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science for global insight

Policy impact on biofuel or electricity production from biomass in Europe

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IEA Bioenergy Workshop

Outline

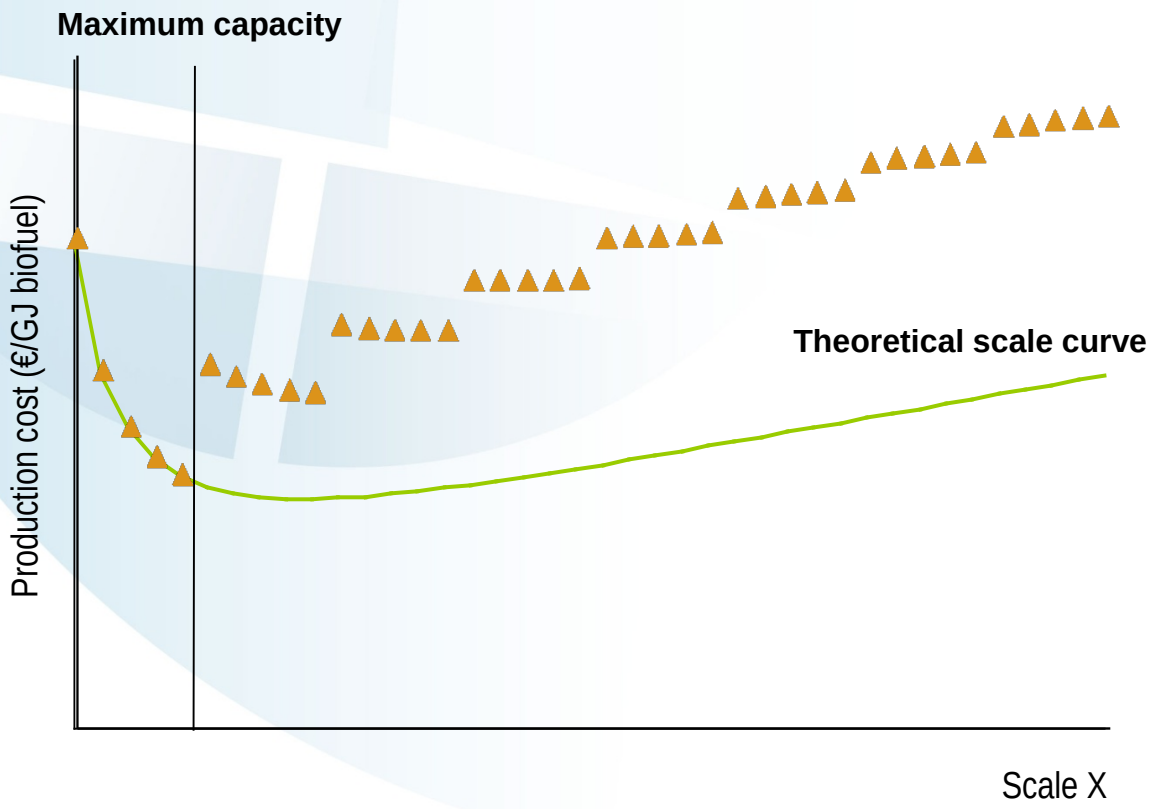
- Background
- Model introduction & description
- Case studies
- Conclusions & future work

2030 EU targets

- GHG **emissions cuts > 40%** (from 1990 levels)
- Renewable **energy share > 32%**
- Energy **efficiency > 32.5%** improvement

How to increase the production?

