Quantifying temporal effects of various GHG abatement strategies for conventional and district heating

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"All biomass are equal, but some are more equal than others"



Analysis

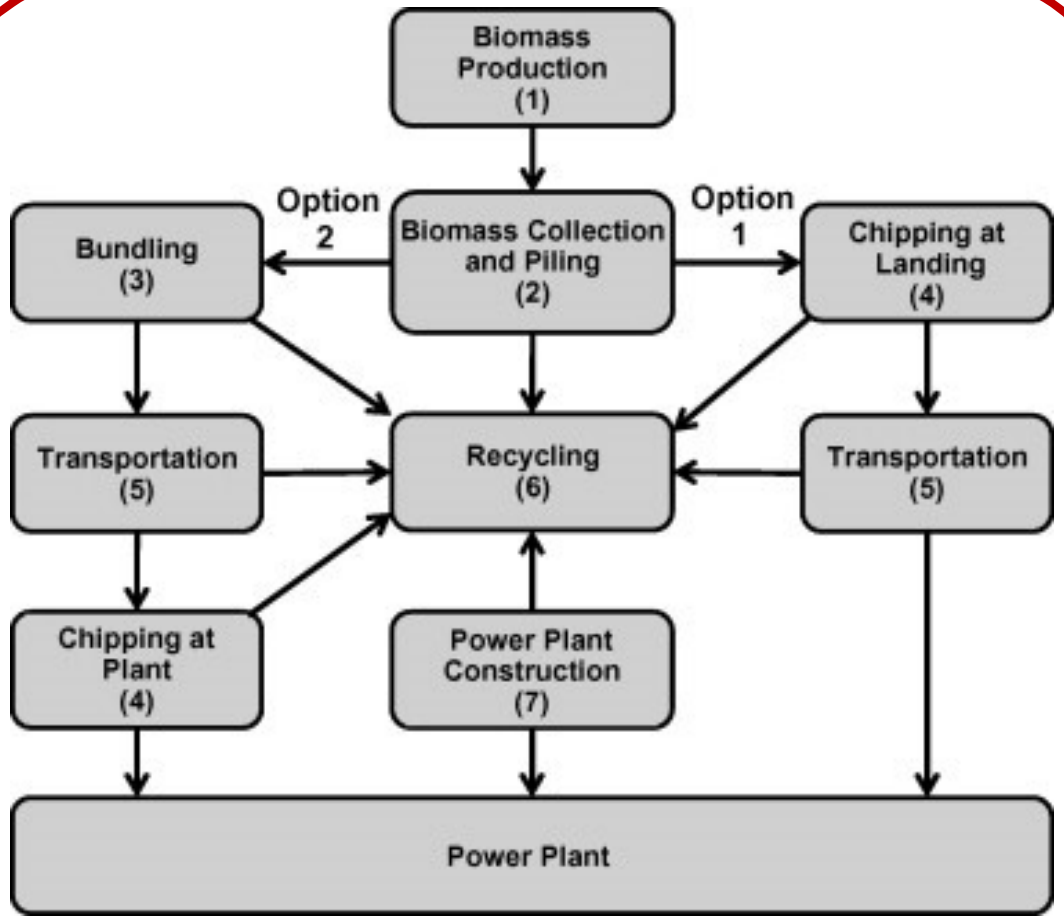
Life Cycle Assessment

M&E Balances (LCI)

