Regional biomass supply chains in Ukraine

2 case studies for supplying biomass for local use

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Wageningen UR (University & Research centre)

Two pillars:

- Wageningen University
- DLO – Specialized Research Institutes

Annual budget about 650 Mm euros

About 6500 employees

9500 BSc/MSc; 1200 PhD (>100 countr.)

Extensive international network

In the Dutch Food Valley

…to explore the potential of nature to improve the quality of life…

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Outline:

- Analysis biomass supply for heating in Ukraine
- Analysis setting up biomass local biomas to pellets supply.

Current biomass situation

- Biomass for heating is taking off fast.

- The main biomass types are:
  - Wood pellets
  - Firewood
  - Wood chips
  - Sunflower husk pellets
  - (Crop field residue: straw / corn stover)

- Wood is good quality
- Availability is limited
- Residues and crops have a much larger potential

Biomass market

- Pellet supply is relative cheap (€ 50 to €100 per ton)
- Concerns exists about:
  - Security of supply
  - Quality
- Current supply is bought in summer or fall for use in winter – (summer price 10 to 50% lower than in winter)

- There is wish by boiler operators to integrate vertically / control pellet supply → How?

The biomass potential

Secondary residues:

At factory gate: Sunflower husks
wood processing residues

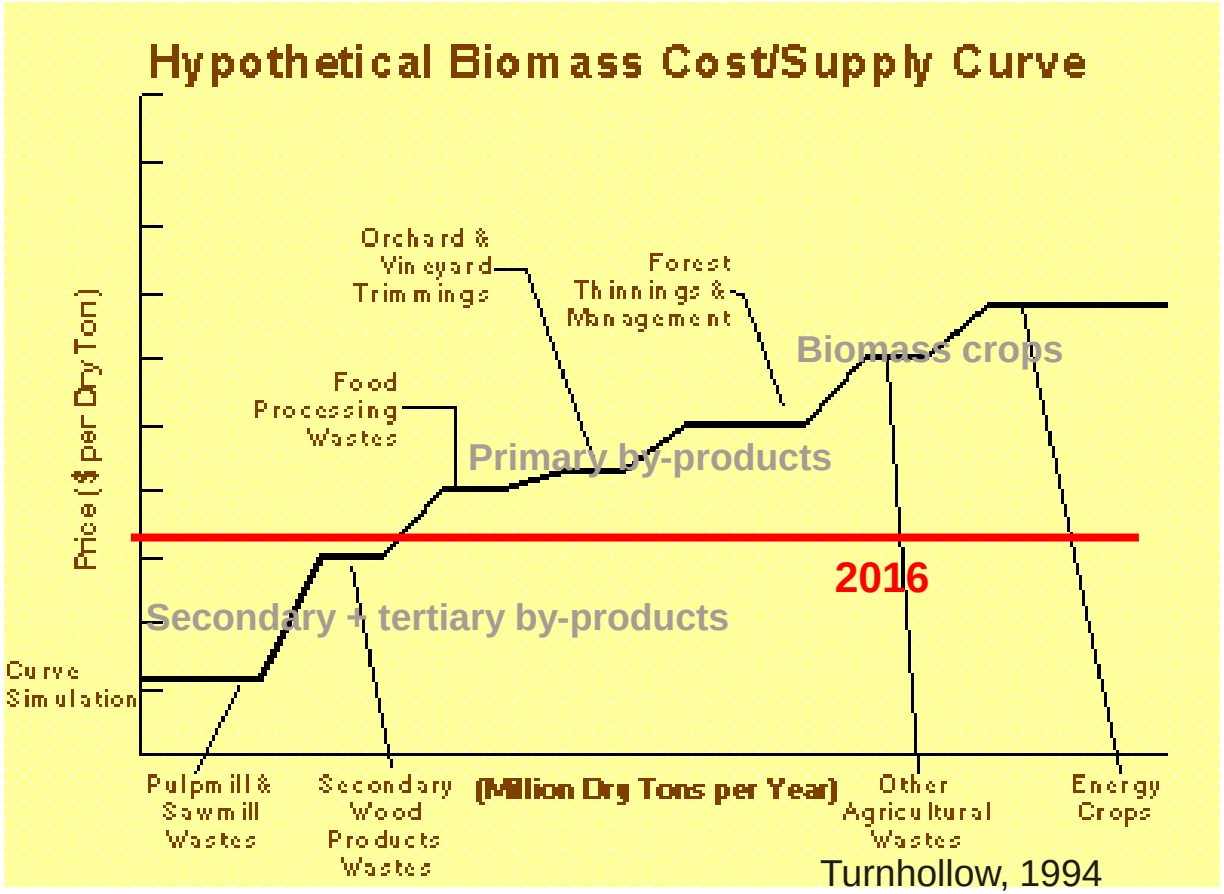
Primary (field) residues:

In the field.

