



Facilitating logistics and transport of biomass

Removing barriers within the internal market for the bio-economy, EP, Brussels, 20 April 2015

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Feedstock supply and sustainability: key factors of success for bio-based projects



Meeting bioeconomy development targets requires a several-fold increase in the current delivery of biomass ;

Biomass conversion processes require a regular supply in terms of quantity and quality,

Large feedstock input rates (eg, 200 000 tons/year),

And low feedstock prices (which typically makes up 30 to 50% of total production costs...)

... but biomass production is variable by nature, competes with other end-uses, and is increasingly constrained.



Bioenergy chains must meet sustainability targets

Designing supply chains



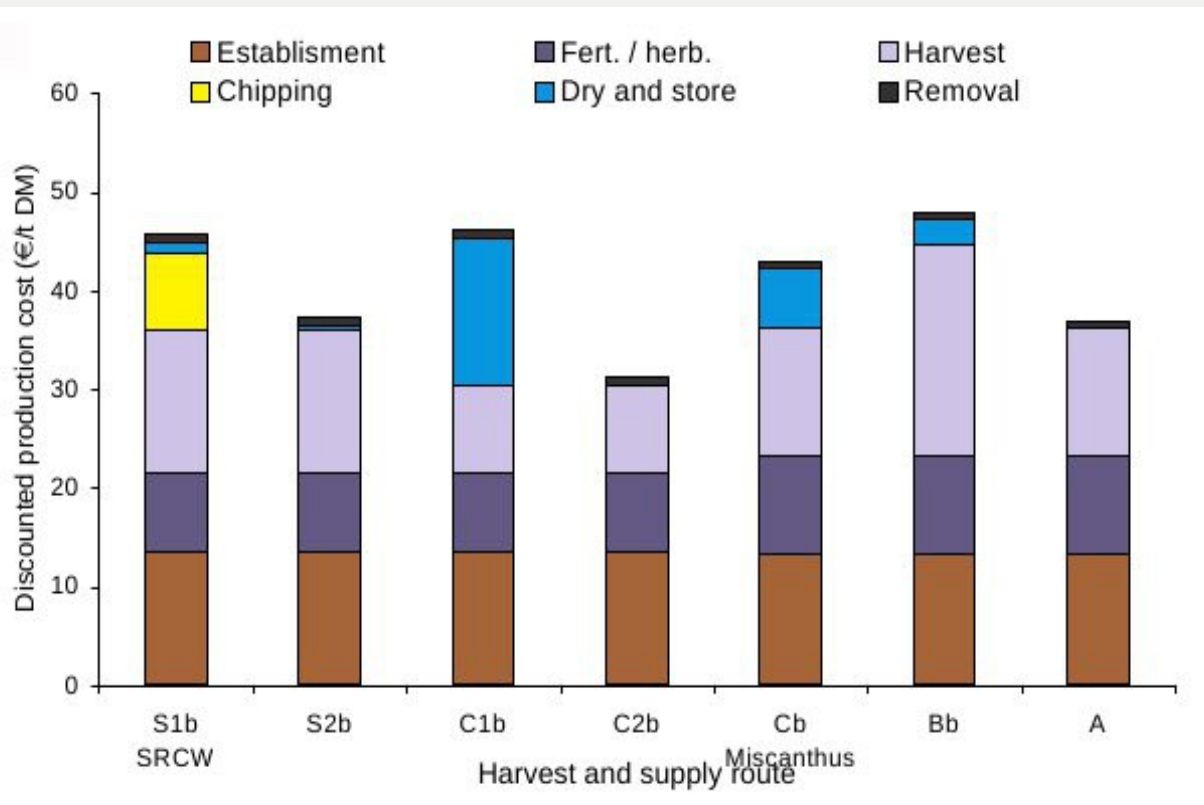
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Cropping Har