LCIA

IMPACT
e.g. Climate Change
kg CO2-eq./FU

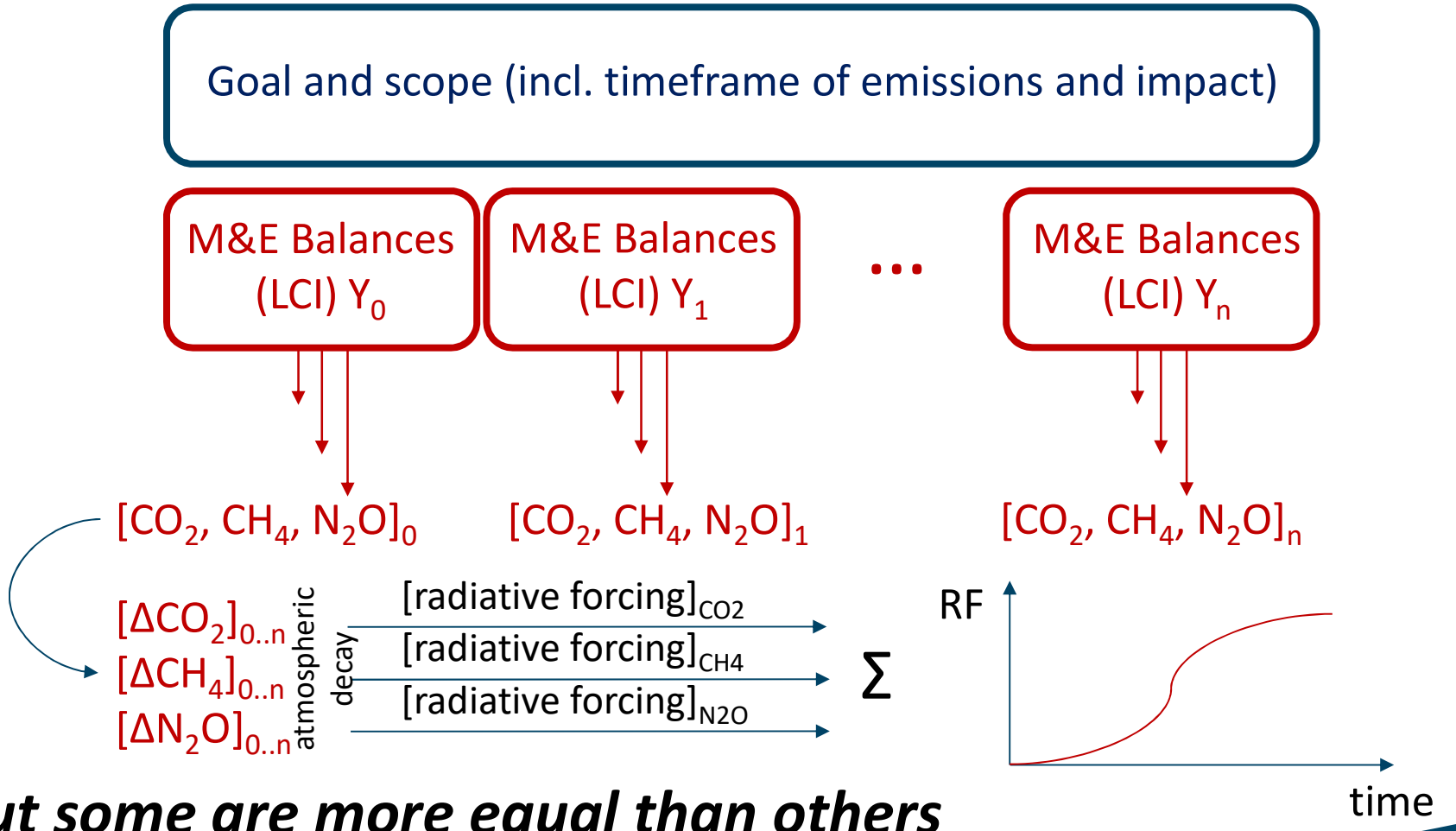
All biomass are equal