Energy crops:

2 to 5 million ha “surplus land” =
20 to 50 million tons of biomass?

Cost supply curve is starting



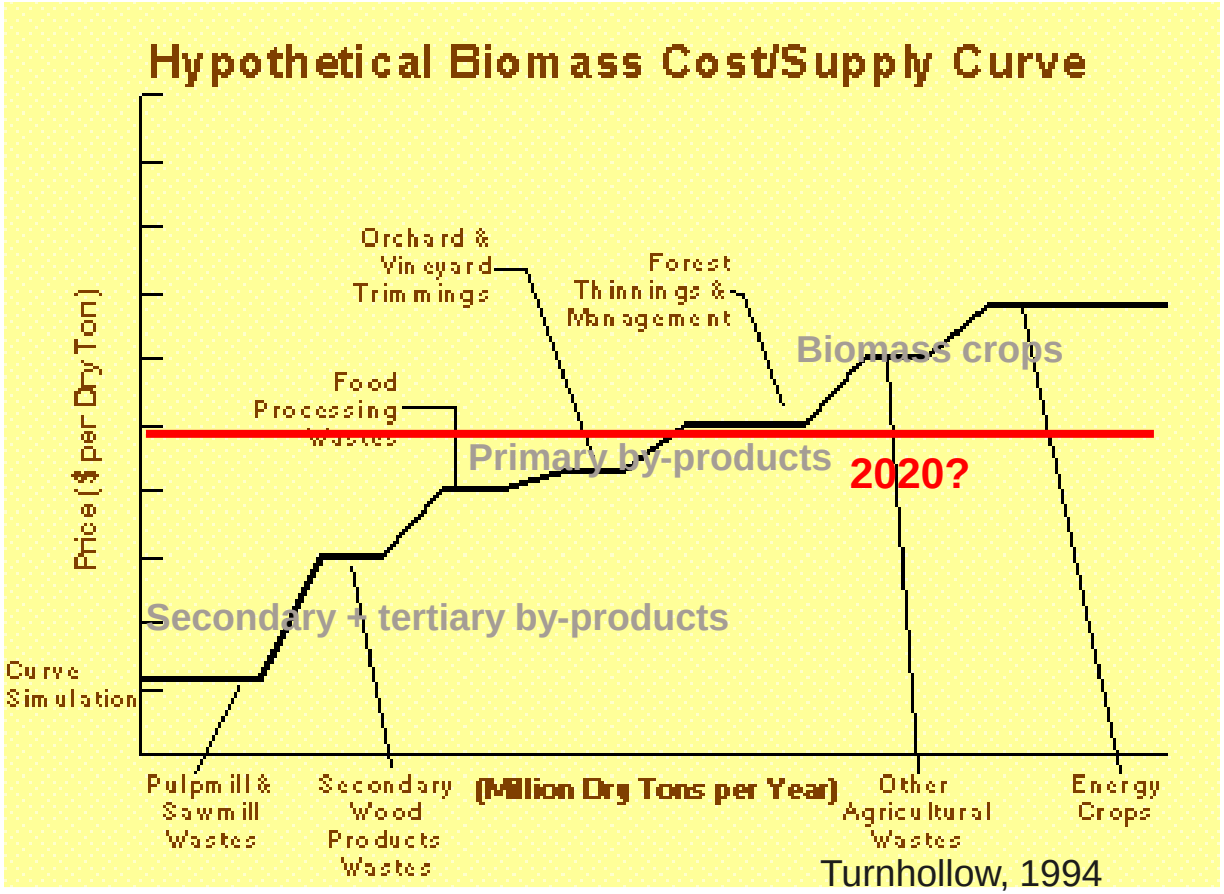
Tertiary by-products

Secondary by-products

Primary by-products

Dedicated crops

Byproducts and/or dedicated crops?



