

Key elements to assess sustainability of bioenergy projects

Gustavo Best
Simmons Rose
FAO



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HOW DOES BIOENERGY CONTRIBUTE TO SUSTAINABILITY?

Economic development

- mobilizes investment in rural areas
- generates new infrastructure and business opportunities
- generates income

Social benefits

- new livelihood opportunities
- increases access to modern energy services
- improving quality of life

Environmental advantages

- promotes resource conservation and ecosystem rehabilitation
- climate change mitigation through use of cleaner fuels
- opens opportunities for marginal/degraded land rehabilitation

Issues for reflexion/action

- **Is the production, use and trade of bioenergy based on sustainability?**
- **What is the demand/supply balance?**
- **Institutional capacities and coordination?**
- **Who will benefit? Are farmers benefited?**
- **Agriculture and energy sector considerations?**

In order to assess sustainability,
we need a closer look at the

(physical, biological and human)

Environmental

impacts related to

bioenergy



		IMPACT-CAUSING ACTIVITIES							
		Production and supply of agricultural inputs (fertilizer, fuel, machinery)	Production of biomass for energy (forestry or agriculture)	Collection of biomass by-products of existing processes	Production of liquid biofuel (ethanol, methanol, biodiesel)	Transportation of biomass waste and/or energy crops	Transportation of liquid biofuel	Use of liquid biofuels (combustion)	International trade of biomass and liquid biofuels
ENVIRONMENTAL ELEMENTS (Physical)									
Climate (GHG emissions balance)		1•	•		•	•	•	•	
Soil	Structure and stability (erosion)		3•	•					
	Quality (bio-chemical)	2•	•	•					
Water	Water quality (bio-chemical)	•	•		4•				
	Water extraction potential (quantitative)	•	•		•				
Air quality (points of production and use of biofuels, and materials transport routes)		•	•		•	5•	•	11•	

		IMPACT-CAUSING ACTIVITIES								
ENVIRONMENTAL ELEMENTS (Biological)		Production and supply of agricultural inputs (fertilizer, fuel, machinery)	Production of biomass for energy (forestry or agriculture)	Collection of biomass by-products of existing processes	Production of liquid biofuel (ethanol, methanol, biodiesel)	Transportation of biomass waste and/or energy crops	Transportation of liquid biofuel	Use of liquid biofuels (combustion)	International trade of biomass and liquid biofuels	Research and development in the area of liquid biofuels
	Terrestrial ecosystems and biodiversity		•							
	Marine ecosystems and biodiversity		6•	•						
	Agricultural biodiversity		7•						•	•

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ENVIRONMENTAL ELEMENTS (Human)	Land-use pattern		8•	•	•					
	Rural/agricultural employment and income (level and stability)		9•	•	•	•				
	Food security (effective access to food for the most vulnerable)		10•	•	•	•				
	Public health							12•		
	Global scientific and technical knowledge base		13•		•					•
	Global economy and terms of trade		14•		•			•	•	•

Key parameters conditioning the impact of bioenergy projects

- Environmental and social change from baseline
- Incremental demand on biodiversity, air, land and water resources
- Priority to rural development and agrobiodiversity
- Offset of greenhouse gas emissions



Environmental and social change from baseline depends on:

Intensity of pressures on natural ecosystems and communal lands by anthropogenic land requirements

Agricultural surplus (or deficit) of the region or country affected

Vulnerability of the poorest segments of society in the affected area:

- **security of land tenure for subsistence farmers**
- **existence of “social safety nets”**

Incremental demand on biodiversity, air, land and water resources

Requirement for new land resources:

- **whether a dedicated energy crop (requires new land) or**
- **the exploitation of existing by-products (does not require new land)**

Adequacy of agricultural production techniques to local environmental conditions (soil and water conservation):

- **erosive processes**
- **conservation agriculture – no tillage – “plantao directo”**
- **irrigation requirement**
- **soil nutrient depletion**
- **protection of water resources**

Pollution prevention standards of fertilizer and pesticides:

