



Biofuels and global sustainability; pitfalls and policy options

Ayla Uslu,
project coordinator
ECN

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Intelligent Energy  Europe

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- Introduction of the project
- Sustainability issues considered
- Methodology
- Results
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Project summary

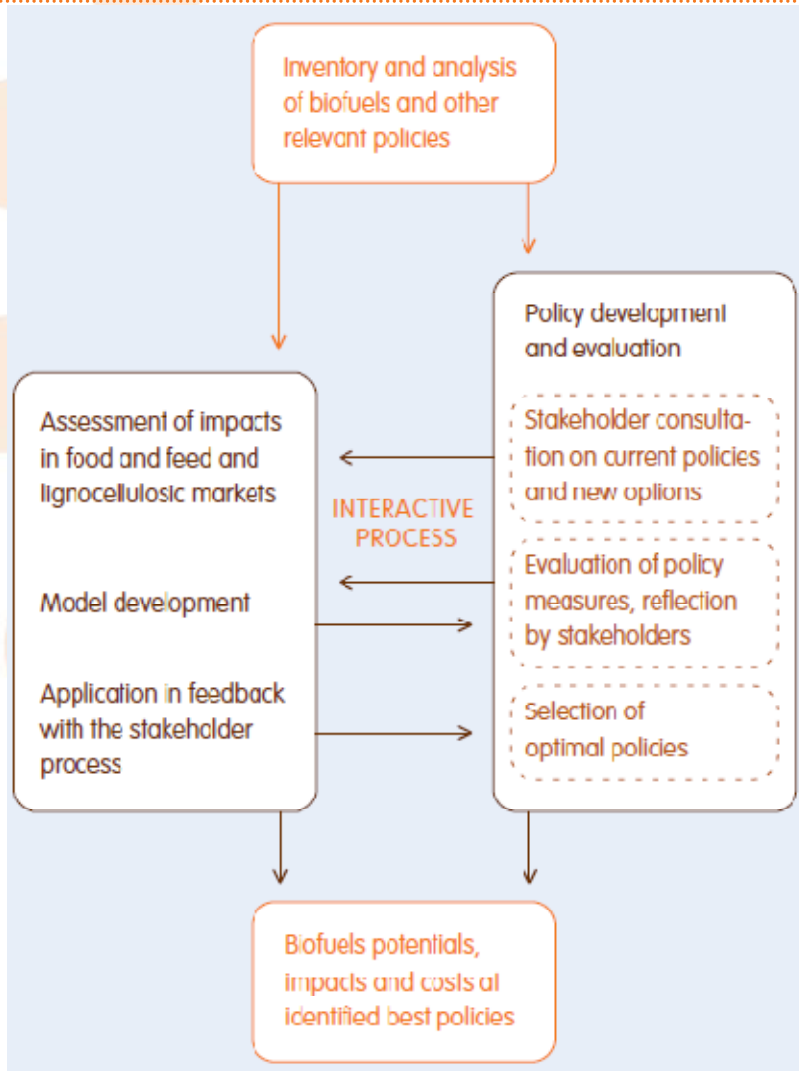
I. The problem:

- Increased demand for biofuels → impacts on commodity markets?
- Disputes on this issue require responsible policy.

II. The objective:

Formulation of *efficient and low-disturbing policy options*, enhancing biofuels and minimizing the impacts on food, feed & biomass (power heat) markets.

Project structure, partners



Sustainability issues considered

- **1st generation**

- **FOOD SECURITY**

Commodity price effects, rural income, risk of hunger

- **ENVIRONMENT**

Land use effects, GHG savings

- **2nd generation**

- **COMPETING uses**

- **Land use competition**

Scenario formulation

Baseline scenario REF describes until 2050

Population development

Economic growth

Agricultural policies (further trade liberalization)

Technology (agricultural productivity growth)

Climate change (Hadley, SRES A2, with CO2 effects)

Land use restrictions (safeguard protected areas)

Biofuels: historic biofuel consumption until 2008,
constant at 2008 level thereafter

Biofuel scenario formulation

Biofuel expansion scenarios:

Scenario **WEO** – based on IEA, 2008

Scenario **TAR** – applies announced biofuel targets

Sensitivity variants:

Biofuel production by-products

Growth in agricultural productivity

Land use restrictions

Transport Fuels in 2020 and 2030

Million Tons Oil Equivalent

	WEO		TAR	
	<u>2020</u>	<u>2030</u>	<u>2020</u>	<u>2030</u>
Developed Countries				
Transport Fuels	1505	1486	1505	1486
Transport Biofuels	63	80	117	178
Biofuels in Transport Fuel	4.2%	5.4%	8%	12%
Share of 2 nd Generation	4%	19%	33%	51%

	WEO		TAR	
	<u>2020</u>	<u>2030</u>	<u>2020</u>	<u>2030</u>
Developing Countries				
Transport fuels	1174	1529	1174	1529
Transport Biofuels	31	46	72	116
Biofuels in Transport Fuels	2.7%	3.0%	6%	8%
Share of 2 nd Generation	0%	4%	3%	19%

United States, European Union, Japan, Canada, Australia ...
Brazil, China, India, Indonesia, Thailand, South Africa ...

