



A sustainable transition of the energy system towards an increasing share of bioenergy

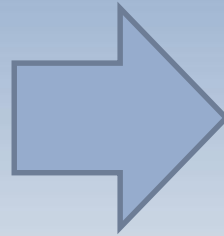
– Localisation and industrial change

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Project background



- **Biorefineries**
 - Feedstock availability
 - Industrial infrastructure
- **Optimal use of limited resource**

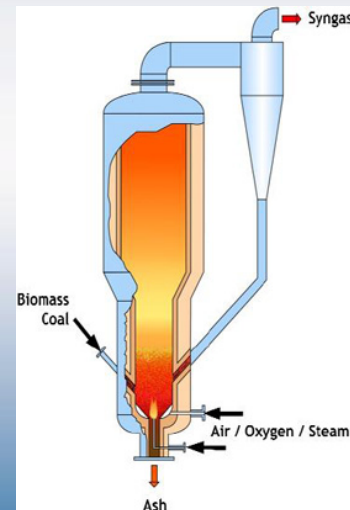


Project background

- Biomass utilisation



- Efficient technologies





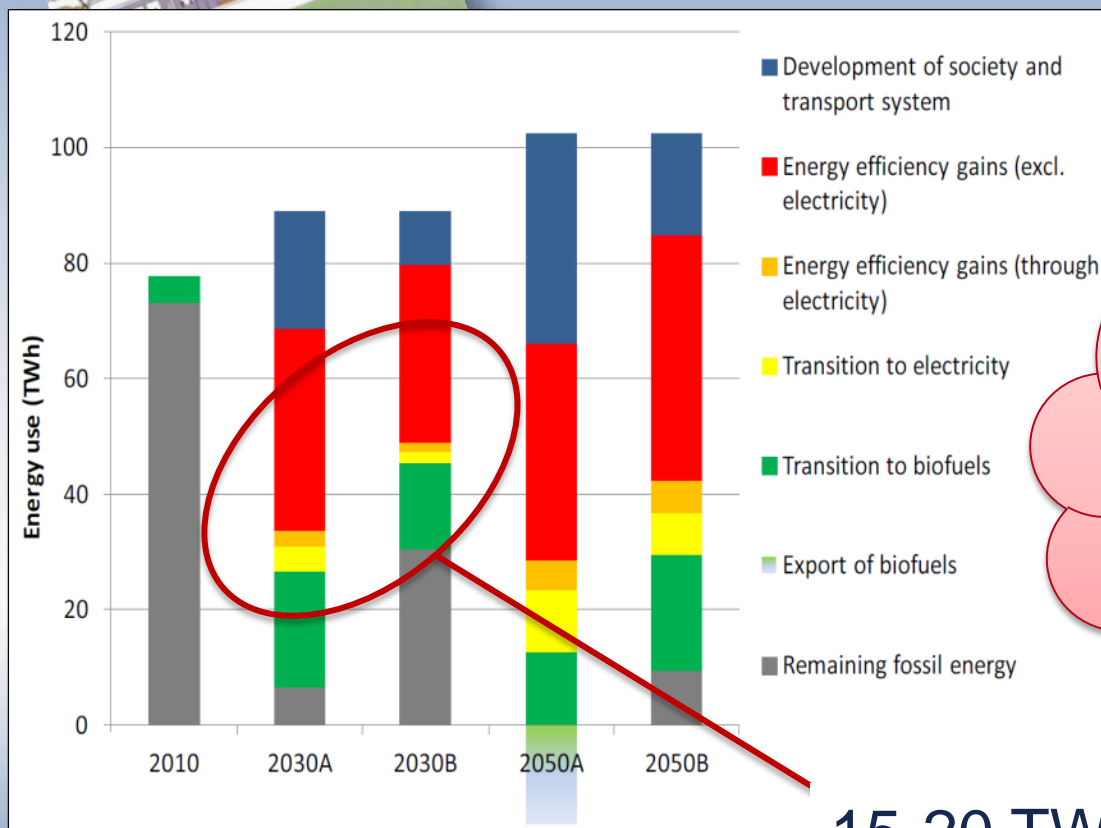
Project background

- Localisation and important actors





Fossil-free road transport



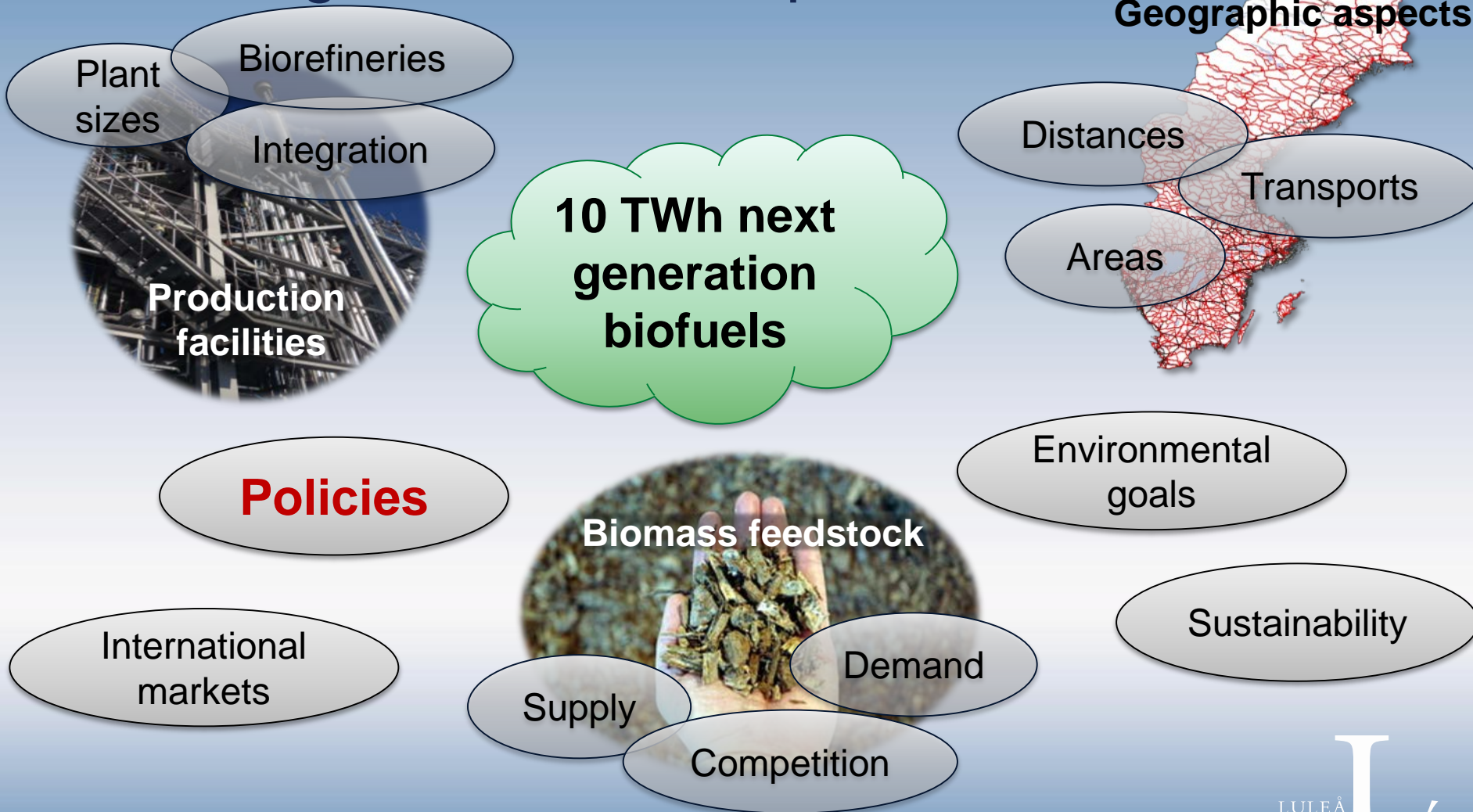
2030
Fossil fuel independent vehicle fleet

