Logistics in Crop Production
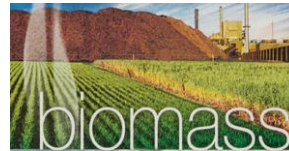
Logistics

How is production, transport and storage optimized?

Many parameters need optimization and coordination

Type of biomass

Harvest method Cost

Use of biomass

Logistics & Economy
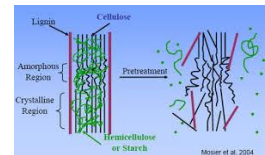
Pretreatment Cost & revenue

Storage Type, cost, loss

Transport Cost & distance

Wheat straw as an example:

Straw bale or briquette?

Transport in field/on road?

Loading/unloading?

Stored in open barn, closed barn, silo, container?

Density 0.2T/m$_3$
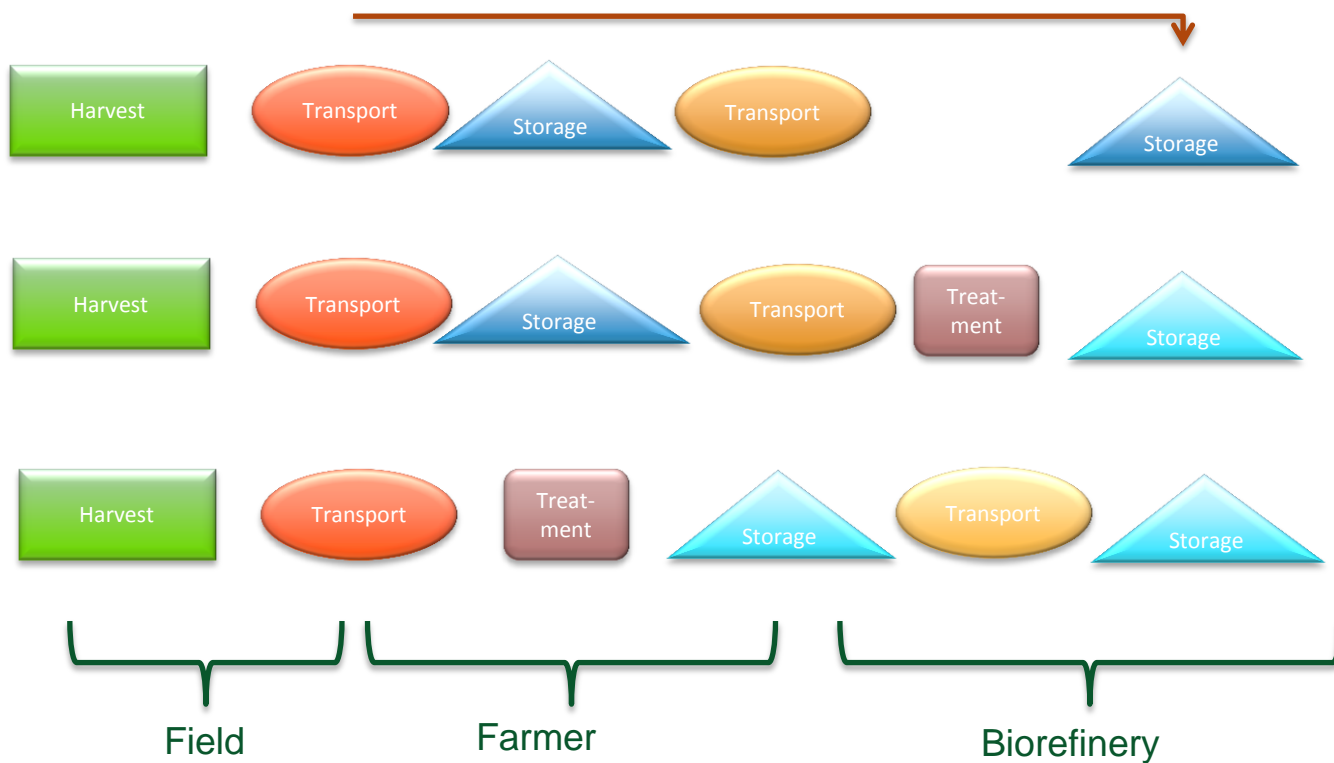
Ø= 7-9 cm
Density 0.5 T/m$_3$

Logistics in crop production

How can all these parameters be optimized?

