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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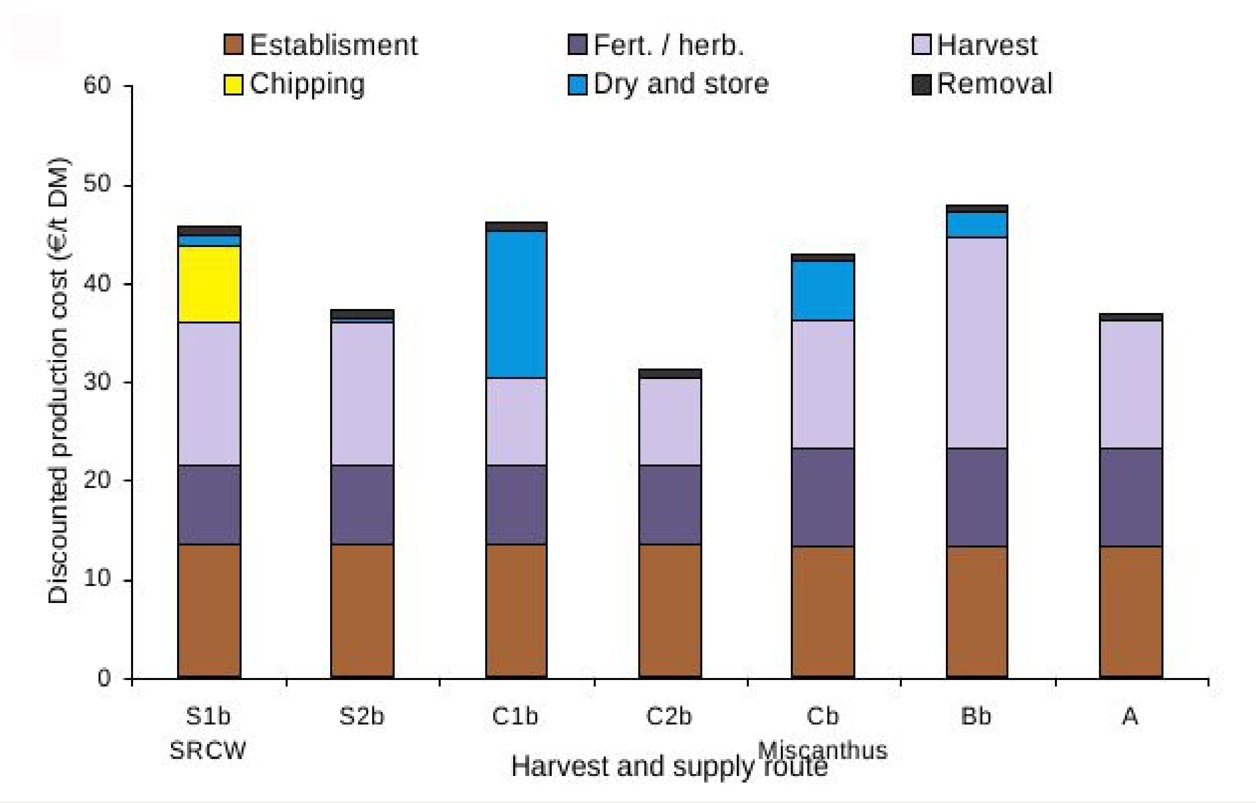
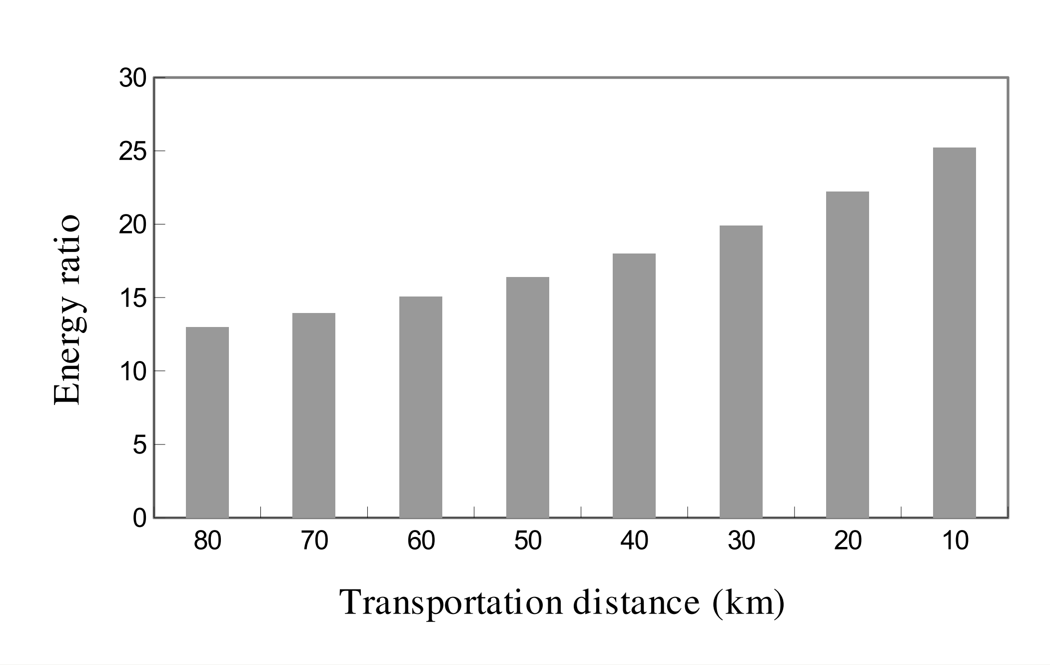
...tions...

