

# Long-term RES potentials and costs

## The role of international biomass trade

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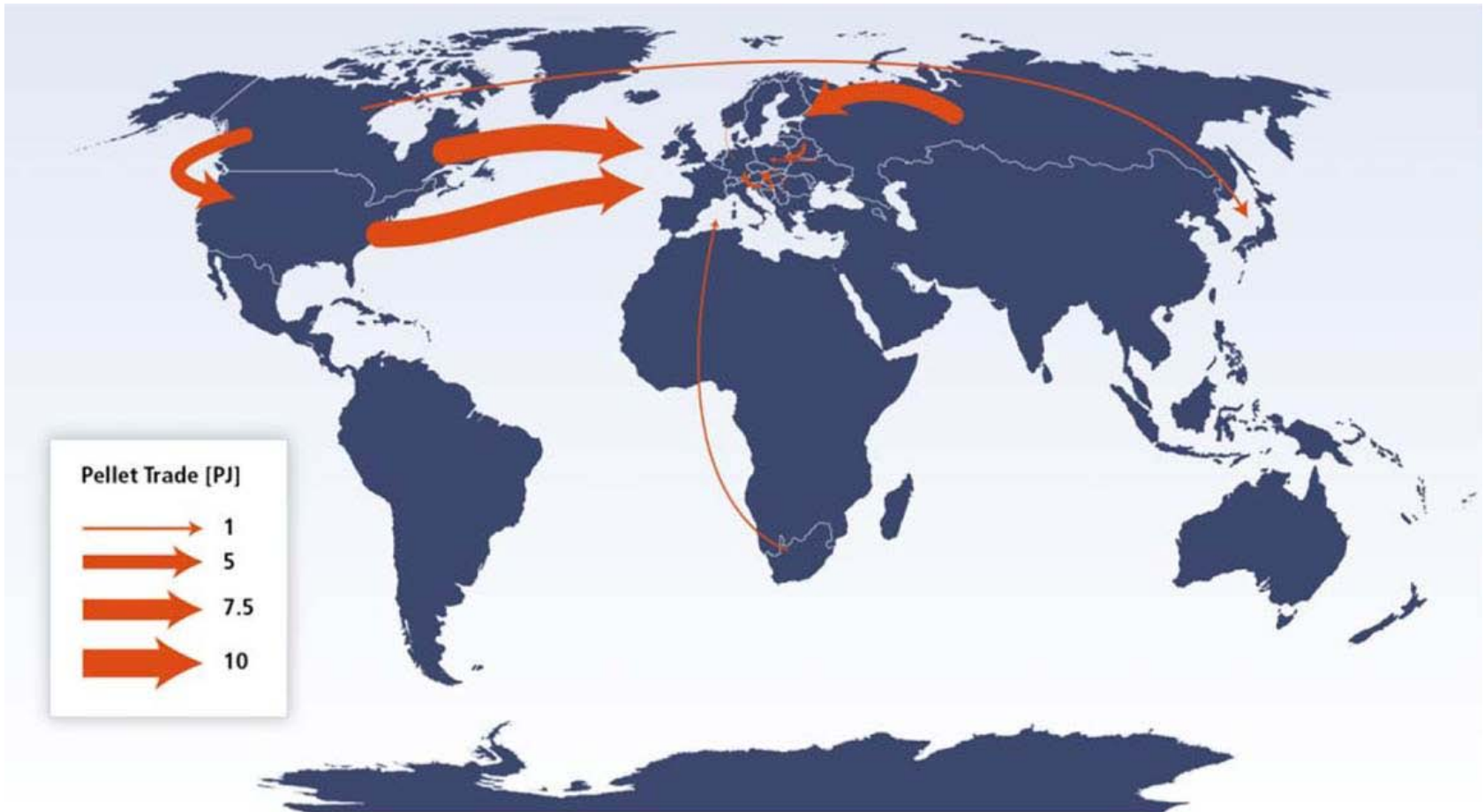
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## Agenda

