

The logo for Econ, a member of the Pöyry Group. It features the word "econ" in a dark blue, lowercase, sans-serif font. The letter "o" is stylized as a dark blue circle with a white crescent shape on its right side, and a solid green circle is positioned inside the white crescent.

MEMBER OF THE PÖYRY GROUP

Model results from the NEP scenarios

March 17, 2009

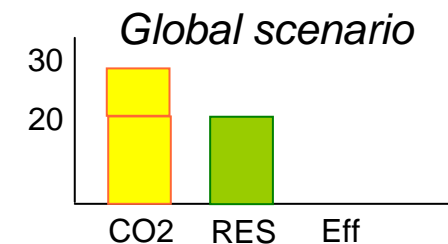
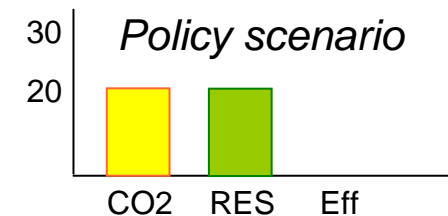
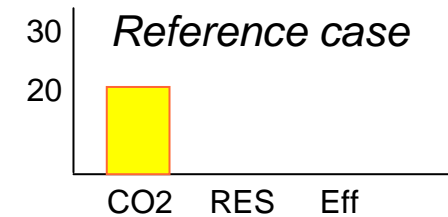
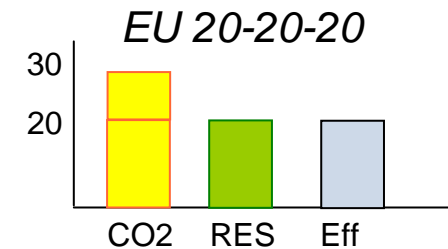
Berit Tennbakk, on behalf of the NEP modelling group

The NEP scenarios differ according to climate policies

- Basis for scenario formulation: EU 20-20-20 targets to 2020
 - 20% reduction in GHG emissions compared to 1990 levels (30% if global agreement)
 - 20% share of final energy consumption should be renewable energy
 - 20% increase in energy efficiency
- Reference case: 20-0-0
 - EU emission reduction policy, renewables according to national targets and policies
- Policy scenario: 20-20-0
 - EU emission reduction policy, renewables according to EU RES target
- Global scenario: 30-20-0
 - Global emission reduction agreement, renewables according to EU RES target

- **Focus of the analysis**
 - **Impact on Nordic energy balance and prices**
 - **Impact on Nordic CO2 emissions**

- **Important objective:**
 - **Gain insights through the use of different modelling tools**

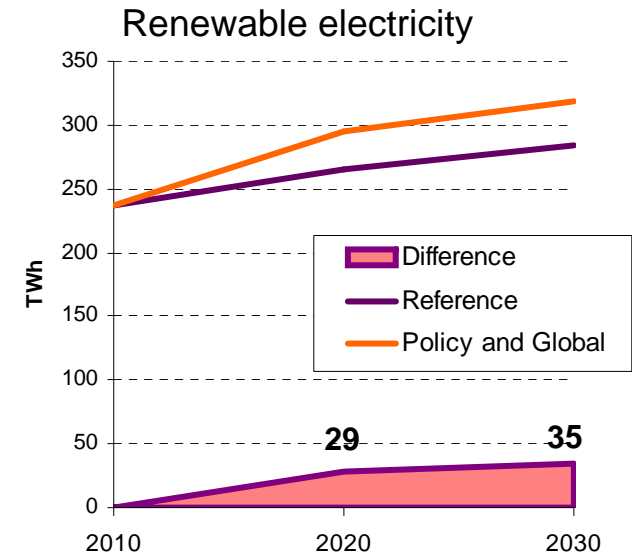


Main conclusions

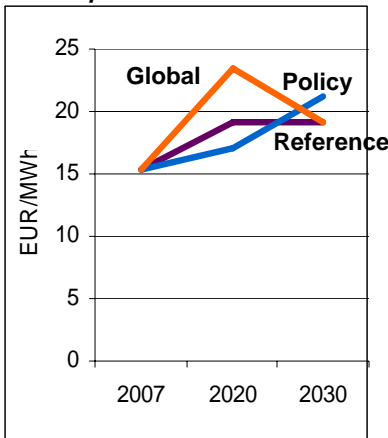
- *Qualitative results are fairly robust across models:*
 - Nordic electricity market balance: Increasing electricity surplus
 - Even with national policy targets and measures
 - EU policies imply even greater surplus
 - Prices stay below long run marginal costs in the Nordic area
 - No new investments in condensing power profitable
 - Climate and renewable policies have limited effect on electricity consumption
 - CO2 emissions: Reduction to 2020 and 2030 even in the Reference case
- *(Some) quantitative results differ significantly*
 - All models have limitations: Employing a portfolio of models increases insights
 - It is not possible to harmonize all model inputs: Results are not always comparable
 - The most important differences are
 - Demand representation
 - Modelling of trade
 - Coverage
 - Only electricity or inclusion of heat
 - Geographical scope
 - Price structure

