



IFE Kjeller

16.09.2022

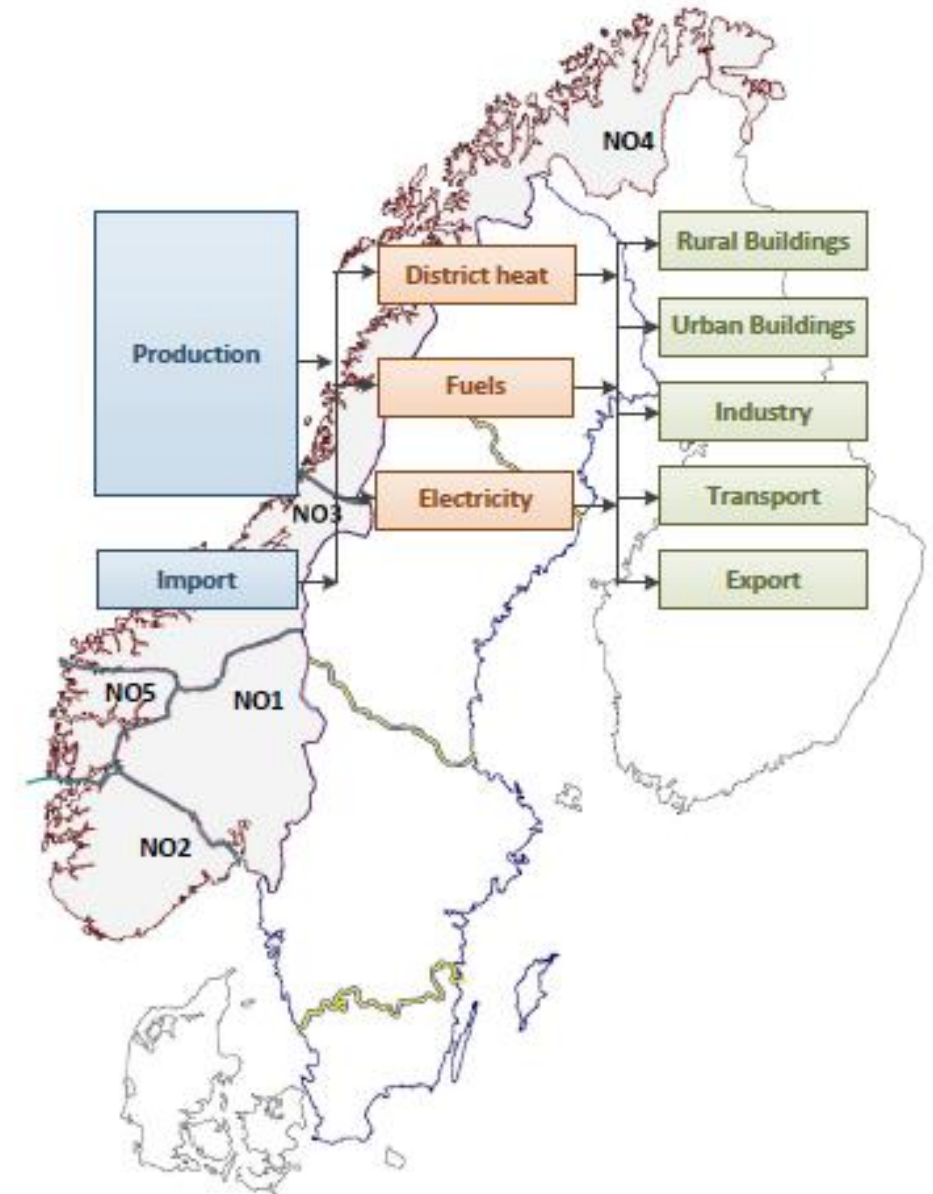
ETSAP WS on  
Human dimension  
and Energy trade

