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Performance of International Biotrade Chains; identification of effective schemes.

(+ and some on IEA Task 40)

IEA Bioenergy Task 38 Conference on the role of carbon sequestration and international Greenhouse Gas Markets - March 22 2004, Rotorua, New Zealand –

Andre Faaij

Copernicus Institute - Utrecht University

The Netherlands

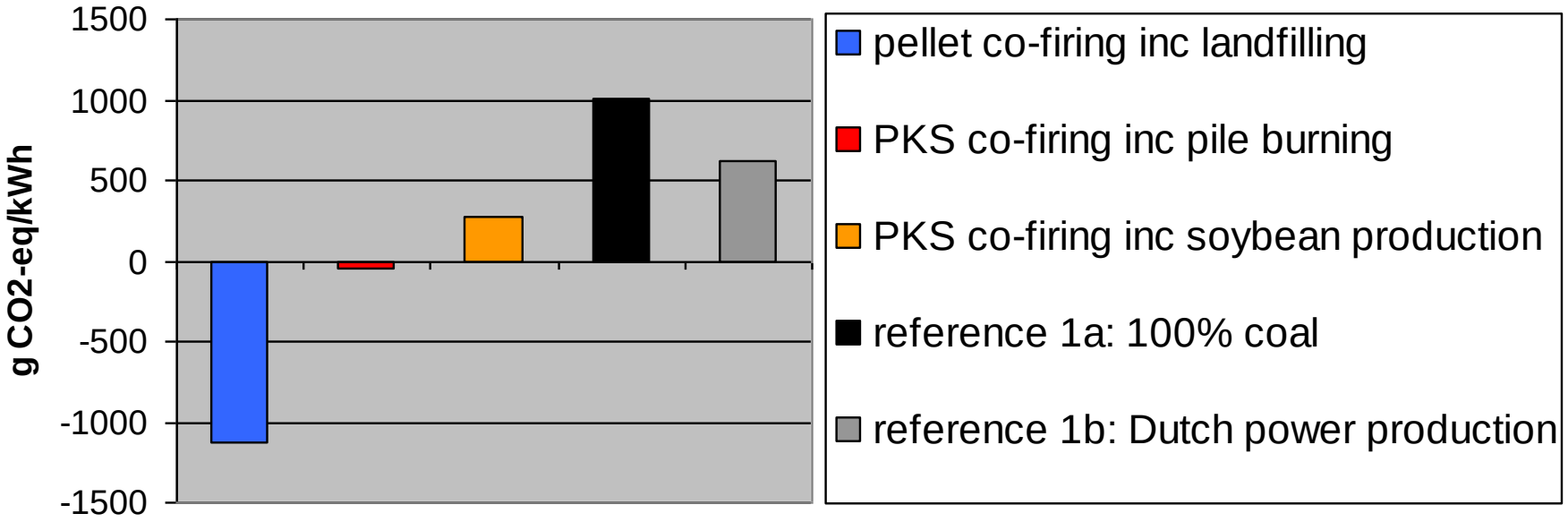
Copernicus Institute

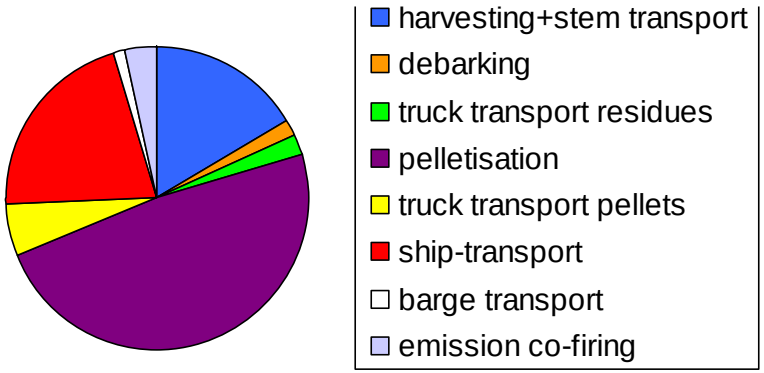
Sustainable Development and Innovation Management

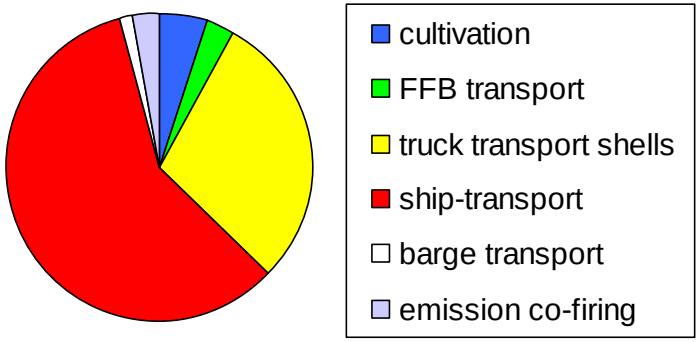
Phases in bio-energy use and market development…

1. Waste treatment and process residues; use on site, low costs.
2. Local use of (more expensive) forest and agricultural residues; some infrastructure development.
3. Regional biomass markets, larger scale utilisation, increasingly complex logistics; supportive policies needed.
4. National markets with complex set of suppliers and buyers; often increased availability.
5. Increasing scale, cross-border flows; role for cultivated biomass; bilateral activities.
6. ***Global commodity market; pricing mechanisms; complex interlinkages with existing markets (food, forestry, feedstocks)?***

