

Decarbonizing Nordic Transports – the Role of Alternative Aviation Fuels

Julia Hansson, Martin Hagberg, Selma Brynolf, Maria Grahn,
Kenneth Karlsson, Raffaele Salvucci



Aim

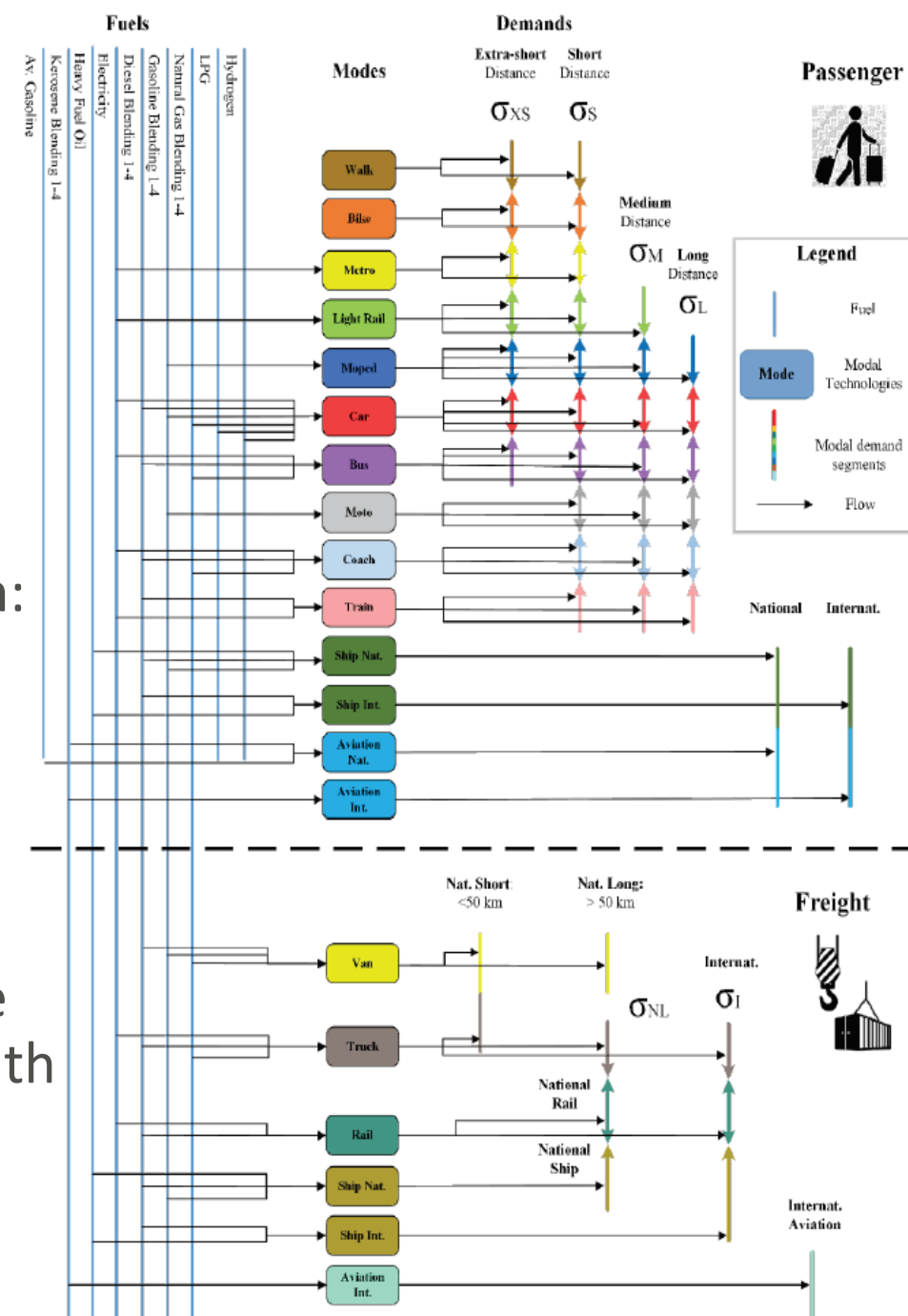
- To assess what alternative fuel options that are cost-effective for aviation but also other transport modes in the future Scandinavian region (Sweden, Norway and Denmark) in an energy system context given carbon reduction requirements

Background

- Transforming transport is a key energy challenge in the Nordic region to achieve the ambitious climate targets
- The potential role of different alternative aviation fuels will beside technical and cost development depend on the development in other transport sectors