Turnhollow, 1994

Tertiary by-products

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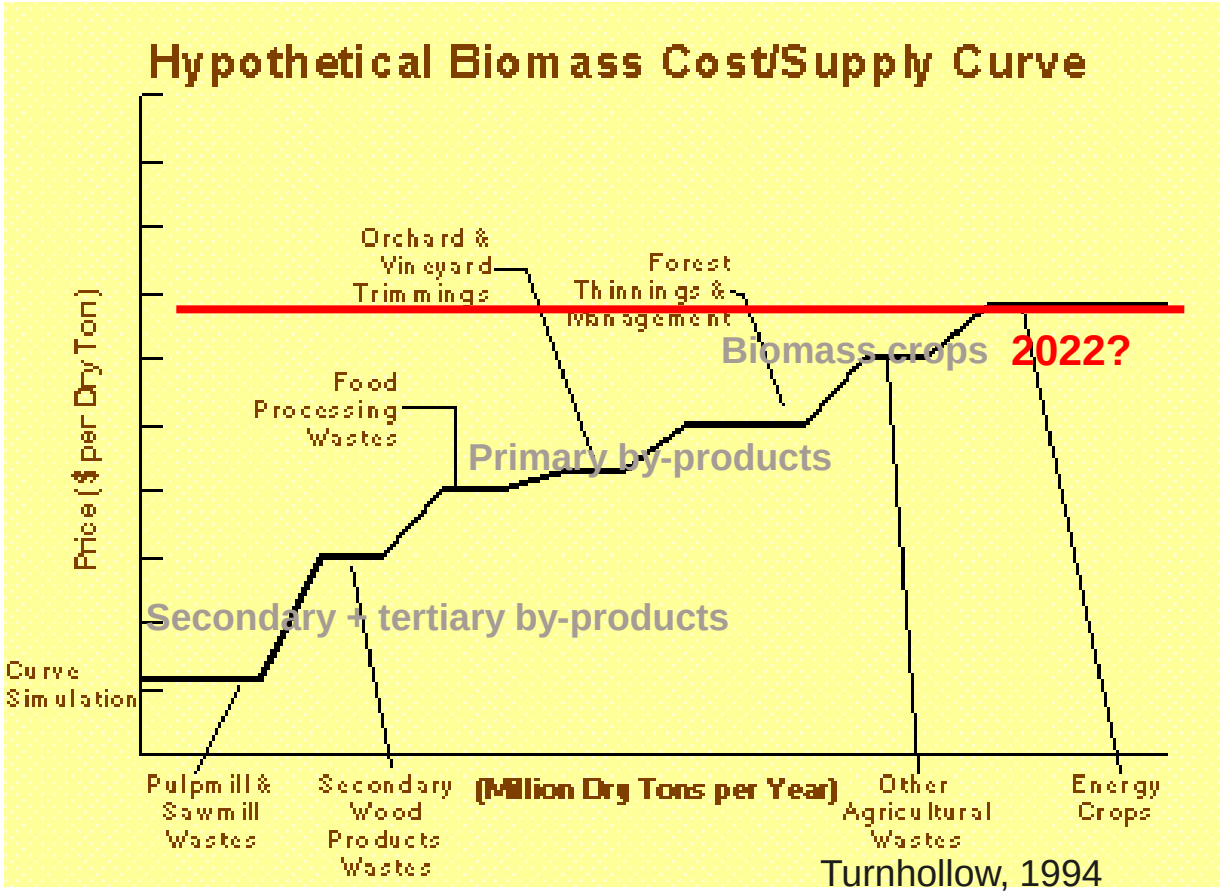


