Optimal use of woody biomass for bio-energy in Europe

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Austrian Biorefining Stakeholder Workshop
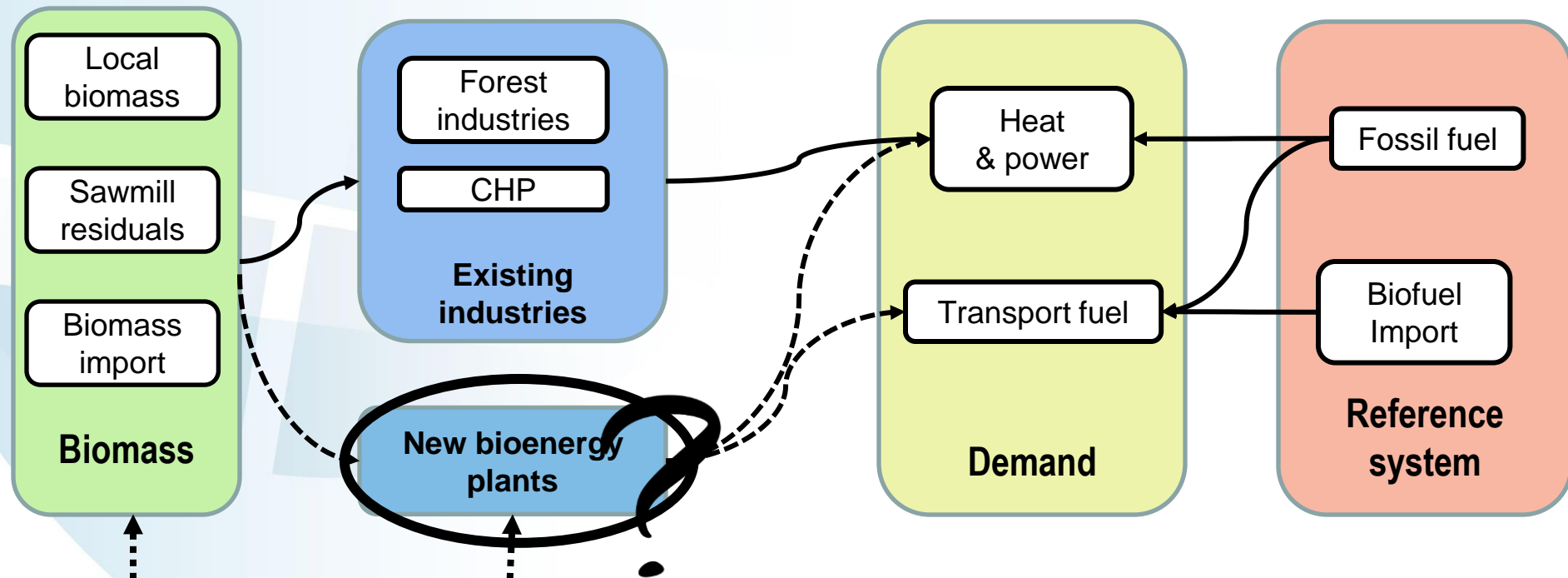23 October 2017

Outline

- Model description (1 slide)

- 2 case studies

  – Sweden (2 slides)

  – Europe (3 slides)

- Online tool (2 slides)

