

# Electricity Market Design

## Experiences and Issues in the Nordic Countries

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# The Nordic Electricity Market

- Annual electricity consumption around 390 TWh
- High (Finland and Sweden) and very high (Norway) per capita consumption of electricity
- Hydropower close to 100% of generation in Norway and around 40% in the Nordic area
- C4 around 0.5 for the Nordic market but much higher for the national markets, particularly in Sweden
- Some foreign ownership in Sweden, but not in the other Nordic countries

# Restructuring and market institutions

- The national electricity markets restructured between 1996 and 2000
- No border tariffs and a common power exchange, Nord Pool
- Nord Pool operates both spot and financial (futures/forward) markets
- National TSO:s responsible for system operation and the operation of real-time balancing markets

# Key design features 1

- Competition in generation
- Regulated TPA to the transmission and distribution network
- Full market opening and retail competition
  - Legal separation between distribution and retailing in Sweden and Finland
  - Accounting and management separation between distribution and retailing in Norway

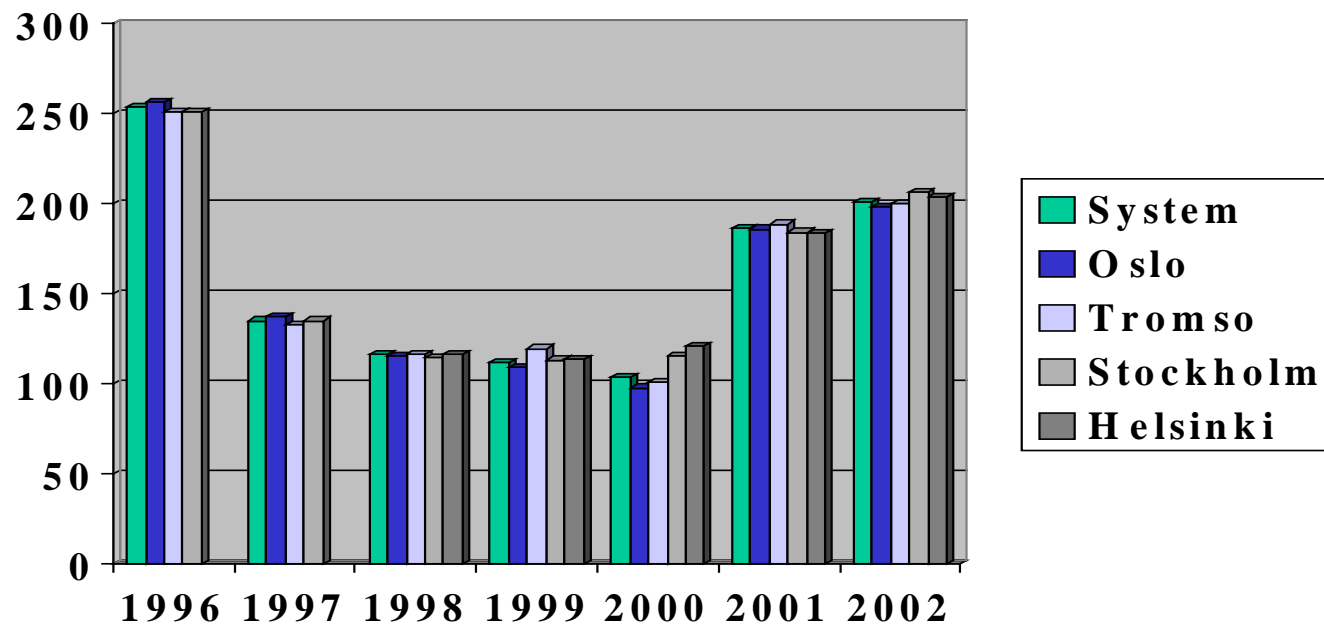
# Key design features 2

- Point-of-connection transmission tariffs
  - Transmission prices independent of distance between sellers and buyers
- Congestion management rules
  - Each country is a “price area”
  - Norway divided into several “price areas”
  - Counter-trade in Sweden and Finland
- Capacity payments
  - In Norway the TSO buys options to use peak capacity
  - In Sweden the TSO pays the power companies to keep a certain amount of reserve capacity