2050
Resource-efficient energy supply with zero net emissions of GHG

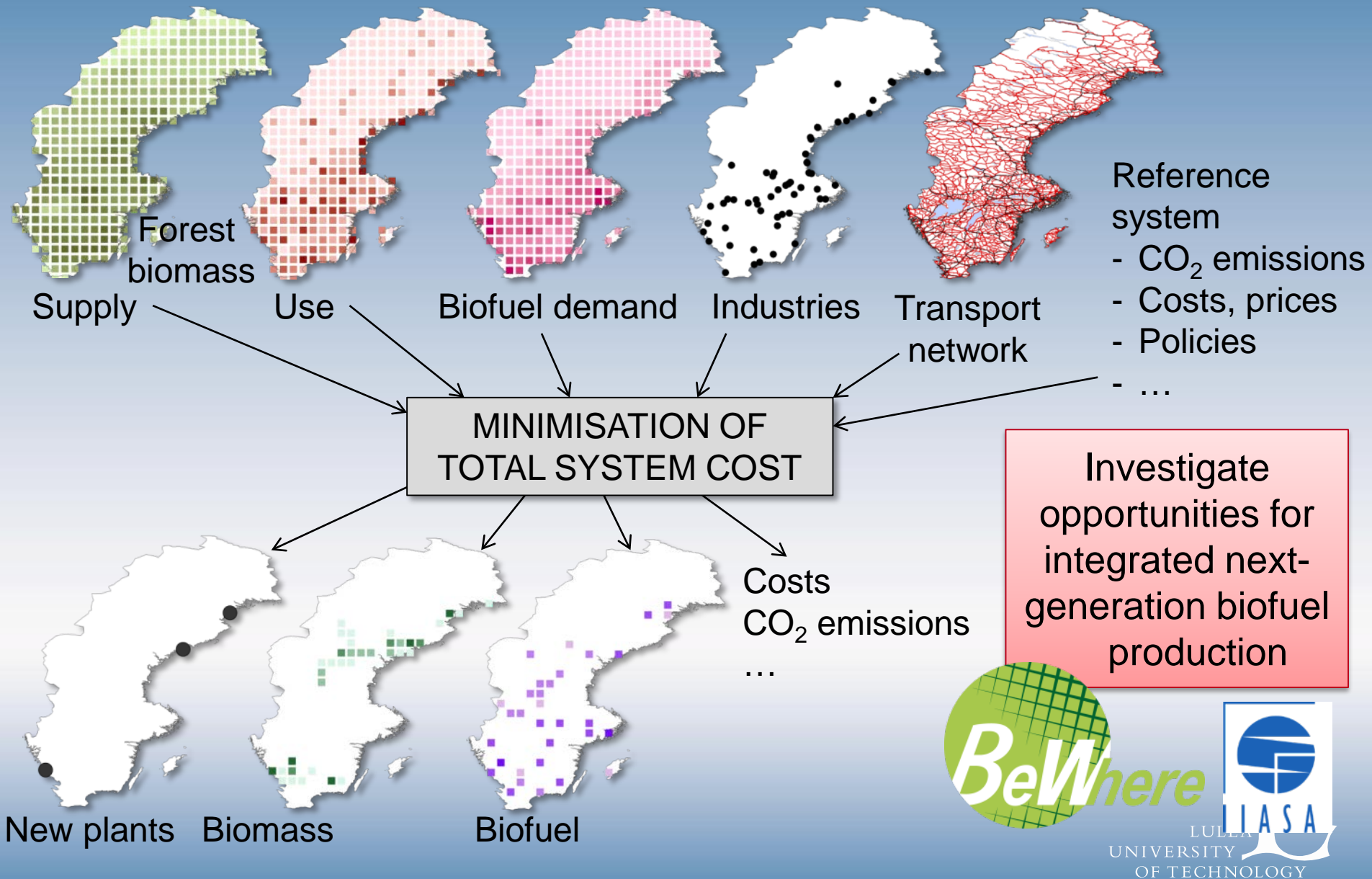
15-20 TWh



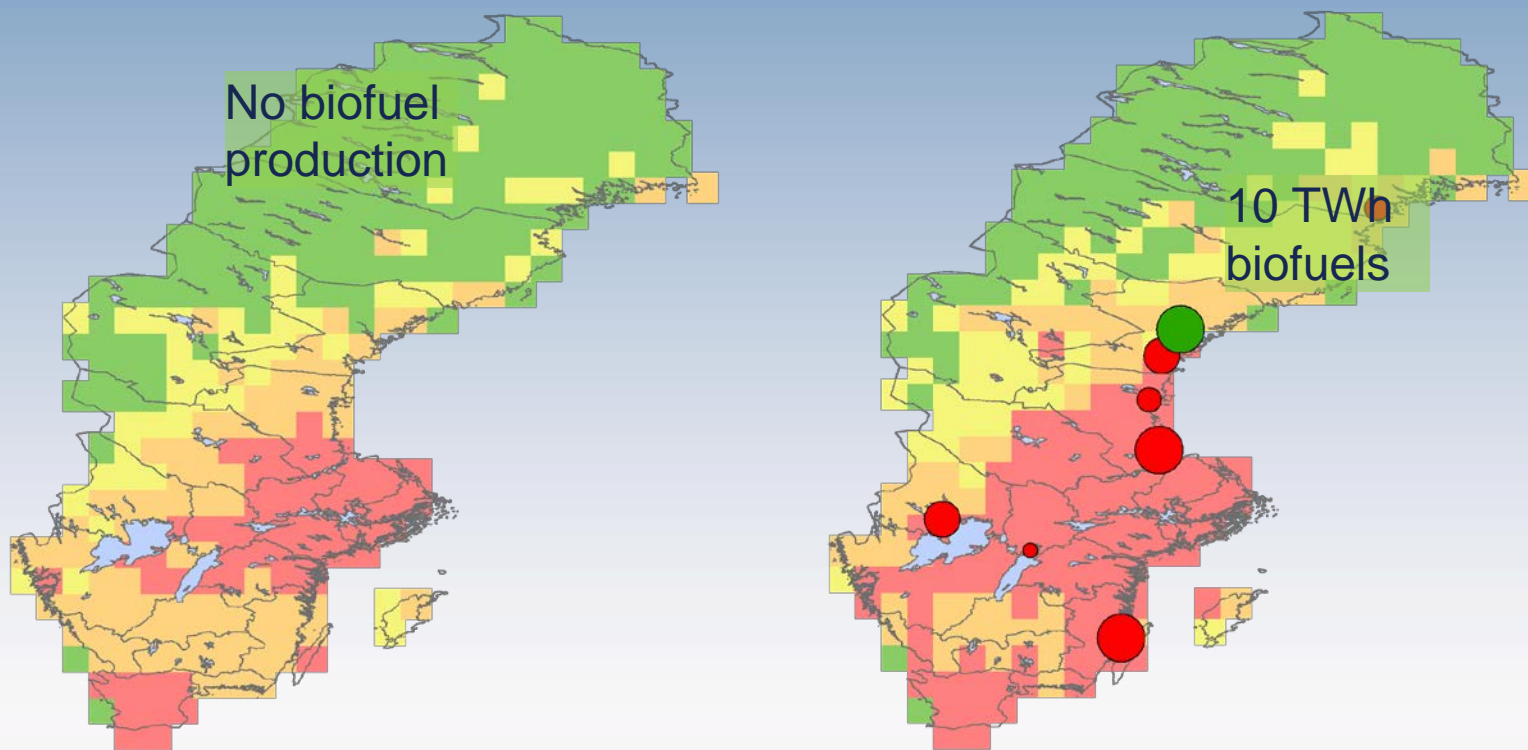
Large-scale biofuel plants where...?



