

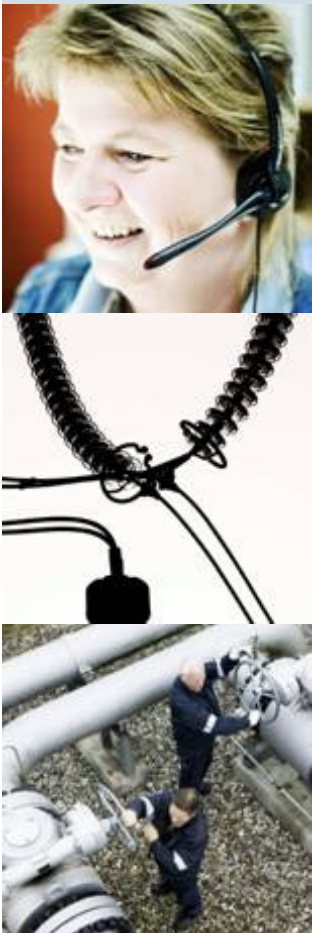
Correlation between Wind Power and local CHP

by

Gitte Agersbæk

Energinet.dk

Facts about Energinet.dk



- Approx. 475 employees
- Head office in Jutland (Skærbæk near Fredericia)
- Local offices in Ballerup, Egtved, Tjele, Vester Hassing and Lille Torup
- Four subsidiaries: Eltransmission.dk A/S, Gastransmission.dk A/S, Energinet.dk Gaslager A/S and Fibertransmission A/S
- Co-owner of the Nordic power exchange, Nord Pool Spot
- Annual turnover: approx. DKK 6 billion

Mission and vision



Mission

As the owner of the main infrastructure, we maintain the security of supply and ensure an efficient market for electricity and gas



Vision

Through cooperation and innovation, we wish to be known nationally and internationally as a competent, business-oriented and trustworthy TSO*



* TSO = Transmission System Operator

Energinet.dk's strategies

- Well-functioning markets
- Optimum security of supply
- Controlled growth
- Cost efficiency
- Development and attraction of competencies