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)

Projects' objectives

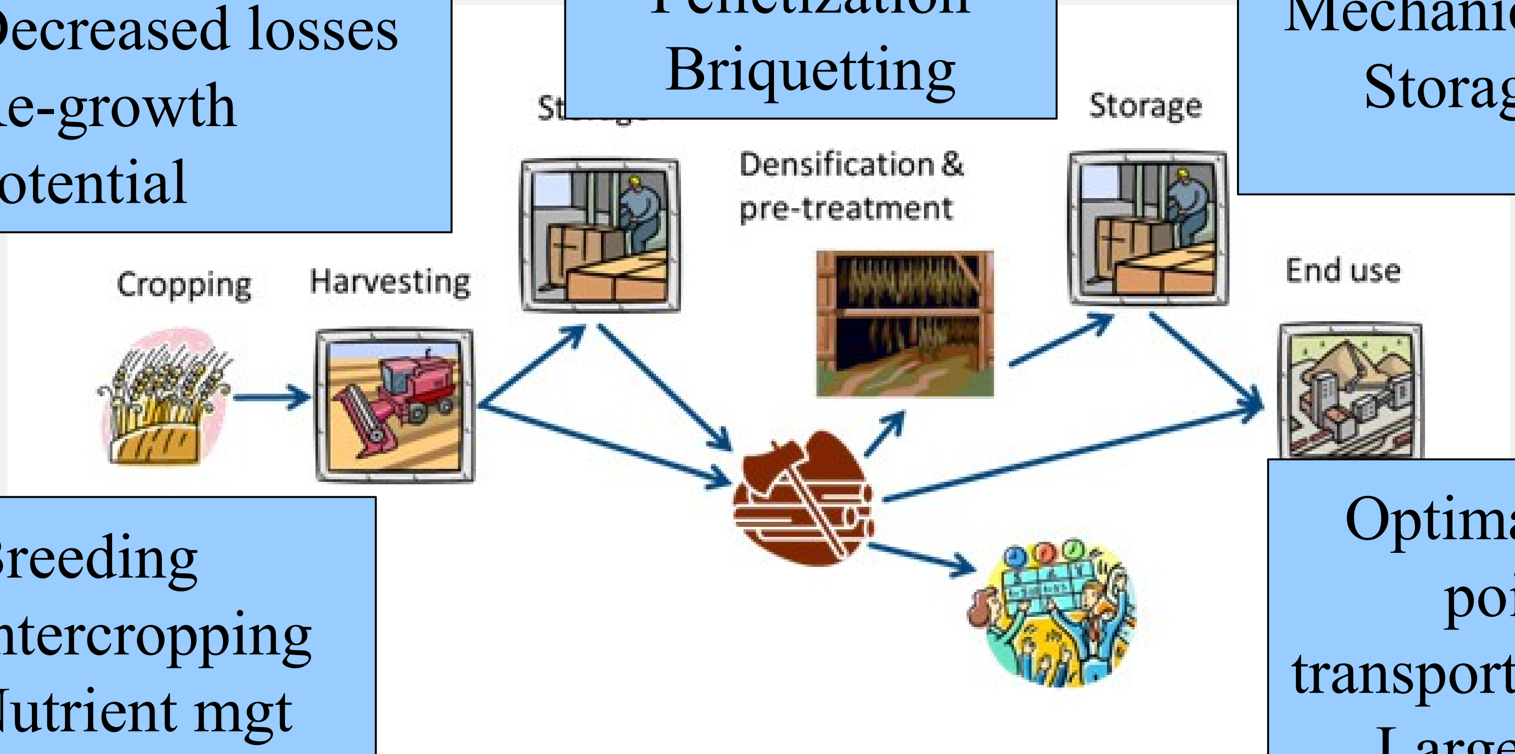
- To develop innovative crop management practices and recycling of process residues to maintain soil quality and reduce environmental impacts
- To adapt agricultural machinery for cost-efficient biomass harvesting and handling
- To characterize new pre-treatment technologies to densify biomass prior 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 feasability 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

