

SECOND GENERATION BIOFUEL POTENTIAL IN EUROPE

Leduc S.^{*}, Wetterlund E.^{*,**}, Dotzauer E.^{***}

^{*} International Institute for Applied System Analysis (IIASA), A-2361 Laxenburg, Austria

^{**} Linköping University, SE-581 83 Linköping, Sweden

^{***} Mälardalen University, SE-721 23 Västerås, Sweden

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Outline

- Introduction
- Model description
- Results
- Conclusion



Background

- 2020: 10% target for renewable energy in the transport sector
- Second generation biofuel
- Large scale

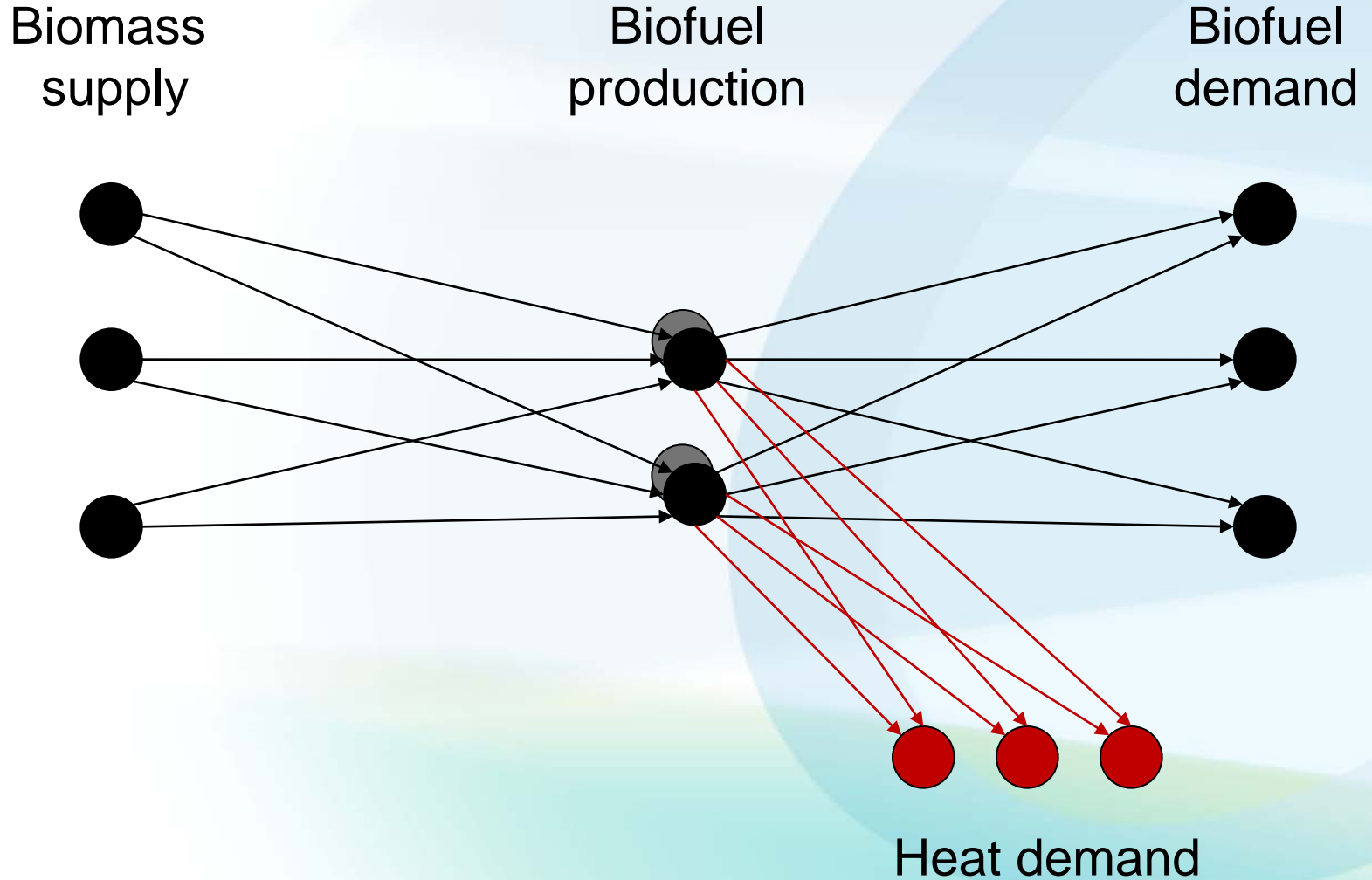


Objective

- To investigate
 - the **biofuel production potential** from woody biomass in the EU-27, under varying
 - CO₂ costs
 - biofuel support
 - fossil fuel price



Be Where Model





BEWHERE Model

- Techno-economical model
- Spatially explicit (0.2 ° to 0.5° grid cell)
- Dynamic to some extent...
- Minimize the total cost of the whole supply chain for the region's welfare

$$\text{Objective_F} = \text{Total_Cost} + \text{Total_Emissions} * \text{Carbon_Tax}$$