Method: Newly developed TIMES Nordic model

- Bottom-up, optimization (cost minimization) energy system model
- Comprehensive coverage of the national energy system: Power and heat sector, transport sector, industry and service sector, residential sector
- Coverage: Sweden, Norway and Denmark
- Time period: 2010-2050
- The model satisfies the defined modal demands for the entire time horizon by deploying the technology mix with the lowest levelised costs while fulfilling the CO2 constraint (no net CO2 emissions by 2050)

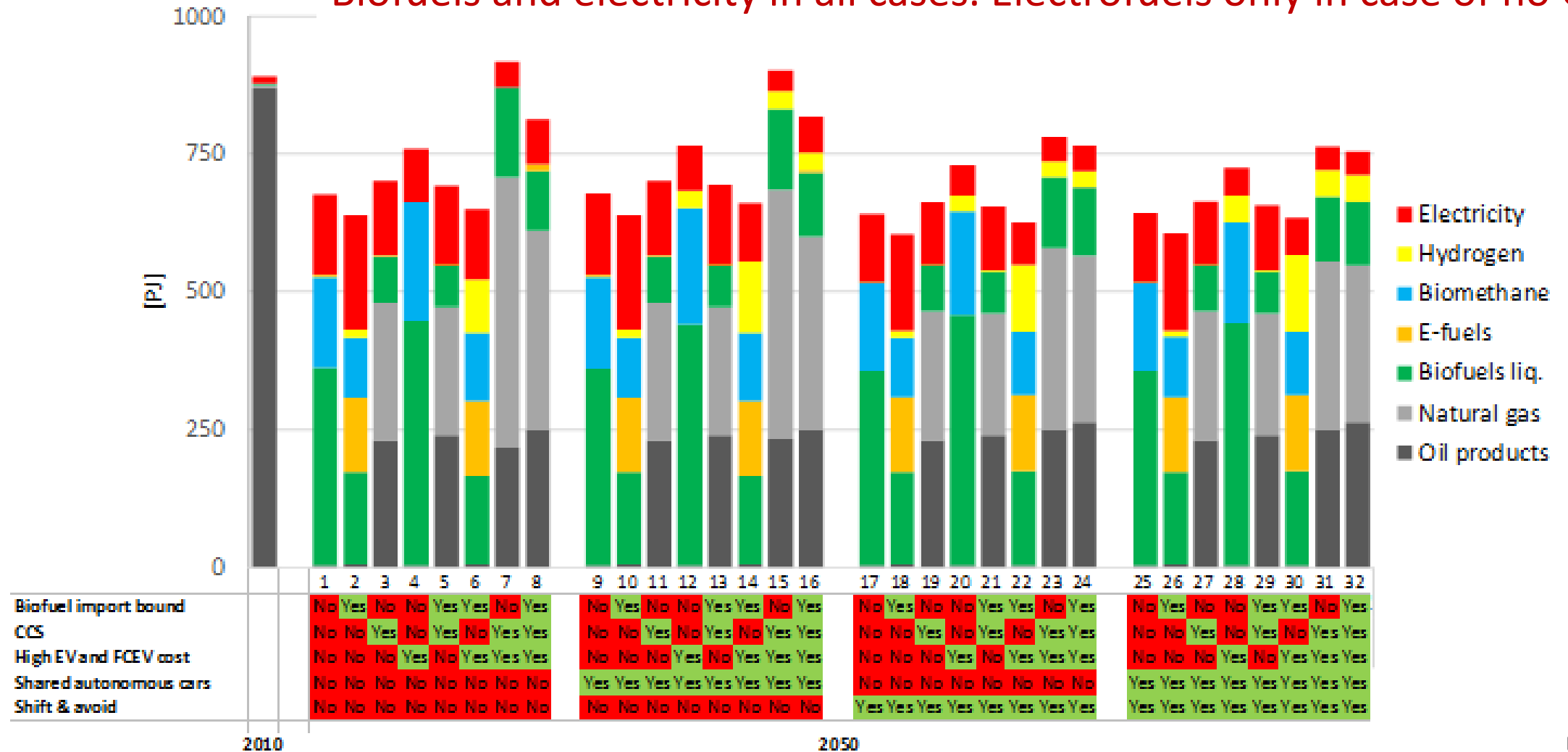


Important assumptions

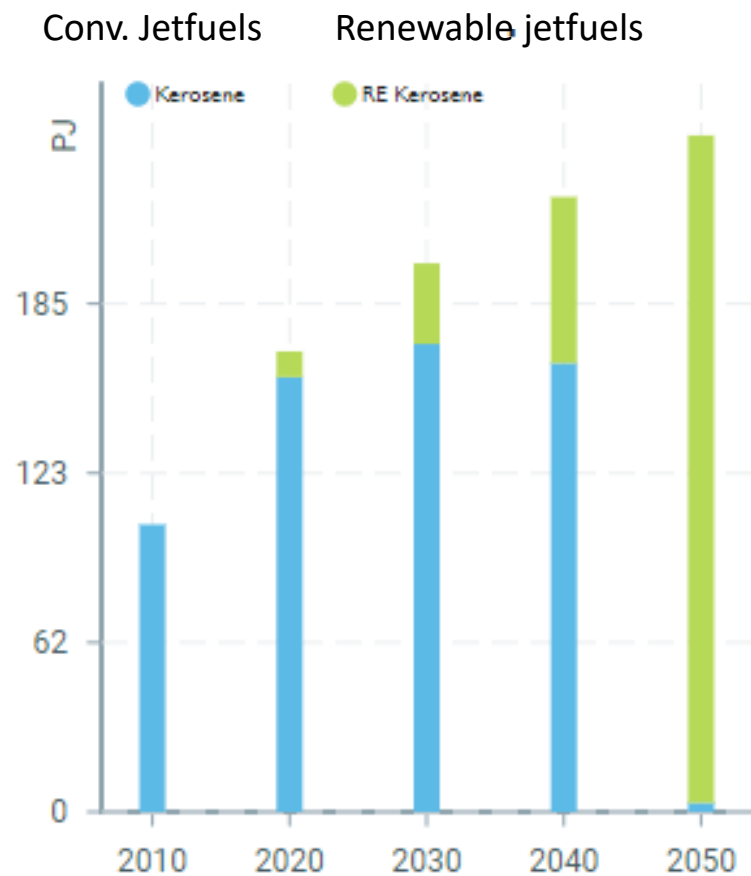