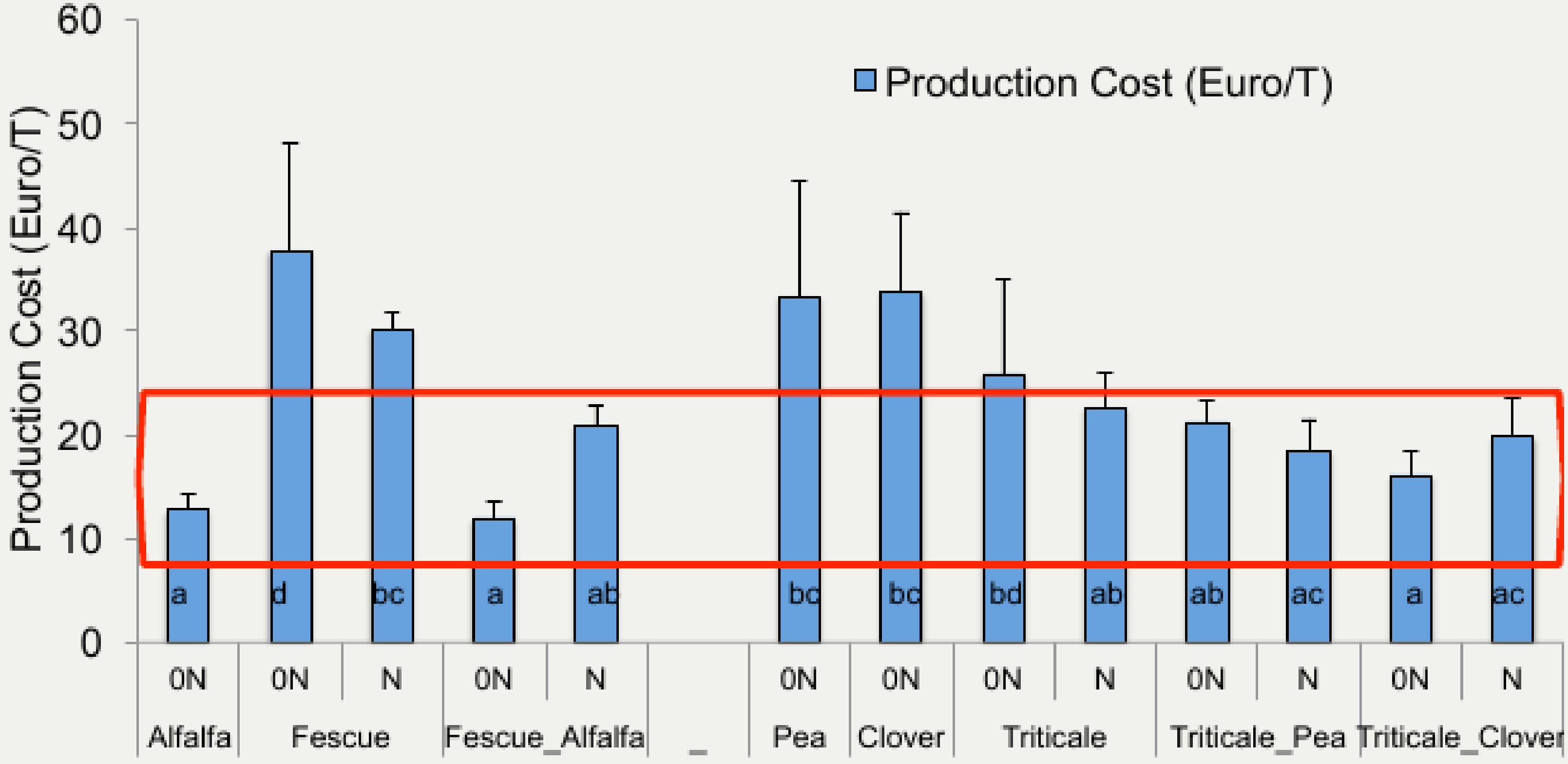
- Whole rods vs chips
- Mechanical drying
- Storage time



