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# The role of biomass in the European energy system

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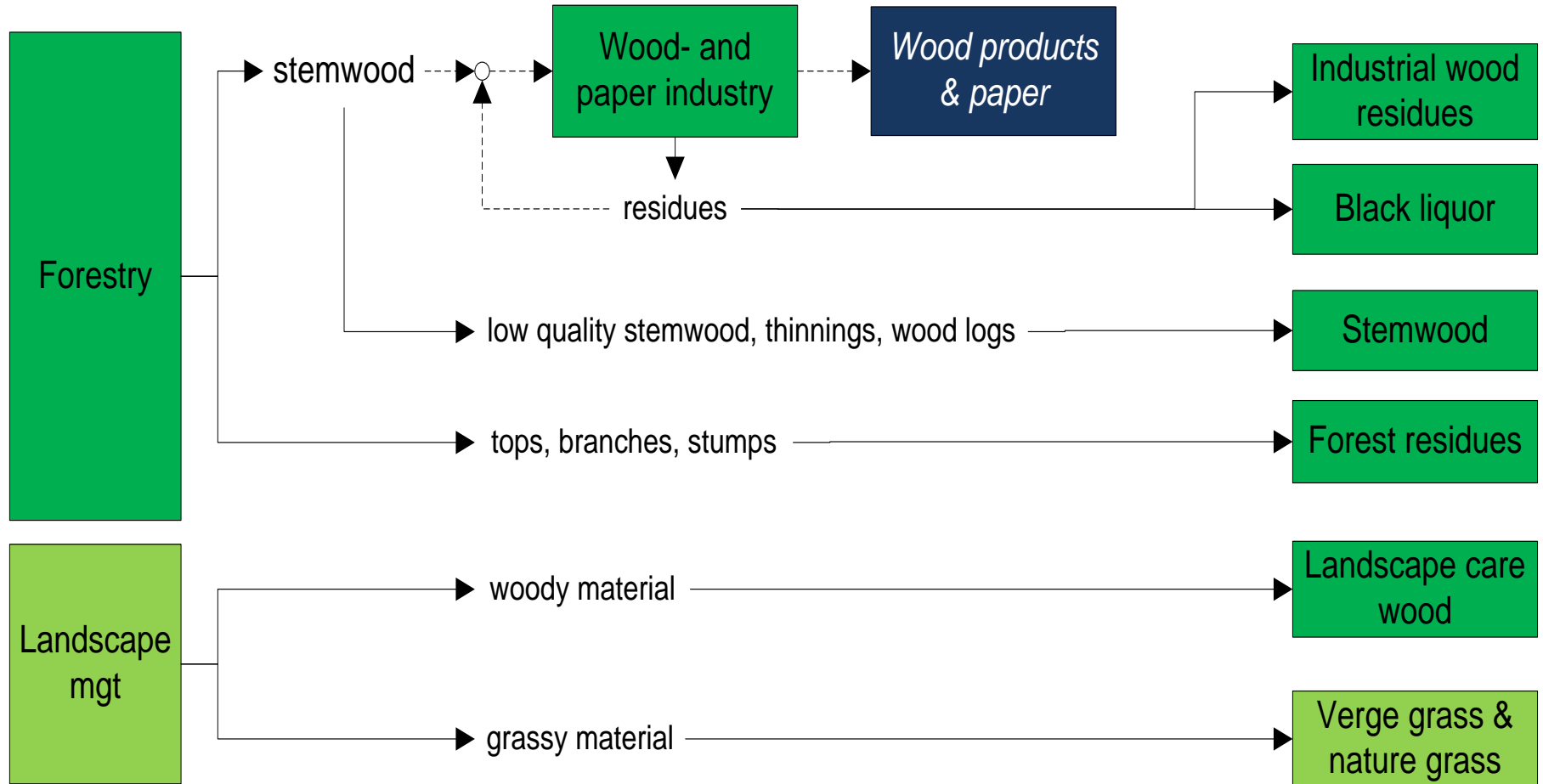
# Contents

- » **Biomass & bioenergy: what ?**
- » EU outlook on the role of biomass in renewable energy targets
- » Issues and discussions in terms of biomass
  - » Sustainability
  - » Resource efficiency
- » Conclusions

# Biomass

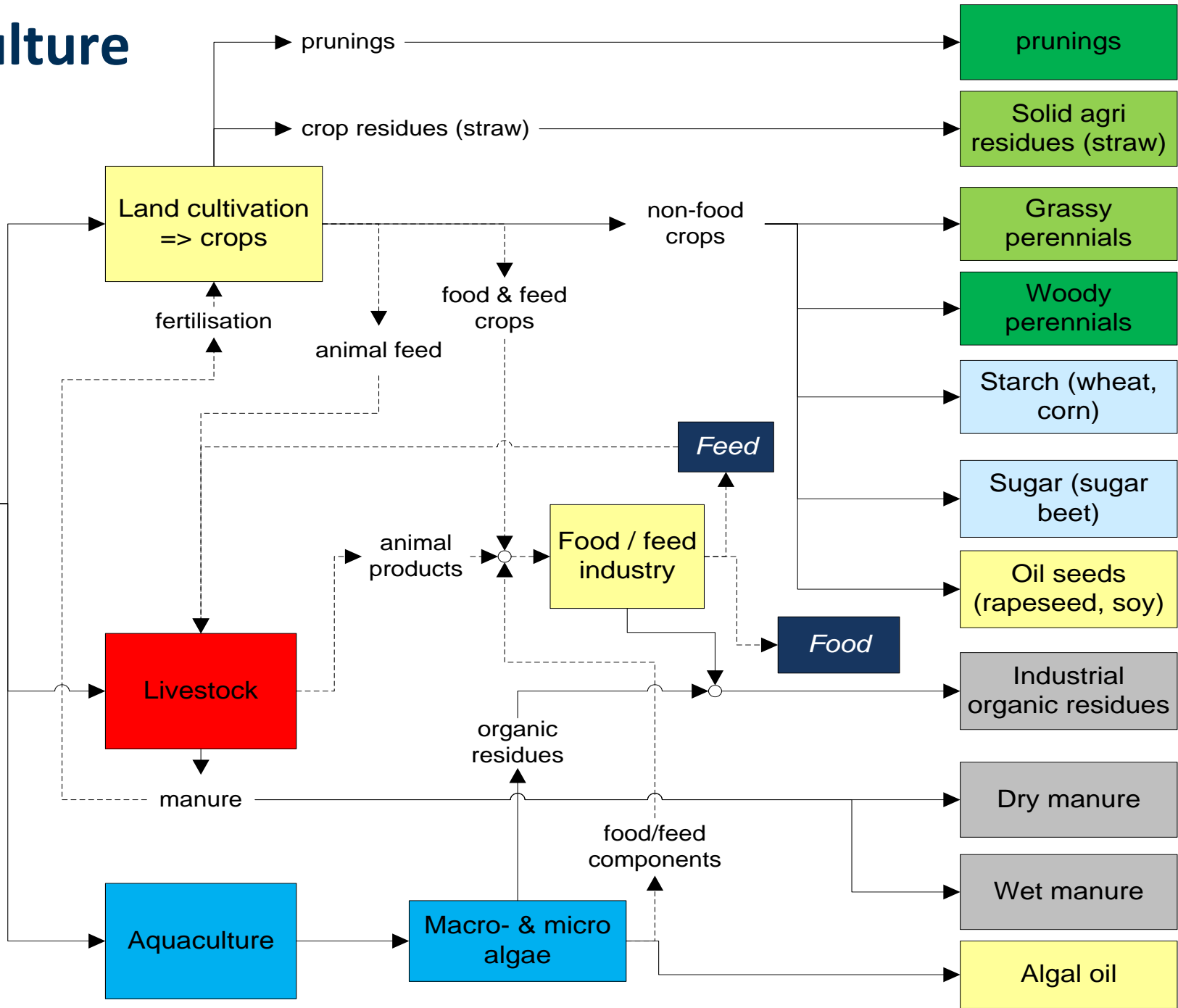
= the **biodegradable fraction** of products, waste and residues from **biological origin** from **agriculture** (including vegetal and animal substances), **forestry** and related industries including fisheries and aquaculture, as well as the biodegradable fraction of **industrial and municipal waste** (EC, 2009)