Full model harmonization is not possible

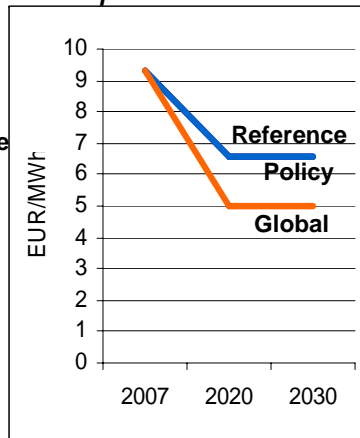
- ... or practical
 - E.g. fixing demand
 - E.g. fixing renewable electricity
- Main areas of harmonization
 - Continental electricity prices (Germany)
 - National renewables targets
 - Demand trend
 - Investment costs
 - New interconnections
 - Fuel and CO2 prices



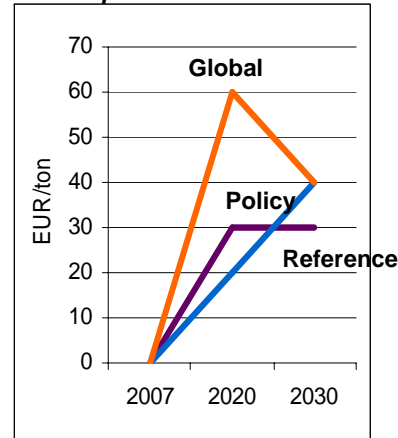
Gas prices



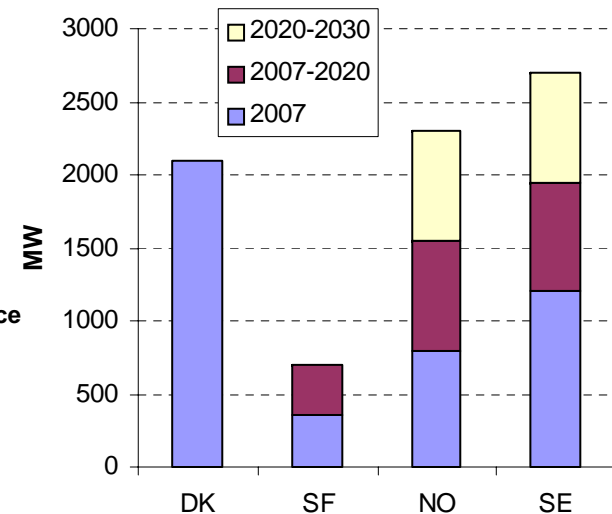
Coal prices



CO2 prices

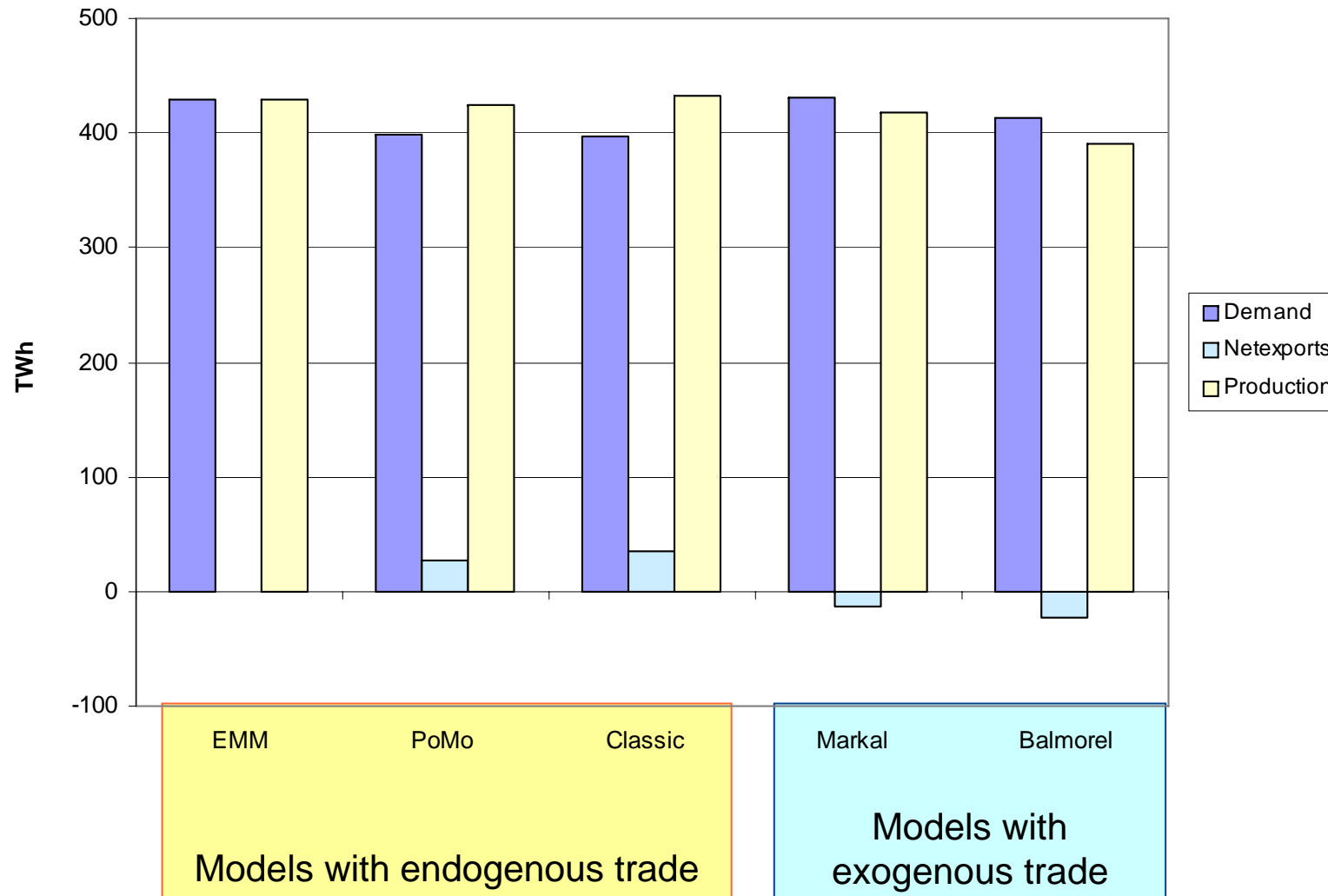


Transmission to Continent



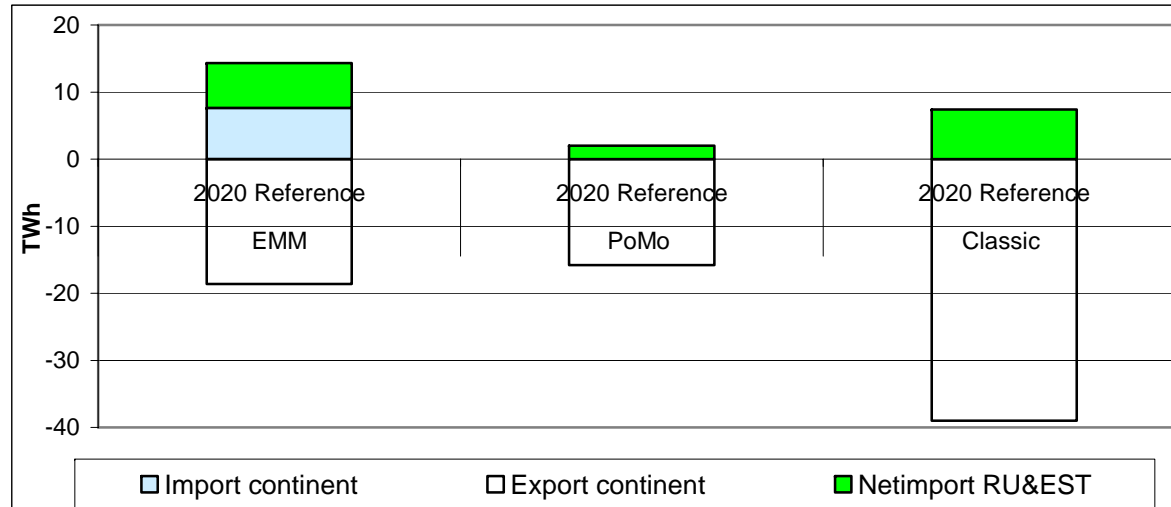
Reference case: Electricity market balances 2020

- Consumption differs according to modelling
- Trade against Continental prices yield net exports