- Conclusions & future work (1 slide)
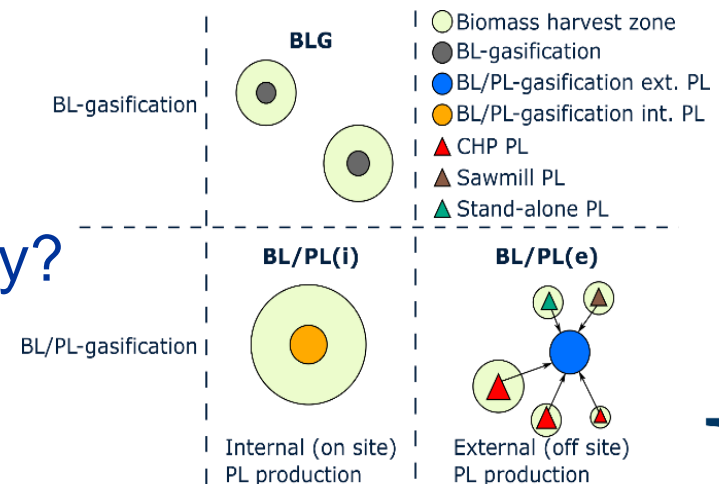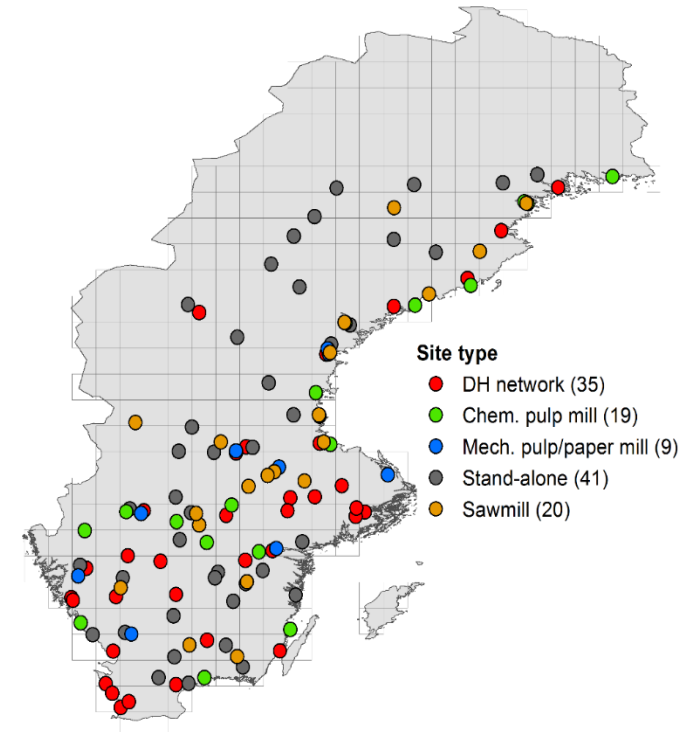
BeWhere

→ Existing flows

⇢ Optional flows

Biomass	Existing industries	Demand	Reference system
Local biomass	Forest industries	Heat & power	Fossil fuel
Sawmill residuals	CHP	Transport fuel	Biofuel Import
Biomass import			

New bioenergy plants

Environmental constraint

Minimization of **COST** for the region welfare

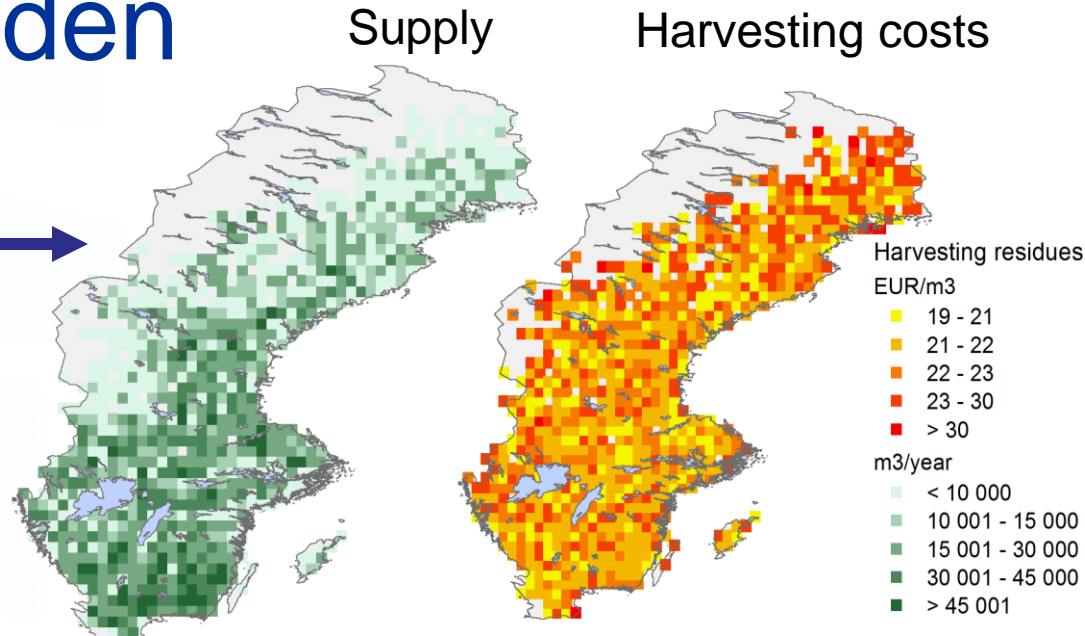**COST** = (Total Cost) + (Total Emission)*(Carbon Cost)

