WHY DID GREEN BIOREFINERY OF GRASS NOT HAPPEN BEFORE IN LARGE SCALE?

Scenario of decentral production in Denmark

Capacity assumptions:
- 40 ton fresh biomass/hour
- 21.600 t dry matter/year
- 3000 operational hours/year
- In combination with existing biogas

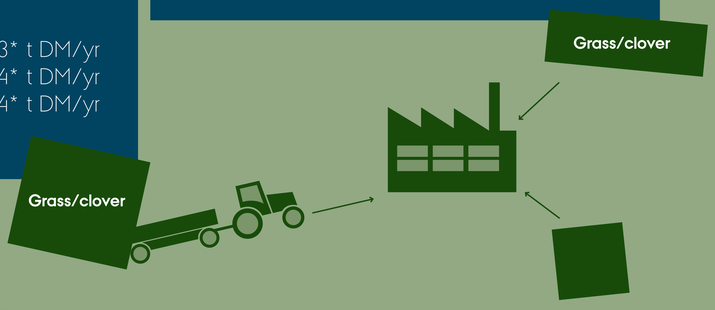
Biomass and logistics

Areal density of green crops	30	%
Average biomass yield	12	t DM/ha
Needed production area	1.800	ha
Needed collection area	60	km2
Average radius (½ areal)	3,1	km
Longest radius	4,4	km

Production

Protein concentrate	3.643* t DM/yr
Fiber pulp	15.034* t DM/yr
Rest juice	2.924* t DM/yr

* Based on assumed production efficiencies



Economic assumptions
- Biorefinery CAPEX: 3.36 mio EUR
- Depreciation time: 15 year
- 5% Interest rate, 5% Maintenance

- **Grass price**
- Organic: 0.15 EUR/kg
- Conventional: 0.13 EUR/kg

- **Protein price**
- Organic: 0.67 EUR/kg
- Conventional: 0.34 EUR/kg

- **Fiber pulp price**
- Identical to grass price

Residue juice is not given either any cost or value - It is used for internal energy production at the biogas plant.

Economy	Scenario	
	Organic	Conventional
	Mio. EUR	Mio. EUR
Income		
Protein concentrate/Fiber	4.70	3.25
Expenses		
Grass	3.33	2.90
Energy and salary	0.19	0.19
Maintenance	0.17	0.17
Depreciation and interests	0.32	0.32
Result	0.66	-0.34

It seems so obvious to utilize grassland to produce protein concentrate to substitute imported soy as well as fossil energy and fibre products. Furthermore, the local production will create commerce and jobs in rural areas; they will increase agricultural sustainability and help fulfil societal targets on climate, environment and sustainable food production. So what is stopping it?

According to preliminary, economic studies, it might be a good business case to produce organic grass protein concentrate. This is due to the high price of organic soy, which the grass protein will substitute. Two Danish consortia are now investing in the first commercial biorefinery facilities to see if it will work in practice.

According to the same studies, production of conventional grass protein concentrate are not yet a good business case – but this may change with the right framework conditions.

The challenge is that the environmental and societal benefits from perennial grasslands are not included in the business case. In other words, farmers do not have an economic incentive to increase carbon storage, reduce nitrate and phosphorous losses, and decrease the use of pesticides.

There seems to be two possible routes for improving framework conditions for grassland biorefinery:

1. Consumers are made aware of the sustainability improvements from grass based products, and will pay a premium for this type of product.
2. The EU policy framework, especially the Common Agricultural Policy, can be used to increase profitability of the most sustainable cropping systems.

This raises a number of issues to be investigated and discussed:
- Crop performance and sustainability varies with climate zones – meaning that the CAP has to be adjusted and implemented at regional levels
- It is a question of transition to a new production system, so new subsidy schemes for such transition could push developments
- Large investments is needed in new technology and infrastructure, and capital and assurance of investments are critical to promote transition
- Further research, development and agro-environmental impact assessments in the area will be needed, to mature technologies and their implementation, and ensure a sustainable and resilient green transition
- What type of labelling – if any – could be used for this type of new products?

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References

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