Biobased products: a real opportunity for ensuring a sustainable development in the Mediterranean region

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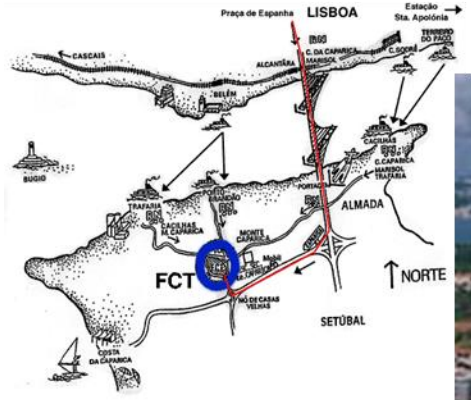
- *campus* - located in Monte de Caparica



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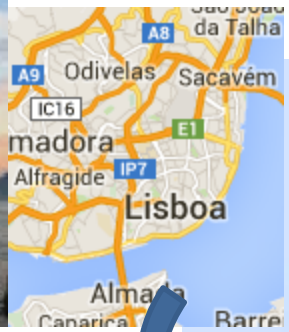
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Barre


Porto
Madri
Portugal
Espanha
Lisboa
Sevilha

⇨ *development of commercially viable "green products" based on natural resources (e.g. biomass)*

⇨ *directed to a wide range of applications*

⇨ *increased importance!!!!*

Why? *Opportunities/Barriers*

- ✓ **Environmental**
- ✓ **Economic**
- ✓ **Social**
- ✓ **Technological**
- ✓ **Political**

Biomass

✓ offer advantages

- ❖ renewable
  - ❖ reducing the dependence on non-renewable resources
- ❖ biocompatible with existing systems
  - ❖ ex: biodiesel/diesel

Biomass

- ✓ **offer ecological advantages over fossil resources**
  - ❖ **lower environmental impacts**
    - ❖ **as fossil fuels**
      - ❖ **reduction of GHG emissions**
    - ❖ **biomaterials**
      - ❖ **biodegradable - end of the technical life**

Biomass

- ✓ offer social-economic advantages
- ✓ production of biomass
  - ✓ sustains employment and income
    - ✓ in many regions,
      - ✓ <u>including rural areas</u>

Political support

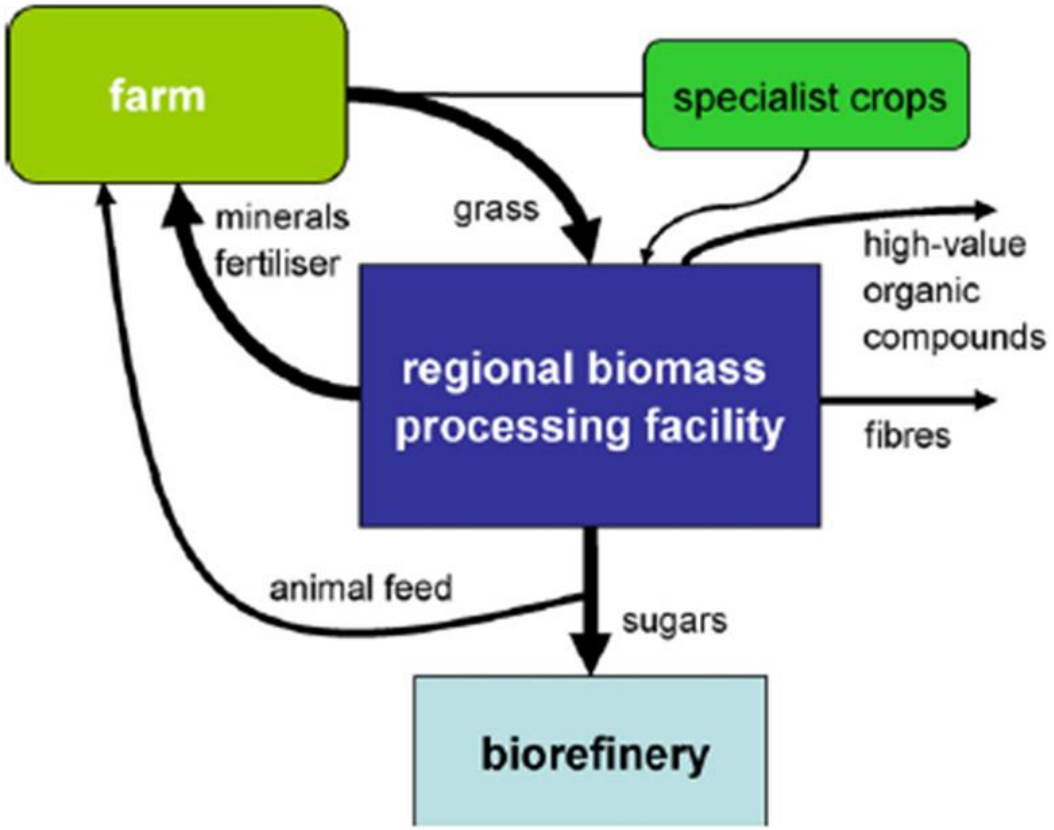
- ✓ **Extremely important**
  - ✓ **Subsidies/legislation**
  - ✓ **linking farmers with industrials**
- ✓ **Brasil with ethanol**
- ✓ **Miscanthus in England**

Political support

- *Norway is considering to give tax incentives to bio-based products as the first country in the world*

- *In December 2014, the Norwegian parliament decided to evaluate different options of tax incentives for bio-based polymers – e.g. introduce a new tax on fossil CO2 content in polymers, which is not taxed today.*
-
- *This will be a market pull for the bio-based economy:*
  .use of more Bio-PET in bottles

