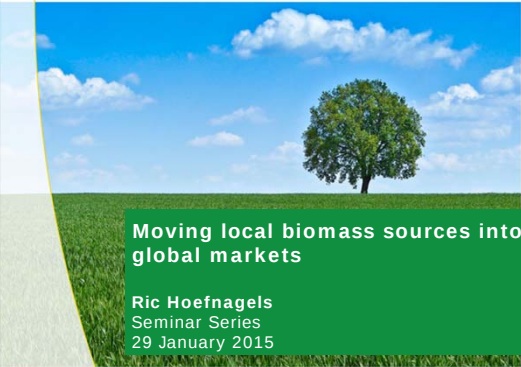


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Moving local biomass sources into global markets

Ric Hoefnagels
Seminar Series
29 January 2015

Universiteit Utrecht

Agenda

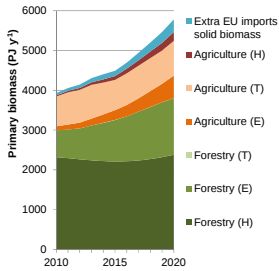
- Role of bioenergy in the EU
- Overcoming geographic challenges
- International trade of wood pellets
- Cost and greenhouse gas emissions
- Options for improved design

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Primary biomass demand in the EU27, meeting the 20% RES target in 2020

- Green-X scenario projection (TU Wien)
- 47 % increase in primary biomass demand
- Heat will remain largest (44 % in 2020)
- Growing extra-EU imports, but share remains modest (6% in 2020, 18 Mt wood pellets).



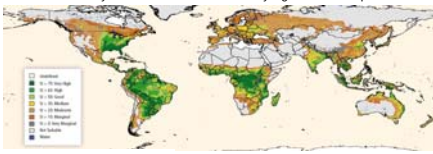
Hoefnagels, Resch et al., 2014

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Overcoming geographic challenges: energy demand is often remote from areas of biomass supply

Global land suitability for herbaceous and woody lignocellulosic plants



Earth at Night (NASA)



Chum et al. 2011, IPCC SRREN, Chapter 2 Bioenergy

NASA Earth Observatory/ NOAA NGDC, 2012

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When processed, solid biomass becomes 'tradable'

Wood pellet production in the US for export to Europe

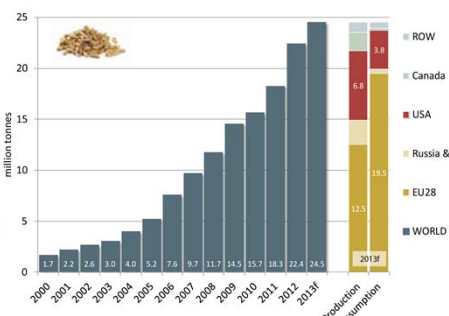


RWE website: Georgia Biomass (GA, USA)