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?

Site type
- DH network (35)
- Chem. pulp mill (19)
- Mech. pulp/paper mill (9)
- Stand-alone (41)
- Sawmill (20)

- Biomass harvest zone
- BL-gasification
- BL/PL-gasification ext. PL
- BL/PL-gasification int. PL
- CHP PL
- Sawmill PL
- Stand-alone PL

BLG

BL-gasification

BL/PL-gasification

BL/PL(i)

BL/PL(e)

Internal (on site) PL production

External (off site) PL production

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BeWhere Sweden

Supply   Harvesting costs

- Forest biomass resources
  - SKA08 / SKA15
  - bottom-up cost approach

Harvesting residues
EUR/m3
- 19 - 21
- 21 - 22
- 22 - 23
- 23 - 30
- > 30

m3/year
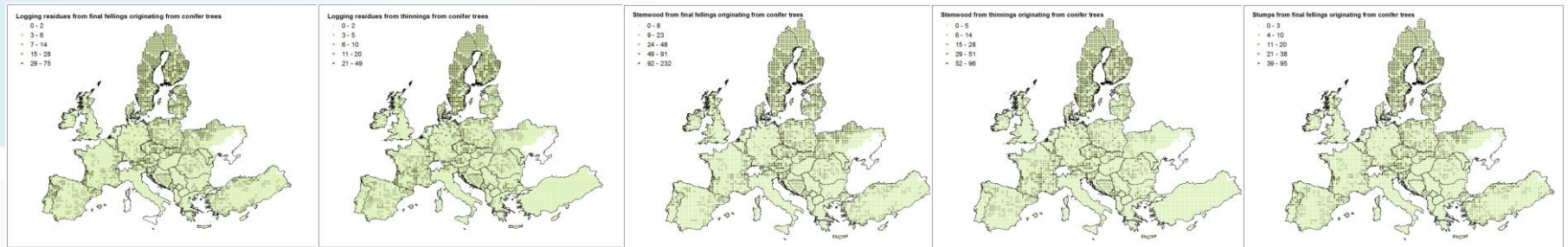- < 10 000
- 10 001 - 15 000
- 15 001 - 30 000
- 30 001 - 45 000
- > 45 001

- Competing use
  - existing (forest industry, district heating, CHP)
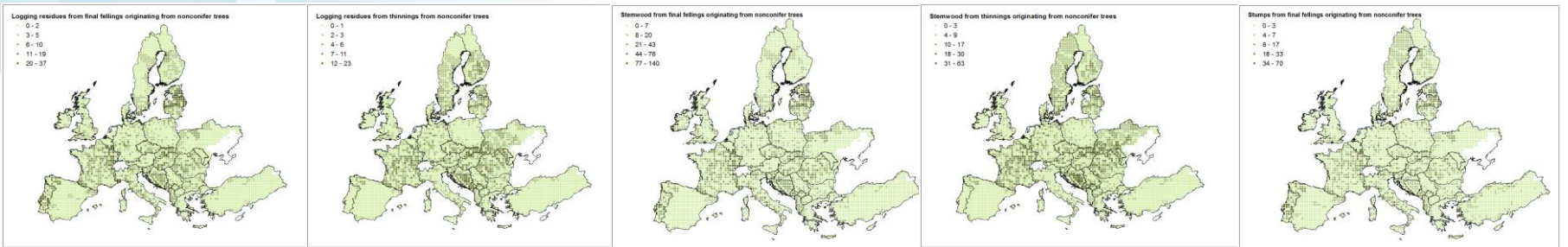 - Emerging (e.g., iron and steel, biofuels)

