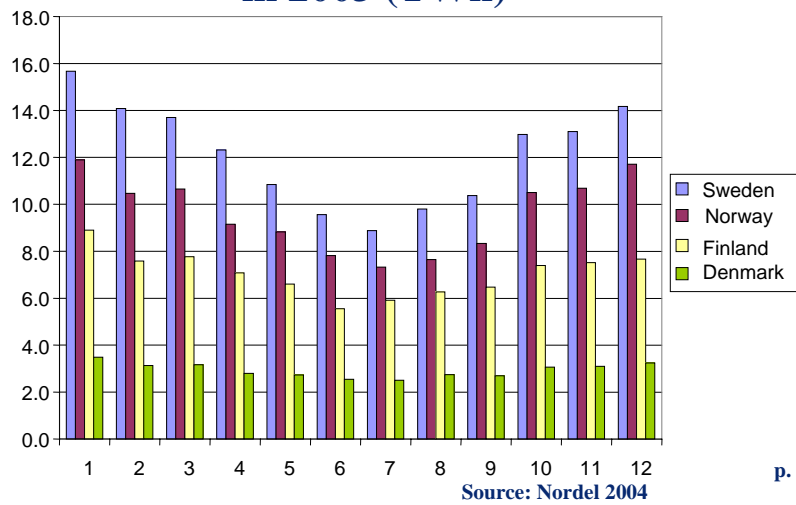


MARKAL/TIMES in Sweden - 2005 an update

Anna Krook Riekkola
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Monthly Electricity Demand in 2003 (TWh)

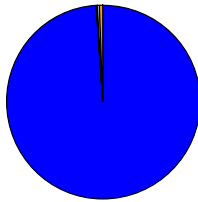


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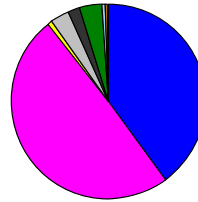
Total electricity generation by energy source 2003

- Hydropower
- Nuclear power
- Natural gas
- Oil
- Coal
- Biomass & Peat
- Wind power
- Other

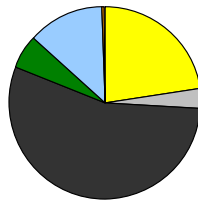
Norway: 107 TWh



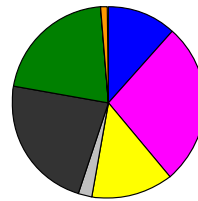
Sweden: 133 TWh



Denmark: 44 TWh

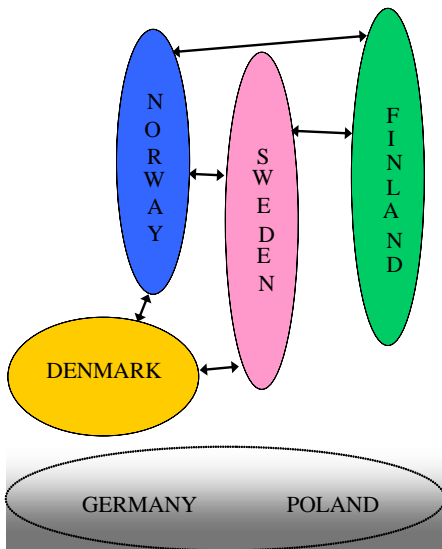


Finland: 80 TWh



Source: Nordel 2004

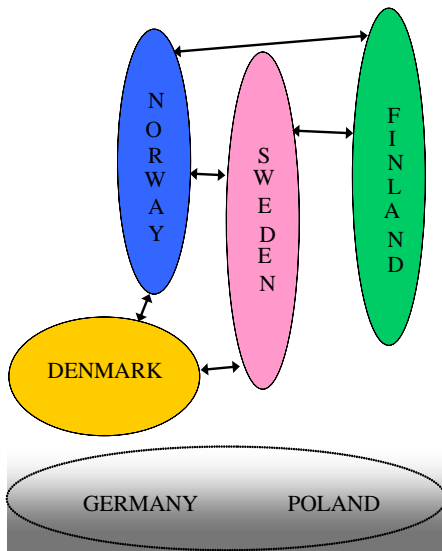
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Total trade in year: 2003	
To	To
Norway <=> Finland	0.2 / 0.1
Norway <=> Sweden	8.6 / 4.8
Norway <=> Denmark	4.5 / 0.7
Sweden <=> Finland	7.3 / 0.8
Sweden <=> Denmark	7.5 / 1.4