# Forestry & landscape management

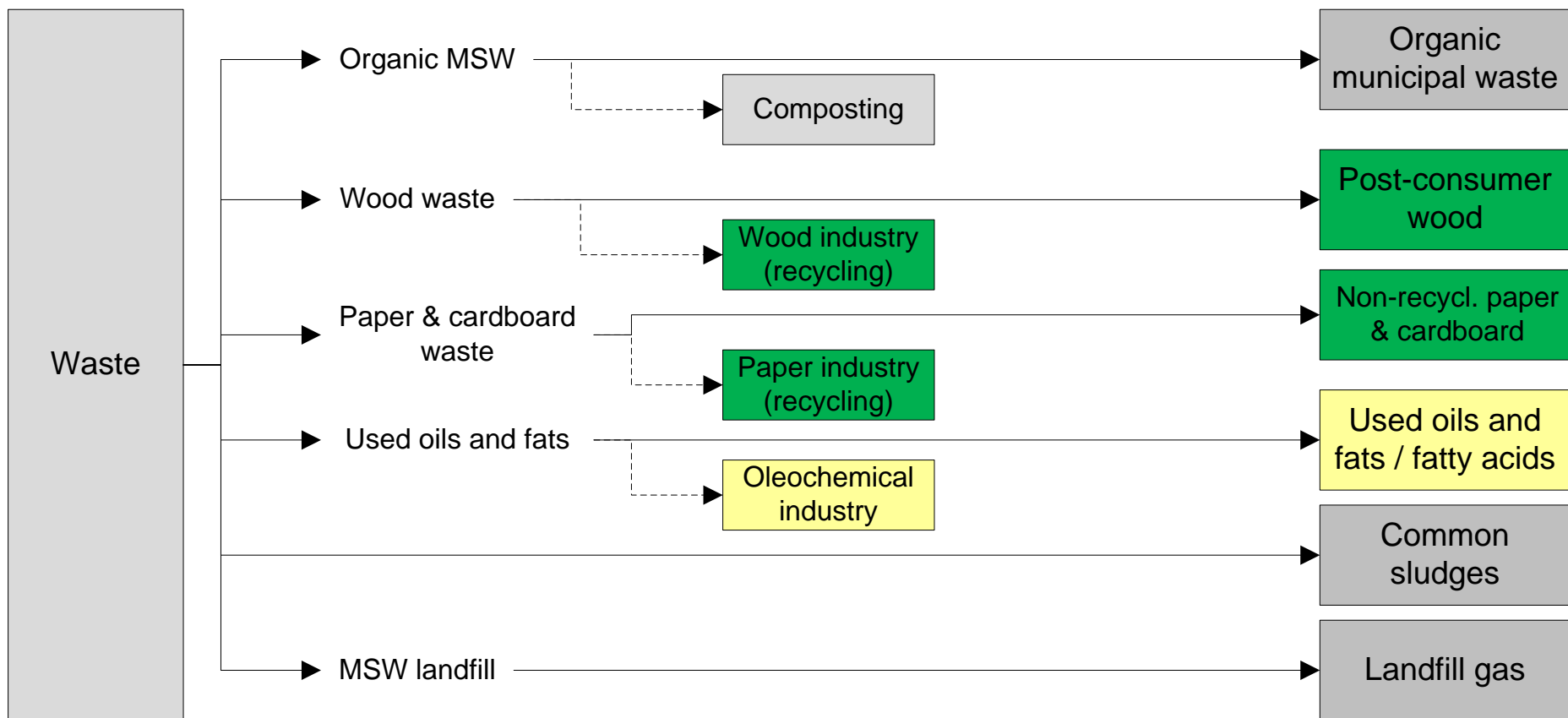


# Agriculture

Agriculture



# Waste



# Types of biomass

## » Lignocellulose

- » Stemwood, forest residues, industrial wood residues, post-consumer wood, woody crops (willow, poplar)
- » Energy grasses (miscanthus, reed, bamboo, ...), straw



## » Sugars & starch

- Sugar cane, sugar beet, wheat, barley, corn, potato, ...



## » Oils & fats

- Rapeseed, palm, sunflower, soy, animal fats, algae oil, used frying oil

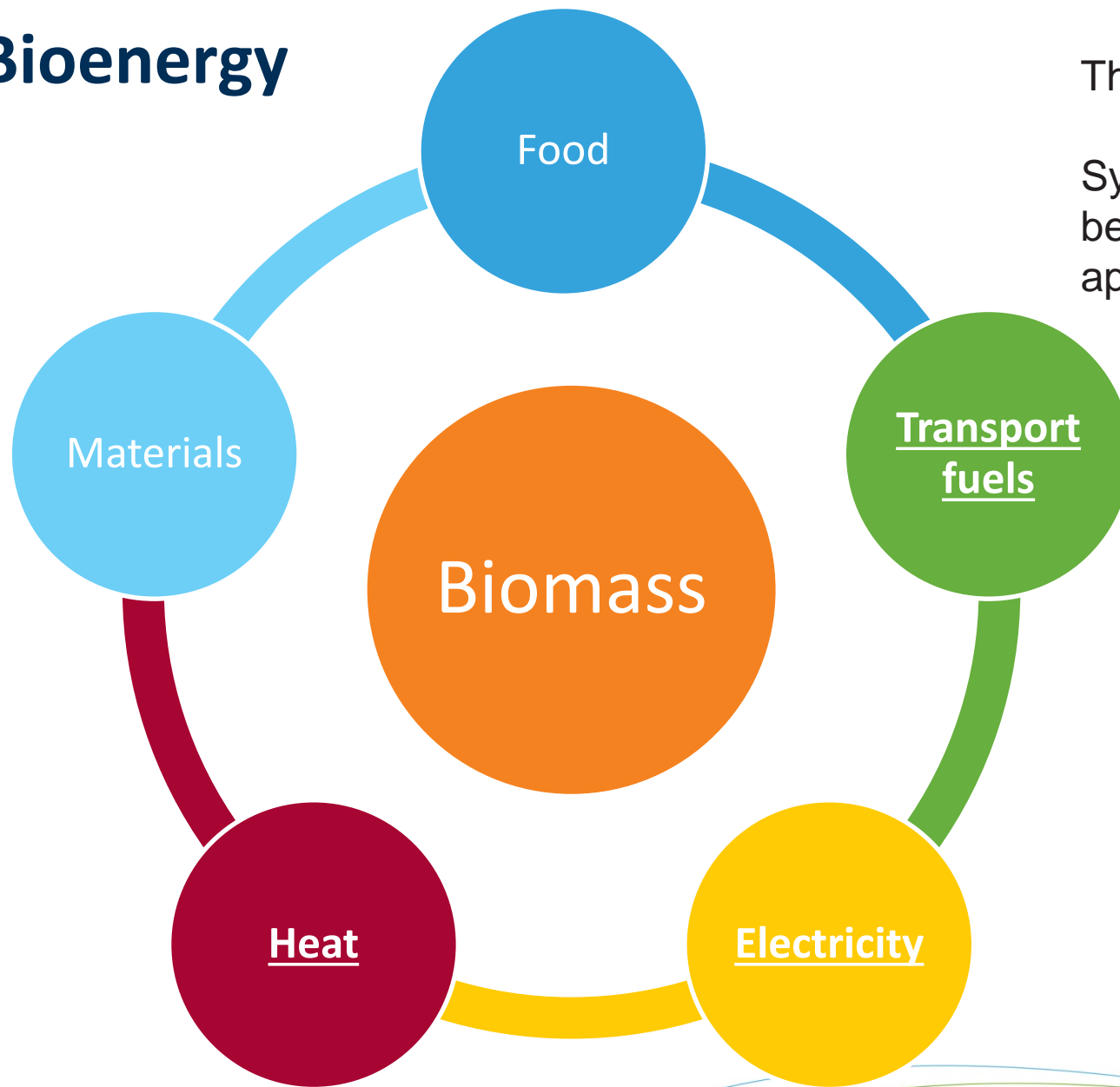


## » Digestible products

- » Maize, sludge, organic waste, manure, ...