Finding the sweet spots



Total biomass utilisation

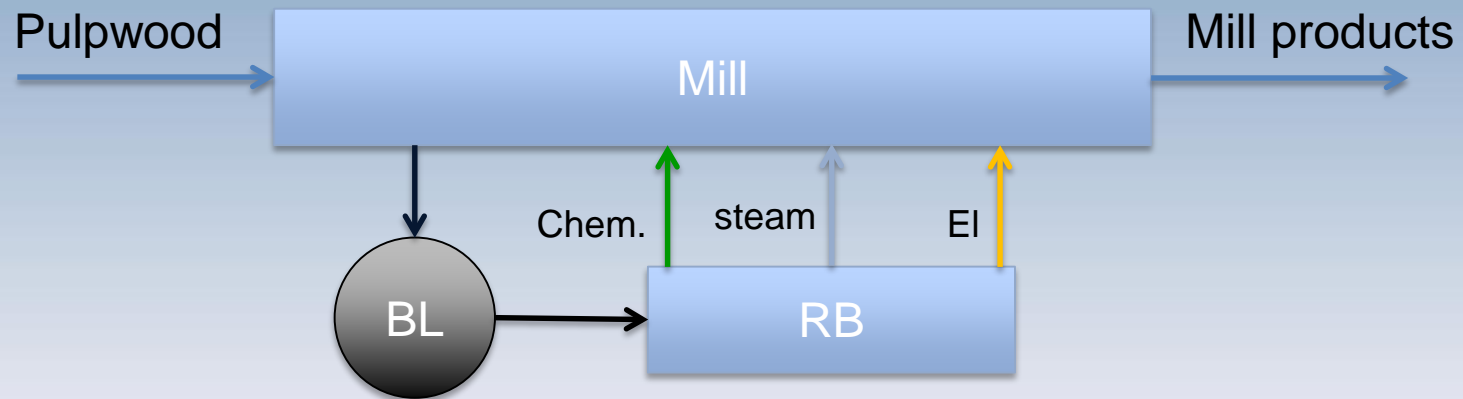


Forest residues and stumps –
utilization share