GHG impacts existing biotrade chains

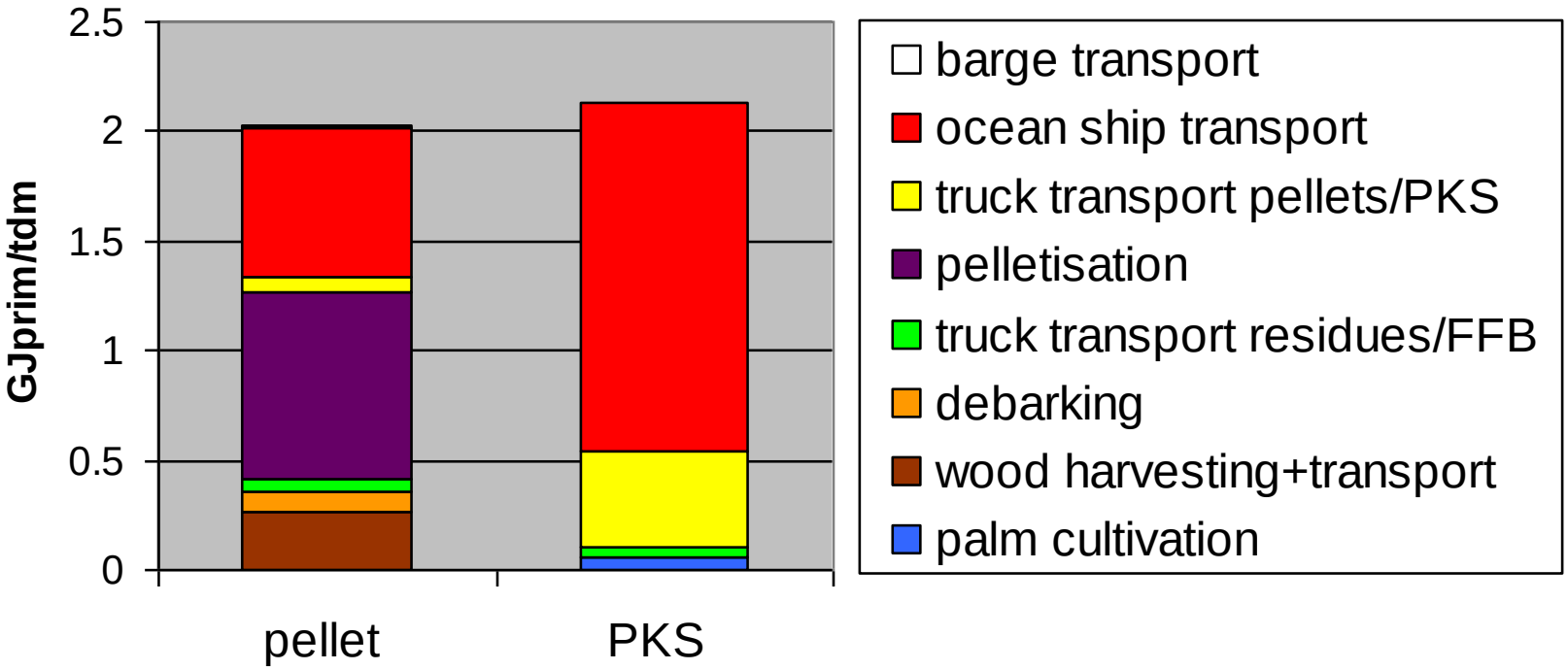




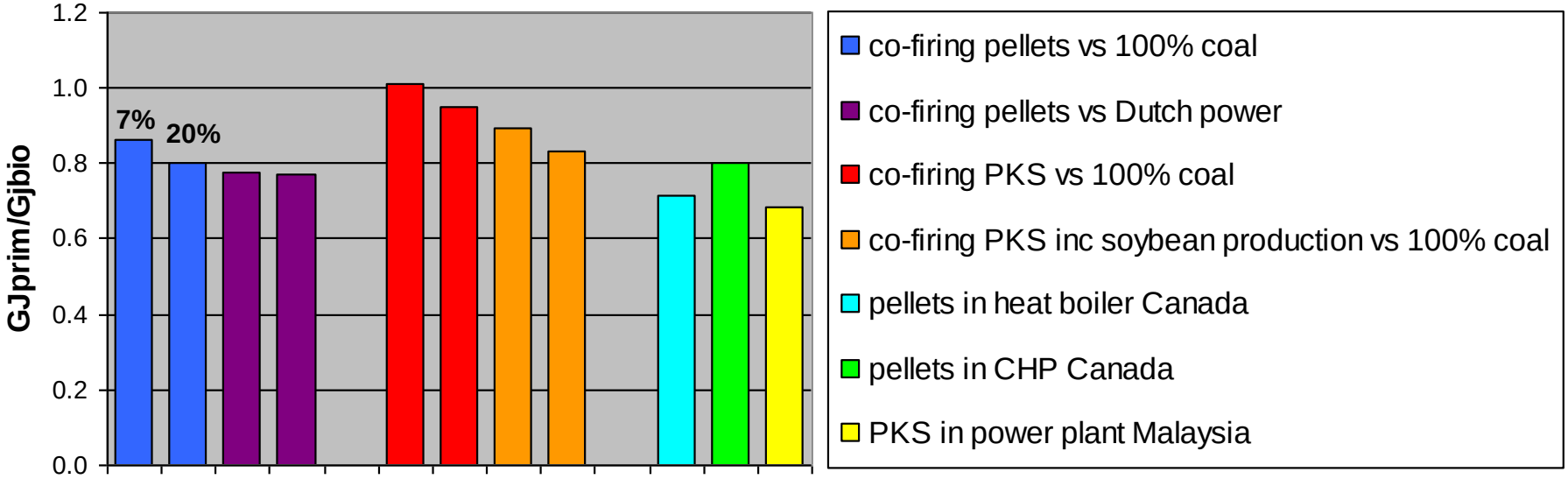


Damen, Faaij, 2003

Energy use biomass import



Net avoided primary energy



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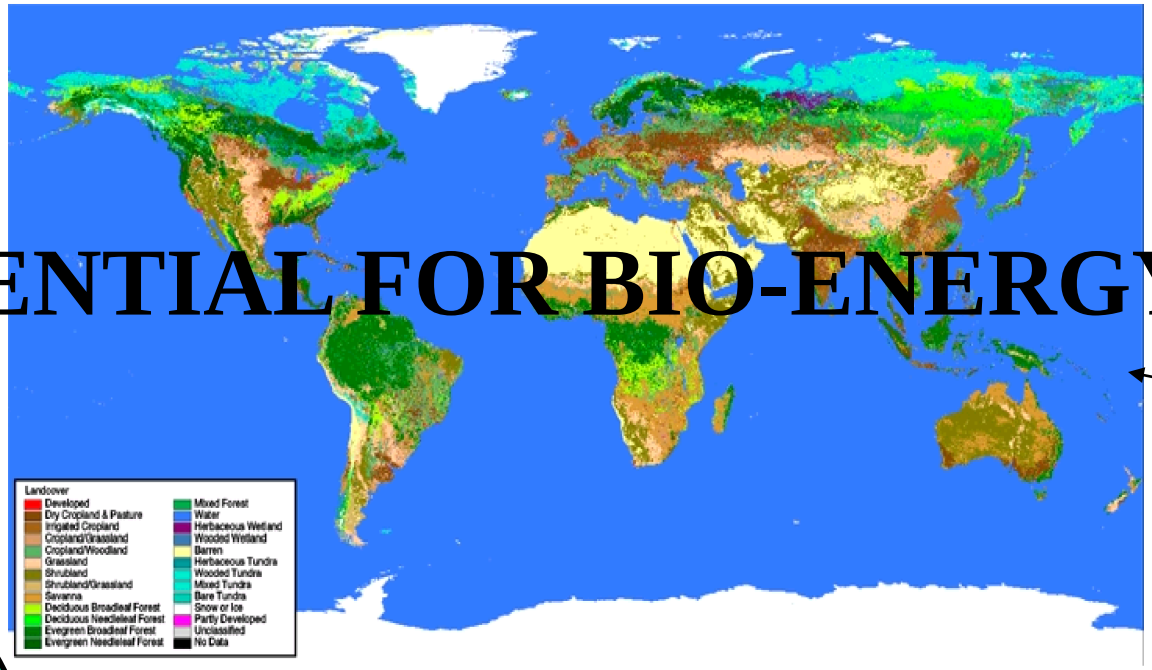
population

energy consumption

trade

future land use patterns

biotechnology



POTENTIAL FOR BIO-ENERGY?

GDP

agricultural system irrigation, breeding, mechanization, chemicals

land productivity

agricultural policy

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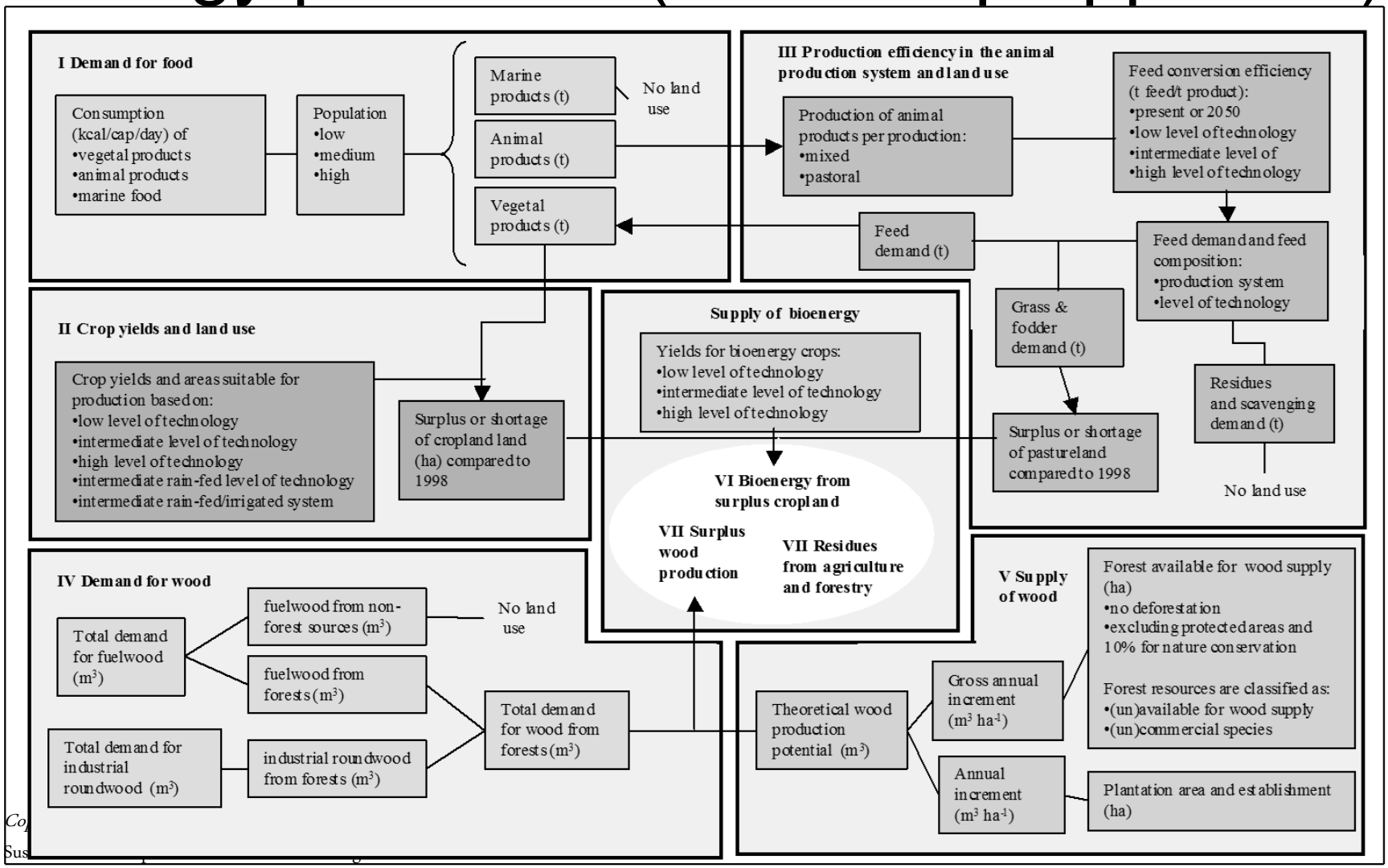
Key elements for assessing future bioenergy potentials (bottom-up approach)



Source: Smeets, Faaij 2004

B1-2010

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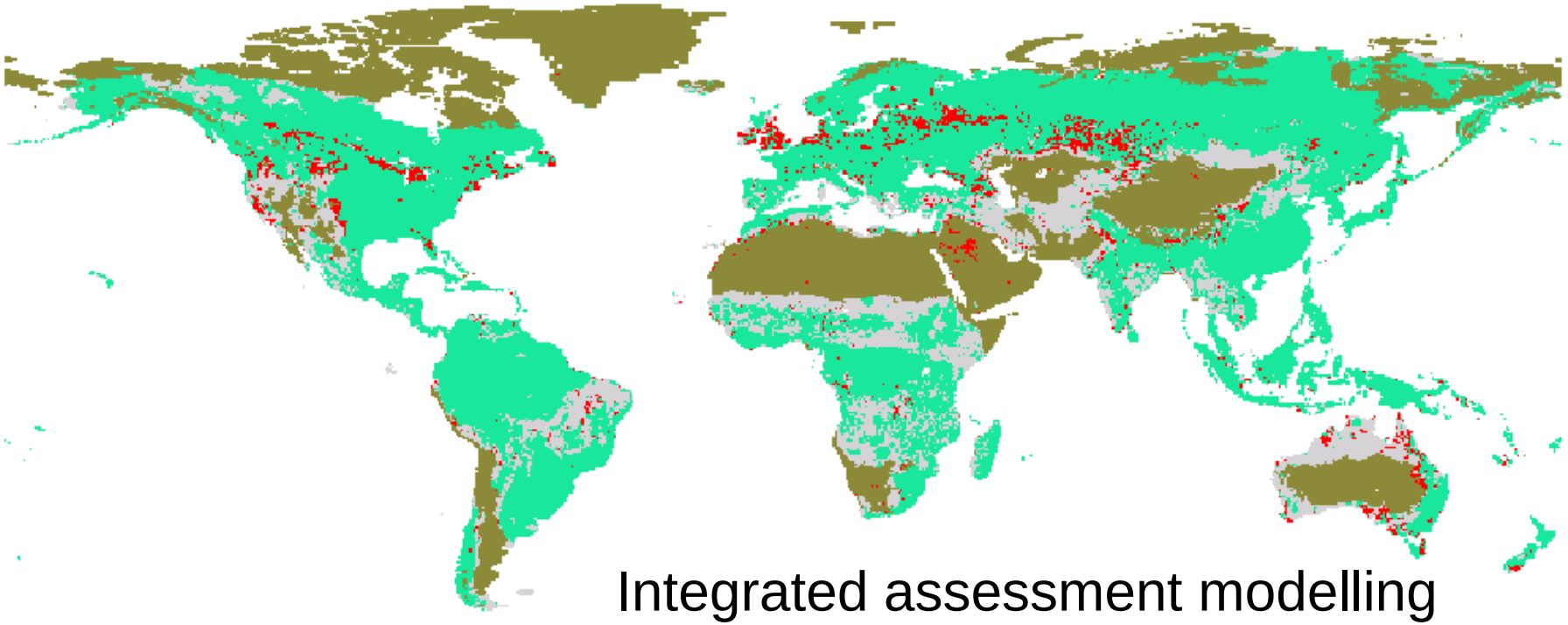

Source: Hoogwijk, Faaij 2004

rest land
Abandoned cropland
low-productive Land
Other

Integrated assessment modelling using IMAGE (RIVM) for assessing land-use and production potentials of biomass for energy