System descriptions the Western part of Denmark

The Western Danish Power System

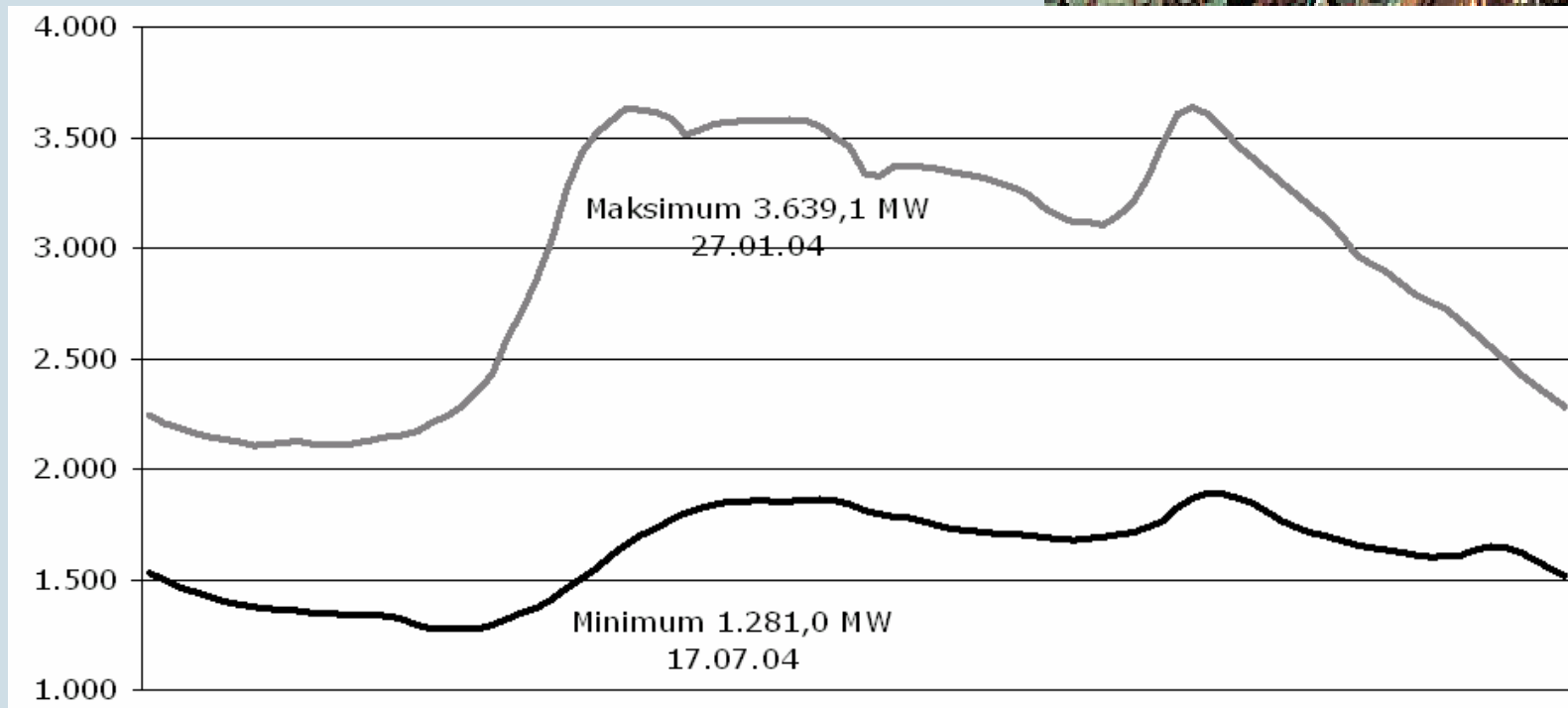
System Load

Minimum consumption:

approx. 1,200 MW (summer weekend)

Maximum consumption:

approx. 3,800 MW (Cold winter working day)



The Western Danish Power System

Installed Capacity, January 1st, 2007

11 Central Power Plants

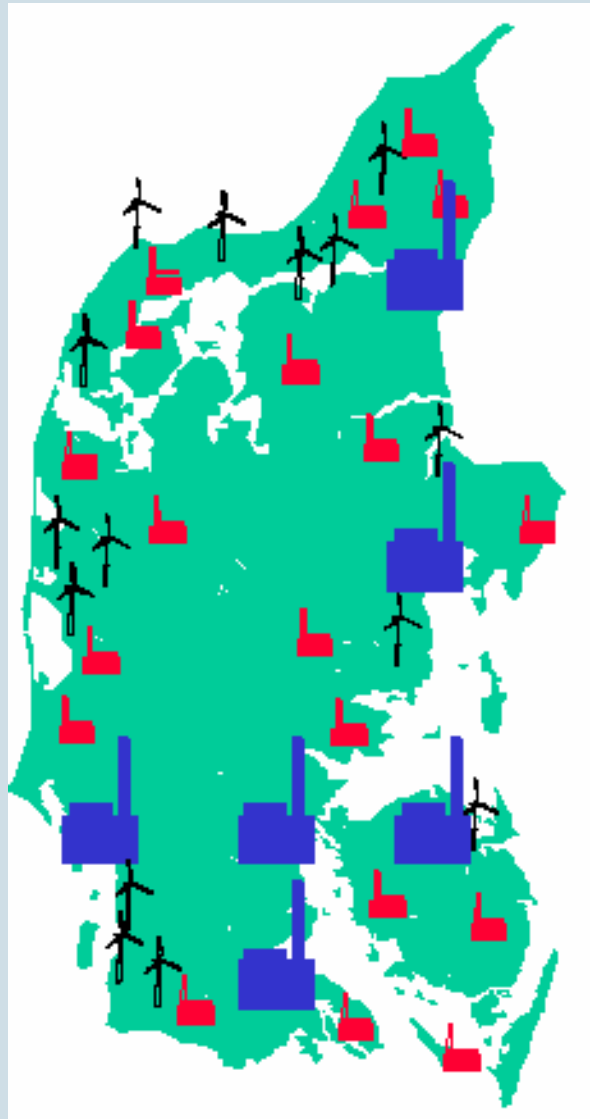


3,516 MW

560 Local CHPs



1,593 MW



4,156 Wind Turbines



2,379 MW

**Total
Production
Capacity
7488 MW**

**Total
Demand
1290 - 3700 MW**

The surroundings of the Western Danish Power System:

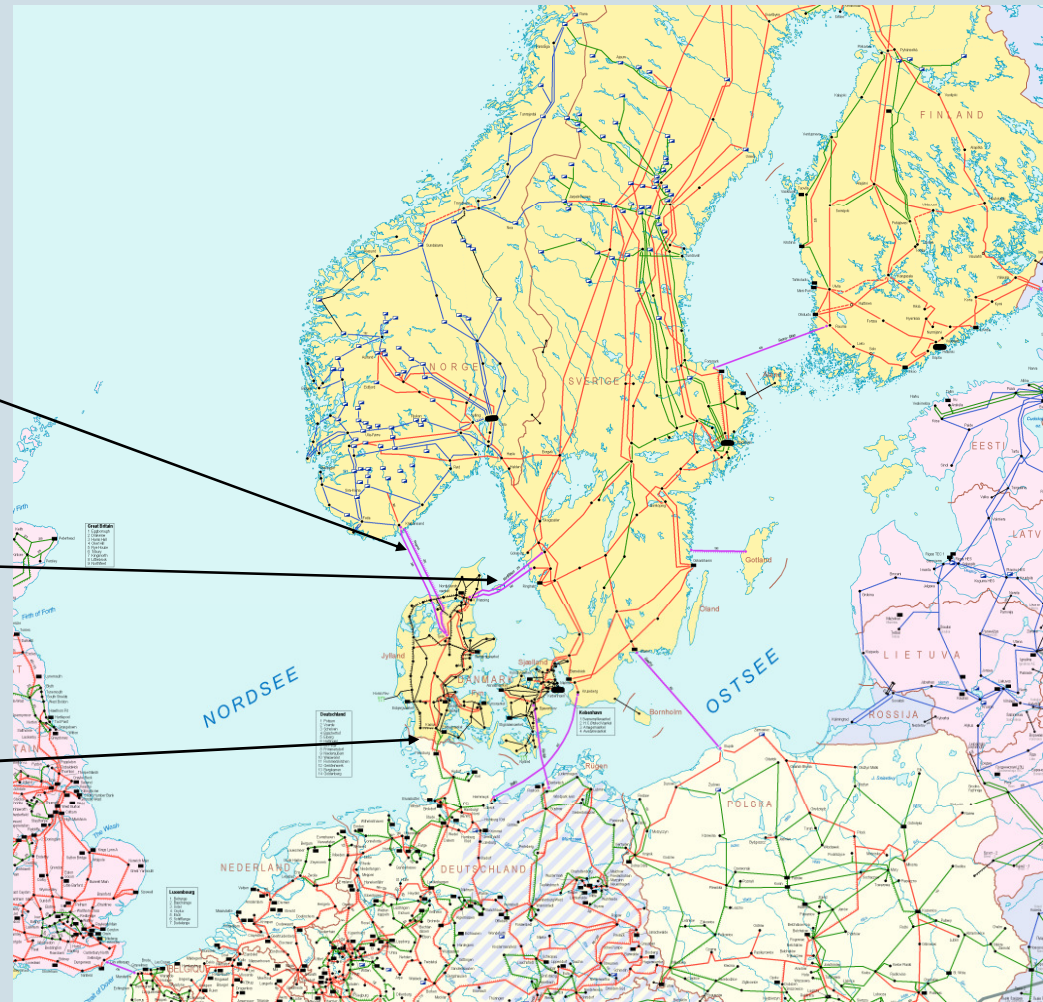
- connecting the transmission systems of Nordel (Scandinavia) and UCTE (Continental Europe).

DK West is a regular transit area with large interconnections to the neighbouring areas:

Norway (HVDC "Skagerrak"):
Capacity: 1,000 MW

Sweden (HVDC "KontiSkan"):
Capacity 720 MW

Germany (AC):
Capacity, import: 900 MW
Capacity, export: 1,500 MW

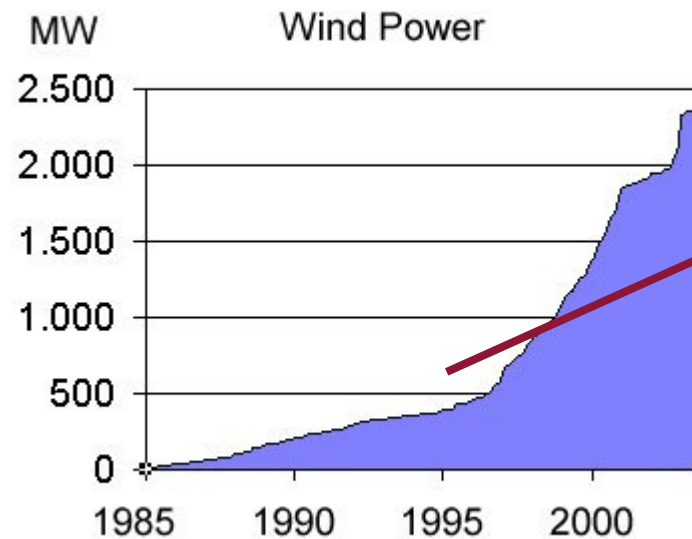
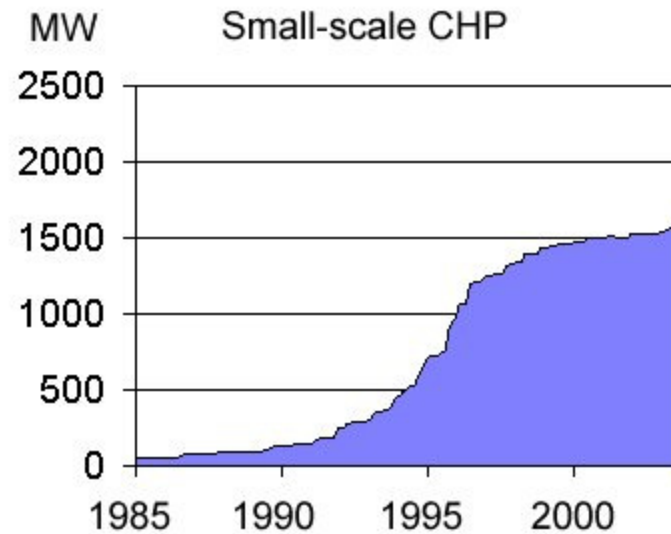