- Does not maximize the profit of a plant

Input

Biomass: possible location, yield, and collecting cost

Production plants: economic parameters, conversion efficiency

Demand: cities location, heat and transport fuel consumption

Economic factors: transportation costs, carbon cost

Modeling

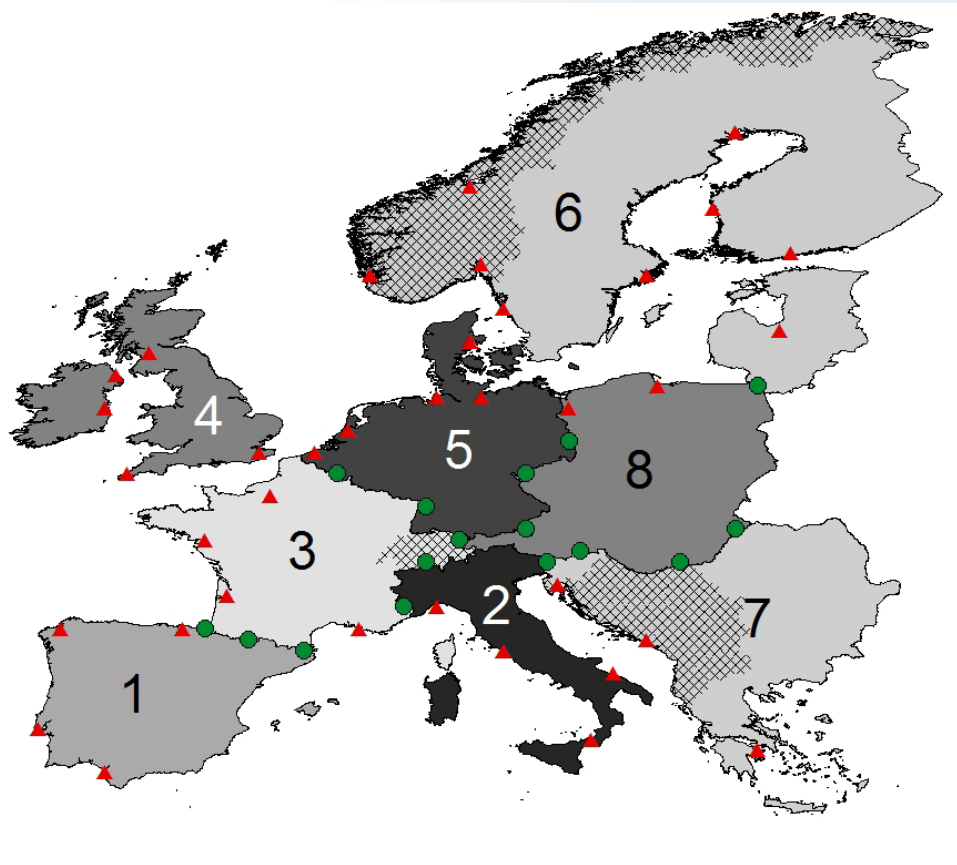
Minimize costs & emissions

Output

1. Production plants: number, position, size, type of fuel
2. Biomass used/plant(s)
3. Cities delivered/plant(s)
4. Costs, Emissions



Model Boundaries



- ▲ Major harbor
- Inland trade points between two regions
- ▨ Country not considered

Technologies

<i>Key parameters</i>	<i>Unit</i>	<i>Ethanol^a</i>	<i>Methanol^a</i>	<i>FT diesel^b</i>
Base plant capacity	$t_{\text{biomass}}/\text{hour}$	100	100	100
Base investment cost	M€a	43	65	67
Operating and maintenance cost	M€PJ _{biofuel}	8.2	2.2	2.9
Biofuel efficiency	$\text{GJ}_{\text{biofuel}}/\text{GJ}_{\text{biomass}}$	0.26	0.55	0.45
Electrical efficiency	$\text{GJ}_{\text{electricity}}/\text{GJ}_{\text{biomass}}$	0.09	0	0.06
District heating efficiency	$\text{GJ}_{\text{heat}}/\text{GJ}_{\text{biomass}}$	0.35	0.11	0.06
Total efficiency	$\text{GJ}_{\text{in}}/\text{GJ}_{\text{out}}$	0.82	0.66	0.57

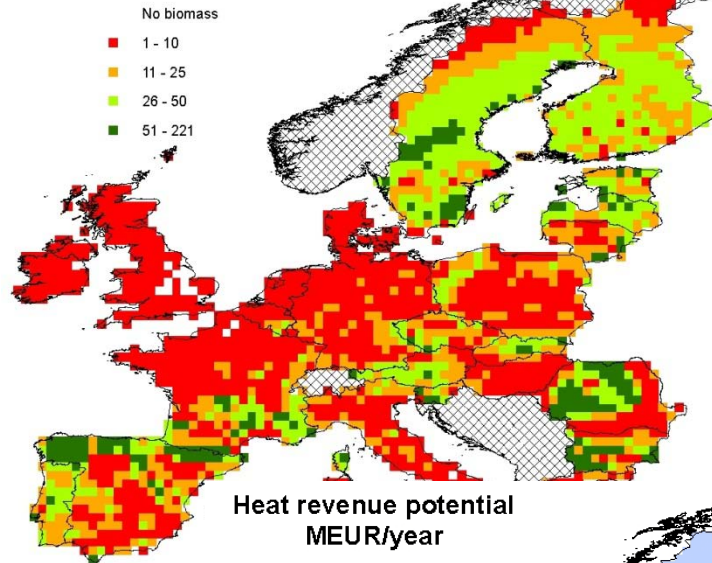
^a Hansson et al., 2007.

^b van Vliet, et al., 2009, van Vliet, 2010.



Europe – Input Data

Biomass availability / cost
(GWh/ EUR/MWh)