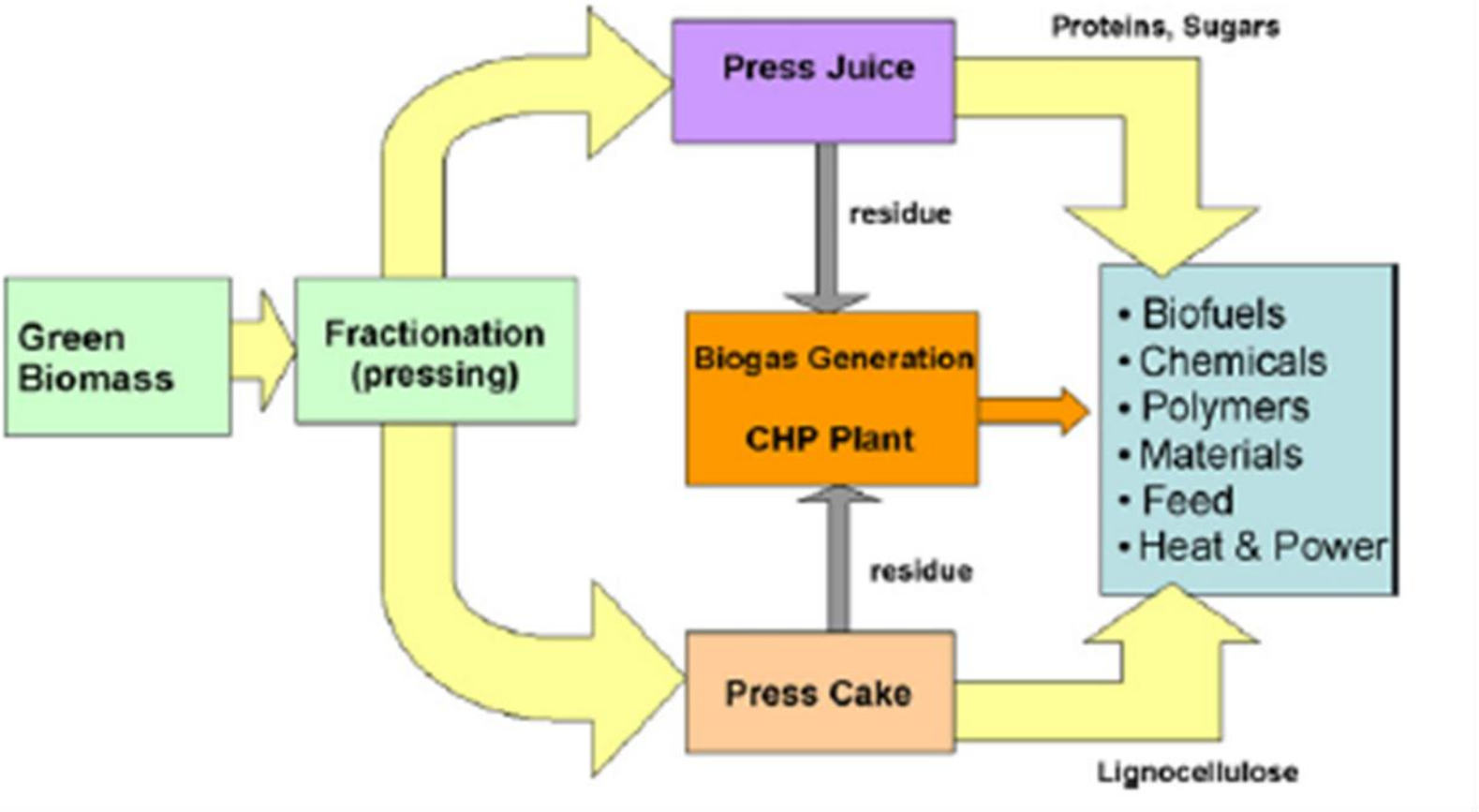
Concept



Regional Biomass Processing facility

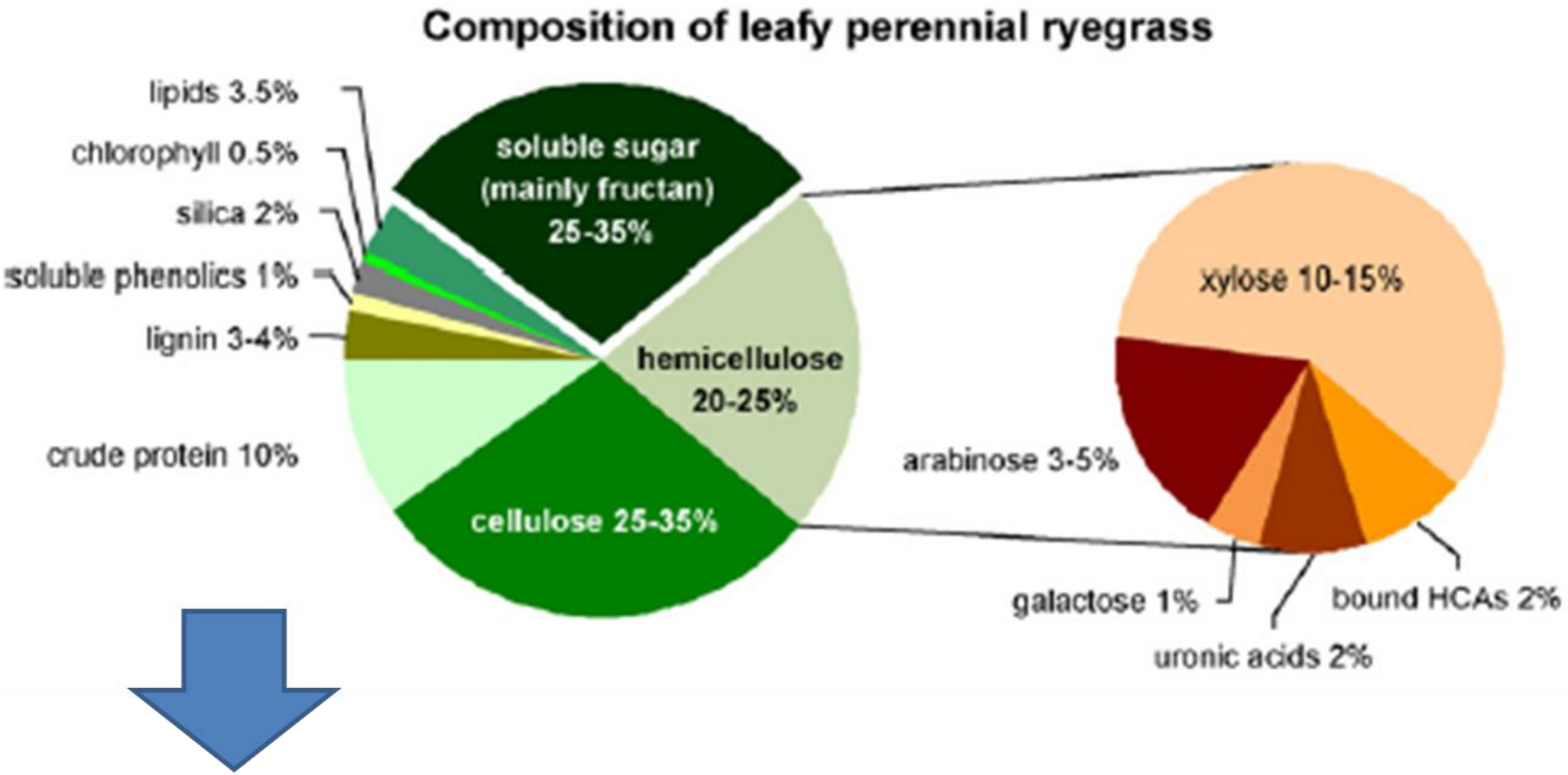
(CI-KTN, 2008)

Concept



The green biorefinery for processing green biomass (NNFCC, 2007).

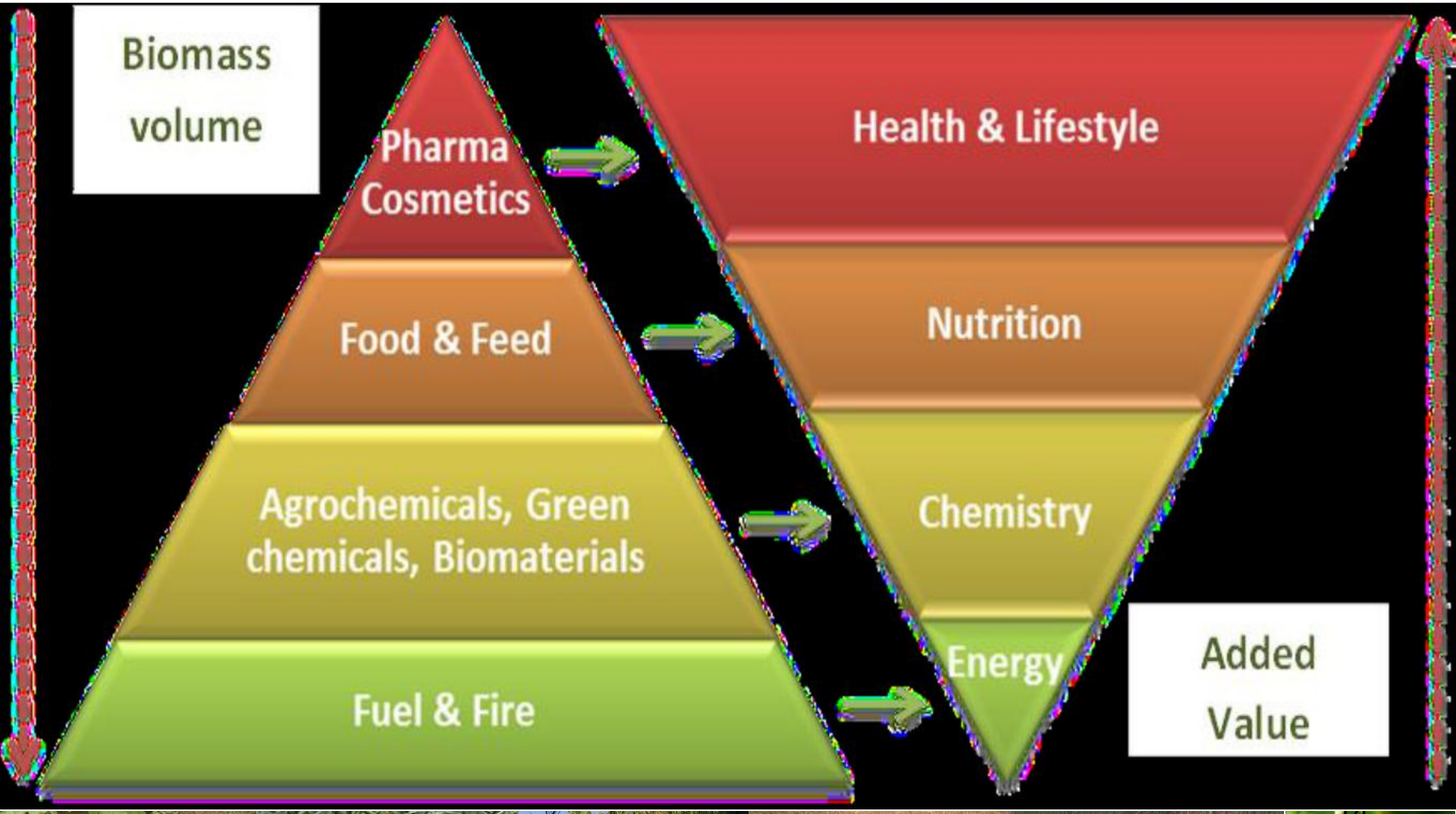
Concept



What can we do with this?