Thakur et al. Applied Energy 2014:128,246-53

Analysis

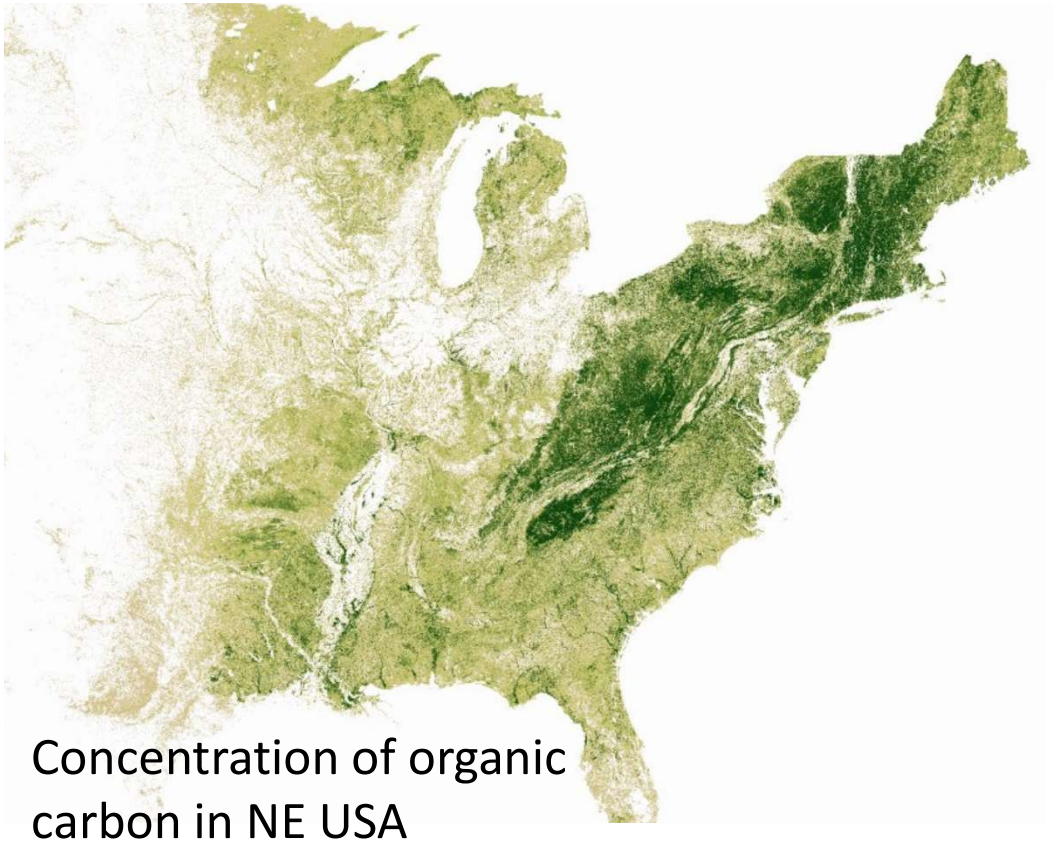
Temporal Life Cycle Climate Change Impact Assessment