- Trade of solid biomass
- Approach to estimate cost and greenhouse gas emissions emissions of biomass transport
- Implementation of biomass trade implications in GREEN-X
- Results and conclusions

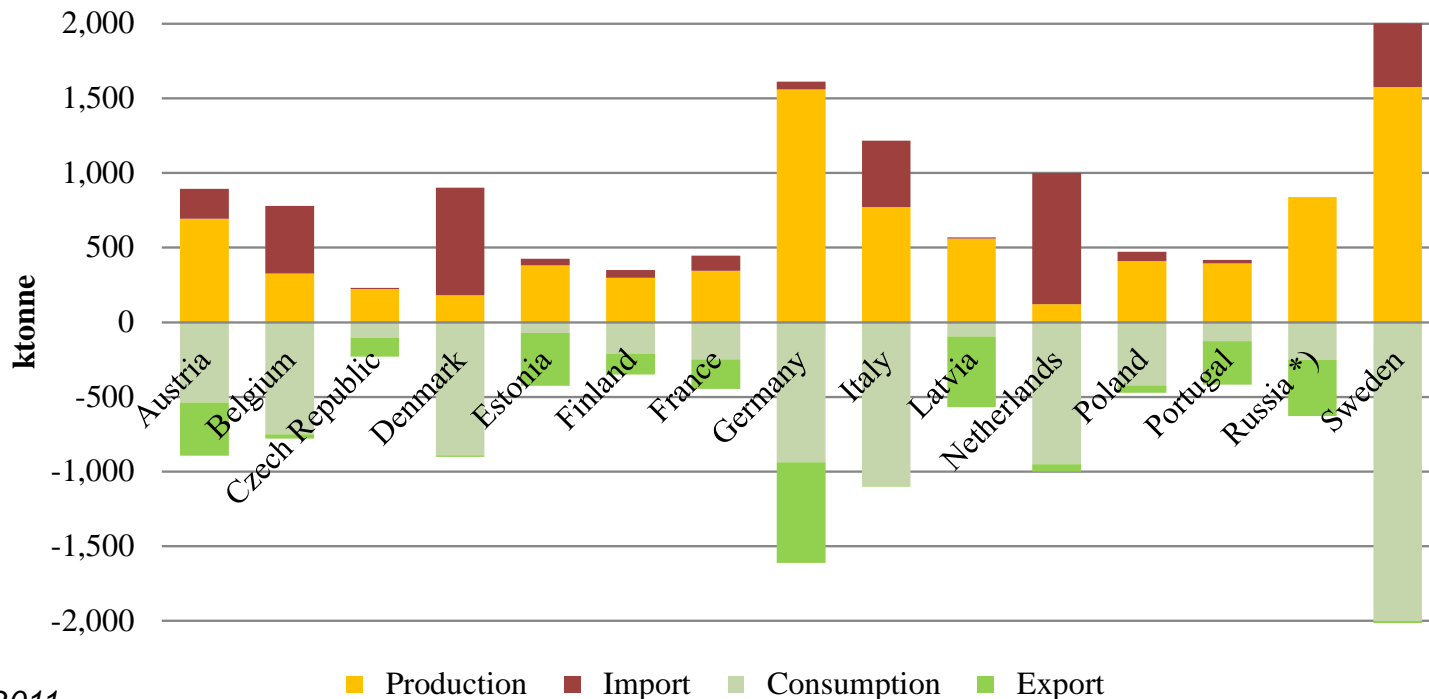
## Trade of solid biomass



*IPCC SRREN (2011)*

## Intra- and inter-European trade of wood pellets (2009)

- Intra European trade EU-27: 2.1 Mt (37 PJ)
- Import other Europe: 0.6 Mt (11 PJ)
- Import North America: 1.0 Mt (18 PJ)



Sikkema et al. 2011

## Biomass potentials and distribution

- Origins: distribution of bioenergy potentials per NUTS-2 region (REFUEL, Wit et al., 2010) and EUROSTAT
- Destinations: Largest cities, NUTS-1 regions