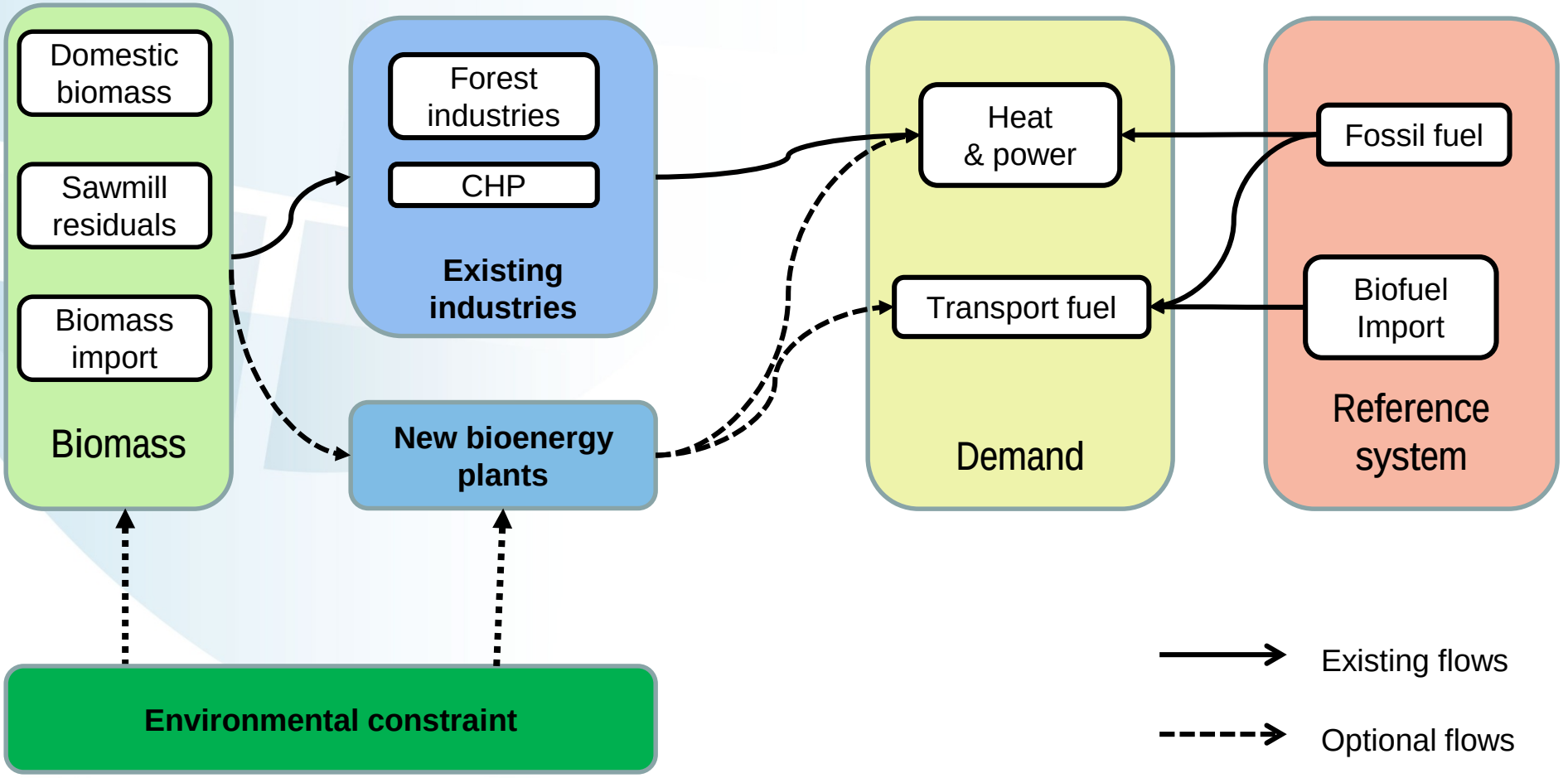
In practice there are more parameters which affect the theoretical scale curve



Additional factors affecting the scaling curve in practice, e.g.

- Maximum capacity
- Supply chain configurations
- Inhomogeneous feedstock density
- Inhomogeneous feedstock price
- Competing demand
- Transport infrastructure
- Transport modes
- Integration with host industries

BeWhere


Domestic biomass
Sawmill residuals
Biomass import
Biomass
Forest industries
CHP
Existing industries
New bioenergy plants
Heat & power
Transport fuel
Demand
Fossil fuel
Biofuel Import
Reference system
Environmental constraint
Existing flows
Optional flows

BeWhere Model

- Techno-economical model
- Mixed integer linear program (written in GAMS)
- Spatially explicit (40 km grid for Europe)
- Can be run dynamic
- Minimize the total cost of the whole supply chain for the region's welfare

$$Objective_F = Total_Cost + Total_Emissions * Carbon_Tax$$

- !!! Does not maximize the profit of a plant !!!