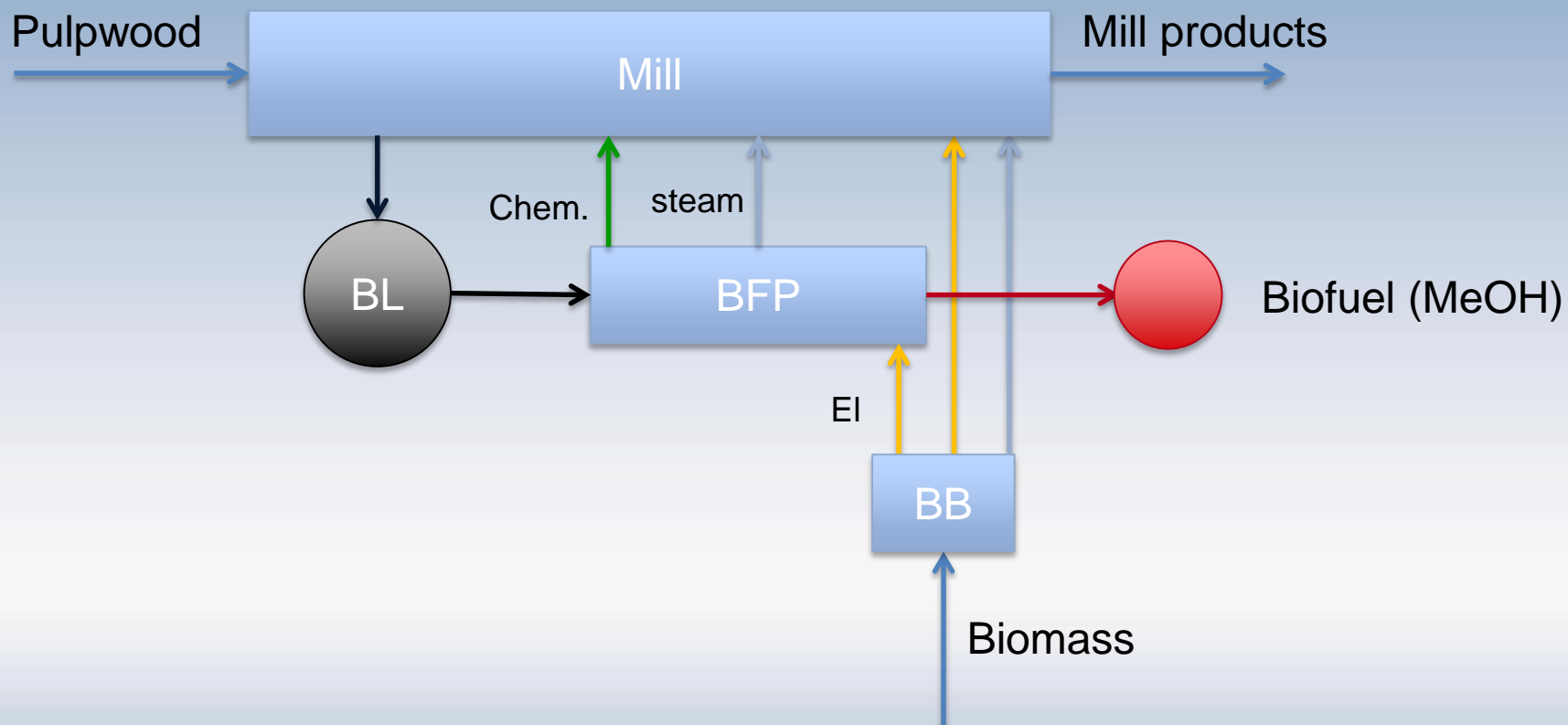


Co-gasification of BL and PL

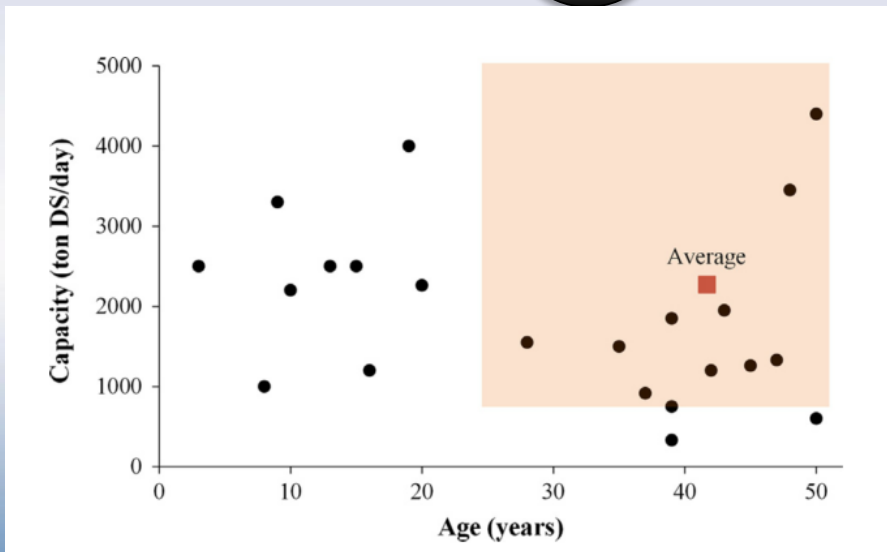
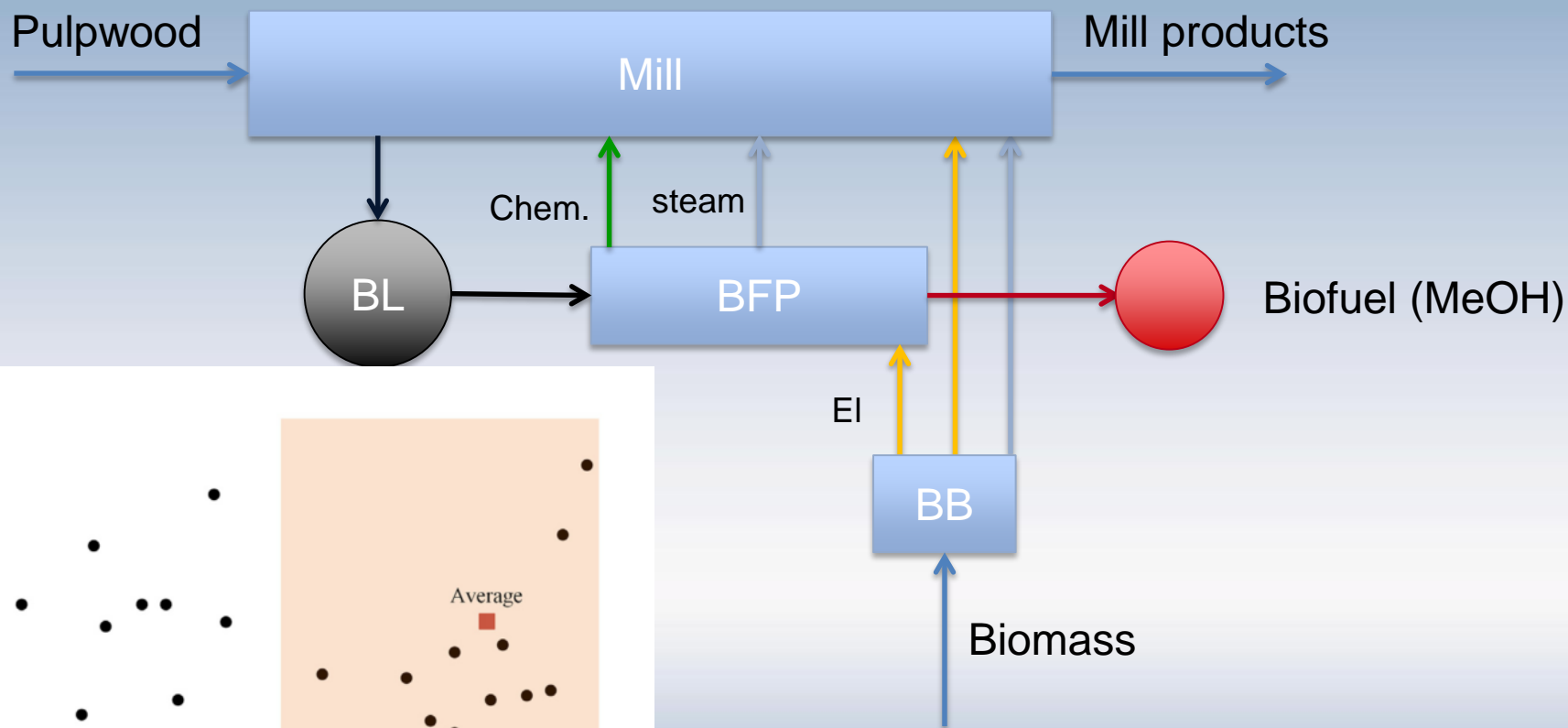