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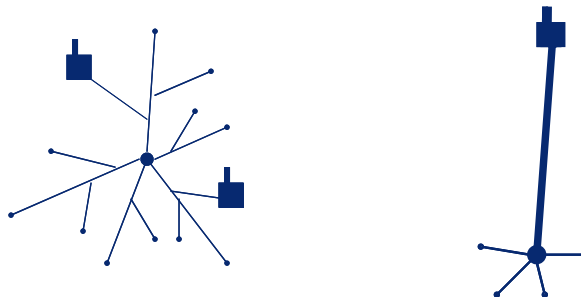


Total trade in year: 2002	
To	To
Norway <=>	Finland
0.2	0.1
Norway <=>	Sweden
2.8	12.0
Norway <=>	Denmark
2.2	2.9
Sweden <=>	Finland
2.5	6.5
Sweden <=>	Denmark
4.1	3.5

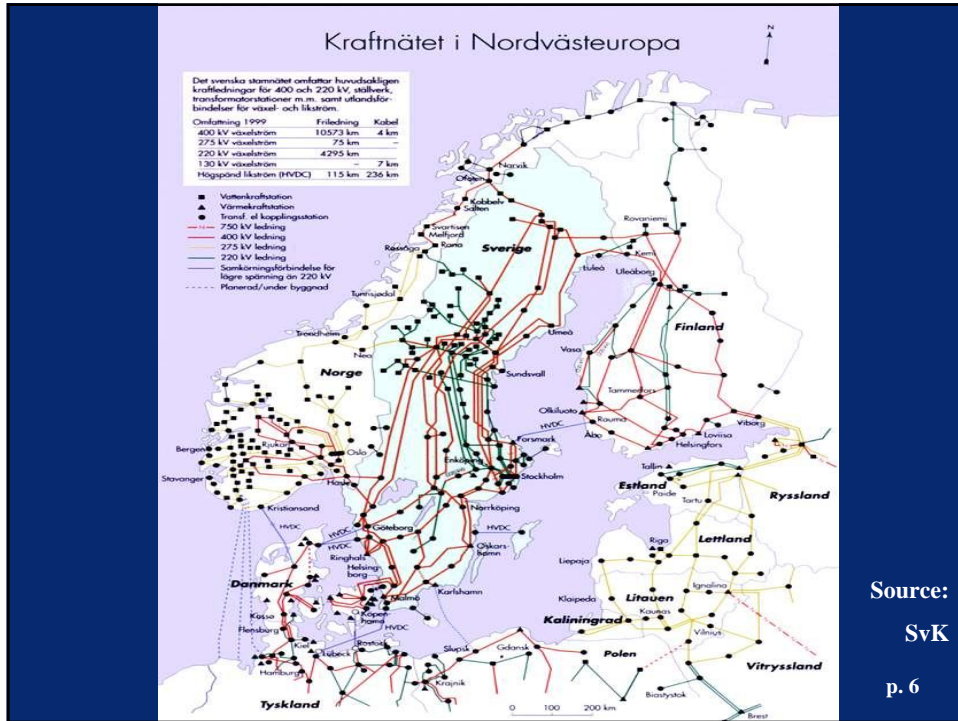
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p. 4-2

Development of electricity grids



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Trade of electricity – *Historical perspective*

- Around 1960: ”Samkörningsgruppen”
- 1995: Norway started Nordpool
- 1996: Sweden
- 1998: Finland
- 1999/2000: Denmark (West/East)