- **wastewater**
- **solid waste**
- **air pollutants**

Emission of air pollutants for transport:

- **biomass from field to biofuels plant**
- **biofuels from plant to consumers**

Project priority to rural development and agrobiodiversity

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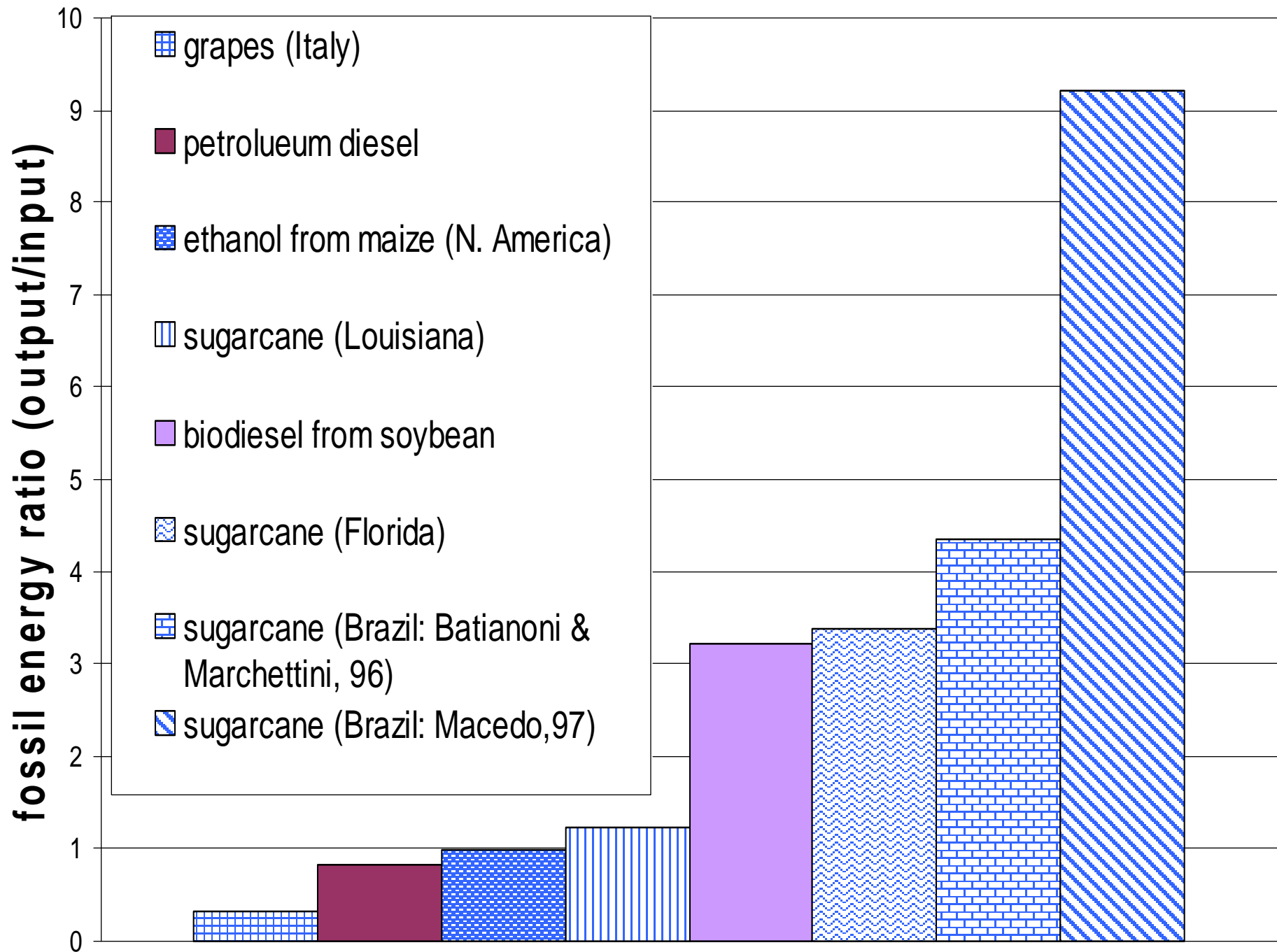
Integration of the project with existing agricultural traditions:

- **using exogenous or indigenous agricultural products**
- **produced on small scale**
- **promoting the culture of multi-use crops (providing food and energy)**

Key to sustainability is:

energy balance

some examples



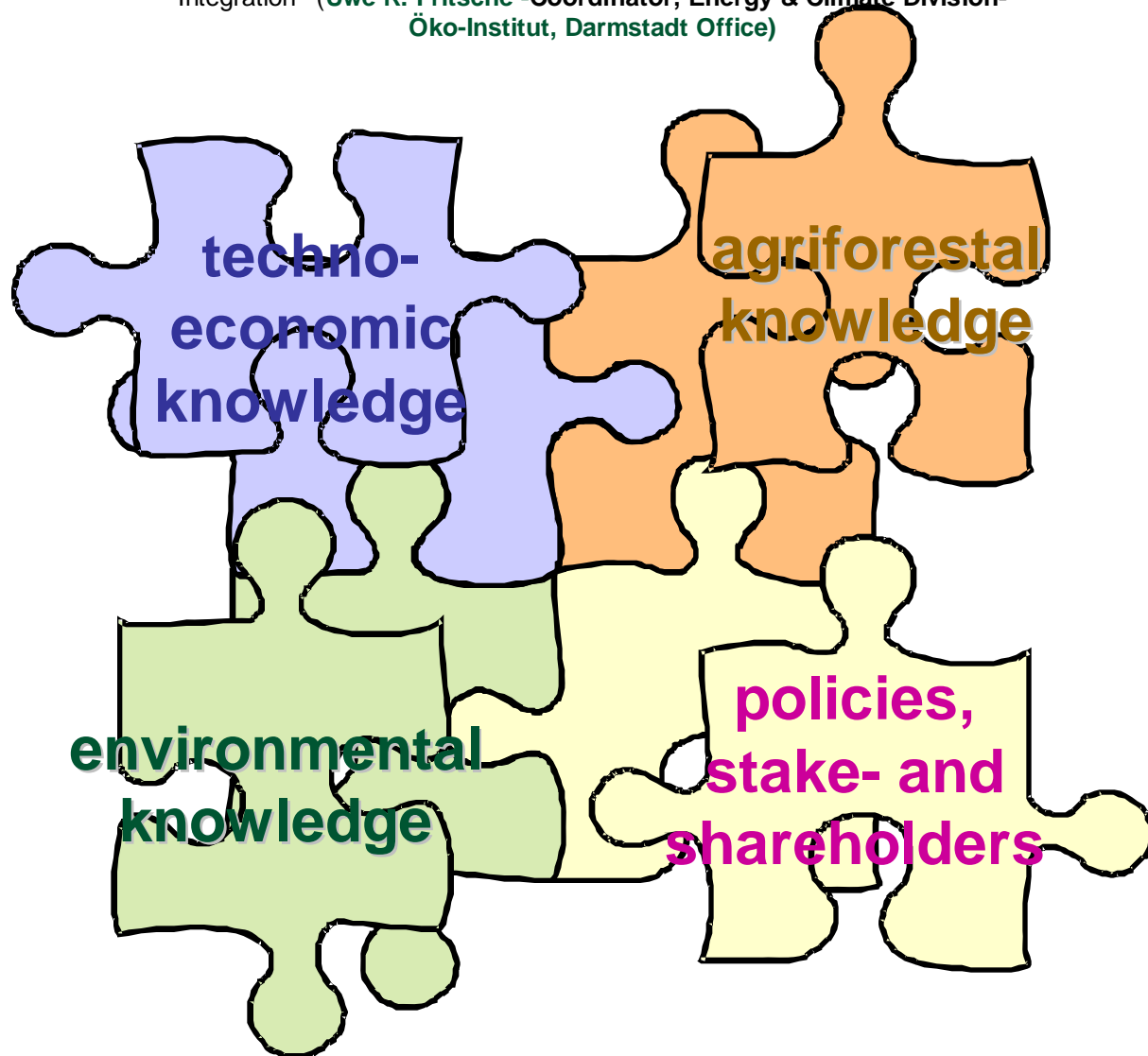
Another key element for
achieving sustainability is:

integration of knowledge

(but also policies and actors)