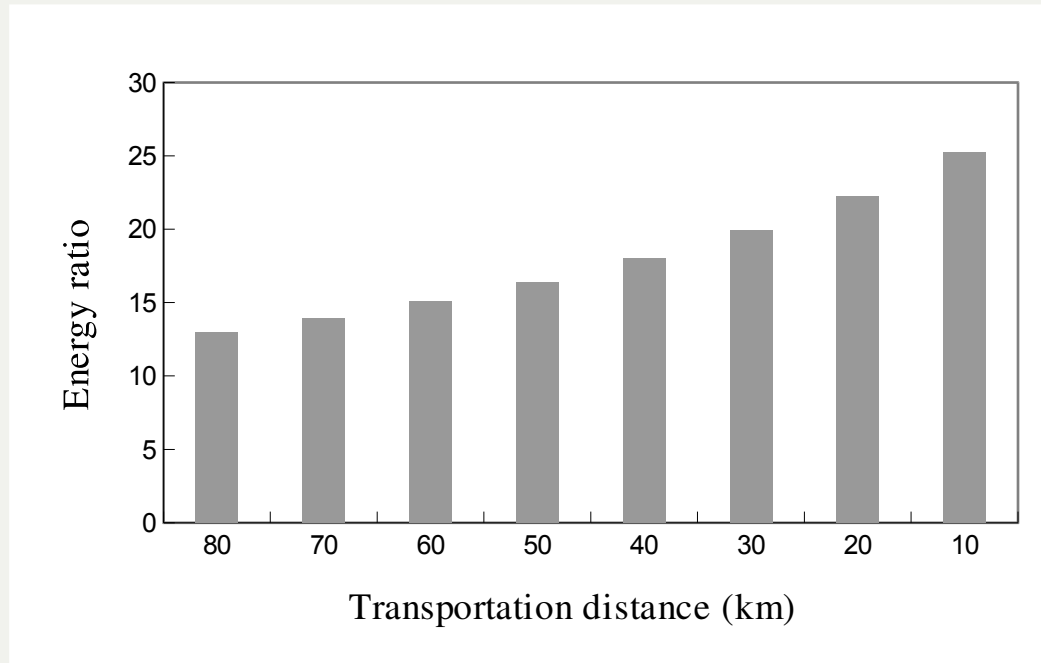
Logistics do matter for biomass procurement



Breakdown of production costs per t of combustible dry matter for willow SRC and Miscanthus in Ireland. Several logistics pathways are represented : the supply of wet chips (C2), dried chips with forced heating (C1), dried chips from stick harvesting (S2), or dried sticks (S1) for willow SRC ; the supply of dried, chopped biomass (C), dried bales (B), semi-dried, chopped biomass (A) for Miscanthus (source: Styles and Jones, 2007).



Transportation distance affects chain efficiency



Energy efficiency (ratio of energy output/input) for the provision of heat from short rotation eucalyptus wood chips, as a function of transportation distance from roadside pick-up point to the boiler (Gabrielle et al., GCB Bioenergy, 2013).



Background on Logist'EC



Project funded under FP7 (KBBE)
Timeframe: 2012-2016

Budget: 3.5 M€

2 sister projects on forest residues (INFRES) and horticultural residues (EUROPRUNING)



Logistics for Energy Crops Biomass

The Logist'EC project supported by FP7 aims to develop new or improved technologies of the biomass logistics chains. Cost-efficient, environmental-friendly and socially sustainable biomass supply chains are needed to achieve the 2020 EU RES targets that might be impeded by the potential scarcity of lignocellulosic biomass from agriculture. The project covers all types of lignocellulosic crops: annual and multi-annual crops, perennial grasses, and short-rotation coppice.

Logist'EC - sustainable biomass supply chains in terms of environmental, economic and social impacts.

The project focuses on improvement of all biomass value chain components and assesses the sustainability in terms of environmental, economic and social impacts. Innovative techniques for crop management, biomass harvesting, storage and transport provide a possibility to increase biomass supply whilst keeping costs down and minimizing adverse environmental impacts.

Timeline: the project is running from September 2012 until the end of February 2016 with a budget of 3.5M€ for activities.

Target groups: feedstock producers, biomass project developers, rural communities, farming industries, supply chain, retail, logistics and transport companies, end-users of biomass; NGOs and consumer associations; policy makers; and scientists.

Stakeholder platform: a virtual stakeholder platform will be created in order to follow the most recent project achievements.

developments and to provide a possibility to get involved in project activities and to transfer the knowhow on the ground.

Optimizing bioenergy supply chains

The barriers for optimal use of supply chains include scattered and bulky nature of biomass, high moisture content, unsuitable for lignocellulosic crops harvesting equipment, biomass deterioration during storage and transport etc. Therefore, by employing specific meta-analysis, laboratory tests, field trials, ecosystem modelling and mechanical engineering, the project will deliver recommendations for optimal technologies as well as new equipments and systems.