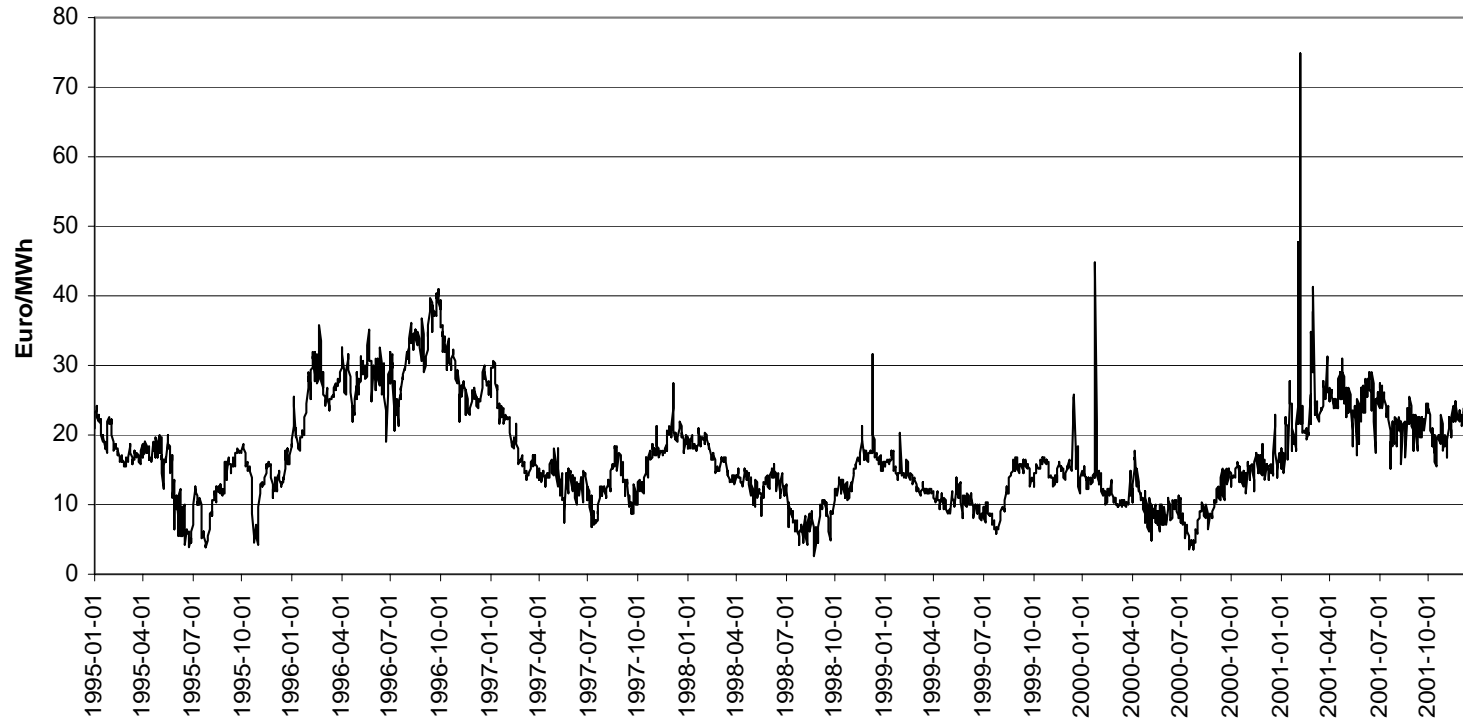
# Major experiences

- The lights are still on
  - But load close to capacity limits in January 2001
- Pre-tax electricity prices fell until 2002
  - But have increased in 2003
- Power industry productivity has increased
  - But around 4 000 MW of reserve capacity mothballed
- Significant restructuring of the power industry
  - Increasing integration of generation and retailing in Sweden

# Elspot system and area prices (NOK/MWh)



# Nord Pool system prices 1995-2001



# Wholesale prices

- Significant variations in annual average prices
  - Primarily reflecting hydropower supply variations
- Average area prices do not differ significantly
  - Indicates that the wholesale market is well integrated
- Except for short term price spikes no obvious signs of market power 1996-2002