Sensitivity runs

1. The importance of biofuel by-products

Assume DDGS is not used as animal feed

Scenario **WEO-vD** and **TAR-vD**

2. Growth in agricultural productivity

Assume higher productivity growth compared to REF

Scenario **WEO-vP** and **TAR-vP**

Country Group 1: high productivity growth (Sub-Saharan Africa)

+ 7.5 % by 2025 and + 20% by 2050

Country Group 2: medium productivity growth (India, Pakistan, Argentina,....)

+ 4 % by 2025 and + 10 % by 2050

Group 3: no changes (developed countries)

3. Land use restrictions - Assume no deforestation

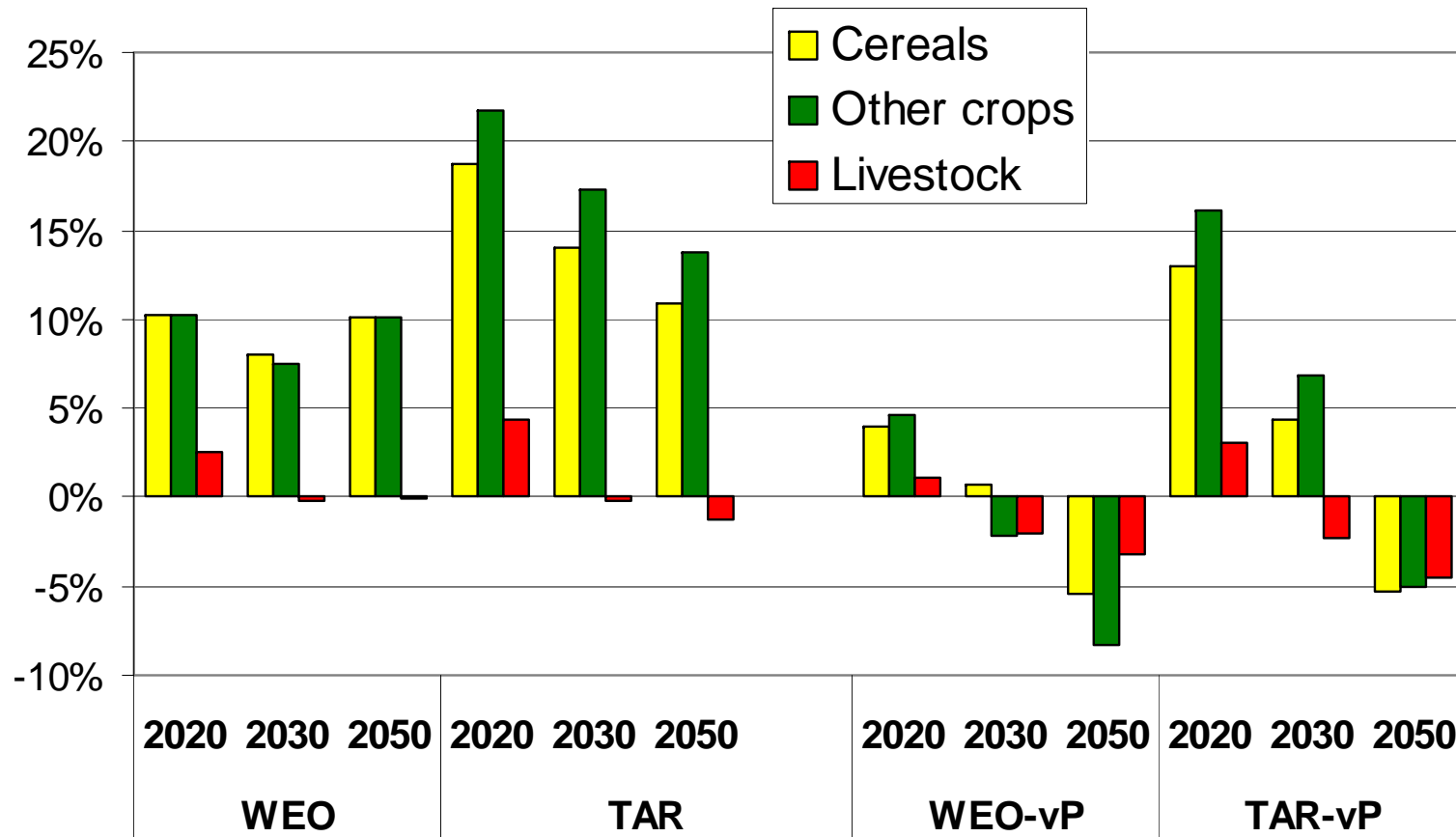
RESULTS

Impacts of biofuel expansion on FOOD SYSTEM



Impacts of first-generation biofuels on agricultural prices

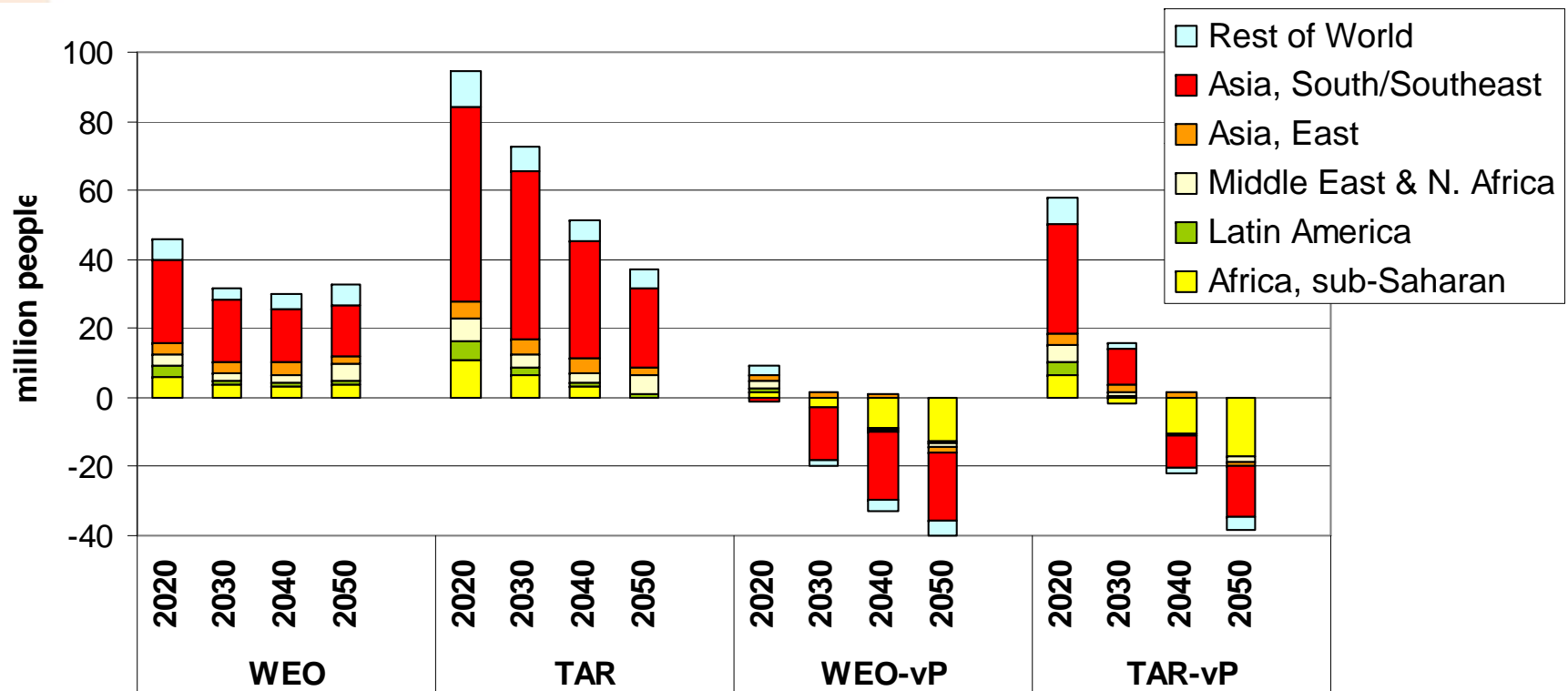
Percentage price changes, relative to REF