(IBERS, Aberystwyth University).

Concept


Biomass volume
Pharma Cosmetics
Food & Feed
Agrochemicals, Green chemicals, Biomaterials
Fuel & Fire
Health & Lifestyle
Nutrition
Chemistry
Energy
Added Value

But….

- ✓ What if there is an increasing demand for biomass?
  - ✓ intensive use of land
    - ✓ pressure on natural resources
      - ✓ Biodiversity/water/soil
      - ✓ Increment of agrochemicals
  - ✓ increased competition for land

So…how to solve this?

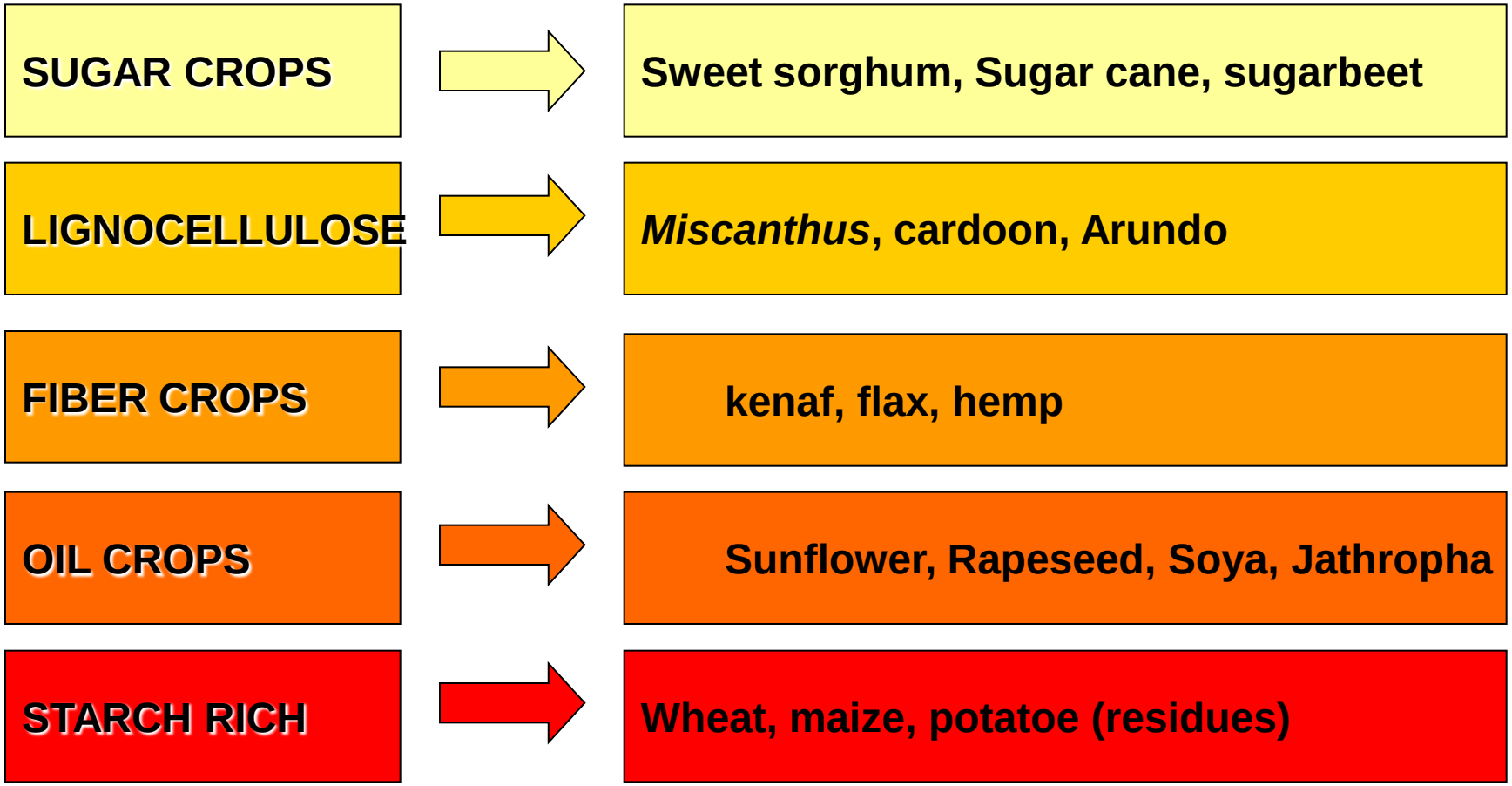
- ✓ **Use of residues**
- ✓ **Wastes from agro-food technologies**

✓ **But not enough**

Dedicated crops - Which crops?

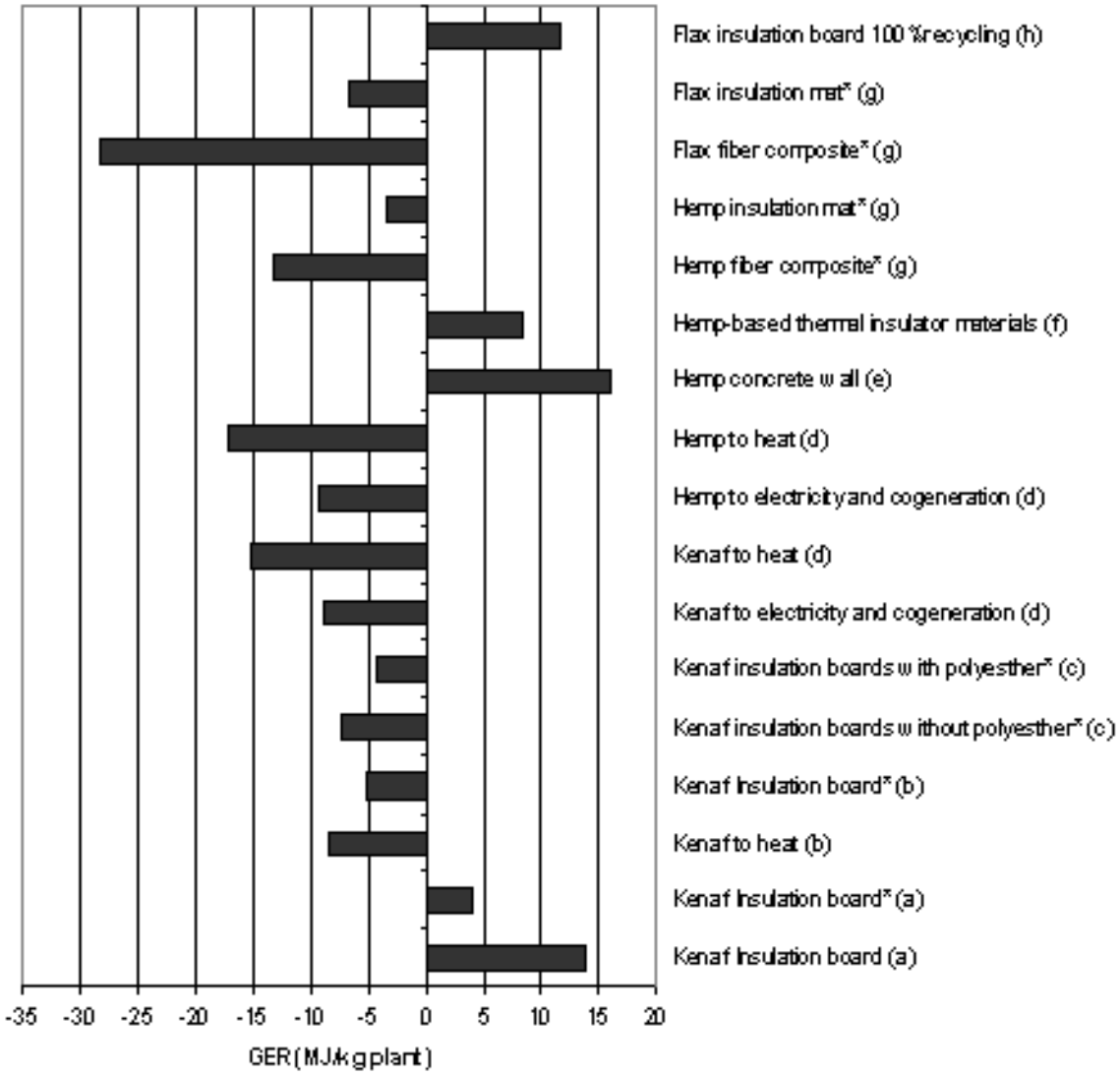
- ✓ **Non-food crops**
- ✓ **Tolerant crops to marginal land**
  - ✓ **to limit the ethical issues associated with competition with food crops**
- ✓ **Low input requirements (fertilizers, pesticides, water, etc)**
  - ✓ **To limit emissions (GHG, acidifying, euthophication) and use of resources (energy, water, mineral)**