# Bioenergy



Three types of bioenergy

Synergies & interactions  
between the different  
applications



# Heating

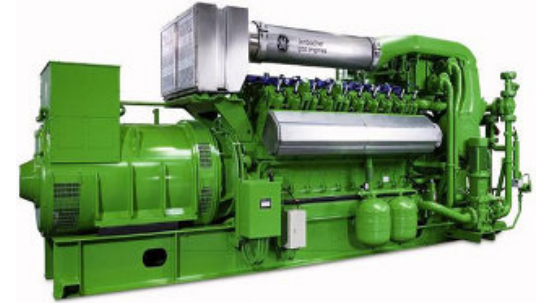
- » Small scale combustion (stoves, boilers)
- » Small-to-medium scale heating (buildings)
- » District heating
- » Industry process heat



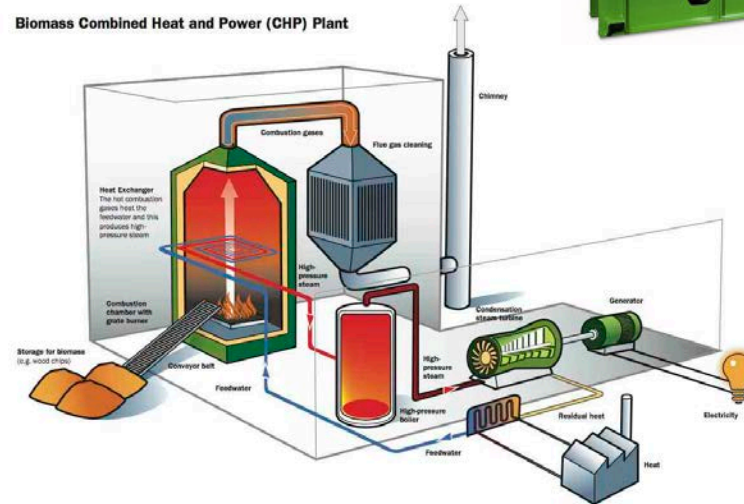
=> possibly in CHP mode (combined heat & electricity)

# Electricity

» Biogas engine/turbine, CHP



» Medium scale CHP



» Large scale combustion (potentially co-firing)

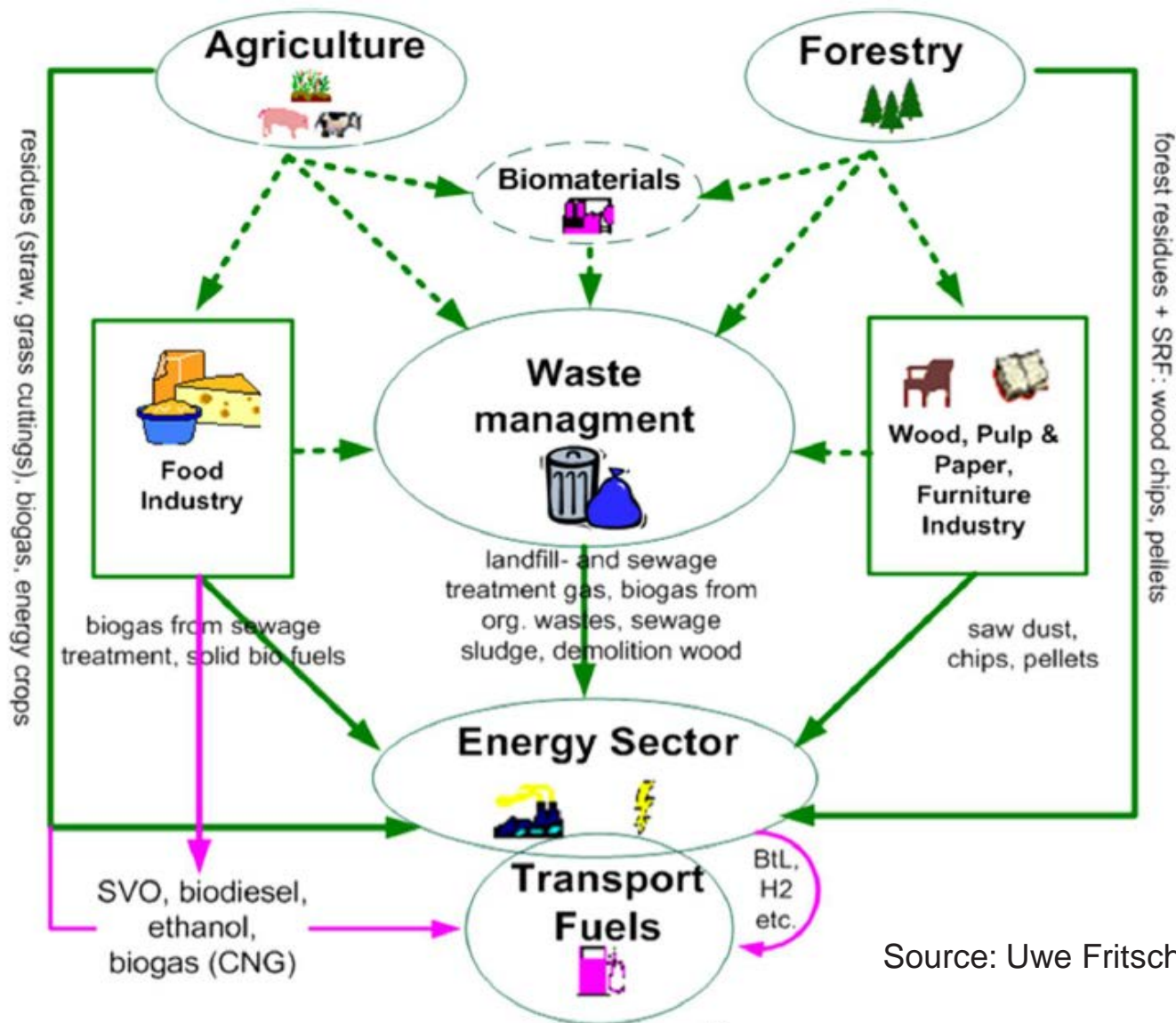


# Transport biofuels

- » Diesel type fuels (*compression ignition*):
  - » **Biodiesel** (fatty acid methyl ester)
  - » Pure vegetable oil
  - » Hydrotreated vegetable oils (HVO)
  - » Synthetic biodiesel: upgraded pyrolysis oil, Fischer Tropsch diesel (BTL)
  - » Bio-DME (di-methyl ether)
- » Gasoline type fuels (*spark ignition*):
  - » **Bio-ethanol**
  - » Bio-butanol
  - » Bio-methanol
- » Gaseous fuels:
  - » Bio-methane / SNG (synthetic natural gas)
  - » Bio-hydrogen



# Bioenergy - overview



Source: Uwe Fritsche, 2012

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# Situation 2012 (EU28)