Key Figures - ENKDWest

	2001	2002	2003	2004	2005	2006
Consumption TWh	20.9	20.9	21.0	21.3	21.3	21.8
Production TWh	23.1	23.5	27.4	24.7	21.9	26.3
CHP TWh	6.8	6.7	6.8	6.8	6.4	6.0
Wind power TWh	3.4	3.8	4.4	4.9	5.0	4.6
Wind power in % of consumption	16.3 %	18.2 %	21.0 %	23.0 %	23,5 %	21.1 %
Exchange TWh	- 2.2	- 2.6	- 6.3	- 3.4	-0.6	-4.5

System development

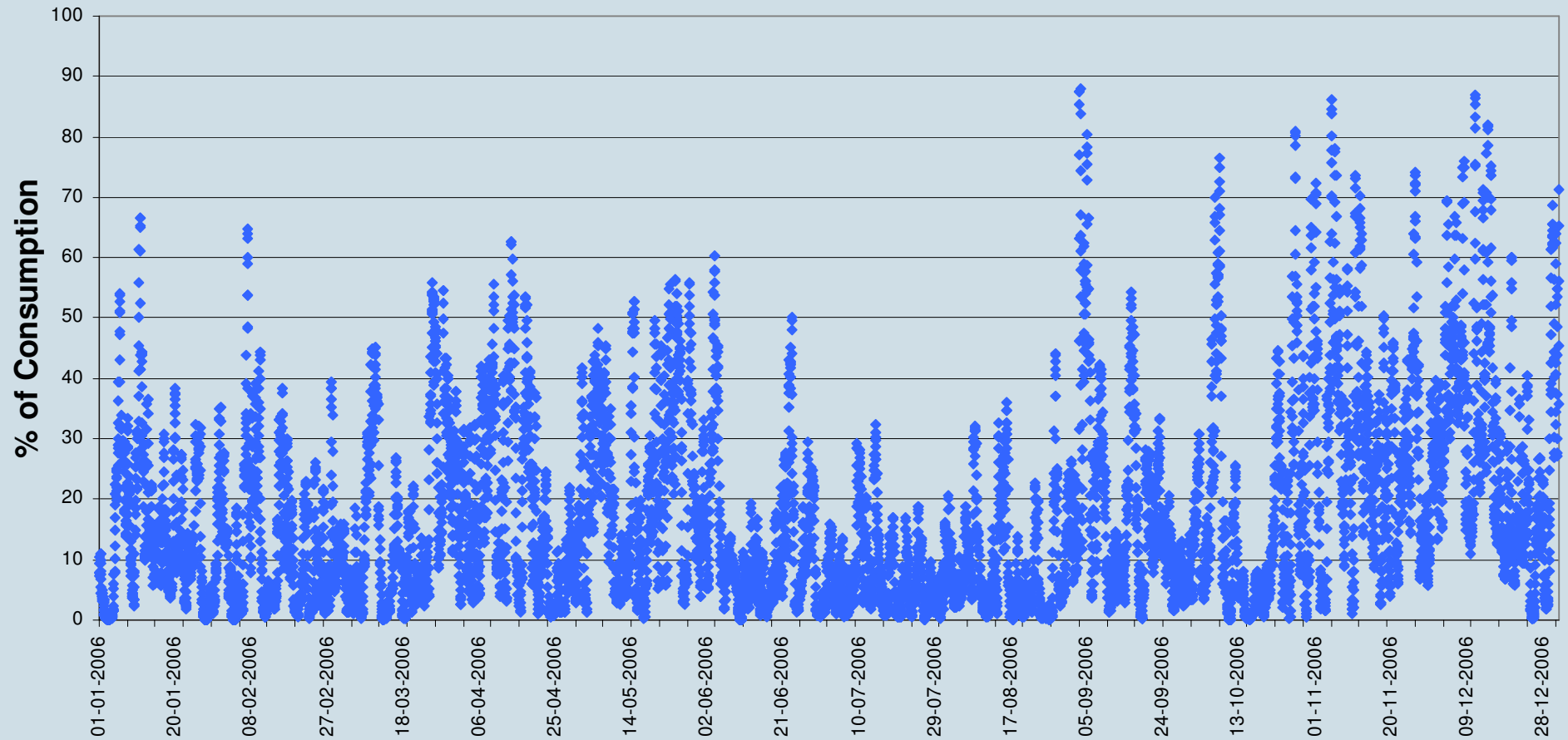
A Surge of Small-scale CHP and Wind Power