The recommendations will be based on the project partners' work on the following:

Crop management
 Innovative crop management practices such as intercropping or multifunctional land use and recycling of process residues and other waste streams will be developed in order to maintain soil quality, reduce environmental impacts and increase economic profitability.

Agricultural machinery

Existing harvesting equipment is not sufficiently adapted to harvest lignocellulosic crops such as grasses or short-rotation woody crops. Development of improved agricultural machinery would ensure cost-efficient biomass harvesting and handling and lower environmental impacts.

New pre-treatment technologies

In order to optimize biomass production, there is a need to have feedstock of consistent quality, particle size and moisture content. This can partially be done via conventional densification (pelletisation, briquetting); however the aim is also to develop pre-treatment technologies to improve biomass properties prior to densification and transport (hydrophobicity, grindability, mildew) so that it can be handled in existing transport, handling and storage equipment.

Multi-criteria assessment

The implementation of innovative techniques at different steps of the supply chain will not lead to an improved supply chain if the system is not envisaged as a whole. Therefore, the project will employ multi-criteria assessment to optimize all steps of the supply chain

(feedstock types, cultivation sites, crop management, harvesting and pre-treatment technologies, transport and storage).

Decision Support System tool

A Decision Support System will be used for the optimisation of biomass supply chains in a spatially explicit manner taking into account environmental, economic and social sustainability criteria and regulatory framework thus facilitating the supply of lignocellulosic biomass for bioenergy. It will also help to explore various scenarios.

Demonstration

The developed system will be tested in bio-energy and bio-materials projects all across Europe. Improved logistics will be demonstrated at a pilot and industrial scales in 2 regions (Eastern France and Southern Spain) for existing bio-energy and bio-materials value chains. All technology developments will be carried out with industrial partners in order to speed up their transfer to the market.

Logist'EC partners:

AERBOM Belgium	ORL UK	Rio DTU Denmark	Nobilis Italy
Acciona Energia Spain	ICM Spain	EPIC UK	PMOAT Poland
Avicenne Netherlands	FCBA France	SGP UK	Rio DTU Germany
Biomass Spain	INRA Transfert France	SINTEP Netherlands	EPIC UK
Bioenergy Spain	INRA France	SESA UK	SGP UK
Bourgenne Peltier France	INRA Systèmes France	INRA Transfert France	SINTEP Netherlands
CENER Spain	INRA France	INRA France	SESA Italy
CFN Germany	Novas Italy	INRA Systèmes France	SESA Italy
CEMAT Spain	PMOAT Poland	INRA France	SESA Italy

Logist'EC Demonstration Sites:

- Viticola, sorghum and poplar cultivation Spain
- Miscanthus to supply a pellet plant Poland
- Transfection pre-treatment The Netherlands
- Transfection pre-treatment and briquetting Germany
- Power from grassy crops and poplar Spain
- Energy grass harvester Italy
- Willow harvester UK
- Storage of torrefied feedstock Spain



Projects' objectives



- To develop innovative crop management practices and recycling of process residues to maintain soil quality and reduce environmental impacts
- To adapt agricultural machinery for cost-efficient biomass harvesting and handling
- To characterize new pre-treatment technologies to densify biomass prior to transport.
- To optimize the supply-chain logistics according to the demand of conversion process (location of plant, storage sites, pre-treatment type, transport routes and means) through multi-criteria assessment.
- To demonstrate the performance and feasibility of improved process operations for all the steps from harvesting to transport at pilot-scale