The BeWhere Umbrella

Forest resources

Crop residuals

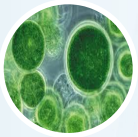
Biofuel

Heat

MSW

Biochar

Algae



Fertilizers

Solar

Biogas

Wind

Bio-plastic

Hydro

Power

Ecosystem services

Power to liquid/gas

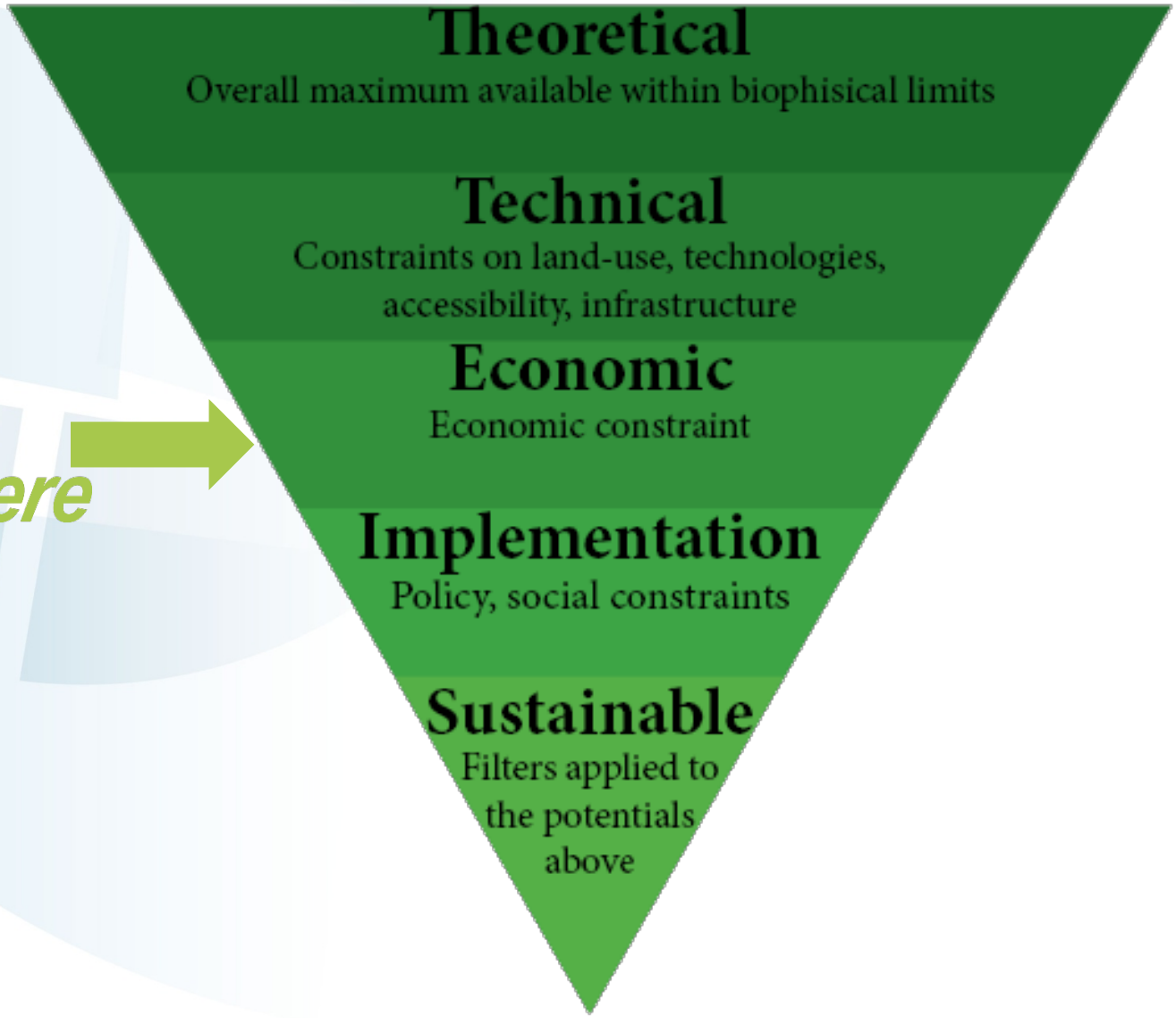
Electrobus

Co-firing

Geothermal

BECCS

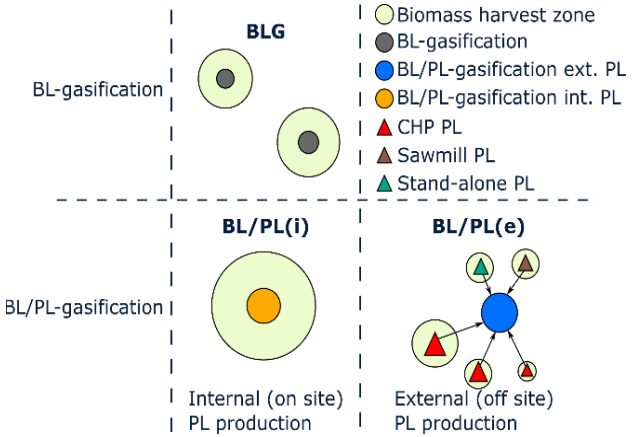
Potentials

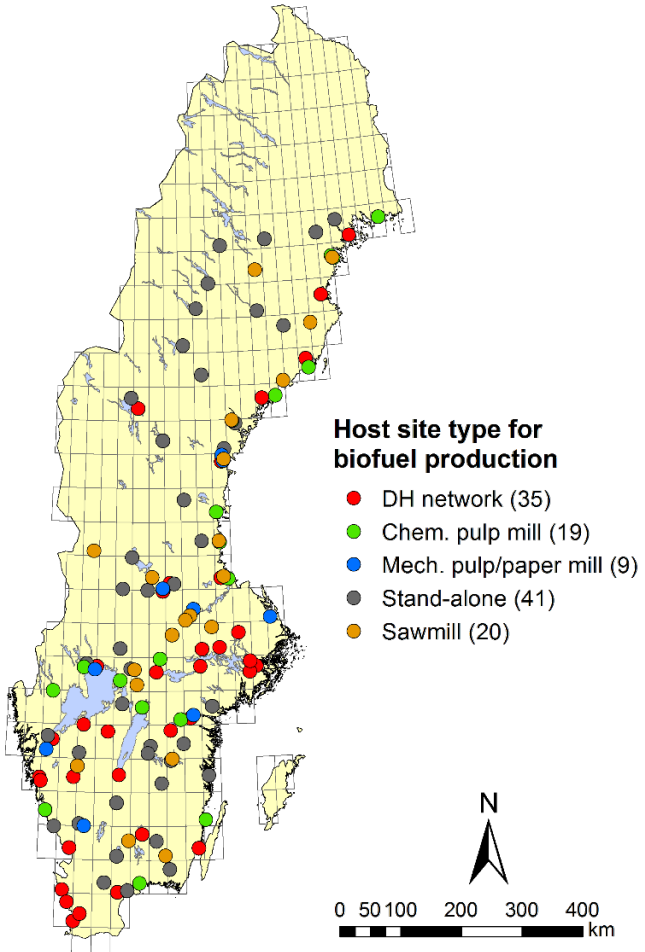


BeWhere

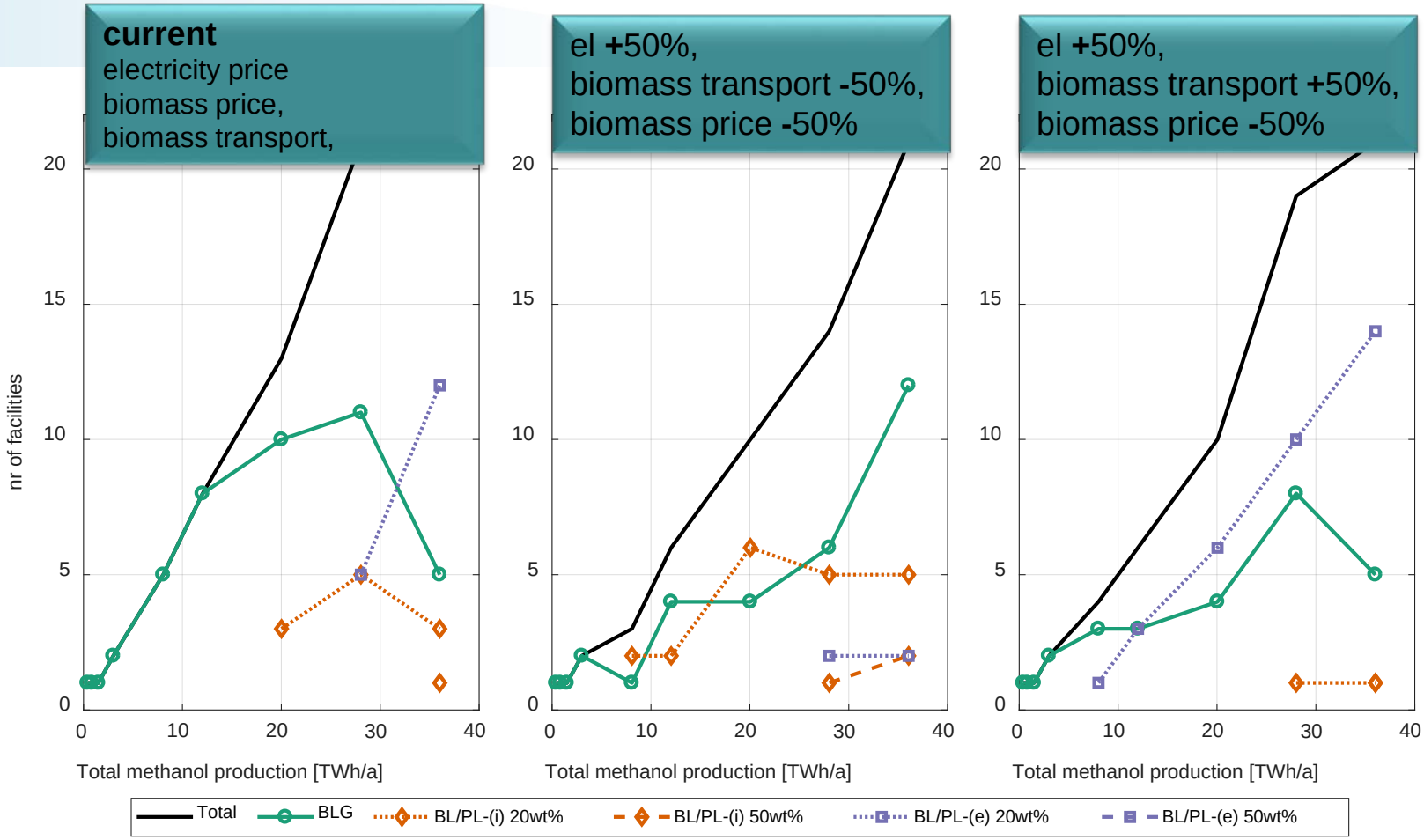
