Energy balances 2012

Power balances 2012/2013

June 2009

CONTENTS

Prepared by Nordel's Balance Group May 2009

SUMMARY OF THE FORECASTS

Energy balance 2012

The annual electricity consumption in the Nordic market (excl. Iceland) is estimated to grow to about 398 TWh by the end of year 2012 from 396 TWh in 2008 (not temperature corrected, including electrical boilers). The consumption for Iceland was in 2008 16 TWh and is estimated to grow to about 19 TWh. The production in the Nordic market (excl. Iceland) in a year with normal conditions is estimated to be 414 TWh in year 2012.

Power balance 2012/13

The Nordic peak demand in a winter with normal temperature (1 of 2 years) is estimated to 68 100 MWh/h. The Nordic peak demand in a cold winter (1 of 10 years) is estimated to 71 700 MWh/h. All time high is 69 000 MWh/h (February 2001).

New production

Investments in production capacity before the end of 2012 are estimated to increase the installed production capacity by about 7 000 MW.

The new nuclear unit in Finland is expected to be in operation in 2012, and is included in the energy balance (part of the year) and in the power balance 2012/2013.

Iceland is presented separately and it is not included in the other figures.

CONCLUSIONS

Energy balance 2012

The Nordic electricity system is able to meet the estimated consumption and the corresponding typical power demand pattern in average conditions even without imports.

The energy balance in 2012 is better than the former Nordel estimates. This is primarily because of lower consumption prognosis due to the financial crisis and new, planned production capacity.

In order to meet the energy demand in extremely low inflow conditions the Nordic power system needs to import from neighbouring countries. Some areas in Norway can be exposed to a risk of rationing in case of extremely low precipitation.

Power balance 2012/13

The Nordic power system is sufficient to handle the peak demand situation even on a cold winter day (1 of 10 years).

In practice, the balance between Nordic supply and import/export will be based on the prevailing market situation between the Nordic electricity market and the neighbouring markets.

Security of Supply 2012/13

Security of Supply was analysed last year for 2011/12 and the analyses clearly showed that all the Nordic countries fulfilled the criteria of Nordel for security of supply. Considering this years balances, it is judged that this will also be the case for 2012/13.

Chapter 1

FORECASTS

CONSUMPTION

	Energy 2008 TWh/a	Energy 2008 TWh/a Temp corr	Energy 2012 TWh/a	All time peak MWh/h	Peak 2012/13 MWh/h Cold
Denmark	36	35	35	6 480	6 800 1)
Finland	87	89	85	14 900	14 200 1)
Norway	129	133	130	23 050	23 800 1)
Sweden	144	147	148	27 000	28 600 1)
Nordel	396	404	398	69 800	71 700 2)

1) Probability once in 10 years

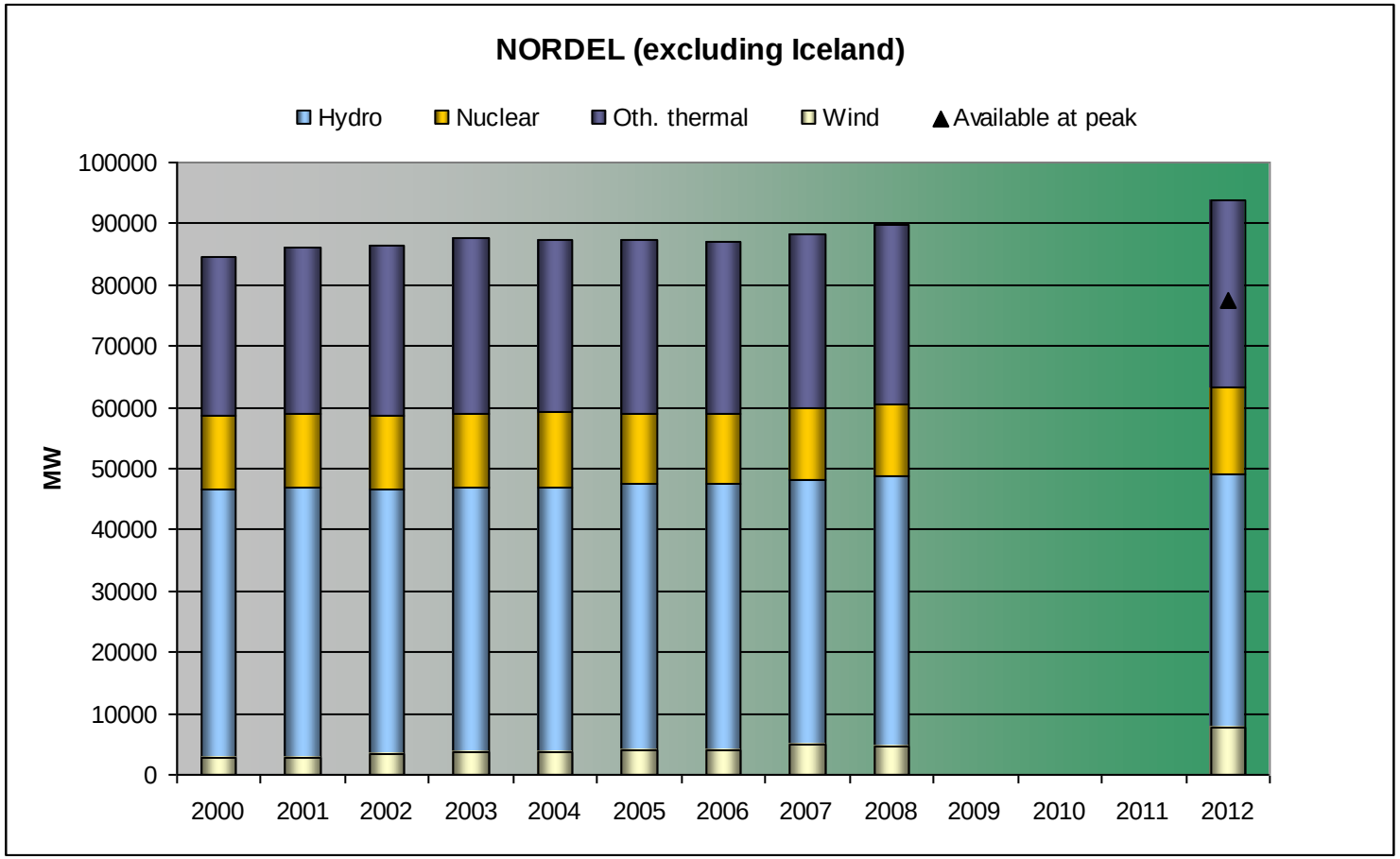
2) The peak for the whole system is calculated to be 97,7 % of the sum of the country specific peak.

NET ADDITIONS IN GENERATION CAPACITY [MW] 2009 to 2012 (decided and planned)

	Hydro	Nuclear	Other thermal	Wind	Planned new capacity	Available capacity at peak*)	Investment decided
Denmark			106	830	936	106	80 %
Finland	50	1650	320	40	2060	2020	95 %
Norway	600		280	130	1010	880	80 %
Sweden		1090	700	1740	3530	1790	85 %
Nordel	650	2740	1406	2740	7536	4960	

- Available wind capacity at peak is 0% for each country but 6% for Nordic countries together

INSTALLED PRODUCTION CAPACITY
(at the end of year)



2000 to 2008 are historic values. 2012 is the balance made this year.