Based on REFUEL

Based on REFUEL

Based on EUROSTAT

## Biomass potentials and network layers

### Inland waterways (Class II to Class VI)

- 1,000 nodes, 6,000 links
  - Four ship types (550 to 10,800 t, per class type)
- Short sea shipping**
- 30 nodes (important sea harbors), 870 links

### Rail freight network

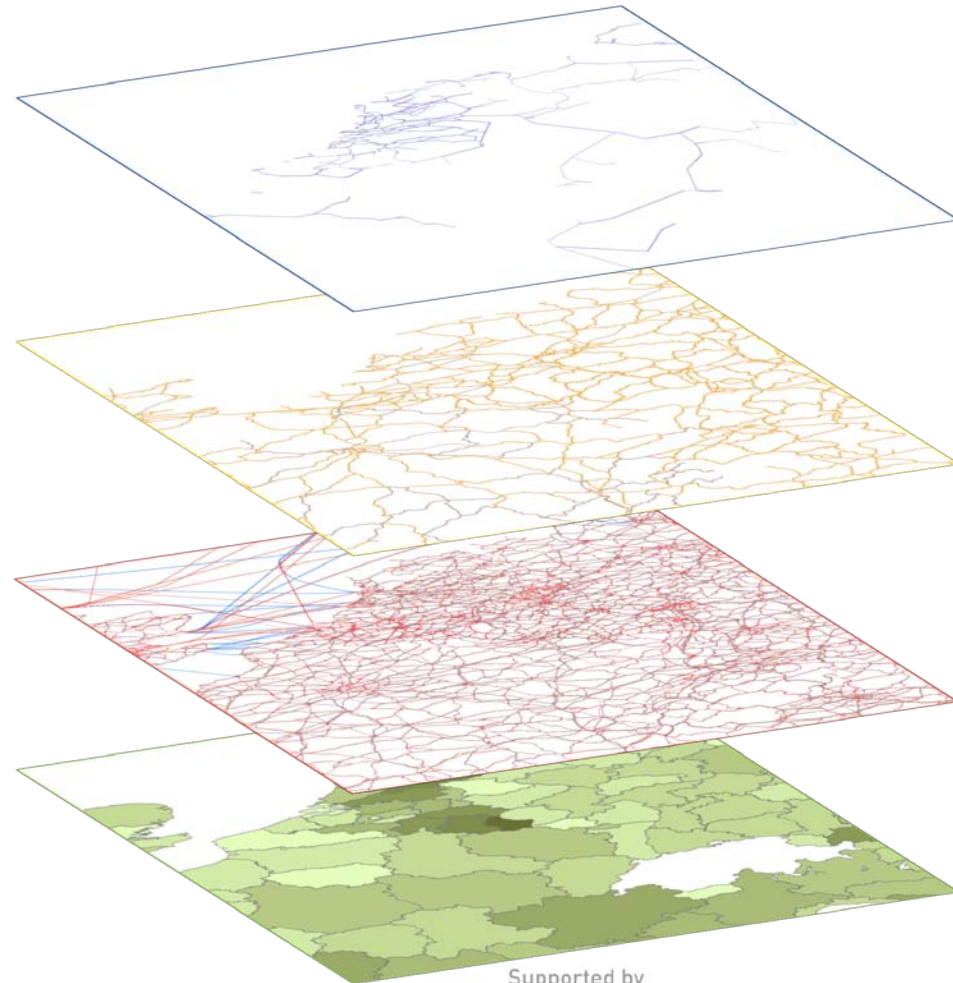
- 4,500 nodes
- 6,000 links
- Diesel locomotive (payload: 1600 t)

### Road network

- 30,000 nodes,
- 50,000 links
- Truck transport (payload: 27 t)

### NUTS-2 distribution of biomass resources

- Lignocellulosic energy crops (REFUEL)
- Forestry products and residues (EUROSTAT forestry cover)