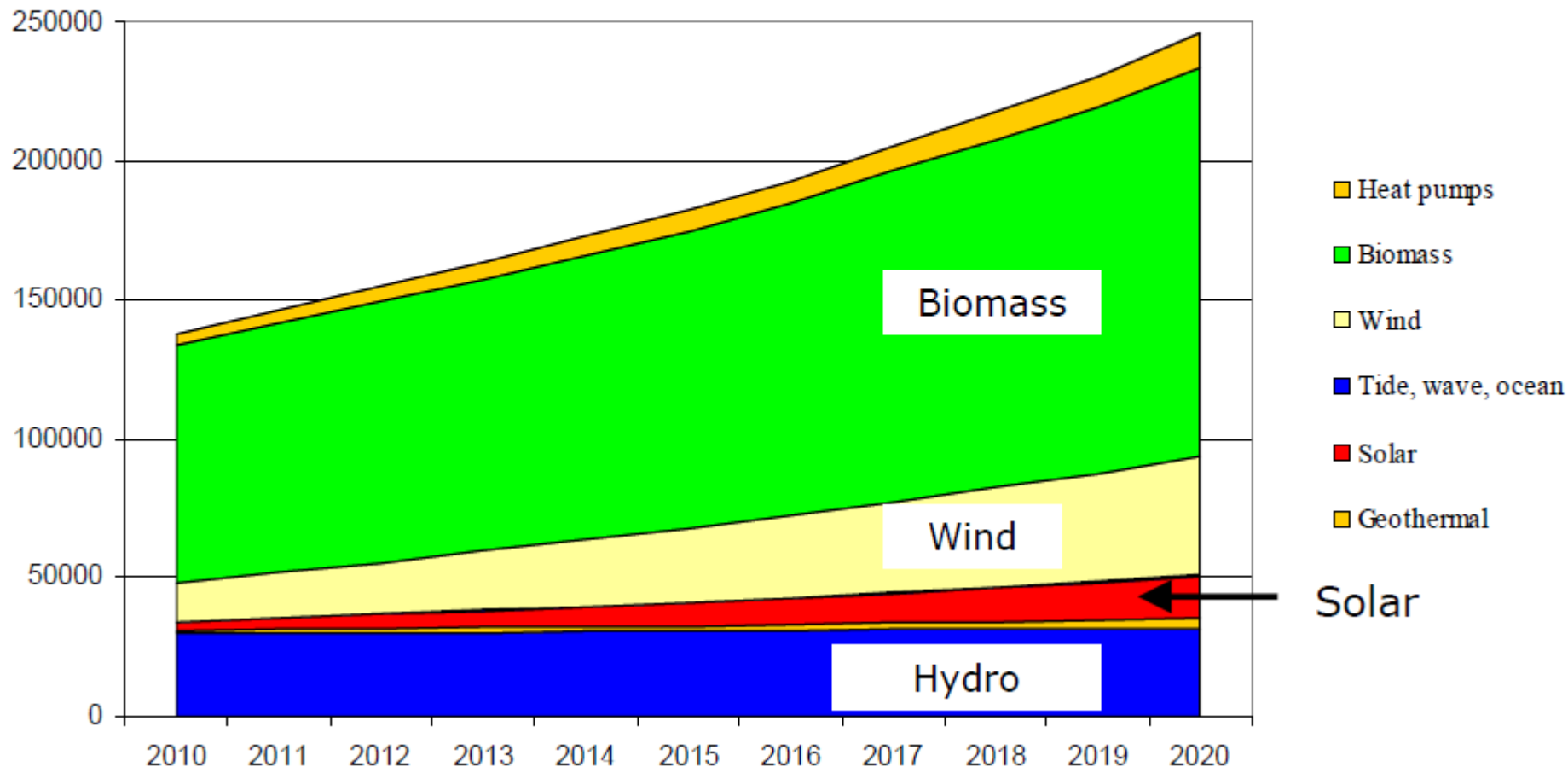
	2012	2020 target*
Overall renewable energy share	14.1 %	20.0 %
In electricity	23.5 %	31.3 %
In heating & cooling	15.6 %	19.2 %
In transport	5.1 %	10.1 %

\* According to NREAPs



# EU renewable energy outlook by 2020

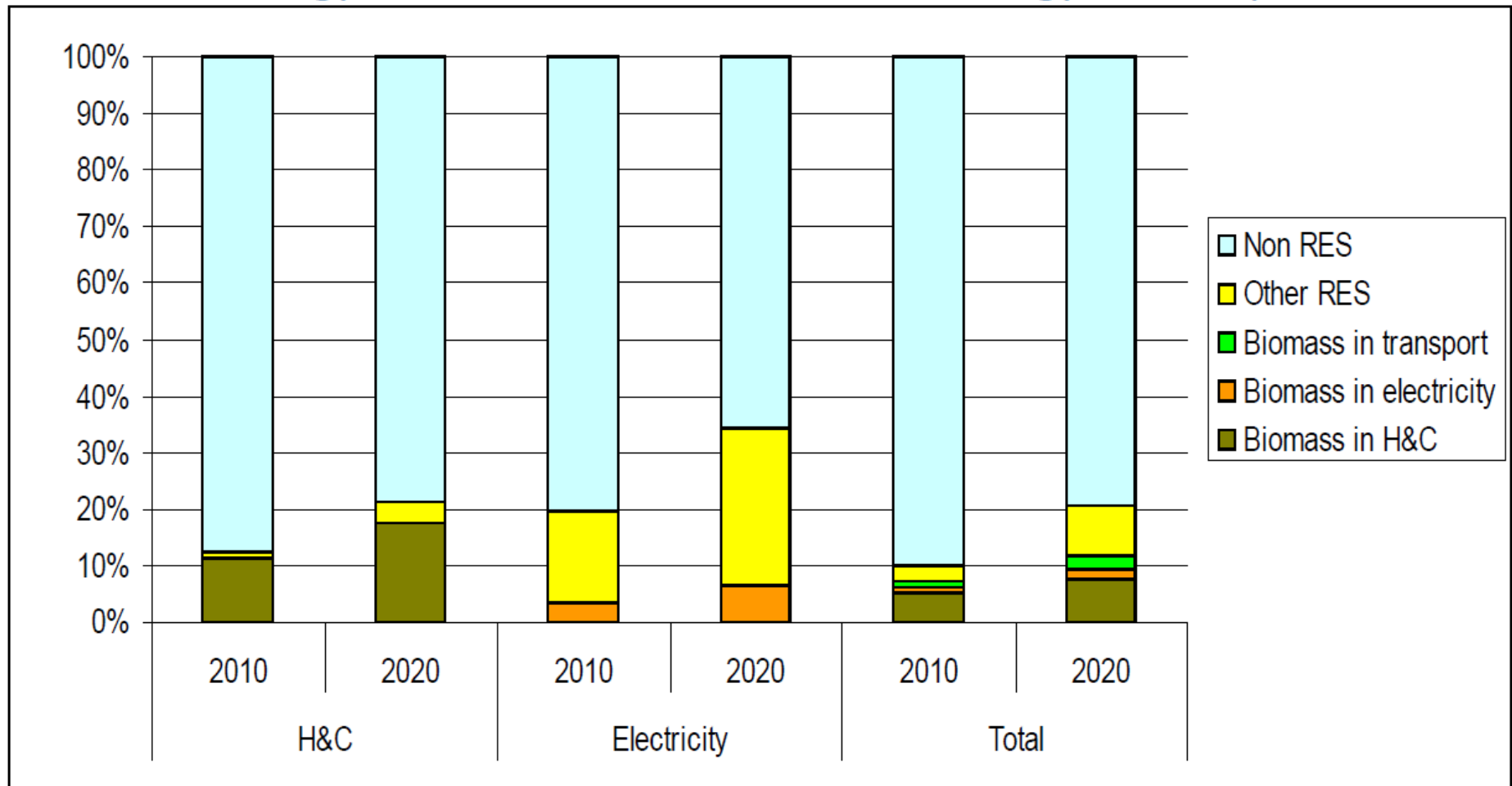
kep *Bioenergy = over 10% of EU total final energy consumption*