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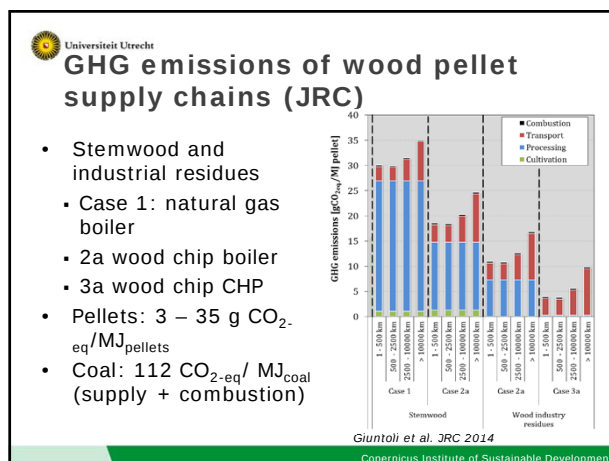
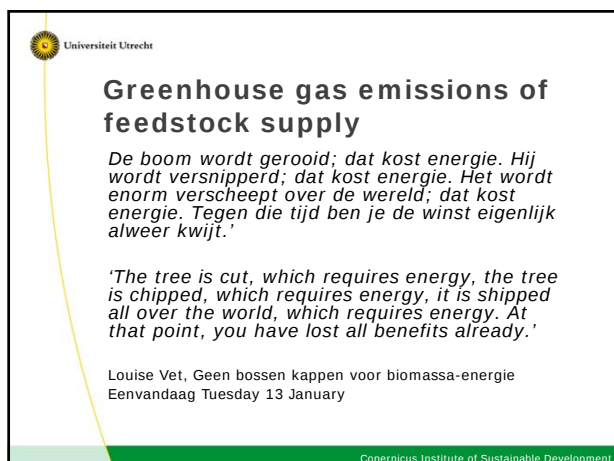
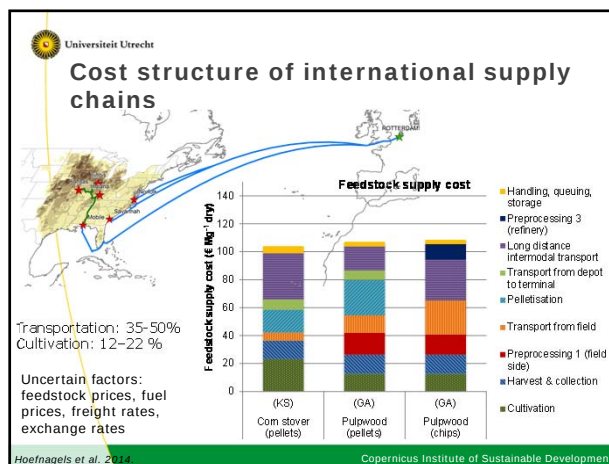
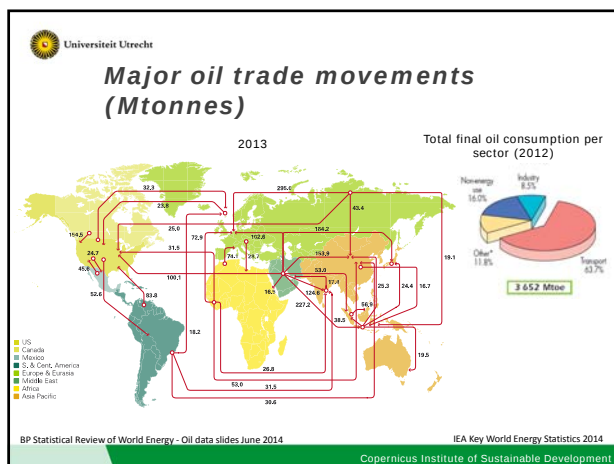
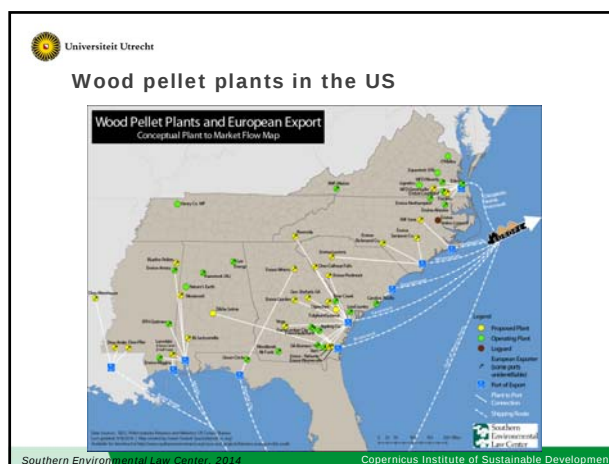
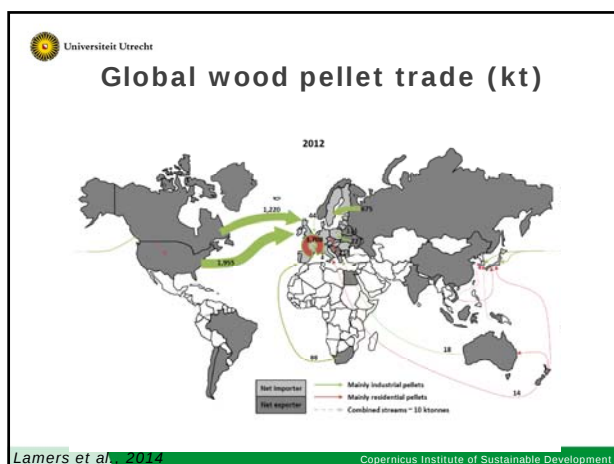
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Global wood pellet production and consumption