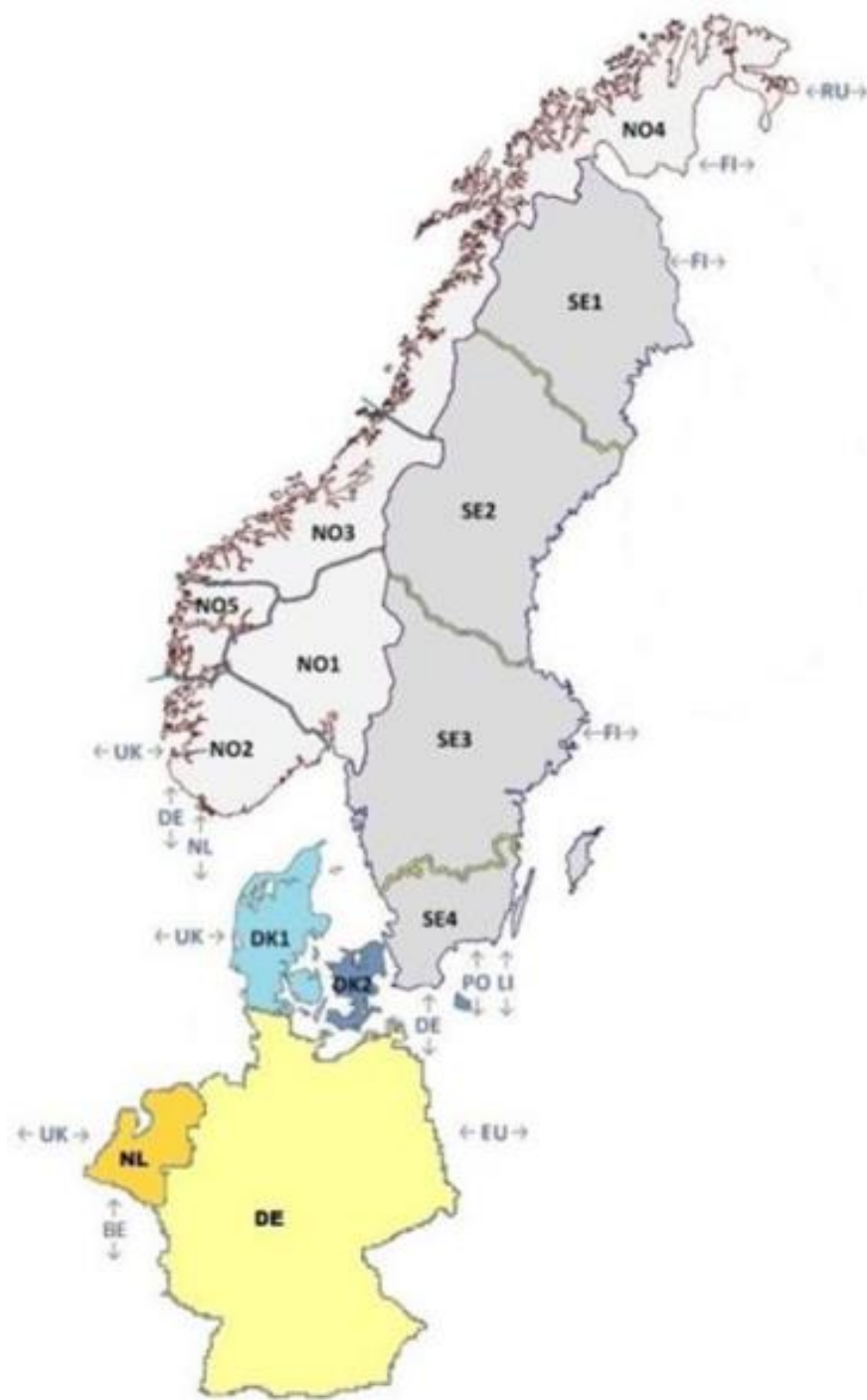
Current modelling practices: Energy trade in IFE-  
TIMES-Norway  
16.09.2022

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# IFE-TIMES-Norway

- ❑ Long-term optimization model of the Norwegian energy system
- ❑ Model strength
  - ❑ Covers the entire energy system
  - ❑ Detailed on end-use; buildings, industry and transport
- ❑ Model specifications
  - ❑ 5 spot price regions
  - ❑ Time horizon: 2018-2050
  - ❑ Temporal resolution: 4 seasons x 24h
- ❑ Electricity trade
  - ❑ Connections to DK, UK, SE, NL and DE



