Industrial Material Use of Renewable Raw Materials (RRM) - incl. Green Chemistry and bio-based materials and products

Feedstock and Policy

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NACHWACHSENDE ROHSTOFFE
RENEWABLE RAW MATERIALS

DIVISION

Renewable Resources

Markets, Economy & Technology

Communication

nova institute
for ecology and innovation

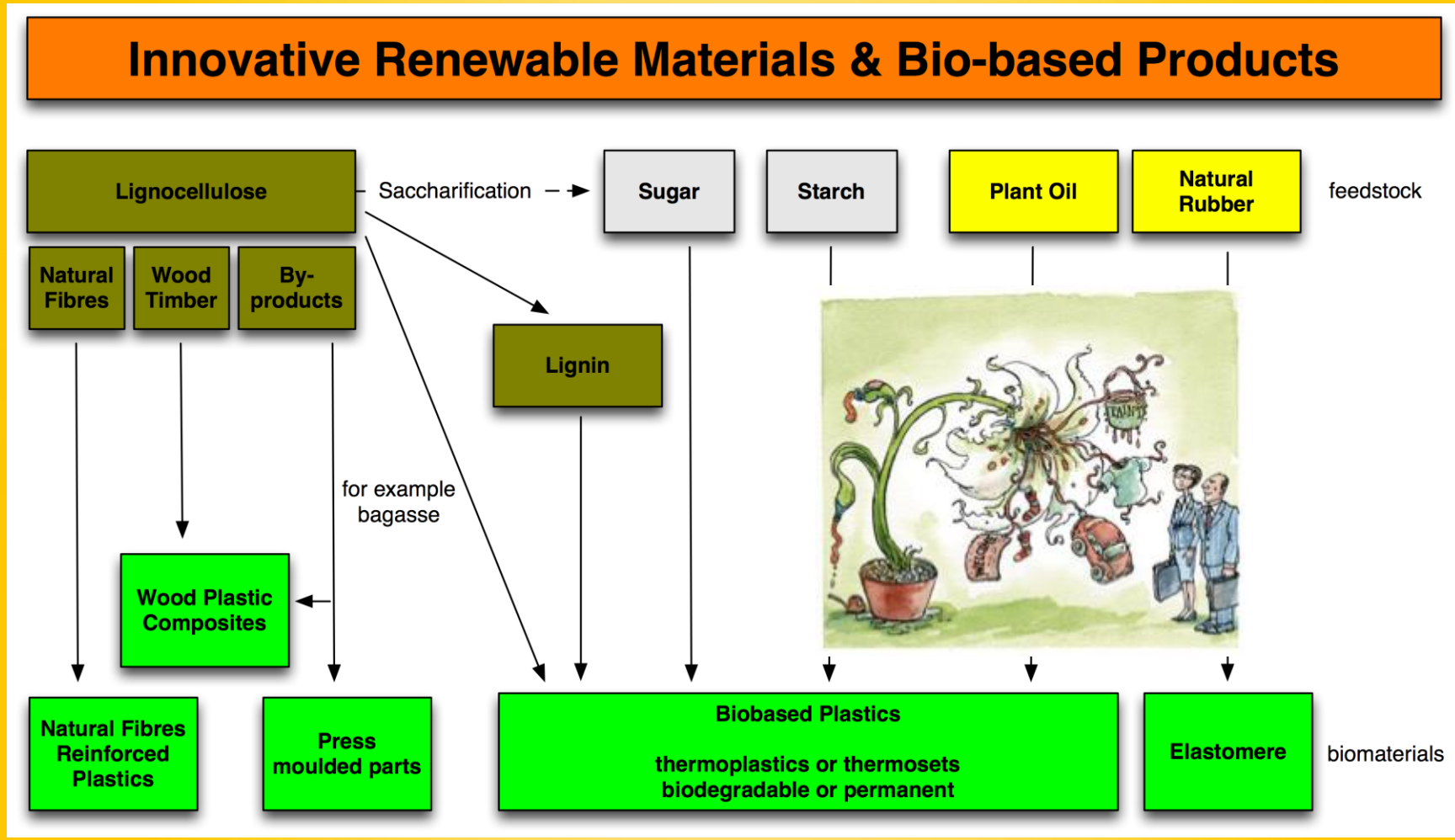
Areas of Work

- Resource management - feedstock availability, price development and usage competition: agricultural, forest and fossil resources
- Industrial material use of renwable resources and bioenergy
  - Industrial biotechnology / biorefinery
  - Bio-based products – bio-based plastics and composites, WPC and Natural Fibres Reinforced Plastics (NFRP)
  - Cascading utilization
- Electro-Mobility
- Political framework for a sustainable bio-based economy

Services

Market, Economy & Technology	■ Market research and economic analysis ■ Feasibility and potential studies ■ Techno-economic evaluation ■ LCA-Meta-Analyses ■ Network and project management
Communication	■ Marketing support ■ Dissemination of information – internet and print ■ Wikipedia Training ■ Workshop & Conferences ■ Collaboration with associations & committees

Innovative Renewable Materials & Bio-based Products



A) Agricultural Feedstock worldwide – How to increase the production?