Sawlogs   Pulp wood   Bioenergy

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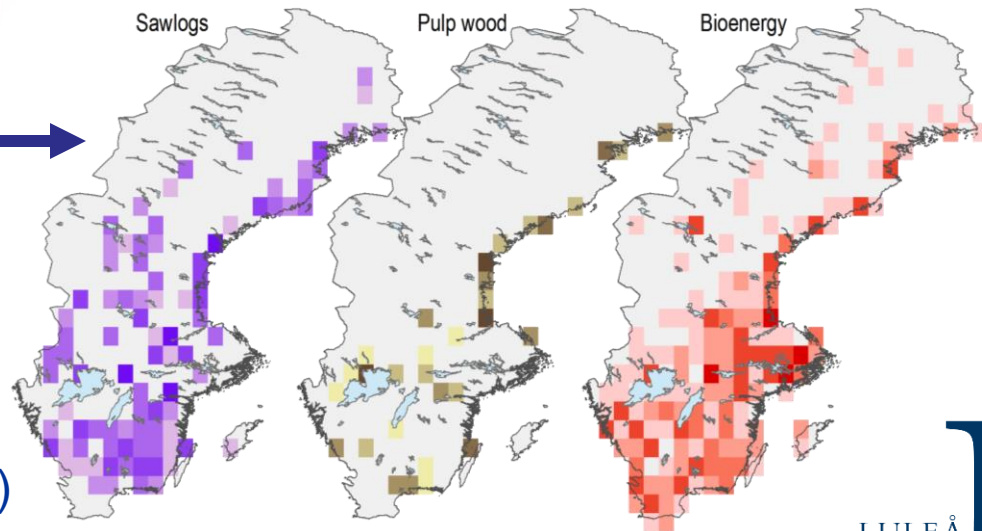
Woody biomass feedstock

