Towards Integrated Sustainability Assessment for Energetic Use of Biomass

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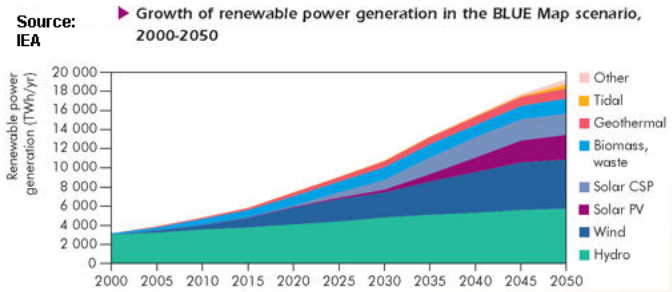
Workshop IEA Bioenergy Task 40

Brussels, 29-30 January 2009

Background & Motivation

Climate change
Growing Energy Demand
Energy Security
…

ENERGY SAVING & TRANSITION



Rapid growth of economical, environmental and social sustainability principles, strategies, actions and tools

Many companies are willing to green their energy system and integrate sustainability

Implementation ?

Lack of clarity
Need to draw interconnections
Need for role models

Research Questions

Definition?
What to do?
How to do?

What is sustainability assessment?
Is there a practical definition?
How to apply sustainability concepts?
Is there a process to follow?
What strategies, actions and tools are suggested?
How do these approaches differ or interrelate?
Which sustainability criteria should be used?
What is obliged by European, national or regional legislation?
Can different scenarios or products be compared?
…

Struggling with Sustainability

- **Brundtland definition = vague, not concrete**
- **Inherently dynamic, indefinite and contested concept**
- **Sustainable development = unending process of learning and adaptation**

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More practical definitions in industry/commerce:

"A sustainable product or process is one that constrains resource consumption and waste generation to an acceptable level, makes a positive contribution to the satisfaction of human needs, and provides enduring economic value to the business enterprise." (Bakshi et al., 2003)

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High level of sustainability consensus by using a

Systematic and science-based approach

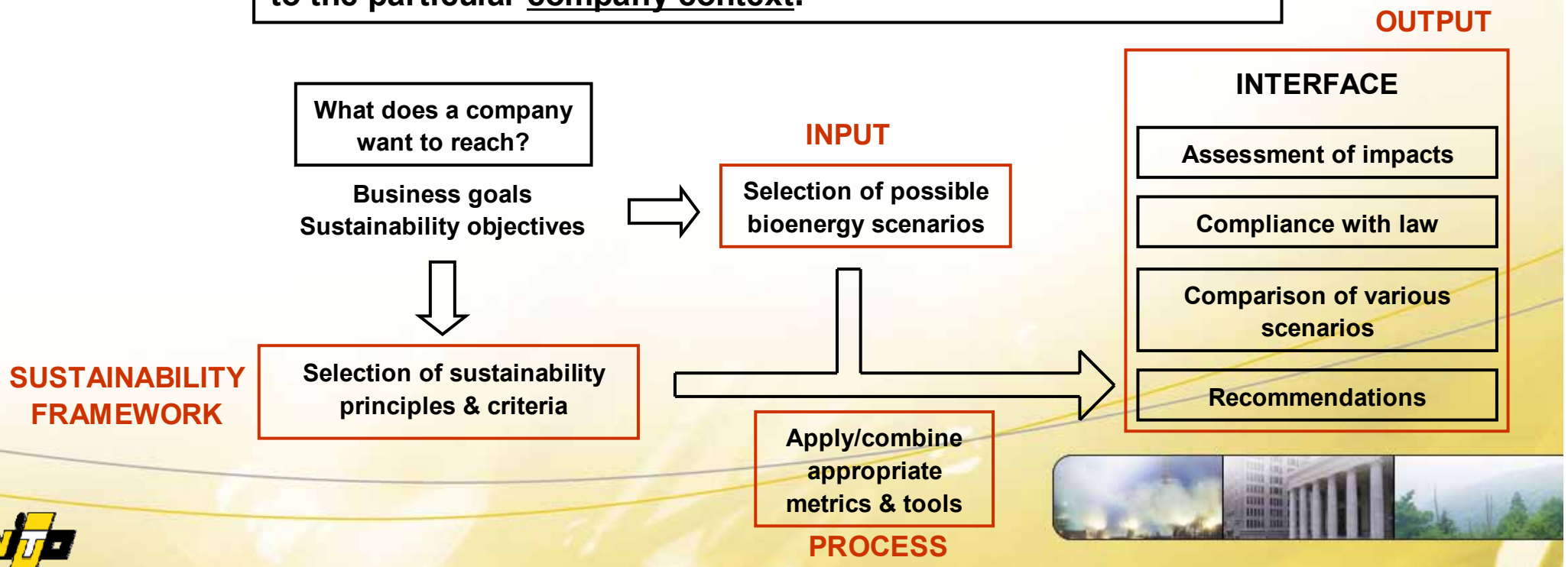
Extended
Widespread
Generally accepted

Economic
Social
Environmental

Building a Decision Support System

= synergy between scientists & business decision makers

To provide advice for policy and planning decisions regarding sustainable use of biomass for energy, based on economical, environmental and social sustainability principles, and adapted to the particular company context.