CHANGES IN INTERCONNECTIONS

The prioritised grid investments in the Nordic Grid Master Plan 2004/2008 are scheduled as followed:

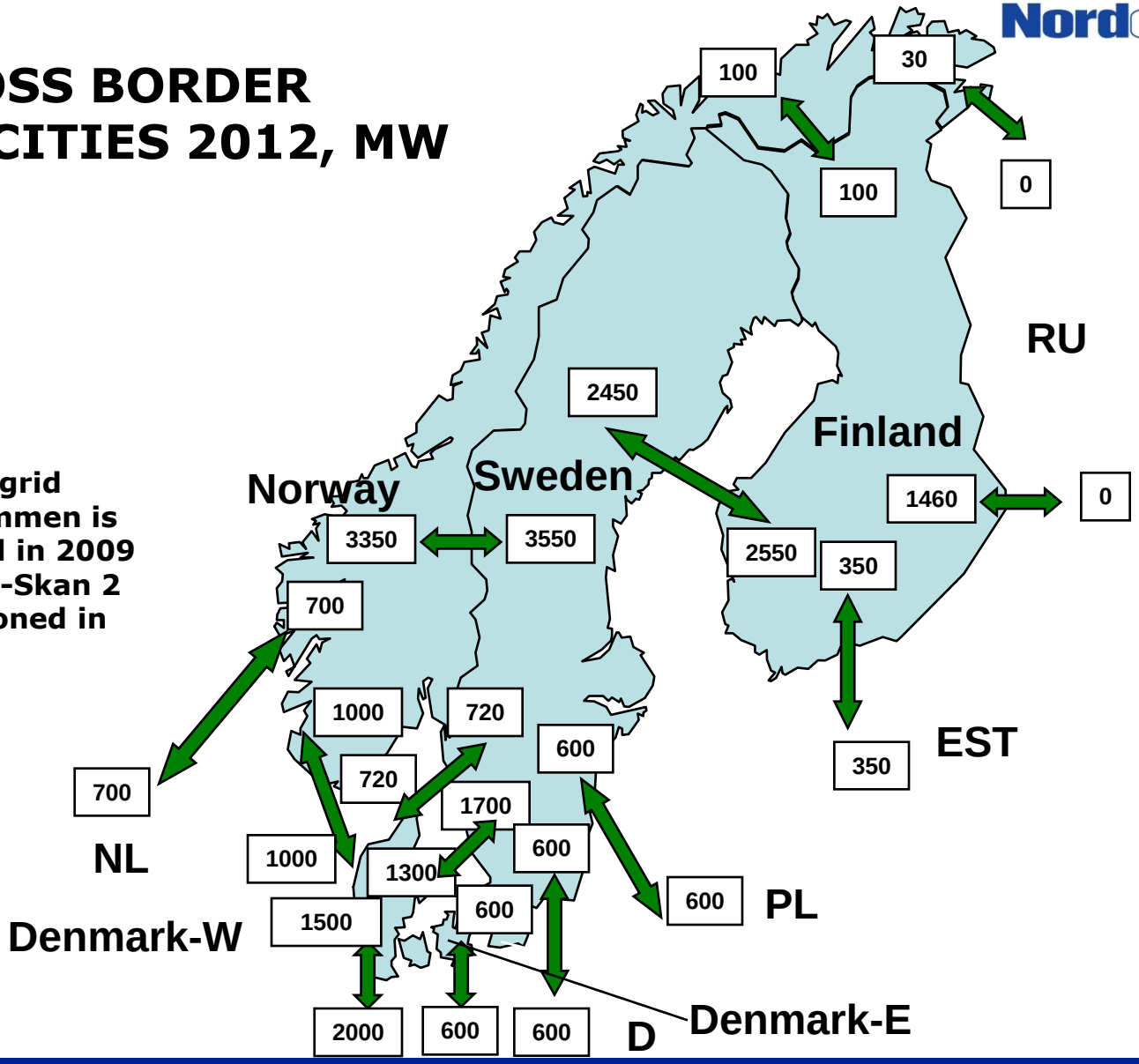
Nea – Järpströmmen, 420 kV line between Norway and Sweden is expected to be commissioned in autumn 2009.
Great Belt, 600 MW connection between Eastern and Western Denmark, is expected to be commissioned 2010.
Fenno-Skan 2, 800 MW new capacity on the connection between Finland and Sweden, is expected to be commissioned at the end of 2011.
SouthWest link (earlier South link), a 1200 MW link Southern Sweden – Norway expected to be commissioned in 2016.
Skagerrak 4, a Letter of Intent for the project is signed. According to the time schedule connection can be commissioned earliest in 2014.
Ørskog-Fardal (North-South axis), 420 kV line in Norway is expected to be commissioned in 2013.
Ofoten-Balsfjord-Hammerfest (Arctic region), 420 kV line in Norway is expected to be fully commissioned in 2016.

The interconnection between Jutland and Germany is expected to be upgraded to 1500 MW northbound and 2000 MW southbound before 2011.

A number of new interconnections out of the Nordel area will undergo further analysis in the coming years. Among these are interconnections between Sweden and the Baltic countries, Kriegers Flak between Denmark, Sweden and Germany, interconnections from Norway to Germany, Holland and Great Britain, a second interconnector between Estonia and Finland and an interconnector between The Netherlands and Denmark.
None of these will be in commission by the end of 2012.

AVAILABLE CROSS BORDER TRADING CAPACITIES 2012, MW

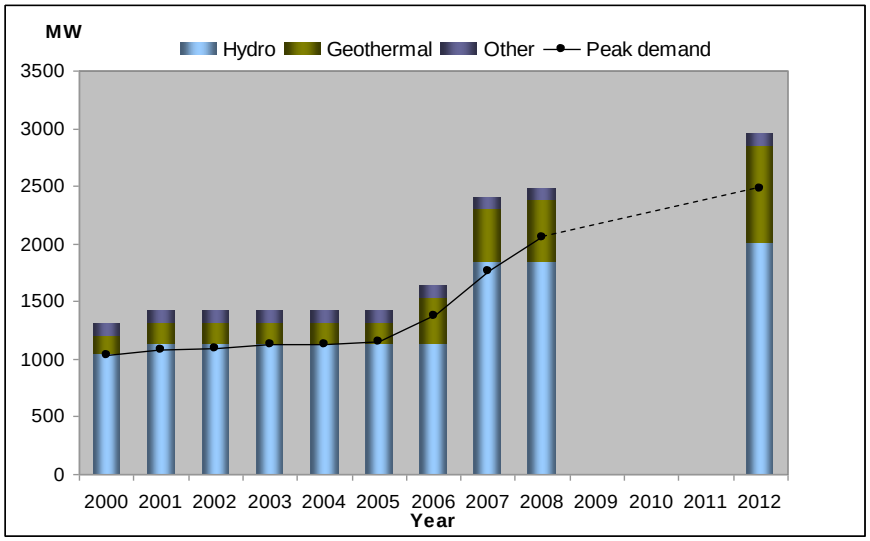
Of the five prioritised Nordic grid investments, Nea – Järpströmmen is expected to be commissioned in 2009 and the Great Belt and Fenno-Skan 2 are expected to be commissioned in 2010 and 2011, respectively.