Scenarios: Higher agric. productivity

Socio-economic effects - Hunger

Additional people at risk of hunger, relative to REF



higher agric. productivity

→ Strong impact of higher agric. productivity in LDCs

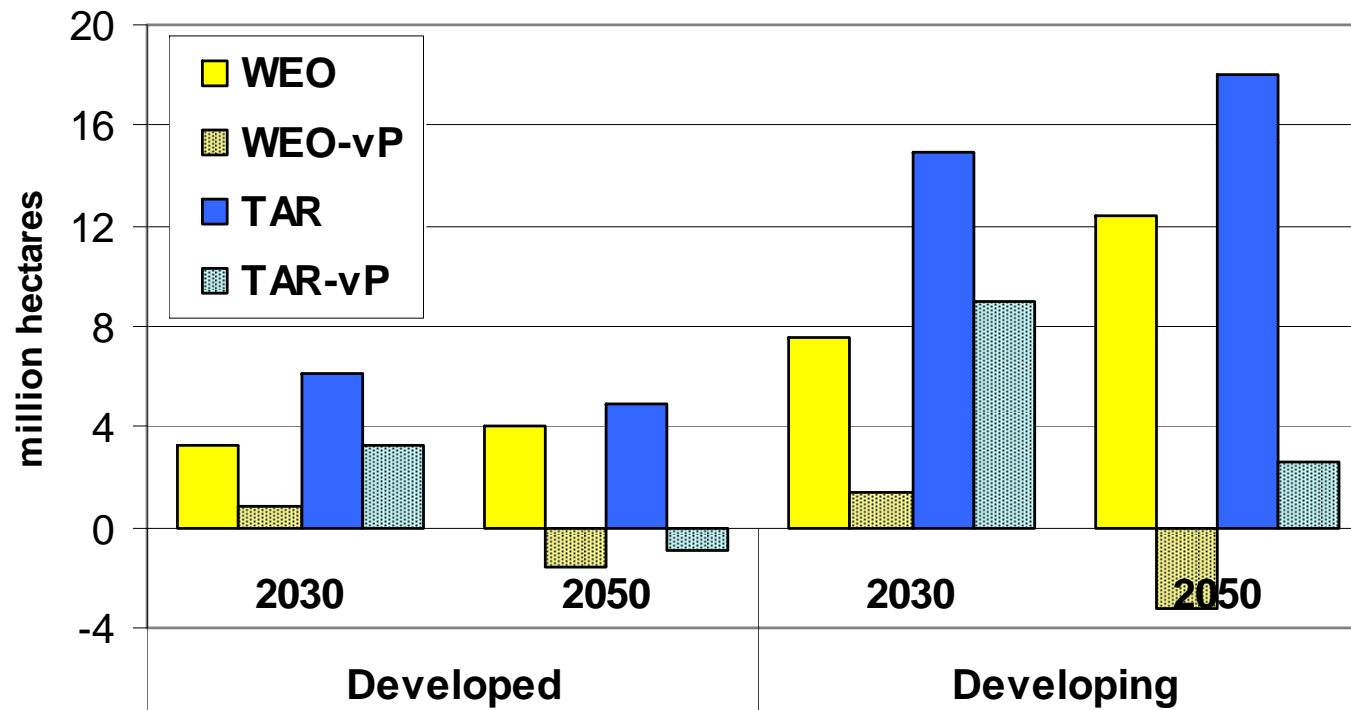
RESULTS

Impacts of biofuel expansion on the ENVIRONMENT



Land use changes – Agricultural expansion