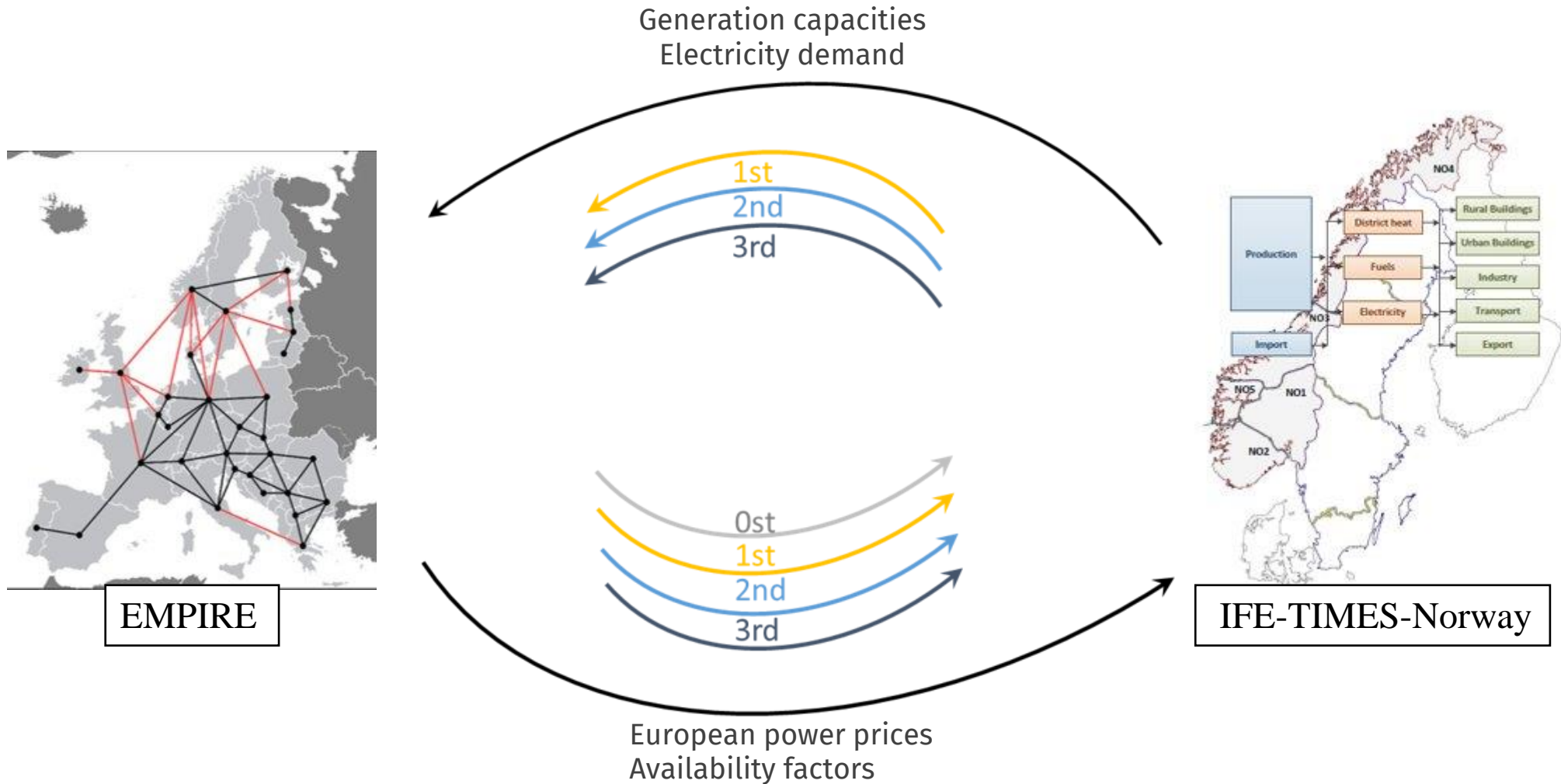


# Electricity trade

- ❑ Bi-directional trade links
- ❑ Capacity expansion:
  - ❑ International: based on ENTSO-E
  - ❑ National: 20% increase
- ❑ First year of investment: 2030
- ❑ Availability factors on cables
  - ❑ Historical values or input from European power models
- ❑ Exogenous prices for Europe
  - ❑ Trade amounts does not affect price
  - ❑ Different price sets to represent price variations
- ❑ Current work: IFE-TIMES-Europe