Electricity revenue
EUR/GJ



Heat revenue potential
MEUR/year



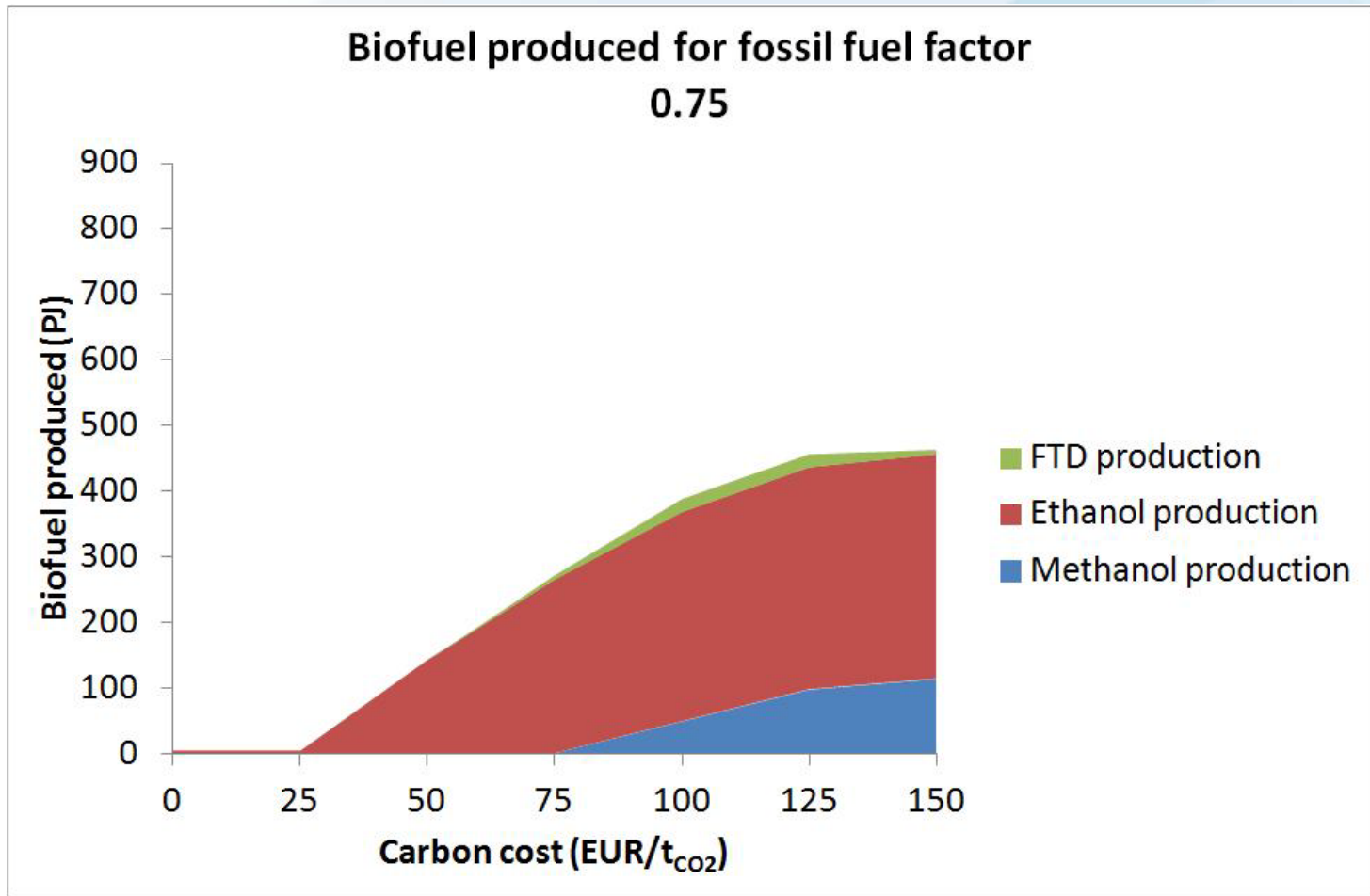
44 Scenarios

	Fossil fuel price factor	Carbon cost (€/t _{CO2})	Biofuel Support (€/GJ)
Min	0.75	0	0
Max	1.5	150	20
Step	0.25	25	5



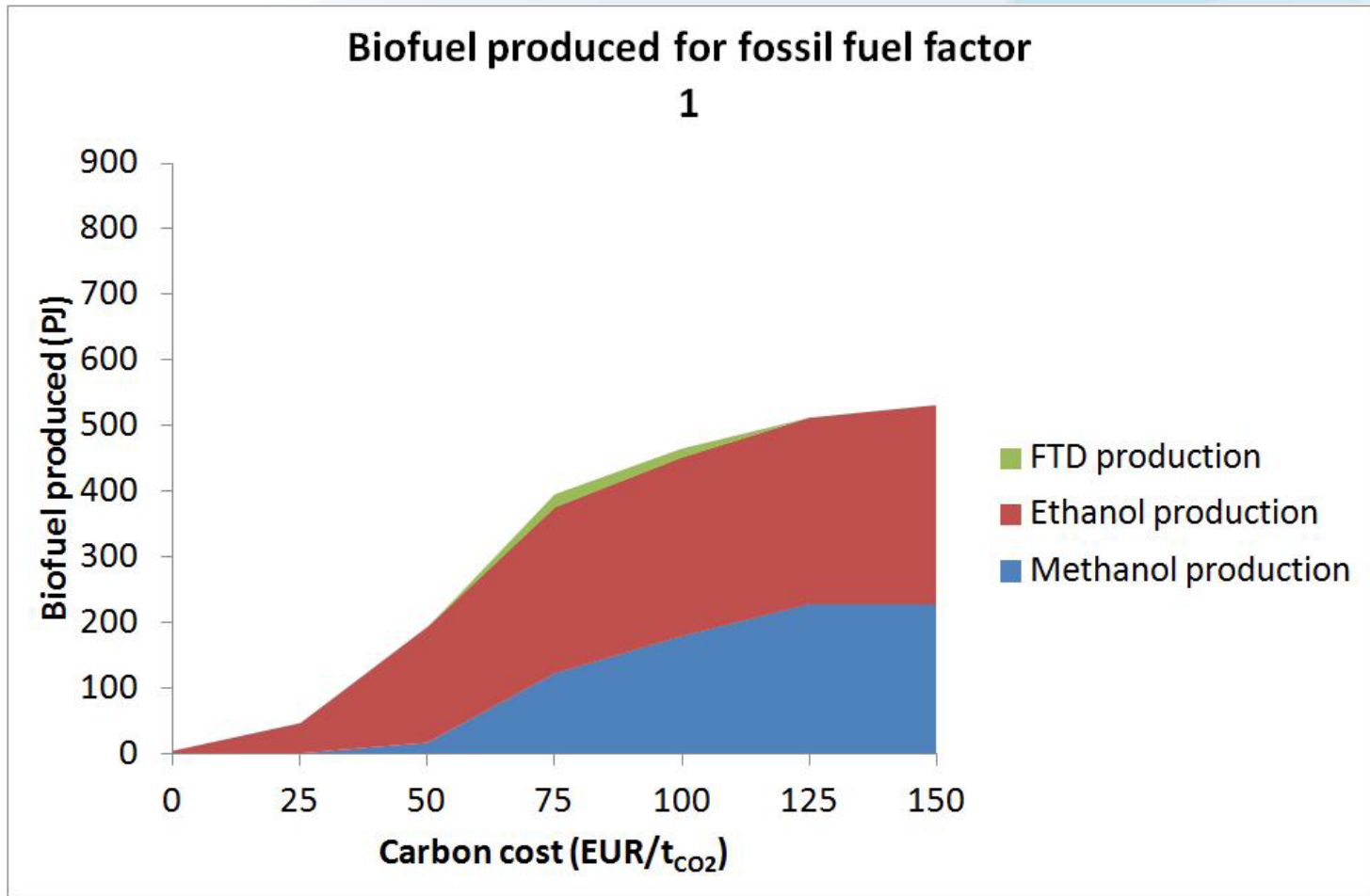
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Biofuel Type