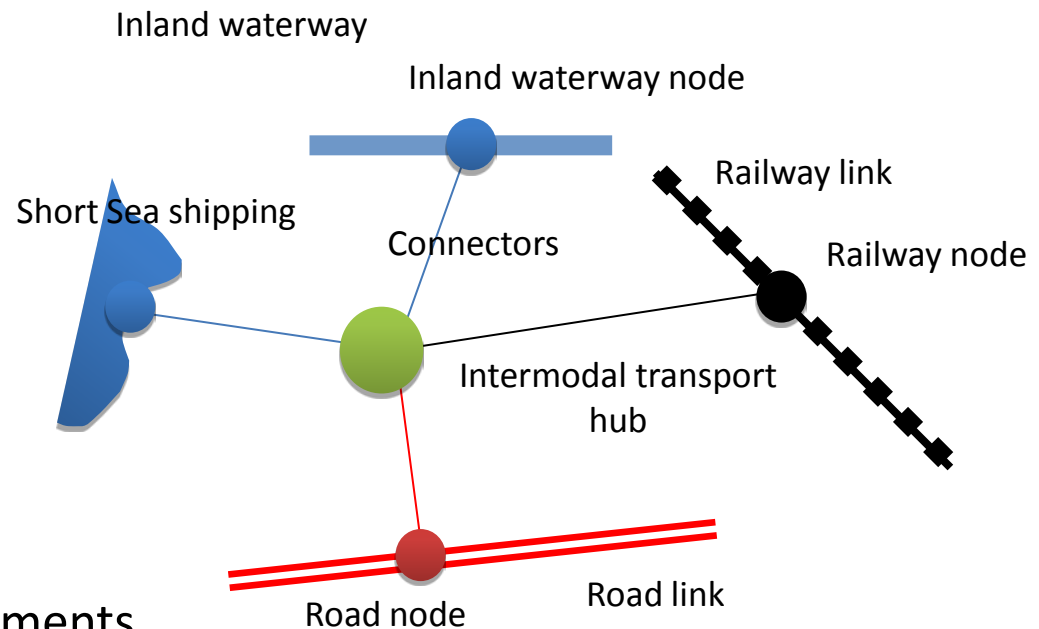
## Hub-spoke network

### Links

- Length
- Speed
- Tolls, etc.

