

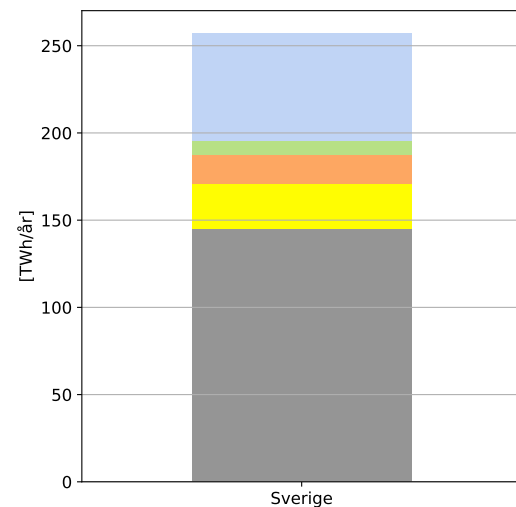
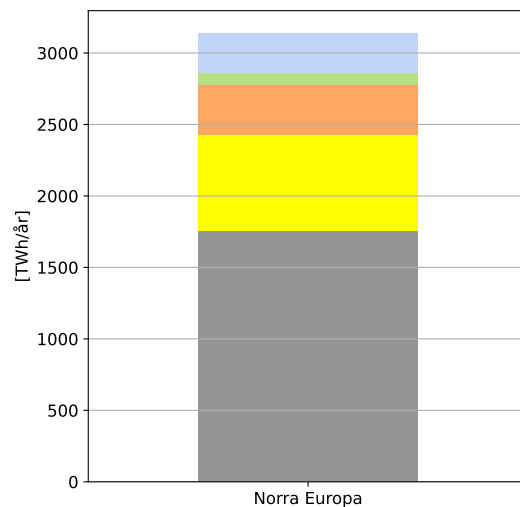
Possible Swedish Electricity Systems 2045

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Meet the demand of electricity to the lowest cost



Historisk elefterfrågan
 Direkt till transport
 El till värme
 Direkt till industri
 El till vätgas



Electricity production



Three cases
Cost-optimal
Nuclear

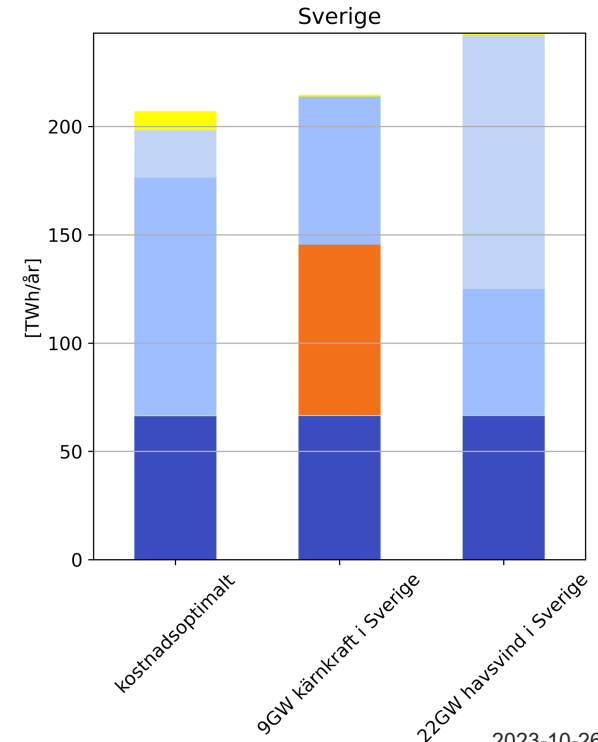
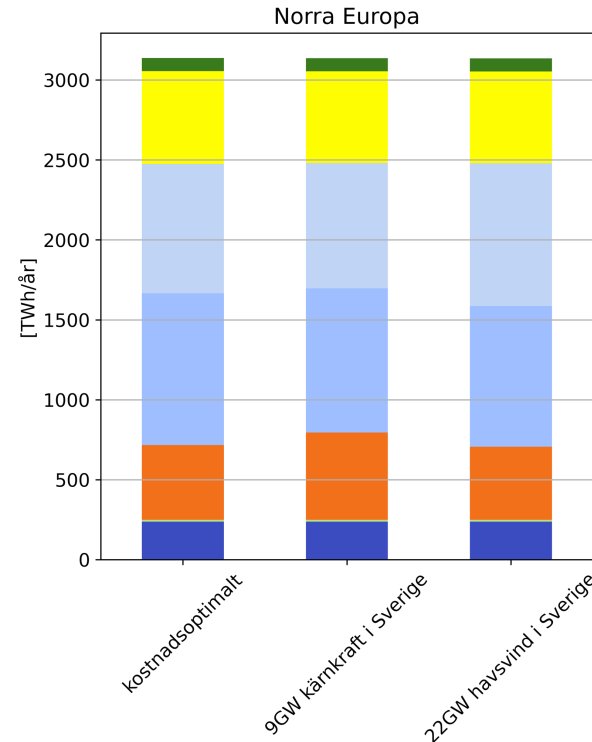
At least 9 GW nuclear
in south Sweden