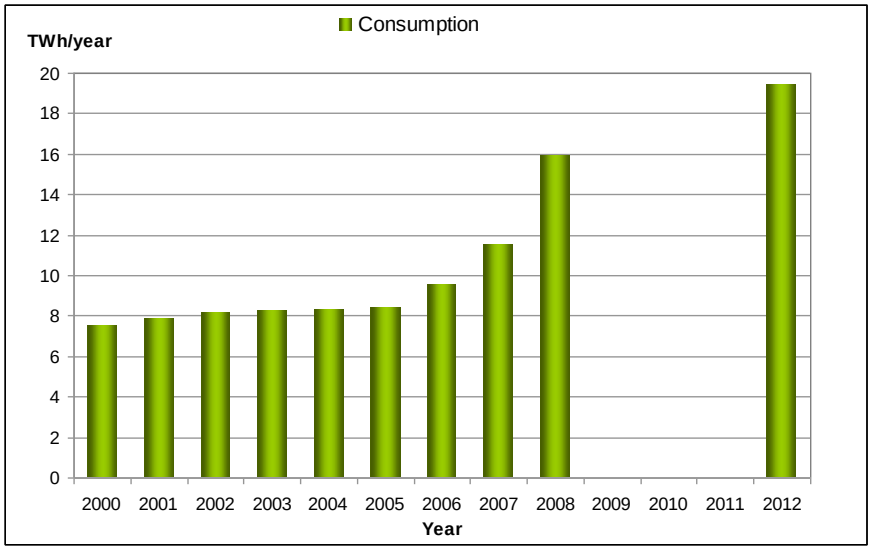


ICELAND

Iceland is not included in the figures elsewhere in the report.

The annual energy consumption in Iceland is estimated to grow by about 3.5 TWh by year 2012 (5.1 %/a) due to aluminium foil plant and new aluminium plant to be started in the period from 2009 to 2012. The consumption growth will be balanced by existing plants, extensions in existing plants and new power plants.





Chapter 2

ENERGY BALANCES 2012

Energy balances

ENERGY BALANCE 2012
Average conditions

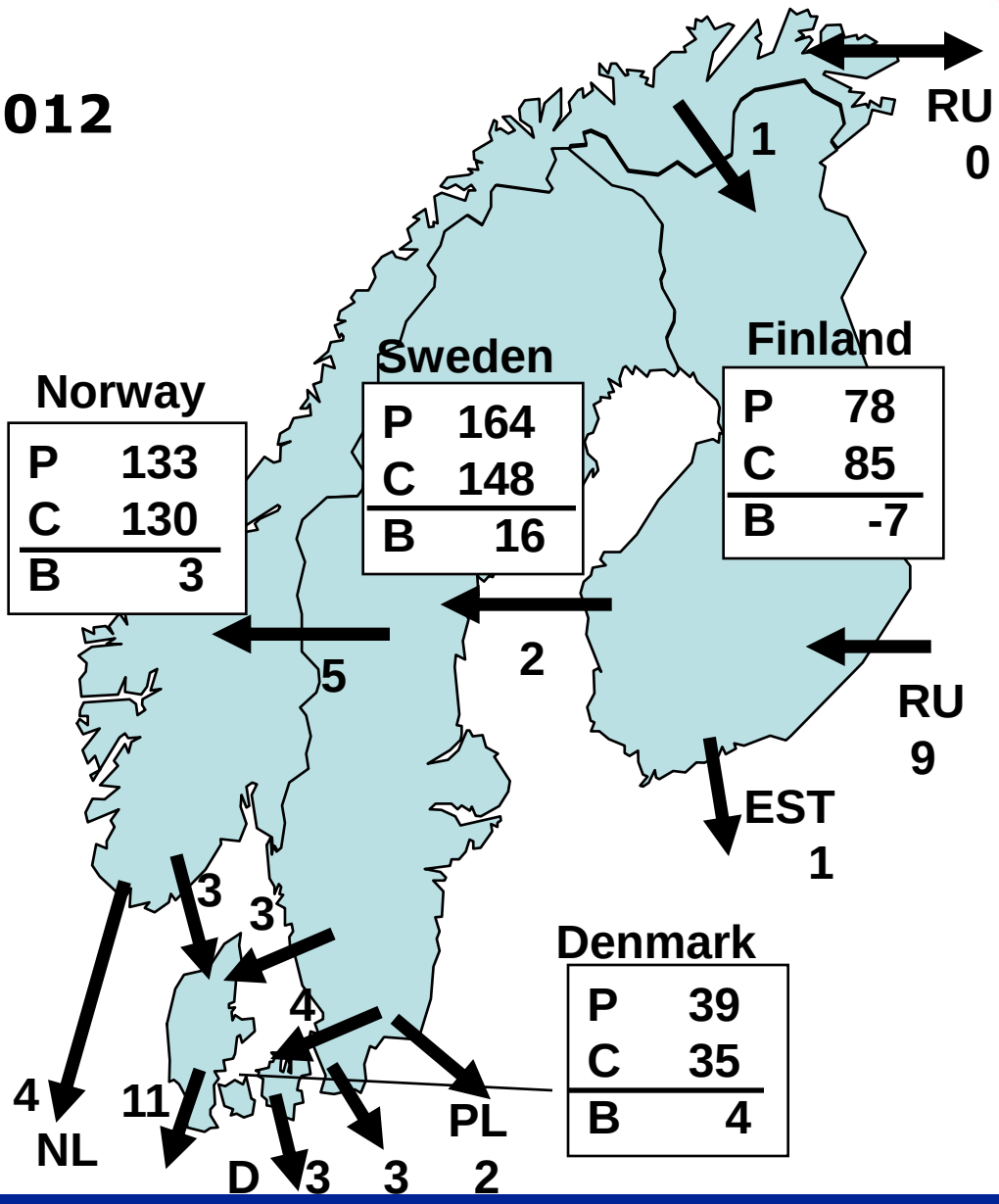
The *Energy Balance* on pages 14 to 15 illustrates the market-analysed physical exchanges between areas in a normal year. The exchange between the Nordic and Continental markets is based on market-analyses of the Nordic market and price forecast for the Continental market. The analysis assumes the fifth nuclear power plant in Finland coming in operation during the year.

- **The Nordic electricity system is able to meet the estimated consumption and the corresponding typical power demand pattern in average conditions even without imports.**
- **The overall Nordic balance has increased with 15 TWh compared to the balance made last year. The Nordic consumption has dropped by 22 TWh compared to the energy balance 2011 made last year.**
- **Like in the 3 year balance from last year there is still significant import from Russia.**
- **Net export towards Central-Europe is increasing. From last year there has been an increase of 13 TWh. This better balance is mostly due to a large decrease in the consumption in all the Nordic countries. The Financial crisis has set its mark on the electricity consumption, and if it continues the consumption may be even lower than assumed here.**
- **It is expected that there will be net export from Finland to Estonia due to the closing of the nuclear power plant Ignalina in Lithuania in 2009.**

ENERGY BALANCE 2012

Average of all inflow years

P = Production
C = Consumption
B = Balance without energy exchange
All units in TWh