1. **Increasing the yields**

The tremendous potential for increasing yields in the developing countries is hindered by lack of technology and infrastructure unfavourable agricultural policies like no access to credits, an insufficient transmission of price incentives, poorly enforced land rights.

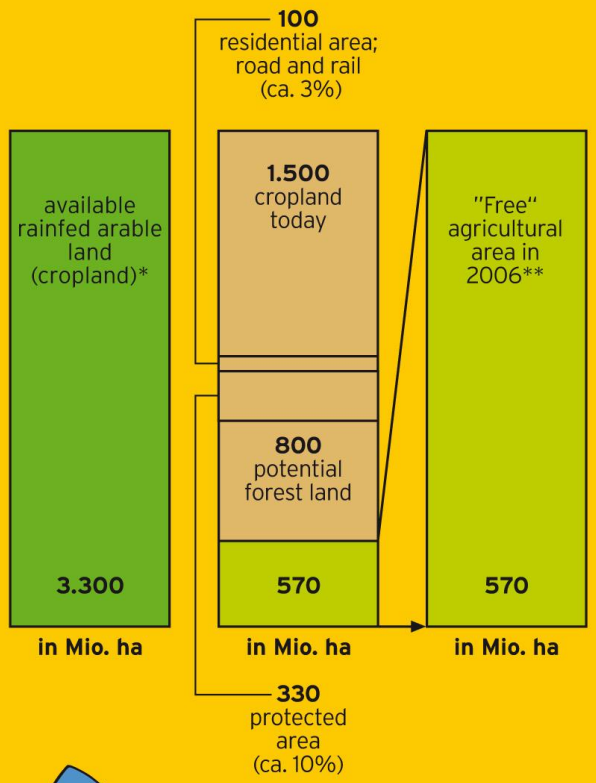
2. **Expansion of arable land**

Some 0.6 (nova 2008) to 1.6 billion (FAO 2009) ha could be added to the current 1.4 billion ha of cropland (excluding forests, urban areas, protected areas).

The solution for 1 & 2: Political reforms, investment in agro-technologies

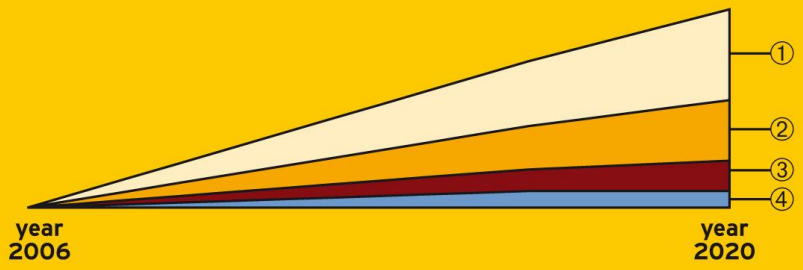
3. **GMO (not my topic)**

"Free" agricultural area in 2006 and the global demand of area in 2020



The global demand on land use in 2020:

1	increasing demand of food per capita due to an increase in purchasing power (more meat,...)	**ca. 96 Mio. ha**
2	increasing demand of food due to population growth	**ca. 64 Mio. ha**
3	residential area, road and rail	**ca. 32 Mio. ha**
4	Biofuel in the most important Biofuel countries***	**ca. 18 Mio. ha**
		Σ 210 Mio. ha