### Connectors

- (Un)loading cost
- (Un)loading time
- (Un)loading energy requirements



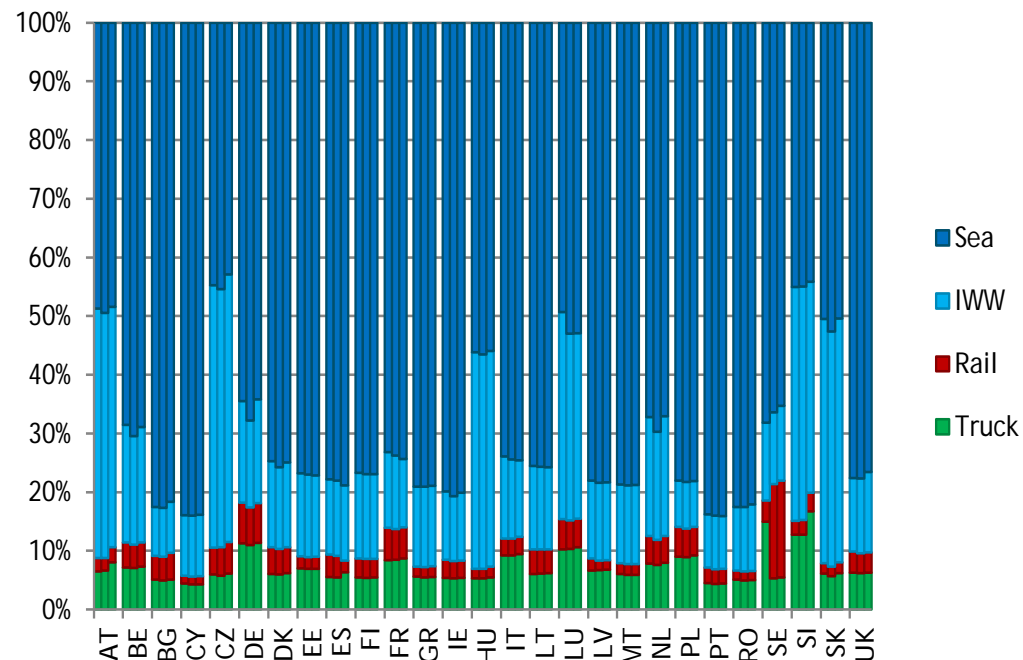
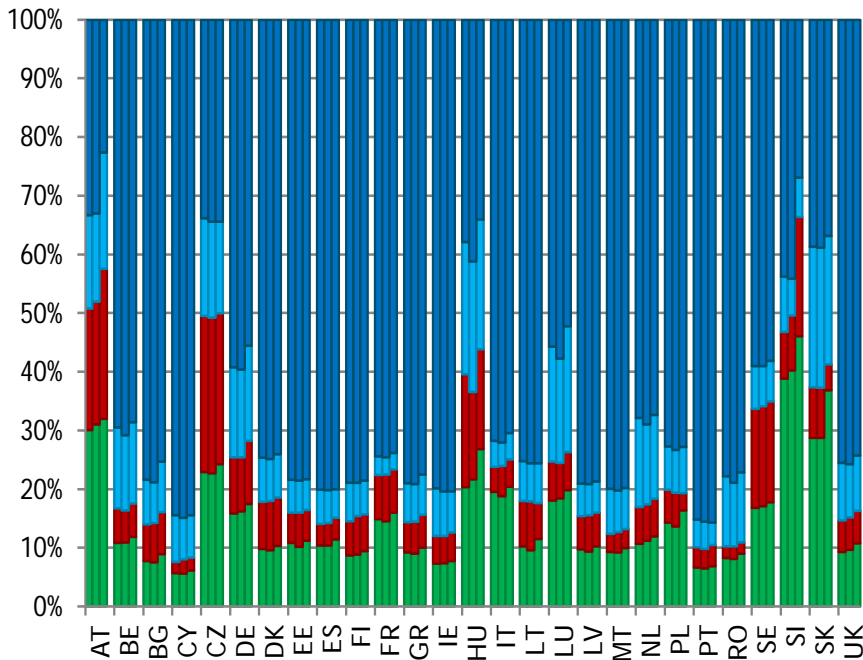
Following Winebrake et al. 2008

## Means of transport for wood chips and wood pellets

- Land locked countries (Austria, Czech Republic, Hungary, Slovakia)
- Ships, inland waterways (IWW) and sea are less cost effective for high volume products like wood chips compared to wood pellets