Conifers

Non-conifers

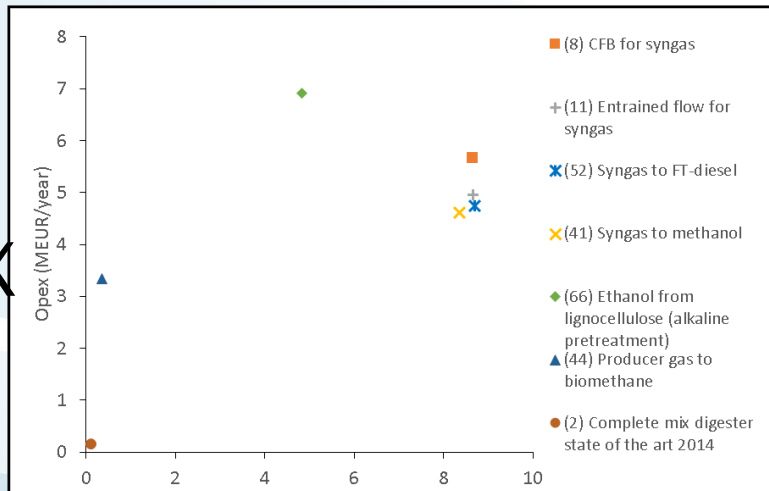Stumps final fellings | Stemwood final fellings | Stemwood thinning | Logging residues final fellings | Logging residues thinnings