- Breeding
- Intercropping
- Nutrient mgt
- Soil C mgt

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

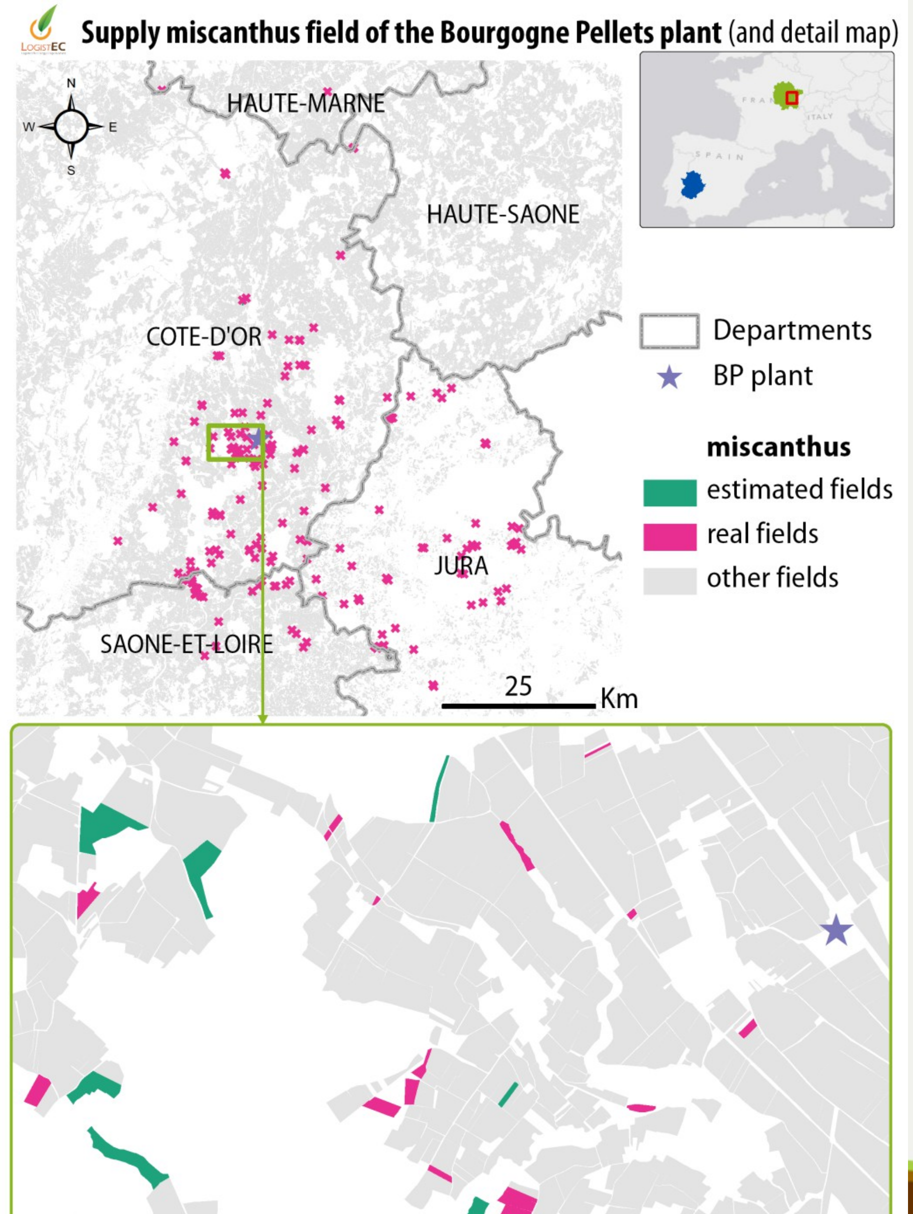
Inter-cropping saves inputs and costs



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 Burdungy (left, Rizzo et al., 2014). The