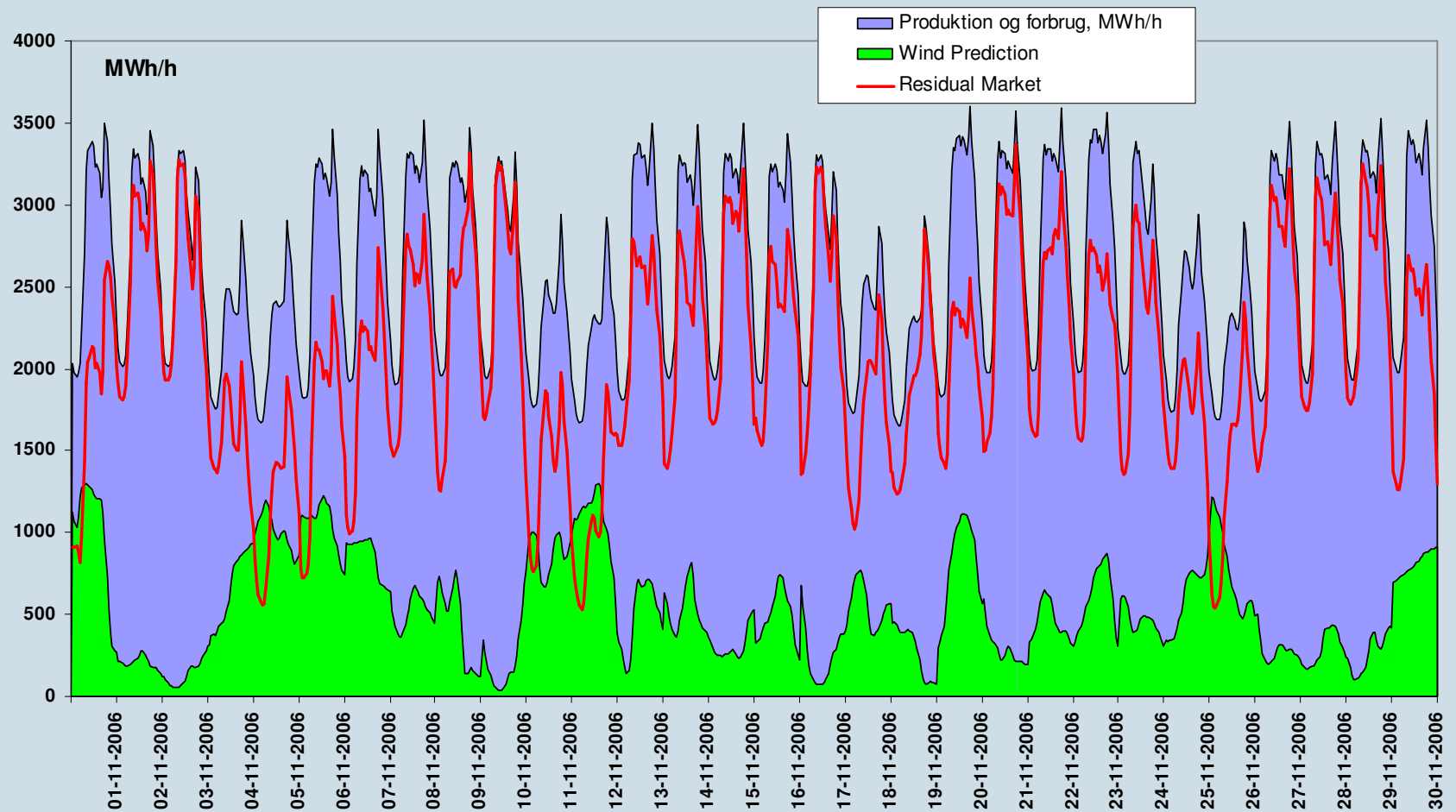
DK West
(2,374 MW ultimo 2003)

National target
(1,500 MW in 2005, "Energy 21", 1996)