Based on NREAPs, Source: EC, 2012

# Renewable energy projections for 2020

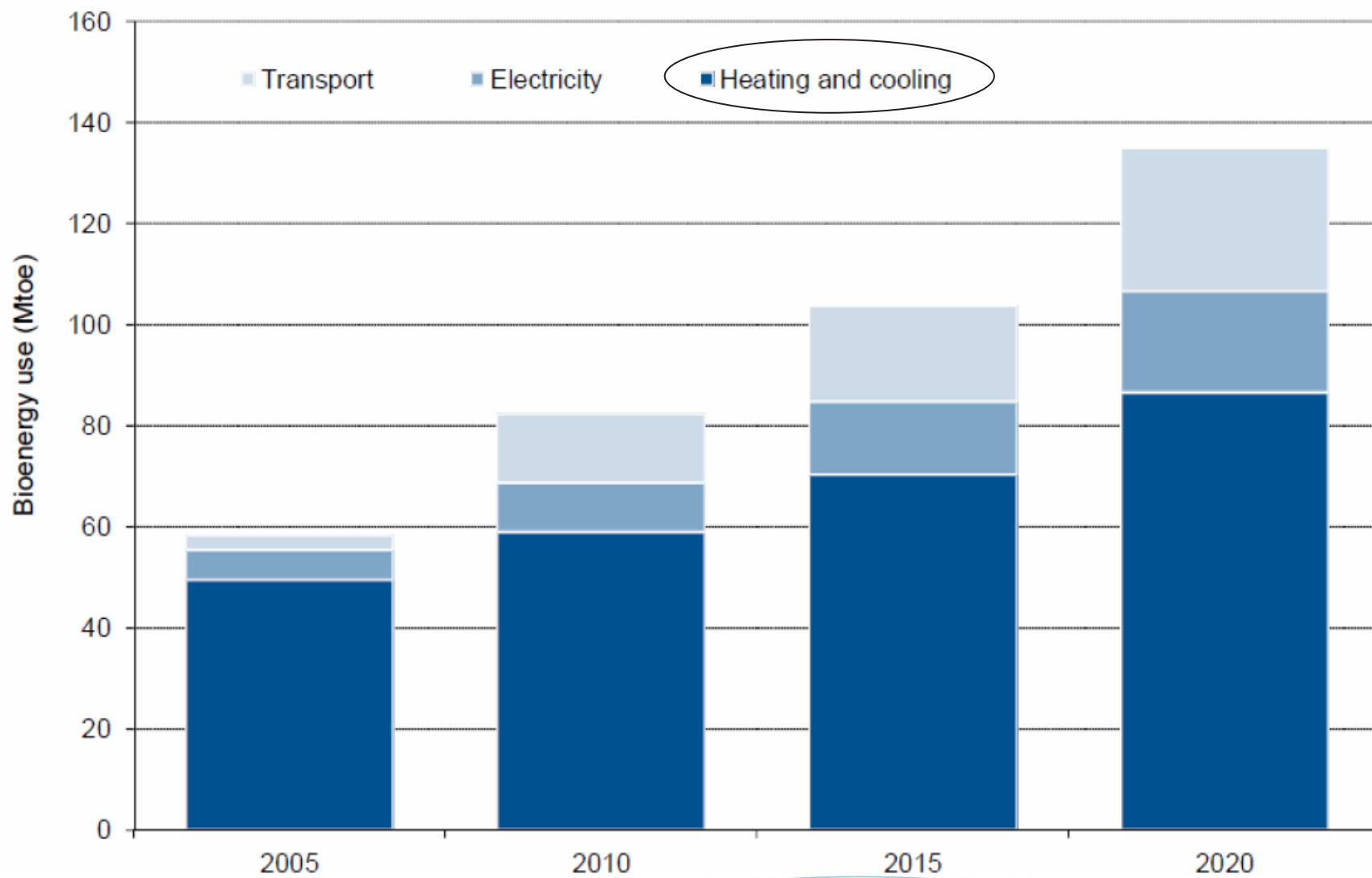
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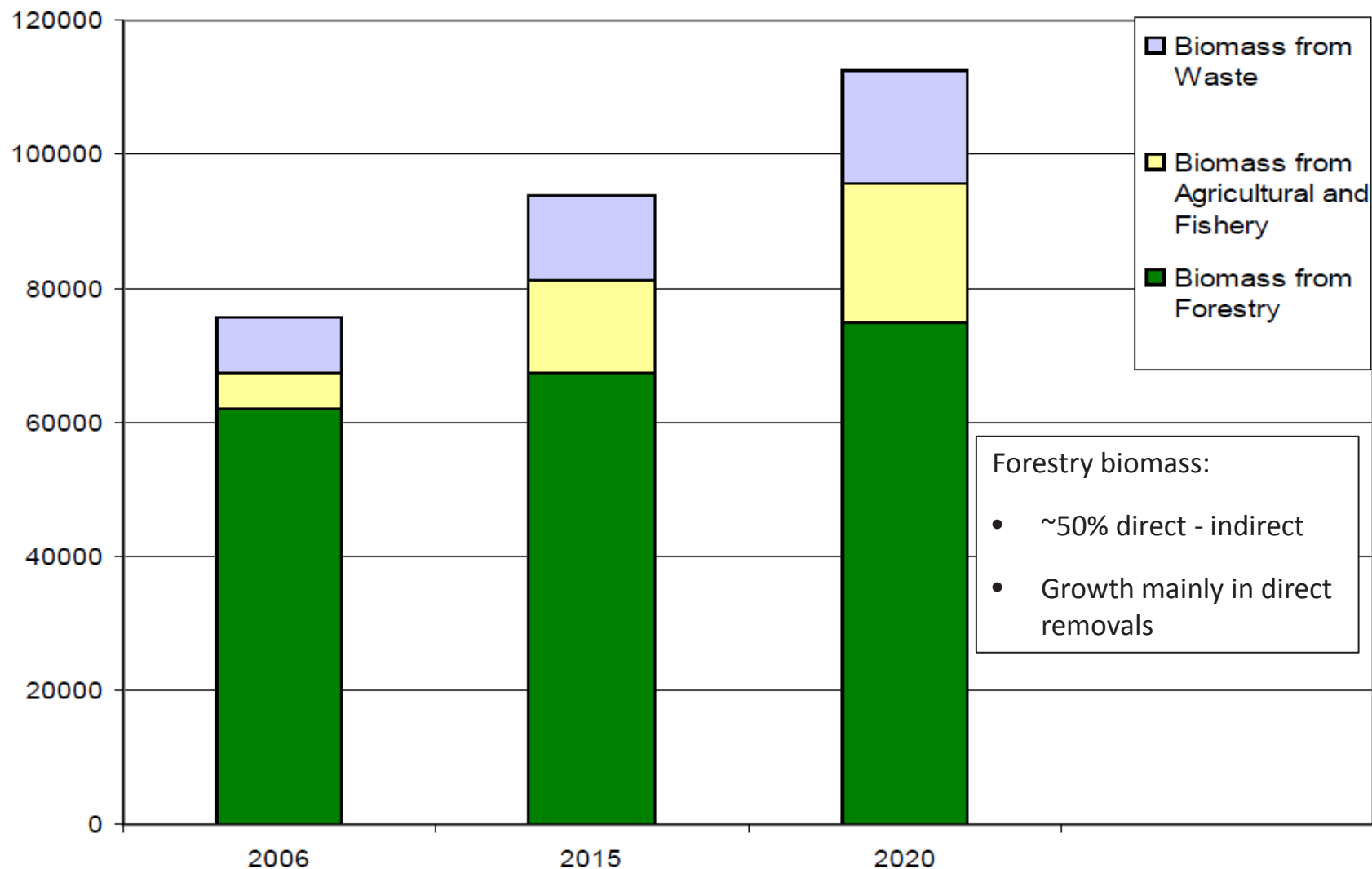
Based on NREAPs, Source: EC, 2012