model is based on a map of miscanthus yields, and economic factors.

Harvesting of loose straw

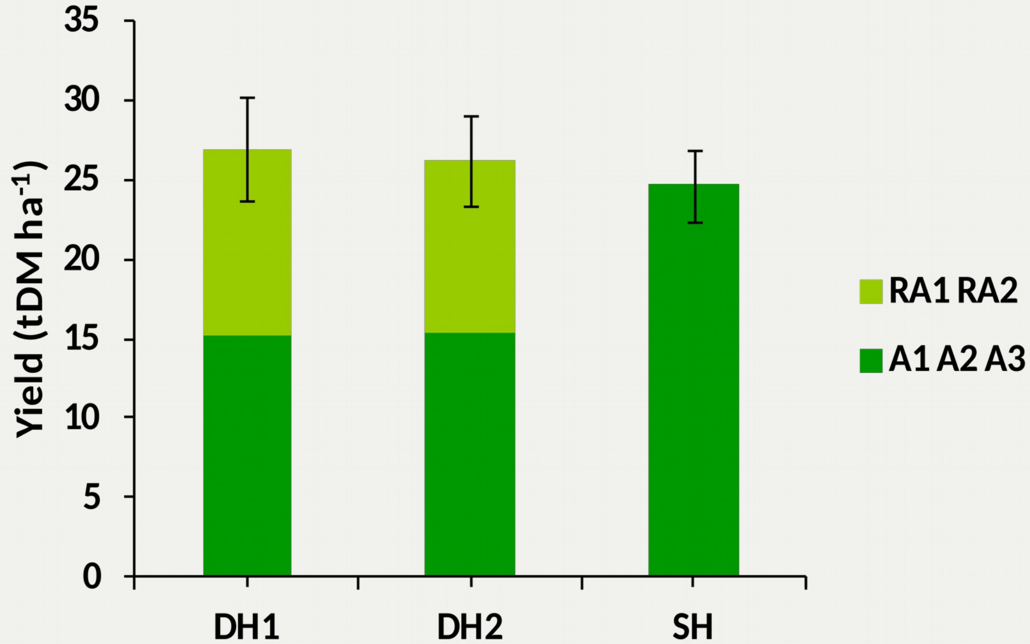
Harvesting loose straw yields an extra 1.5 t DM ha^{-1} yr^{-1} of biomass, with little additional costs
(source : Grignon Positive Energy project, 2008).