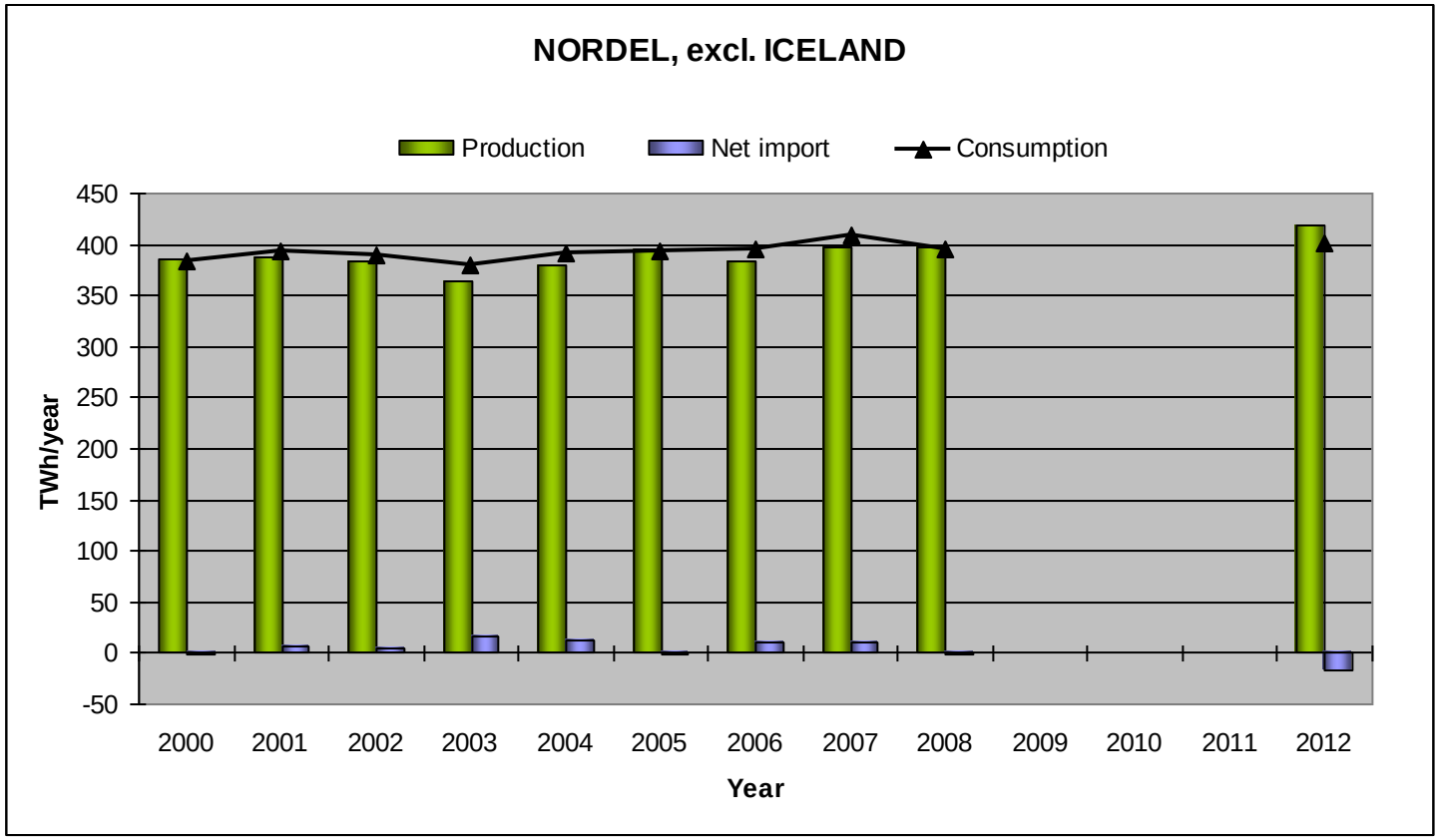


Nordel

P	414
C	398
B	16

ENERGY BALANCE 2012

Average of all inflow years



2000 to 2008 are historic values. 2012 is the balance made this year.

ENERGY BALANCE 2012
Low inflow

The *Energy Balance* on page 17 illustrates the market balance in low inflow conditions (1 of 10 years). The inflow series used is 1978.

Compared to an average situation the analyses show:

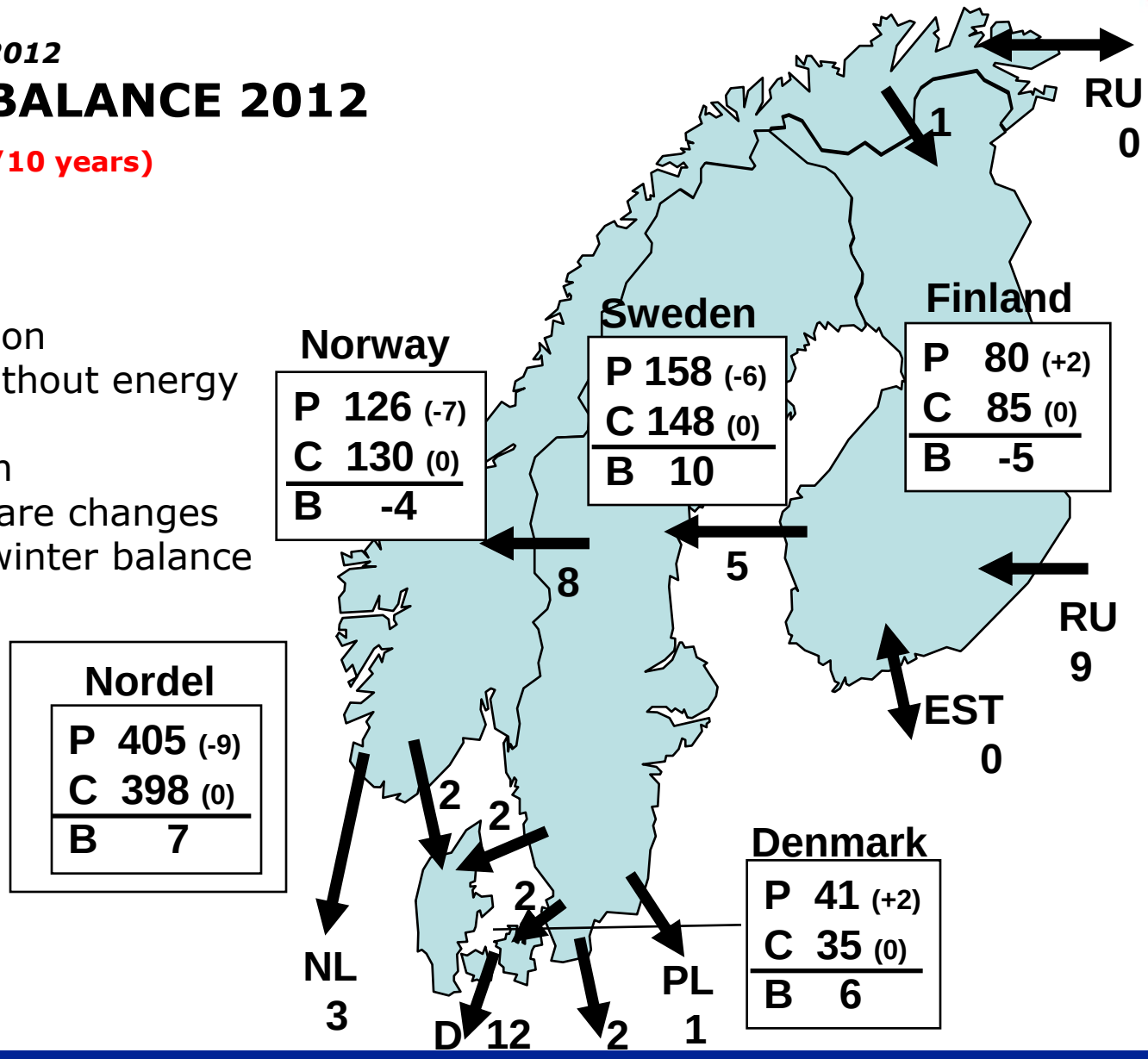
- **overall balance is decreased with 9 TWh**
- **hydro production is decreased by 16 TWh**
- **thermal production is increased by 10 TWh**
- **there has been no demand response**
- **import from outside is the same, but exports have decreased by 6 TWh**

Compared to last year balance for low inflow (-5 TWh), the balance has improved because of low expected consumption this year.
The Nordic Energy balance is excepcted to be positive also during low inflow conditions.

ENERGY BALANCE 2012

Low inflow (1/10 years)

P = Production
C = Consumption
B = Balance without energy exchange
All units in TWh
Numbers in () are changes from average winter balance



ENERGY BALANCE 2012
Extremely low inflow

The *Energy Balance* on page 19 illustrates the market balance in a year with extremely low inflow conditions (1 of 50 years). The year used is 1970 which followed another low inflow year 1969.