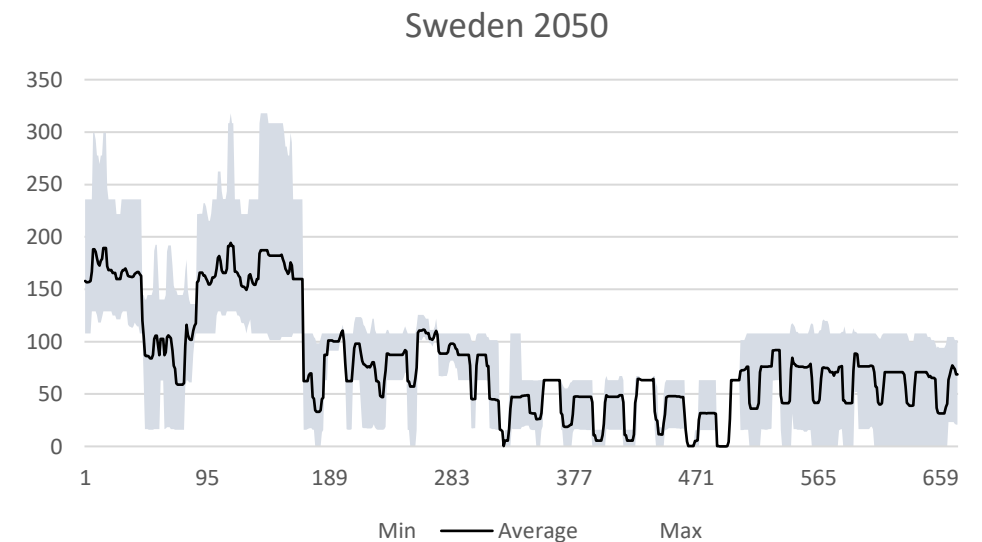
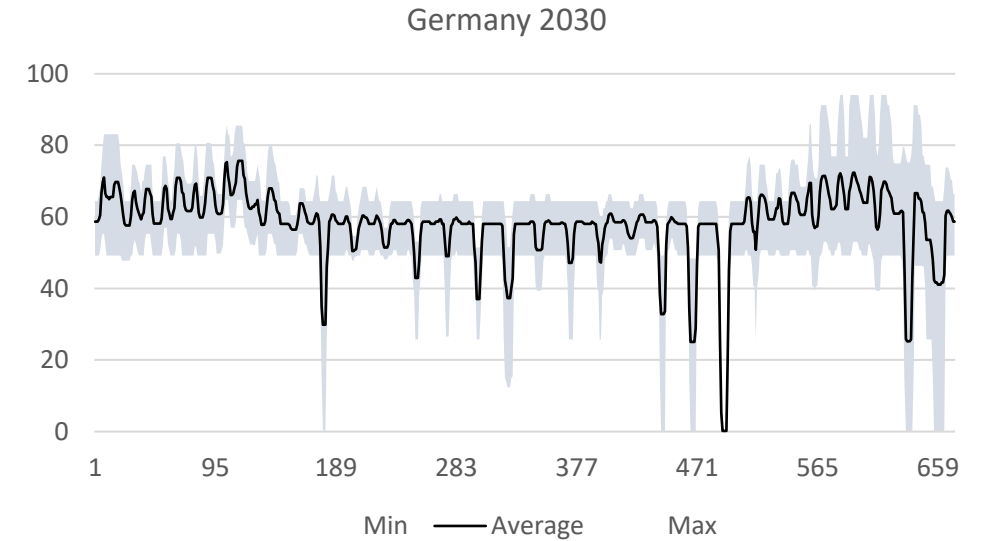
# Bi-directional linking with European power model