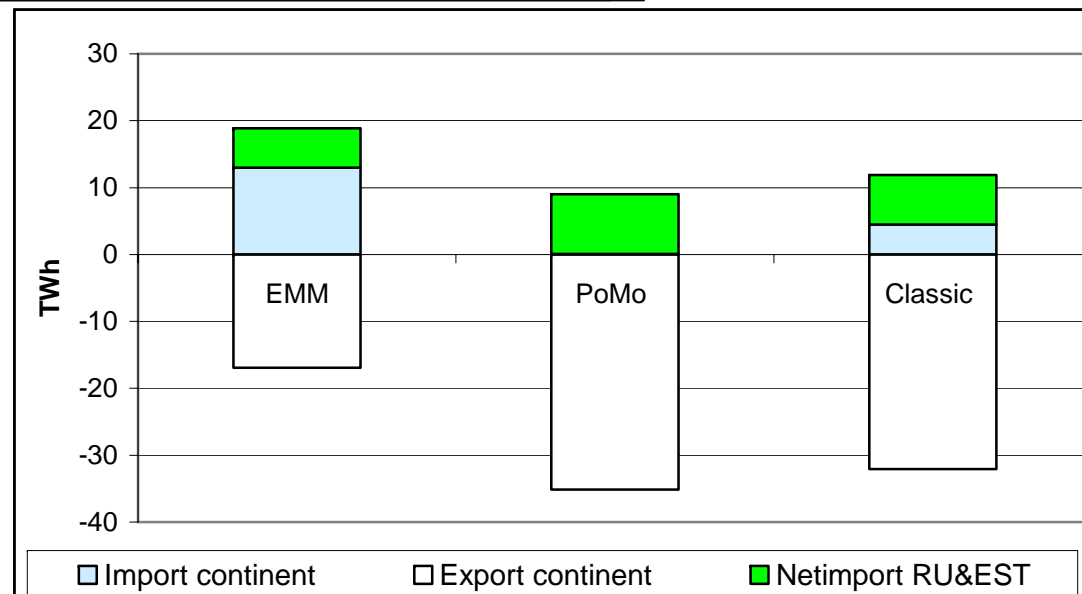
Reference case: Imports and exports

2020



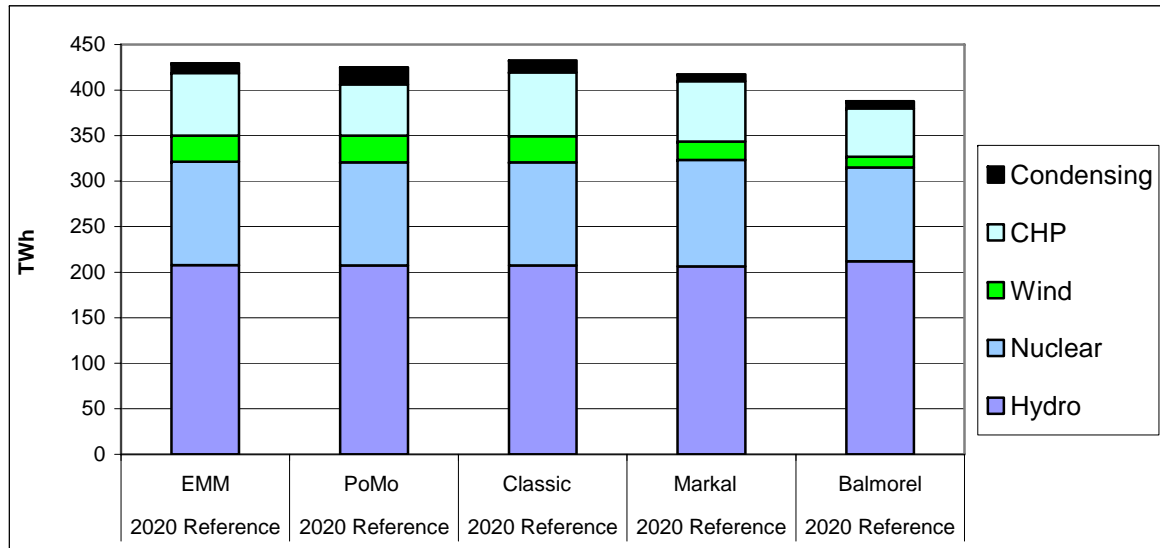
- Adjustments of trade flows:
 - EMM: Price structures and levels
 - PoMo: Weekly availability
 - Classic: Observed maximum flows

