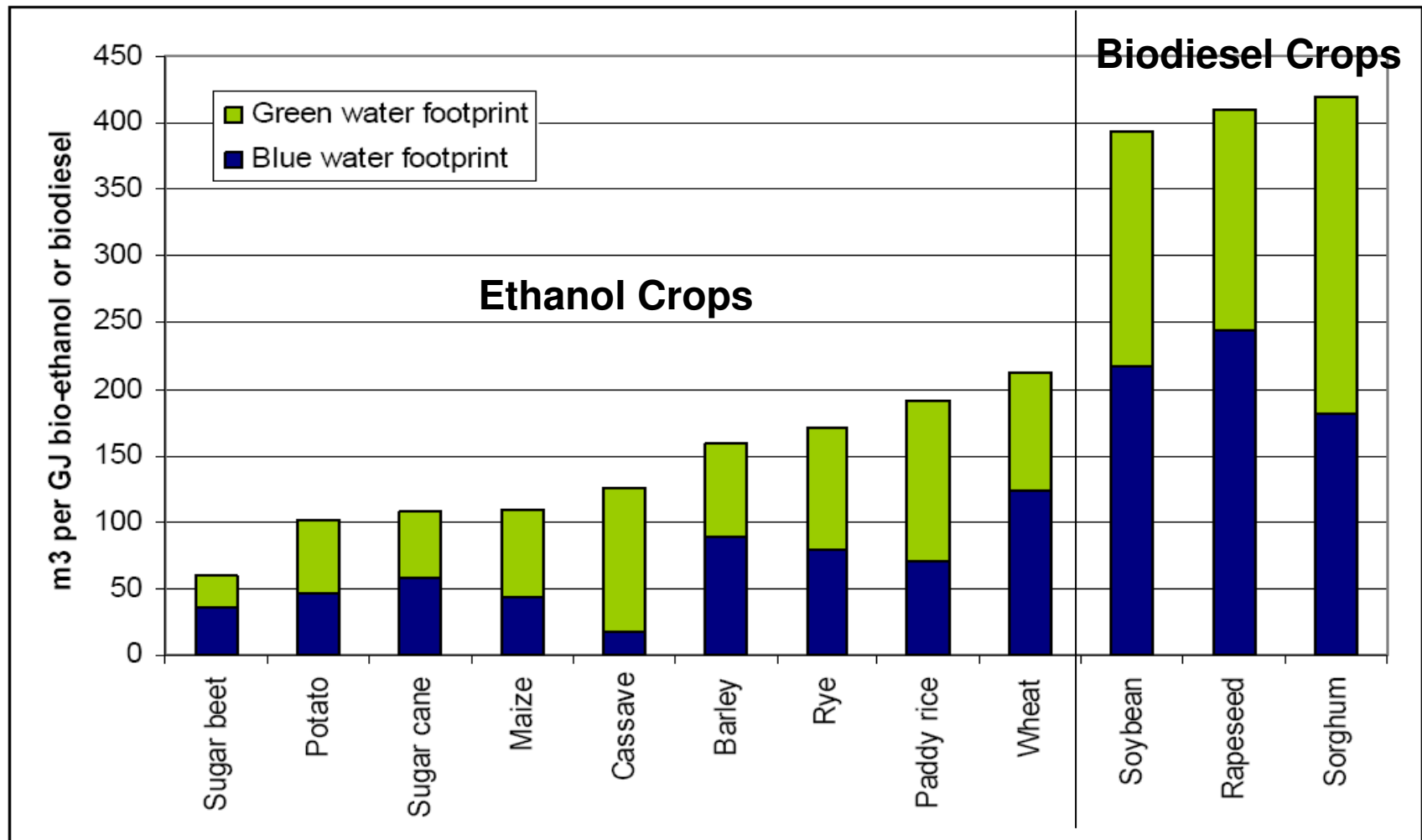


Impacts of biofuels policies on tropical areas:

- Environmental/social effects in the producing countries
- Measures to limit deforestation and other damaging effects

JRC IES TREES Project





Source: UNESCO 2008, P.W. GERBENS-LEENES et al. THE WATER FOOTPRINT OF BIO-ENERGY: GLOBAL WATER USE FOR BIO-ETHANOL, BIODIESEL, HEAT AND ELECTRICITY, REPORT SERIES 34

Bio-Fuel and Bio-Energy Policy today

Sustainability Certification Scheme

GHG “Default Values”

Carbon-Rich Soil

Accounting

Imports from Non EU-countries

Internal exchange