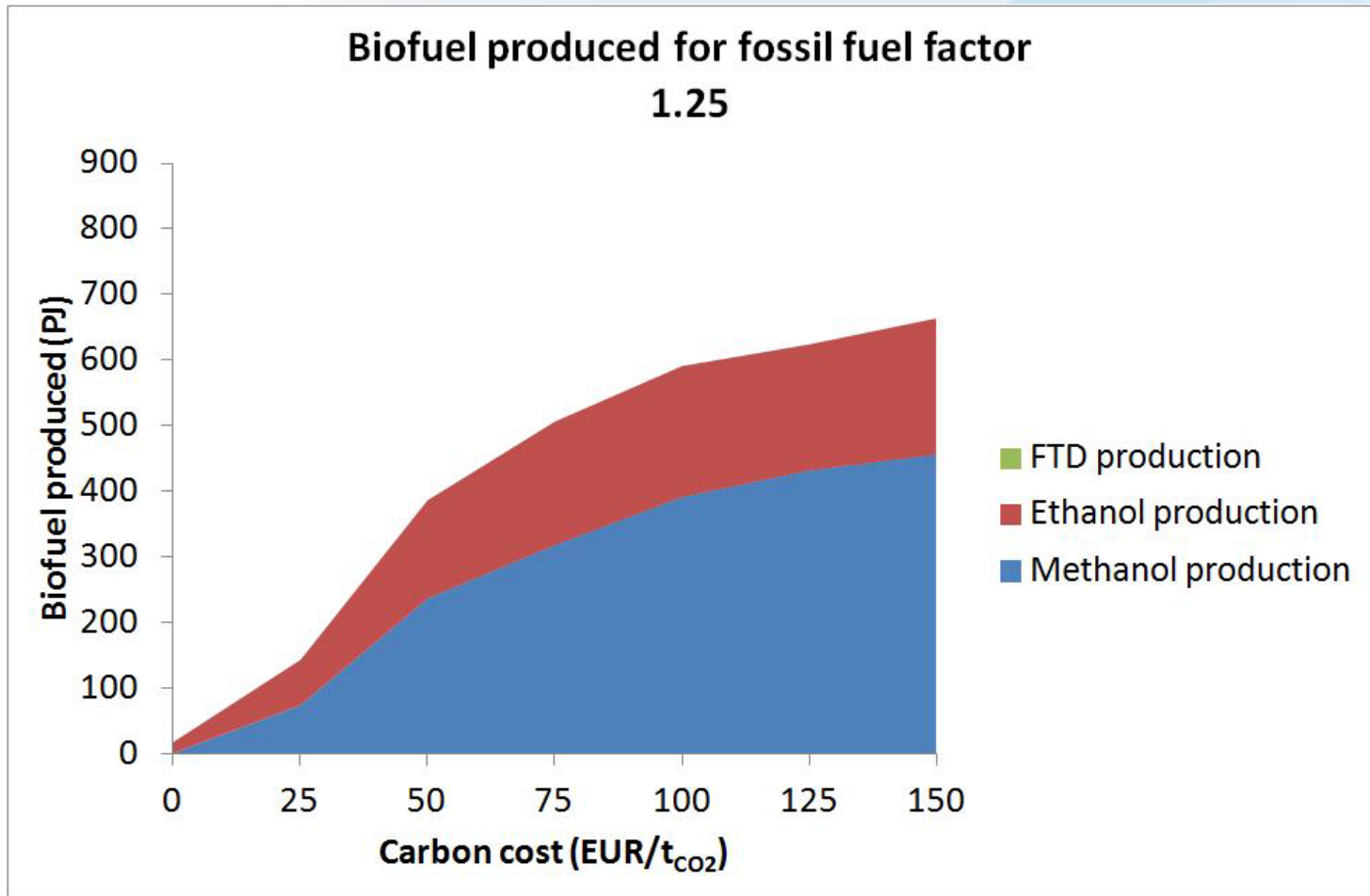


Biofuel Type



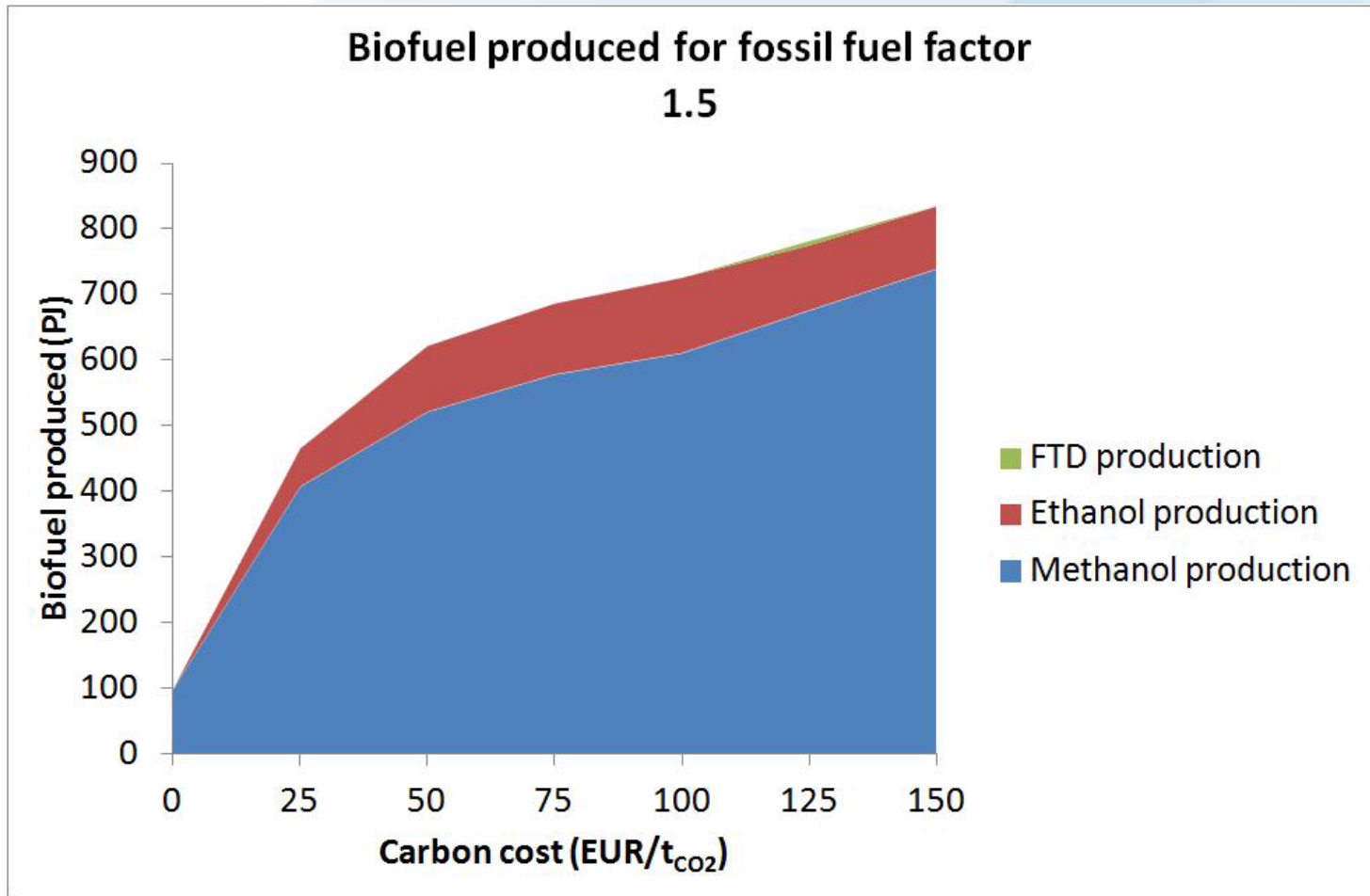


Biofuel Type

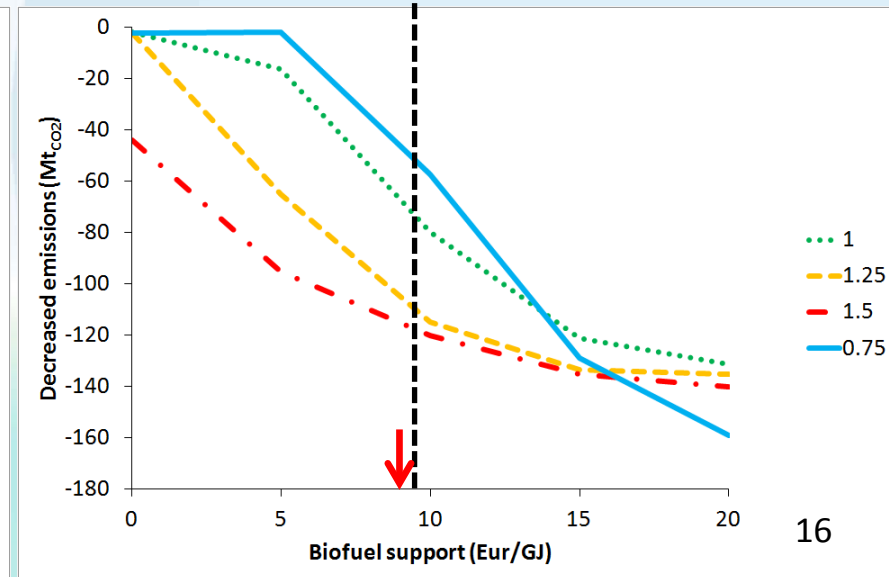