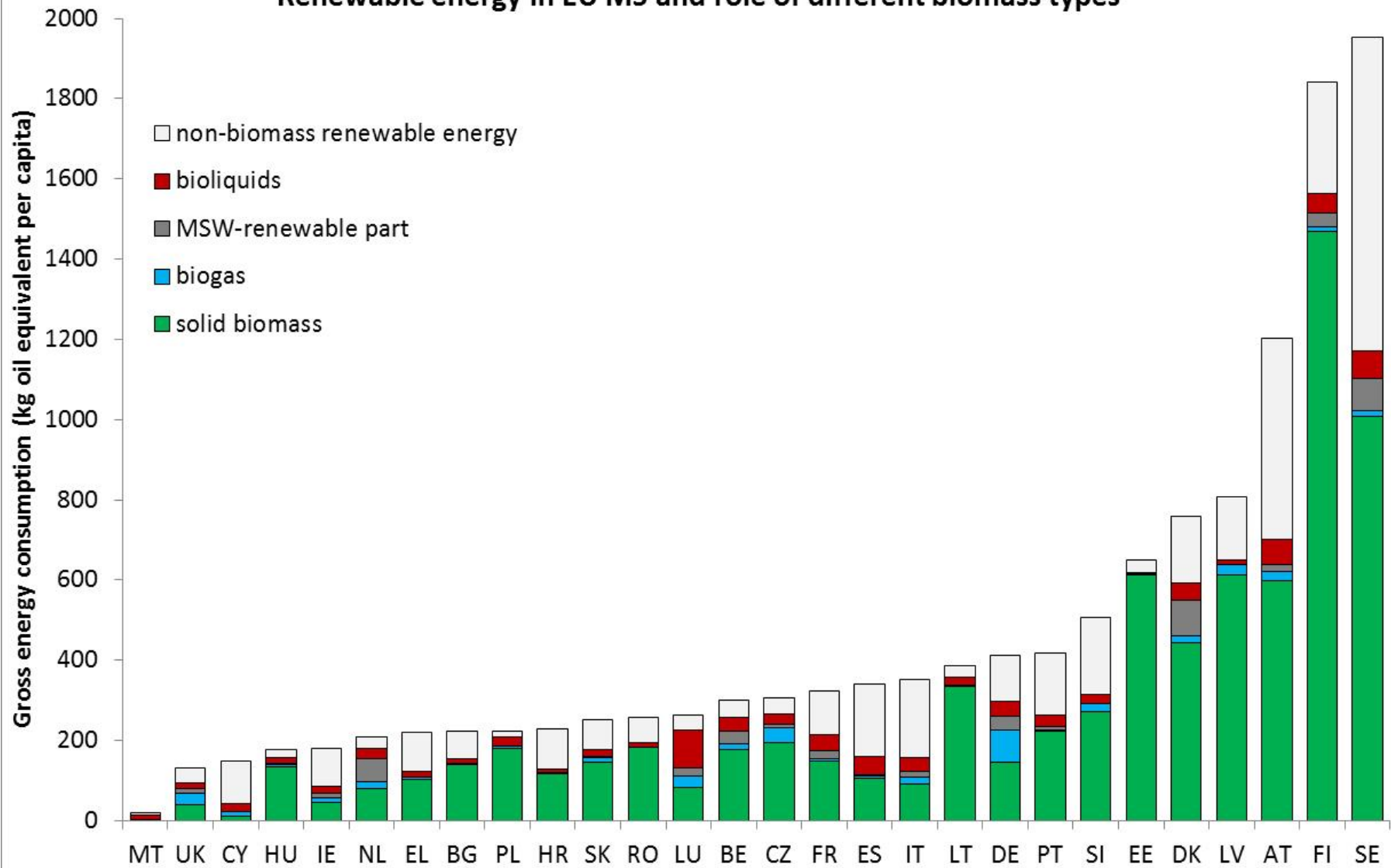
# Bioenergy projections for 2020



# Domestic biomass supply for 2020

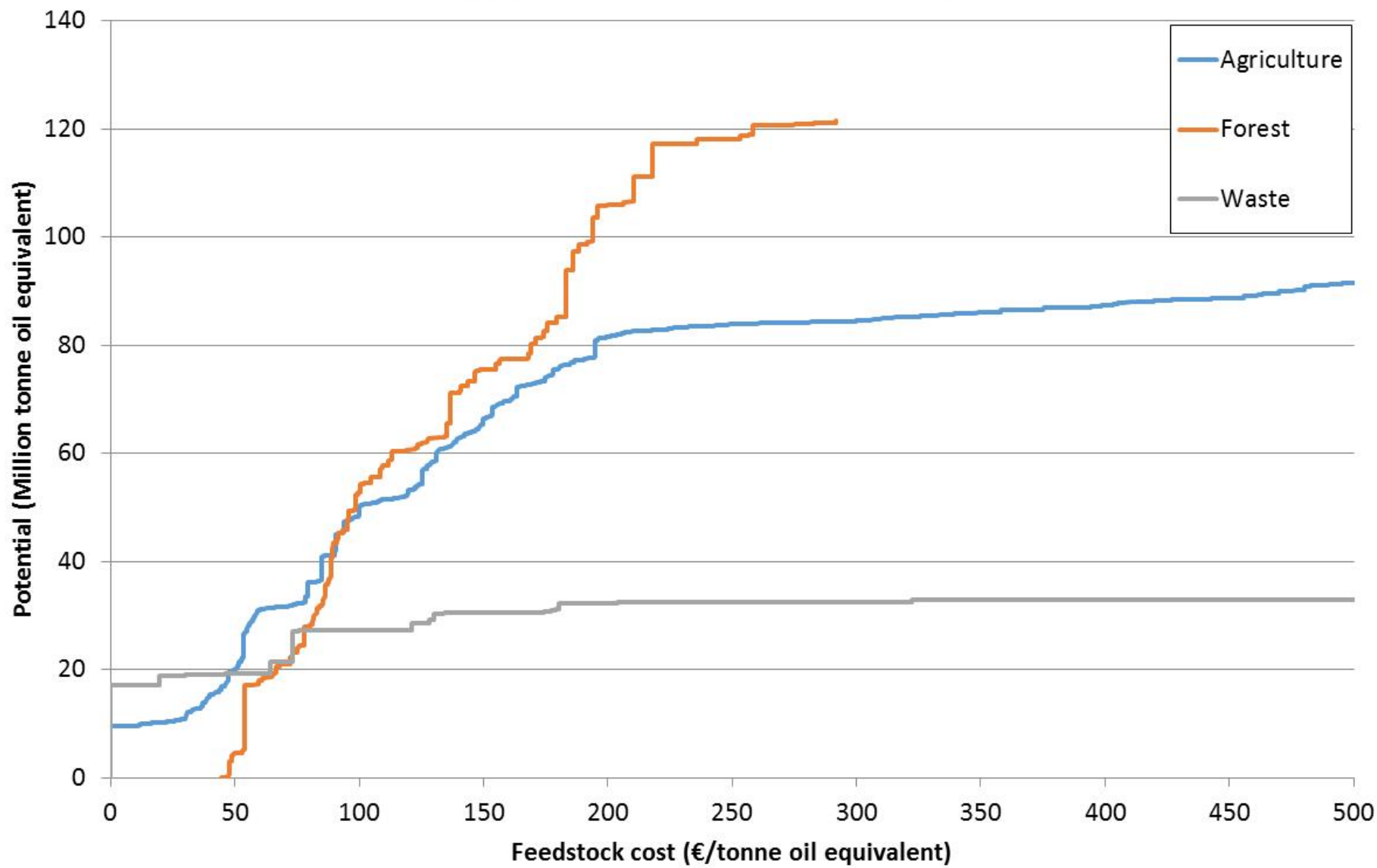


## Renewable energy in EU MS and role of different biomass types



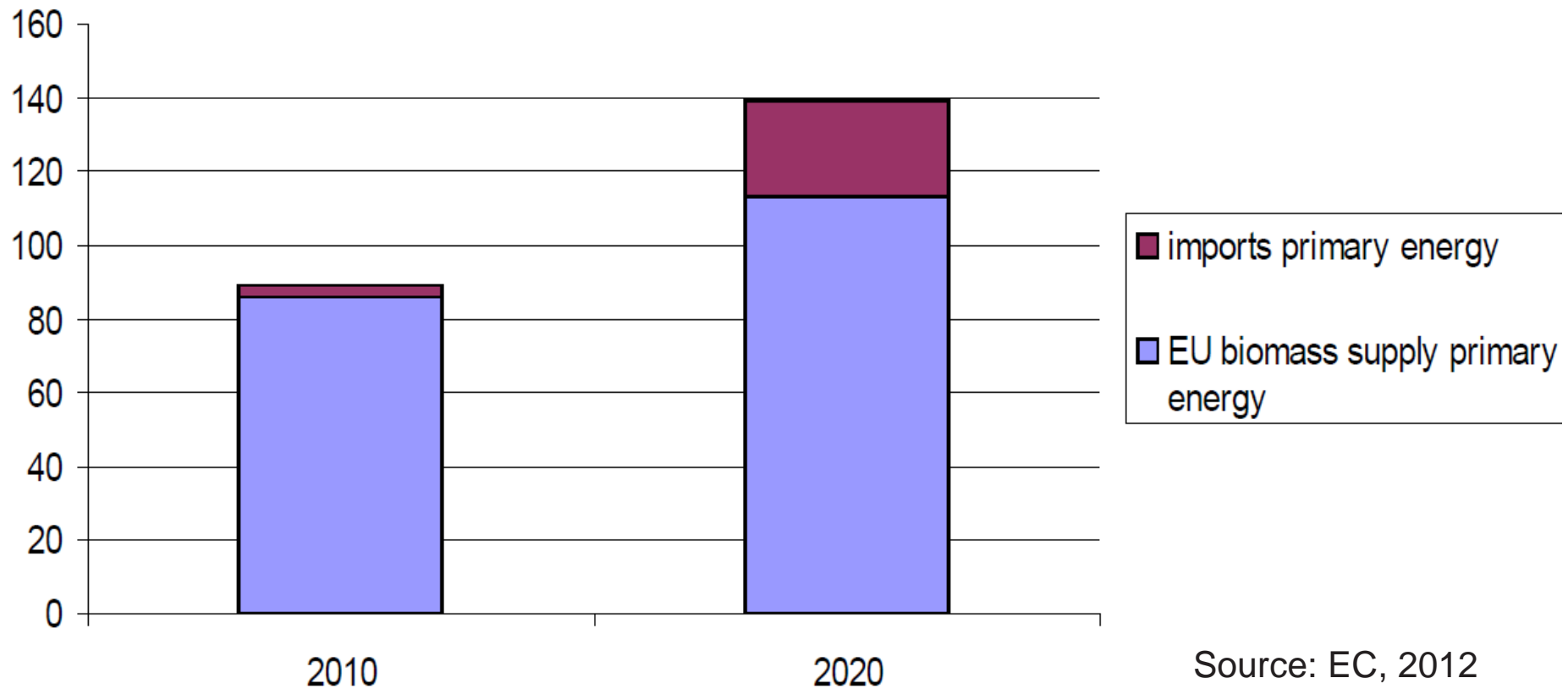
2012 data; source of the data: Eurostat

## Cost-supply curves - EU biomass potential (2020)



# Imports projections for 2020

Primary energy from biomass for H&C and electricity (Mtoe)



Source: EC, 2012

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# Sustainability

- » Driver bioenergy = **more sustainable fuel / energy supply**
  - need to ensure that biofuel & bioenergy deployment happens in a “sustainable” way
  - for domestic and imported biomass (*supply-demand balance*)
- » Public debate on greenhouse gas advantage, land use change, biodiversity loss, food vs fuel, carbon stock, ...
- » Society wants to see proof / safeguards
  - binding sustainability requirements in regulations
  - labels, voluntary certification schemes

# Sustainability principles (e.g. Cramer criteria, NL)

1. Positive **greenhouse gas balance of the biomass value chain**
2. No depletion of **carbon sinks** in the vegetation and in the soil
3. Not endanger **food supply and local biomass applications** (energy supply, medicines, building materials)
4. Not affect protected or vulnerable **biodiversity**
5. **Soil** and soil quality should be retained or improved.
6. Surface **water** must not be depleted and the **water quality** must be maintained or improved.
7. **Air quality** must be maintained or improved.