Uwe Fritsch shows it very well:

Integration –(Uwe R. Fritsche -Coordinator, Energy & Climate Division-
Öko-Institut, Darmstadt Office)



Another is

eco-matching of crop and land



Some commercially important plant for wastelands of arid climates

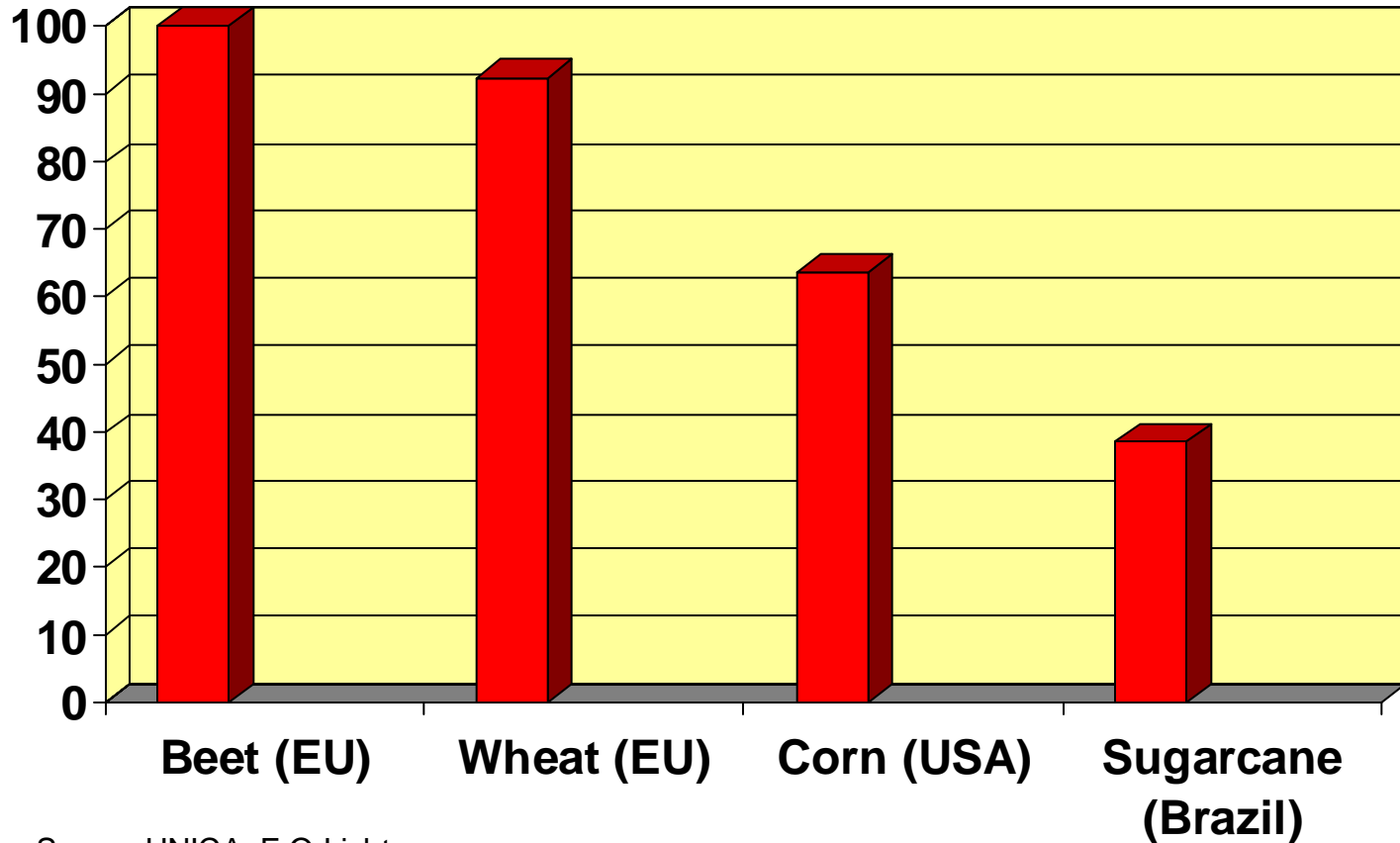


Economics

Critical

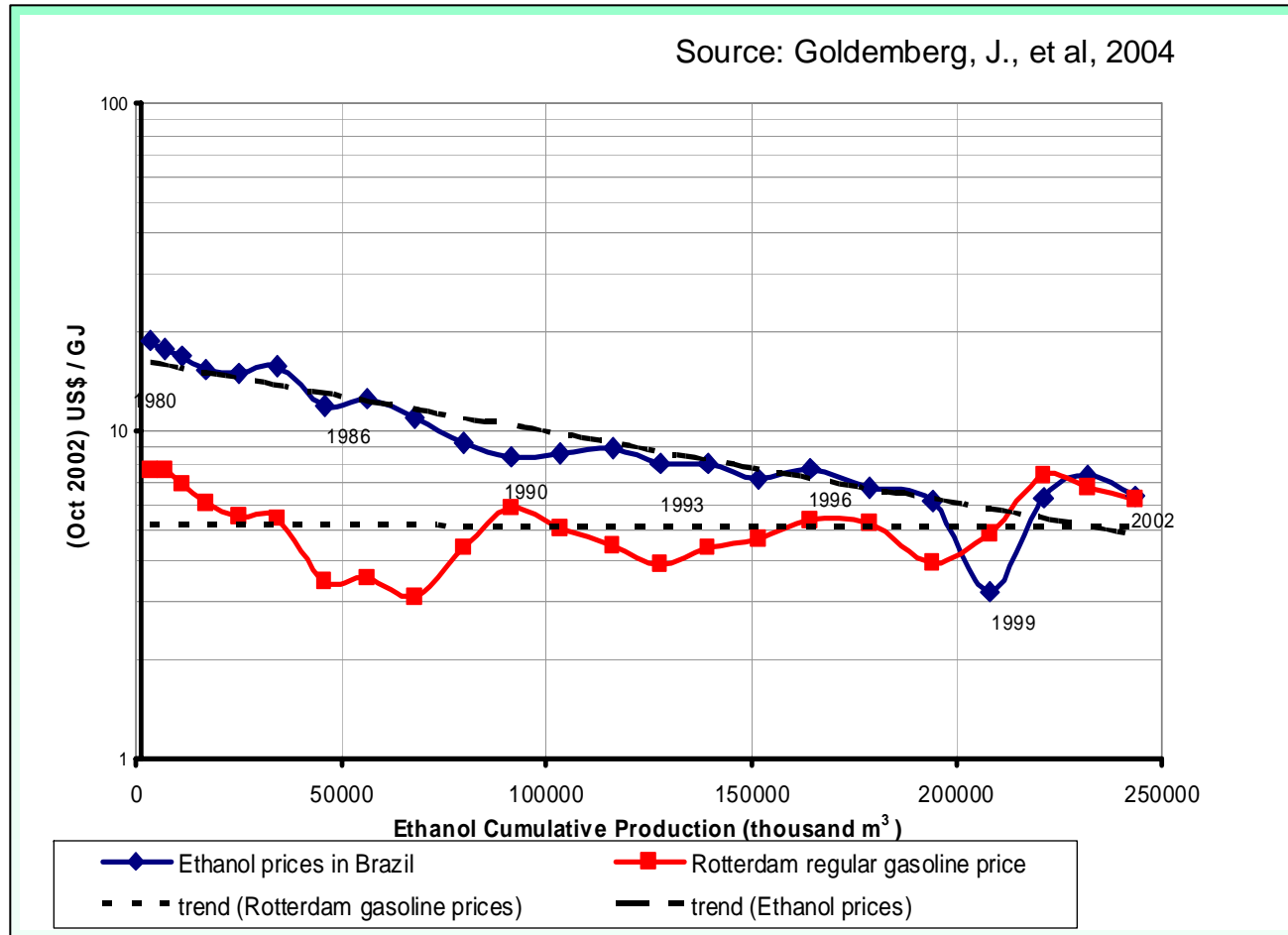
Cost of ethanol in Brazil 40 % of EU beet-ethanol