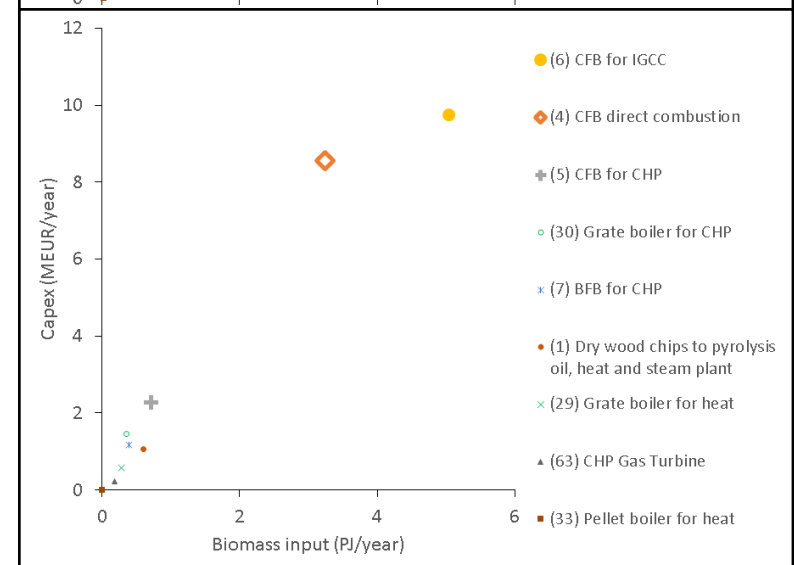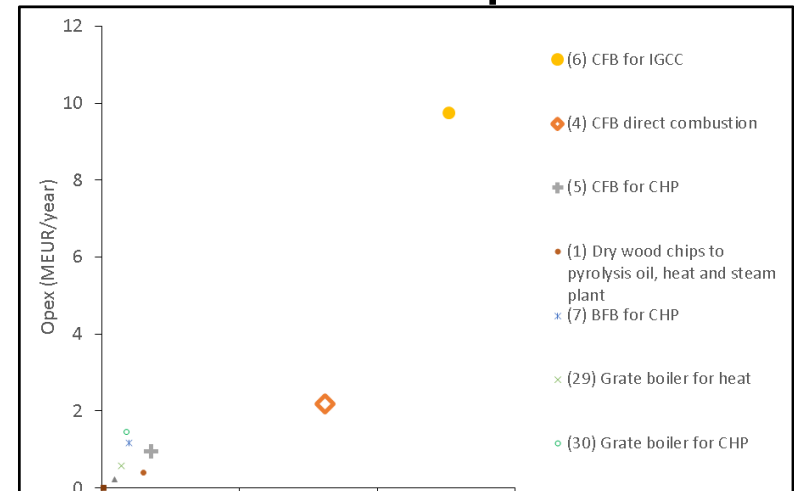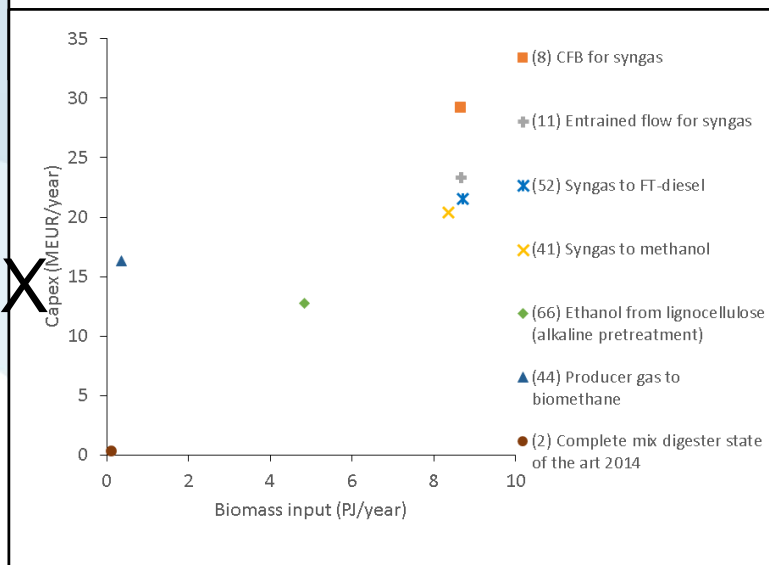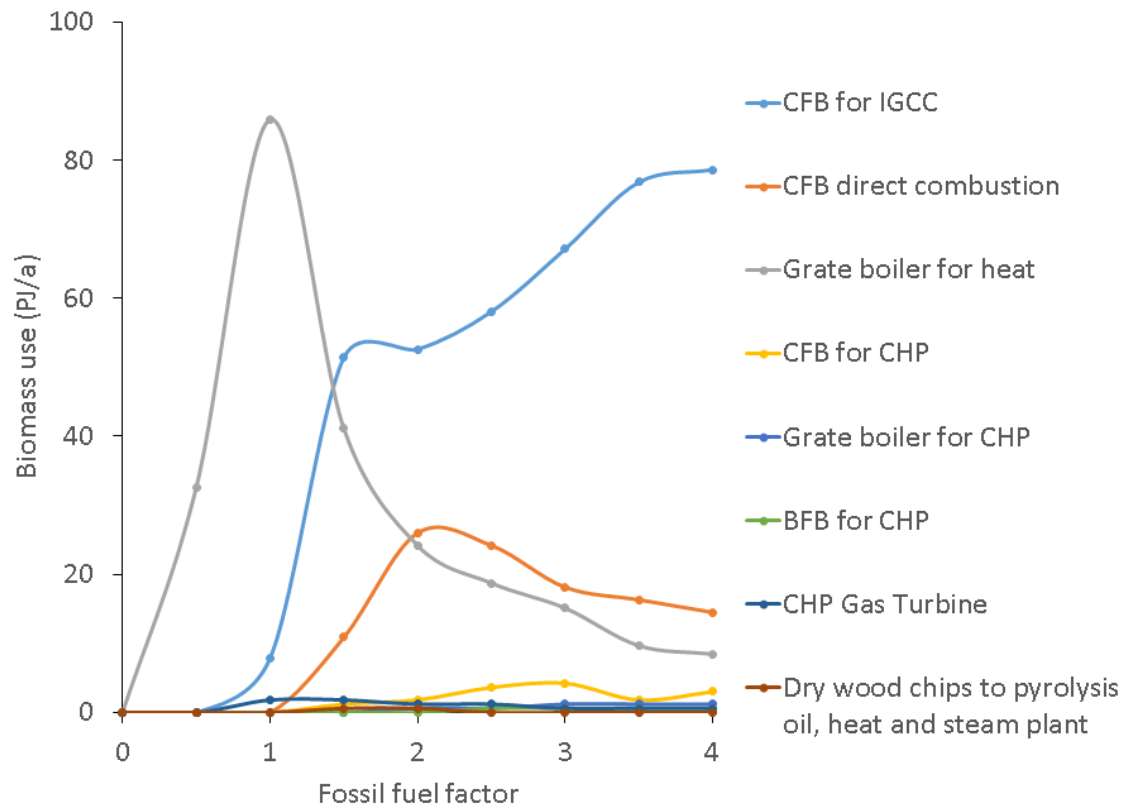
Technology Input (WP2)