B1 2020

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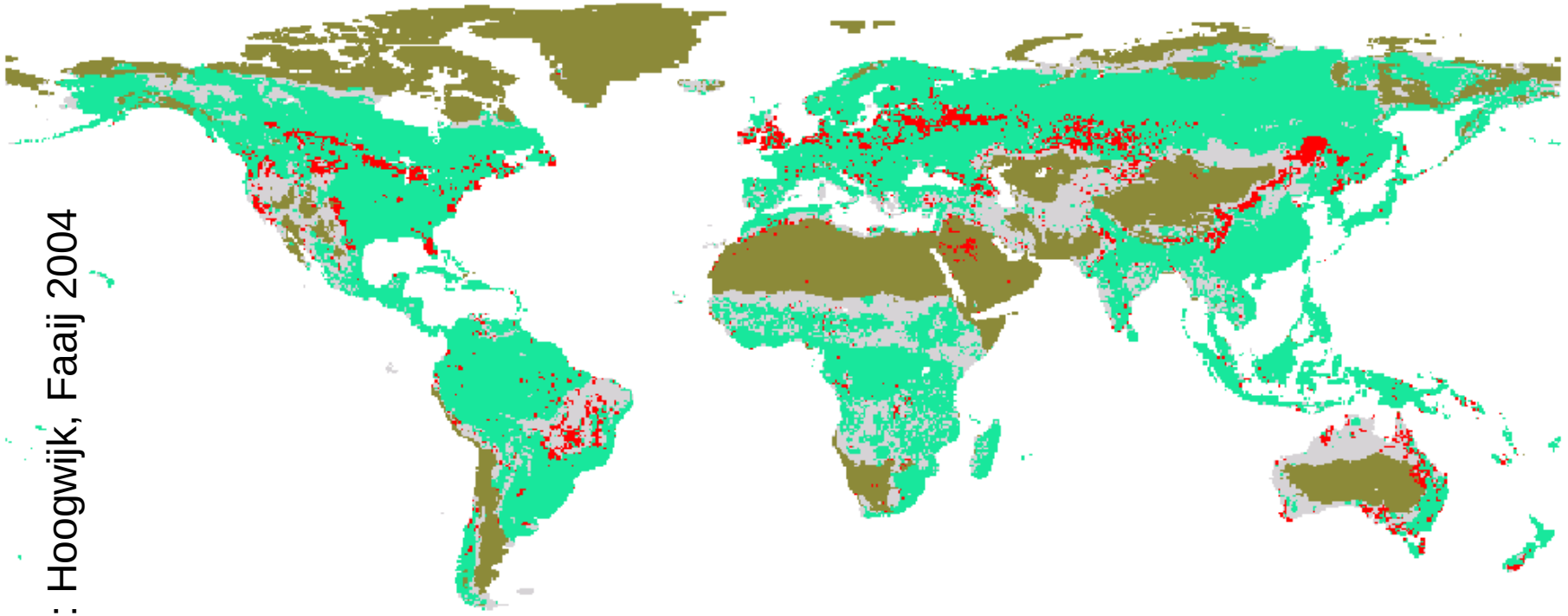

Source: Hoogwijk, Faaij 2004

rest land
Abandoned cropland
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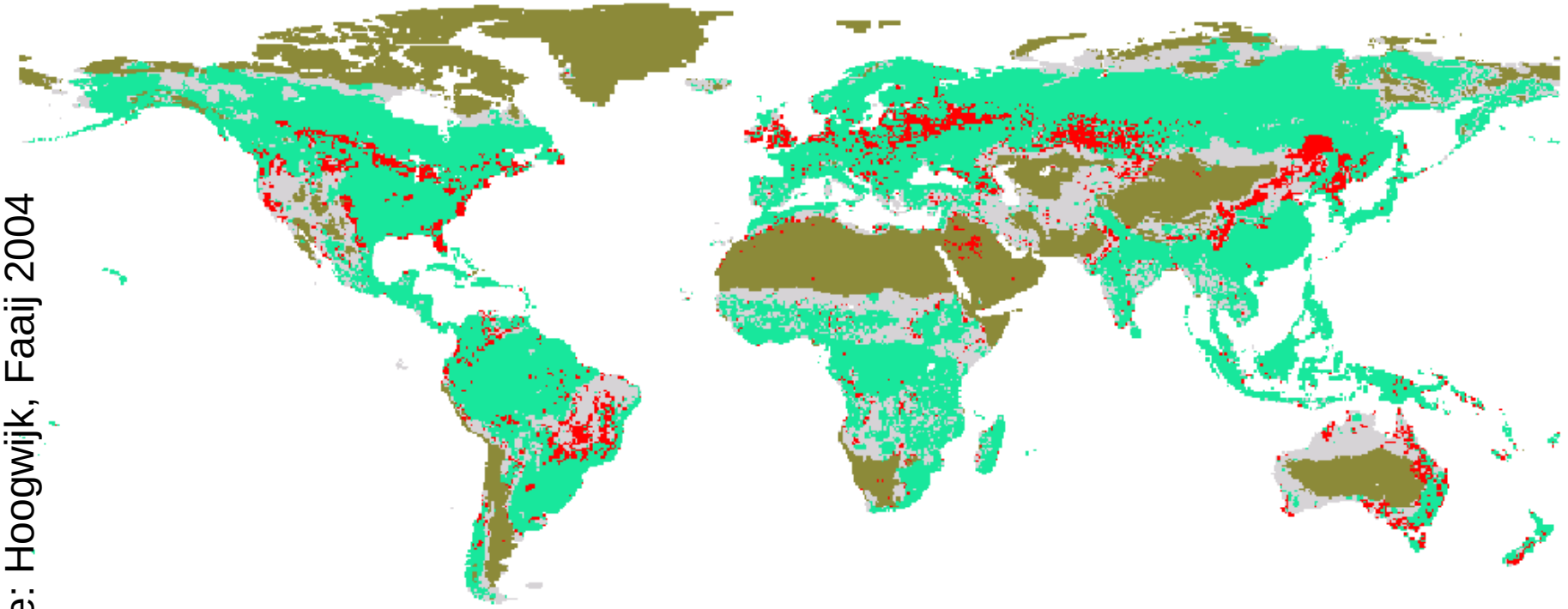
Other

B1 2030



Source: Hoogwijk, Faaij 2004

rest land
Abandoned cropland
low-productive Land
Other

B1 2040

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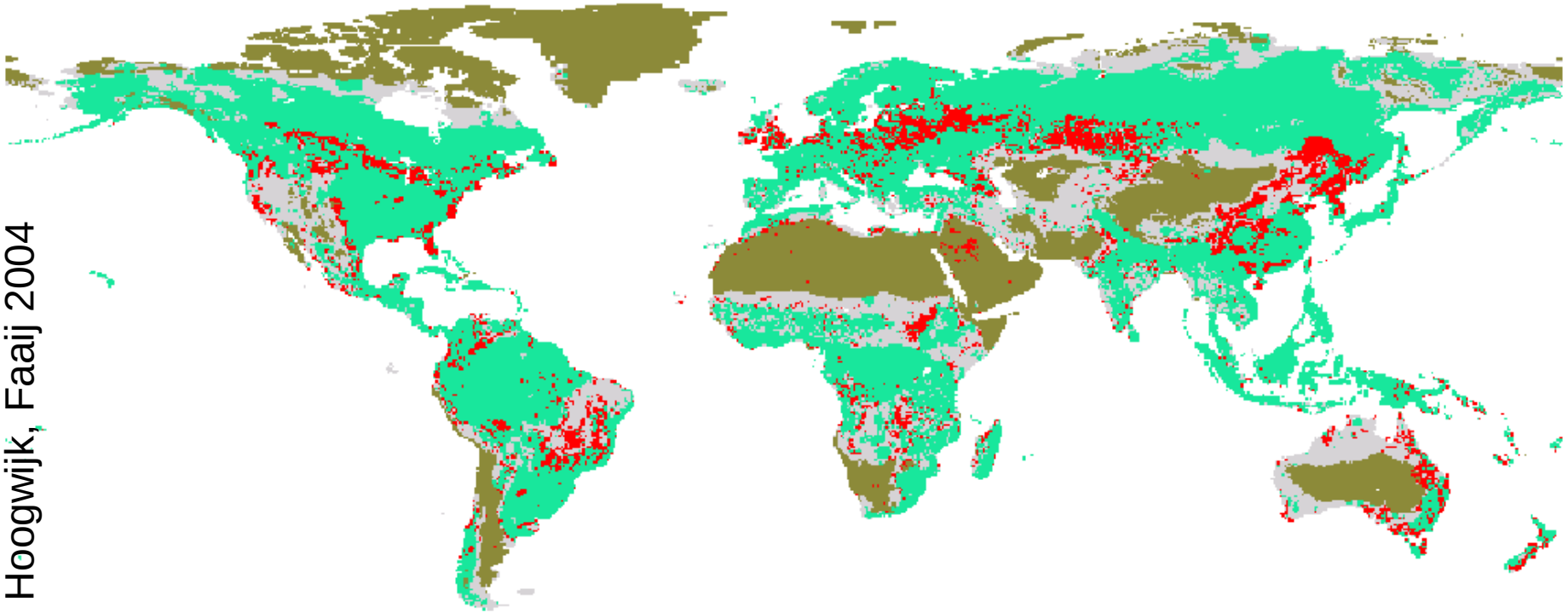

Source: Hoogwijk, Faaij 2004

rest land
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Other

B1 2050

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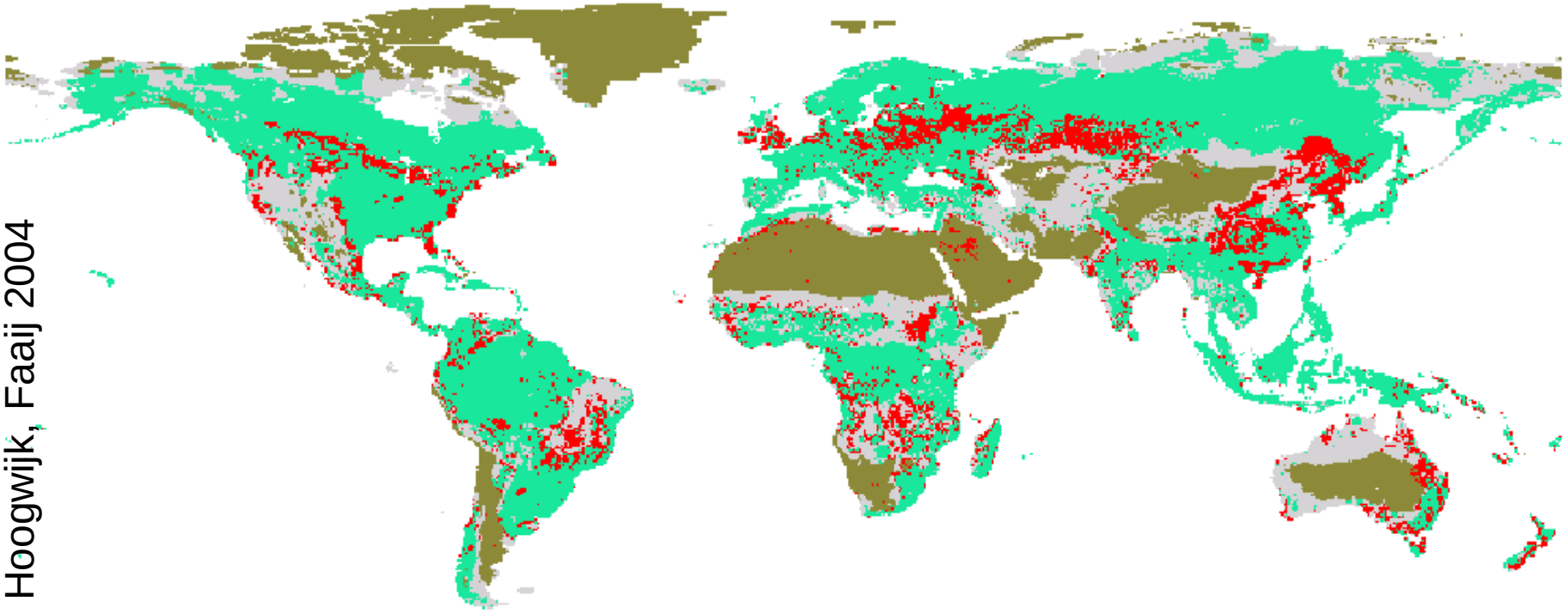

Source: Hoogwijk, Faaij 2004

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Abandoned cropland
low-productive Land
Other