Wood chips

Wood pellets

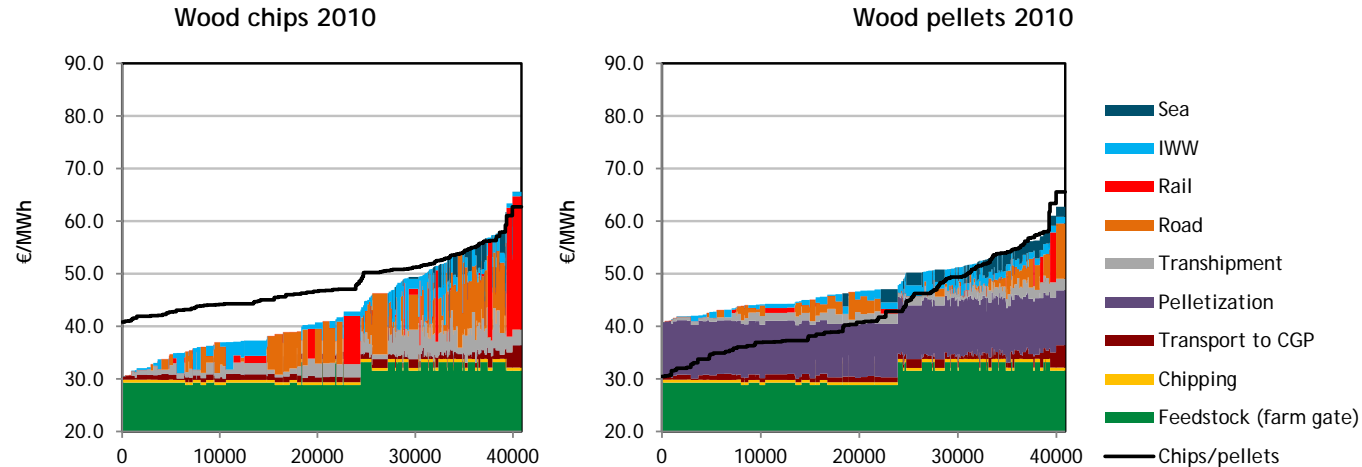


Year: 2010 (left), 2020 (centre), 2030 (right)