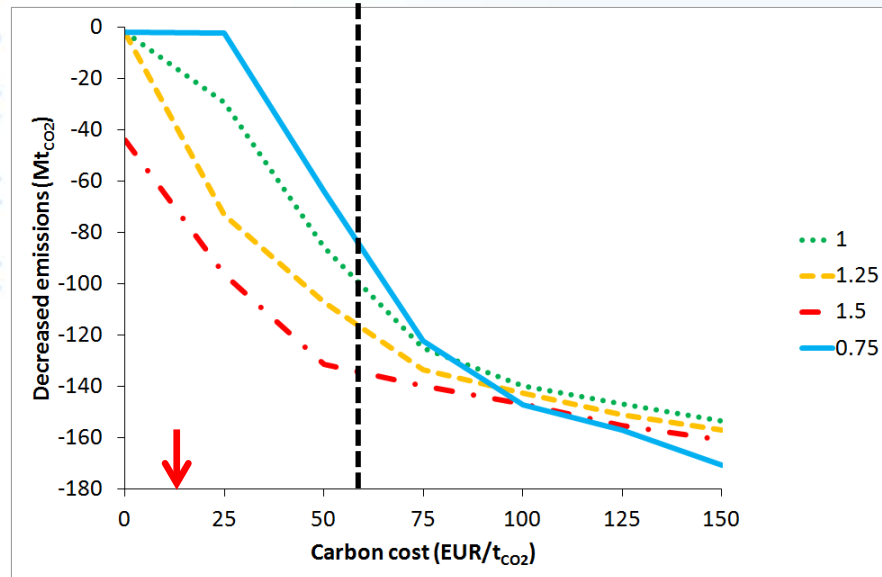
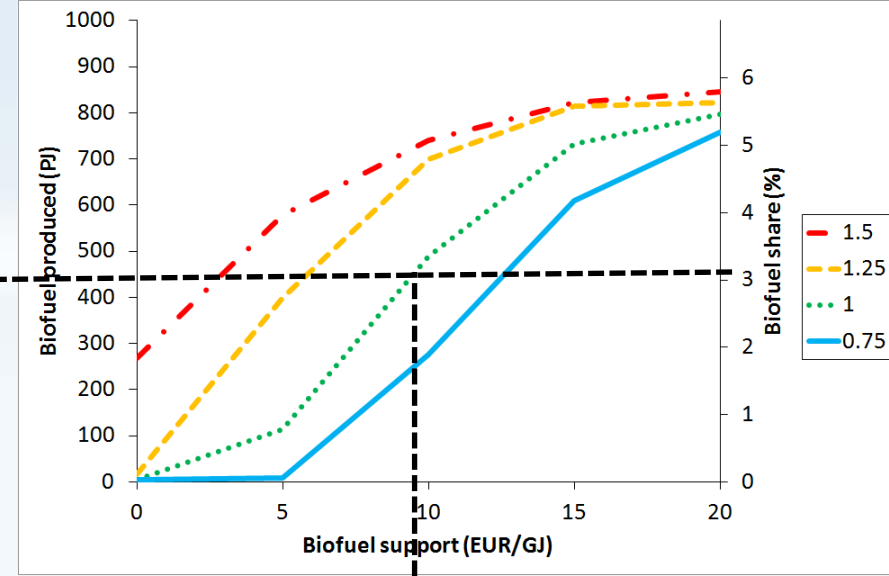
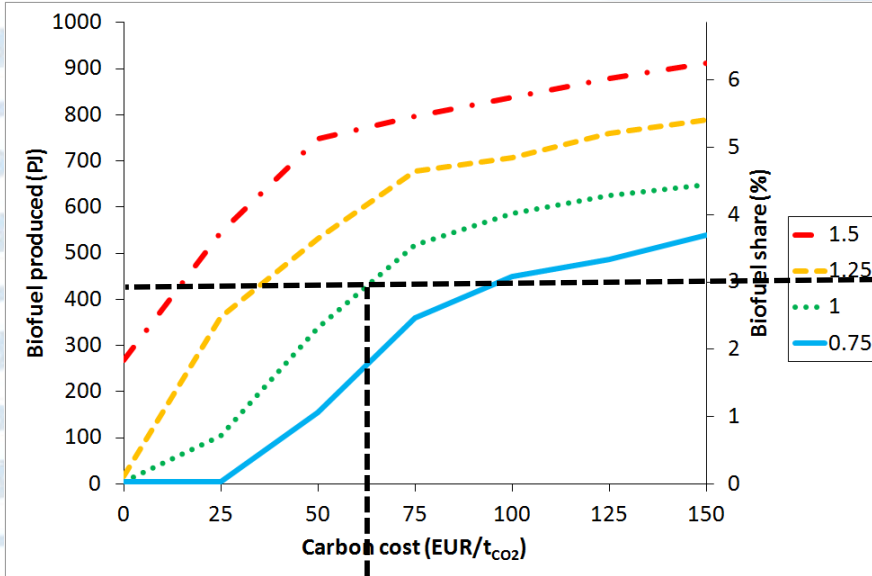