Aim: enable better decision-making and reduce limitations of the models



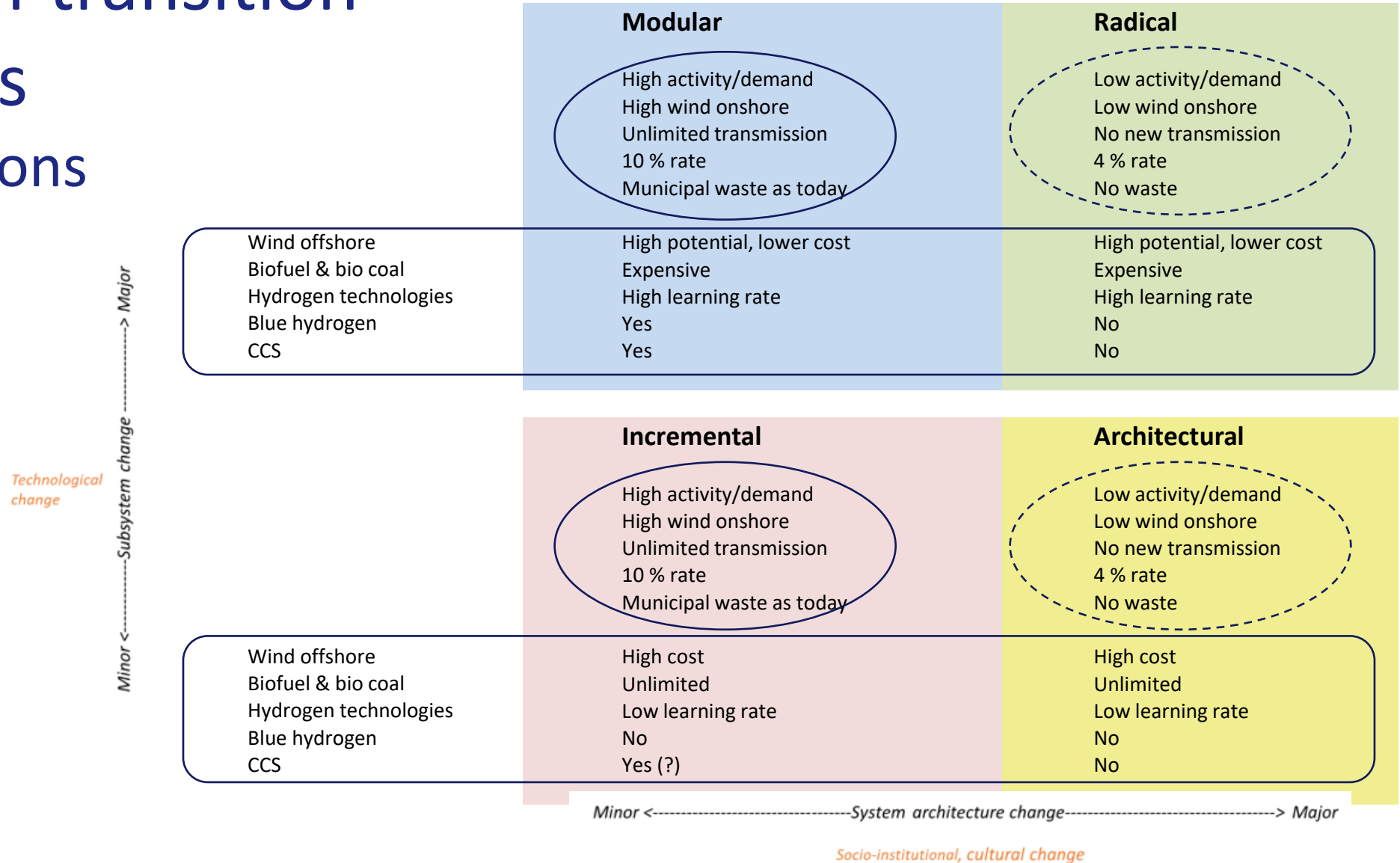
# Impact of stochastic modelling

- ❑ Stochastic price scenarios from European power model
- ❑ Initial temporal resolution: 720 h
  - ❑ Aggregated to 96 h
  - ❑ Some of the hourly variability is lost
  
- ❑ Prices vary largely with scenario
- ❑ We want to capture the span in prices in our modelling
- ❑ Long-term investment decisions might change