Co-gasification of BL and PL

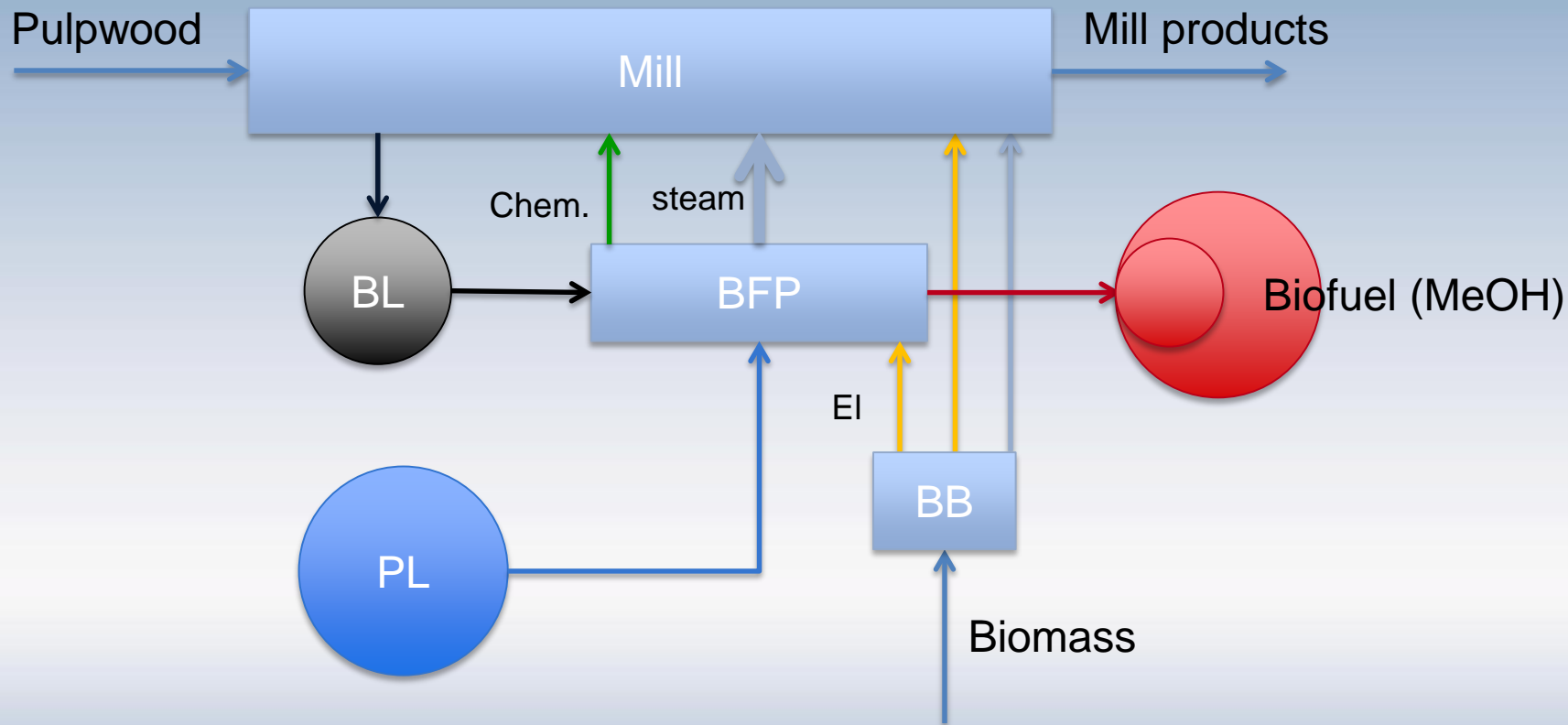


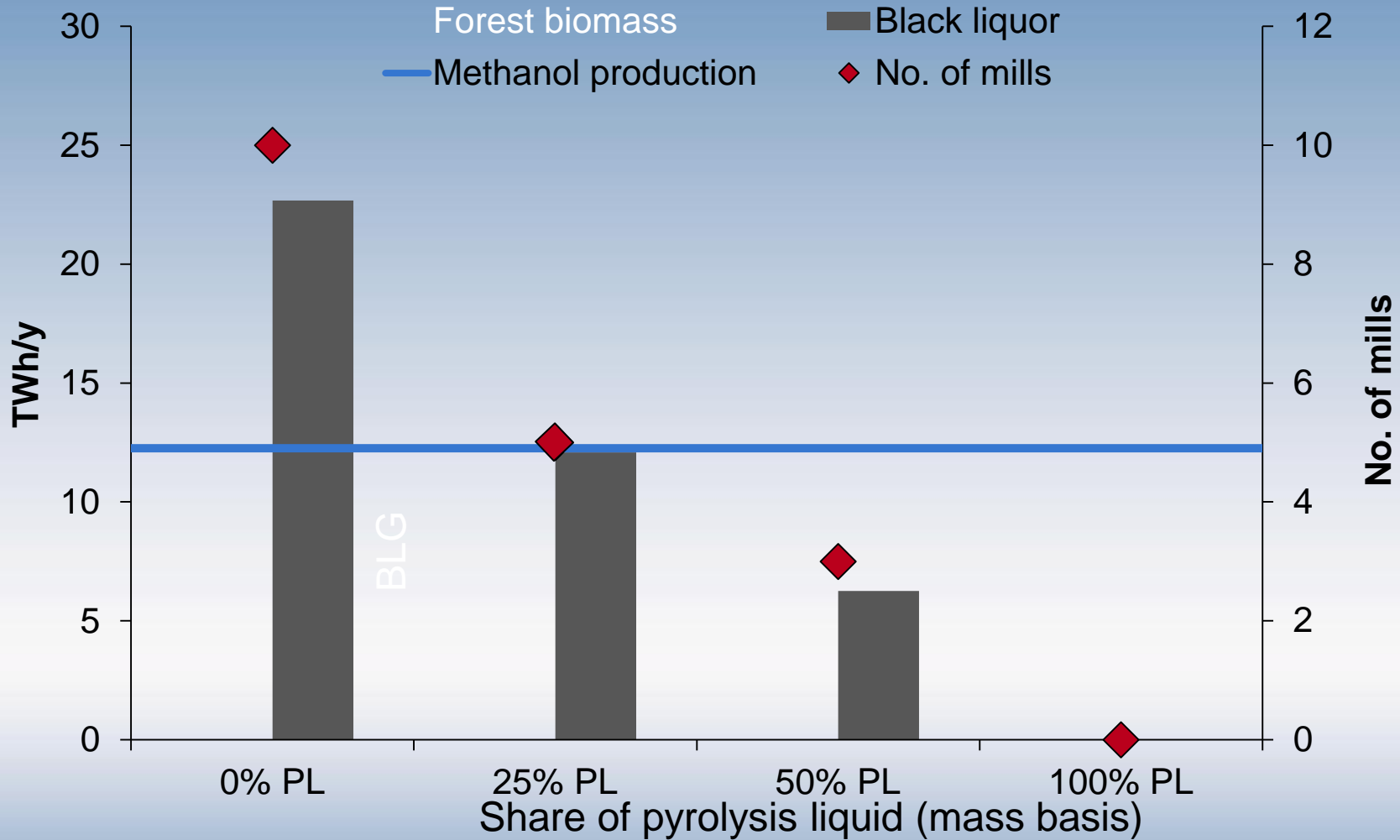
Co-gasification of BL and PL