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Source: UNICA, F.O.Lichts

Learning curve in Brazil



Examples of social indicators of sustainability

(from Farioli, 2004)

Improved access to services

- Availability of services (water, energy, facilities, health, education). Assessment against local policies and plans

Capacity development

- Know-how/knowledge of project participants and beneficiaries.

Access to affordable energy services

- % of energy expenditure in the overall household budget.

Energy self-reliance

- Independence; use of local energy resources.

Employment (quality)

- Quality and long term of new jobs created.

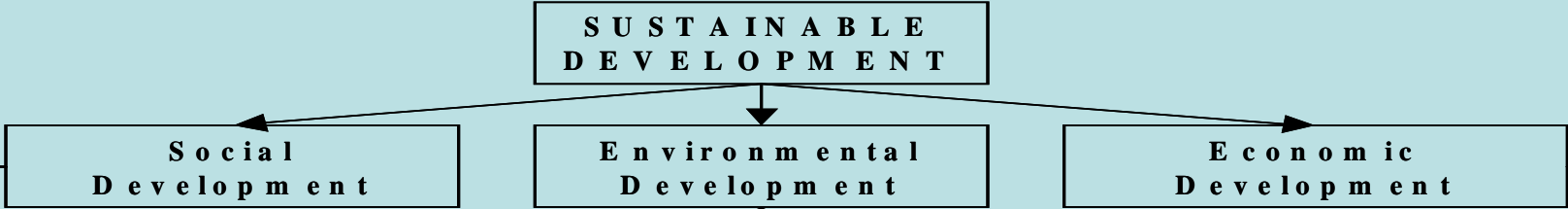
Poverty alleviation

- Increase of the number of people living above poverty line.

Social equity

- Contribution to empowerment of excluded social groups and wealth distribution.

SD criteria: objective-tree



- Improved social service availability
- Capacity development
- Access to affordable energy services
- Energy self-reliance
- Poverty alleviation
- Social equity
- Employment (quality)

- Sustainable use of mineral and energy resources
- Contribution to water quality
- Contribution to air quality
- Contribution to soil condition
- Contribution to biodiversity

- Employment generation
- Sustainability of balance of payments
- Sustainable technology transfer
- Potential to contribute to capital accumulation