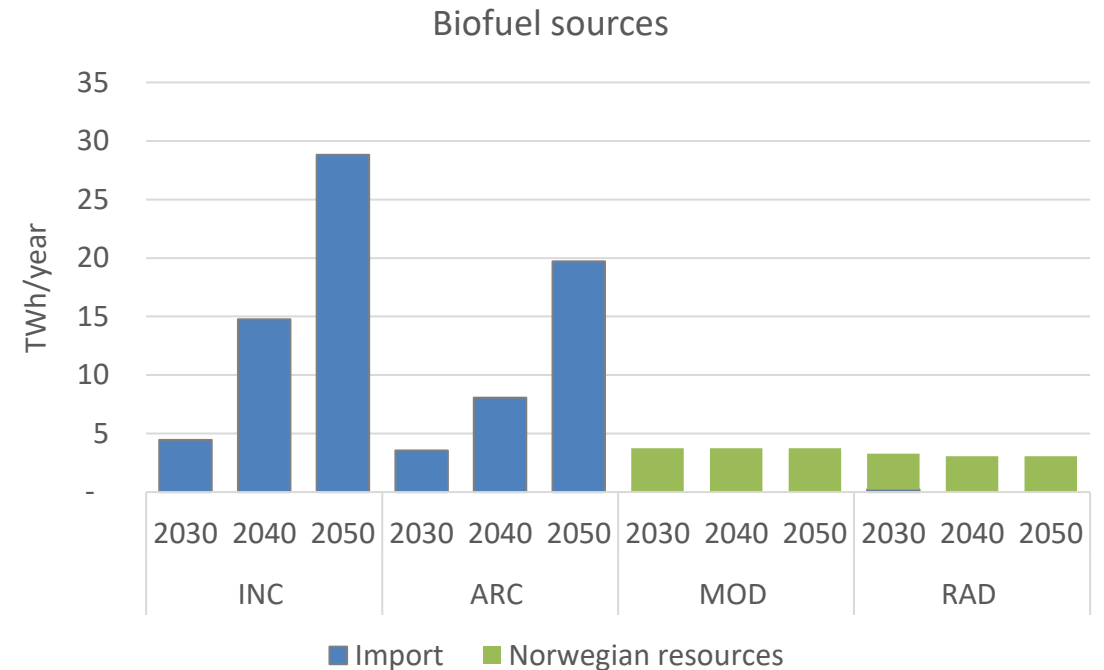
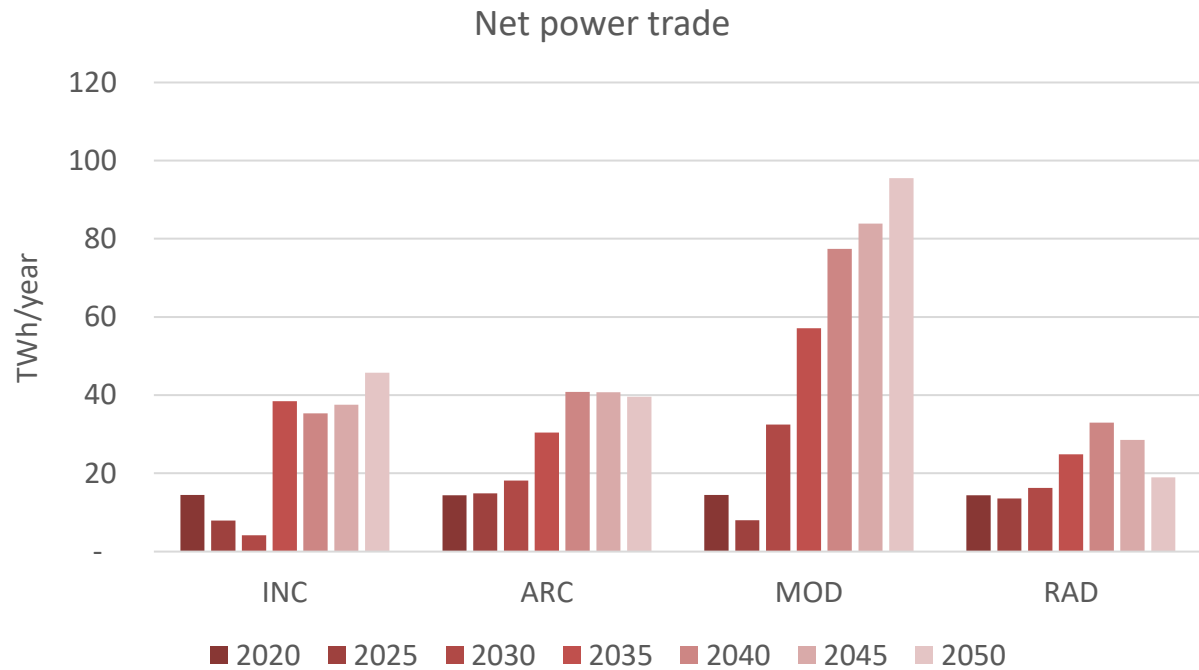
# Impact of transition pathways