Compared to an average situation the analyses show:

- **hydro power production is decreased by 39 TWh**
- **thermal production is increased by 21 TWh**
- **demand is decreased by 3 TWh (demand response)**
- **import from outside have increased by 1, while exports have decreased by 14 TWh**

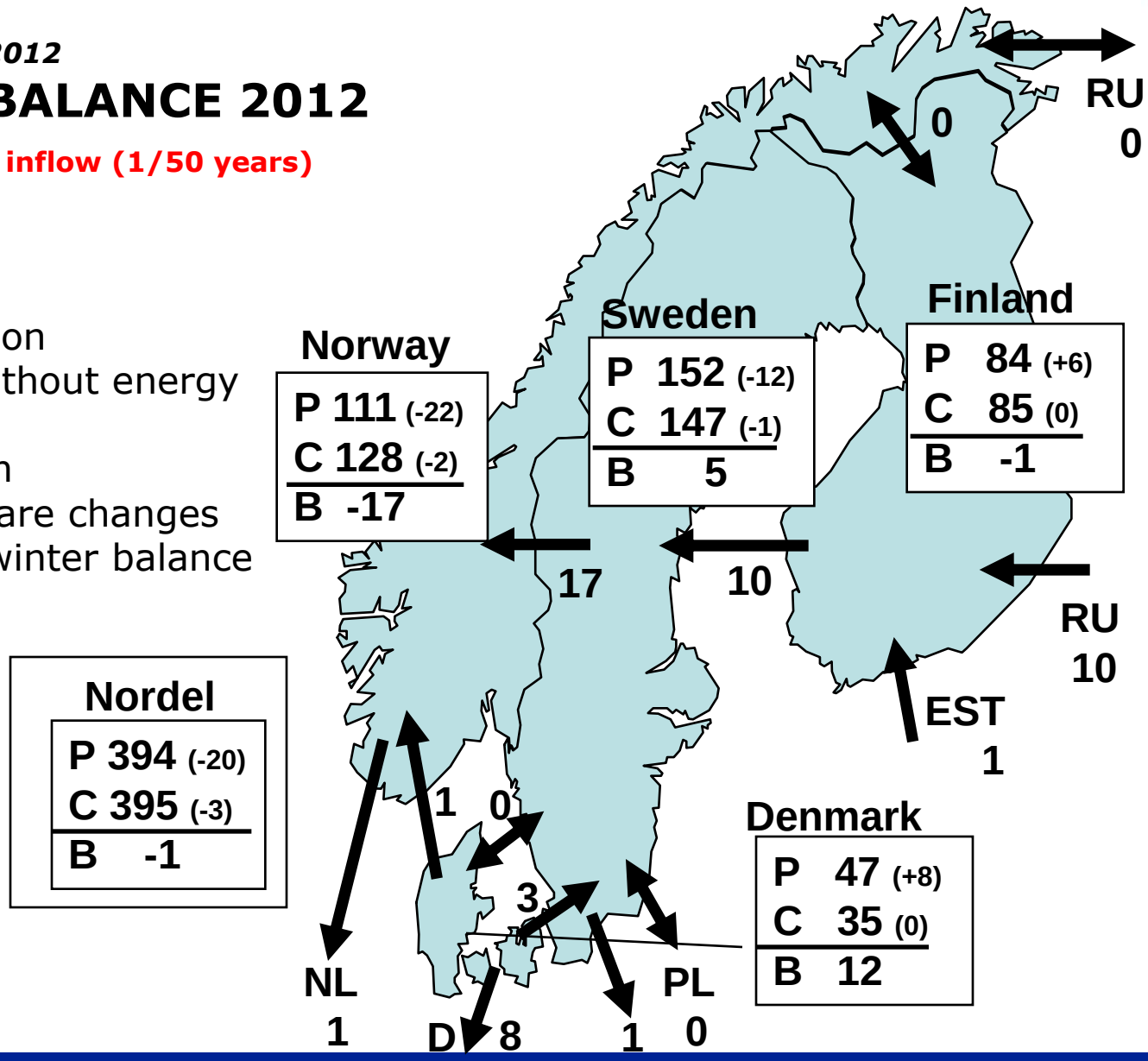
⇨ **In a hydro-based system the market price can be very high during dry years.**
⇨ **Some areas in Norway can be exposed to a risk for rationing or other measures in case of extremely low precipitation.**

Compared to last year balance for extremely low inflow (-14 TWh), the balance has improved because of lower expected consumption in this years balance.

ENERGY BALANCE 2012

Extremely low inflow (1/50 years)

P = Production
C = Consumption
B = Balance without energy exchange
All units in TWh
Numbers in () are changes from average winter balance



Chapter 3

POWER BALANCES 2012/13

AVAILABLE POWER CAPACITY AND PEAK DEMAND 2012/13

Average winter temperatures

The maximum available production capacity exceeds the sum of national peak demand by 7 600 MWh/h. Both sum of national peak demands and simultaneous peak demand is used in the forecasts. The simultaneous peak is estimated to be 1 600 MWh/h lower. Considering this the capacity margin is even bigger and exceeds export capacity outside the area.

- ⇨ **Every Nordic country is able to meet an average winter day peak demand with its own production capacity. As a whole, the Nordic area is able to export to the continental market during the peak load.**
- ⇨ **New nuclear unit in Finland is included in the power balance. This gives a positive balance also for Finland.**

AVAILABLE POWER CAPACITY AND PEAK DEMAND 2012/13

No exchange between areas

Average winter temperatures

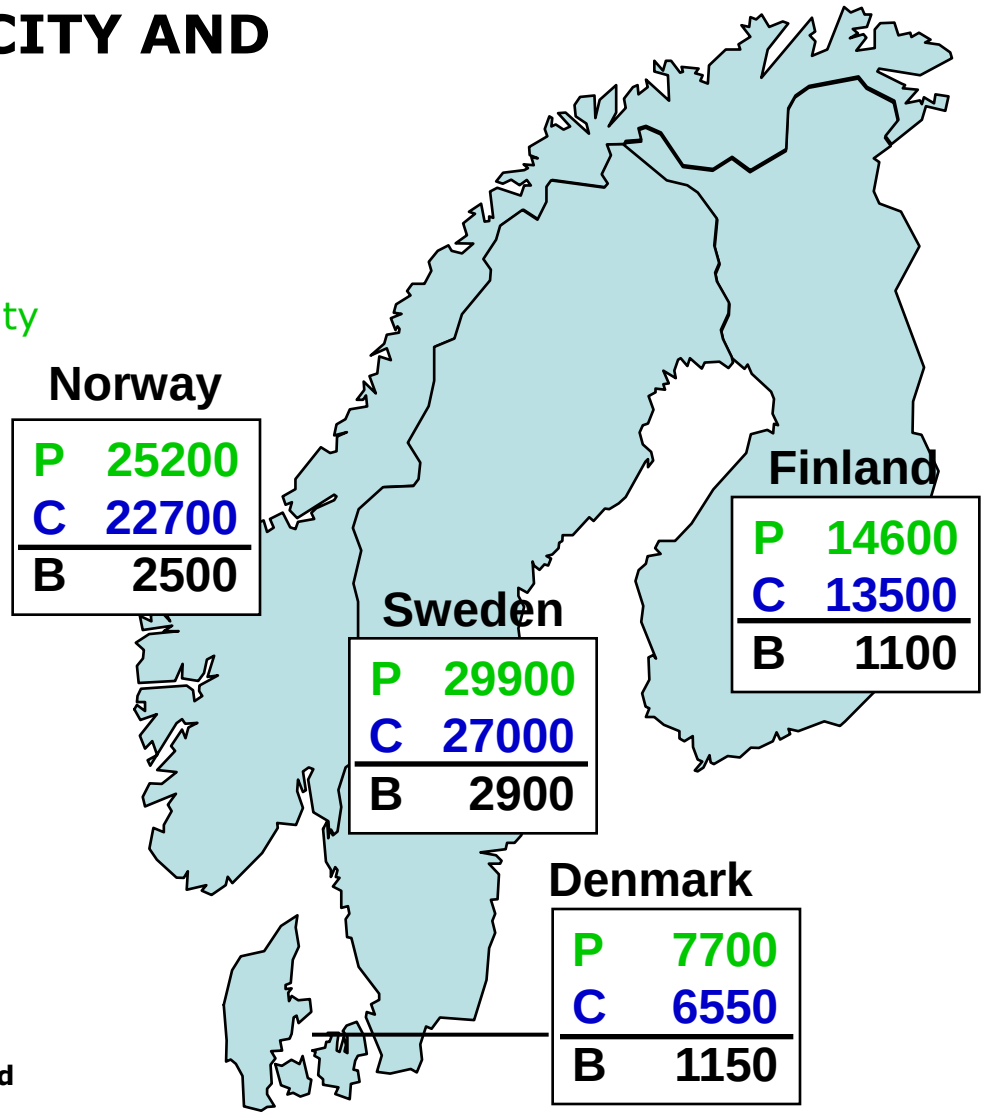
P - maximum available production capacity (operational reserves excluded)
C - peak demand in each country
B - power balance