Dedicated crops - Which crops?



www.bio-based.eu/IBIB

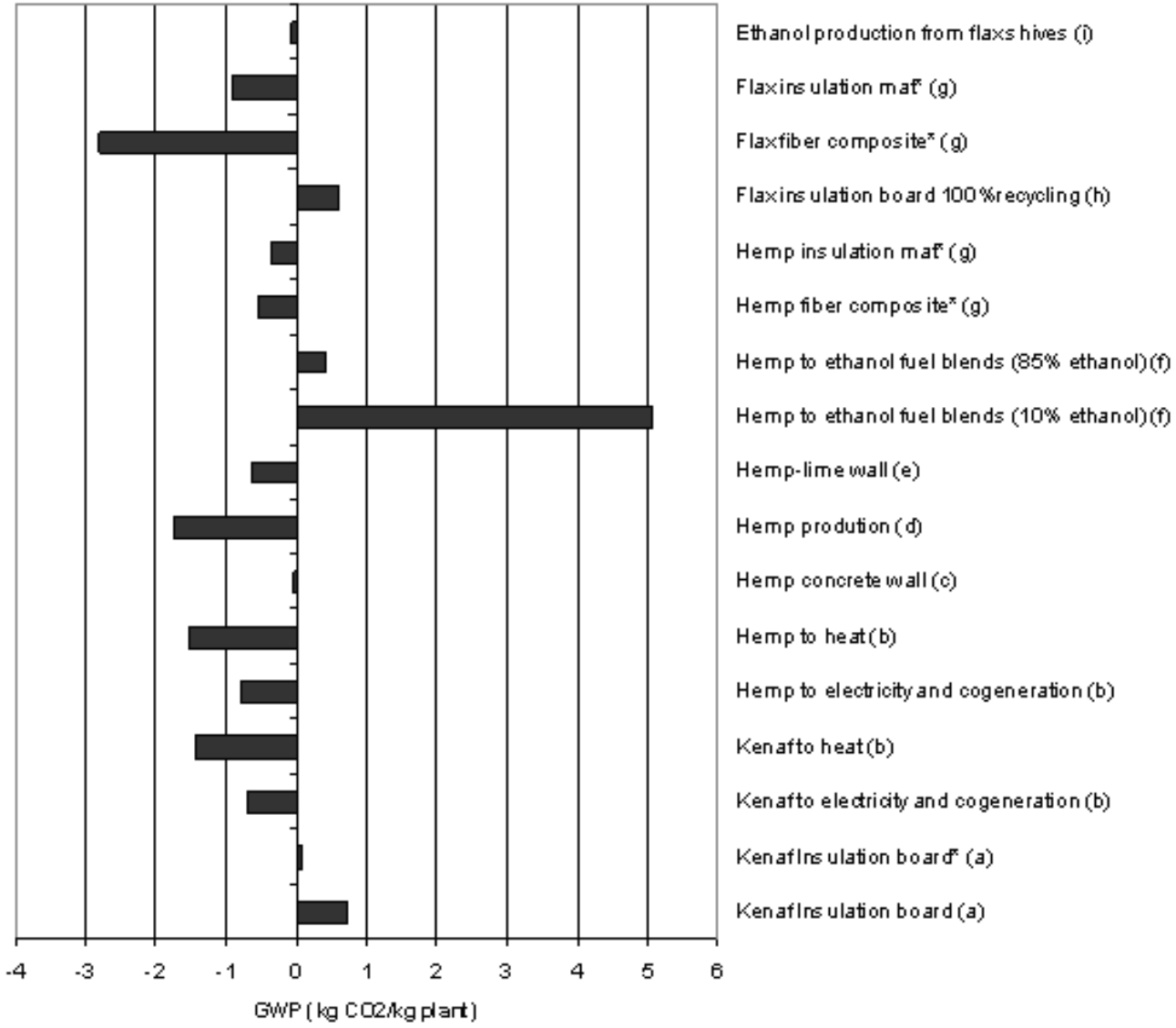
Some environmental benefits



Fossil Energy savings

Fernando et al. 2014

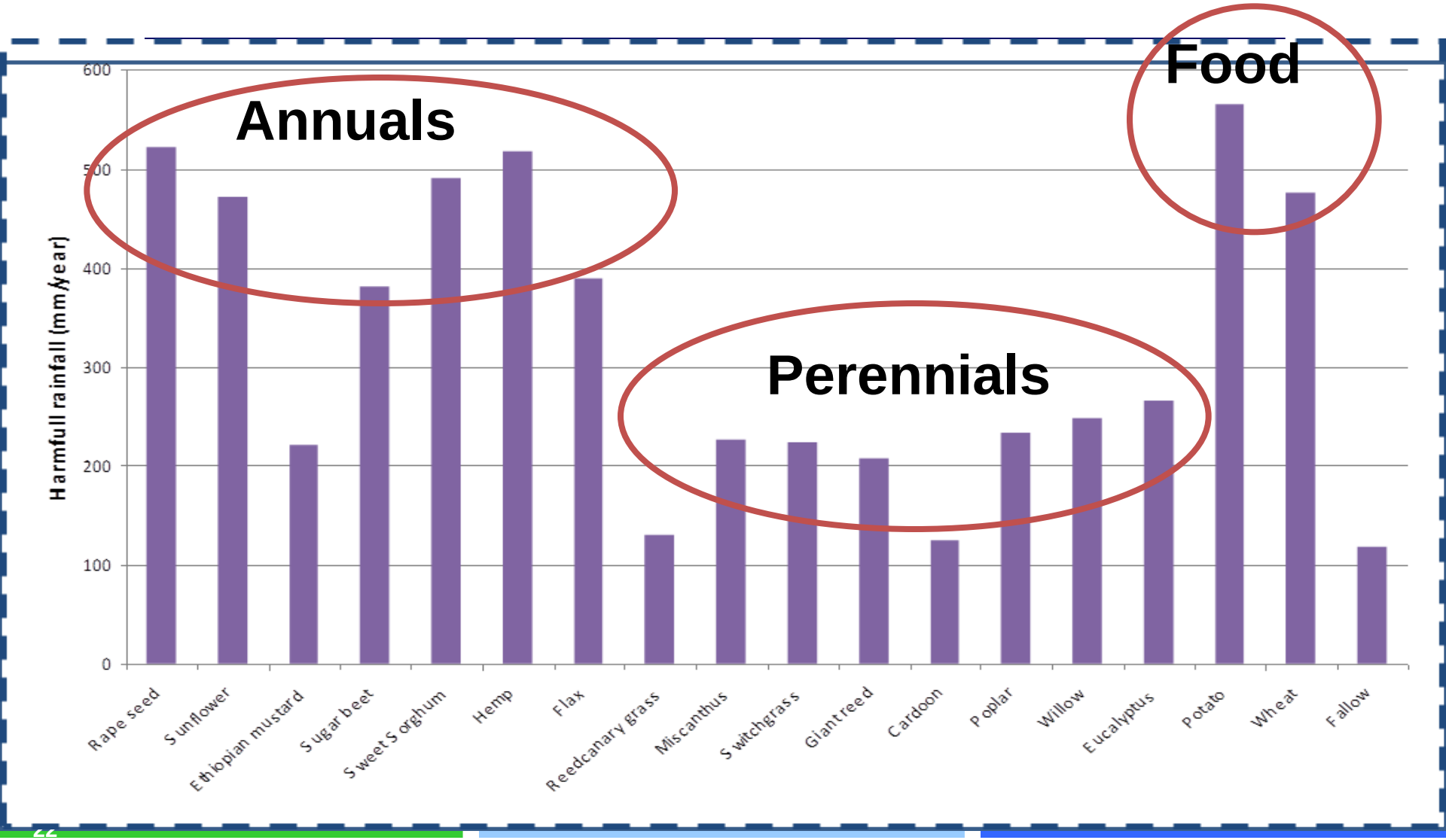
Some environmental benefits