A2 2050

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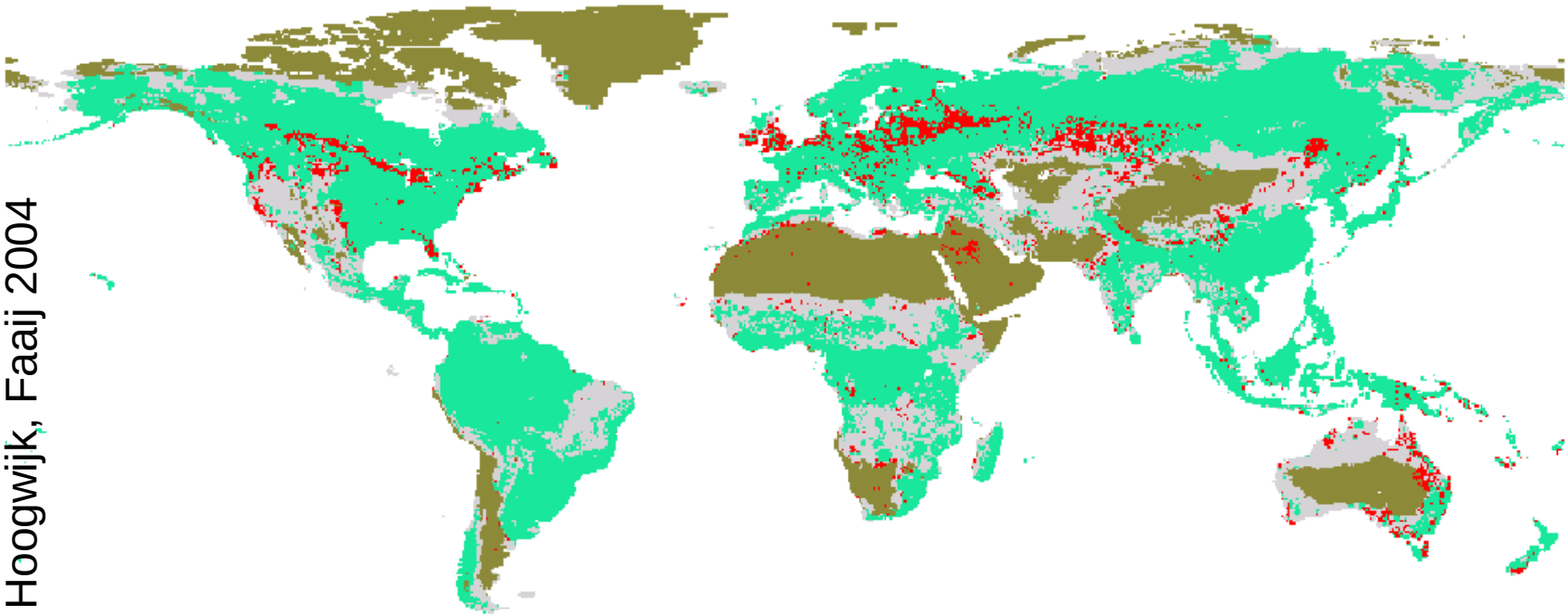

Source: Hoogwijk, Faaij 2004

rest land
Abandoned cropland
low-productive Land
Other

A1 2050

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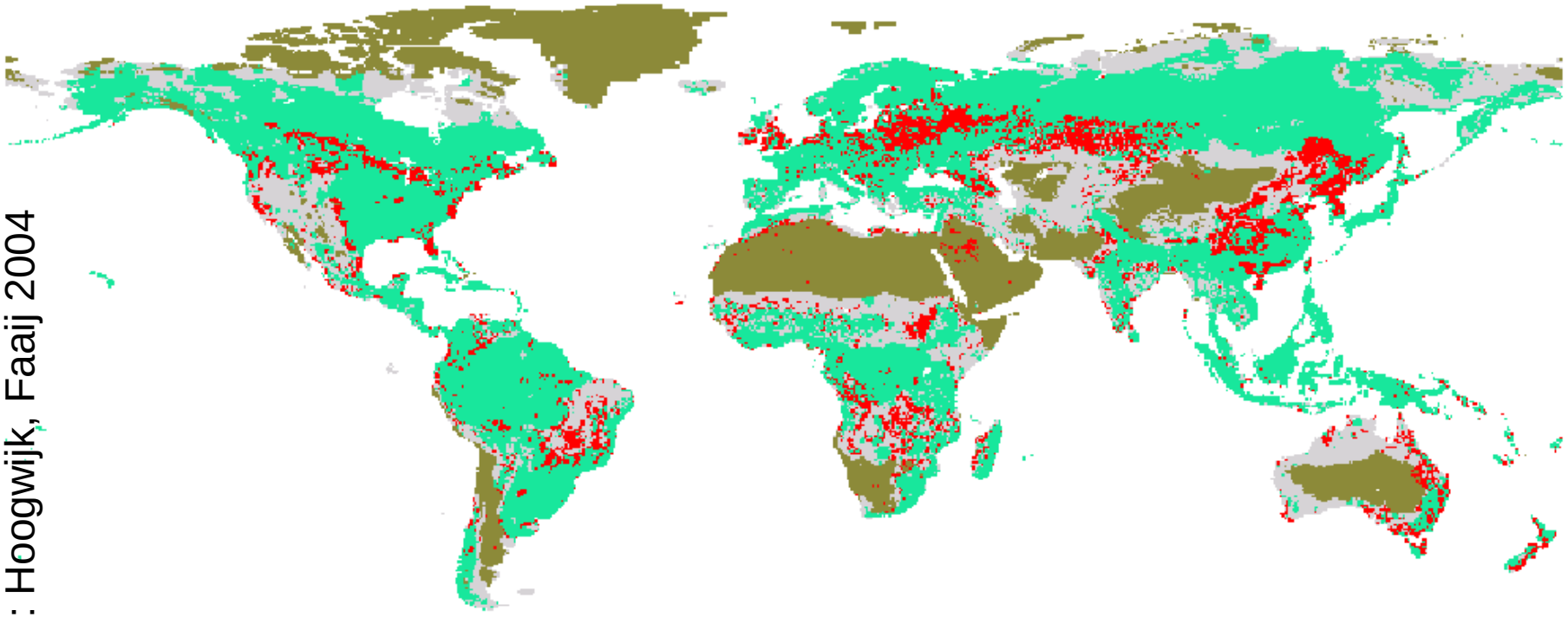

Source: Hoogwijk, Faaij 2004

rest land
Abandoned cropland
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Other

B2 2050

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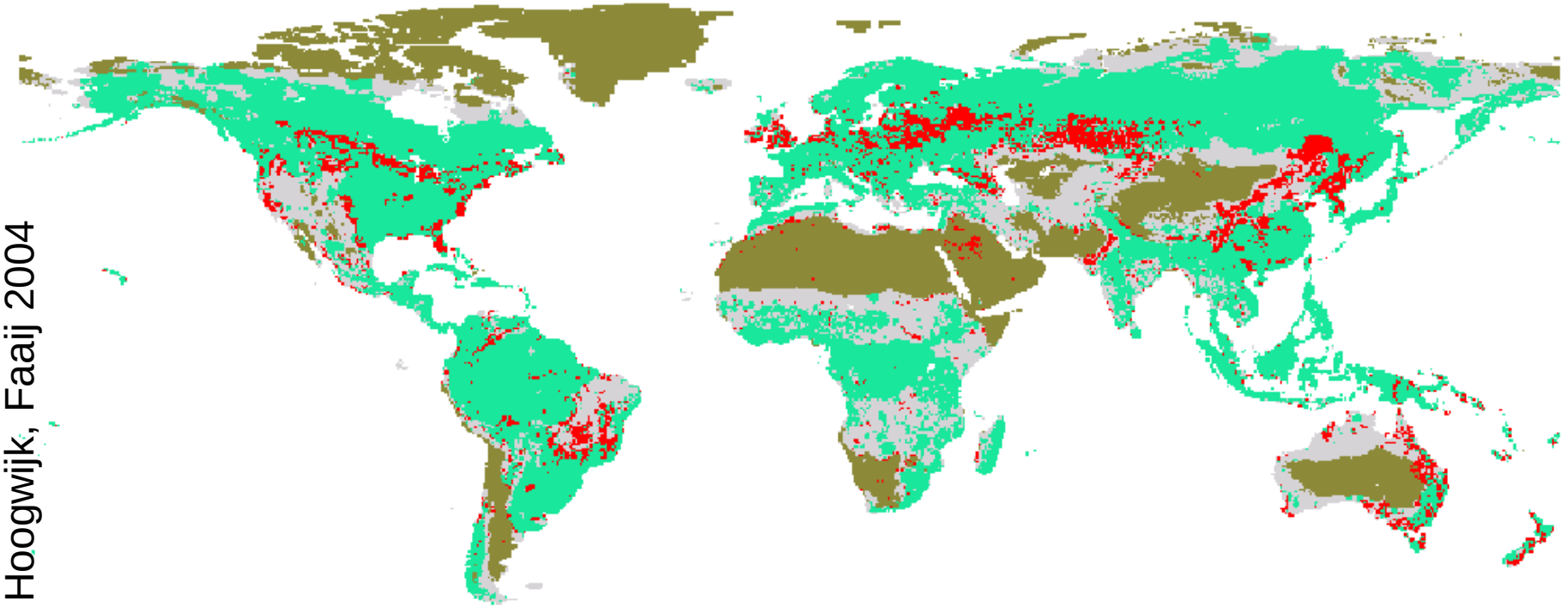