Biofuel

Heat and power

OPEX

CAPEX

CHP: Carbon cost or subsidy?

Online tools

- http://S2biom-test.Alterra.wur.nl
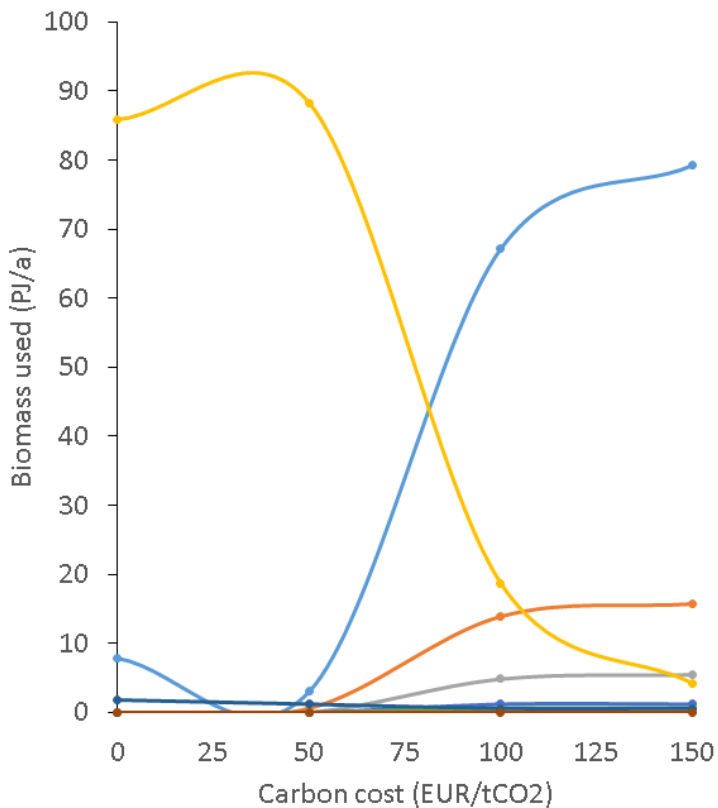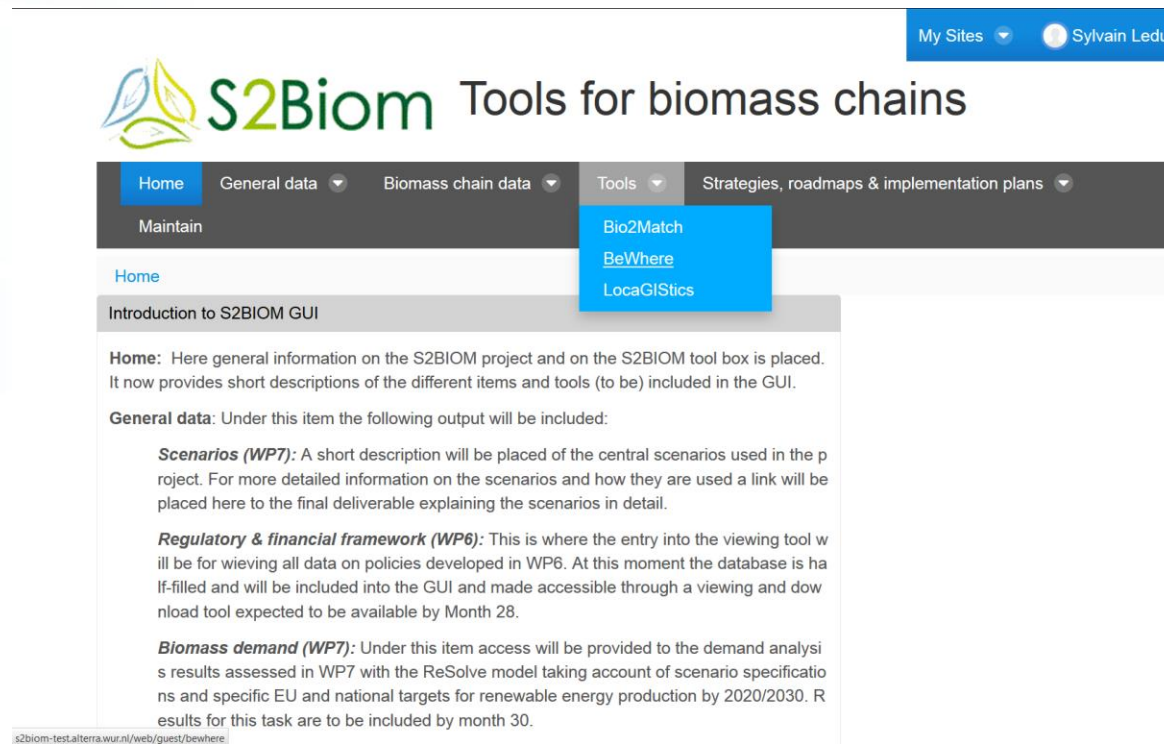
- Login:
  - Username: demo
  - Password: helsinki

S2Biom

Scenario #20

Feedstock: crops
Final poduct: heat and power

Plant

70°N

- <2.6
- 2.6-5.0
- >5.0

30°W

10°W

Disclaimer: The results presented have been c
do not reflect reality but present an overview o
can only be compared with each other.
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S2Biom — Biomass used