- Aviation fuel options: conventional jetfuels, bio-jetfuels, hydrogen and electrofuels
- Consider cost estimates, technical performance and CO₂ emissions
- Domestic and international aviation is included (represented by the share filled in the included countries)
- Several scenario cases: biofuel import bound, carbon capture and storage (CCS), cost for electric and fuel cell vehicle

Scenarios for fuel use in entire Scandinavian transport sector - no net CO2 emissions by 2050

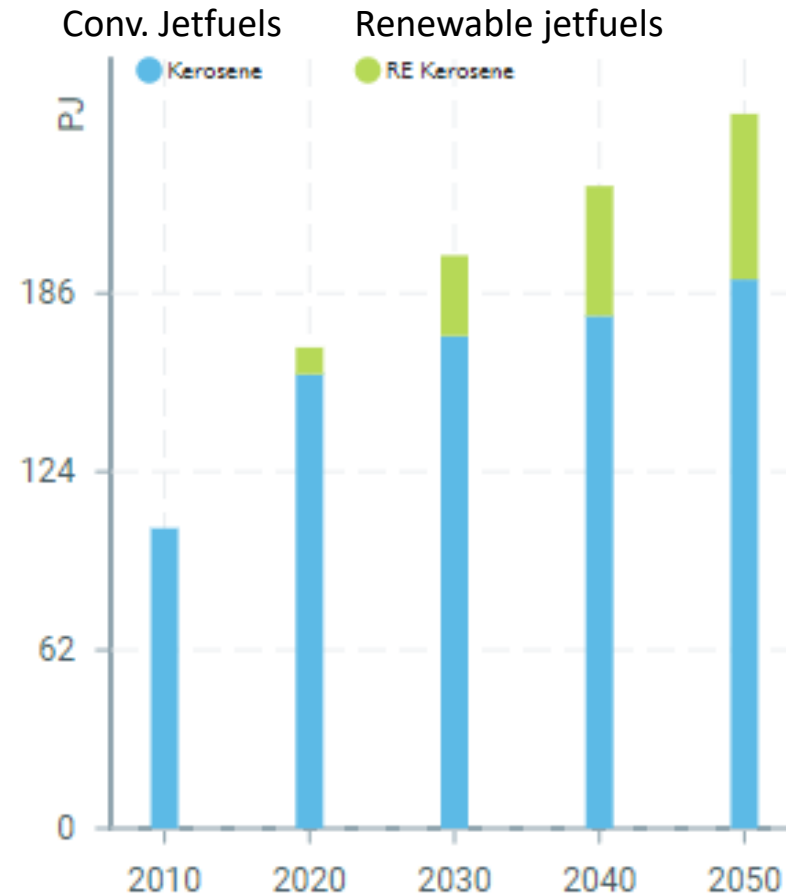
Biofuels and electricity in all cases. Electrofuels only in case of no CCS



Scenarios for Scandinavian use of aviation fuels with no net CO2 emissions by 2050