# Autumn 2002 – spring 2003 (1)

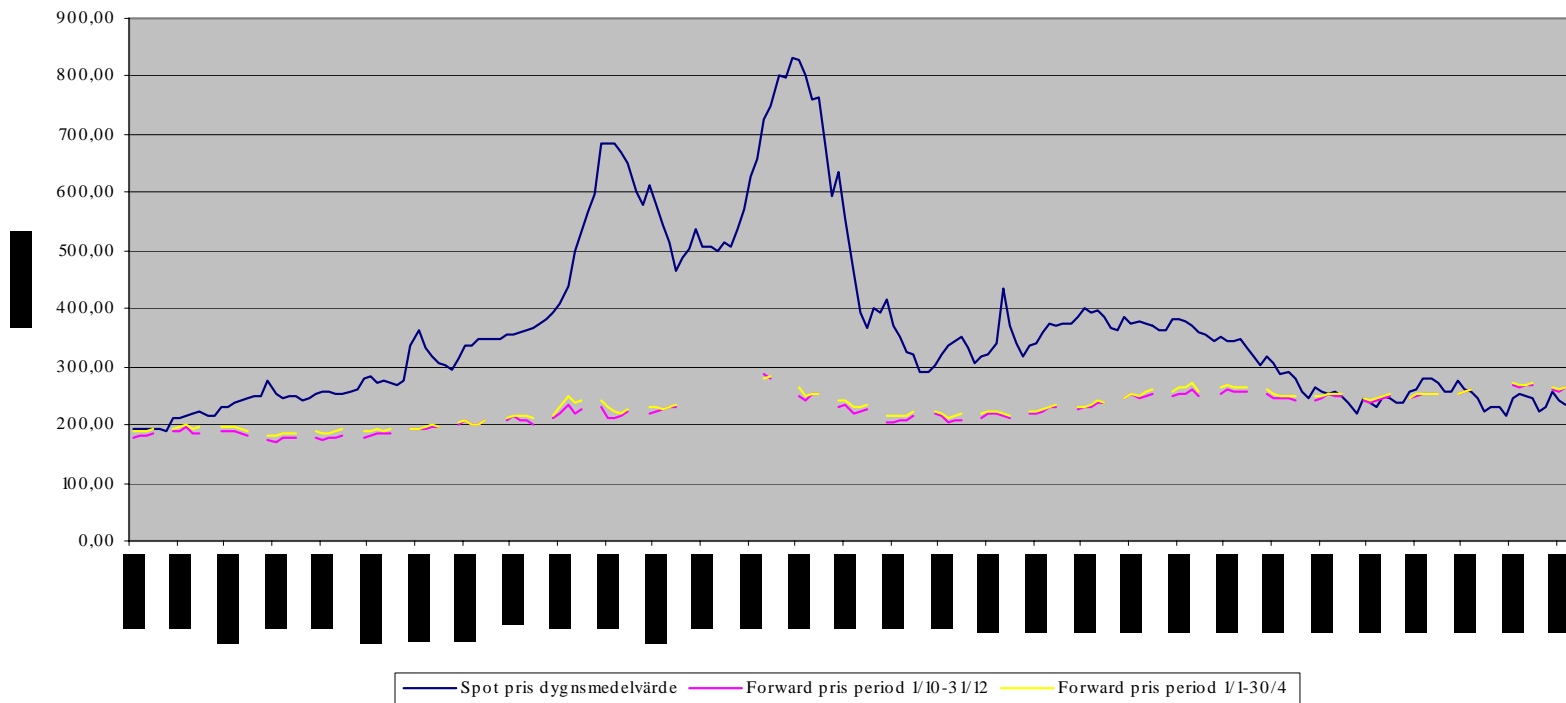
- The summer and autumn 2002 was extremely dry both in Norway and Sweden
- As a result stored water reached the lowest level in 50 years
- In view of uncertainty about winter temperatures and precipitation power companies held back hydropower generation