Tertiary by-products

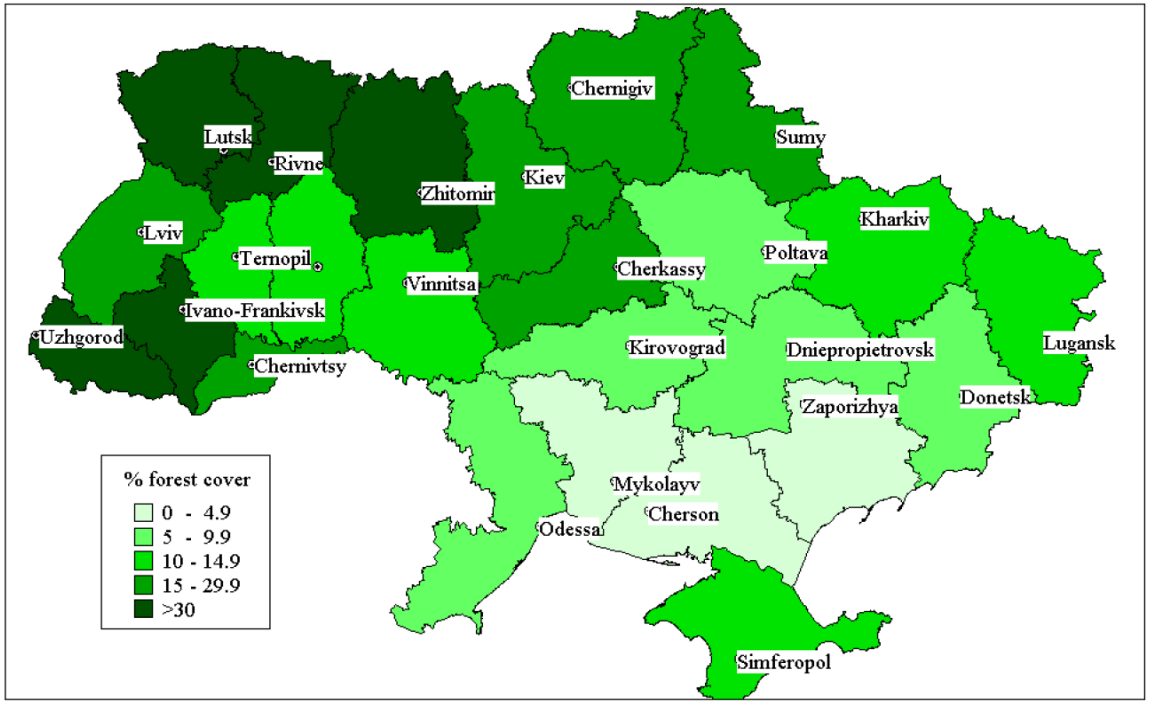
Secondary by-products

Primary by-products

Dedicated crops

Forest and chips and wood pellets: 1.4 Mtoe

- Wood is available in west and NW
- Pellets made form residue
- Already high utilisation rate



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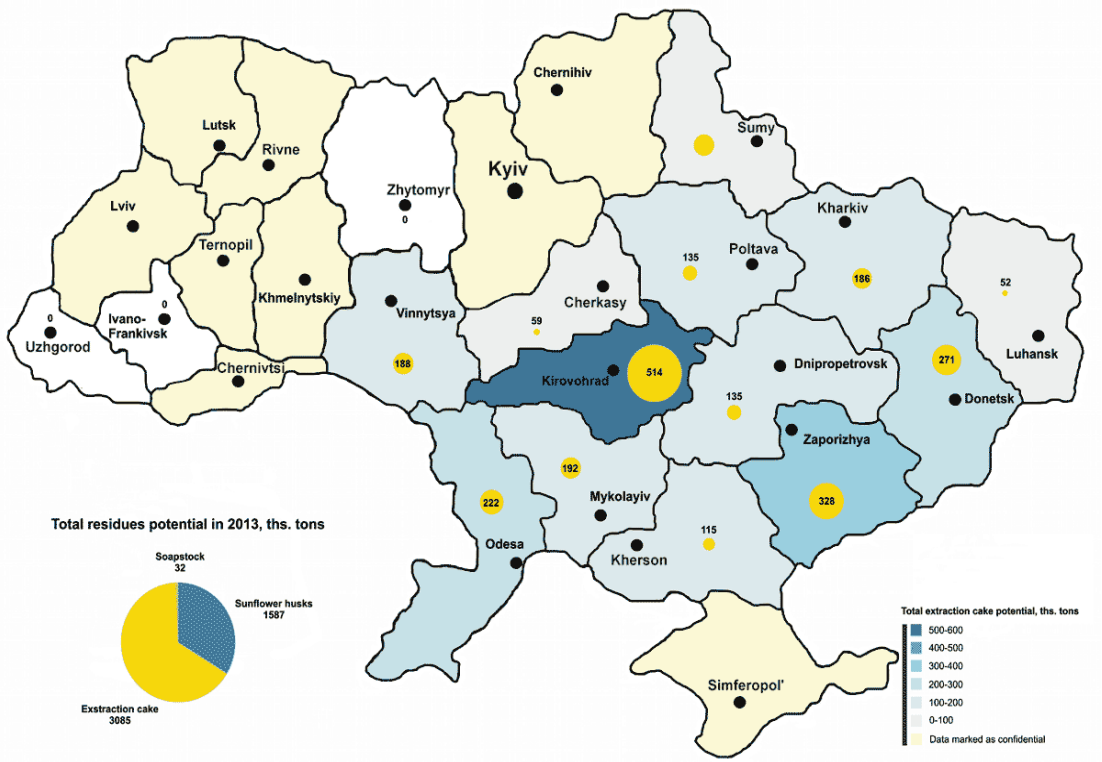
S2Biom project, 2016;
Biotrade2020plus, 2016