BeWhere Sweden

- Focus on
  - forest based biofuels and chemicals
  - use of existing industrial infrastructure
- Identifying
  - *how* can future bio-based value chains be implemented cost efficiently?
  - what role can (forest) industry play?





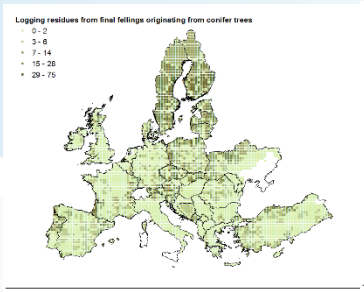
Resulting supply chain configurations

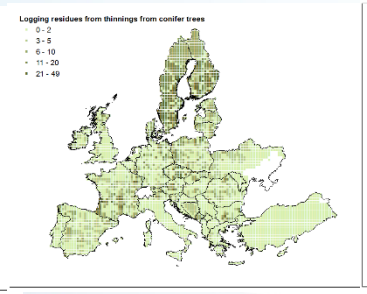


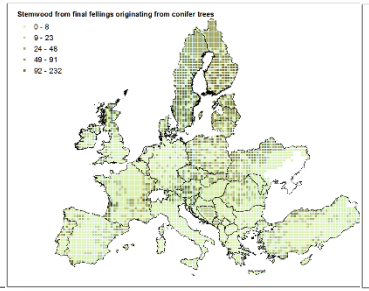
https://doi.org/10.1016/j.apenergy.2018.09.018