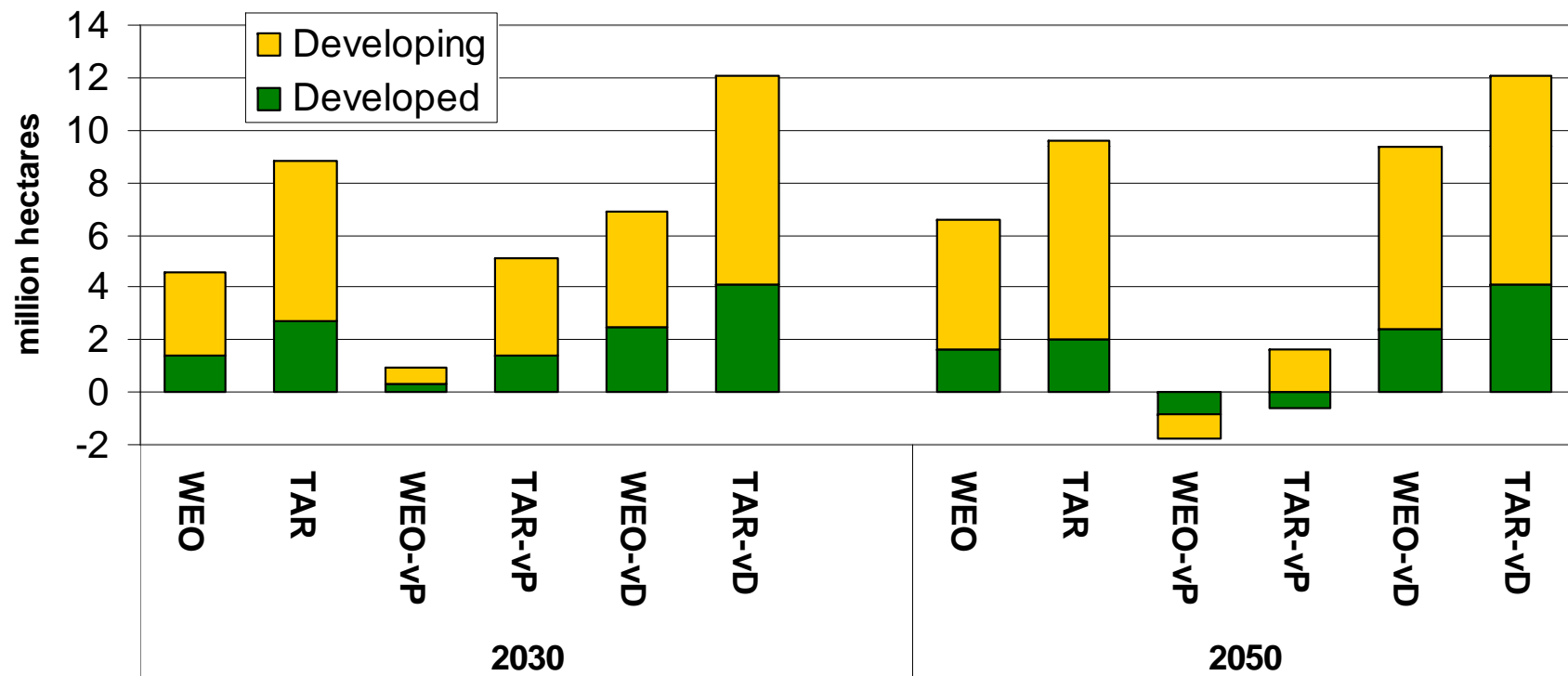
Additional arable land use, relative to REF



Note: If DDGS were not used as animal feed an additional 5 to 8 million hectares arable land would be required globally

Land use changes – Deforestation

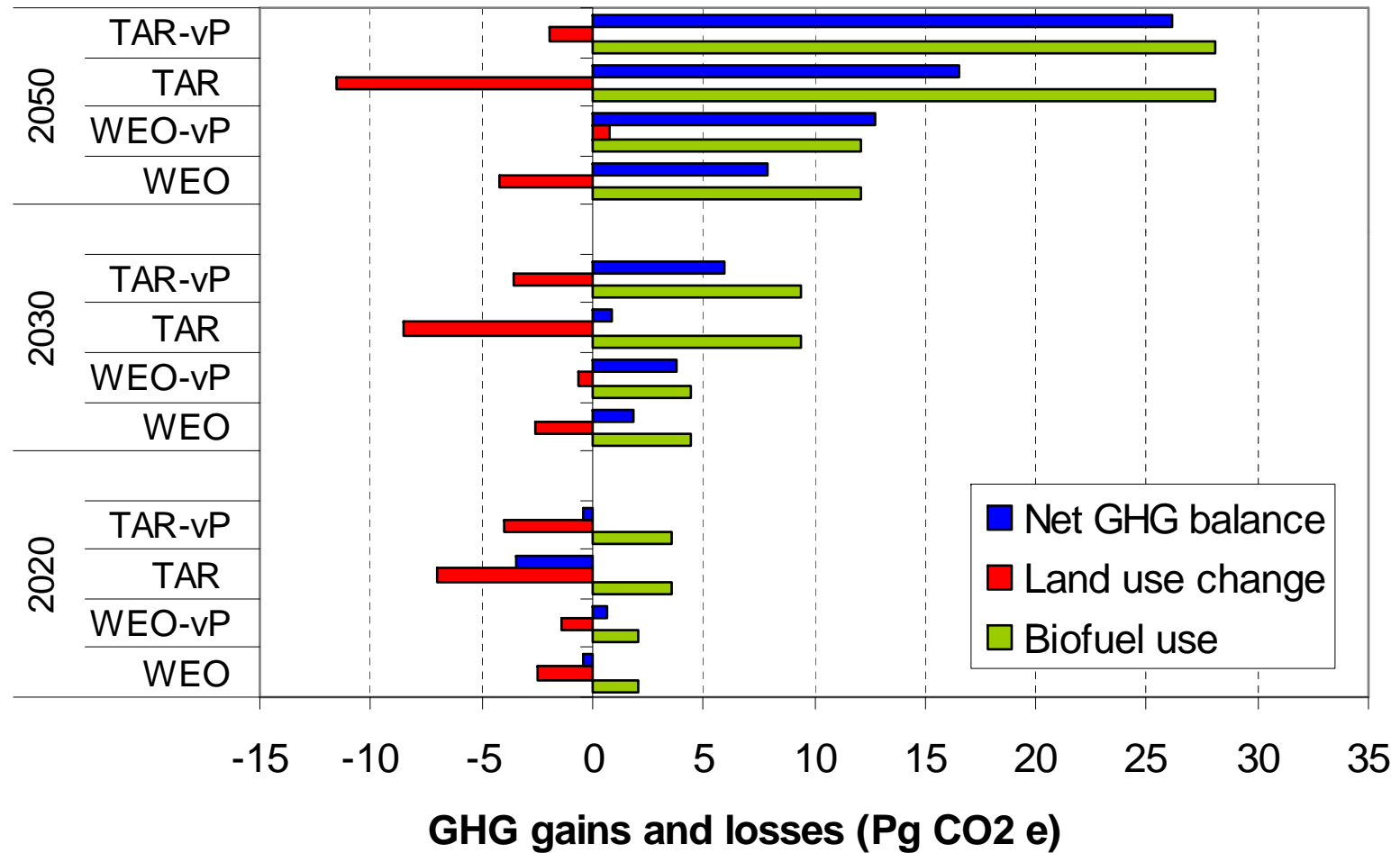
Additional deforestation, relative to REF