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

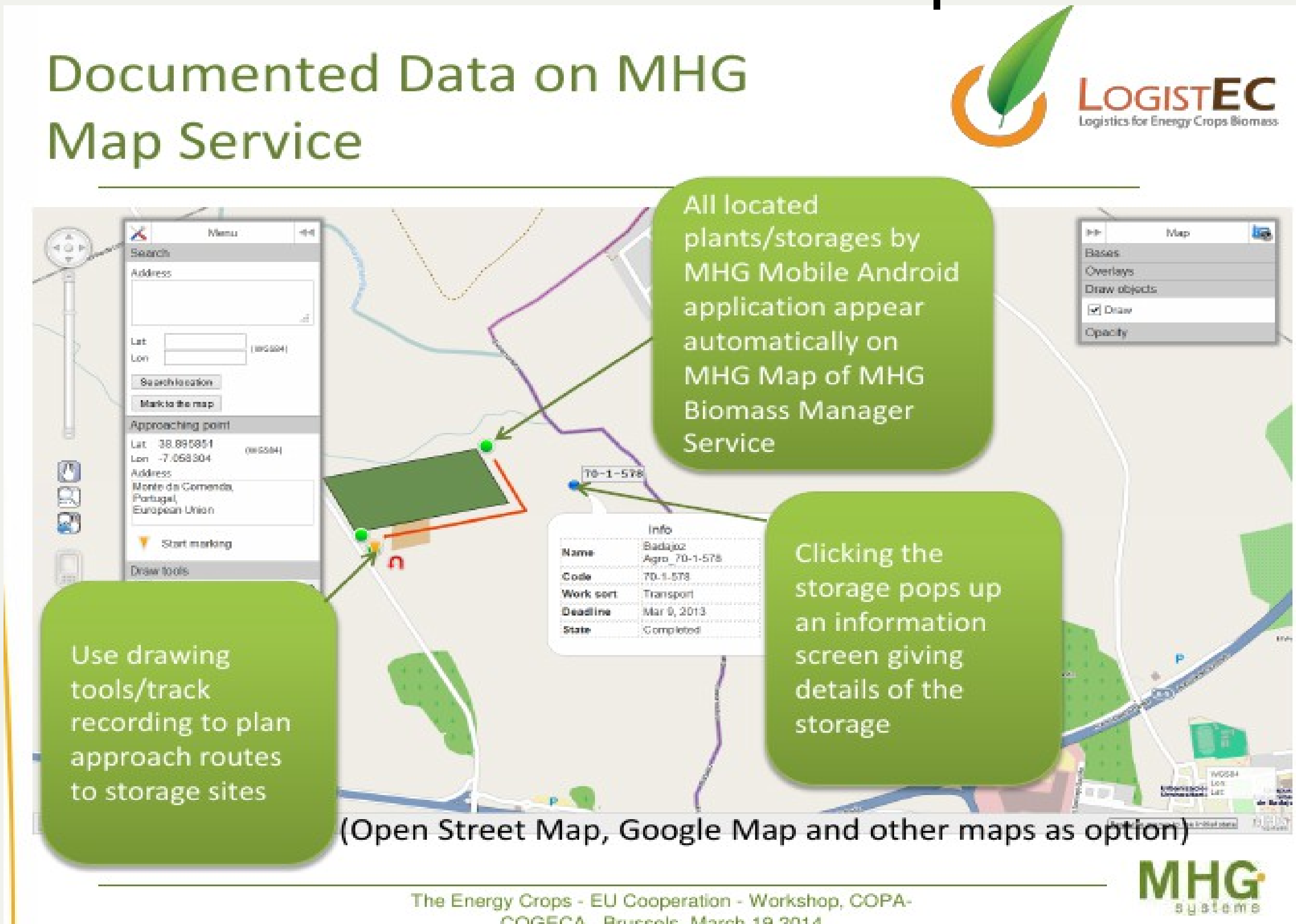
Dry matter yield of a Giant reed plot harvested either once in autumn or twice in early summer and autumn (source : G. Ragaglini, SSSA)



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



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 potentiel 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.

LogistEC
Logistics for Energy Crops Biomass

Thank you for your attention

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