Which parameters inflict most on economy?

This calls for a model !!!

Identification of value chains

Example: Wheat straw, Data entry sheet

Entry for straw

Yield
Yield	676	ton
Cultivated area	200	ha.
Yield per hectare	3,38	ton/ha.
Dry matter	89%	
Organic matter - VS/TS	86%	

Field expenses
Raking	0	kr./ton
Baling	-145	kr./ton

Distance to farmer/barn
Distance	0,5	km
Tractor equipped with frontloader & 2 bale trailers	-650	kr./hr.
Capacity	20	bales/load
Loading rate, field	2,7	min/ton
Loading rate, stock	2,1	min/ton

Farm loading
Telescopic loader
Telescopic loader	-800	kr./hr.
Loading rate	0,82	min/ton

Transport to facility
Truck & trailer
Distance from farm to plant	140	km
Distance from field to bricketing station	0	km
Truck & trailer	-625	kr./hr.
Bale capacity	24	bales/load
Capacity in tonnes	13	ton/load
Driving speed	52	km/hr.

Entries with blue background are locked

- Can be changed in a separate sheet if need be

Example: Wheat straw, Data entry sheet

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Telescopic loader ▾

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White boxes signify required user input

Example: Wheat straw, Data entry sheet

End product

| Ekstruded straw ▾ |

Choose end product

Extruding expenses

Extruder, mixer, conveyor	-5.500.000	kr.
Capacity	10.000	ton/yr
Operation and maintainance	-99	kr./ton
Insurance	-50.000	kr./yr
Service life	10	yr

End product

| Briquetted straw ▾ |

End product

| Straw bales ▾ |

Farm storage

| Open barn ▾ |

| Barn, concrete floor ▾ |

| Barn, gravel floor ▾ |

| Barn, concrete floor, briquettes ▾ |

Choose type and size of storage at farm and at facility

Example: Wheat straw, Comparison sheet

Wheat straw calculator	
End product:	**Briquetted straw**
Expected costs:	
Baling and raking	-145 kr./ton
Farm storage	-197 kr./ton
Plant storage	-119 kr./ton
Transport	-376 kr./ton
Pretreatment	-154 kr./ton
Cost per ton	-991 kr./ton
Total cost	**-669.884 kr.**

Decentral briquetting	
End product	**Briquetted straw**
Expected costs:	
Baling and raking	-145 kr./ton
Farm storage	-155 kr./ton
Plant storage	-356 kr./ton
Transport	-268 kr./ton
Pretreatment	-154 kr./ton
Cost per ton	-1.079 kr./ton
Total cost	**-729.434 kr.**

Expected revenue can be calculated if end use is known

Example: Wheat straw
Print sheet

Economy : Straw

Printet   10-11-2014

Harvest
End product	Briquetted straw
Cultivated area	200 ha.
Transport: Field to farmer	0,5 km with Tractor & frontloader
Transport: Farmer to facility	60 km with Truck & trailer
Loading equipment	Telescopic loader at farm, Tractor with frontloader at facility

Yield
Yield	3,38 Ton/ha.
Dry matter	89%
Ash	3%

Storage
Storage needed	4225 m3 bales or 1502 m3 briquettes
Farmer site, storage	Open barn, 5000 m3
Facility, storage	Barn with concrete floor, 5000 m3
	Note: Storage facility used for multiple purposes

Pretreatment
Briquetting	
Cost, yearly	-kr. 626.590
Hereof, paid by straw	6 % (straw) and 80 % (other)

Economy
Expected costs	kr.	-542.137
Expected yield		?
Difference		?

Print sheets can be used to compare costs

Produktionsomkostninger for enggræs til biogas

Udskrevet d.   11-11-2014

Høstmetode
Færdigt produkt   Ingen forbehandling
Transport til landmand   Dækket af høstomkostninger
Transport udover 12 km   5 km med Traktor med halmvogn
Maskiner anvendt til høst   Pistemaskine
Maskiner anvendt til læsning   Skal ikke omlæsses

Udbytte
Areal   12 ha.
Udbytte   69,6 Ton/ha.
Tørstofindhold   80%
Askeindhold   5%

Lagring
Lagerbehov   249 stk rundballer
Valgt lagringsmetode   Pomi tubewrap
                                        Bemærk: Kun lagret på anlæg

Forbehandling
Ikke valgt

Økonomi
Omkostning, landmand   -98 øre/kgTS

Forventet omkostninger   kr.   -54.465
Forventet udbytte   ?
Difference   ?