8. Contribute towards **local prosperity**.
9. Contribute towards the **social well-being** of the employees and the local population.



# Sustainability requirements in the Renewable Energy Directive (2009/EC/2008)

BIOFUELS CRITERIA	
GHG emission savings	At least 35% life cycle savings (50-60% from 2017/18) compared to fossil fuel
Land use criteria	No conversion of land with high carbon stock <ul style="list-style-type: none"><li>• Densely forested areas, wetlands, peatlands</li></ul> No raw material from land with high biodiversity value <ul style="list-style-type: none"><li>• Primary forest, nature protection areas, highly biodiverse grasslands</li></ul>
Agri-envir. criteria	EU feedstock to comply with cross-compliance rules (Regulation 73/2009)
Implementation	Compliance with criteria mandatory to: <ul style="list-style-type: none"><li>• Count toward the national renewable energy targets</li><li>• Count toward supplier obligations</li><li>• Be eligible for financial support</li></ul>

# EC reporting



- » Every two years report (*starting Dec 2012*) on  
(*both for third countries and Member States*)
  - » measures taken for soil, water and air protection,
  - » impact on social sustainability,
  - » availability of foodstuffs at affordable prices,
  - » land-use rights,
  - » For significant exporters of biofuels raw materials to the EU
    - » Implementation of Conventions of International Labour Organisation,
    - » Implementation of Protocol on Biosafety & Convention on International Trade in Endangered Species of Wild Fauna and Flora.