Total use of crops (Pj/year)

Country	Perennials grassy	Perennials woody	Straw residues	Prunings residues	Grassland
AL	0	0	0	0	0
AT	0				
BE	0				
BA	0				
BG	2.32				
HR	0.57				
CY	0				
CZ	0				
DK	0				
EE	0				
FI	0				
FR	3.97				
DE	2.05				
GR	0				
HU	2.63				
IE	0				
IT	6.65				
KS	0				
LV	0				
LT	0				
LU	0				
MT	0				
MD	0.29				
ME	0				
NL	0				
PL	6.29				
PT	0.29				
RS	0				
RO	4.25				
SK	0.72				
SI	0				
ES	0				
SE	0.41				
MK	0				
TR	1.43				
GB	0.18				
UA	0				

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S2Biom — Export

Export of crops (Pj/year)

Country	Perennials grassy	Perennials woody	Straw residues	Prunings residues	Grassland
AL	0	0	0	0	0
AT	0	0.2	0	0	0
BE	0				
BA	0				
BG	0				
HR	0				
CY	0				
CZ	0				
DK	0				
EE	0				
FI	0				
FR	0				
DE	0				
GR	0				
HU	0				
IE	0				
IT	0				
KS	0				
LV	0				
LT	0				
LU	0				
MT	0				
MD	0				
ME	0				
NL	0				
PL	0				
PT	0				
RS	0				
RO	0				
SK	0				
SI	0				
ES	0				
SE	0				
MK	0				
TR	0				
GB	0				
UA	0				

Disclaimer: The results presented have been calcu
not reflect reality but present an overview of the i
only be compared with each other.
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S2Biom — Import

Country	Perennials grassy	Peren
AL	0	
AT	0	
BE	0	
BA	0	
BG	0	
HR	0	
CY	0	
CZ	0	
DK	0	
EE	0	
FI	0	
FR	0	
DE	0	
GR	0	
HU	0	
IE	0	
IT	0	
KS	0	
LV	0	
LT	0	
LU	0	
MT	0	
MD	0	
ME	0	
NL	0	
PL	0	
PT	0	
RS	0	
RO	0	
SK	0	
SI	0	
ES	0	
SE	0	
MK	0	
TR	0	
GB	0	
UA	0	

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S2Biom — Production

Country	Heat (PJ)	Power (PJ)	Emission avoided (MtonCo₂)
AL	0	0	0
AT	0	0	0
BE	5.688	13.23	0.95
BA	0	0	0
BG	6.1512	12.1361	1.66
HR	1.1862	1.1642	0.19
CY	0	0	0
CZ	15.048	39.312	4.38
DK	0	0	0
EE	0	0	0
FI	0	0	0
FR	6.192	0.756	0.39
DE	3.159	0	0.58
GR	0	0	0
HU	6.0264	6.9401	0.91
IE	0	0	0
IT	9.072	6.804	1.48
KS	0	0	0
LV	0	0	0
LT	0	0	0
LU	0	0	0
MT	0	0	0
MD	0.243	0	0.03
ME	0	0	0
NL	21.456	54.054	4.4
PL	12.834	17.01	3.56
PT	2.511	6.048	0.43
RS	0	0	0
RO	10.611	13.608	1.61
SK	4.689	8.316	0.91
SI	0	0	0
ES	0.72	1.512	0.15
SE	1.566	2.268	0.14
MK	0	0	0
TR	4.455	6.804	1.07
GB	8.883	18.144	1.97
UA	0	0	0

Disclaimer: The results presented have been calculated using the BeWhere model. They
do not reflect reality but present an overview of the impact of different parameters,
and can only be compared with each other.
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BeWhere

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Conclusion

- Highly sensitive to initial conditions

  (e.g., energy mix, policy)

- Process integration

  (e.g., Sweden case)

Future work for EU model

- Develop a dynamic version
- Include more industries

  (e.g., steel, cement)

Contact

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