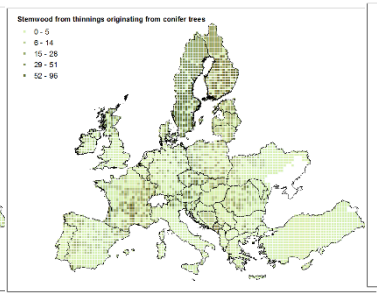
Woody biomass feedstock (S2Biom project)

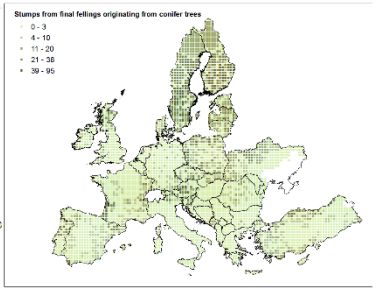
Conifers



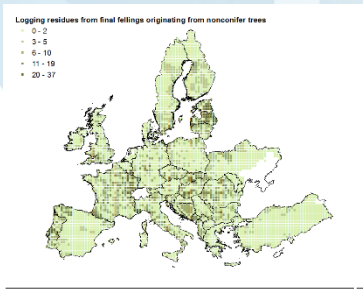


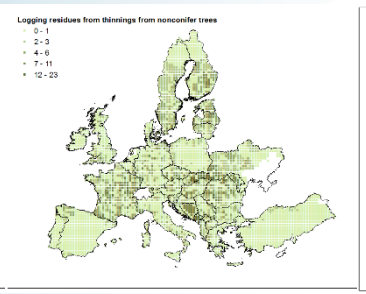


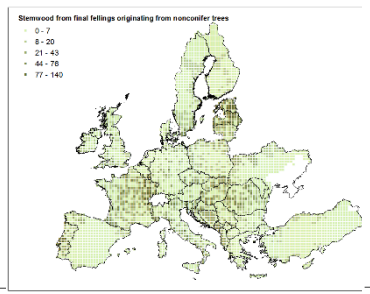


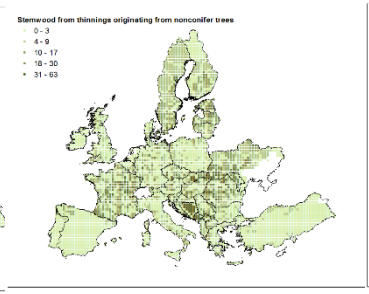


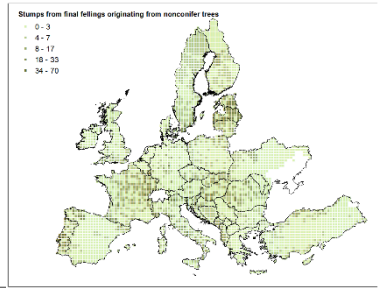
Non-conifers











Stumps final fellings