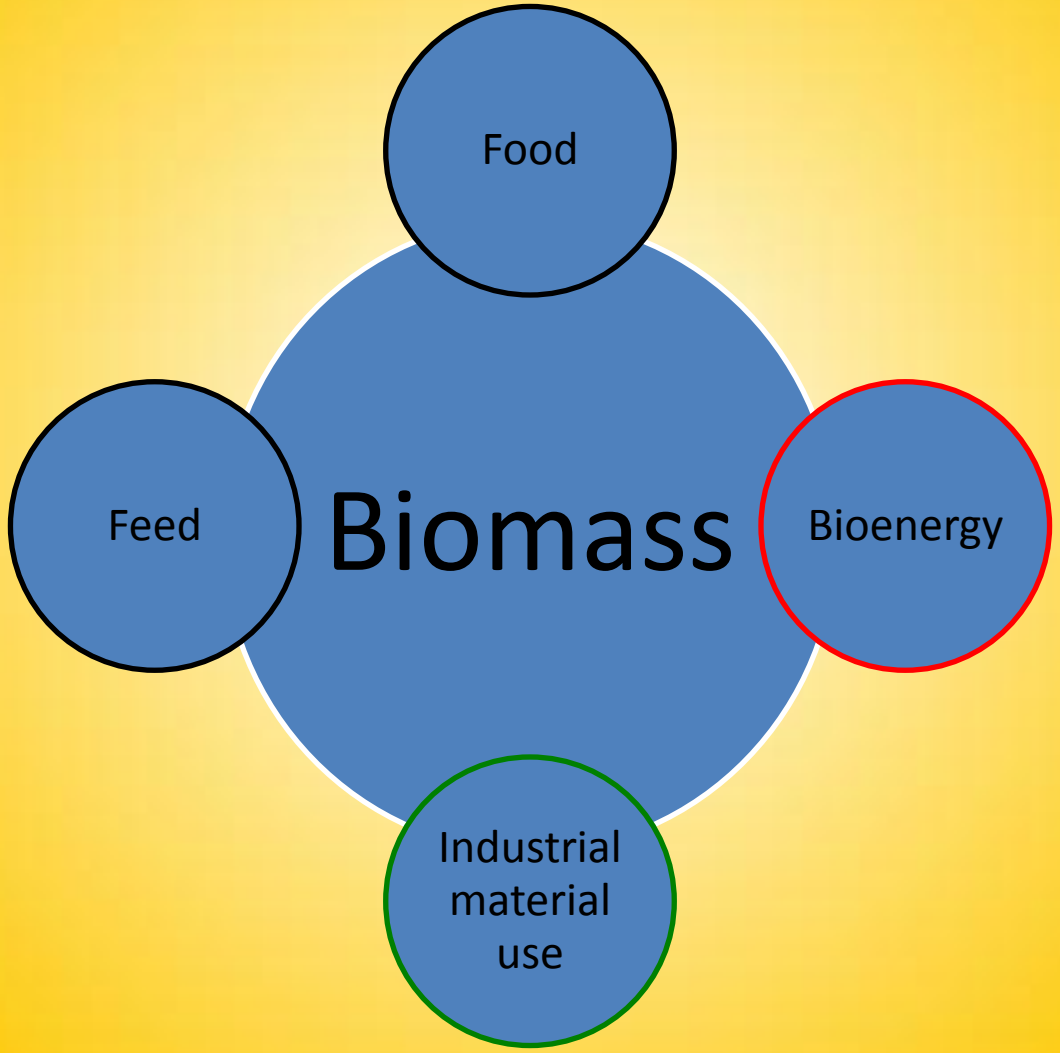
* FAO 2000 indicates a potential of 4,2 Mrd. on ha

** De facto parts of the "free" crop lands could be considerably disadvantageous in terms of natural resources or market access