## - Assumptions



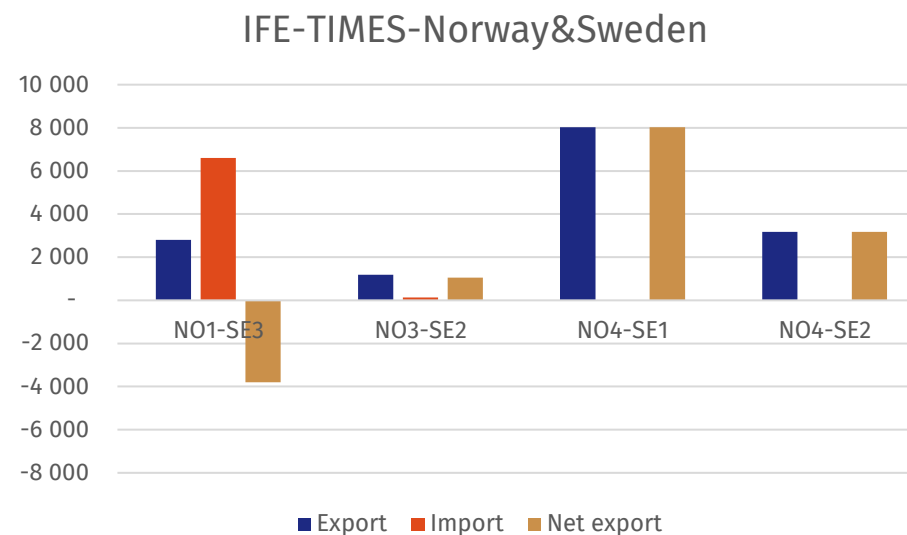
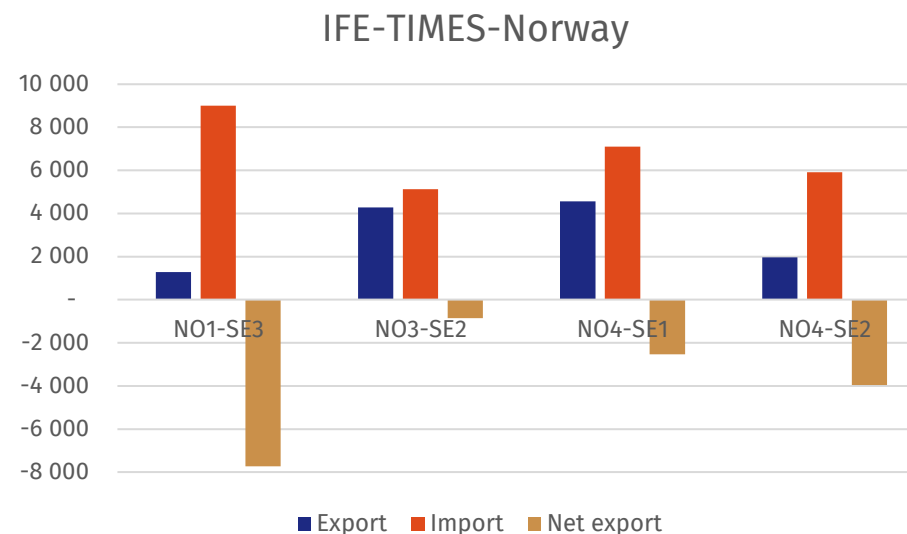
# Impact of transition pathways

## - Results



# IFE-TIMES-Norway&Sweden

- ❑ Optimize both for the Norwegian and Swedish energy system
- ❑ Aim: better understand the interaction between the two countries
  
- ❑ Motivation: Trade between Norway and Sweden misrepresented in IFE-TIMES-Norway
  - ❑ Results indicate net-import from all SE regions





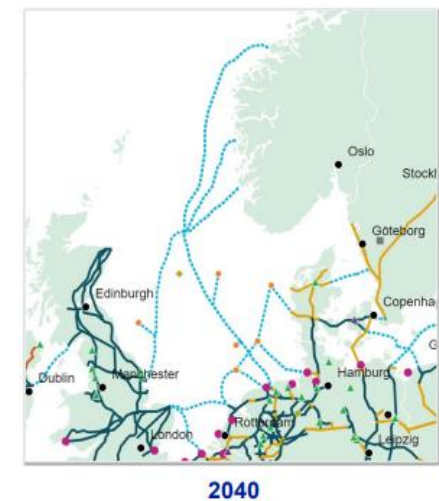
# Bio and fossil products

- ❑ Biogas only from Norway
  - ❑ Biofuel and bio coal import at annual price
    - ❑ Compete with domestic production
  - ❑ Often-used restriction: Total use of bio products in Norway is limited by Norwegian bio resources
- Fossil fuel import at annual price (e.g., coal, oil, natural gas)
  - Price development based on EU reference scenario 2016

# Hydrogen

- ❑ Currently no export of hydrogen, only domestic use
- ❑ Future work is planned
  - ❑ Export of green and blue hydrogen
  - ❑ Using existing and new pipelines + ships
- ❑ Also allowing for export of ammonia

## Potential transport routes (Gassco)





Thank you!

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