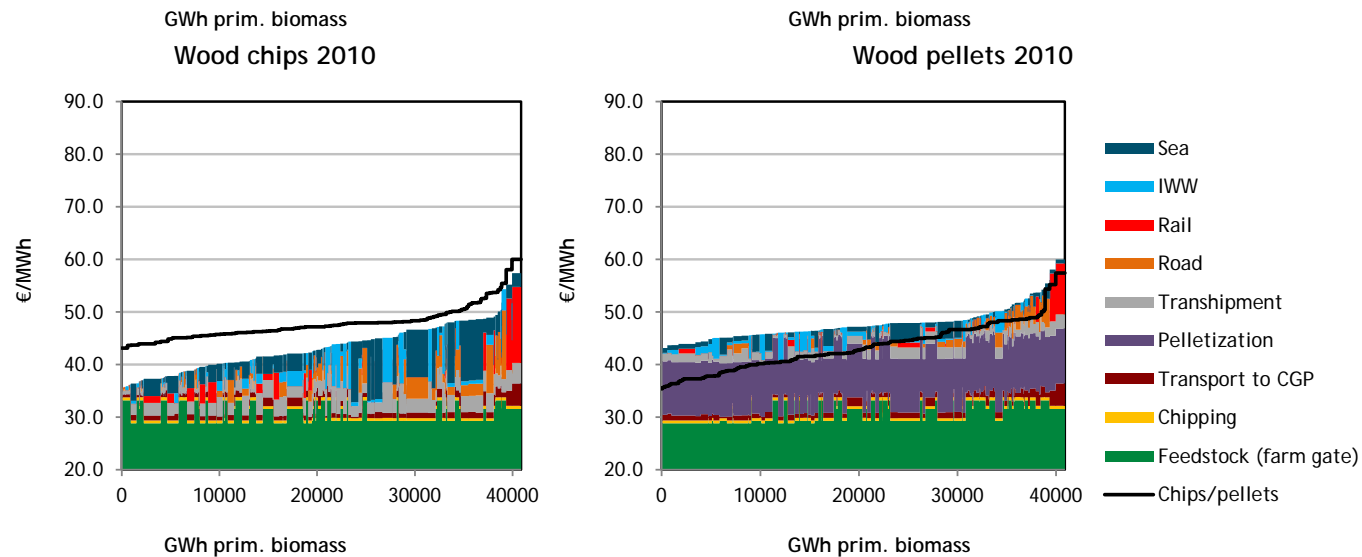


# Cost

## Hungary

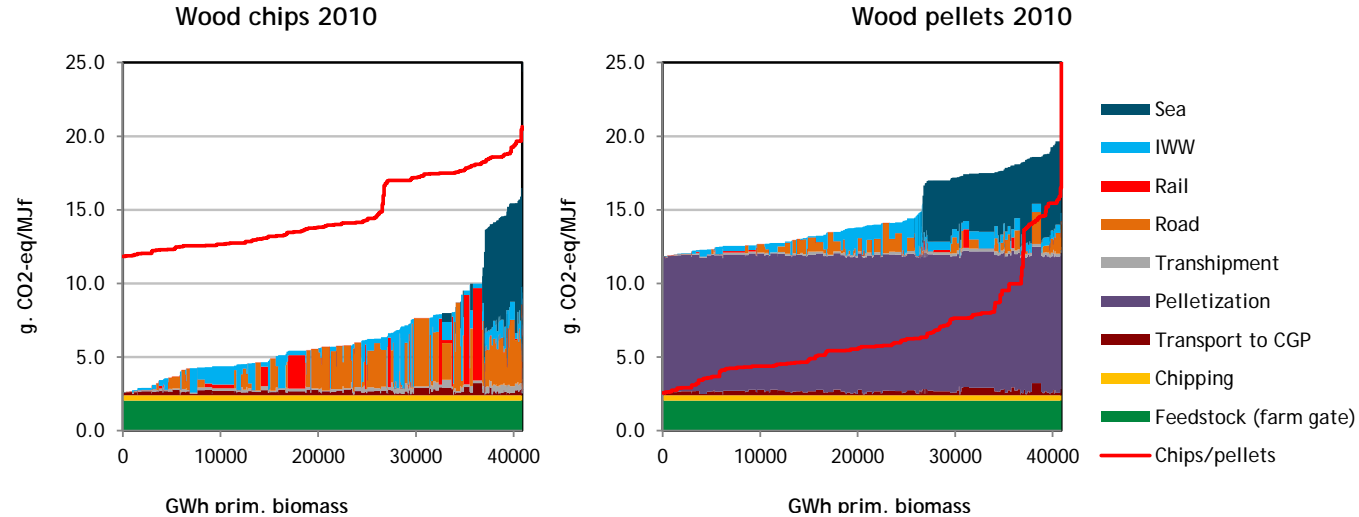


## Netherlands

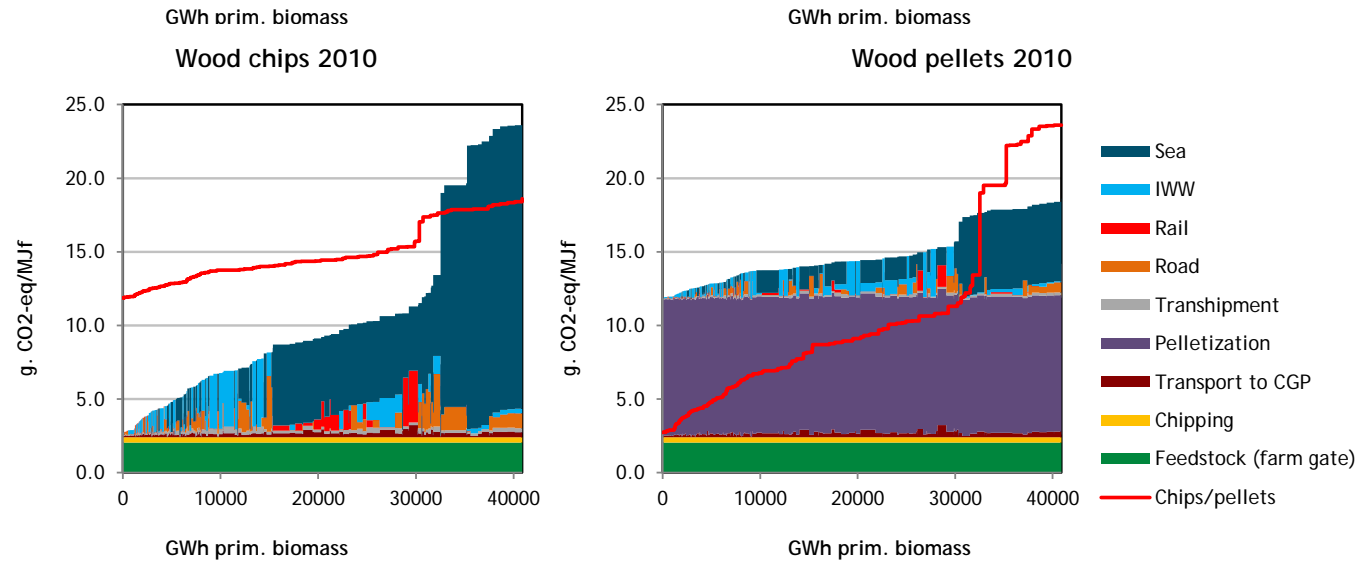


# GHG emissions

## Hungary



## Netherlands



## Trade flows of solid, lignocellulosic biomass (scenarios for demonstration)

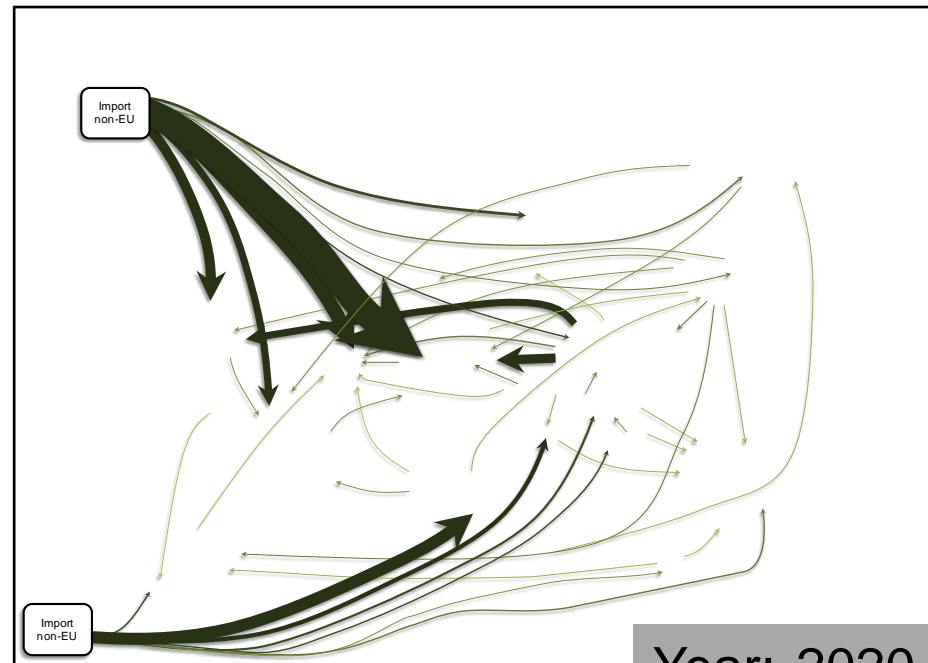
	2009 (pellets)	2015		2020	
		Low Import	High Import	Low Import	High Import
Total trade (Mtoe)	1.6	5.4	6.2	12.6	17.4
Total trade (Mt wood pellet eq.)*	3.8	12	14	29	40
Of which Intra-EU	55%	38%	32%	52%	32%
Of which Inter-EU	45%	62%	68%	48%	68%

\*) Mt eq. = million metric tonne wood pellet equivalent (18 MJ/kg)

### Low Import scenario



### High Import scenario



Year: 2020

## Conclusion

- Transport cost can add substantially to the total cost balance of supplying solid biofuels to the demand region.
- The cost for pelletization does not pay off against the lower transport cost from increased energy density and lower moisture content
- However, the model does not take into account possible end-user requirements and preferences such as improved efficiency
- Pre-treatment and transport constitute the major part of the total GHG balance of these supply chains.
- Emissions for transport add up to 99% for wood chips from forest residues and up to 64% for wood pellets from wood processing residues.
- The developed model is a useful tool to address for cost and GHG emissions related to logistic processes of bioenergy commodities.
- The addition of more (non-EU) regions, improved model parameters and alternative bioenergy commodities could improve the model.

More information on the long-term RES potentials and can be found in the reports of RE-Shaping Work Package 5:

- Part I: Potentials, diffusion and technological learning
- Part II: The role of international biomass trade

**Thank you**

## Contact

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