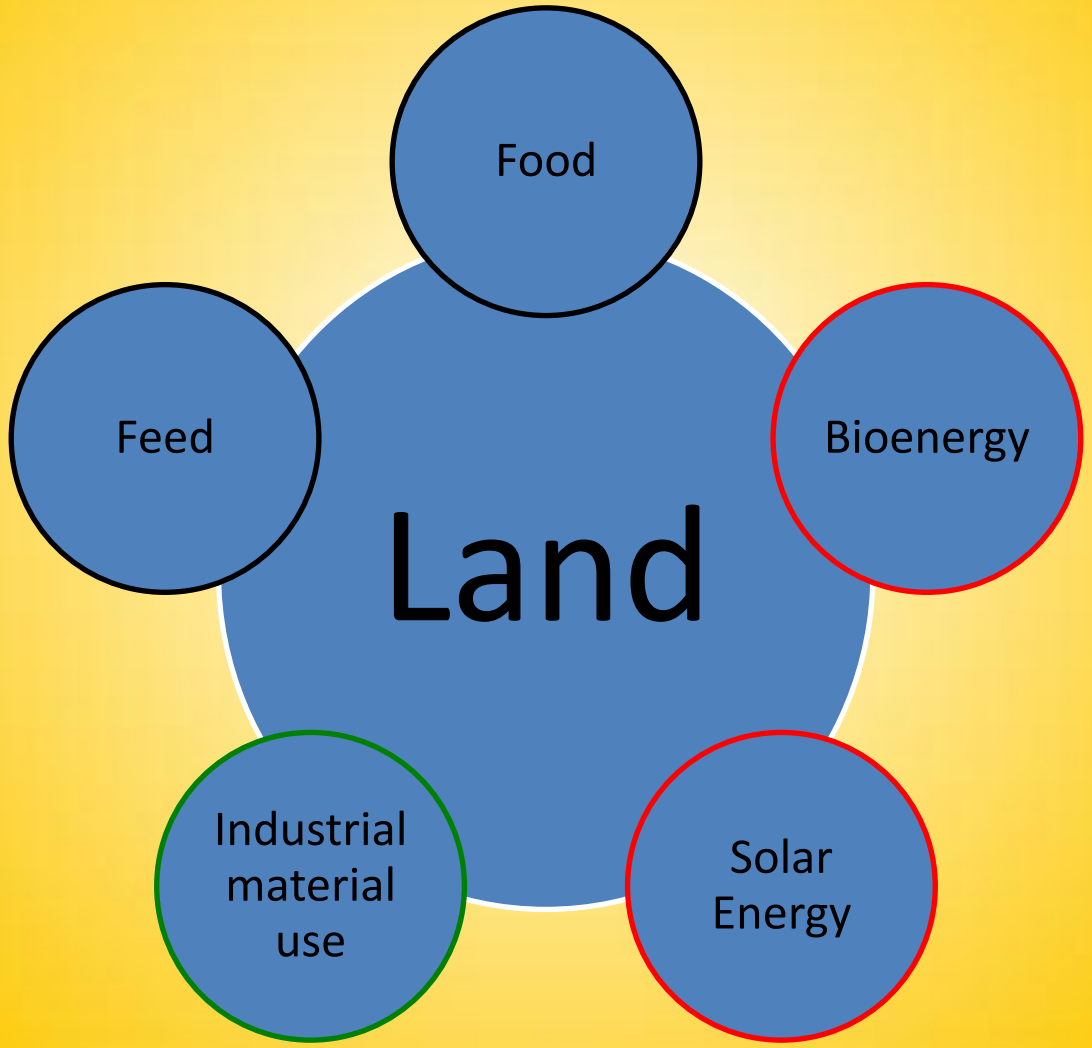
*** The calculation is based on OECD-FAO 2007: It is assured that most of the resources are from the demand region; yield increase of 1%/a, updating product from 2016 to 2020