Stemwood final fellings

Stemwood thinning

Logging residues final fellings

Logging residues thinnings

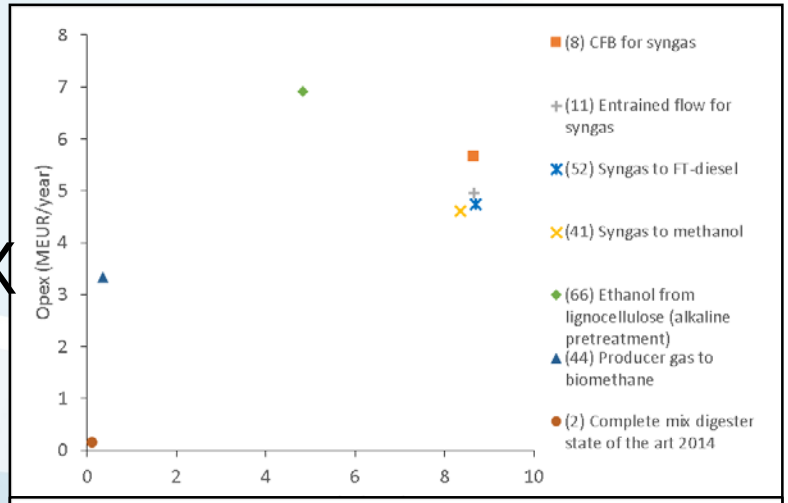
Technology Input in EU model

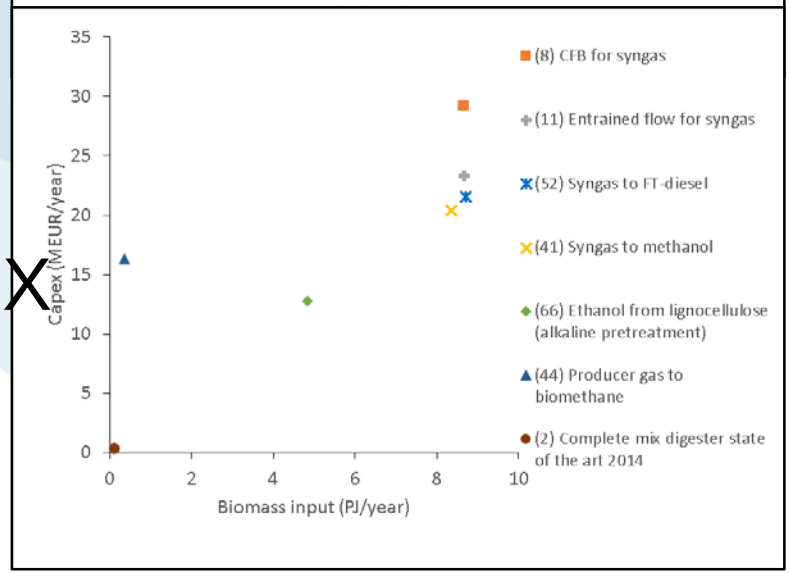
Biofuel

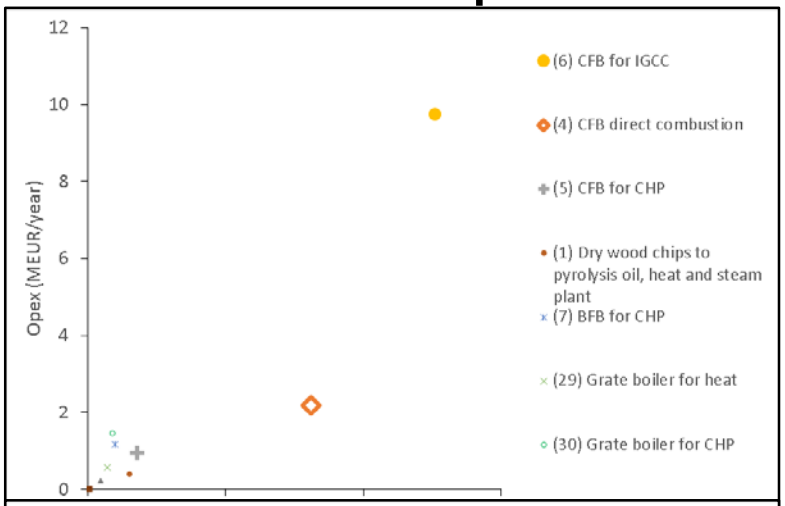
Heat and power

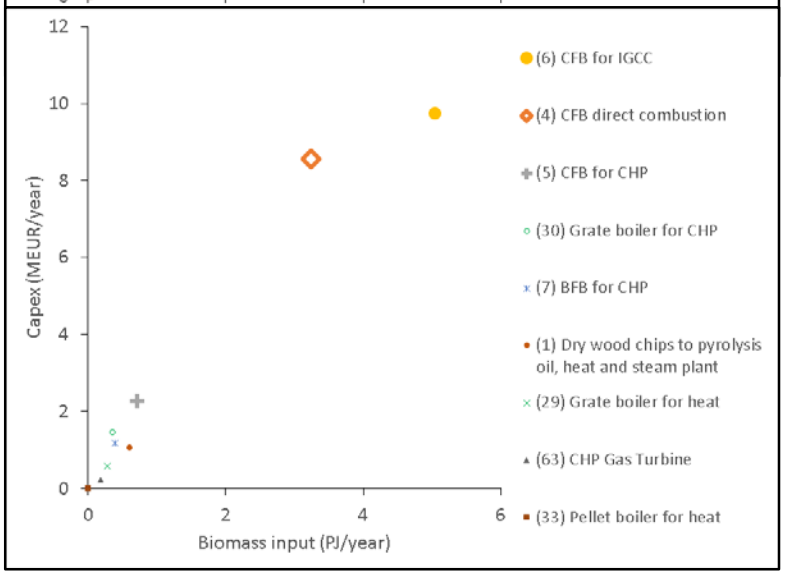
OPEX

CAPEX

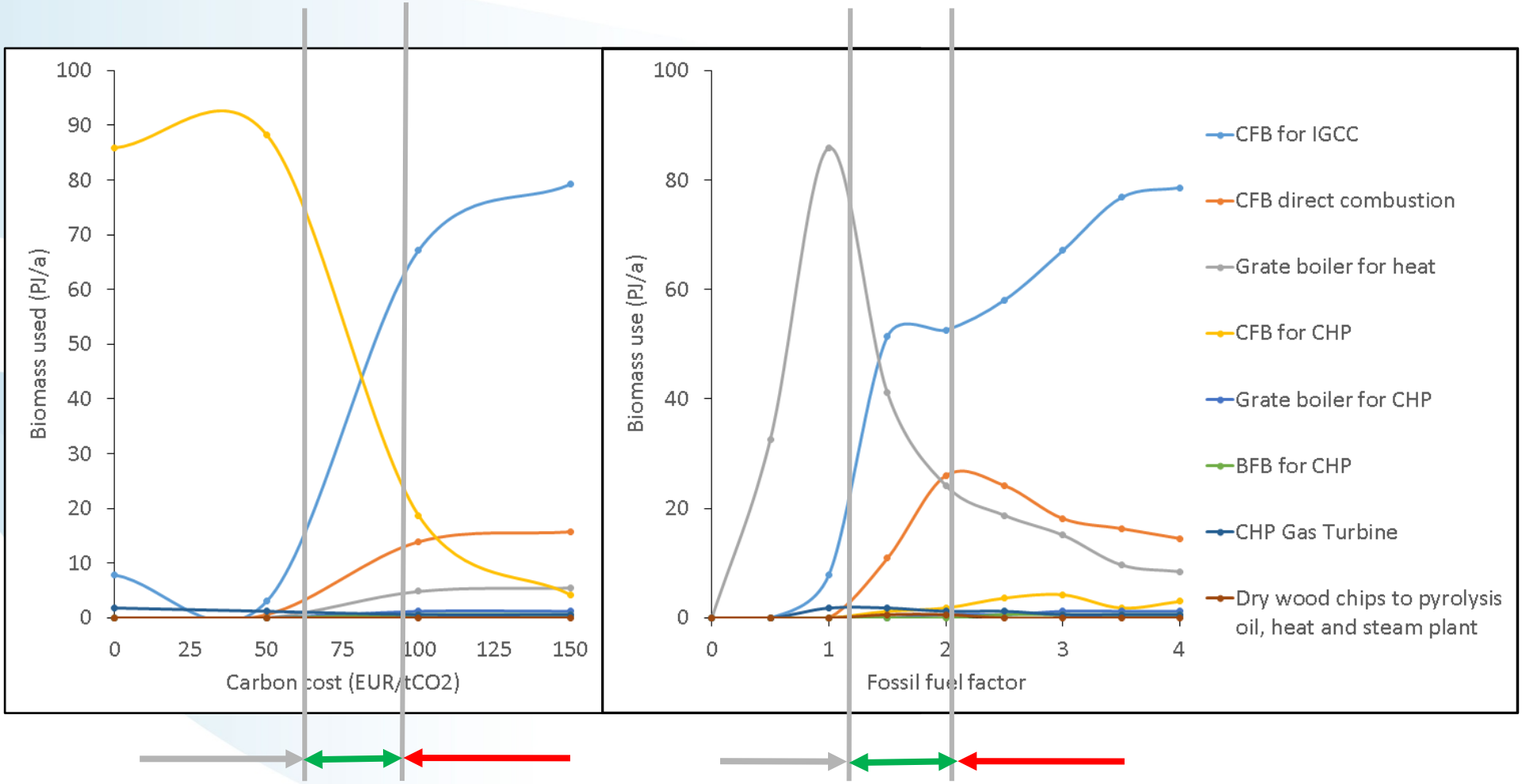








CHP: Carbon cost or subsidy?