Variant -vP: higher agricultural productivity; -vD: no use of DDGS

Net greenhouse gas savings of biofuel scenarios

Scenario WEO, TAR, WEO-vP, TAR-vP



RESULTS

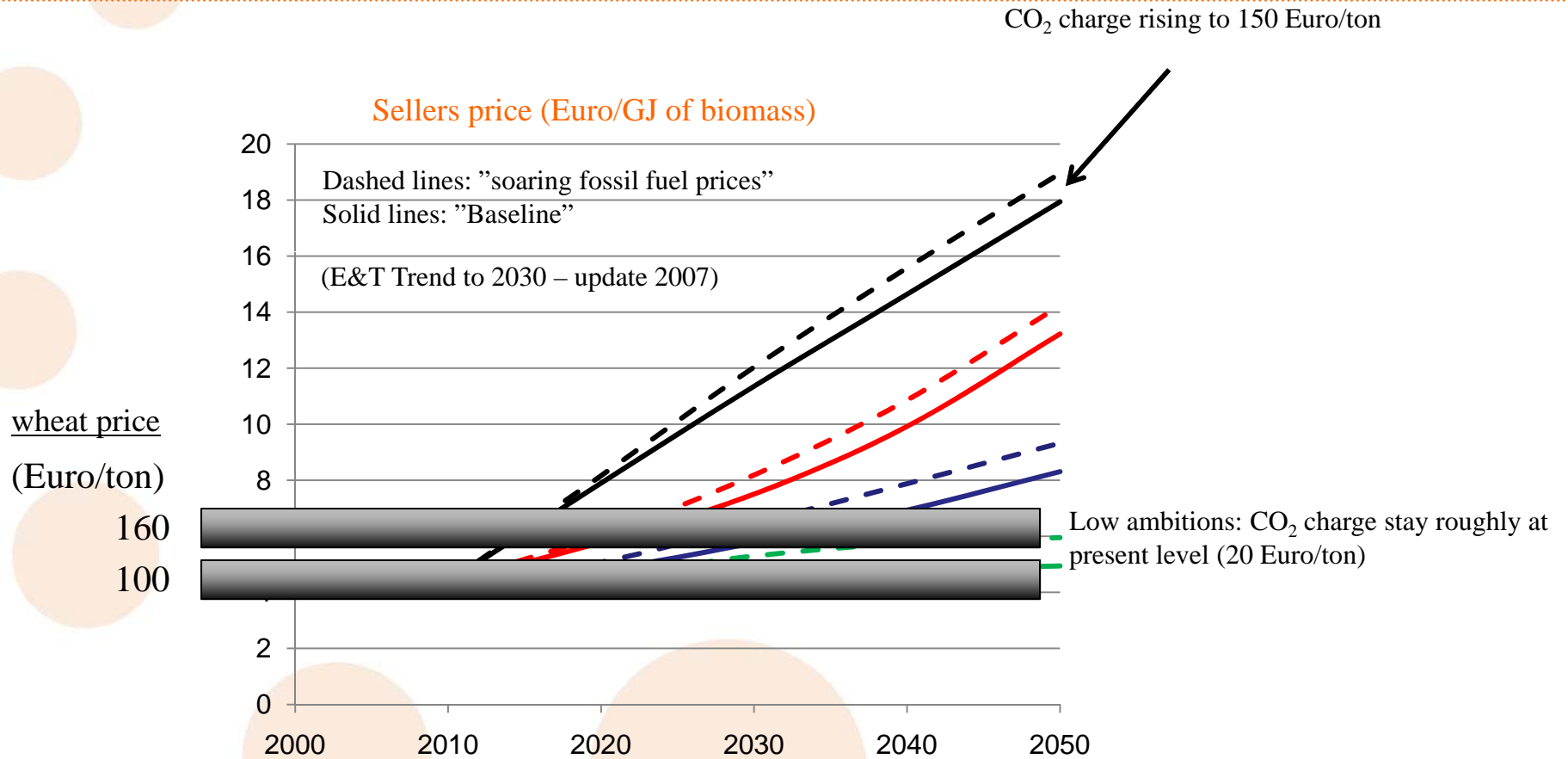
Impacts of 2nd generation biofuels expansion