Source: FAO 2008, OECD 2007, OECD-FAO 2007, FAPRI 2007, nova 2007, FAO 2000

B) Competition for biomass



Competition for land



C) Bioenergy versus Solar Energy

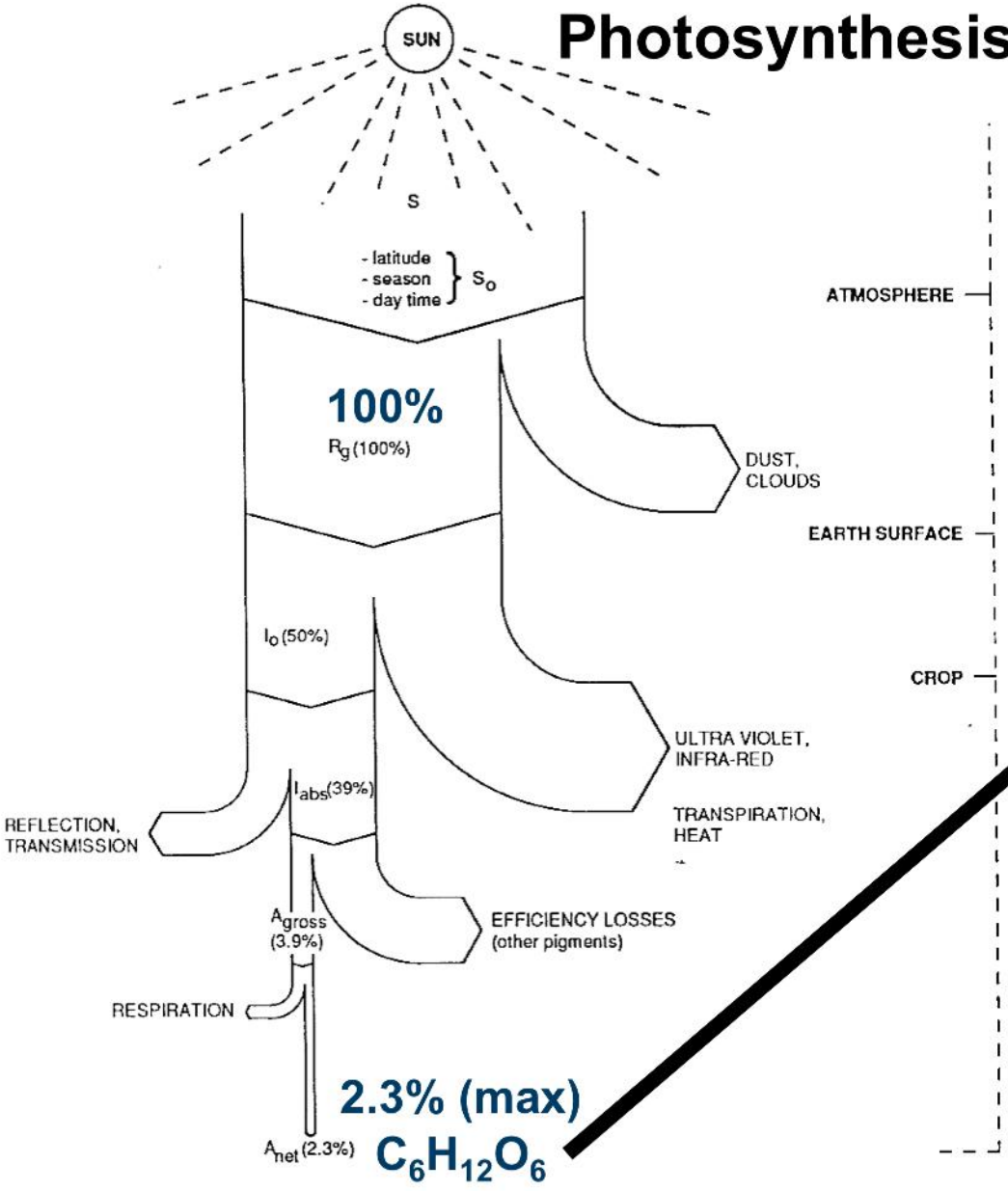
1. Very low efficiency compared to solar energy (low solar yield)

2. Competition to other uses of arable land (food, feed, industrial material use)

3. Too expensive
   - Bioenergy needs strong support from policy
   - Increasing prices for agricultural raw material
   - Decreasing prices for wind and solar energy

4. Using more wind and solar energy instead of bioenergy will liberate huge tracks of land, which can the be used for the production of industrial material and also for food and feed.

Photosynthesis



Energy efficiency

Annual actual efficiency

0.5 – 2.3% gross (crop)

processing to final biofuel:

0.2 – 0.8% net energy

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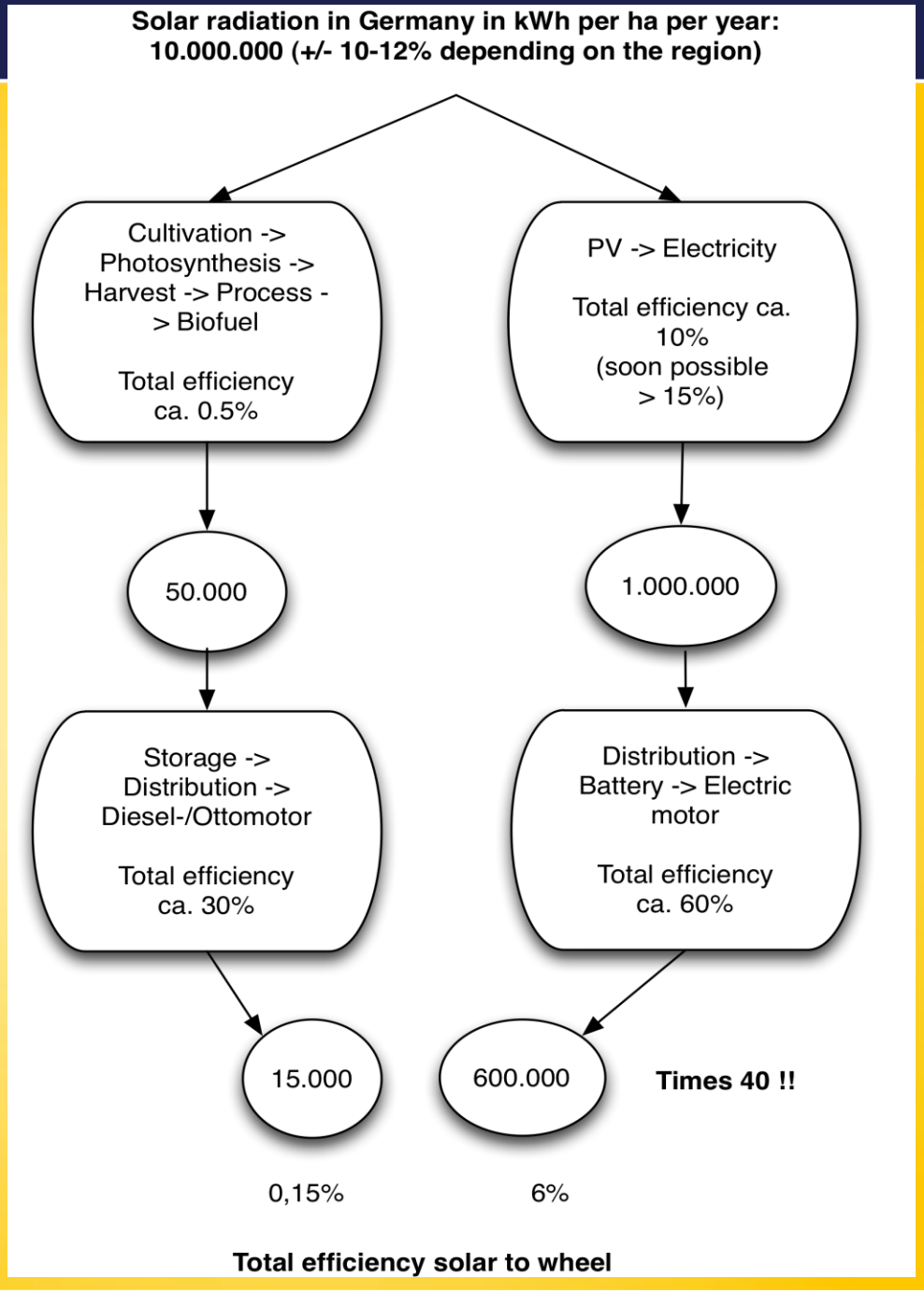
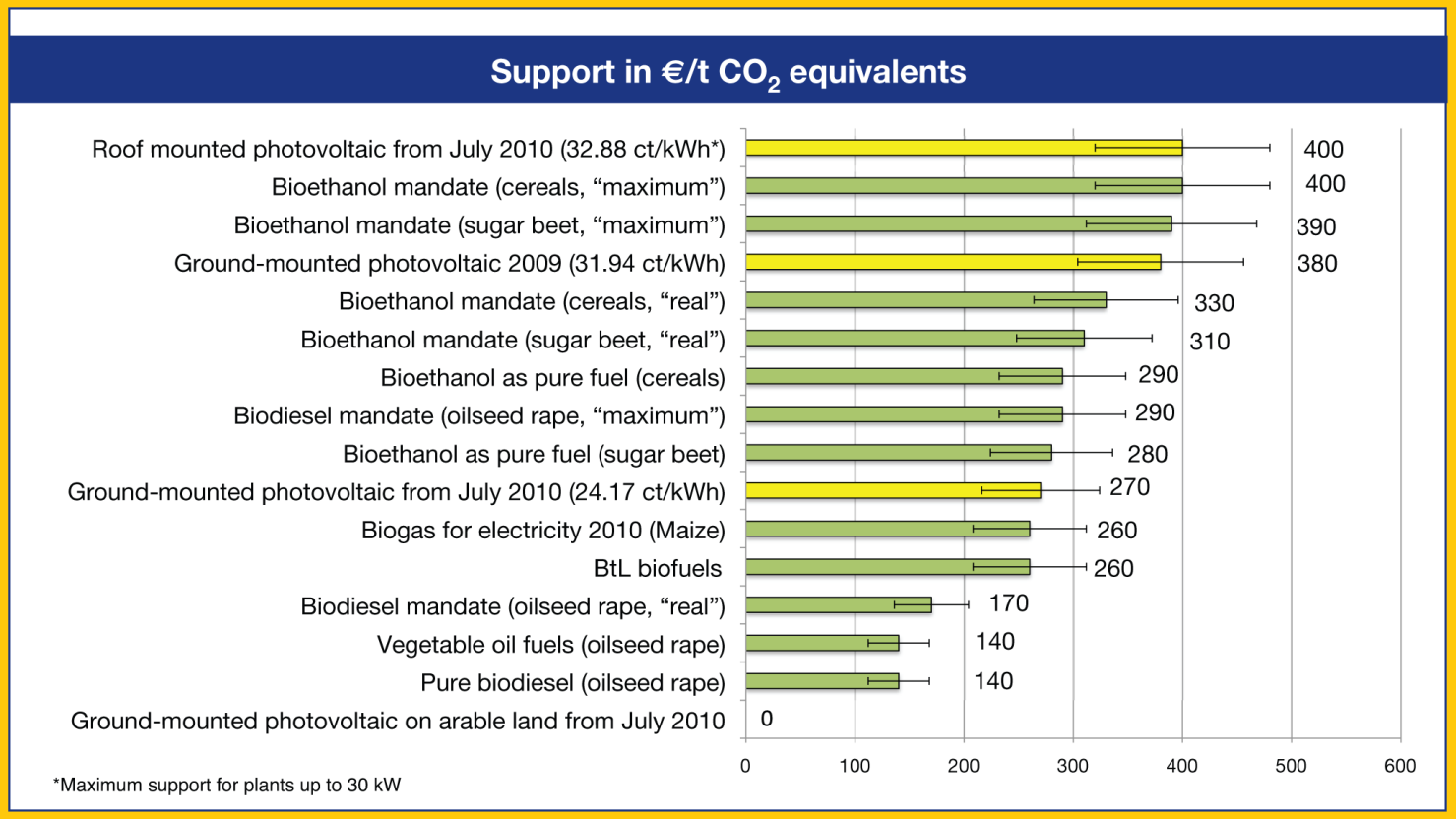
ISRIC World Soil Information