GWP reduction

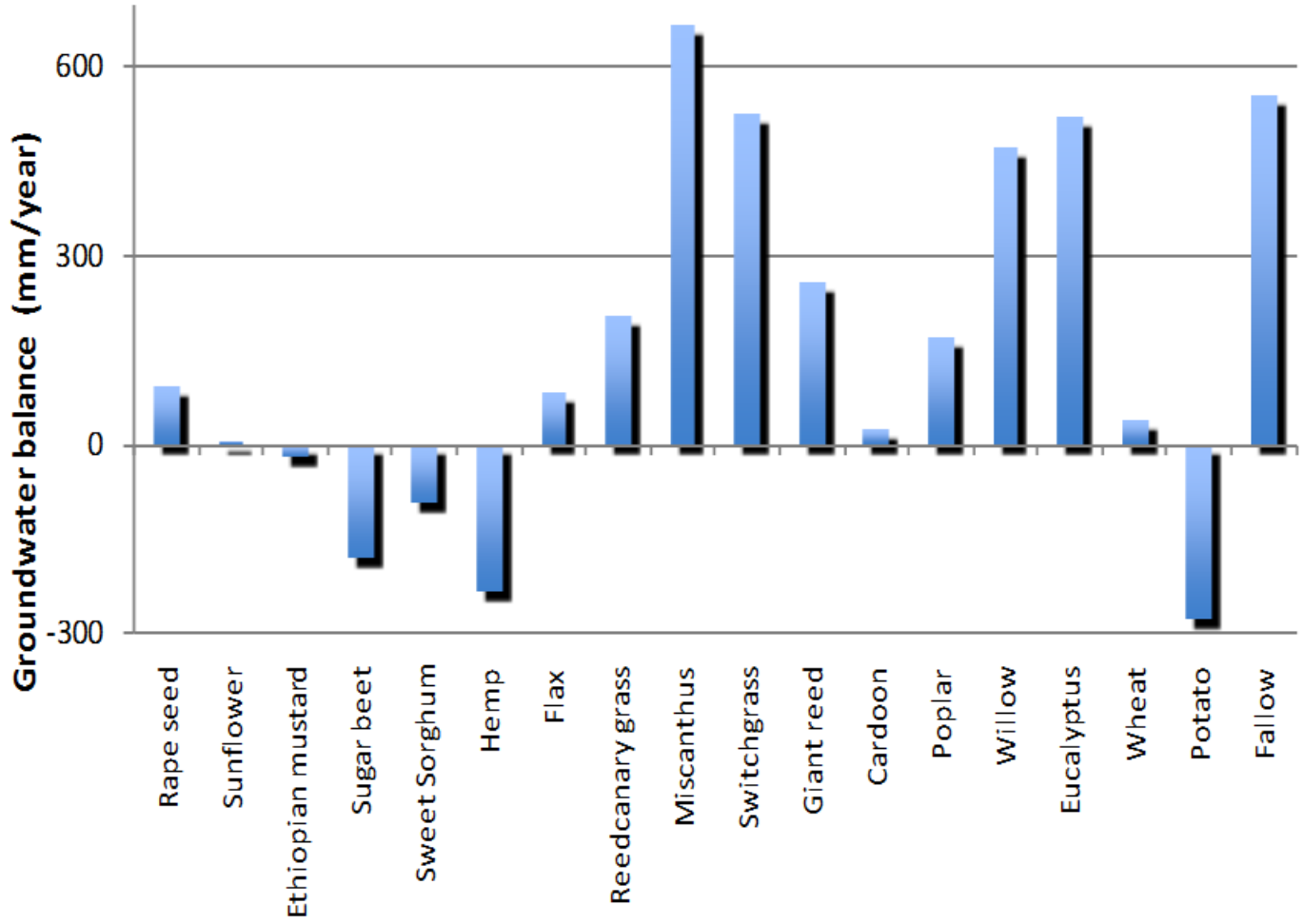
Fernando et al. 2014

Soil erosion impact



Fernando et al. 2010

Impact on water resources – water balance



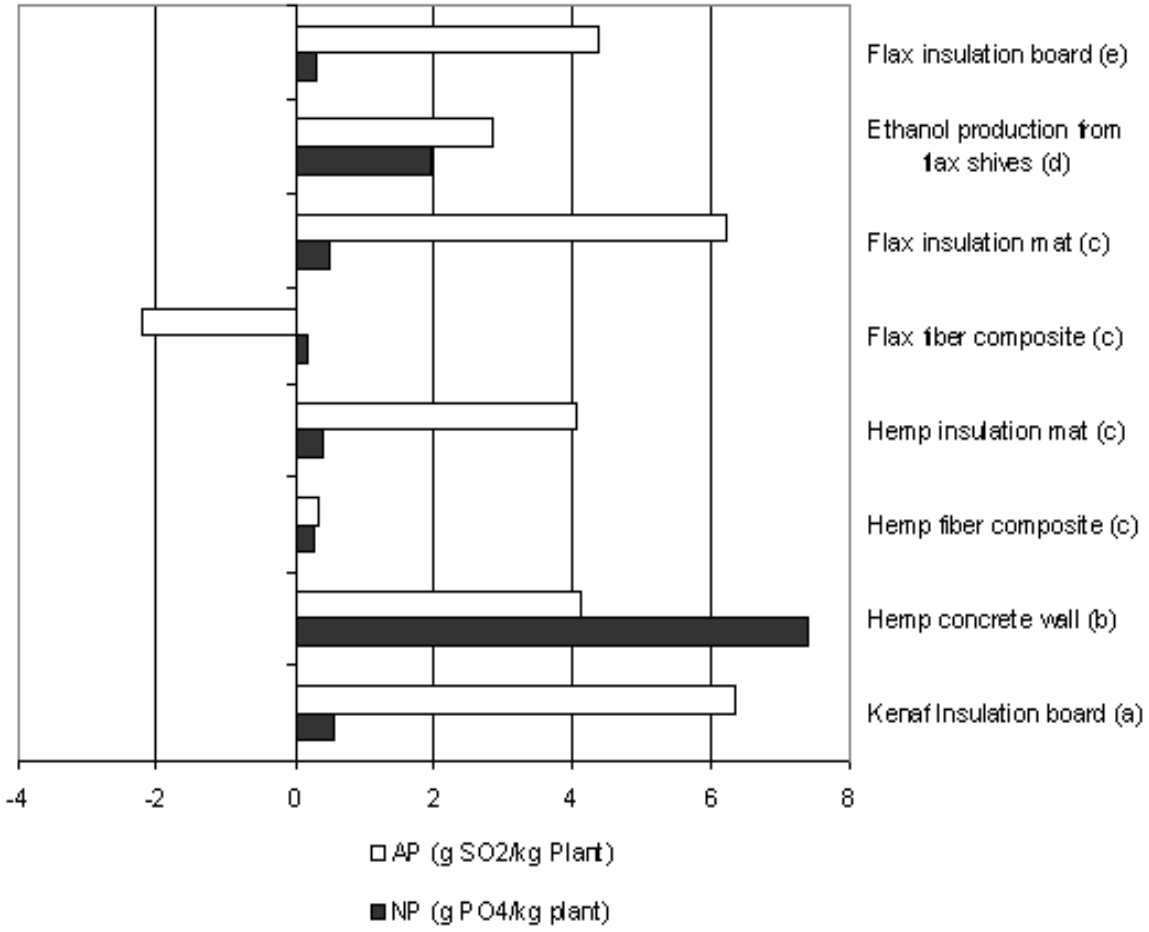
⇨ In Europe, most crops sufficed by rainfall