Many avenues for progress

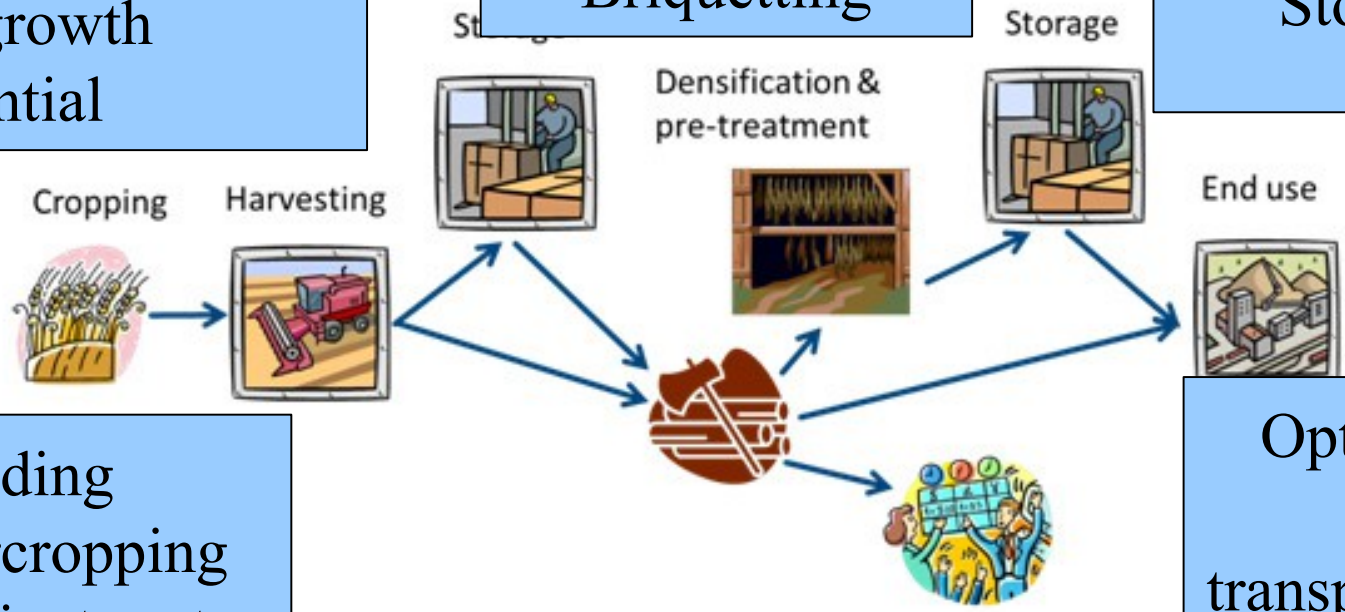
Year-round supply
Decreased losses
Re-growth potential

Torrefaction
Pressing
Pelletization
Briquetting

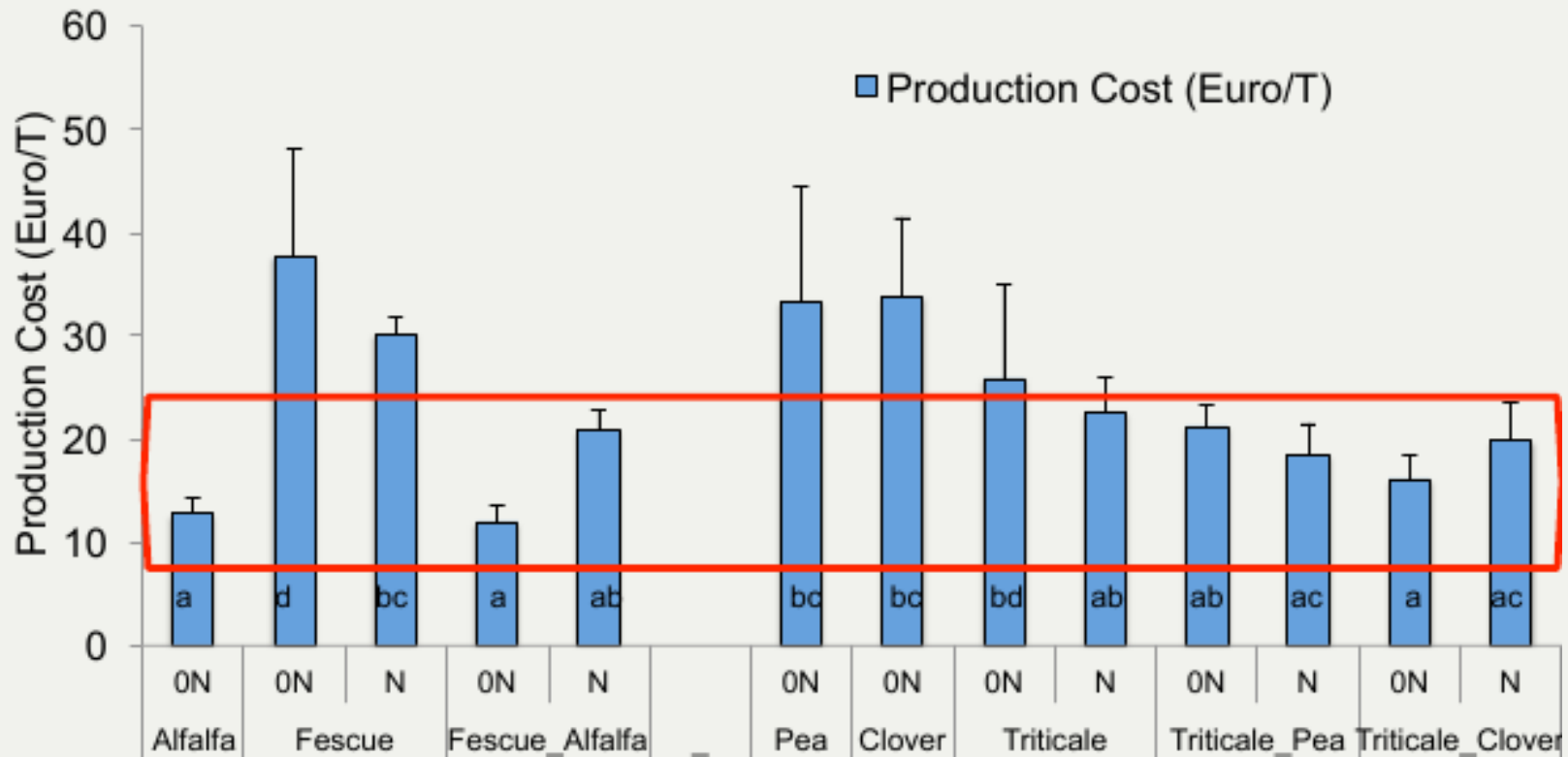
Whole rods vs chips
Mechanical drying
Storage time