All units in MWh/h

Nordic peak values[1]

P	77800
C	68150
B	9650

[1] **Total Nordic values with coincident factors for both wind and demand**



AVAILABLE POWER CAPACITY AND PEAK DEMAND 2012/13

Cold winter day

The national peak demands correspond to a probability of once in ten years.

The sum of peak demands in cold conditions is estimated to be 3 900 MWh/h higher than in average temperature conditions. The simultaneous peak is estimated to be 1 700 MWh/h lower. The power balance is expected to be positive for the Nordic countries in this situation.

⇨ Nordic production capacity is sufficient to cover the simultaneous peak demand without import.

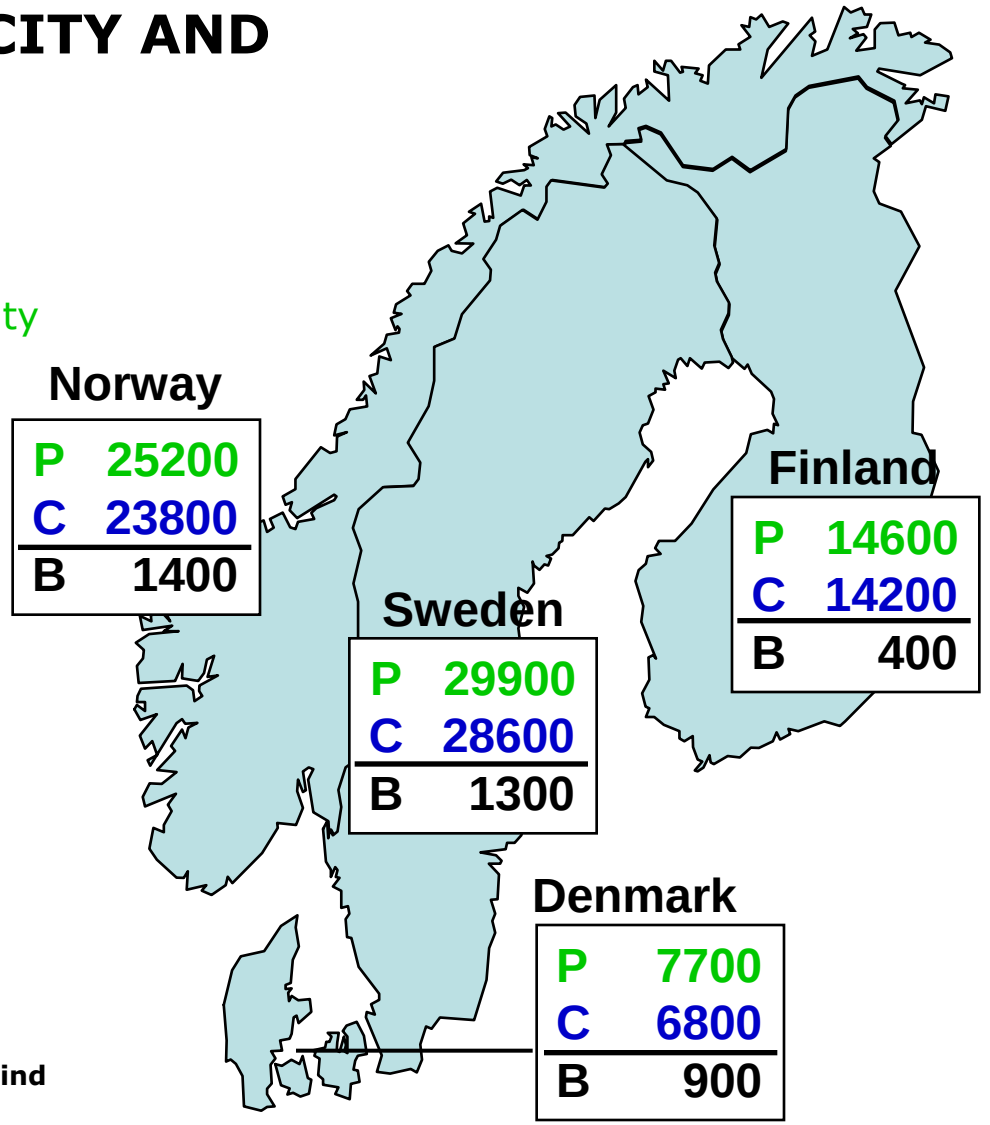
AVAILABLE POWER CAPACITY AND PEAK DEMAND 2012/13

No exchange between areas

Cold winter day (1 of 10 years)

P - maximum available production capacity (operational reserves excluded)
C - peak demand in each country
B - power balance

All units in MWh/h



Nordic peak values[1]

P	77800
C	71700
B	6100

[1] **Total Nordic values with coincident factors for both wind and demand**

APPENDICES

Appendix 1

ENERGY

Purpose

The purpose of this presentation is to give a picture of the energy balance for each country and the whole Nordic electricity market. Focus is set on production capacity and need for import from the neighbouring countries outside Nordel.

Definitions

Low inflow = There is a probability of 10 % to obtain energy below the estimated value.

Extreme low inflow = There is a probability of 2 % to obtain energy below the estimated value (1 of 50 years)

Fundamentals

The exchange between the Nordel countries are market based. Hence it is the spot price that decides flow directions and volumes. The exchange between the Nordel countries and its neighbours is developing towards a market based operation.
The method does not necessarily indicate possible problems in certain areas.
Forecasted consumption/demand includes demand response during extreme dry years.
Forecasted production in the energy balance does part of the year include the 5. nuclear plant in Finland.
Consumption/demand includes network losses.

Appendix 2.1
POWER

Definitions

Available capacity = installed capacity - unavailable capacity - reserves

Reserves = frequency controlled momentary and fast disturbance reserves.

Peak Demand = maximum one hour load in temperature circumstances with occurrence probability one winter during respectively two and ten years, denoted as an average winter day and a cold winter day.