2030



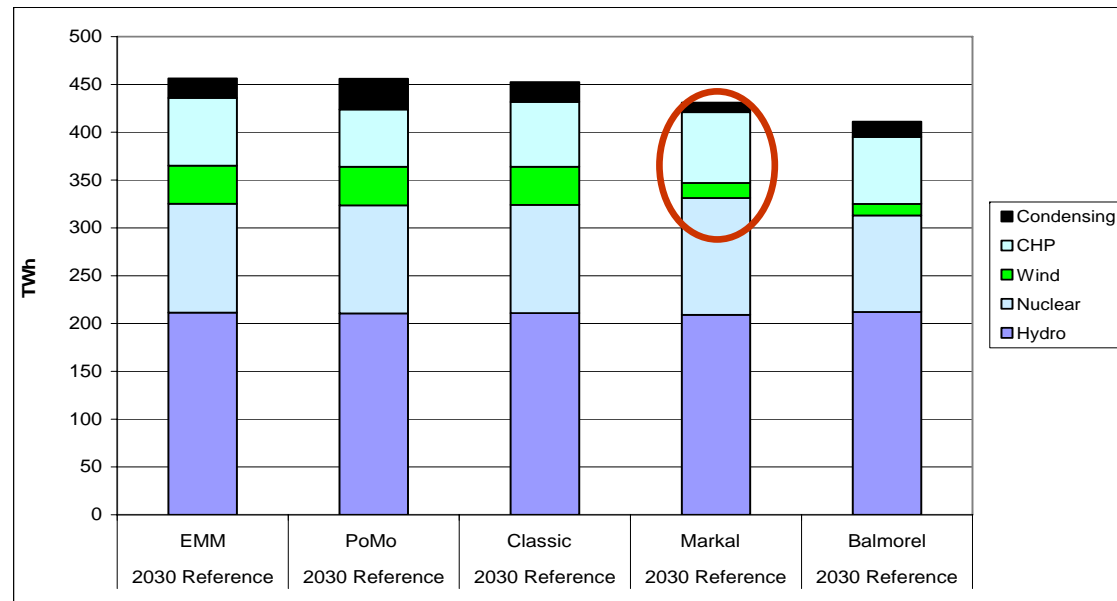
- Significant differences in trade results from different models
- None of the models capture trade accurately
 - Price structures
 - Prices in adjacent markets
 - Capacity utilization