But some are more equal than others

Case Example

Temporal Life Cycle Climate Change Impact Assessment



Concentration of organic carbon in NE USA

Tons per hectare

0 25 100 225 400

NBCD, 2000

Top five residential heating oil consuming states, 2015

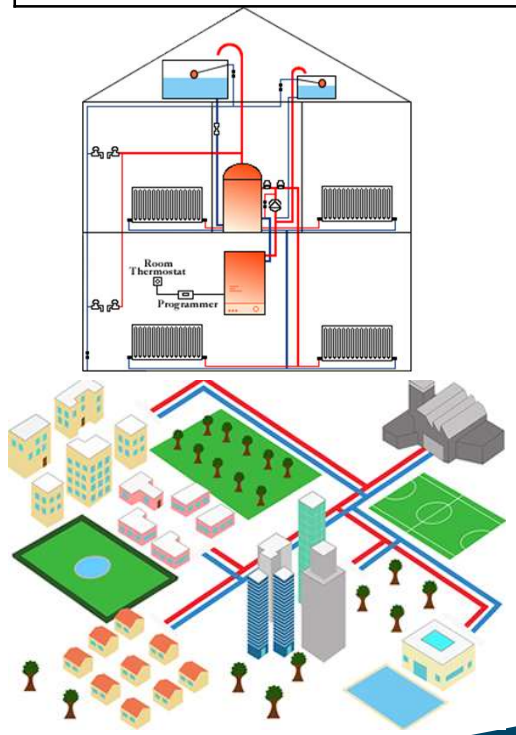
eia

Case Example

Scenario description

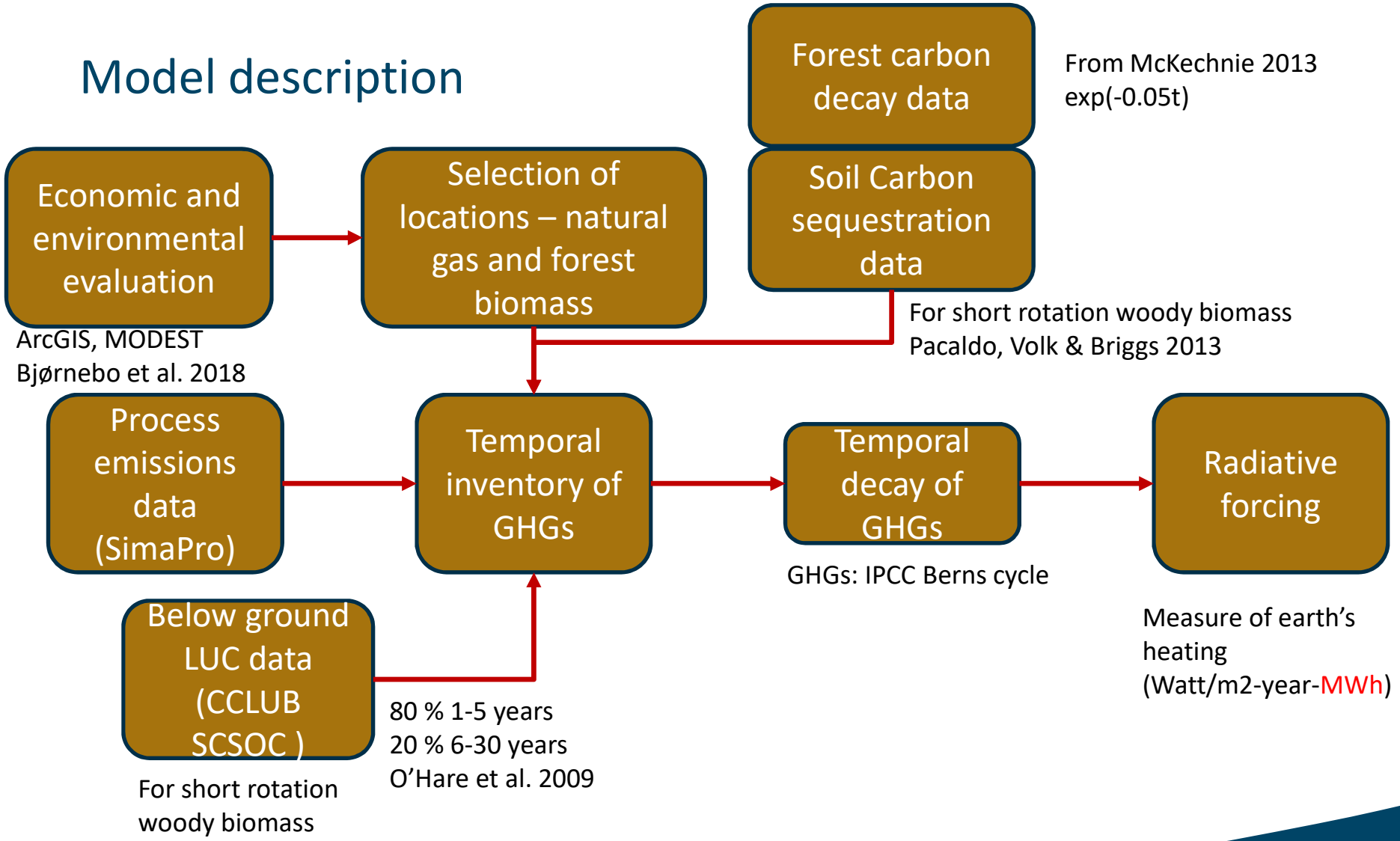
	Heating oil	Natural gas	Forest biomass	Willow
Conventional heating	✓	✓	✓	☒ ☒ ☒
District heating	☒ ☒ ☒	✓ ✓	✓ ✓	✓ ✓ ✓

Heating infrastructure installation	✓
Heat production (combustion)	✓
Land Use Change	✓