# Indirect land use change (iLUC)

- » Major discussions in the past years on iLUC, in relation to the expected growth of biodiesel & bio-ethanol for EU markets
- » Different studies & publications (Searchinger, ...) on the impact of iLUC
  - » Global modelling for very complex interactions
  - » IFPRI study (subcontract for EC)
- » EC decision on how to deal with iLUC (scheduled in 2010) was delayed
  - Uncertainty for the market
  - Proposal to amend the RED & FQD (see further)

# iLUC modelling

Distribution of LUC GHG emissions according to IFPRI (2011), in CO<sub>2</sub>-eq/MJ\* biofuels

*\*Current fossil reference = 83.8 CO<sub>2</sub>-eq/MJ*

	5 percentile	Median	95 percentile
<b>Additional Mandate</b>	<b>24.4</b>	<b>38.8</b>	<b>50.4</b>
Wheat	8.3	13.8	18.4
Maize	6	10.1	13.2
Sugar Beet	0.8	7.2	12.6
Sugar Cane	6.5	15.4	26.5
Soybean	38.4	56.3	73.9
Sunflower	30.6	53.5	72
Rapeseed	28.2	54.9	80.7
Palm Fruit	47.1	54	60.3

Source: MIRAGE-Biof Simulations

Tough story for biodiesel

# COM(2012)595 *(Oct 2012)*: proposal to amend the RED and FQD

- » In relation to iLUC & potential impact on food prices
- » Proposal:
  - » Contribution of food-crop based biofuels limited to 5% (*~current contribution*)
  - » Stimulate non-land using & advanced biofuels (multiple counting)
  - » Min. 60% GHG reduction for new installations from June 2014 (instead of 2018)
  - » Reporting with 'iLUC' factors
  - » From 2021 possibly iLUC factors in GHG calculation (on the basis of EC report in 2017)

# Status iLUC negotiations

- » Negotiation between EU Parliament and the EU Council (MS); agreement on 28 April 2015
  - » 7% cap on agricultural crops (*incl. lignocellulosic crops*)
  - » Non-binding national targets of 0,5% advanced biofuels
  - » List of feedstocks eligible for double counting (*not from waste which is subject to re-use and recycling targets*)
  - » Reporting of iLUC values (not included in carbon accounting)
  - » Higher counting of renewable electricity in transport
- » Formal adoption can be quite soon; will enter into force in 2017
- » iLUC debate started in 2010, created uncertainty for investors

# 2030 climate and energy policy framework

- » Suggested targets for 2030:
  - » Greenhouse gas emissions: at least 40% reduction compared to 1990 levels (EU)
  - » Renewable energy consumption: minimum 27% share, binding at EU level
  - » Energy efficiency: 30% improvement (compared to projections)
- » *No national RE objectives, no specific target for transport*
- » *No support for crop-based biofuels after 2020*
- » *Sustainability criteria remain*

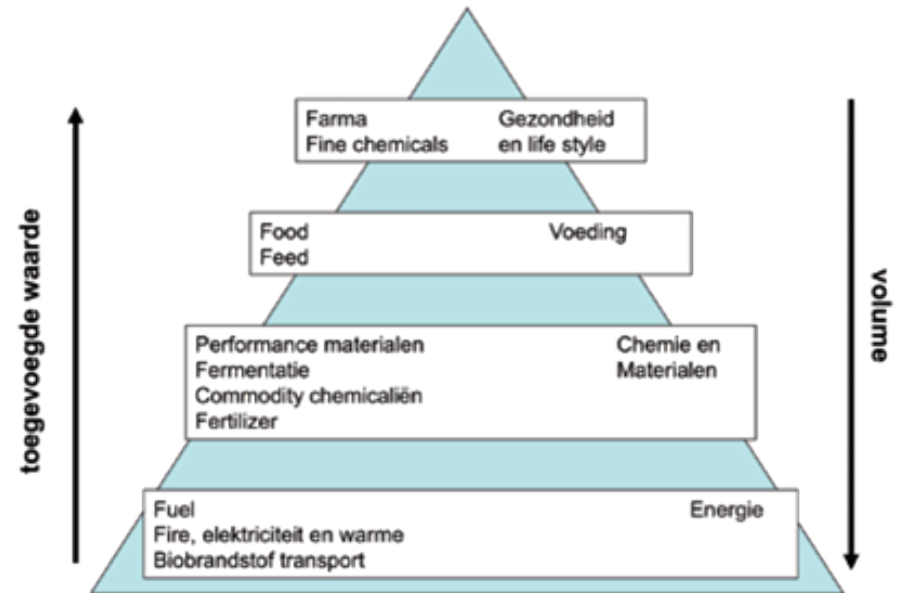
# Resource efficiency

- » *Resources* = all natural resources that are inputs into our economy,
  - metals, minerals, fuels, fish, timber, water, soil, clean air, biomass, biodiversity and land and sea
- » Resource efficiency = **deliver more with less**
  - » more productive use of resources over their life cycle
  - » using resources in a sustainable way, within the planet's long-term boundaries
    - => minimal impact of one resource's use on other resources, incl. environment

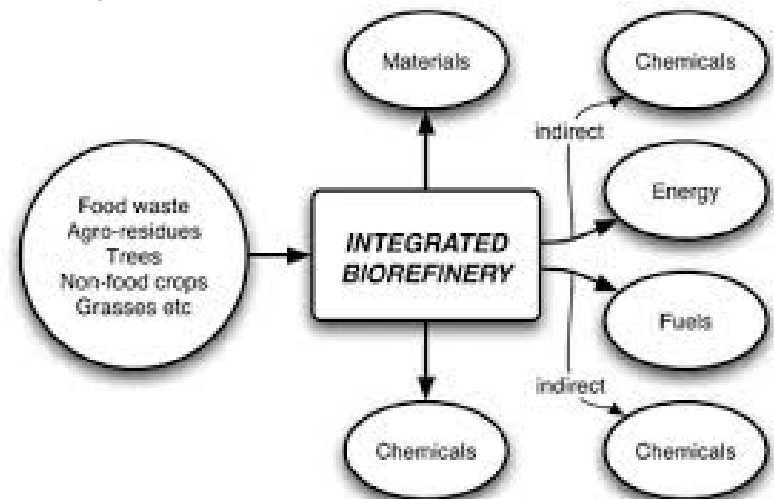


# Resource efficiency

» Cascading use of biomass =>  
“produce higher value products first;  
energy only based on residues”






- » Integrated biorefineries => integration, improve economics
  - » ~ oil refineries
  - » Sugar refineries
  - » Pulp & paper refineries
- » Market driven, difficult to steer



# Conclusions

- » Important role of biomass in the renewable energy target (>50% of RE target through biomass)
- » Importance of biomass in **heating & cooling** (85-90%) => biomass (wood) is traditionally the most important source of renewable heat
- » Role of biomass in electricity is more modest (20% of RE); integration with other renewable electricity sources!
- » Biofuels most important renewable energy in transport (>90%); potential role of (renewable) electricity in transport (on the longer term)
- » Woody biomassa (forestry, direct & indirect) remains dominant.
- » Growing role of imports by 2020 (biofuels & wood pellets)
- » On-going discussions on sustainability and resource efficiency – various policy initiatives to steer this

# Background: EU projects

- » IEE project: Biomass Policies ([www.biomasspolicies.eu](http://www.biomasspolicies.eu))   
*“Strategic Initiative for Resource Efficient Biomass Policies”*
  - develop integrated policies for the mobilisation of “resource efficient” indigenous biomass ‘value chains’. Support policy implementation in the 11 participating MS.
  
- » FP7 project: S2BIOM ([www.s2biom.eu](http://www.s2biom.eu))   
*“Sustainable supply and delivery of non-food biomass to support a “resource-efficient” bio-economy in Europe”*
  - develop strategies and roadmaps with up-to-date harmonized datasets for EU28, western Balkans, Turkey, Moldova and Ukraine.
  
- » IEE project: BioTrade2020+ ([www.biotrade2020plus.eu](http://www.biotrade2020plus.eu))   
*“Supporting a sustainable European Bioenergy trade Strategy for 2020 and beyond”*
  - analyse the potentials (technical, economical and sustainable) and assessing key sustainability risks of current and future lignocellulosic biomass and bioenergy carriers in the main sourcing regions to the EU

# Thanks for your attention

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[www.s2biom.eu](http://www.s2biom.eu)

[www.bioenergytrade.org](http://www.bioenergytrade.org)

[www.ieabioenergy.com](http://www.ieabioenergy.com)