Breeding
Intercropping
Nutrient mgt
Soil C mgt

Optimal pick-up points & transportation routes
Larger trucks;
Resources planning



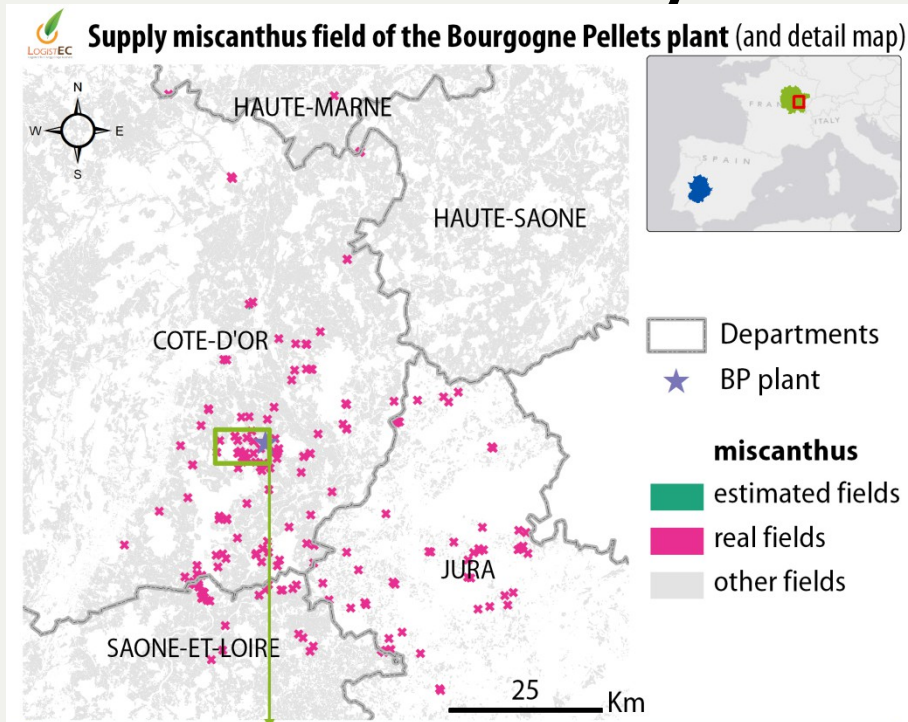
Inter-cropping saves inputs and costs



Production costs for legume/grass intercrops in France
(Pelzer et al., 1st annual meeting, Logist'EC project, June 2013)



Where are energy crops likely to be established?



Prediction of potential miscanthus plots in Burgundy (left, Rizzo et al., 2014). The model is based on a map of miscanthus yields, and economic factors.