Source: Hoogwijk, Faaij 2004

- rest land
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- Other

B1 2050

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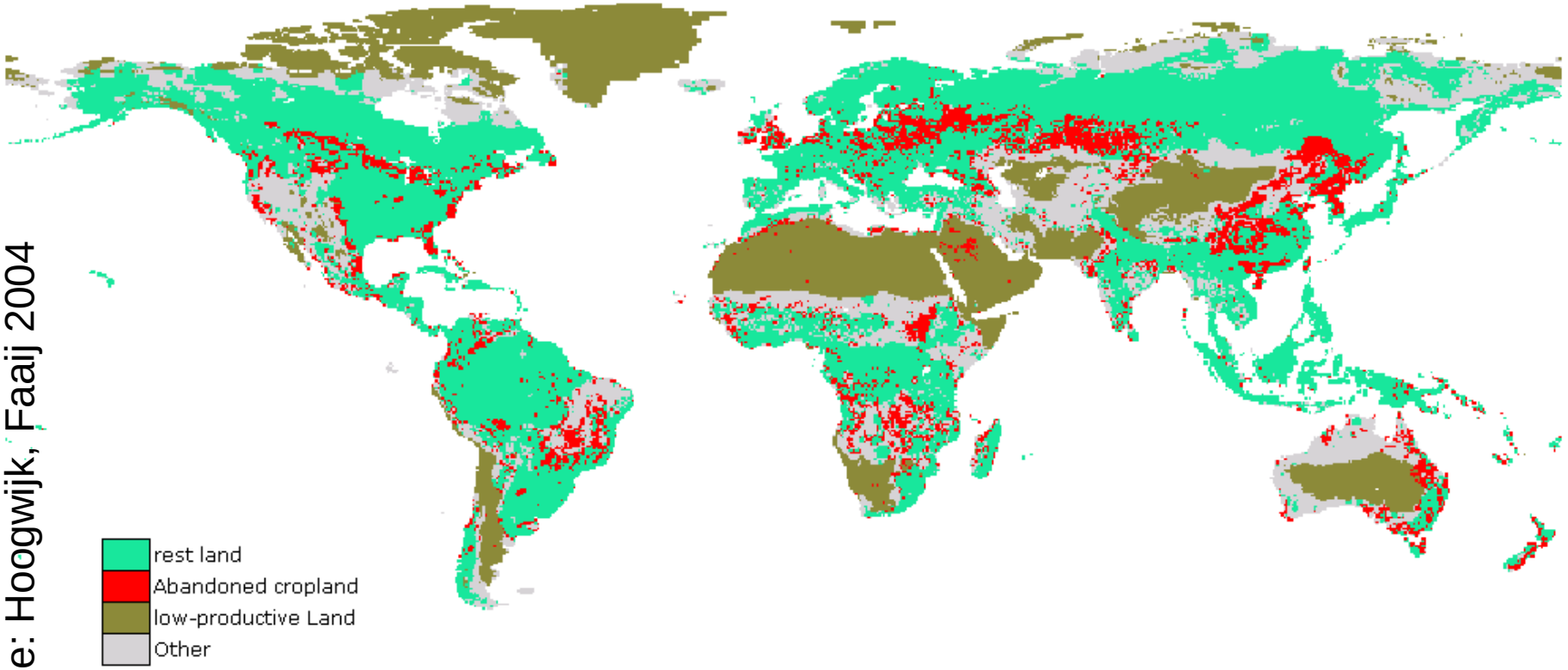
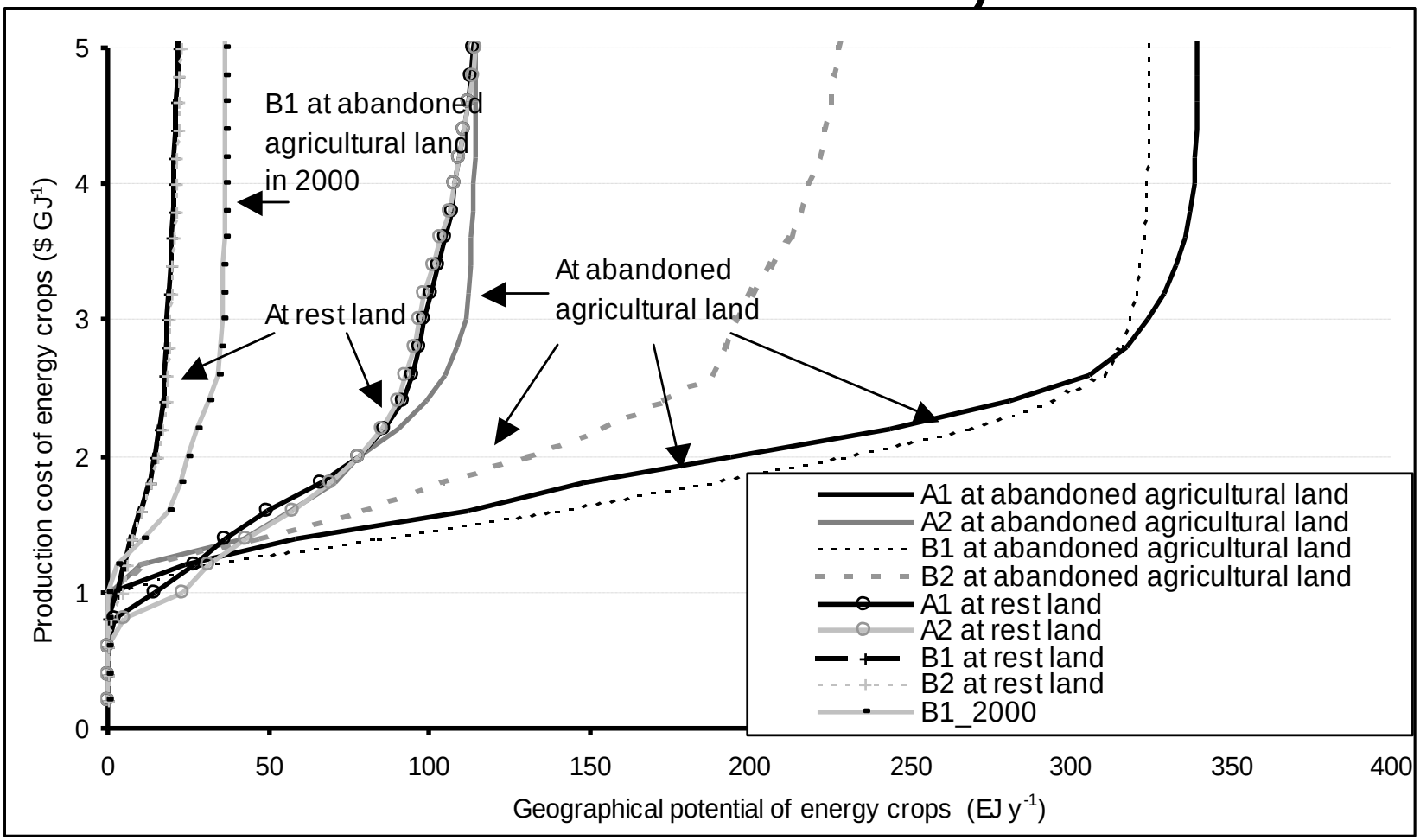


Source: Hoogwijk, Faaij 2004

Global cost-supply curve for energy crops for four scenarios for the year 2050



Source: Hoogwijk, Faaij, 2004

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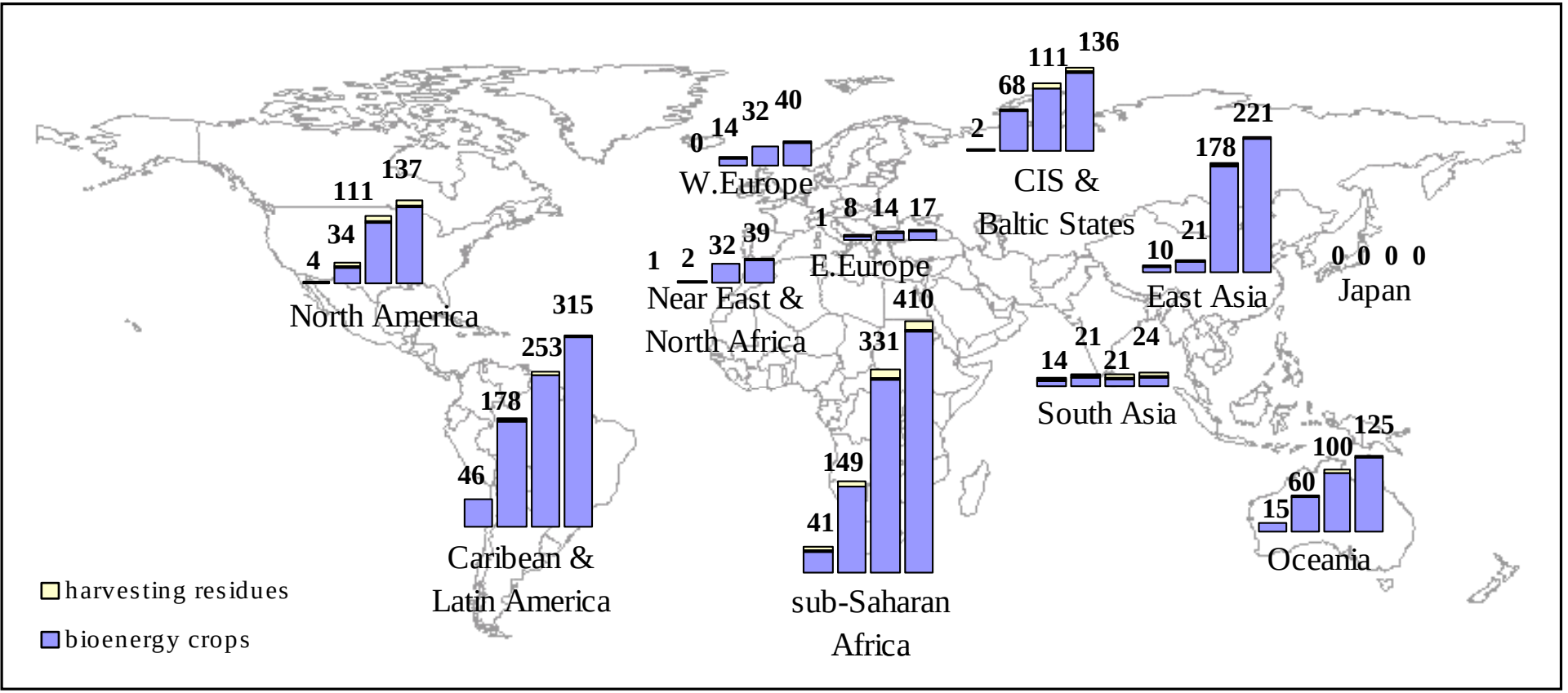
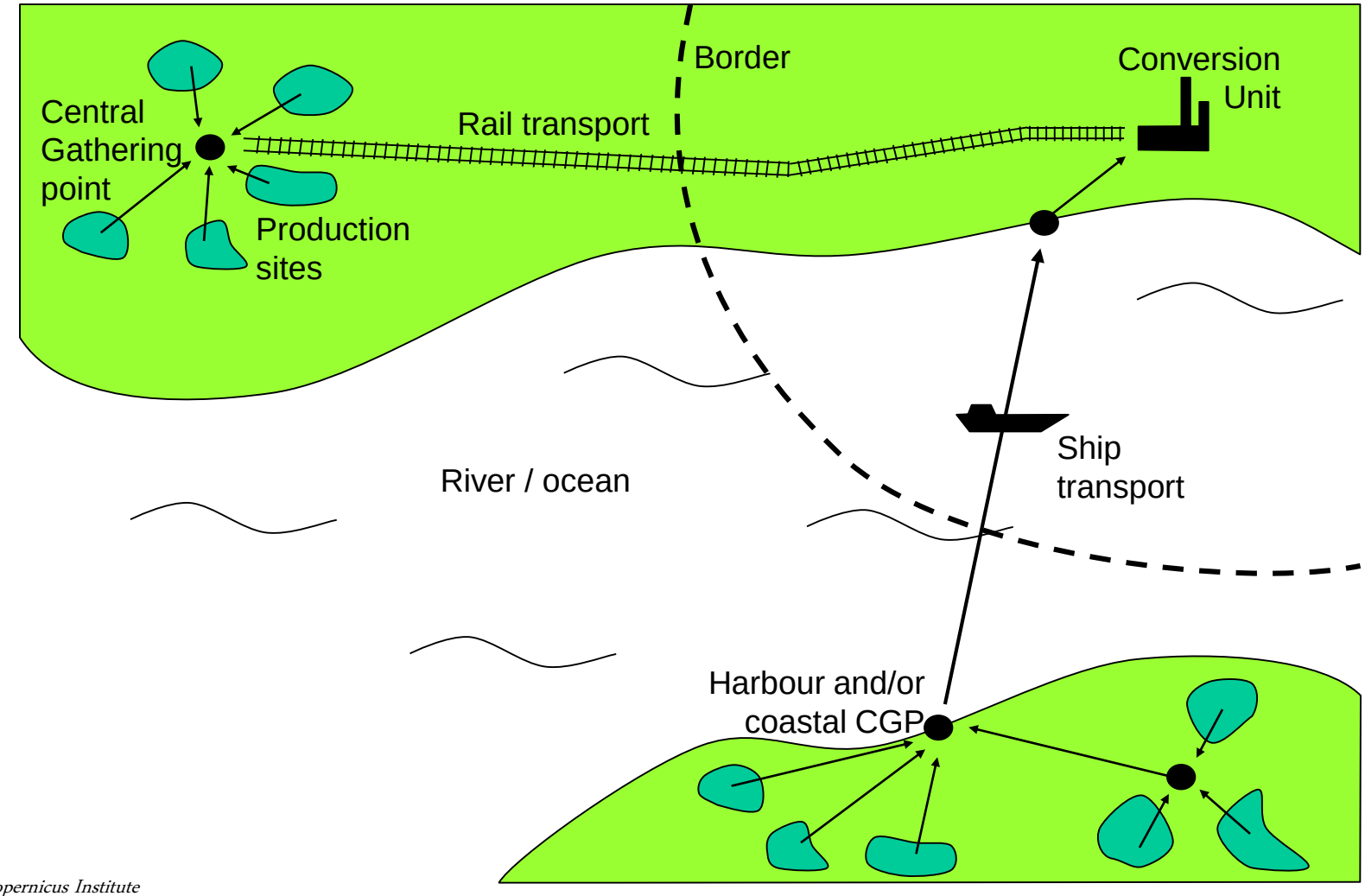
Bioenergy production potential in 2050 for different scenario's