⇨Allocation ↑ water-demanding crops to regions ↑precipitation

⇨Irrigation with WW…

Fernando et al. 2010

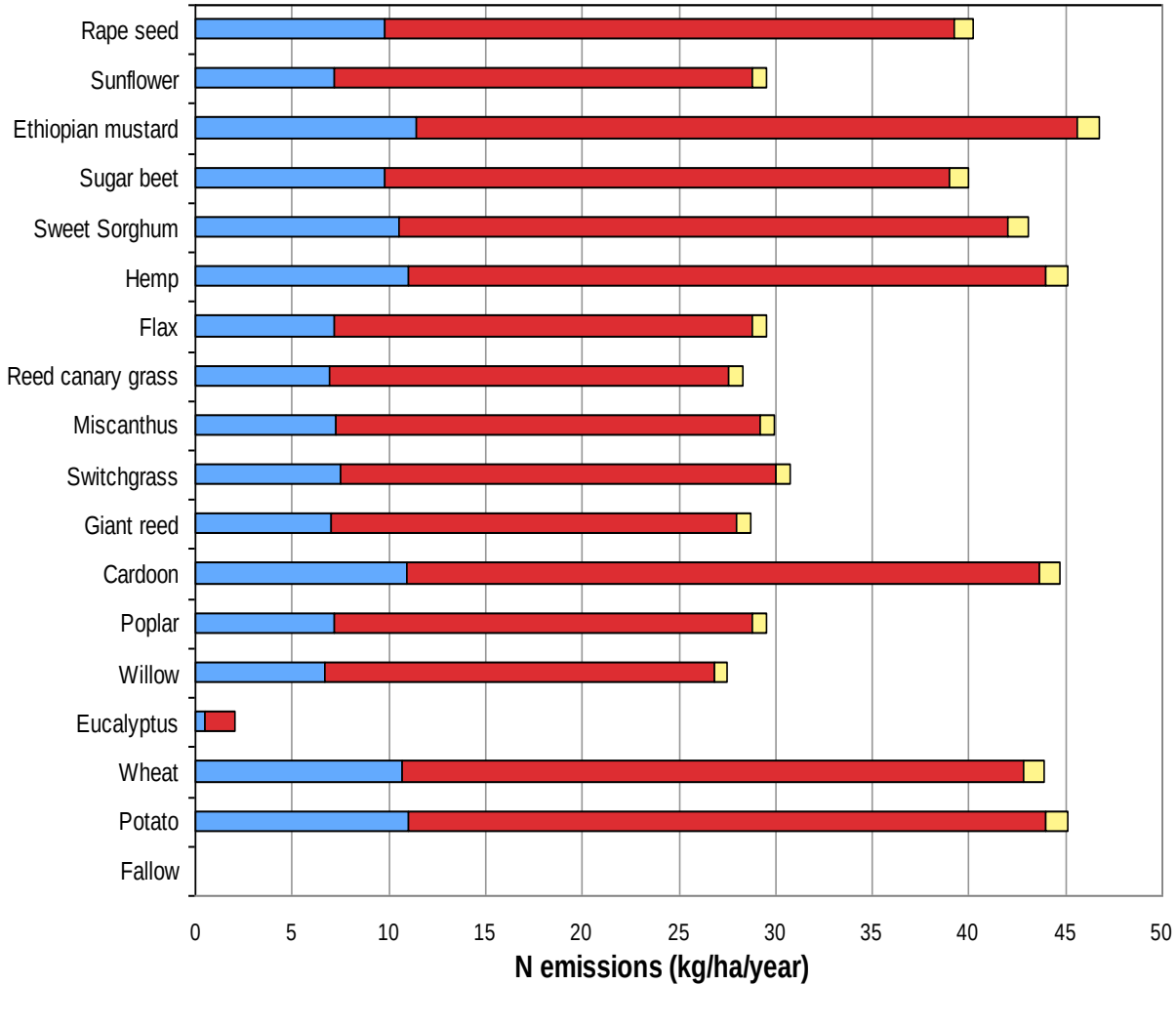
Only positive aspects? No…



⇨ **High acidification and euthrophication potential**

Fernando et al. 2014

Only positive aspects? No…



⇨ **N emission to soil, air, water**

During cultivation

Fernando et al. 2010

How to increase sustainability?

⇨ **Balancing pros and cons!**

⇨ **More info on**

- ⇨ **Crop management**
- ⇨ **Processing options**
- ⇨ **Turning residues into sub-products**