## Autumn 2002 – spring 2003 (2)

- As a result spot prices reached and remained at very high levels:
  - Above 65 €/MWh from early December to late January
  - Between 95 and 115 €/MWh from late December to early January
- But 2-year forward prices were not significantly affected

# Spot and forward prices

## October 2002 – April 2003



# Observations

- The extremely high spot market prices did not create severe financial problems
  - Retail customers in Sweden to a large extent have fixed-price contracts, but less so in Norway
  - Generators, retailers and industrial customers were well hedged by financial contracts (forwards and futures)
- But the limited impact of high spot prices on consumer prices made demand very inelastic to spot market prices

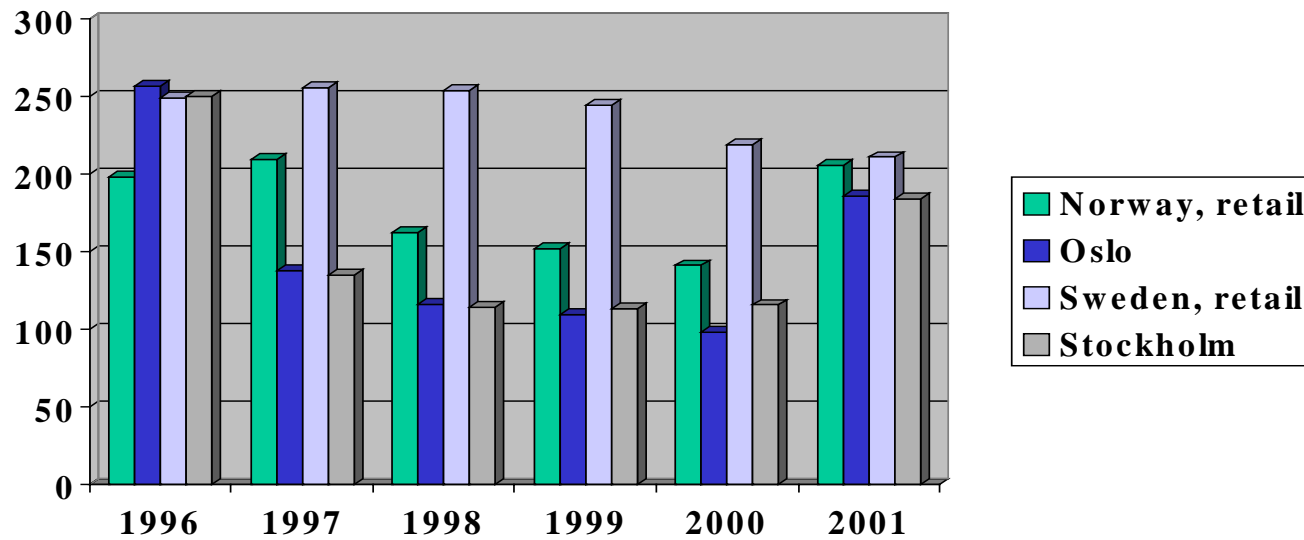
# Two issues for future investigation

- Was the reduced hydropower generation 2002-2003
  - Efficient precaution in view of major uncertainties?or
  - Exercise of market power?
- Fixed-price customers paid less than 30 €/MWh when the spot was above 65 €/MWh
  - How should retail contracts be designed in order to hedge price risks as well as to induce customers to react on spot price variations?

# Market integration

- The wholesale market well integrated
  - “The law of one price” applies a significant share of the time (with 2000 as the majors exception)
- But the retail markets not integrated
  - Prices differ significantly between the countries
  - Most retailers operate only on their home market

# Retail and wholesale prices (NOK/MWh)



# Why are retail prices so high in Sweden?

- 1996-2000: Free choice of supplier only for customers with real-time metering (high "switching costs")
- Increasing concentration in the Swedish retail market
  - To some extent reflecting economies of vertical integration of generation and retailing (made possible by the legal separation of distribution and retailing)

# Emerging problems?

- "Too" low short-term elasticity of demand with respect to the spot market price
  - Excessive price volatility
  - Inefficient consumption
- Market power in the retail market
- Inefficient or insufficient provision of peak-load capacity