+7 EUR/MWh

Offshore wind

At least 22 GW offshore
wind power in south
Sweden

+2,5 EUR/MWh





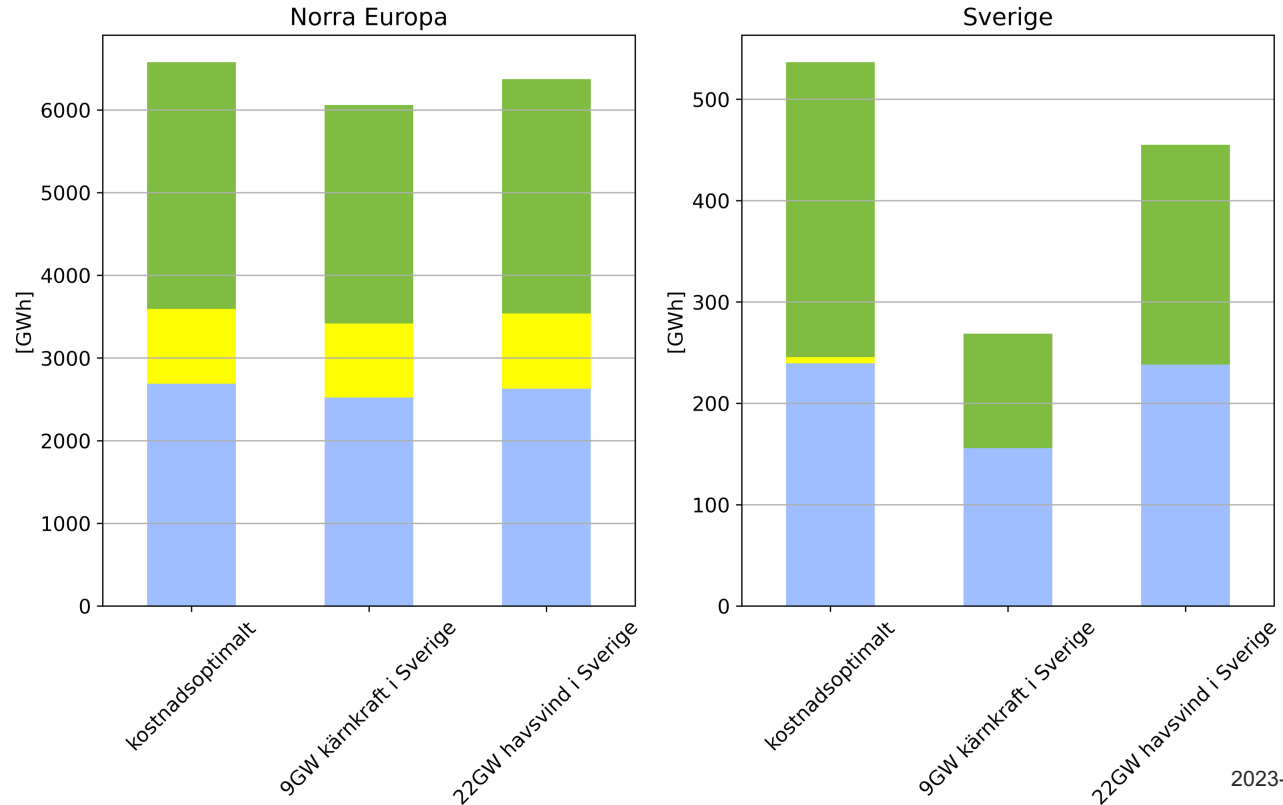
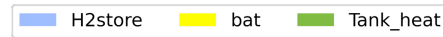
Storage

Batteries in regions with solar PV and extensive transport sector.

Hydrogen storages in regions with extensive industry.