Wind Contribution in Denmark 2006



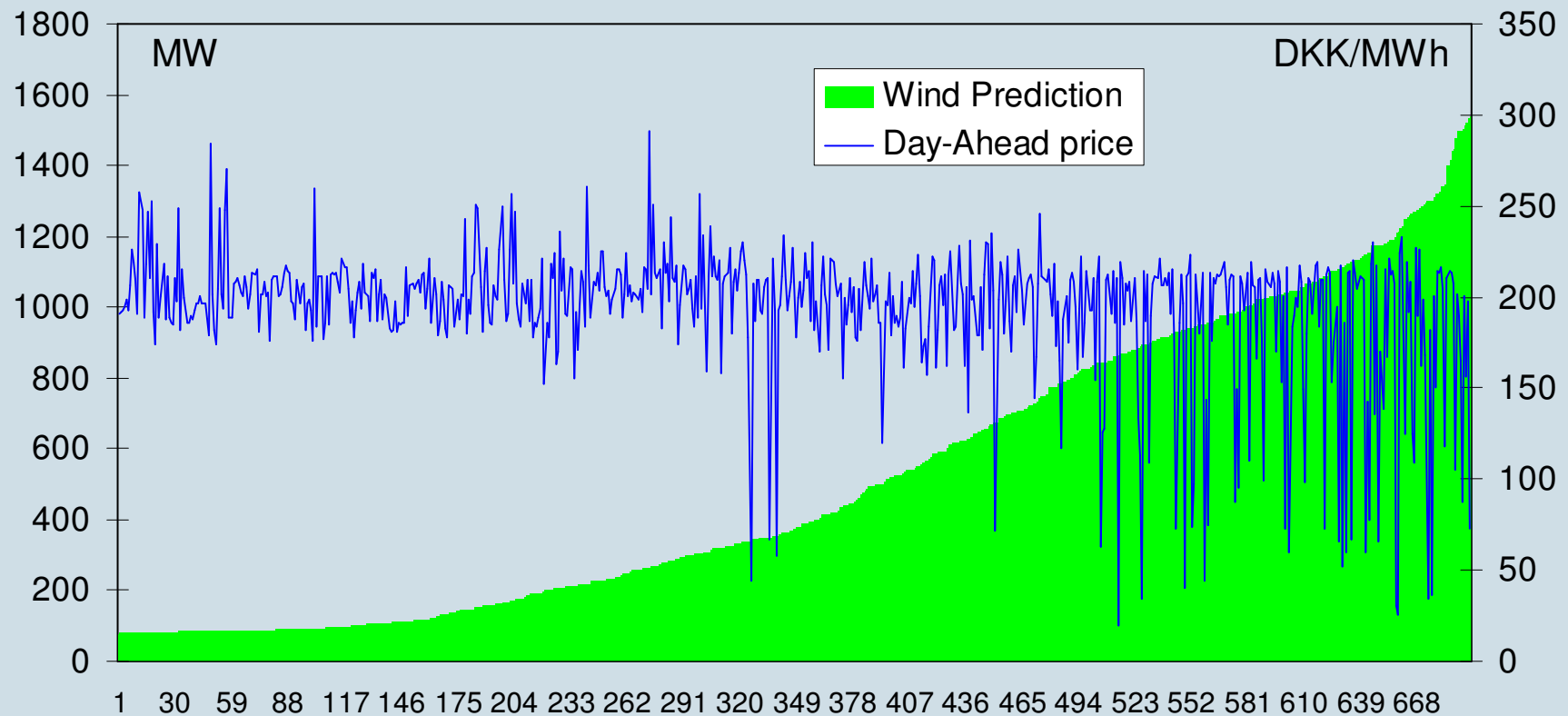
Demand, Wind Power and the Residual Market Western Denmark November 2006