International bio-energy logistics

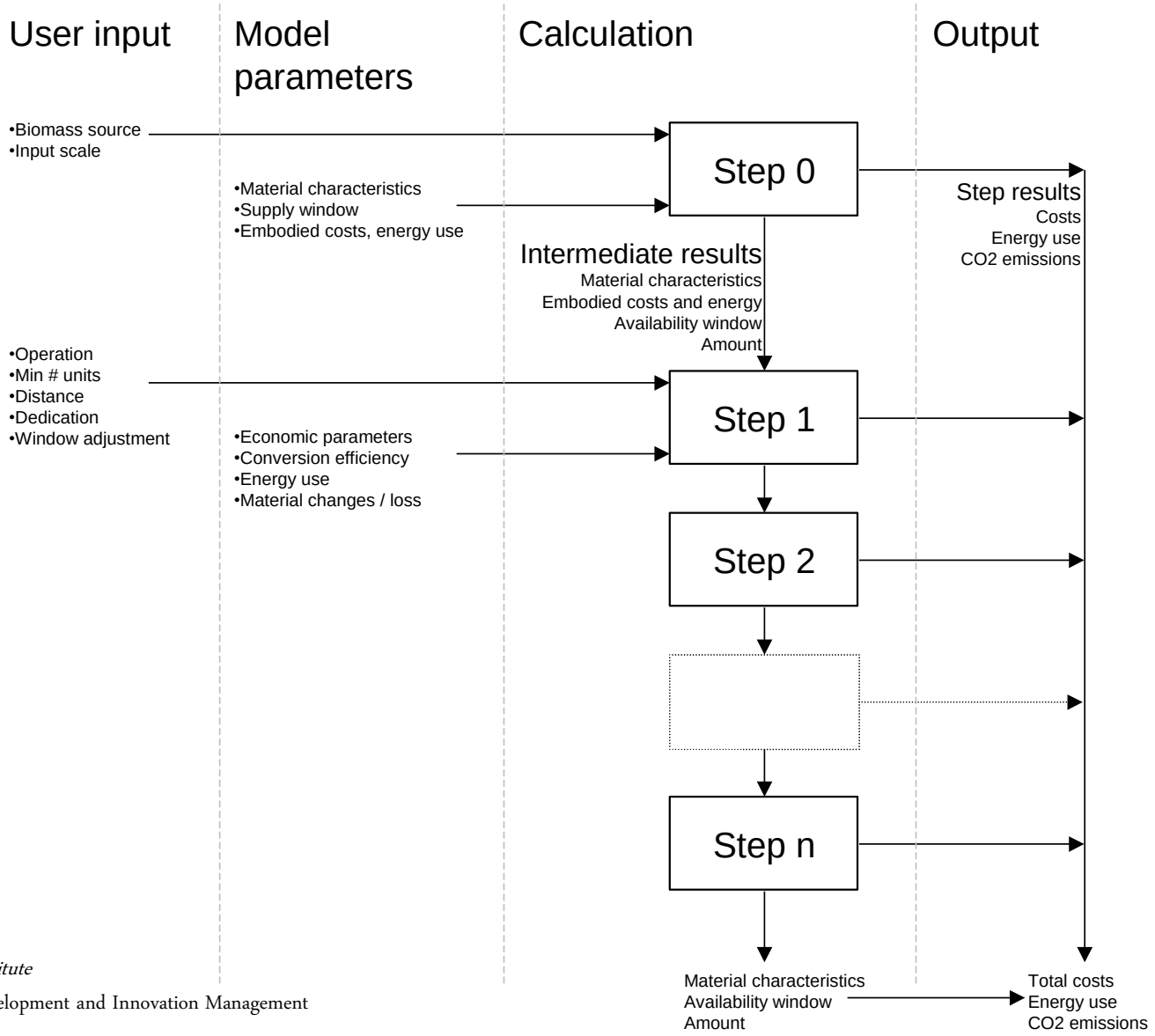


Source: Hamelinck, Faaij, 2003

Possible 'biotrade chains'

Exporter	Transport/transfer/storage	Importer
Biomass production	'raw' biomass	Full conversion
Biomass production & pre-treatment	Pre-treated (pellets, bales, bio-oil) biomass	(partial) conversion
Biomass production & conversion	Fuels (H2, MeOH, EtOH, HC's)	End-use
Production and conversion	Electricity transport	End-use
Biomass production	'conversion along the way'	End-use

model structure for chain analysis



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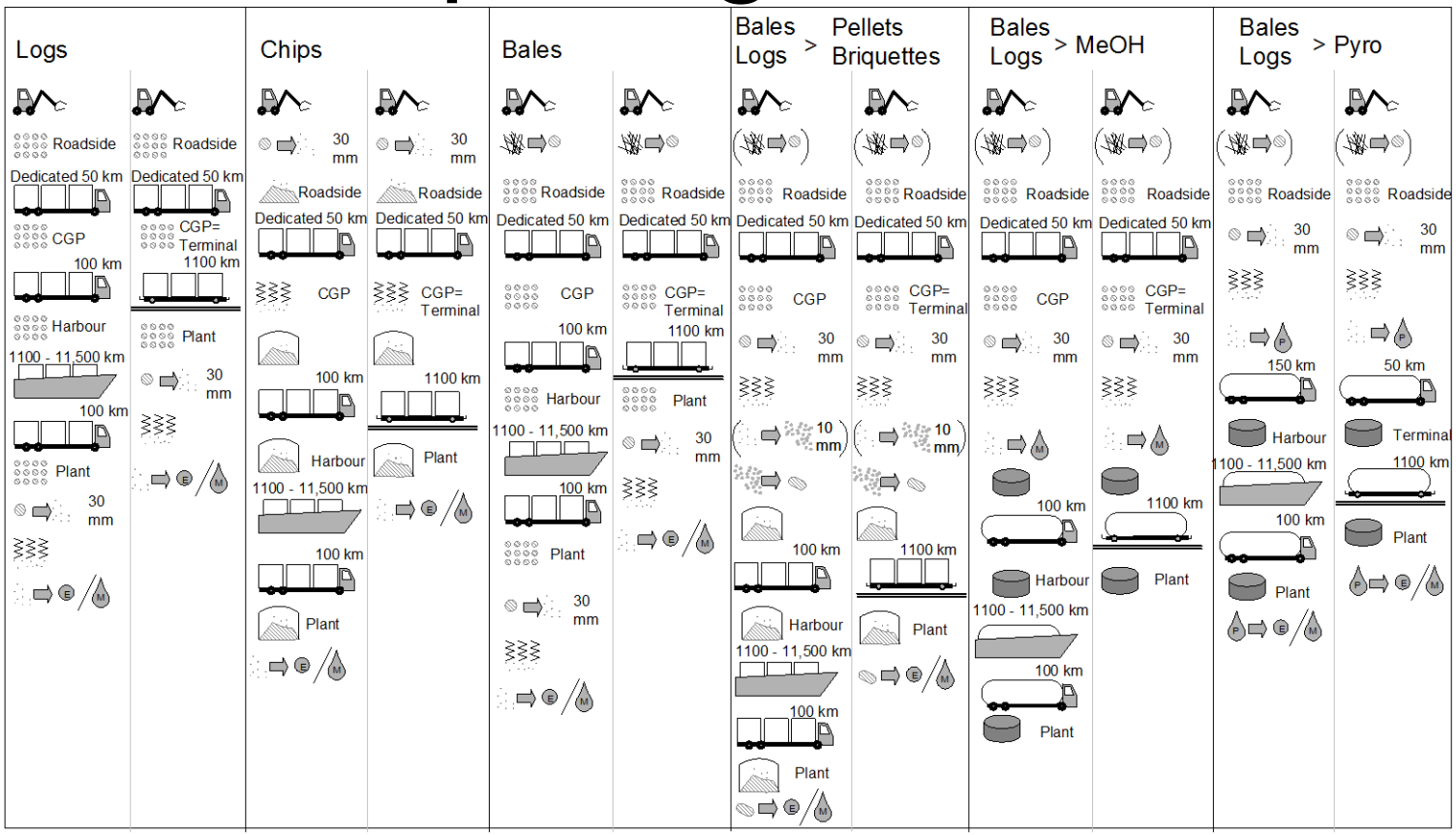
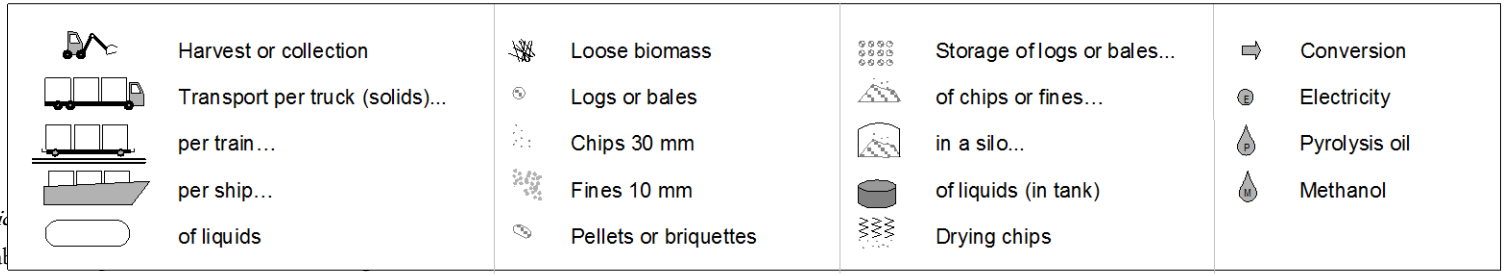
Composing chains…