Competition for feedstock-land use

- Biomass competition may arise between stationary and transport energy uses
- Paying capacity for biomass can become very high
 - food prices may increase due to competition for feedstock as well as for land
 - climate/energy policies affecting stationary energy sector can drive food and land prices in the same way as obligatory biofuel targets – if development is slow for non-bioenergy alternatives in stationary energy

Paying capacity for biomass



Policy recommendations

- Renew efforts to enhance agricultural productivity.
- Protect the poor against impacts of rising and more volatile agricultural prices.
- Foster equitable partnerships; establish “new code of conduct”.
- Apply strict sustainability criteria, regulation and monitoring to protect land and safeguard ecosystems.
- Maintain high potential land in good conditions to facilitate sustainable production increases.

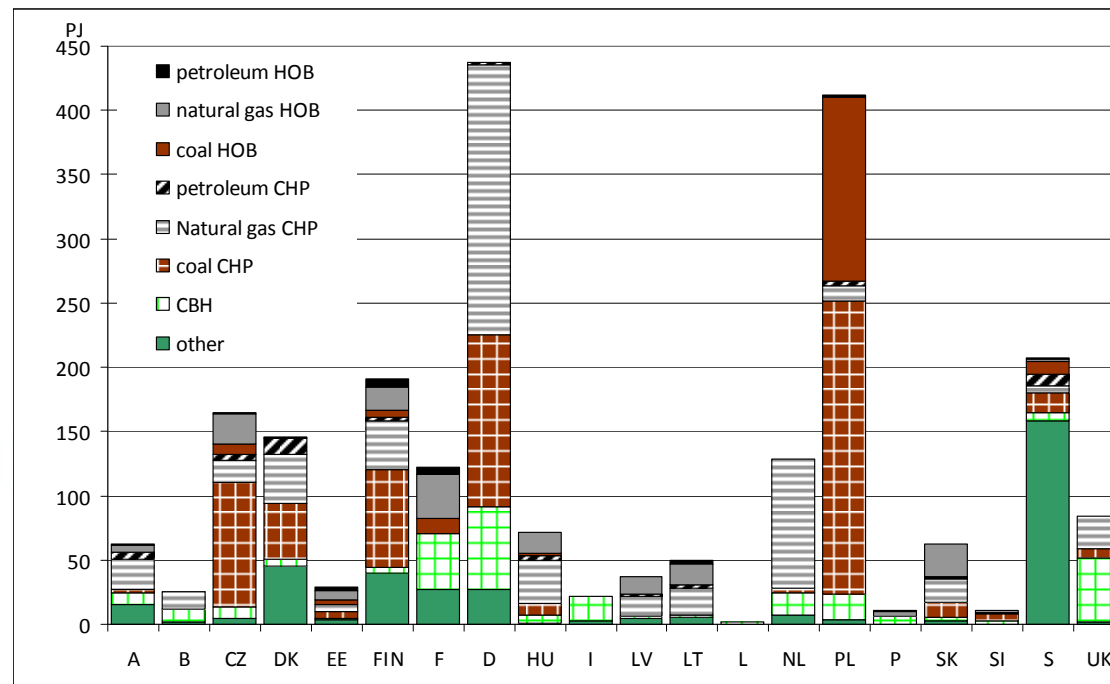
Policy recommendations

- Promote GHG-efficient technologies
 - integration of biofuel production in energy/industry combines can improve overall efficiency and economic performance
 - ✓ *Heat sinks provided by district heating systems can support a large scale establishment of biofuel/heat/power polygeneration plants*