Heat storages in regions with district heating

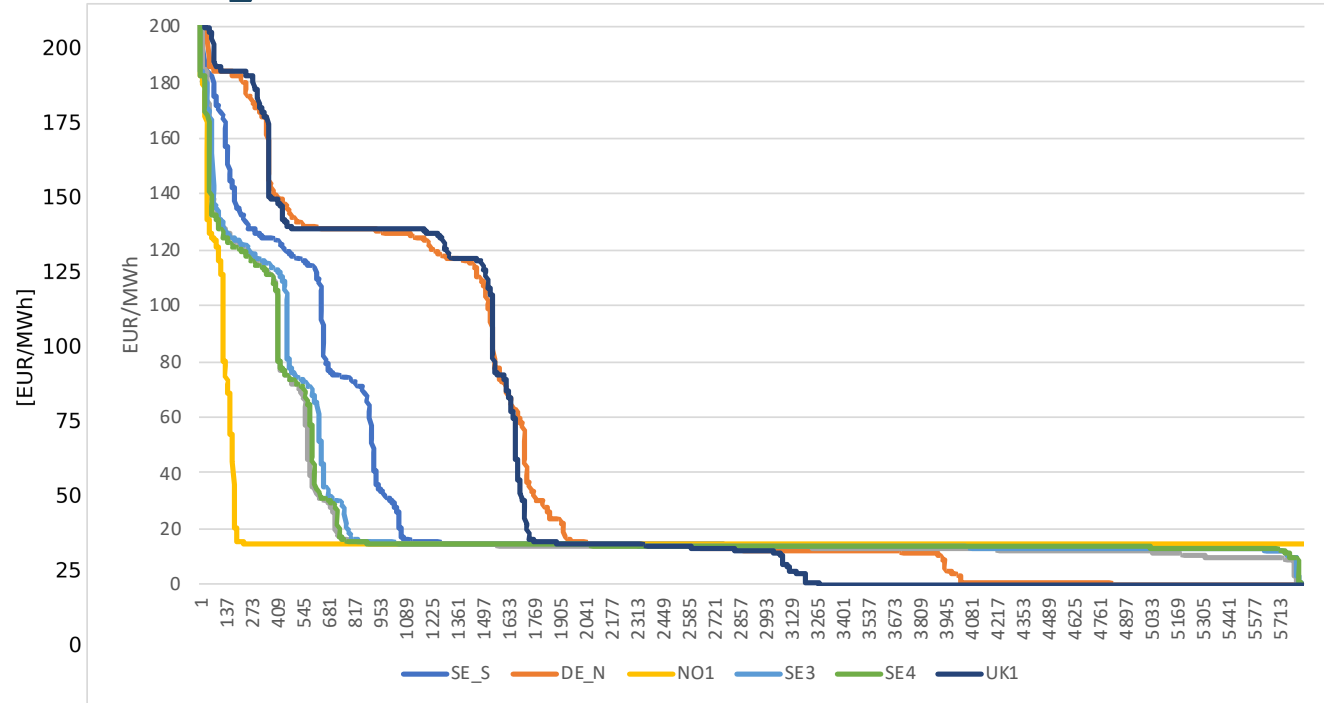
Nuclear reduce investments mainly in heat storages