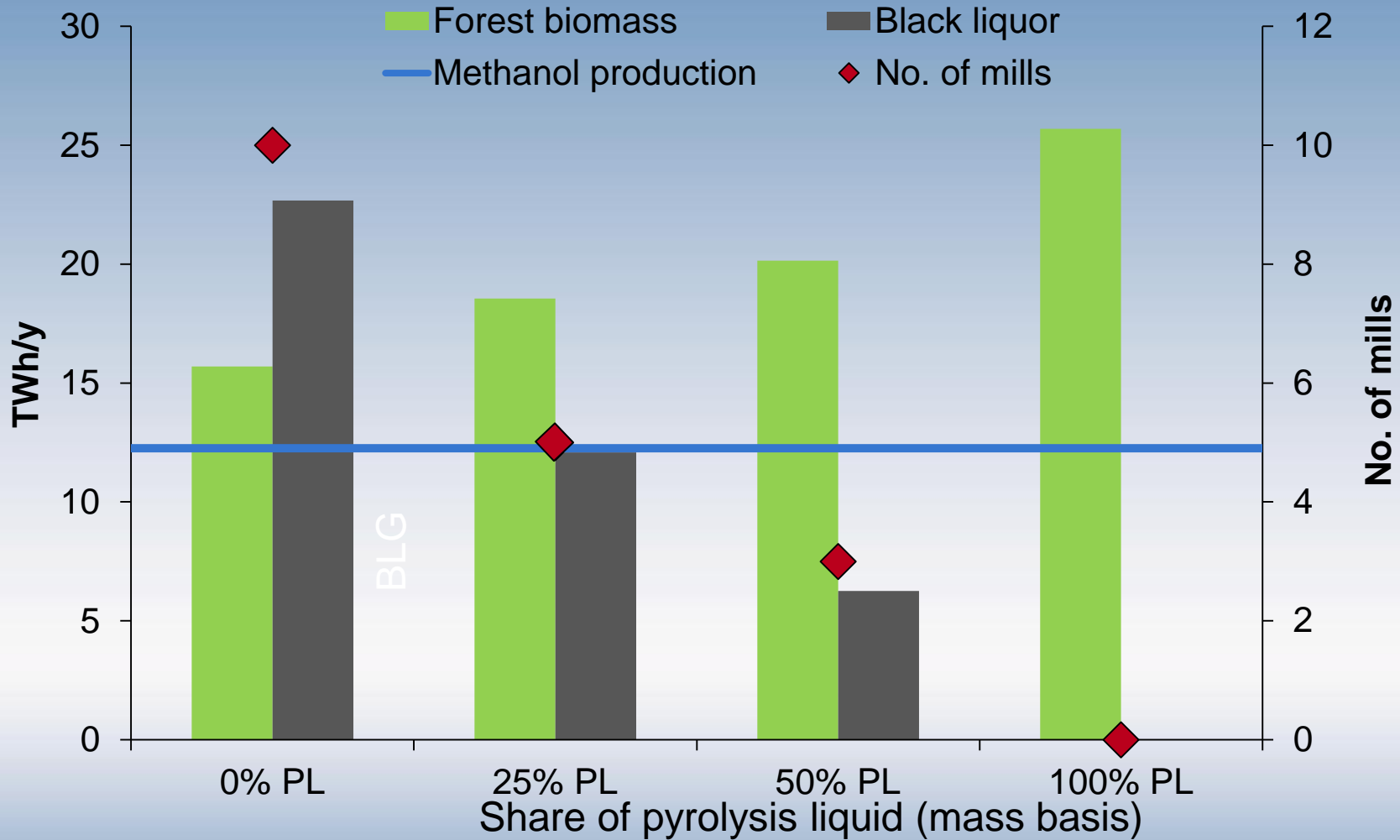


Co-gasification of BL and PL





Adapted from Andersson J, et al. (2016)
Energy Conversion and Management 110:240-248