Harvesting of loose straw



Harvesting loose straw yields an extra $1.5 \text{ t DM ha}^{-1} \text{ yr}^{-1}$ of biomass, with little additional costs
(source : Grignon Positive Energy project, 2008).



Progress with more compact chippers in forestry



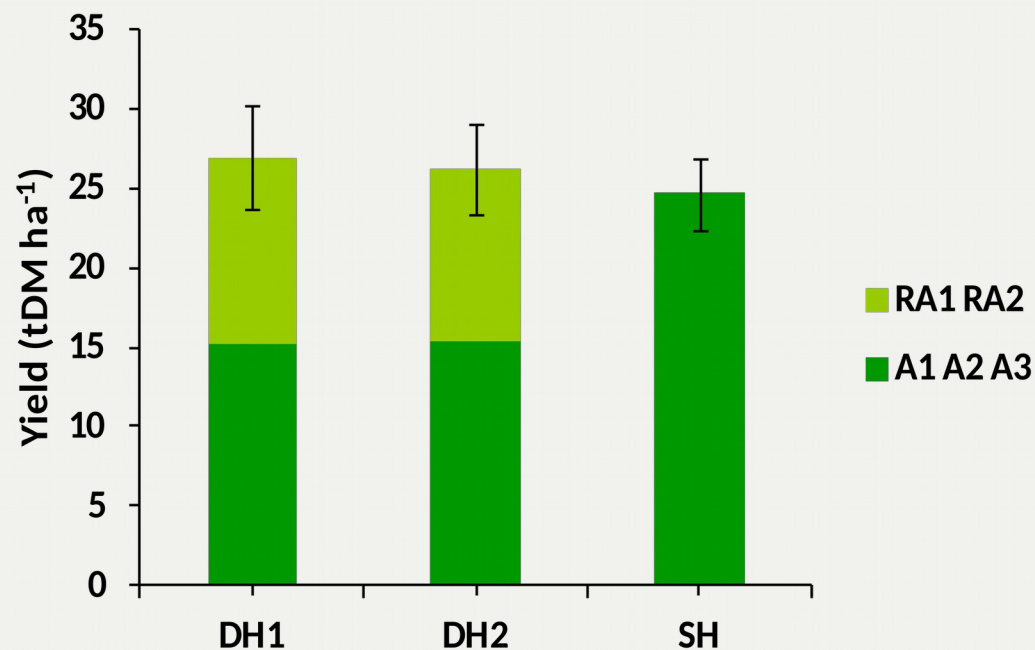
Demonstration of a compact chipper for the recovery of forest residues in Germany (INFRES project Newsletter, 2013).

Fuel costs were reduced by 35 % compared to current equipment.



Double harvests of Giant reed generate more biomass

Dry matter yield of a Giant reed plot harvested either once in autumn or twice in early summer and autumn (source : G. Ragaglini, SSSA)



Densifying biomass to save transport costs



Heating the biomass increased its energy content and density while making it possible to recover nutrients (eg fertilizers that can be used to grow the next crops) and producing a high-standard energy carrier.



Real-time data management systems facilitate chain operation



Documented Data on MHG Map Service



All located plants/storages by MHG Mobile Android application appear automatically on MHG Map of MHG Biomass Manager Service

Clicking the storage pops up an information screen giving details of the storage

Info	
Name	Badajoz
Code	70-1-578
Work sort	Transport
Deadline	Mar 9, 2013
State	Completed

Use drawing tools/track recording to plan approach routes to storage sites

(Open Street Map, Google Map and other maps as option)

The Energy Crops - EU Cooperation - Workshop, COPA-COGECA, Brussels, March 19 2014



Source : S. Huurinainen, MHG System, Finland.



How about real-life implementation ?



Miajadas power station, Spain (Acciona Energia; (c) V. Troillard, INRA Transfert)



Conclusion & outlook



- Bio-based projects should rely on a portfolio of species and residue streams, tailored to local conditions (and process requirements)
- Their production potential is increasingly constrained by physical and economic factors (land availability), and sustainability requirements (GHG savings, biodiversity impacts, social acceptance, competitiveness).
- There are still unknowns in terms of crop management and environmental impacts (especially regarding land-use change effects).
- Many avenues for improved logistics remain to be tested, with a systems approach for feedstock production, harvesting, densification, and transport (to increase the efficiency of the supply chains)
- These options need to be documented and assessed with a similar methodology and set of criteria, and combined into a decision-support system.





Thank you for your attention



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