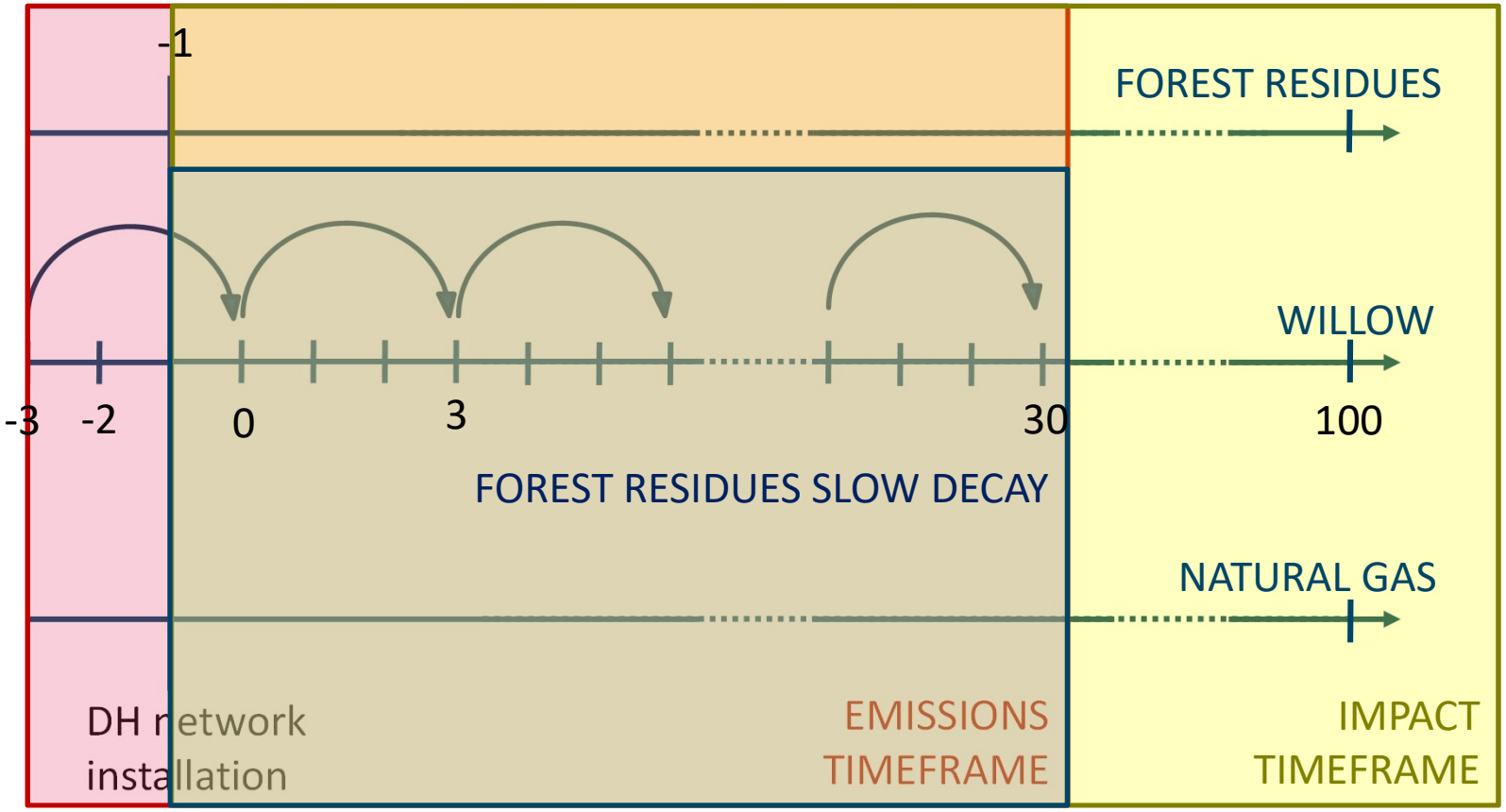
Case Example

Model description

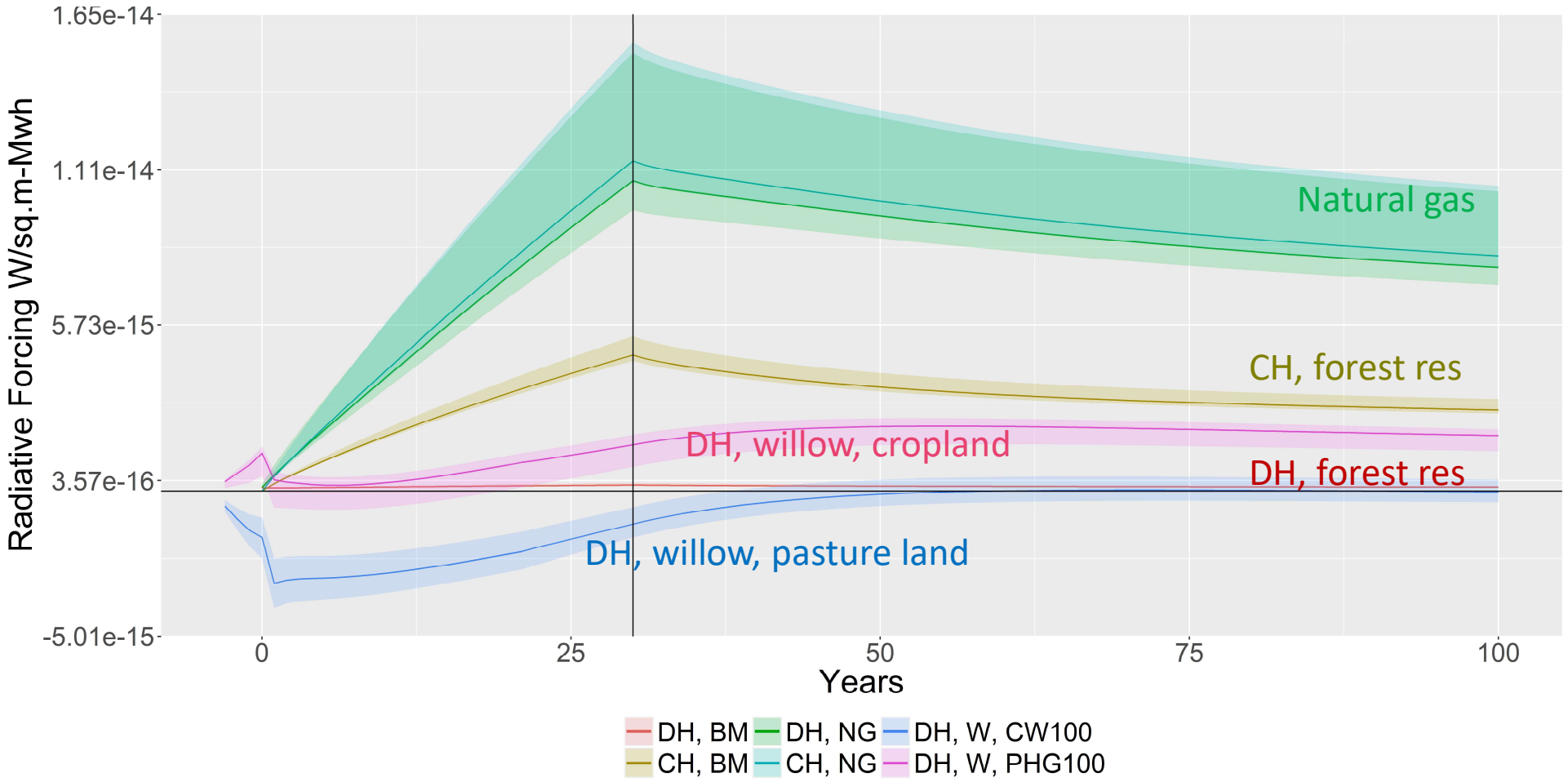


Case Example

Timelines District Heating



Results - RF


1.65e-14
1.11e-14
5.73e-15
3.57e-16
-5.01e-15
Radiative Forcing W/sq.m-Mwh
0
25
50
75
100
Years
Natural gas
CH, forest res
DH, willow, cropland
DH, forest res
DH, willow, pasture land
DH, BM
DH, NG
DH, W, CW100
CH, BM
CH, NG
DH, W, PHG100

Conclusions

Temporal aspects of bioenergy

Carbon stocks, sequestration and land use change

(incl. temporal analysis helps in setting the right system boundaries, may assist consequential approach)