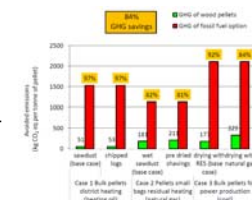
R.G. Watkins, 2014 (Source: REN21, Hawkins Wright)

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GHG savings for heat and electricity

- In general above 60% (JRC)
- Could exceed 70% if efficient conversion systems are used (e.g. co-firing or CHP)
- Or over 80% if substitution of coal is assumed (Sikkema et al.)

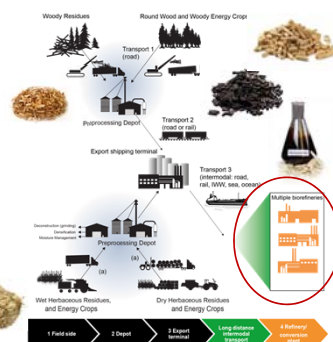


Sikkema et al. 2010

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Advanced supply chain design

- Locate preprocessing early in the supply chain
- Improving energy density (e.g. torrefied pellets, pyrolysis oil)
- Avoid transport of water
- Avoid transport minerals (nutrients)
- Meeting feedstock specifications
- Reducing downstream processing



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Advanced supply chain design: dandelion's hub and spoke system

- Production of refinery intermediates at decentralized locations (within production areas)
- Transport in densified form to large scale refineries to produce chemicals and energy (E/H/T)
- Making use of existing infrastructure when possible

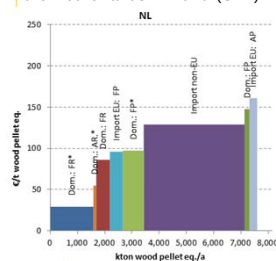


Lane, Biofuels Digest (10/24/2012)

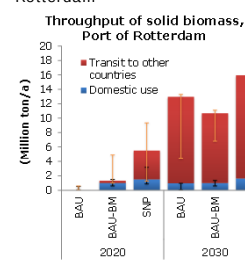
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The Netherlands, a biomass hub?

Cost-supply of solid biomass in the Netherlands in 2020 (SNP)



Throughput solid biomass in Rotterdam



Hoefnagels et al., 2013 (Port of Rotterdam)

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Ongoing research

BioLogikNL (TKI-BBE)

Evaluation of existing and design of optimal (cost, GHG emissions) international biomass feedstock supply chains.

UU, TU Delft, 12 industrial partners

Renewable Jet Fuel Supply Chain Development and Flight Operations (RENJET) (Climate-KIC)

- To develop and enable regional renewable jet fuel supply chains, and to create innovative financial business models to increase and sustain renewable jet fuel off-take.

UU, Imperial College, SkyNRG, KLM, Schiphol

Macro-economic outlook of sustainable energy and biorenewables innovations (MEV-II) (BE-Basic)

- To assess the effects of large scale deployment of biomass for energy (E, H, T) and non-energy purposes (chemicals) in the Netherlands

UU, LEI-WUR, industrial partners (Corbion, DSM, Essent)

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Conclusions

- The shift from traditional to modern uses of bioenergy increases the demand outside production areas
- In its raw form, biomass is difficult to mobilize, especially lignocellulosic residues
- Co-firing and conversion projects have provided experience with large scale international feedstock supply systems
- Advanced feedstock supply can further improve the economic and environmental viability of bioenergy systems

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Thank you for your attention!

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