International Bioenergy Programme

IBEP

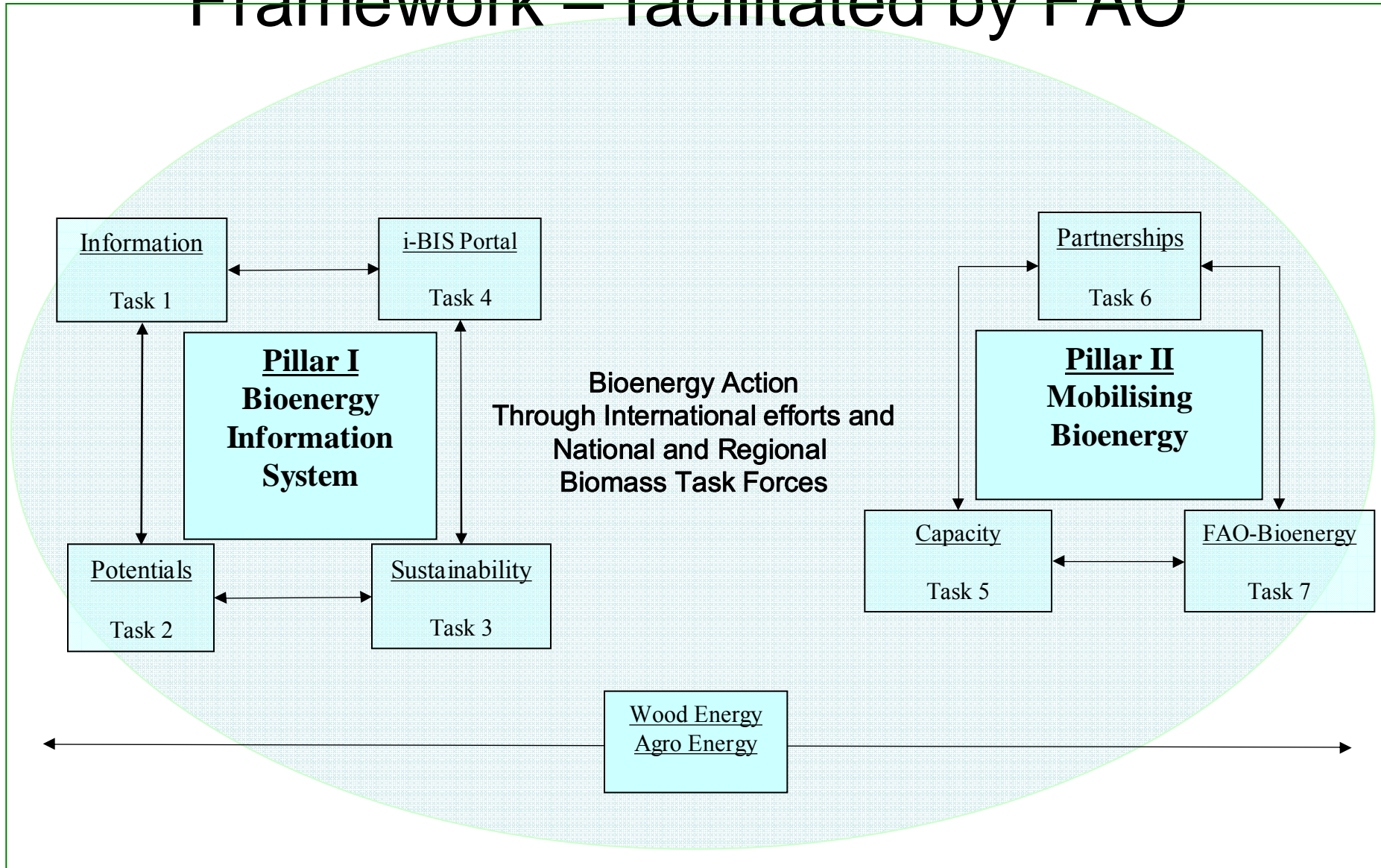
to be launched in 2006



Vision of International Bioenergy Programme:

Promote and monitor the sustainable use of modern biomass energy systems for sustainable development, energy security and climate change mitigation.

International BioEnergy Programme Framework – facilitated by FAO



International Bioenergy Programme - Tasks/Objectives

- 1. Information.** Assist project development by providing examples of success and failure.
- 2. Potentials.** Develop tools to quantify the potential bioenergy resource base on a country-by-country level and therefore highlight opportunities.
- 3. Sustainability.** Assist in the development of sustainability strategies and assurance schemes aimed at ensuring the sustainable development of bioenergy.
- 4. i-BIS (Interactive Bioenergy Information System).** Provide detailed 'real-time' data on consumption patterns and existing activities.





5. Capacity and Stakeholders.

Provide an enabling environment for establishing and developing bioenergy programmes and projects.

6. Partnerships.

Assist international bodies to collaborate in the development of coherent national and international bioenergy programmes.

FAO data and Information for decision making on bioenergy

- Farming practices
- Forest Resources Assessment - FRA
- Land type and use
- Water
- Wood energy (40 years old)
- Agricultural production – including by-products
- Rural institutions
- Livelihoods
- Nutrition
- GTOS
- Fisheries



Thank you !

www.fao.org

http://www.fao.org/sd/en2_en.htm

<http://www.fao.org/forestry/index.jsp>