Ten years winter. The peak demand is based on a temperature that has an occurrence of one out of ten years in each country separately. A simultaneous peak demand in all the countries at a working day has an occurrence probability less than 7 %.

Appendix 2.2
POWER

Fundamentals

Estimated power exchange takes into account limitations both in transmissions and production capabilities. The method does not necessarily indicate possible problems in certain areas.

Generation

Unavailable capacity is based on experiences from earlier peak demand situations. Not available hydropower is approximately 6600 MW of installed capacity.
Nuclear power output is supposed to be 100 % of full capacity.
Availability of other thermal power is reduced by e.g. forced outage rate,
max heat production in combined heat and power plants, use of fuel other than oil etc.
The available wind power during peak load is assumed to be 0 % in each Nordic country individually, and due to coincidence factor, 6 % for the total of the Nordic countries.

Demand

The coincident factor used for the total consumption of the Nordel is 97,7 % of the sum of the country specific demands.

Demand forecast for ten years peak load includes demand response.

Reserves

Nordel has recommended common fast disturbance reserves. From a total of 5 200 MW (3 200 MW in production capacity and 2 000 MW in dispatch able load) it can be reduced to a minimum of 600 MW in a connected system without severe bottlenecks before load shedding is executed. The recommended reserves have been subtracted from available production capacity.

Appendix 3.1

ENERGY
Retrospect 2008

Total consumption in 2008 was 396.1 TWh (400.2 TWh in 2007). Electricity by hydro power production was higher than 2007 (approximately 13 TWh).

Overall Nordic demand decreased by 2 TWh. Consumption in Sweden and Finland fell with 2,3 and 3,3 TWh respectively.

The total production in 2008 was 394.9 TWh (397.4 TWh in 2007 and 383.9 TWh in 2006).
The hydro power production was 226 TWh (214/199 TWh), wind power 10.2 TWh (9.7/8 TWh), thermal power excluding nuclear was 78 TWh (86/97 TWh) and nuclear power was 83 TWh (87/87 TWh).

In 2008 the Nordel countries together had a net import of 1.3 TWh (2.8 TWh import in 2007, 11.4 TWh import in 2006). The import from Russia was 10.9 TWh, Estonia 2.3 TWh, while there was a net export of 2.1 TWh to Poland, 3.4 TWh to the Netherlands and 11.7 TWh to Germany.

Appendix 3.2

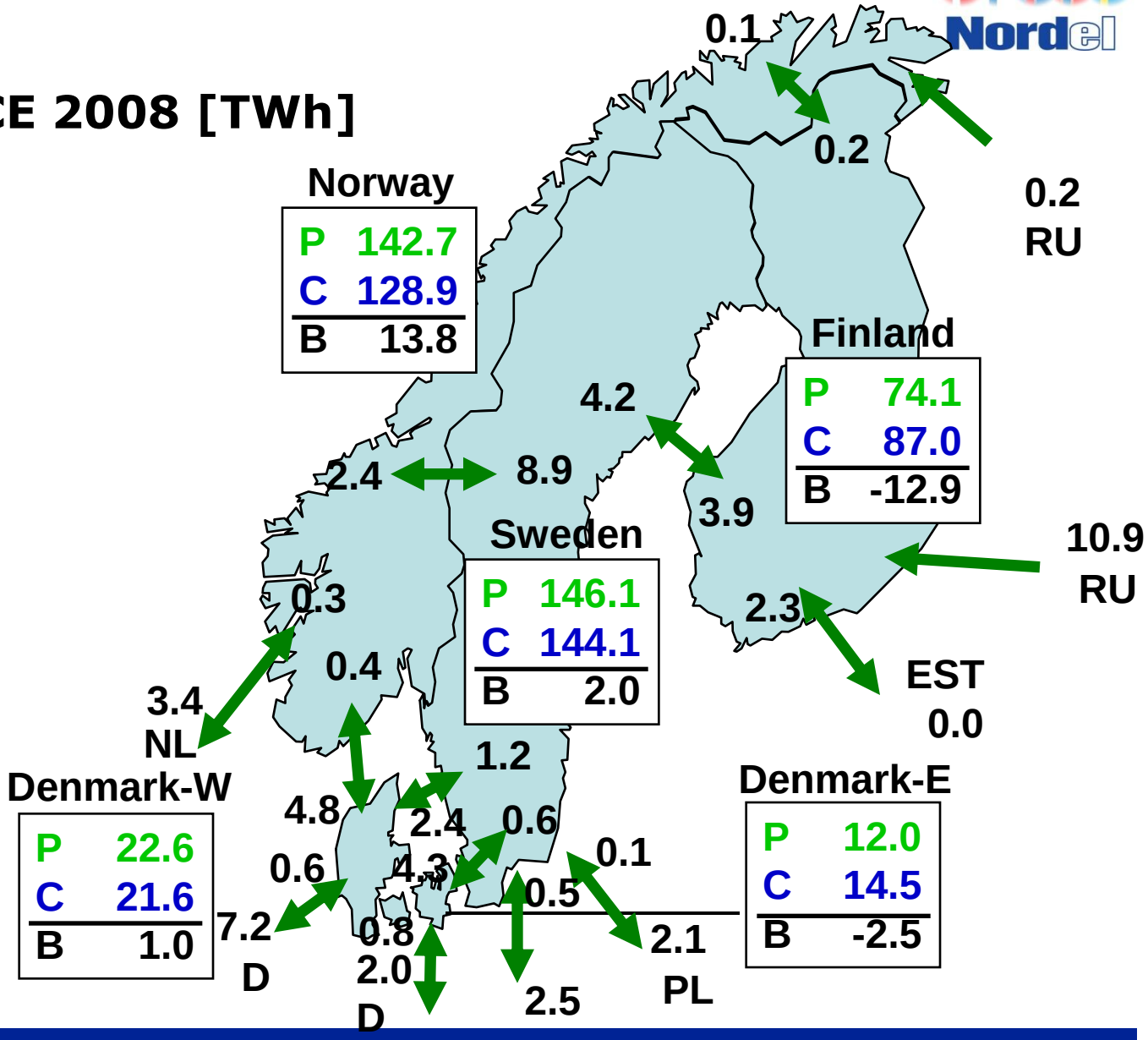
ENERGY BALANCE 2008 [TWh]

Retrospect

P - production
C - consumption
B - energy balance (P-C), export (+) / import (-)

Total Nordel

P	394.9
C	396.1
B	-1.2



Appendix 4.1

POWER BALANCE, Retrospect 2008/09

Synchronous Peak Demand
7 January 2009, hour 17-18 CET

Peak demand this winter was 64 200 MWh/h, while a peak demand with a ten years temperature was estimated to 73 200 MWh/h. The total maximum winter peak demand 2000/2001 was 69 000 MWh/h, which is the all time high peak demand in the Nordel system.

None of the Nordic countries had the country specific peak demand on the same day as the synchronous peak.

Compared to estimated peak demand for ten years winter the difference was between 11% and 22% in the individual areas.