Small scales

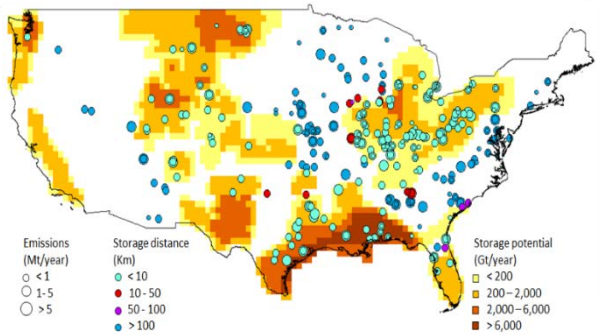
Mixed

Large scales

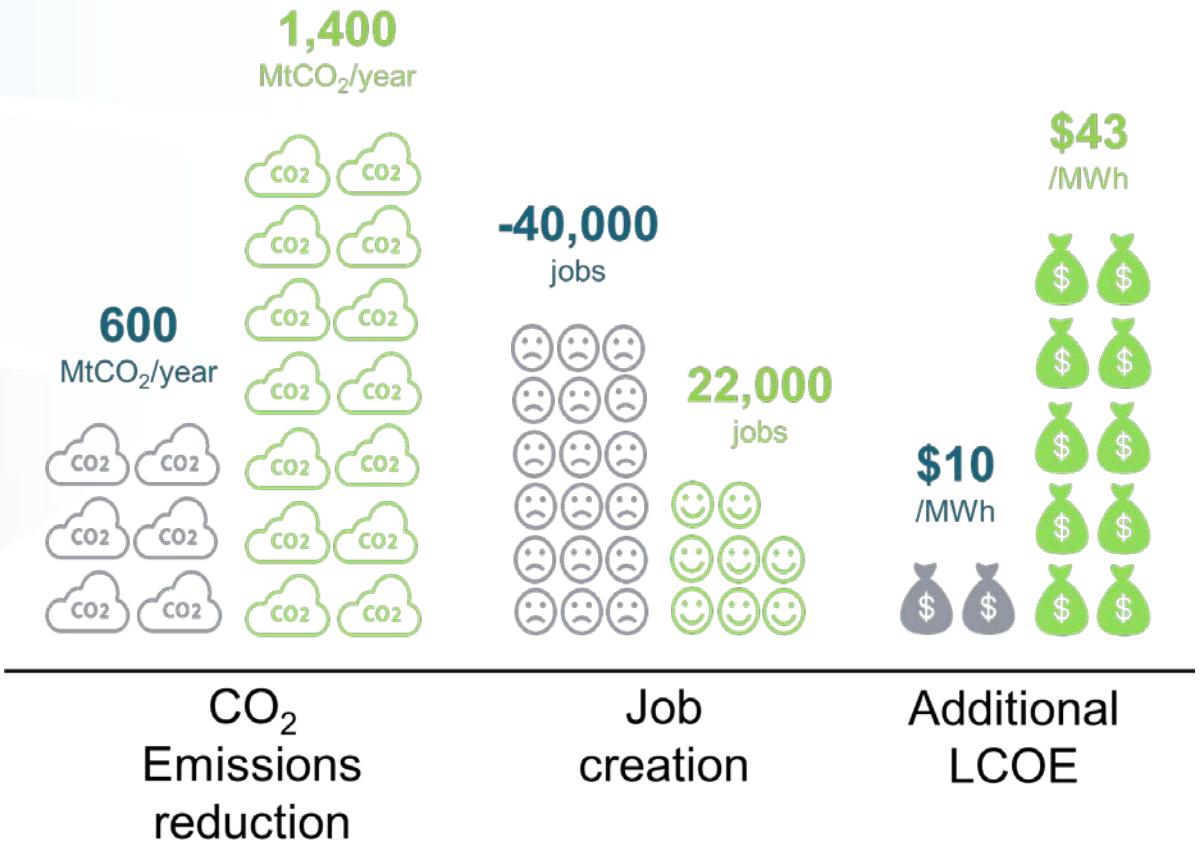
USA: future of coal plants & Job impact

Sustainable Forest Residues (G4M)

Biomass and CO_2 transport



Coal plants & Saline aquifers



BAU vs RCP 2.6 scenarios

https://doi.org/10.1016/j.joule.2018.10.004

Conclusion

- Highly sensitive to local conditions

  (e.g., energy mix, policy)
- Process integration