Project Goals

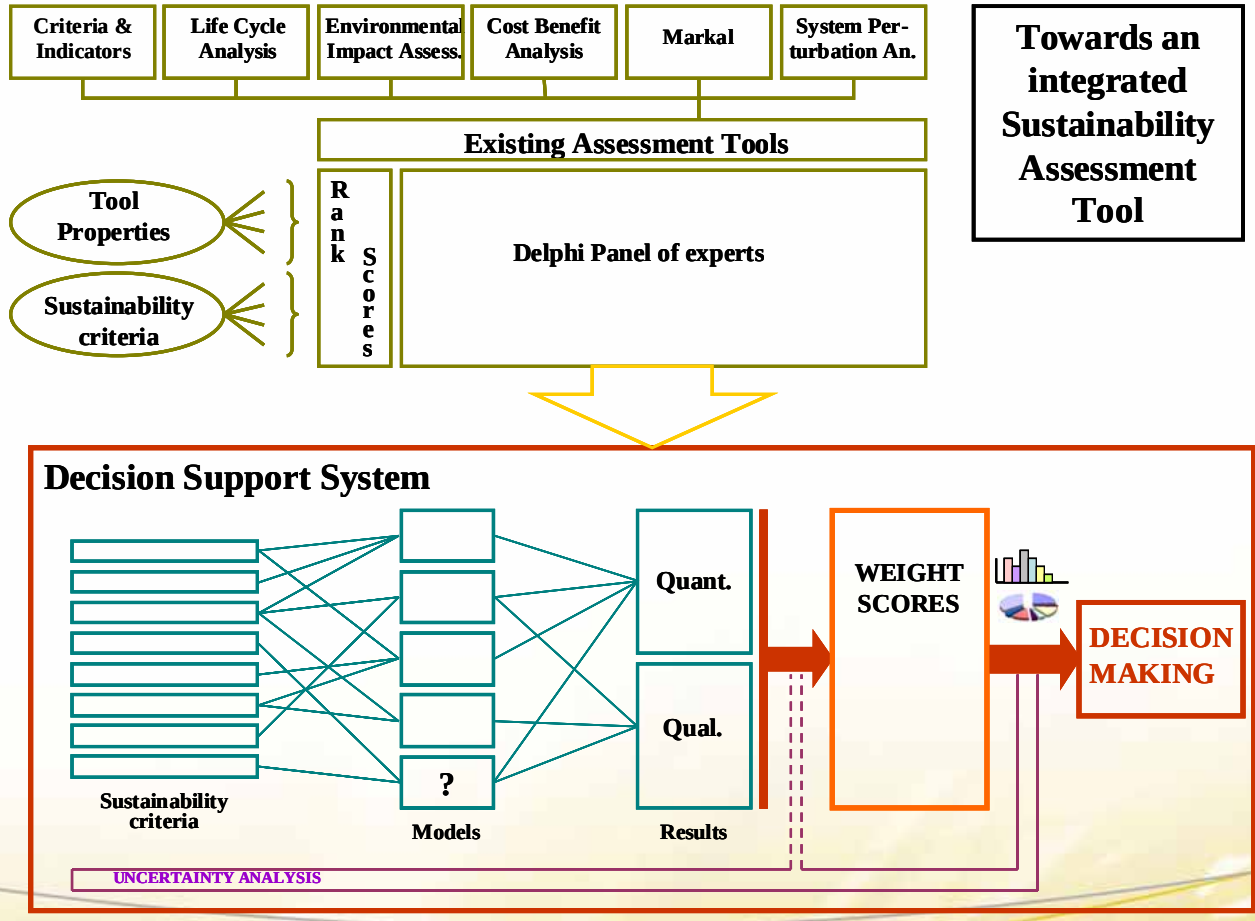
- **Collect and organize information on sustainability of the whole biomass to energy chain using a set of sustainability-related criteria & characteristics**

Processing chain:

- **Selection and comparison of existing assessment tools: how do these tools relate to sustainability and to each other? → analytical map**
- **Identify gaps in the existing set of tools and approaches**
- **Explore the possibility (and utility) of developing a meta-level approach to assessing the sustainability of bioenergy systems**

Bridge the gap between principles of sustainability on a global scale and sustainable actions on a local scale.