Reference case: Electricity generation

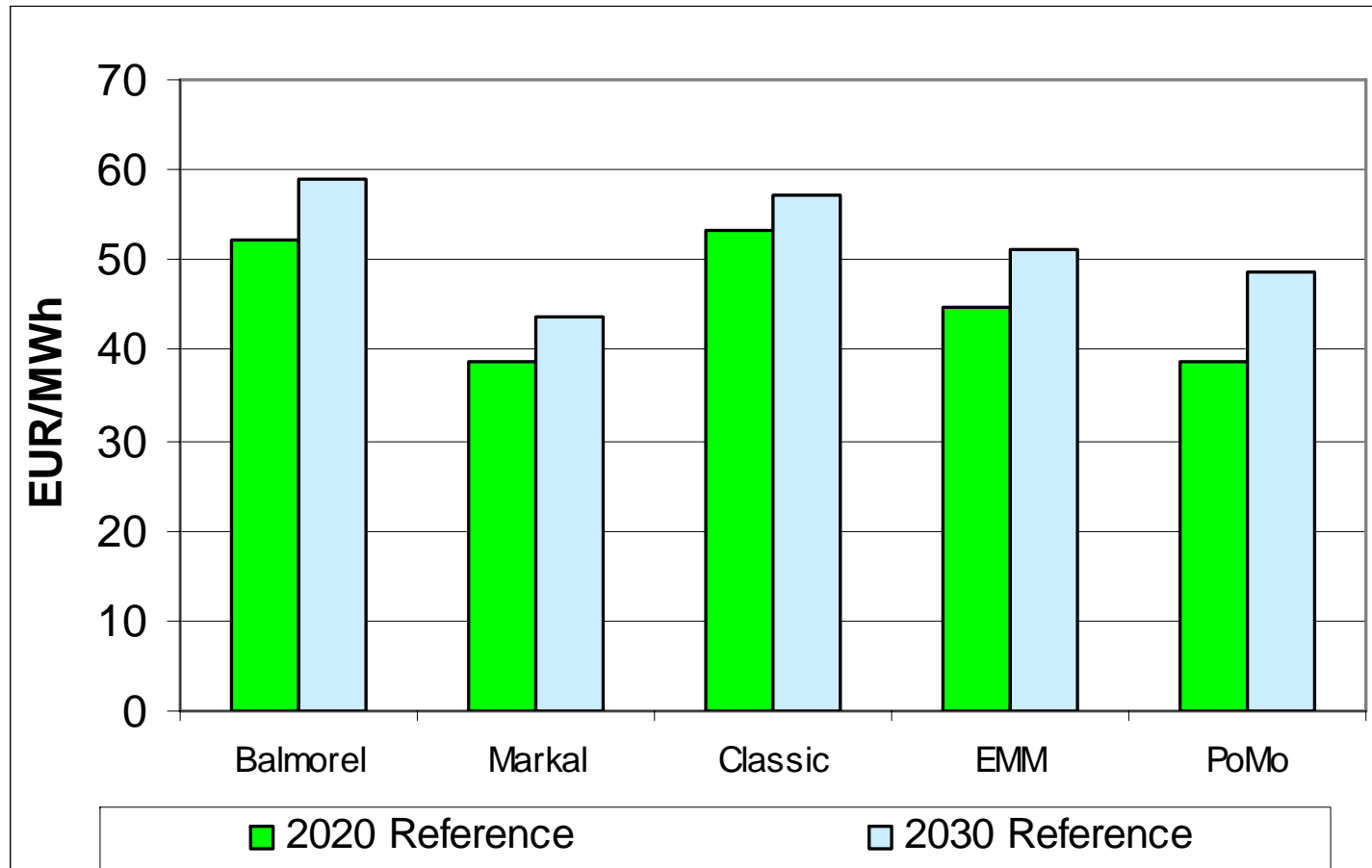


- Strong harmonization:
 - EMM: Price structures
 - PoMo: Weekly availability
 - Classic: Observed maximum flows

- Condensing fossil fuel generation marginal in the Nordic market
- ... but only a small share of total generation

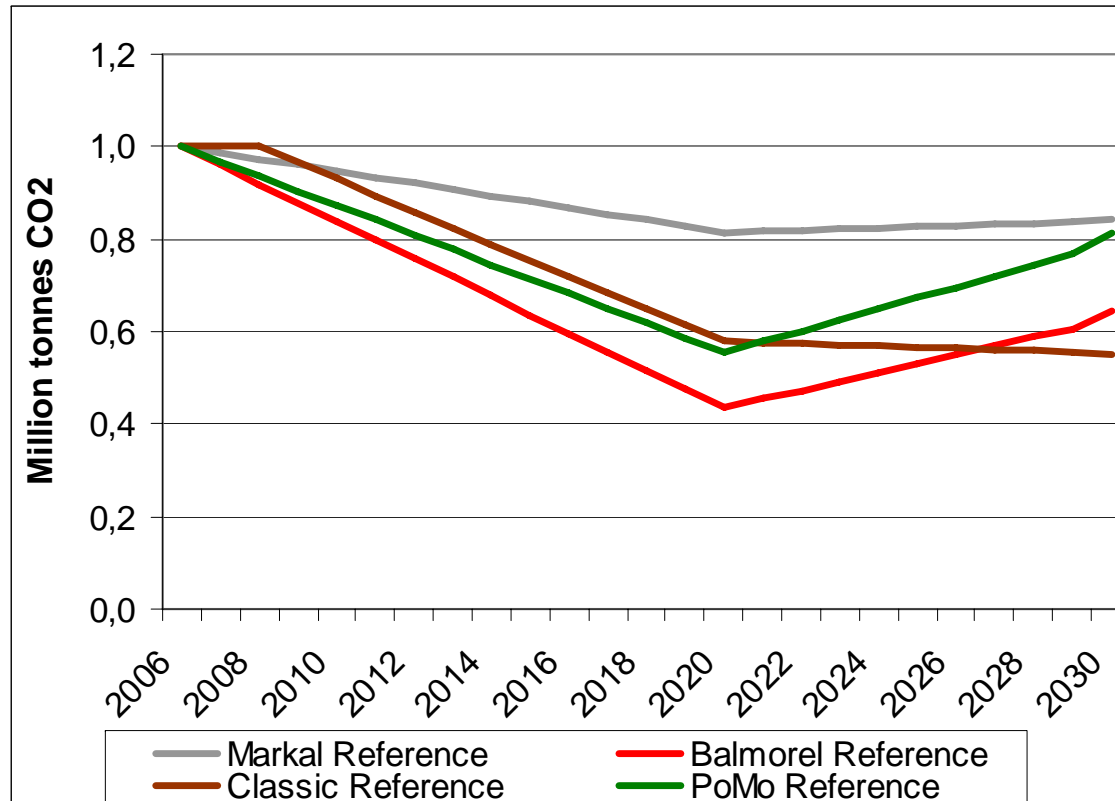


Reference case: Wholesale prices vary significantly!