  (e.g., Sweden case)

Future work

- When?
- LCA
- More link with job creation

BeWhere & YSSP

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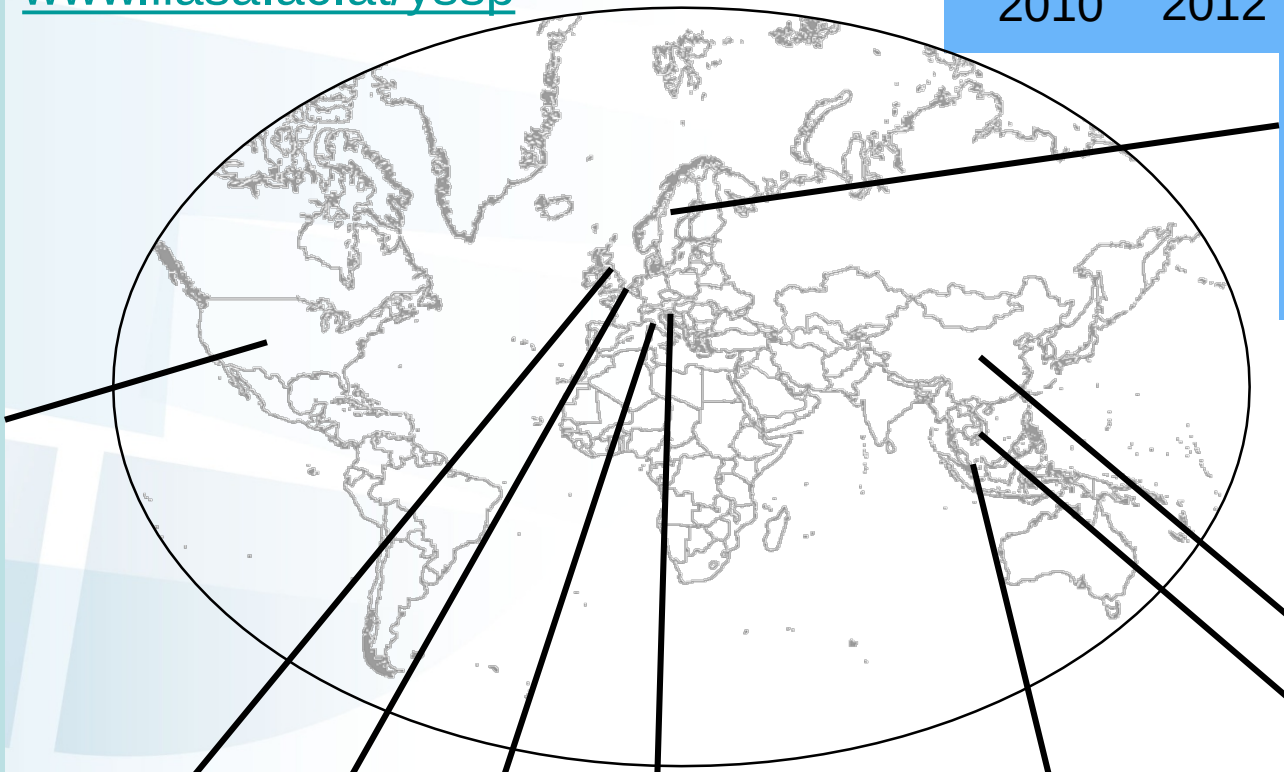


2010

2012

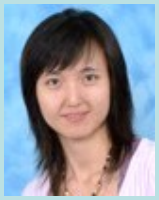
2013

2014

2015

2016

2018


2009

2015

2016

2017

2018

2017

2017

2011

2014

2008

2015

2016

2018

Thank you!

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