Scandinavian aviation fuel use - **No CCS**

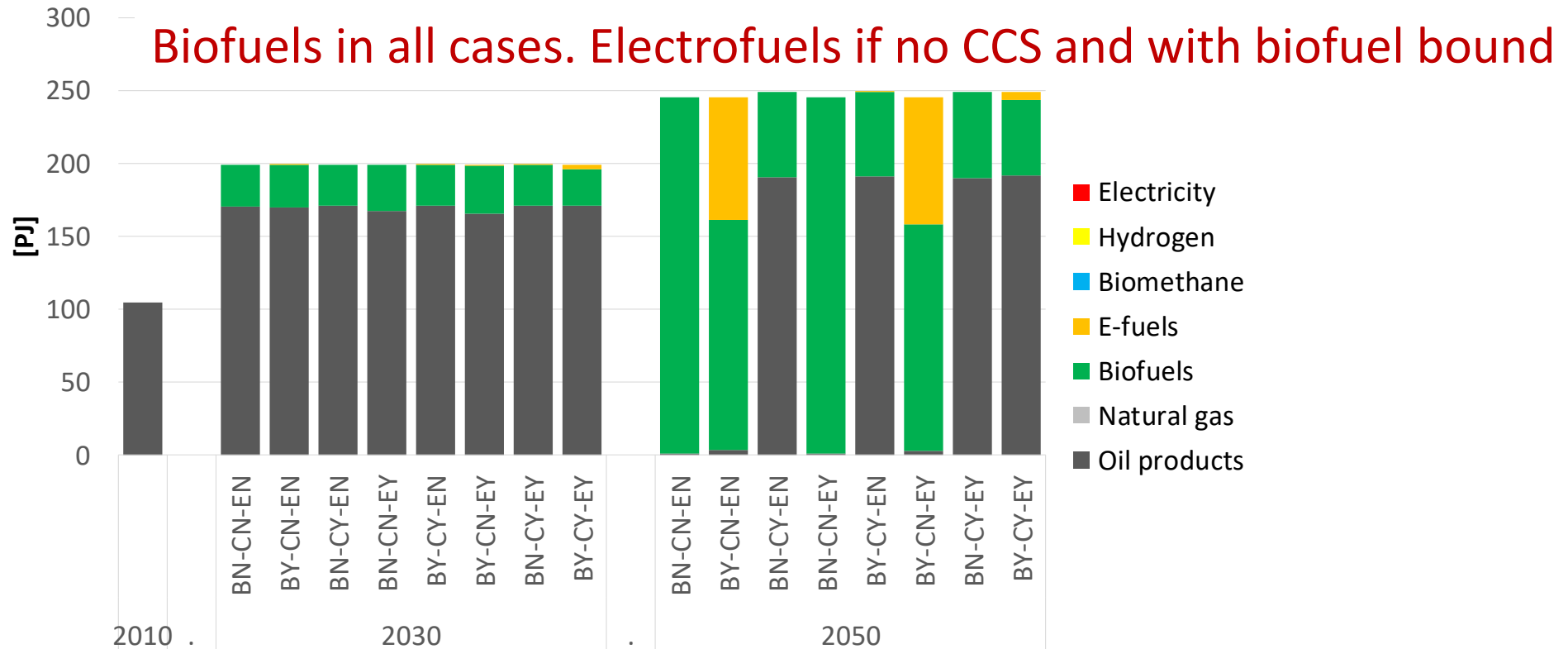


Scandinavian aviation fuel use - **With CCS**

Fuel use in Scandinavian aviation sector in 2030 and 2050 for 8 different scenario cases

No net CO2 emissions by 2050

Aviation



E-fuels: electrofuels (produced from CO2 and H2O using electricity)

BN/Y: biofuel import bound Yes/No,

CN/Y: Carbon capture and storage (CCS) Yes/No,

EN/Y: High electric and fuel cell vehicle cost Yes/NO

Main findings

- Introduction of alternative aviation fuels will play a crucial role in decarbonizing the Nordic transport sector.
- Bio-jet fuels is indicated to represent a cost-effective mitigation measures in the Scandinavian aviation sector for 2030 and 2050 in all studied scenarios.
- Electrofuels to some extent also a cost-effective option but only when CCS is not deployed in large-scale.
- Hydrogen does not seem cost-effective in assessed cases, but further assessment needed before any firm conclusions can be drawn on the potential role for hydrogen in the Nordics.
- Updated cost estimates for different fuel production pathways and propulsion systems will improve the assessment (also electric solutions)

Policies and their design will be key!

Thank you!
julia.hansson@ivl.se



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