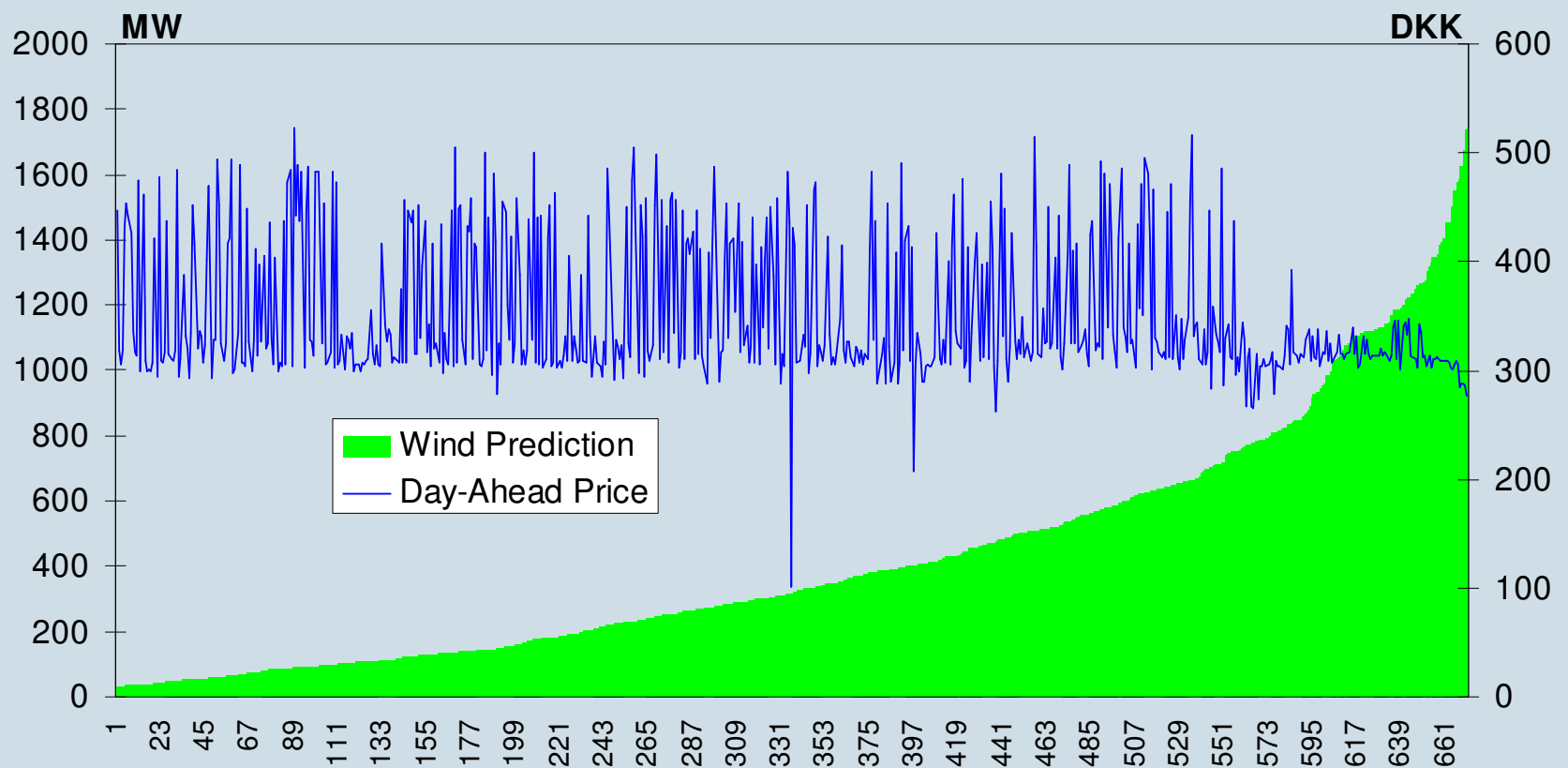
Production Cost in the Residual Market

- A Producer in the Residual Market will experience a growing price per unit (DKK/MWh) due to less operation hours to pay the fixed costs
- Will be compensated partly by the transition to a system with peak load units with low fixed costs
- On the assumption that:
 - Security of Supply will remain the same
 - We look into an isolated system

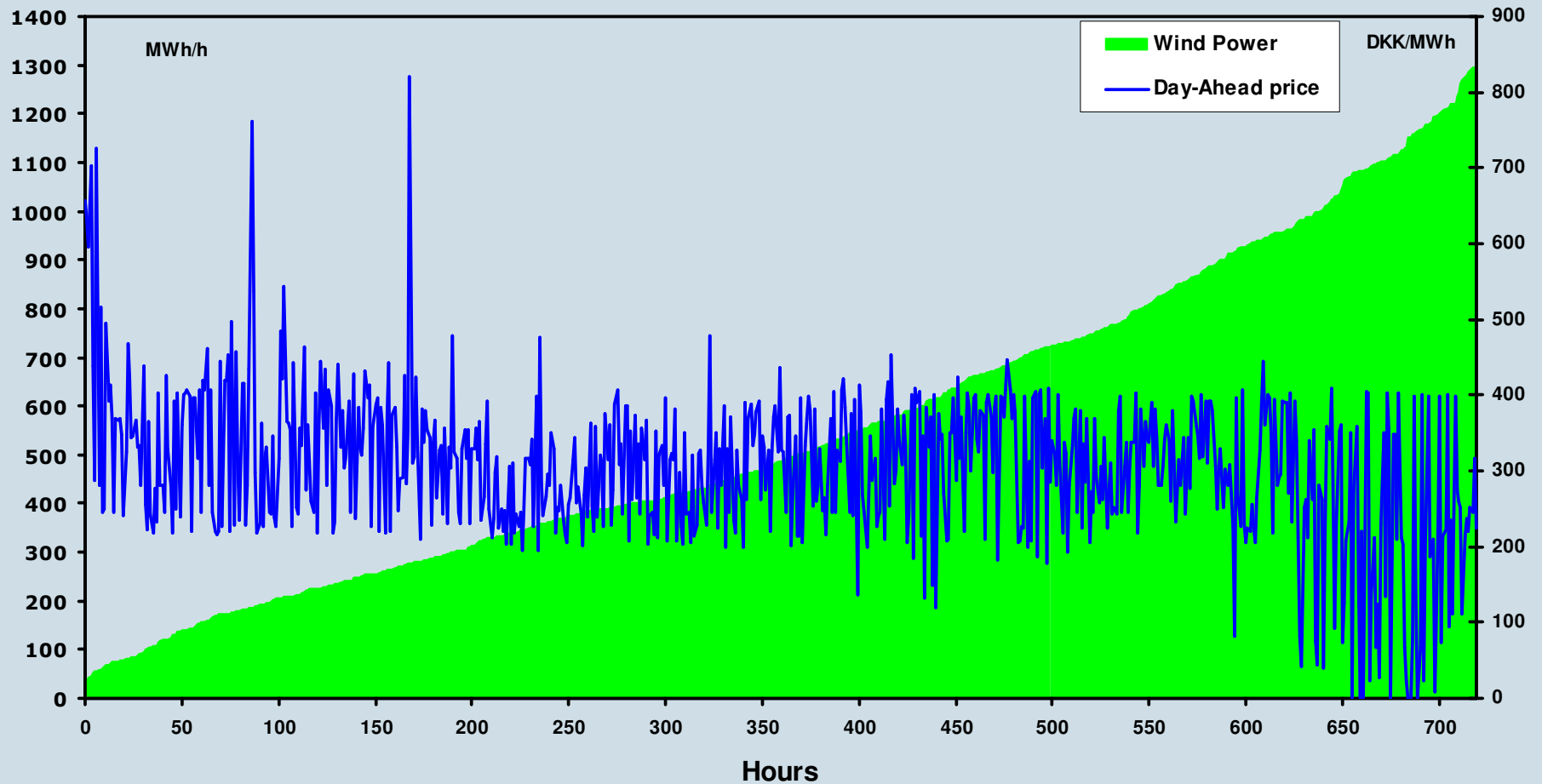
Wind Forecast and Day-Ahead Price February 2004