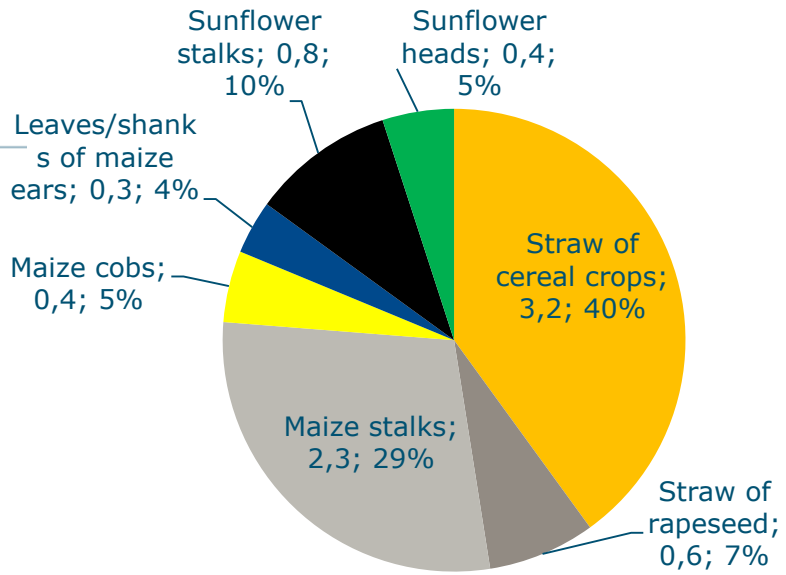
Sunflower husks: 1.4 Mtons = 0.5 Mtoe

- Sunflower hust pellets.
- Potential is used
- Expansion limited by crushing volume