Fernando et al. 2010

Case study – Miscanthus

Energy

Automobilie interior doors

Animal bed

Paper

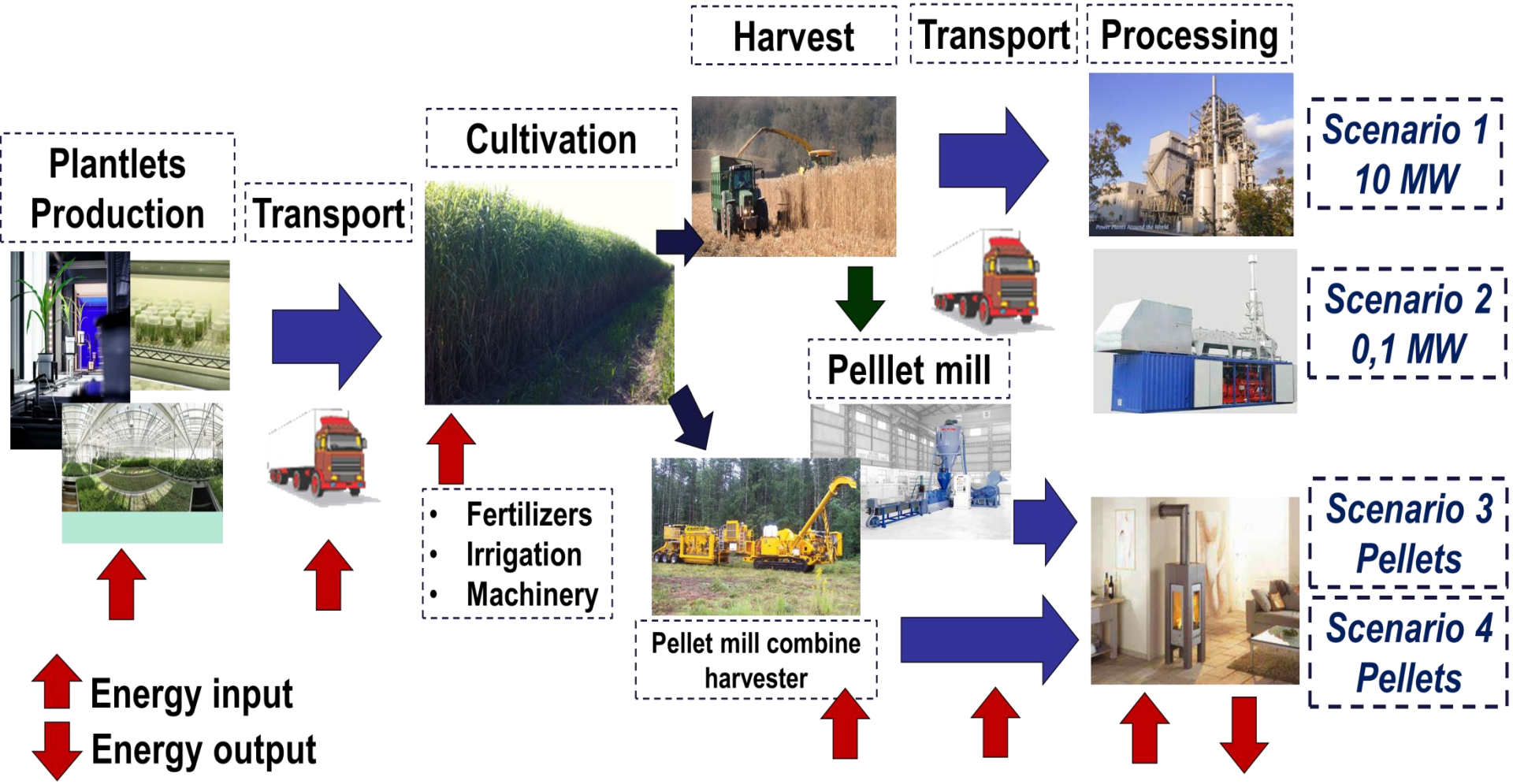
Biopots™

MDF

Roof cover

Compost

Case study – Miscanthus



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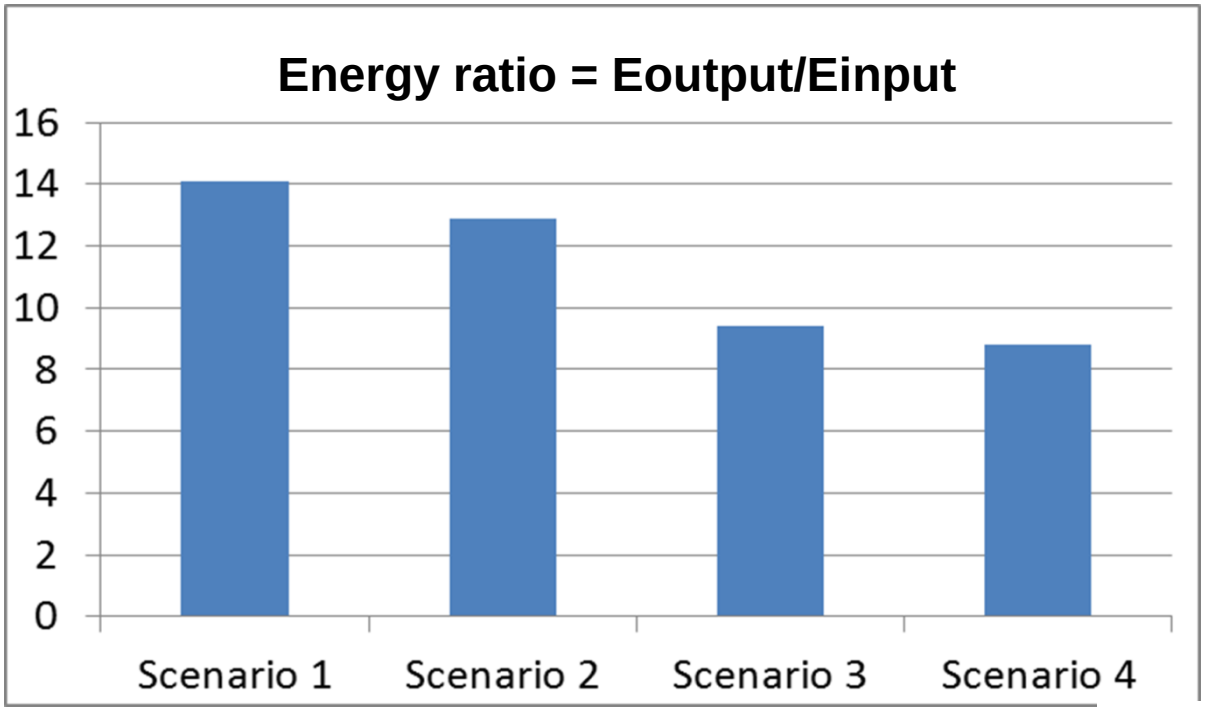
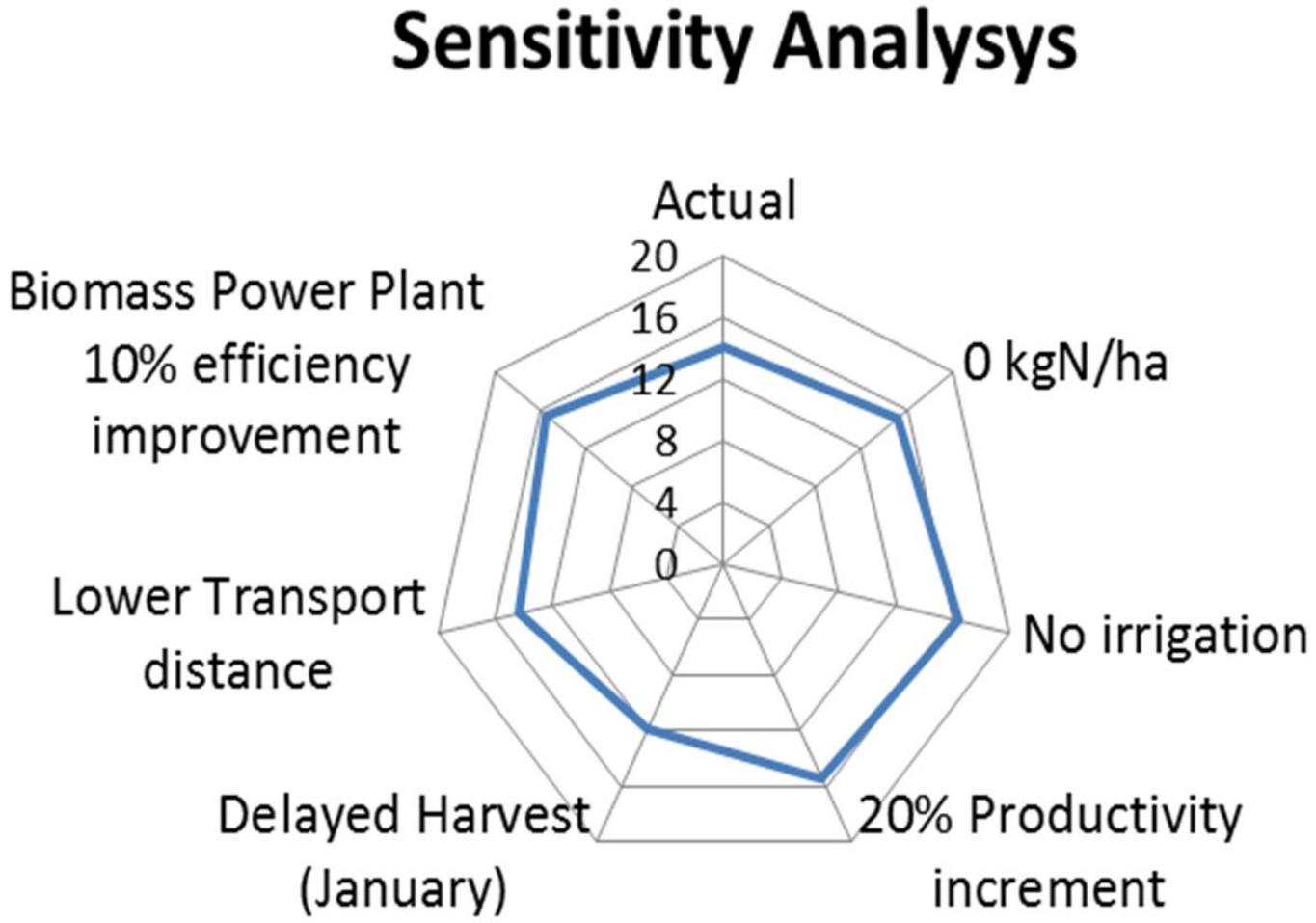
Case study – Miscanthus



Cipriano and Fernando 2012

Case study – Miscanthus



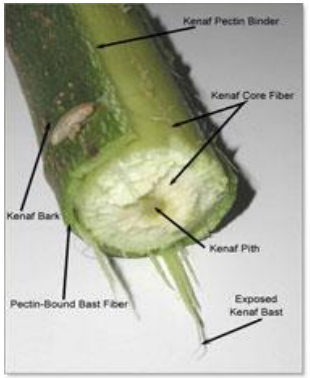
Cipriano and Fernando 2012

Case study - Kenaf (*Hibiscus cannabinus L*)

⇨ **Yielding high quality lignocellulosic material**

⇨ **Both for energy and fibre production**

- **Cordage crop**
- **Paper products**
- **Building material**
- **Absorbents**



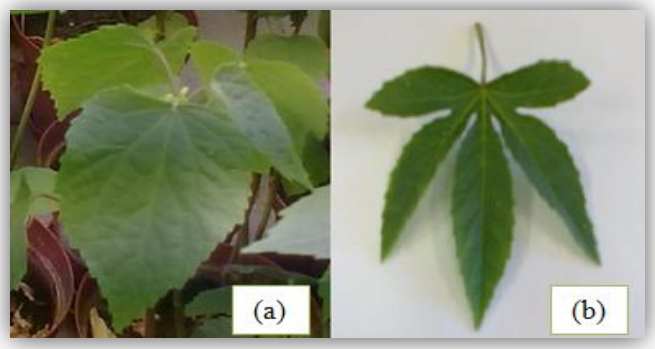
Case study - Kenaf (*Hibiscus cannabinus L*)

⇨ **Seeds, flowers, leaves**

⇨ **source of biopharmaceuticals**

- **pharmacological effects**
- **Antioxidant activity**

Less studied



Case study - Kenaf (*Hibiscus cannabinus L*)