A solar electric car is 40 times more efficient than a biofuel car

(nova 2010)



Higher support for bioenergy than solar on arable land in Germany (2010)



D) Food versus Non-Food crops for industry

1. The question of food versus non-food crops for industry is itself oversimplified and misleading.

2. Question 1: Are there - in the EU, in the member state or in the region - free agricultural areas left, which are not necessary for food and feed - domestic use and export? If yes, continue:

3. Question 2 (the real question): How can we use these free areas for industry with the highest resource efficiency and the highest climate protection?
In many cases food crops will best fulfill these criteria (just because they are breaded to produce maximum yields over many, many years).

4. So “No food crops for industry” can lead to a misallocation of agriculture resources. We need a comprehensive concept for feedstock for food, feed, industrial material use and bioenergy.

E) Competition biomass for energy versus industrial material use

1. Already today we see competition between both sectors in Europe. High subsidies for energy crops lead to high biomass and land prices which make industrial material use unattractive.
In Germany the financial support of bioenergy is between 20% (biodiesel) to 80% (bioethanol, small biogas) of the turn-over!

2. Establish a high-volume bio-based economy, including green chemistry, bio-based plastics and composites, lubricants and others, we will immediately encounter feedstock shortages.

3. A new political-economic framework is needed to rebalance the financial support of energy and industrial material use of RRM. This new framework should be linked for all applications to climate protection, resource efficiency, employment and innovation.