Systematic Approach

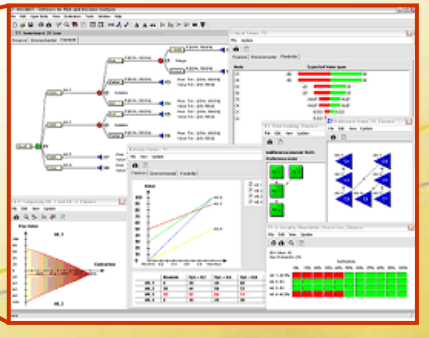


Towards an integrated Sustainability Assessment Tool

Steps towards a DSS:

- Comparison of existing instruments
- Integration of tool aspects into DSS concept
- Data collection
- Allocation of weight scores
- Uncertainty analysis
- System integration

USER INTERFACE



Inventory of sustainability tools and data in the form of a DSS to make the information useful for non-experts

Systematic Approach

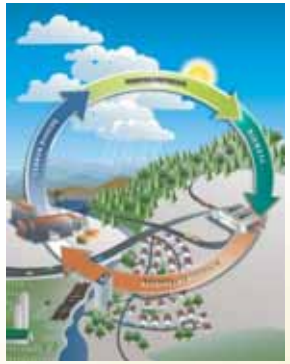
1. Selection of sustainability principles, criteria & indicators (metrics)

Sources:
- Standards, labels & certification systems (ILO, Green Gold, FSC, RSPO, …)
- EU initiatives & legislation (Cramer, UK, EU directive, …)
- Existing assessment methods

Themes:
- Environment
- Energy & transport
- Materials & resources
- Social well-being
- Micro-economic prosperity
- Macro-economic prosperity
- Policy and legislation

Systematic Approach

2. Comparison of existing instruments



Reference points:

- sustainability principles addressed
- tool attributes (transparency, flexibility, simplicity, …)
- which part of production chain assessed
- use of weight scores

Selected methods:

- Criteria & Indicators
- Life Cycle Assessment
- Environmental Risk Assessment
- Cost Benefit Analysis
- Markal
- System Perturbation Analysis
- Exergy Analysis (Extended Exergy Analysis)

Systematic Approach

3. Data collection

Start scenario:
- **Pure plant oil < palm, soybean, jatropha & rapeseed**
- **CHP**
- **Situation for Flanders, Belgium**

= pilot phase to reveal the tool's strengths, weaknesses and inherent limitations



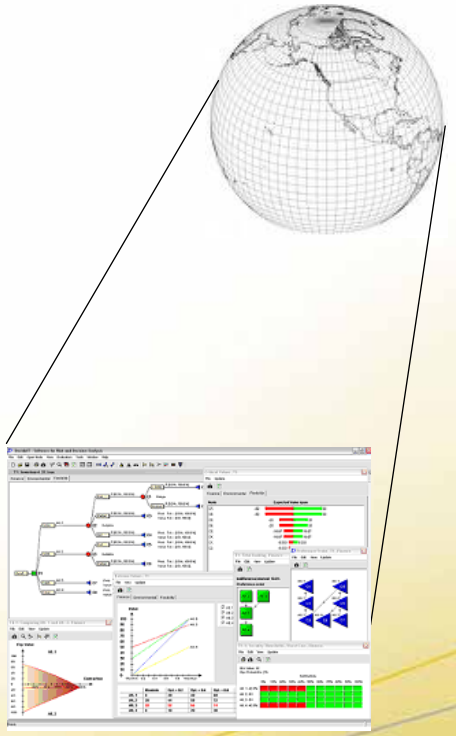

Some issues under debate

- Lack of data, principally on social criteria
- Reliability / uncertainty / availability of data
- Site dependence / spatial variation
- Indirect / rebound effects
- Cumulative effects
- Time horizon
- Tools are human creations and therefore not perfect, indisputable and free of subjectivity

→ always keep the broader sustainability context in mind

Progress & further research

- **Report progress**
  - → First publication in progress
  - → Final PhD dissemination: November 2011
- **Continual adaptation and expansion**
  - → Technology watch
  - → Follow-up of sustainability assessment methods & data
- Elaboration of a **spatial DSS** to tackle problems of site dependence and spatial variation by extending the DSS with a GIS overlay of spatial data.
- …



Thank you for your kind attention

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