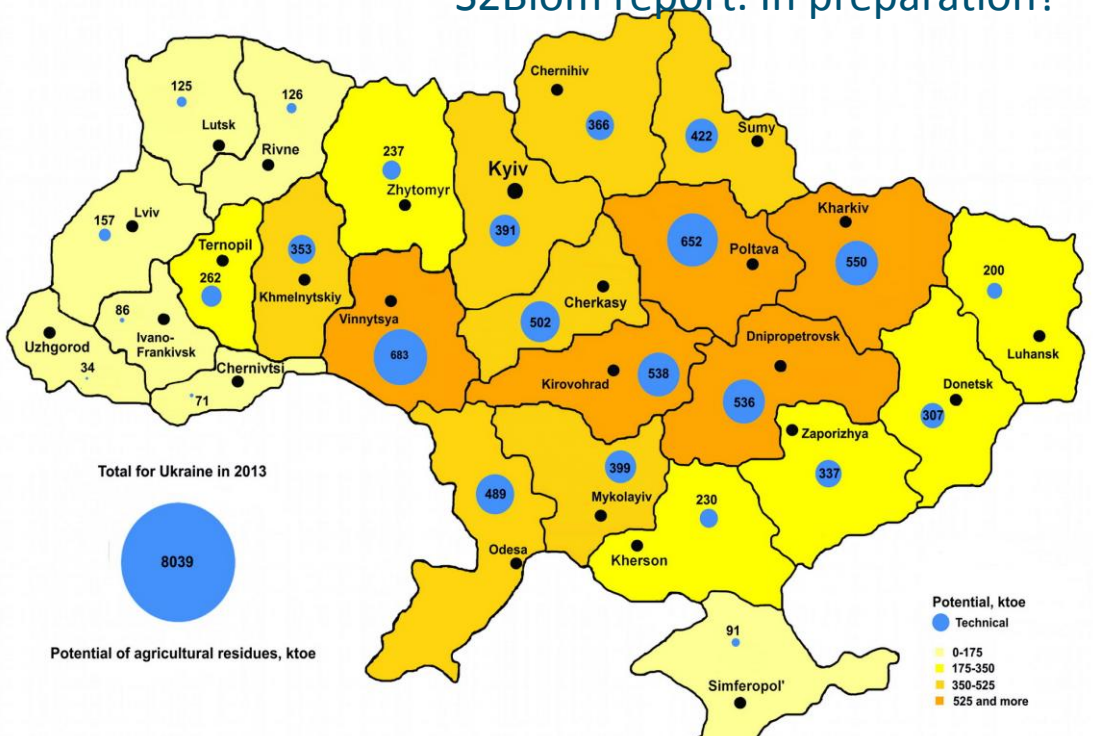
Crop field residues: 8 Mtoe

	Total	--- Available ------	
	Mton (FW)	Mton (FW)	Mtoe
Straw	30.6	9.2	3.2
Rapeseed straw	4.2	1.7	0.6
Corn field residue	40.0	16.0	3.0
Sunflower field residue	21.0	8.3	1.2
Total field residues	95.9	35.2	8.0



S2Biom report. In preparation?

- Large underutilised potential
- Many issues need to be considered



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Feedstock market is characterised by:

- Low prices?: “€50 per ton in summer € 100 in winter”

- Problems with contractibility
- Problems with quality
- Wood resources limited -> need to mobilize agri-residues and biomass crops

“Buyers want more control over their biomass/pellet supply”

Supply costs for pellets from crop residue (corn stover) preliminary estimate

Issues:

- Biomass quality: high ash, K, Cl, N.
- Soil Quality: nutrients and organic matter = underestimated issue
- Bargaining power local pelletizer
- Lack of standards
- Knowledge and experience

	Min	Max
Operation	€/MT	€/MT
Price for farmer	10	20
Harvesting/baling	10	15
Local transport to pelletizer	7	10
Storage	4	8
Pelletizing	30	65
Local transport to boilers	3	5
Total	64	123

Issues and solutions

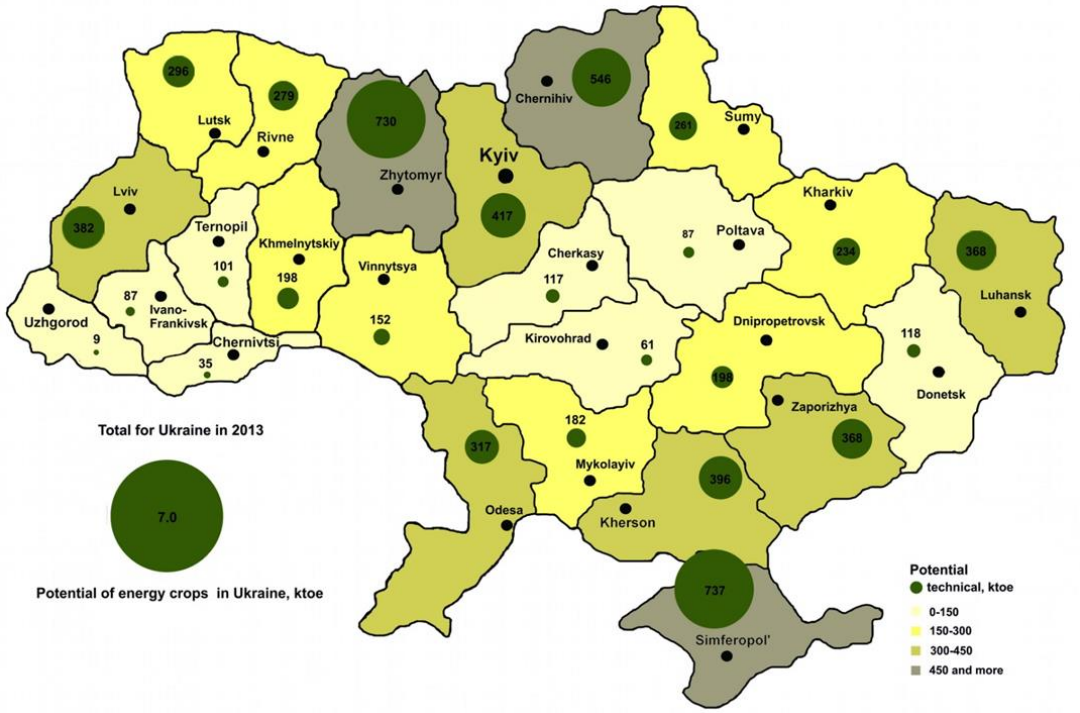
- Cost of harvest is correlated to yield per hectare -> Harvest 1 in 3
- Strip harvesting: harvest seed first, harvest straw after leaching
- No-till planting: allows for more straw removal
- Introduce models to determine optimal straw removal rate
- Harvest and pelletizing in one go!