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Model – MARKAL_Nordic



- Regions: Swe, Nor, Fin and Den
- Time Horizon: 1995-2051 (7 years step)
- Focus on Grid distributed energy carriers
- Demand Sectors: 12-28 / country (no Transport)
- El. Conversion Technologies: 7-33 / country
- Stepwise Trade with Northern Europe
- Example on Studies:
 - Nordleden (trade with green certificates and emission permits)
 - Effects on the Nordic Electricity system from trade with Northern Europe

For more information contact: annak@chalmers.se

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Ongoing Projects with MARKAL/TIMES



- MARKAL_Nordic (Chalmers and Profu)
- NEEDS/TIMES_SNI (Chalmers)
- Externalities (Chalmers/LTU)
- Transport Sector (Chalmers)
- TIMES_VG_region (Chalmers)
- ASEAN MARKAL modeling project (Chalmers, SEI & ASEAN partners)
- Profu Projects

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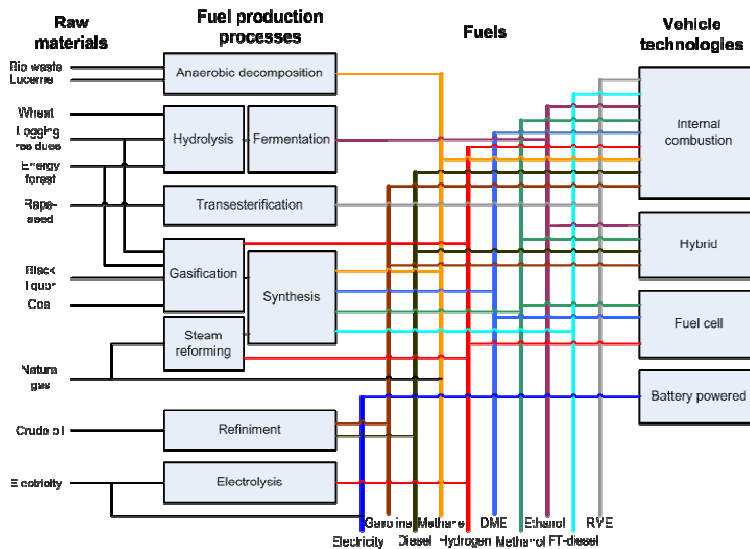
Transport sector



- **Aim:** To analyze the competitiveness of carbon reductions in the transport sector.
- **Developed a separate Transport model:**
 - Five end use demands (of vehicle kilometers); cars, light trucks, heavy trucks, buses, MC.
 - Possible to link to MARKAL_Nordic which enables comparison between CO₂-reductions in stationary energy sector to reductions in transport sector.
- **Preliminary results:**
 - Few early actions in the transport sector.
 - Fuel cells and electric hybrids play important role in the last time period but strongly dependent on cost development
 - Black liquor methanol more competitive in scenarios with no or low carbon constraints than in scenarios with high constraints.
 - Results strongly dependent on discount rate.

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Bio Refinery Rya project and the TIMES_VG_Region model



- **Aim:** To build a regionalized model for the greater Gothenburg Region (“Västra Götaland Region”) in order to analyze the importance of the district heat demand for distributed power generation.
- A part of a larger project where the possible role of biomass gasification are being explored.
- **Focus:** Comparing gasification technologies with other biomass technologies (especially CHP).

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ASEAN modeling project



- **Aim:** To study the importance of different energy scenarios for three ASEAN countries (VietNam, Philippines and Indonesia) from a European perspective.
- The modeling activities will build on a MARKAL model developed earlier in collaboration with Australian partners.
- **Focus:** Possible roles of renewable and in particular European renewable technologies.

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Profu - Studies with MARKAL



- A common Swedish-Norwegian market for Green Certificates – Focusing on the power production and certificate prices.
- New principle for allocation of emissions rights – A comparison between different allocation principles effects on the power production mix.
- Analyses for the forth Swedish Climate rapport – Focusing on the impact of different policy instruments on CO₂-emissions since 1990 up to 2020

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Important Energy issues for Sweden:

- Nuclear Phase Out
 - Renewable Energy
 - Waste incineration (good or bad?)
 - Energy saving
- Carbon emission trading



Thanks!