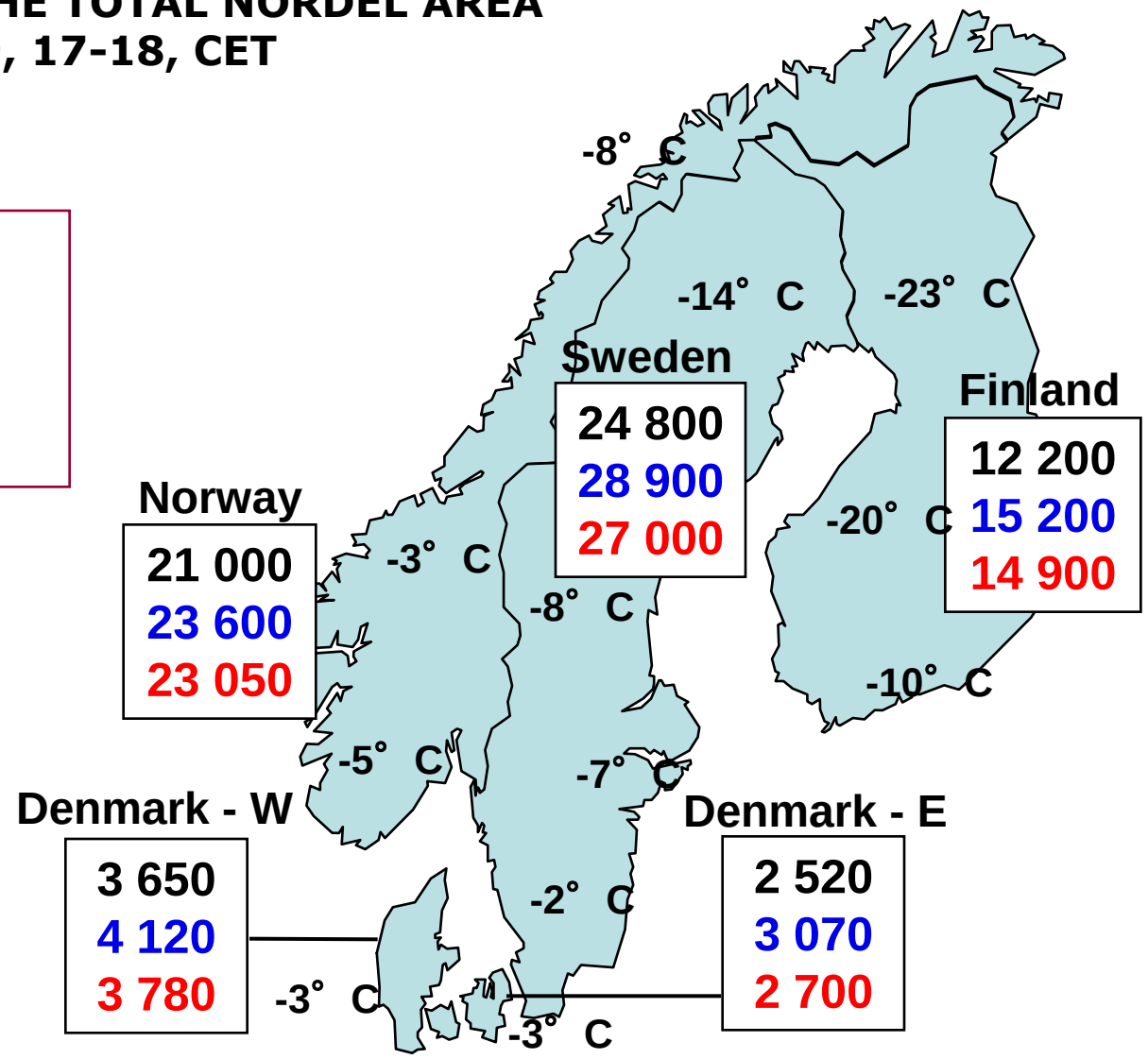
Country specific peak demands

The different Nordic countries had their peaks between January 5, 2009 and January 16, 2009. The sum of the individual peaks is app. 3 % higher than the synchronous peak.

Appendix 4.2
PEAK LOAD 2008/2009 IN THE TOTAL NORDEL AREA
Measured on 7 January 2009, 17-18, CET

Measured consumtion [MWh/h]
Forecasted peak demand [MWh/h]
(one of 10 winters)
All time high [MWh/h]
Simultaneous all time high;
5 Feb 2001 [MWh/h]
Estimated statistics from Nordpool

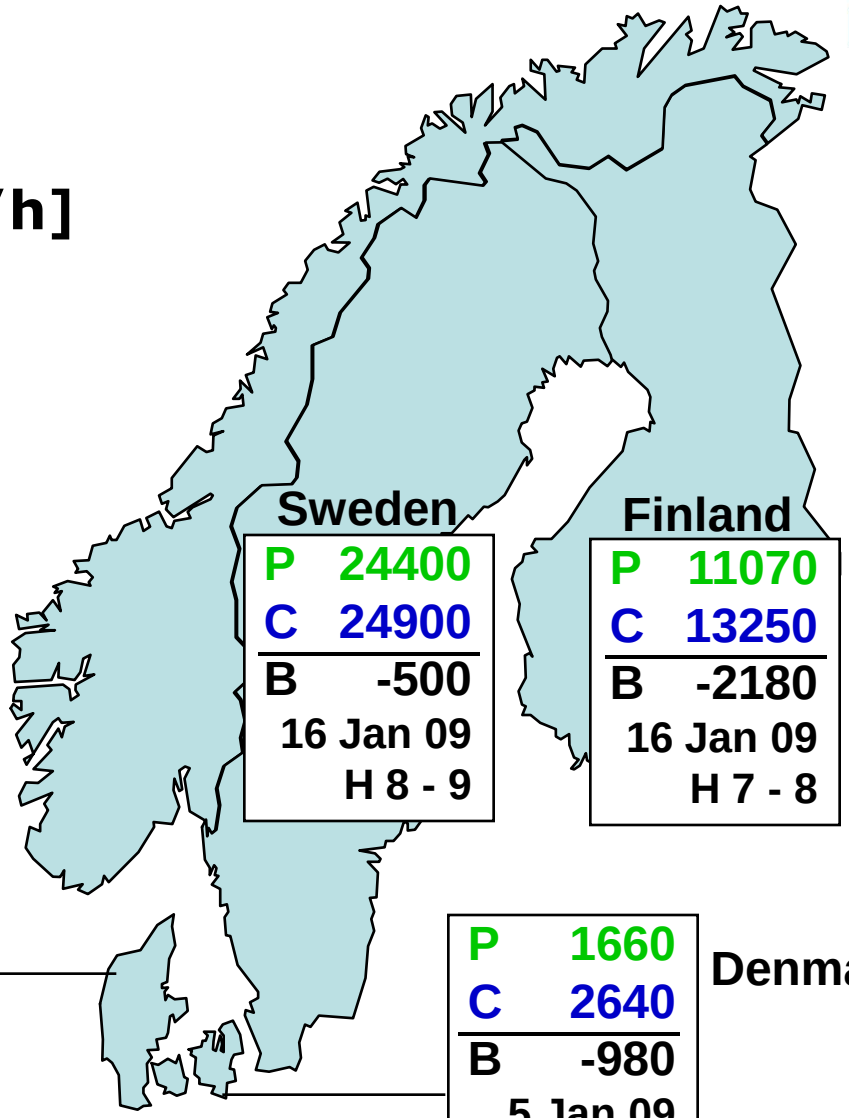
Nordel
64 164
73 200
69 000



Appendix 4.3

COUNTRY SPECIFIC PEAK DEMAND 2008/09 [MWh/h]

P - production
C - consumption
B - power balance excluding exchange export (+) / import (-)
H - hour, CET



Norway

P	24300
C	21890
B	2410
	5 Jan 09
	H 8 - 9

Sweden

P	24400
C	24900
B	-500
	16 Jan 09
	H 8 - 9

Finland

P	11070
C	13250
B	-2180
	16 Jan 09
	H 7 - 8

Denmark - W

P	5180
C	3670
B	1510
	6 Jan 09
	H 17 - 18

Denmark - E

P	1660
C	2640
B	-980
	5 Jan 09
	H 17 - 18