Produktionsomkostninger for enggræs til biogas

Udskrevet d.   11-11-2014

Høstmetode
Færdigt produkt   Ingen forbehandling
Transport til landmand   Dækket af høstomkostninger
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Udbytte
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Udbytte   69,6 Ton/ha.
Tørstofindhold   80%
Askeindhold   5%

Lagring
Lagerbehov   249 stk rundballer
Valgt lagringsmetode   Ingen lagring/lagring i det fri
                                        Bemærk: Kun lagret på anlæg

Forbehandling
Ikke valgt

Økonomi
Omkostning, landmand   -80 øre/kgTS

Forventet omkostninger   kr.   -44.025
Forventet udbytte   ?
Difference   ?
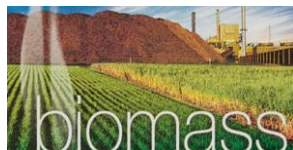
Use of model to calculate transport costs

Case: Straw can be transported from farmer to facility as bales, or 17 km as bales to a local briquetting station and then further as briquettes to the facility. Briquettes are transported using a dumper.
Cost includes transport as bales and loading/unloading of bales/briquettes.
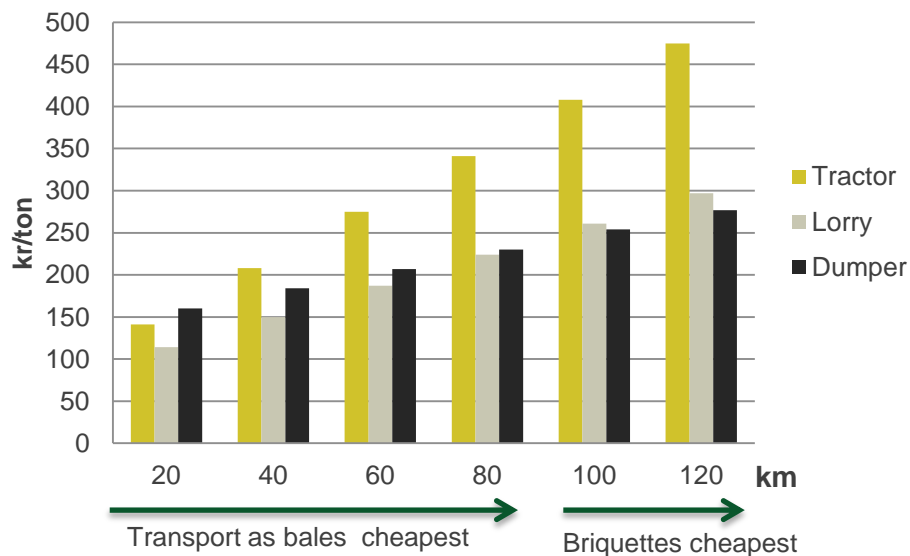
	Tractor	Lorry	Dumper
Kr./hr	550	625	650
Load	24 bales	24 bales	22 ton
Km/hr.	25	52	52

Cost calculations – questions answered by the model

- "How is cost affected if…"
    - Another type of storage is chosen?
    - The grass is pretreated?
    - Beets are produced instead of straw?
    - The distance to the facility changes?
    - Straw is briquetted locally instead of at the facility?
    - Electricity cost changes?
    - Trucks are used for transport instead of tractors?

- 50-100 parameters can be varied for each crop
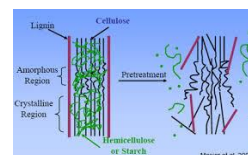- The outcomes can easily be compared

Type of biomass

**Harvest method
Cost**

Use of biomass

Logistics & Economy

**Pretreatment
Cost & revenue**

**Storage
Type, cost, loss**

**Transport
Cost & distance**