Policy recommendations

- District heating systems are significant heat sinks in EU

- the diagram shows heat sink allocation for making productive use of surplus heat from biofuel production corresponding to 10% of projected transport fuel use in 2020



Policy recommendations

- Stationary energy most important near term market for lignocellulosic biomass

Co-firing can be a significant market...and bridging option

- ✓ may contribute to 2nd gen biofuels development by inducing earlier development of the supply infrastructure for 2nd gen biofuel feedstocks
- ✓ biomass co-firing appears to be an attractive early option with longer term prospects
- ✓ in case biomass co-firing cannot remain competitive, expansion of 2nd gen biofuel production can benefit from an established feedstock supply infrastructure

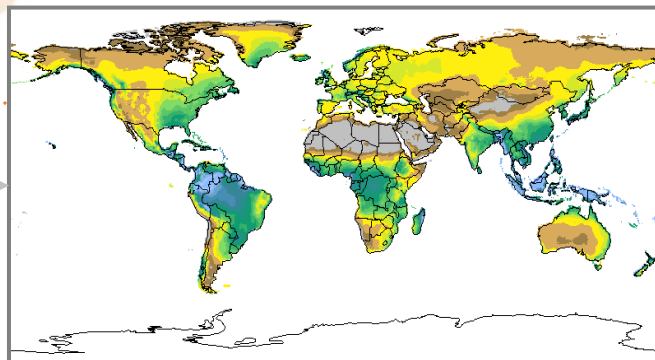
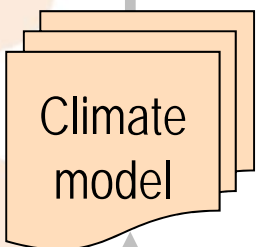
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Additional slides

Assessment Framework

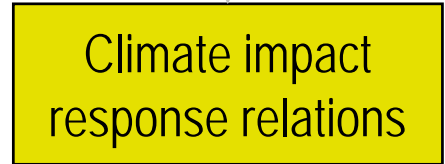
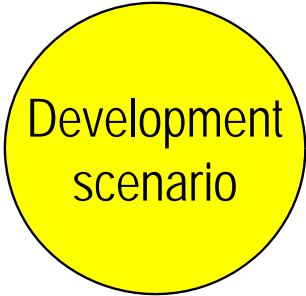
Agro-ecological suitability and land productivity

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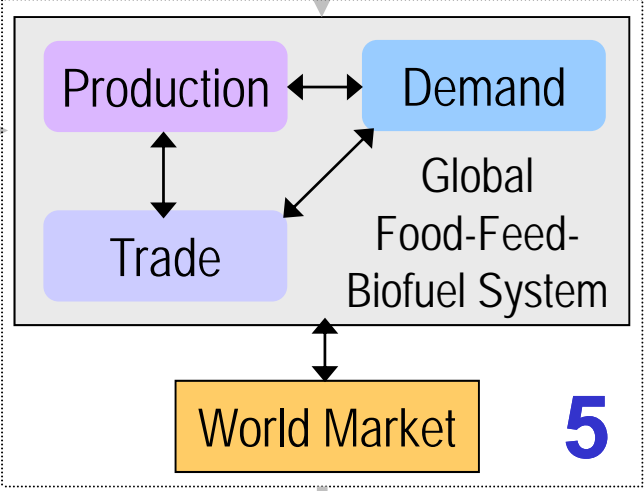


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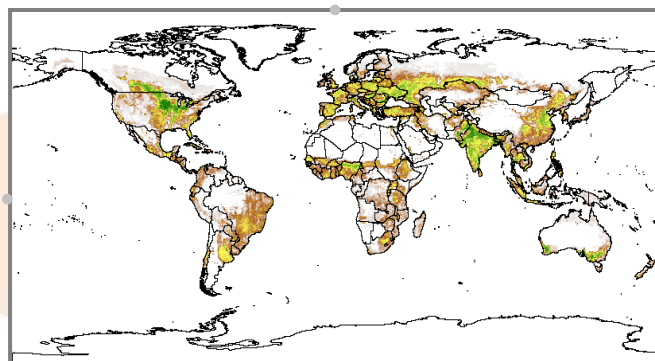
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Spatial distribution of land use