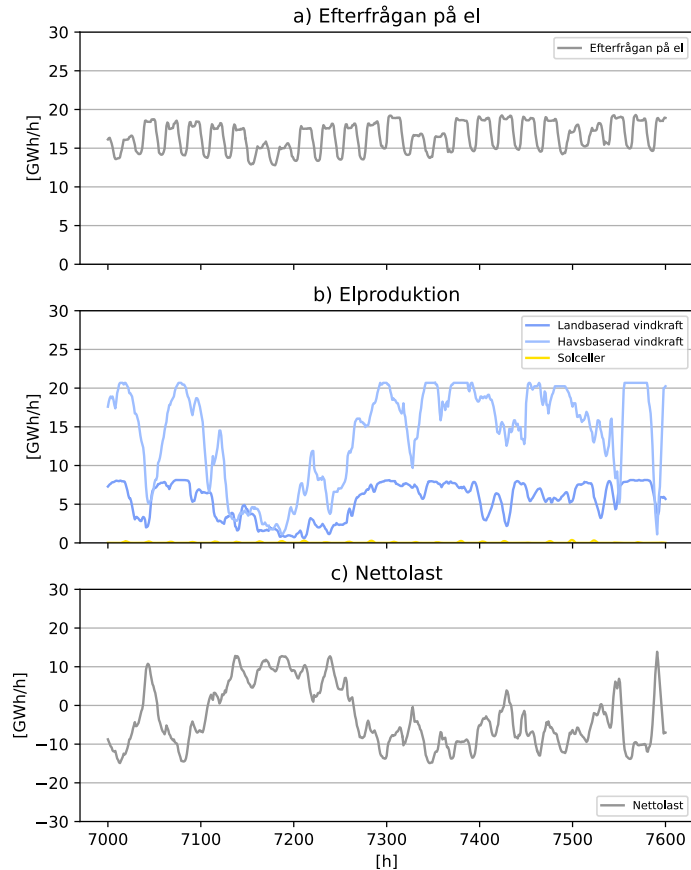


Value of electricity

Defined by wind power.

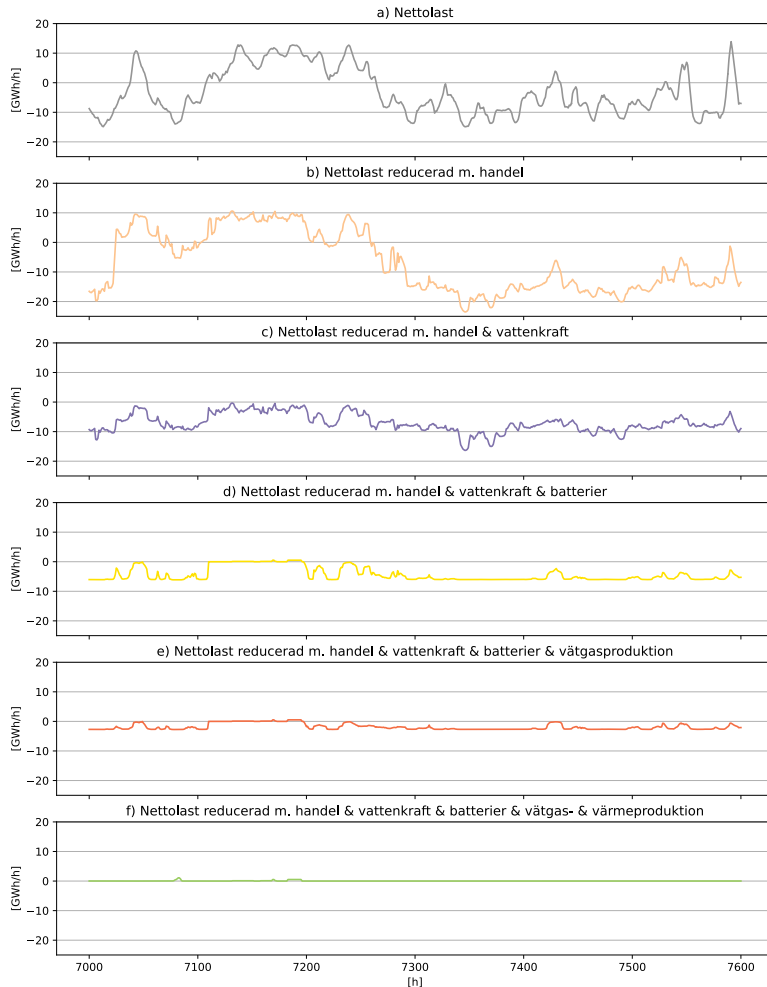
Highly varying even with nuclear power.





Variability

- Hydropower (30%) + wind power (70%)
- What if the wind isn't blowing?
- Strategies to manage variations
 - Trade
 - Hydropower
 - Stationary batteries and electric cars
 - Adapted hydrogen production
 - Adapted heat production



Strategies to manage variations

- South Sweden 3 weeks in fall 1991
- Trade reduce some peaks above 10 GW
- Hydropower reduce net loads up to 10 GW
- Batteries even out variations
- Hydrogen and heat lift the negative net load
 - Stimulate wind investments while avoiding consumption during low wind events -> reduce net load

Summary

- May go from net exporter to net importer
 - Depending on conditions for new electricity generation
- A varying electricity price in all three cases
 - Determined by the surrounding countries
 - 1500-1700h of high electricity prices
 - 7000 h of low electricity prices
- Electricity demand can be met in all three cases
 - Many options for flexibility
 - Combination of measures manage different types of variations
 - Overcapacity in electrolyser and heat pump
 - Investments in hydrogen storage and heat storage



CHALMERS