Biofuel Type



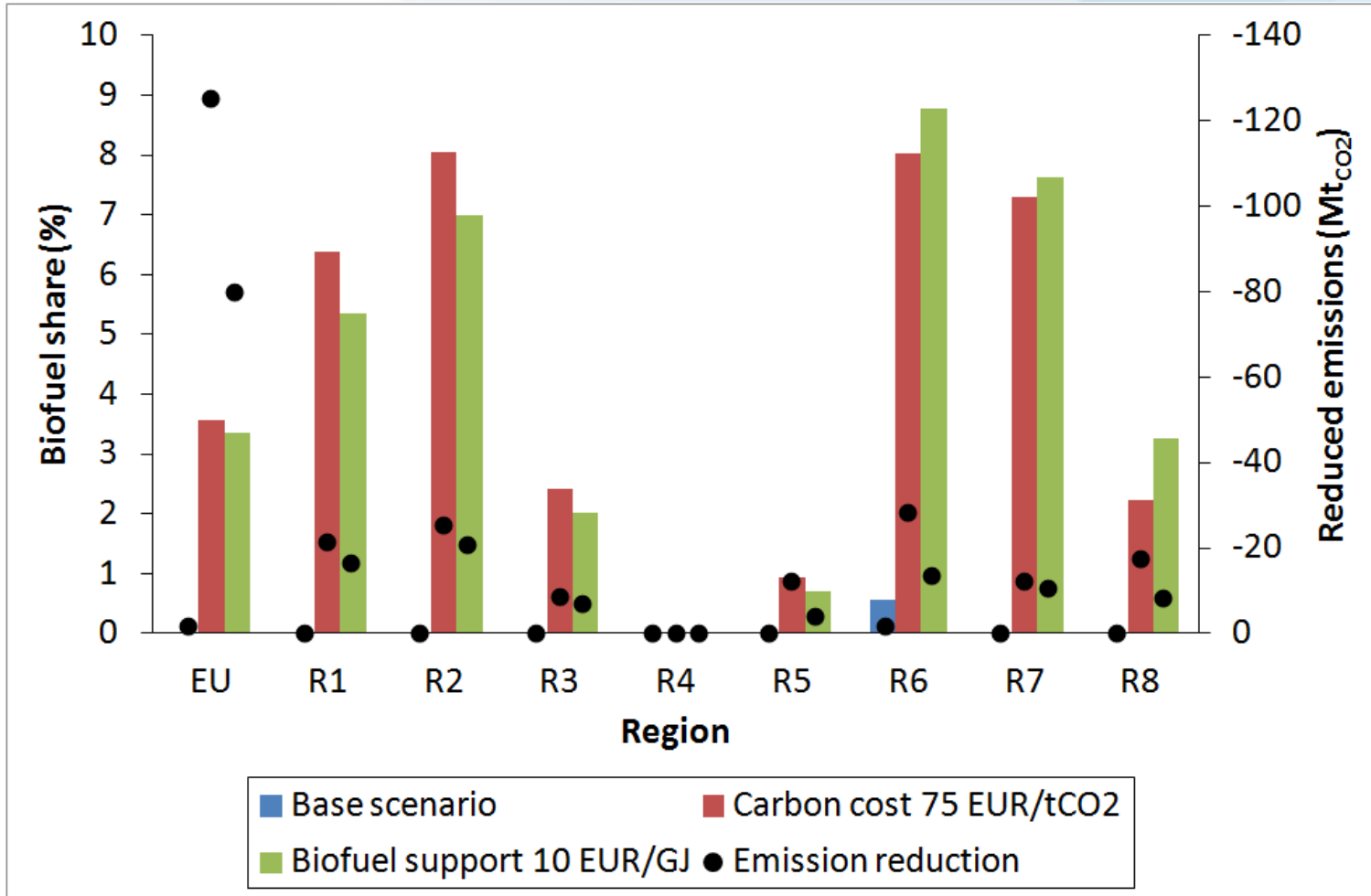
Carbon Cost / Biofuel Support





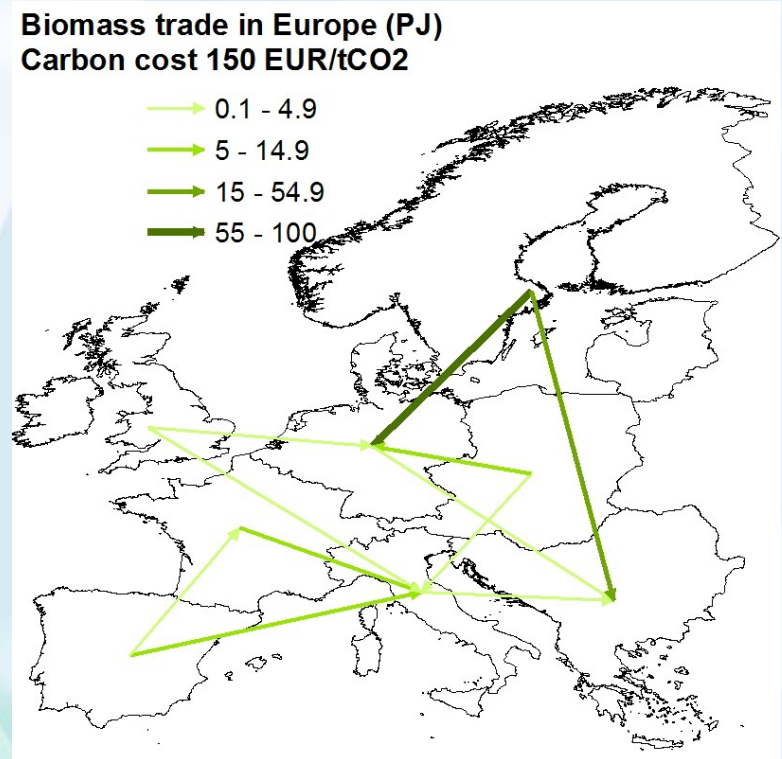