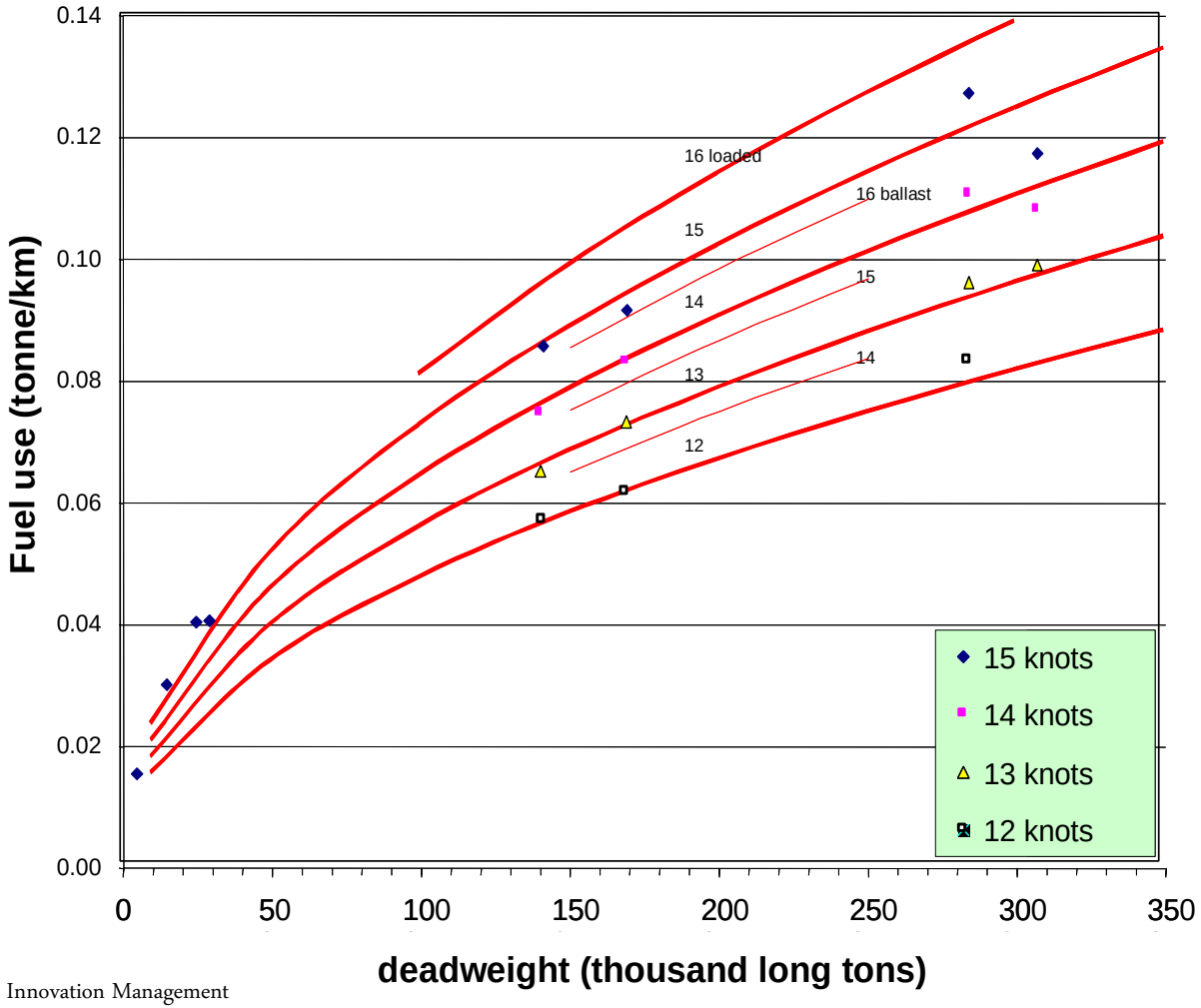


Legend

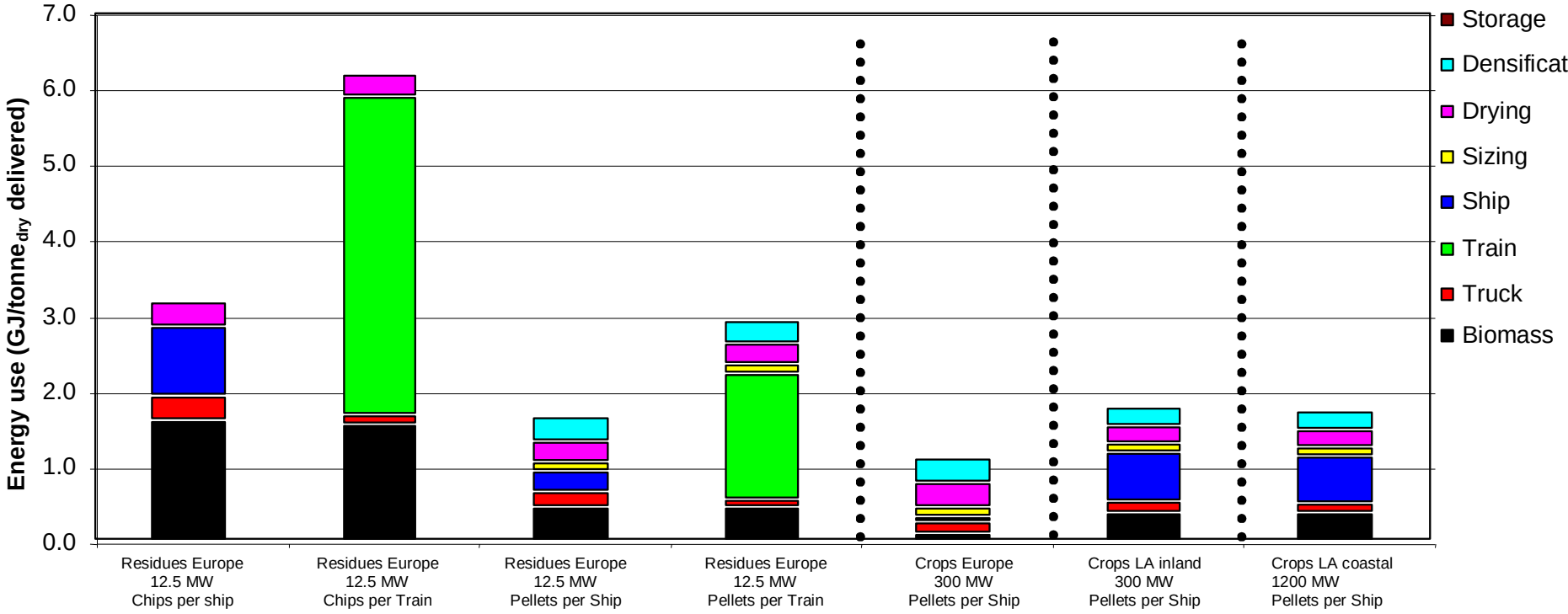


Copernic
Sustainal

Fuel use as a function of the ship size



Breakdown primary energy use of biomass supply chains to a Dutch power plant



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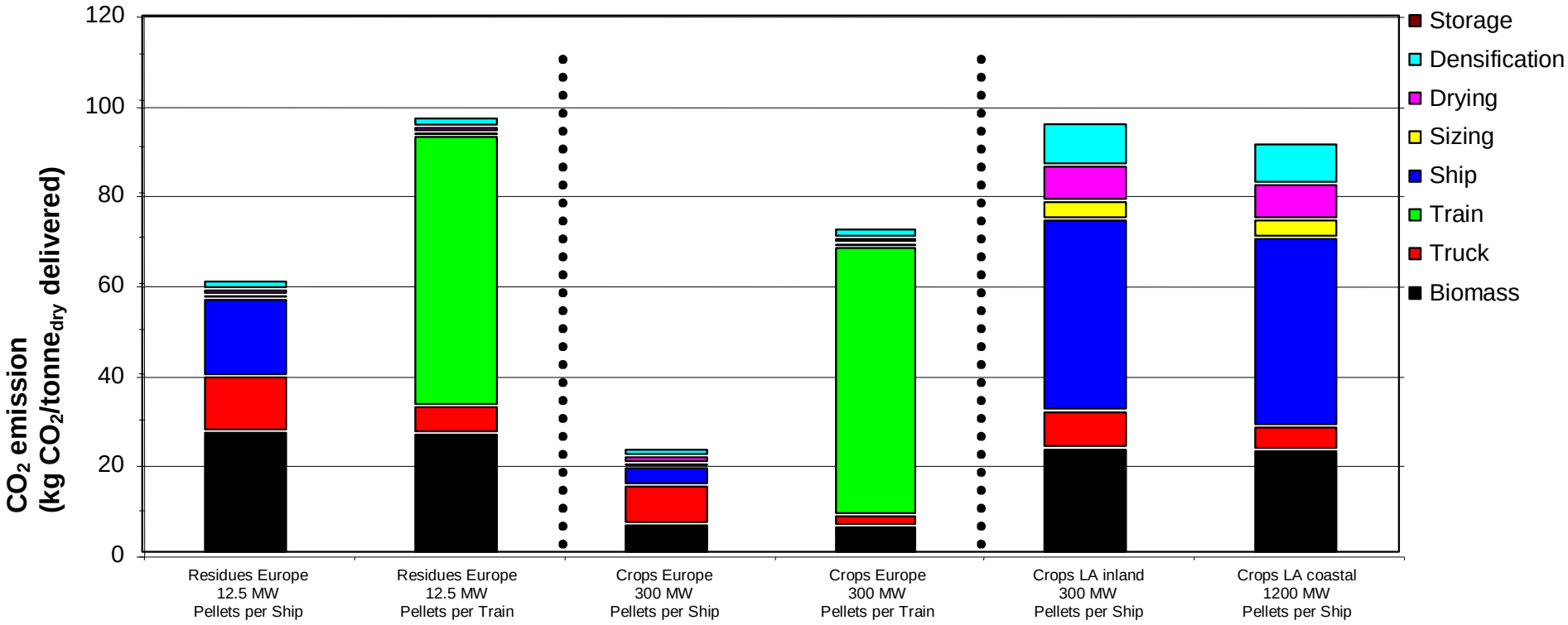
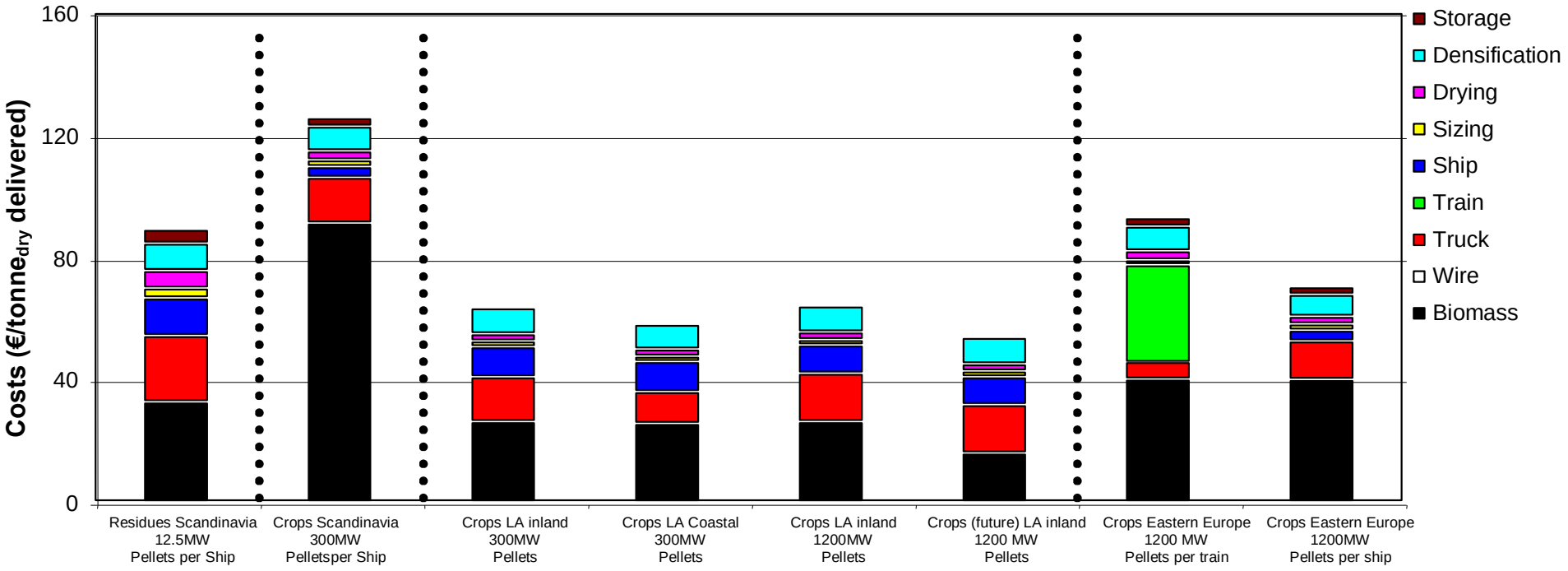
CO_2 emissions for chains delivering pellets