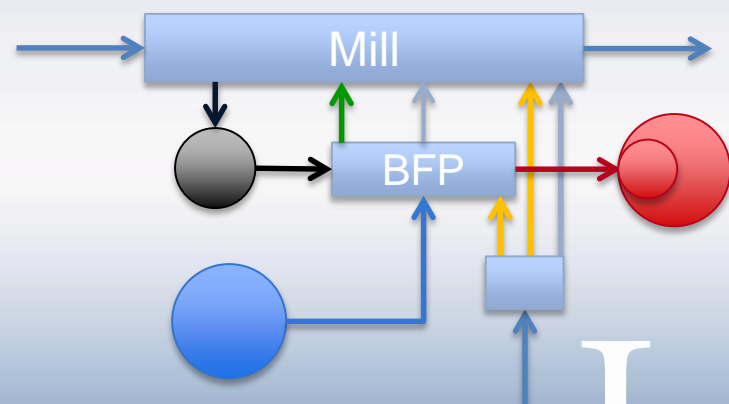


Adapted from Andersson J, et al. (2016)
Energy Conversion and Management 110:240-248



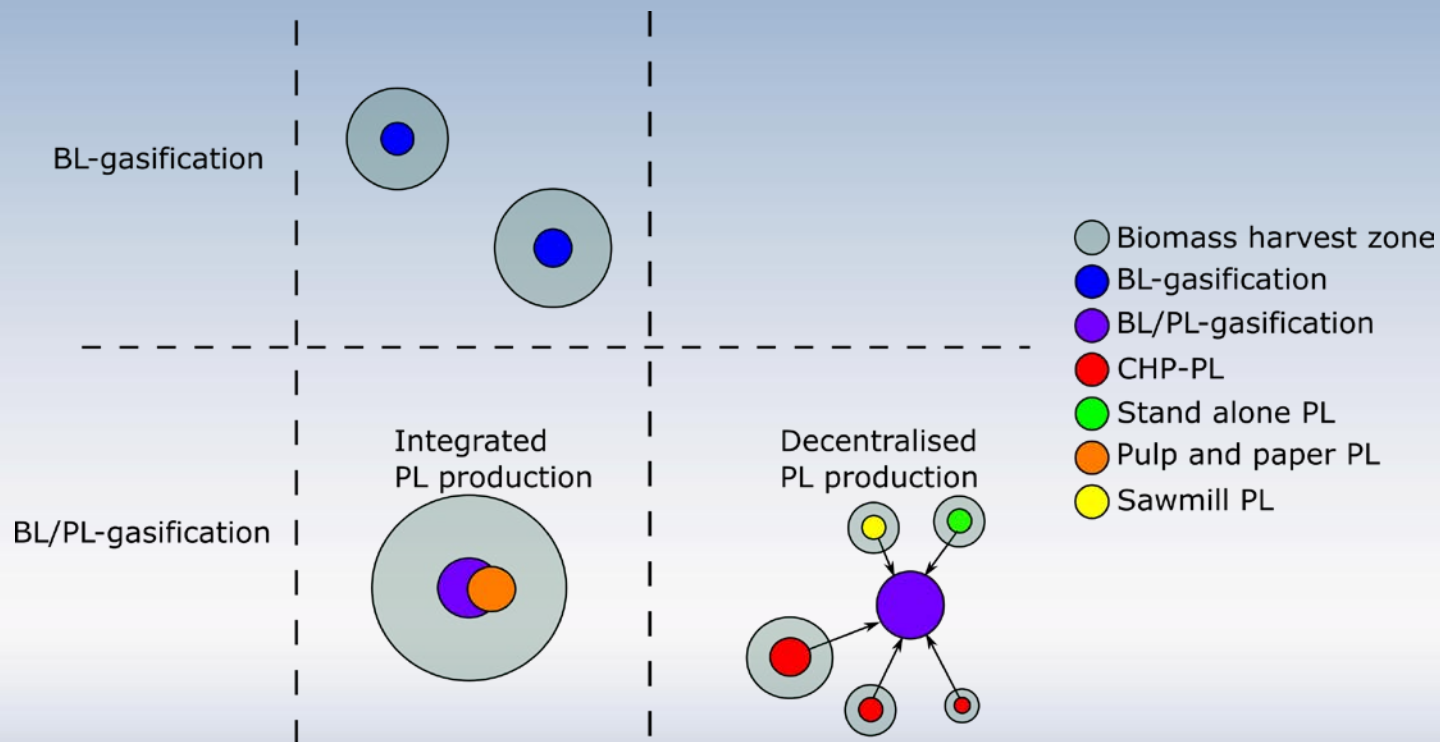
Co-gasification of BL and PL

- Economy of scale
- Beneficial for small mills
- Using catalytic effect
- Not considered:
 - Full supply chain
 - Localisation of PL production
 - Economy of scale benefits from national perspective





Supply chain configurations



Expected outcome

- Small pulp mills will have BL/PL-G
- Mix of BLG and BL/PL-G most beneficial
- PL-production integrated at pulpmill

Future

- Risk associated cost
- Additional cost for integration with certain process
- Dynamic price for biomass