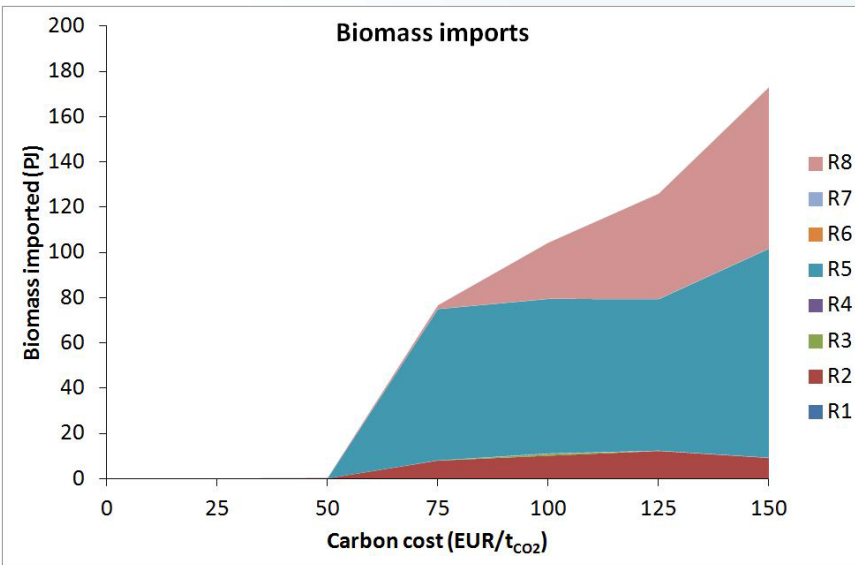
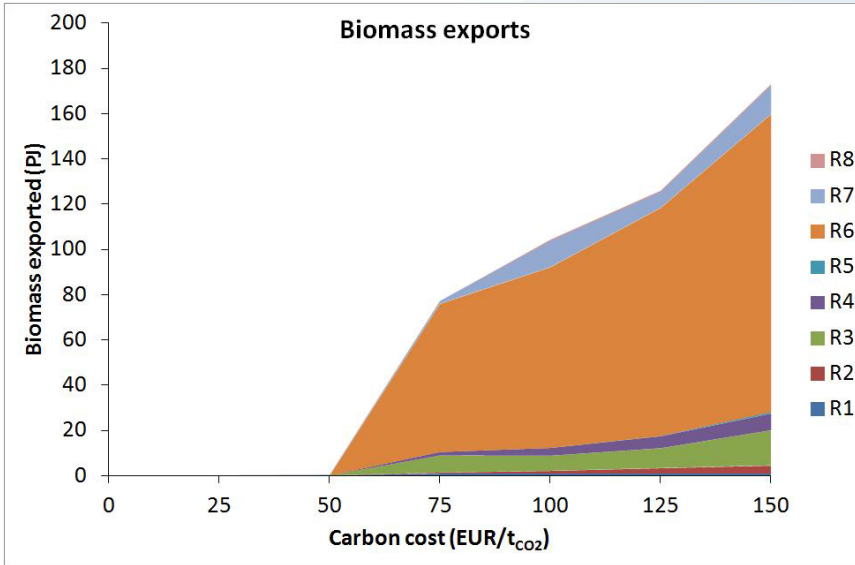
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3 Scenarios