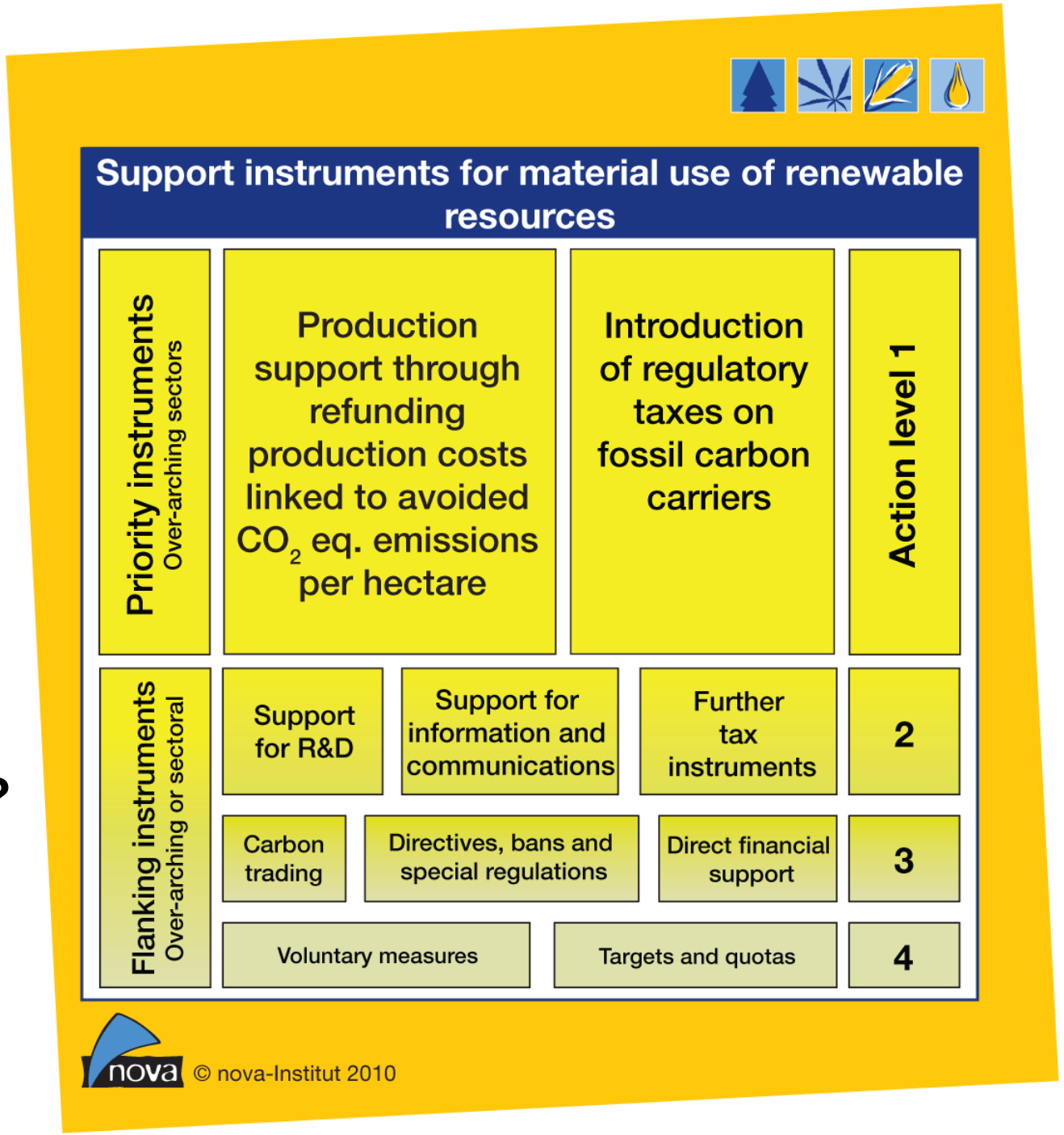
Socio-political effects of the material and energy uses of renewable materials

Criteria	Energy	Material uses
Employment and value-added per unit raw biomass or land area	Short, simple value chains	5–10 fold effect on employment and 4–9 fold value-added compared with energy uses; predominantly long and complex value chains
Biodiversity effects	Depends on a few widely-grown crops such as wheat, oilseed rape, maize and sugar beet. High fertiliser and pesticide needs, risk of monocultures	10 % of the cropped area comprises a very diverse range of species with low fertiliser and pesticide requirements; no differences in the case of widely grown species.
Greenhouse gas mitigation per ha	Significant reduction compared to fossil energy sources	Often higher mitigation effects compared with energy uses; long-term carbon storage
Cascading utilization	No cascade of uses	Multiple and successive material uses possible, ending with energy use
Future prospects	Limited – there are many alternatives (sun, wind etc.)	High – there are no alternatives
Markets	Highly regulated, standardised products with local markets (apart from transport biofuels)	Diverse range of products, unregulated markets, global competition
Subsidy support	High	Low, and time limited
Growth in the production area in Germany	Ten-fold growth over the last ten years	No growth over the last 10 years

More information: „A new assessment of the material use of renewable raw materials“ (nova 2010). Free download at: www.nova-institut.de/nr

Results from nova study –

perhaps targets and quota should be put from level 4 to action level 1?



Support of the industrial material use – more than R & D and standardisation!!

How?

- ? **Quota for bio-based material & products?**
- ? **Refund system for the industry, using renewable raw materials as input (based on CO_2 savings)**
- ? **Increasing taxes on non-renewable carbon – crude oil, natural gas, coal – also for the Chemical Industry**

Final conclusions

Due to the results of different nova-studies, there will be only enough feedstock for Industrial Material Use/Industrial Biotechnology, if:

- **we will be able to activate strongly the potentially free areas (0.6 – 1.6 Billion ha) for agriculture and to increase the productivity (times 5-10) in developing countries - that means huge investment and political reforms,**

- **we switch from bioenergy to solar and wind energy (ca. 50 times more land efficient) and strongly increase the use of solar and wind energy,**

- **we establish a new policy for equal support of bioenergy and industrial material use based on their efficiency, GHG reduction/ha and employment/ha.**

Otherwise „Food & Feed first“ and increasing population and meat consumption means: No feedstock left for high-volume industrial material use & biotechnology of RRM!

Thank you for your attention!

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