Cost breakdown of solid biomass delivered to a power plant in the Netherlands



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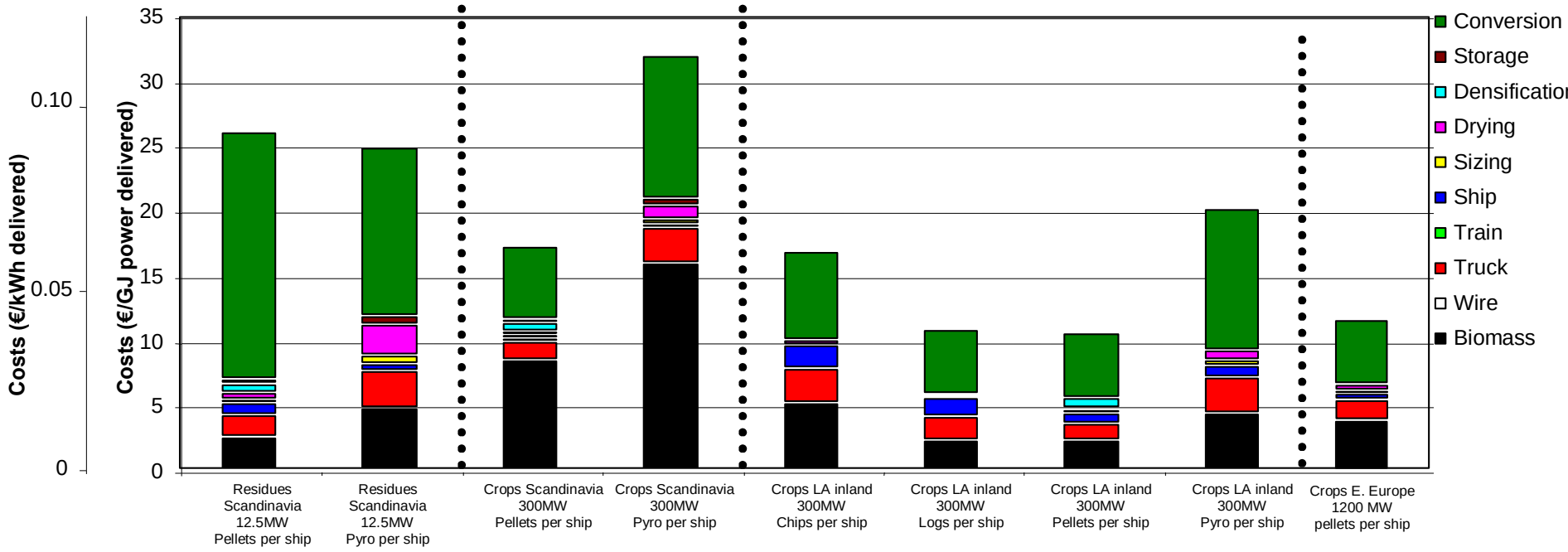
Cost breakdown of electricity delivered to the Dutch grid



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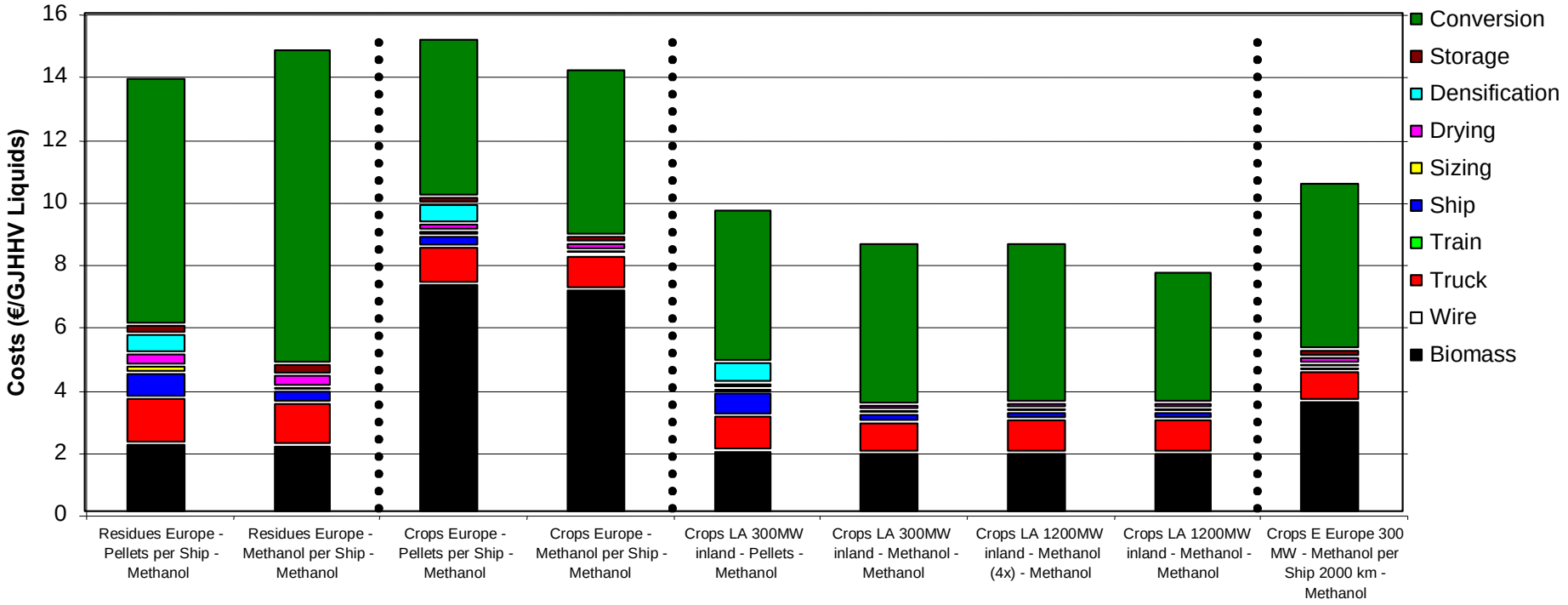
International logistic chains: bio- methanol produced from North & Eastern European and Latin American biomass supplied to Rotterdam Harbour.



Some (!) key findings…

- Reference systems importing & exporting country crucial for net GHG impact
- Economies of scale crucial
- Pre-treated biomass of secondary energy carriers preferred for international transport.
- Sea transport limited impact; road transport significant.
- Regional conditions (biomass distribution density, transport parameters, etc..

Background (1)

- A reliable and sustainable supply of biomass is vital to any market activity aimed at bio-energy production.
- Given high expectations for bio-energy on global scale, pressure on available biomass resources increases.
- Without the development of biomass resource potentials (e.g. energy crops) and a well functioning biomass market those ambitions may not be met.
- A lack of availability of good quality (and competitive) biomass resources has proven to be a structural showstopper for many market initiatives.

Background (2)

- Much experience in various countries with building biomass markets, as well as related sectors.
- Relatively recently, international trade of biomass resources became part of the portfolio of market parties.
- Optimism about opportunities, fear for unsustainable practice.

- **Previous debate concluded**: *"Structure and institutionalise (...) debate for a longer period of time, involving all key stakeholders. This does include international institutions, NGO's, industry, national bodies and the scientific community alike..."*

Rationale of international bio-energy trade:

- Cost effective emission reduction of greenhouse gases: Several world regions have inherent advantages in producing lower cost and large quantities of biofuels.
- Socio-economic development: benefits for national trade balances and a sustainable source of income for rural communities.
- Sustainable management and the rational use of natural resources: biomass production combined with better agricultural methods and restoration of degraded and marginal lands.
- Fuel supply security: diversify portfolio of fuels used & imported; also true for bio-energy as such (!)

The concept of international bio-energy trade is fetching momentum at World Bank, FAO, WTO and the UN and pursued by countries as Brazil, Russia, USA, Japan and various European nations.

Main objectives

- Investigate what is needed to create a *"commodity market"* for bio-energy.

- Contribute to the development of *sustainable* bio-energy markets on short and on long term and on different scale levels.

Gross list (1): objectives/activities/deliverables

- Overview & exchange of available information on biomass markets (resources and utilisation).
- Improve insights in influencing factors on the supply and demand of biomass for the short, medium and long term
- Overview of development of biomass markets in various contexts
- Synthesis of existing trade experiences and survey possible effects on existing markets (e.g. pulp wood, forestry and agricultural products and residues)
- Synthesis of existing barriers, hampering development of a (global) commodity market
- Identification of strategies to overcome “barriers”

Gross list (2): objectives/activities/deliverables

- Identification of sustainability criteria (best practice guidelines)
- Evaluation of the political, social, economic and ecological impact of biomass production and trade on rural regions.
- Dynamic demand and supply models of bio energy.
- Strategies for integrating the production of biomass for energy and export into agricultural and agro-forestry systems (DC's)
- Increasing public awareness of international bio energy trade
- Strategic advice (IEA a.o. …); action plan.
- International platform -> *basis for activities*!
- Website/internet forum, newsletter, FAQ, communication plan

Task management

- Combination of scientific and market party:
  - *The Copernicus Institute of Utrecht University:* Scientific coordination; reporting, synthesis and integration work - Andre Faaij
  - *Essent Sustainable Energy*: Management of finance and communication - Martijn Wagener & Rob Remmers

- Planned budget: ~100 kU$/yr; common breakdown.

Interest so far:

- **Countries:**
  - 4 Confirmed (Netherlands, Sweden, Norway, Brazil)
  - 4 (!) Observers (Finland, EC, Croatia, Italy)
  - 2 undecided; industrial participation worked on (Canada, UK).
  - No participation but efforts made: Austria, Denmark, NZ…
- **International bodies participating**
  - FAO, World Bank; (UNECE is interested)
- **Remarkable (++) combination of market parties and scientific world.**

Intended collaboration with other IEA Tasks:

- **Task 30 (Forestry systems);** e.g on guidelines for sustainable production.
- **Task 31 (Short Rotation Coppice systems);** e.g on guidelines for sustainable production and land-use impacts.
- **Task 29 (Socio-economic drivers in implementing bio-energy projects);** e.g on “FairTrade” concepts for exporting bio-energy.
- **Task 38 GreenHouse Gas Balances);** e.g. on accounting rules and relevant international frameworks .

Final remarks

- Preliminary work programme now started.
- Team may grow over time (flexible starting phase…).
- Task as a **platform** for other activities: projects, pilots, networking…
- IEA Strategic objectives: task aims to meet market needs, use global experience and work in supra-national setting.