Energy crops: 3.2 Mha = 32 Mtons?

Energy crop potential on fallow and unused land.

In north woody crops wet areas: willow and poplar

In central region: Switchgrass and Miscanthus



Perennial biomass crops

- Woody crops: Short rotation crops
  - Short rotation willow coppice
  - Poplar?

- Perennial biomass grasses:
  - Miscanthus
  - Switchgrass
  - Reed
  - Reed canary grass

Woody crops vs herbaceous crop/grass

	Wood	Grass
Moisture:	**high**	**low**
Bulk	**high**	**very high**
Cl	**low**	**high**
K	**low**	**high**
Ash	**low**	**high**
Cost	**low**	**maybe lower**

Supply costs for pellets from energy crops (switchgrass), preliminary estimate

Issues

- Steep learning curve needed
- Cost is projection for large scale
- Optimal crop management methods need to be developed
- Locally adapted varieties needed
- Yields on lower quality soils unknown
- Storage + transport needs development
- Zoning needed: where what?

	Min	Max
Operation	€/MT	€/MT
Inputs	8	12
Field operations	4	8
Baling + local storage	8	12
Land rent	4	5
Loading, field and road transport	15	20
Pelletizing	30	65
Transport to boilers	5	10
Total	74	132

END

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Refs:

- SEC Biomass: Geletukha et al.
- Institute of Bioenergy Crops and Sugar Beet (Ukraine)
- Biotrade2020plus
- S2Biom
- Pellets for Power

Quality?

Parameter	Effect
Ash ☹	Cost of transport . Cost of ash removal. Higher dust emissions. Clogging ash removal system
N ☹	Easily volatile and release in gas phase during combustion at temperatures between 800 – 1100 C - NOx emissions – corrosion? - Loss of nutrients
S ☹	Easily volatile and release in gas during combustion. Produces gaseosus compounds SO3and SO4 - SOx emissions - Corrosive effects
Cl ☹	Easily volatile and release in gas during combustion - HCl formation → corrosion - Cl influences the formation of polychlorinated dibenzodioxins and furans (PCDD/F) - Agglomeration (with K)
Ca ☺	- Increase the melting temperaturte of ash - Relevant plant nutrient, ash can be recycled as a fertiliser
Mg ☺	- Increase the melting temperature of ash
K ☹	Lowering ash melting point: - Slagging and deposit formation in furnaces and boilers Main aerosol forming during combustion - Lowering of the efficiency, higher operating cost KCL formation in the gaseous phase - Raise emission of fine PM and increases fouling in the boiler. - KCL causes corrosion of heating surfaces and it is a catalyst of NOx Can be recycled as fertiliser
Na ☹	Lowering ash melting point: - Slagging and deposit formation in furnaces and boilers Main aerosol forming during combustion - Raise emission of fine particulate matter PM - Increases fouling in the boiler

Miscanthus – switchgrass – switchgrass- Miscanthus