Biomass Trades

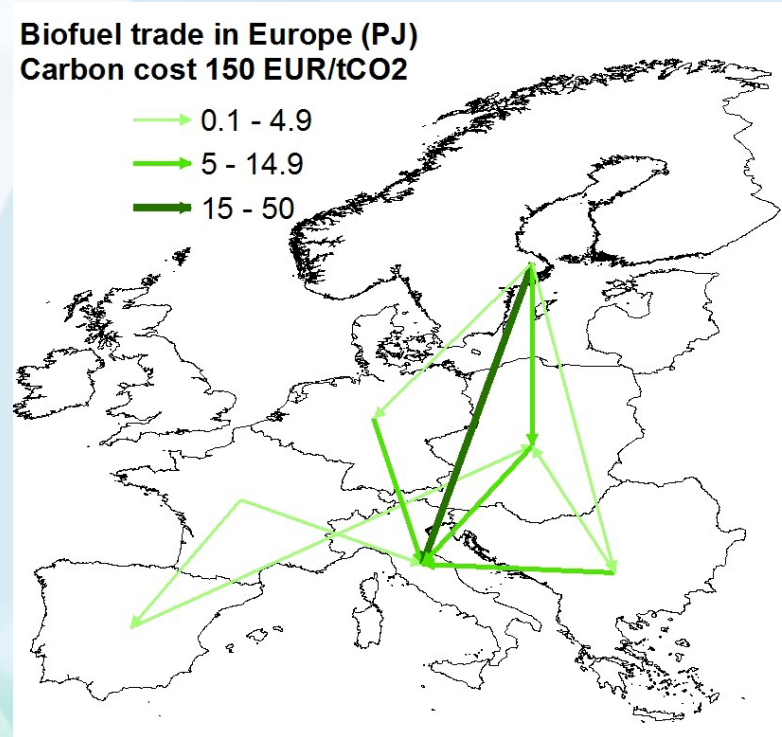
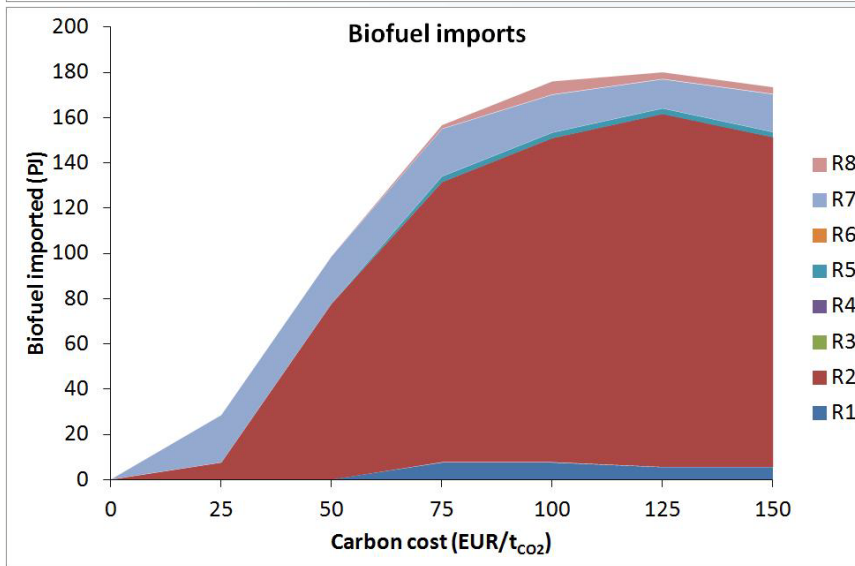
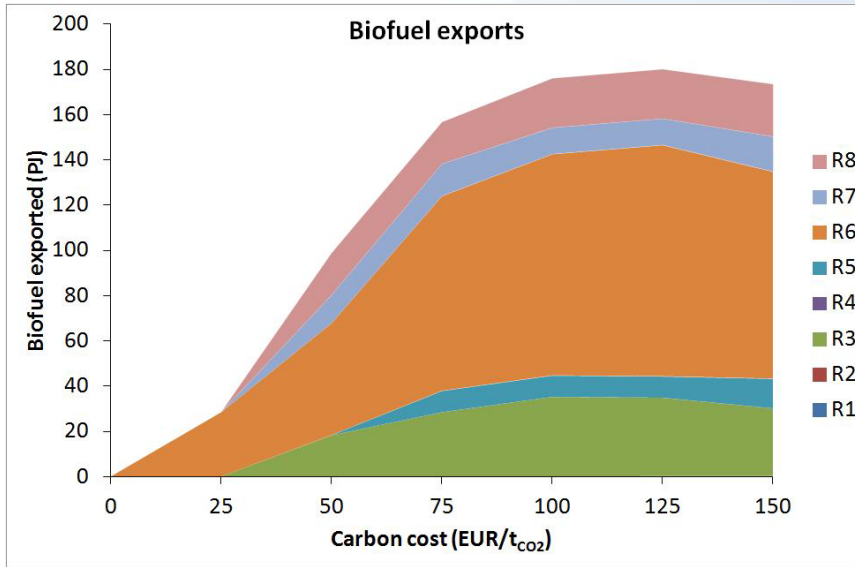


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Biofuel Trades

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Conclusion

- Methanol biofuel of choice
- Carbon cost more impact on the emissions than biofuel support
- Baltic area is a source of both biomass and biofuel

Thank you for your attention

For further information about **IIASA**:

www.iiasa.ac.at

For further information about **BEWHERE**:

www.iiasa.ac.at/Research/FOR/biofuels.html