- Seeds
- Fertilizers
- Irrigation
- Machinery

Cultivation

Harvest

Transport

Processing

Use

Energy input

Energy output

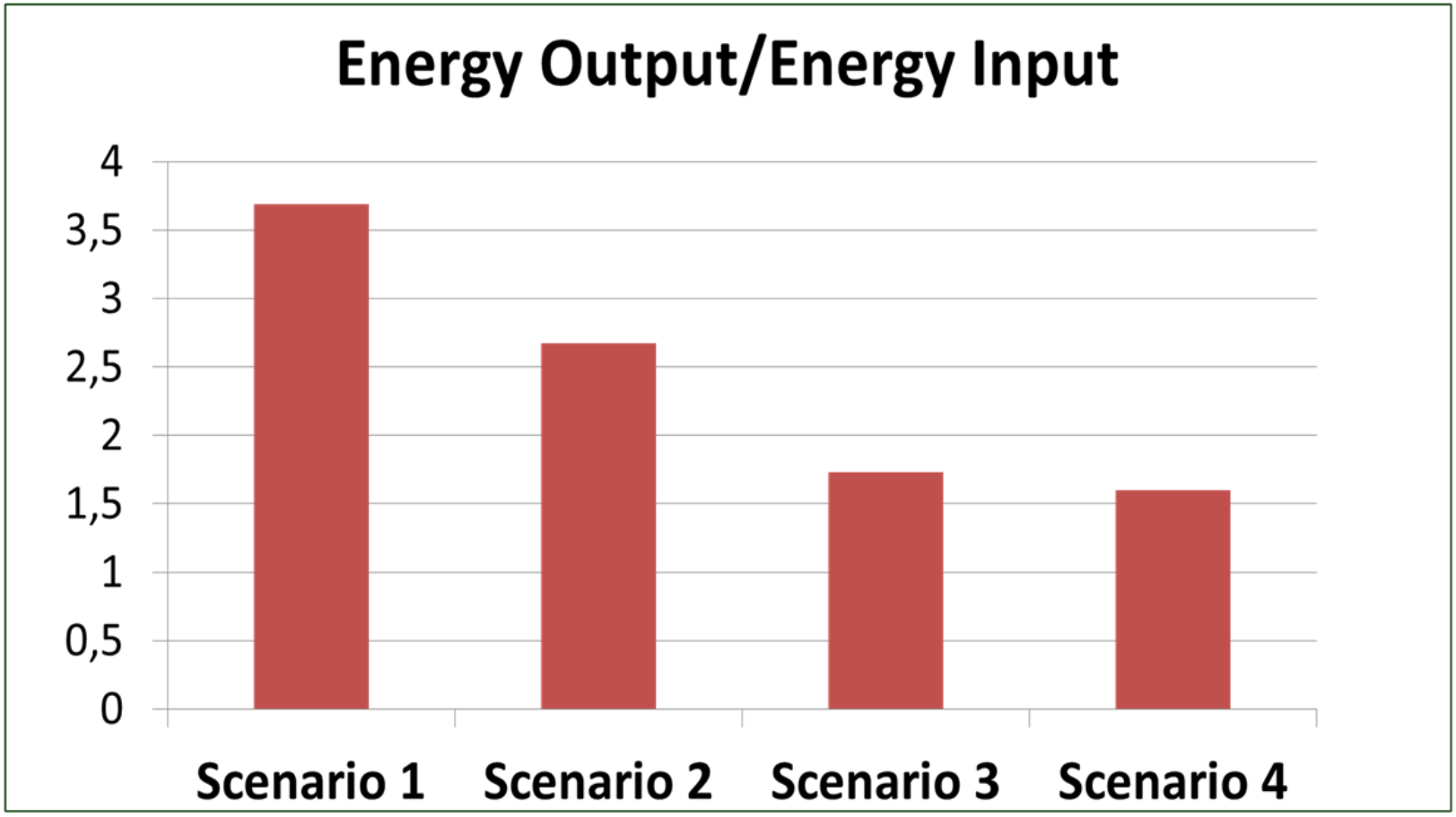
Scenario 1
- 100% bark-board
- Residues - combustion

Scenario 3
- Bark+polyester- board
- Residues - combustion

Scenario 2
- 100% bark-board
- Residues - pellets

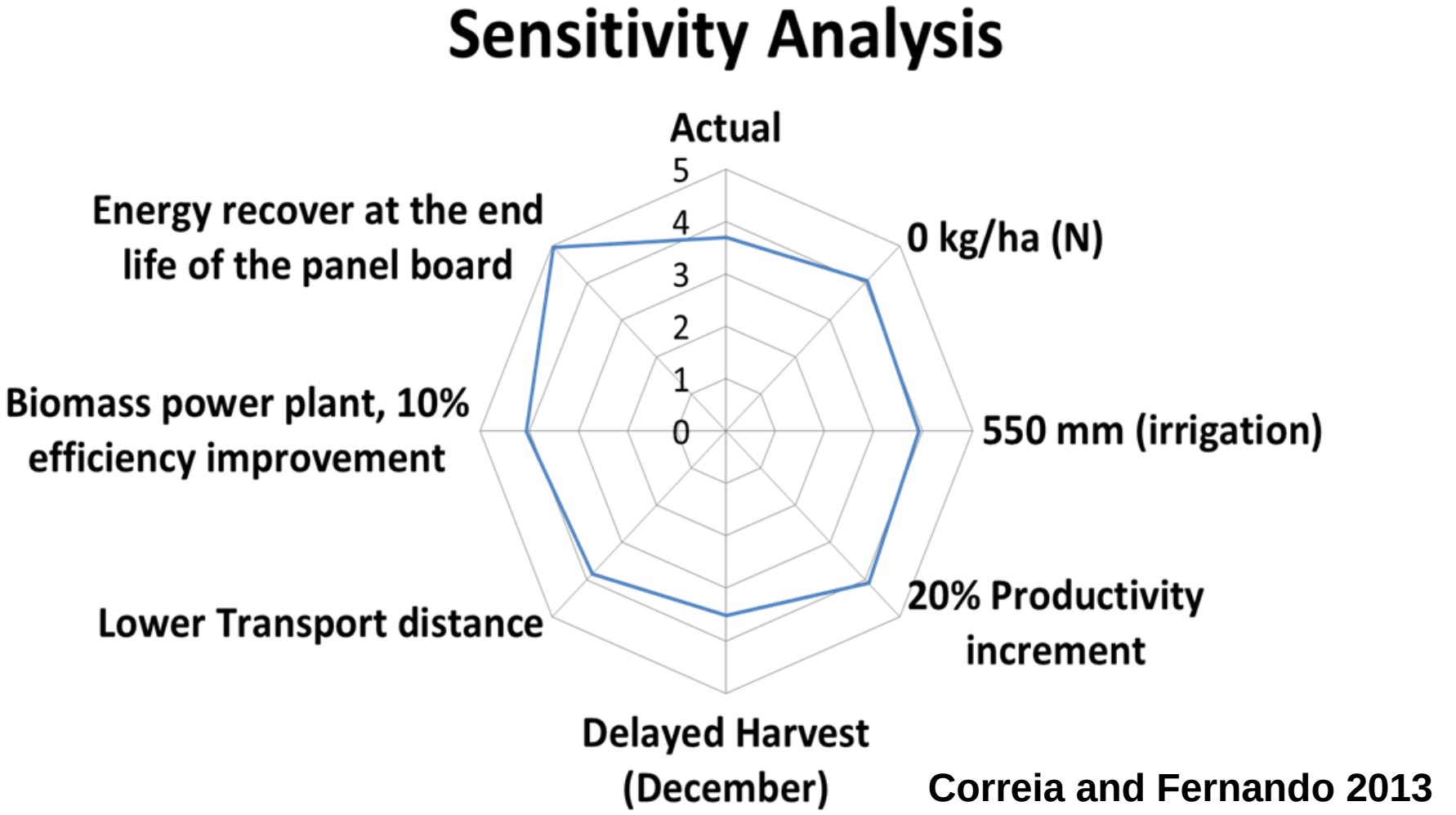
Scenario 4
- Bark+polyester- board
- Residues - pellets

Case study - Kenaf (*Hibiscus cannabinus L*)



Correia and Fernando 2013

Case study - Kenaf (*Hibiscus cannabinus L*)



Correia and Fernando 2013

Concluding remarks

- biobased products vs conventional products
  - Benefits
  - Shortcomings
    - Crop management options and processing choices can influence the outcomes
    - Site specific factors should be accurately assessed to evaluate the adequacy between crop and location

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Concluding remarks

- ⇨ sustainability of agro-industrial schemes
  - ⇨ should root as well on
    - ⇨ technological
    - ⇨ socio-economic assessments

Acknowledgment

Project

“Fiber Crops as a Sustainable Source of Bio-based Materials for Industrial Products in Europe and China”, FIBRA, EU

Thank you

for your attention!