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Thank you

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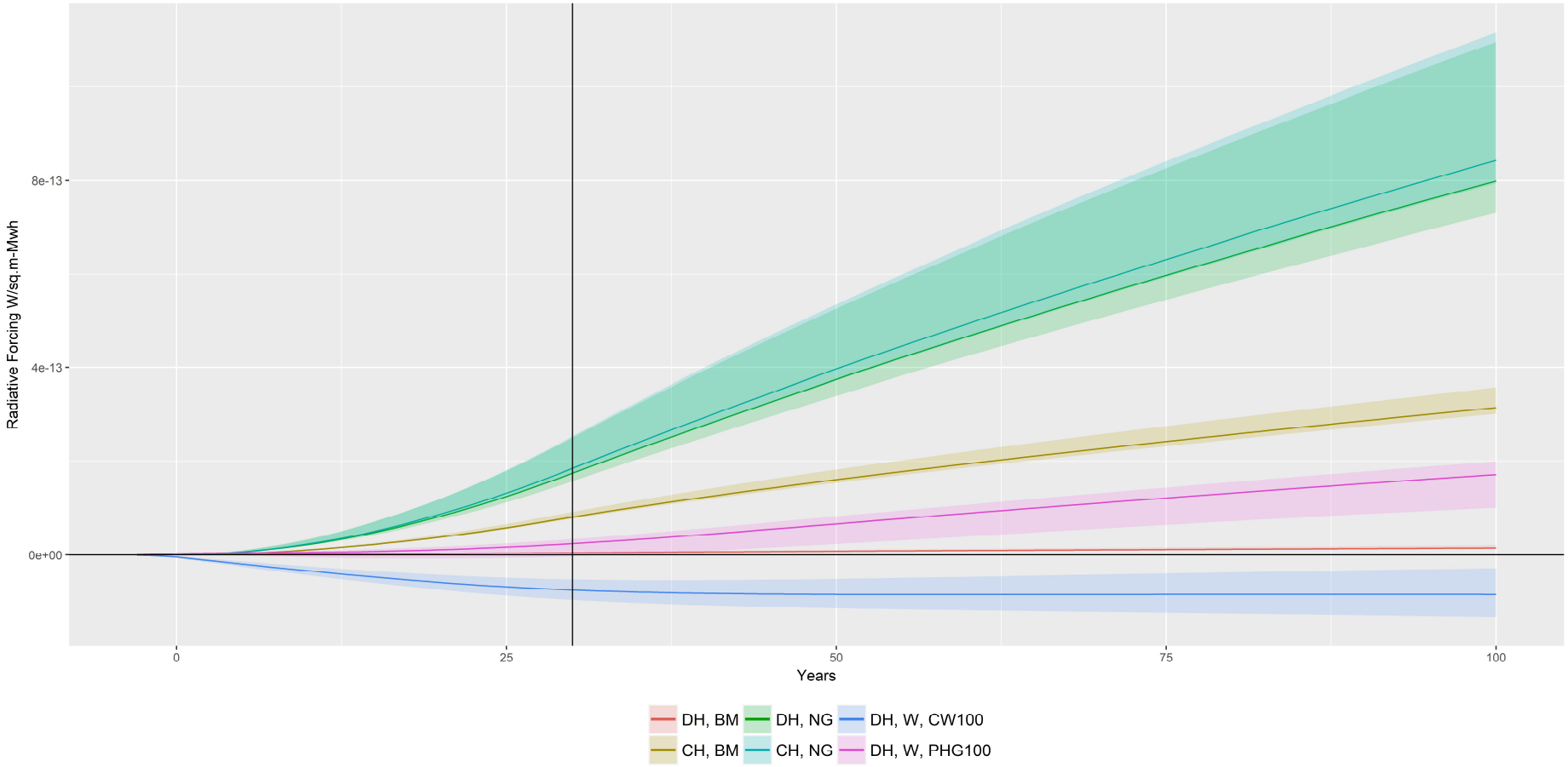
Results - CRF


Radiative Forcing W/sq.m-Mwh
8e-13
4e-13
0e+00
0
25
50
75
100
Years
DH, BM
DH, NG
DH, W, CW100
CH, BM
CH, NG
DH, W, PHG100