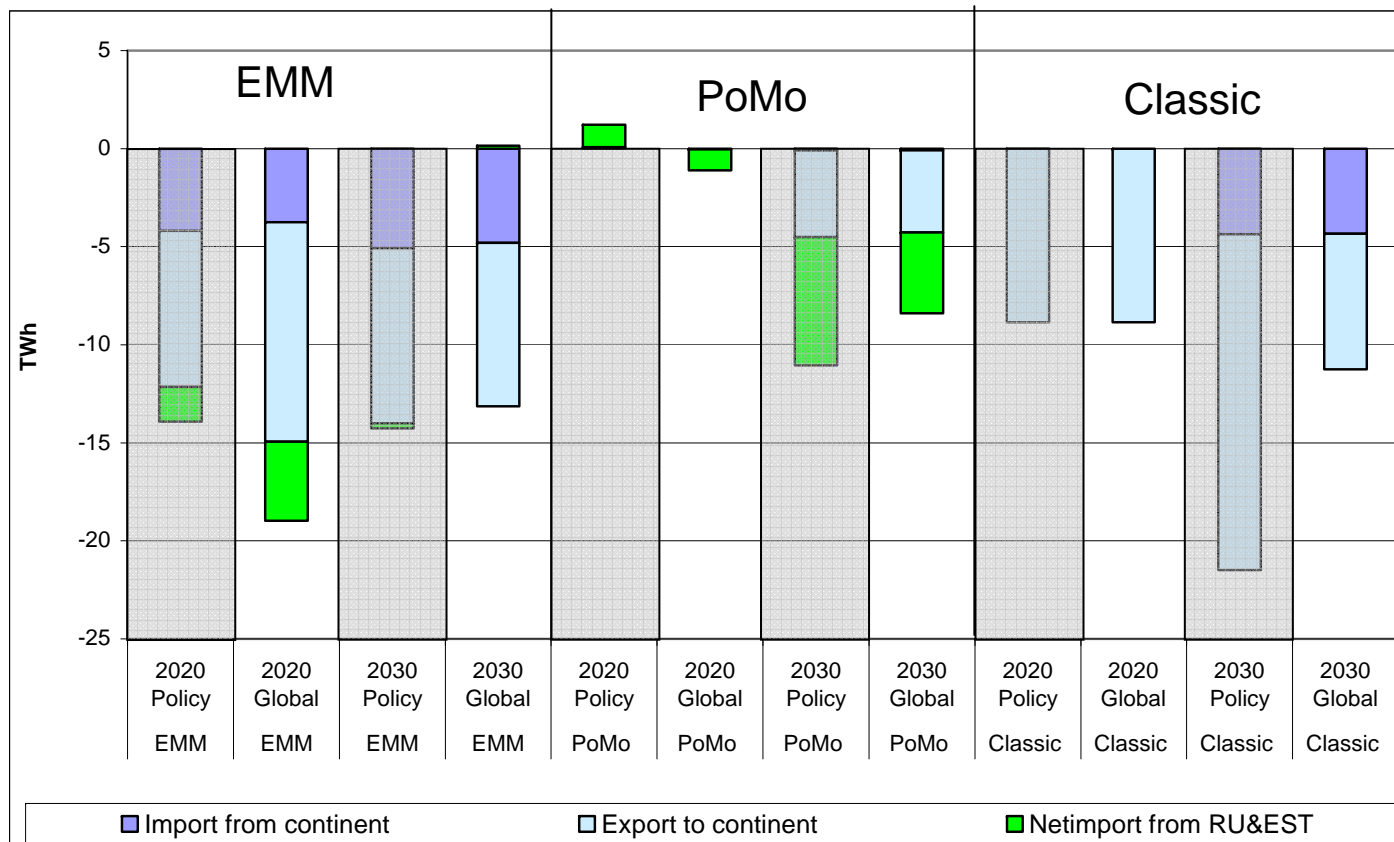
- Prices increase from 2020 to 2030 in all models
- With one exception, markets are not in long-term equilibrium
- Trade and demand modelling explains a great deal, plus investments

Reference case: CO2 emissions



- All models yield reductions
- CO2 emission levels are not directly comparable – differences in coverage

Scenarios: Increased exports to Continent



- Significant increase in exports to the Continent in all models
- Increases in exogenous capacities replace generation in condensing and CHP
- Only small changes in electricity consumption
- No robust *pattern*
 - Several inputs change – counteracting effects – uncertain total result

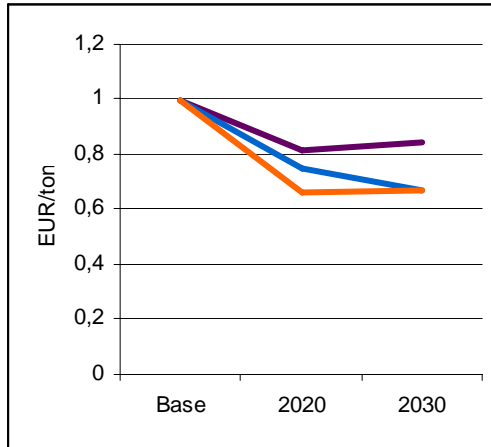
Scenarios: Prices still differ hugely



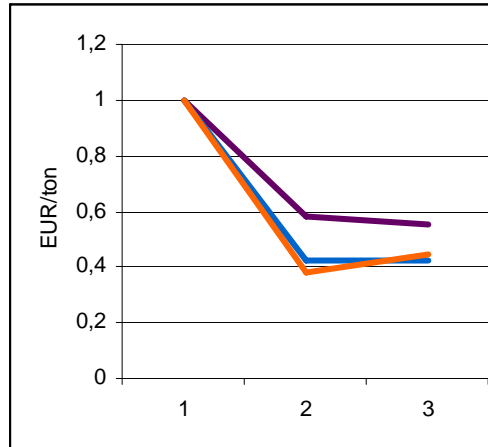
- Some patterns can be observed
 - Policy generally lower in 2020 – not so clear in 2030
 - Balmorel and Classic generally yield higher prices – but for different reasons

Scenarios: CO2 emissions

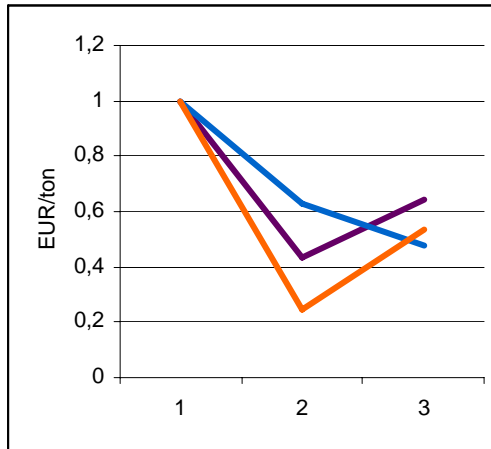
Markal



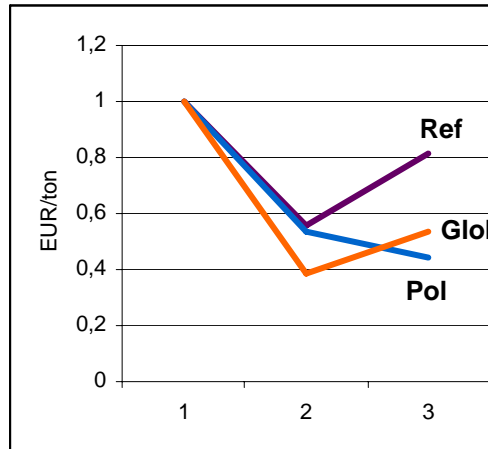
Classic



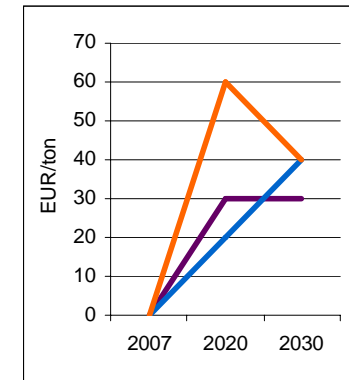
Balmorel



PoMo



Assumed CO2 prices



- Generally CO2 emissions tend to be lower in the policy scenarios
 - Policy scenario has stonger effect on emissions than Global scenario in the long run
 - To be expected given the CO2 price assumptions

Different model attributes and coverage affect results

- Demand representation
 - Fixed consumption: Assessments made outside the model
 - Demand elasticities: Demand responds to changes in prices and economic growth
 - Bottom-up consumption model – generates demand curve
 - Trade-offs in heat market
- Investments in new capacity
 - Exogenous input: Assessments made outside the model
 - Endogenous: According to profitability
 - Conventional capacities: Full costs vs. market price level
 - Renewables: Full costs vs. market price level and/or support level
 - Electricity only or electricity/heat/energy efficiency trade-off
 - Full investment horizon
- Trade with surrounding market areas
 - Exogenous input: Assessments made outside the model
 - Endogenous: According to price differences
 - May be adjusted to take account of simplifications in time resolution
 - Adjustment of availability (capacities)
 - Adjustment of prices in other areas
- Price structure according to time resolution
 - Seasonal prices
 - Weekly average prices
 - Load blocks
 - Hourly resolution

Lessons learned

- *It is not possible or desirable to harmonize all input assumptions*
- *Important results are similar in different models*
- *Important results differ between models*
- *... but we can explain why*
- *Using different models increases insights*



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