Wind Prediction and Day-Ahead Price February 2006



Wind Forecast and Day-Ahead Price November 2006



Contribution from CHPs

- As regulator – Buffer
 - Participating in day-ahead market
 - Participating in reserve market
 - Participating in adjustments market

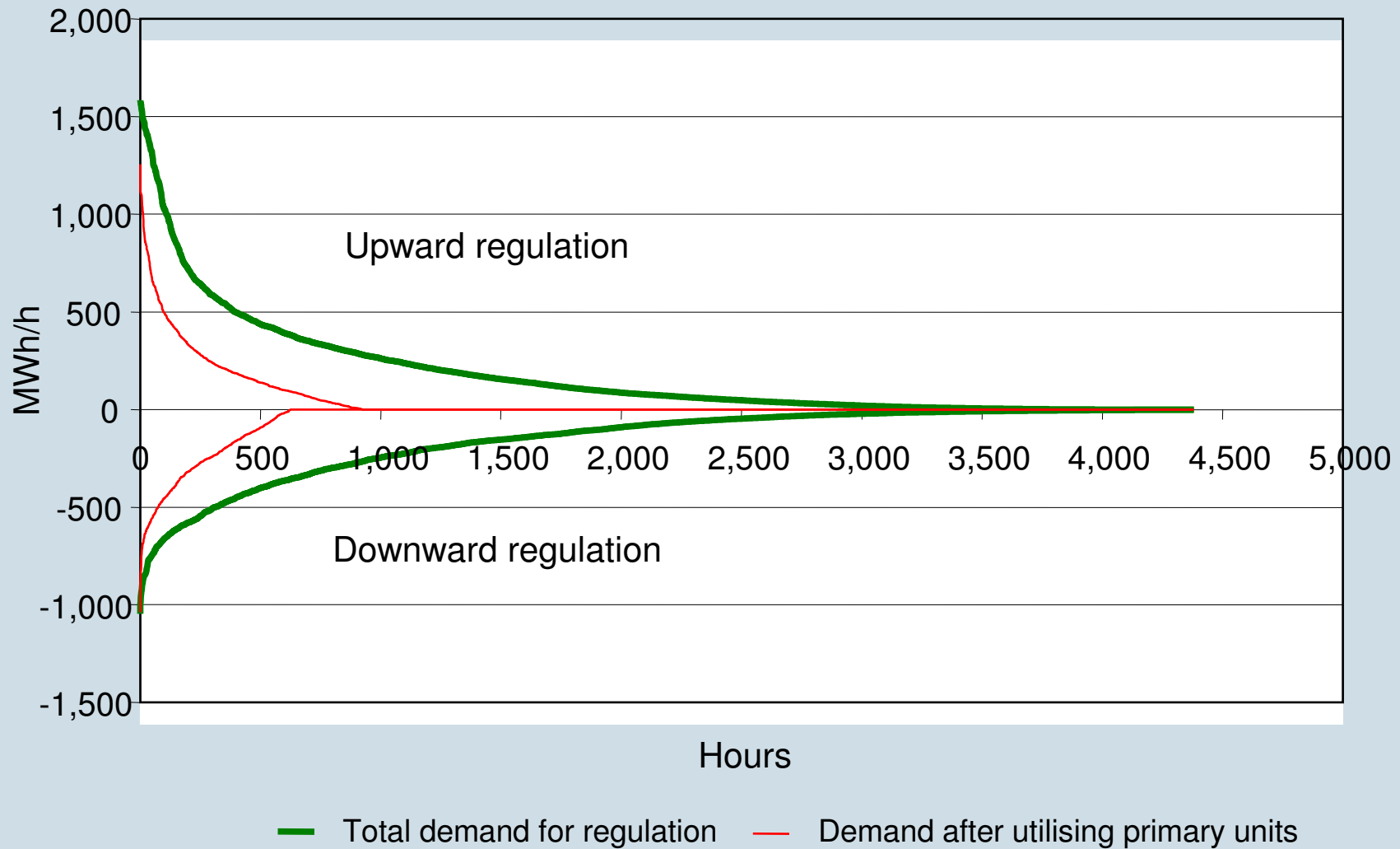
- As storage
 - Easy start and stop
 - Water accumulator
 - Electrical Boilers

Ancillary Services in the DK1

- Primary reserves
 - UCTE requirement: ~ 30 MW
- Automatic regulating capacity
 - secondary reserves / grid regulator: 140 MW
- Manually activated regulating capacity
 - tertiary reserves: +470 MW

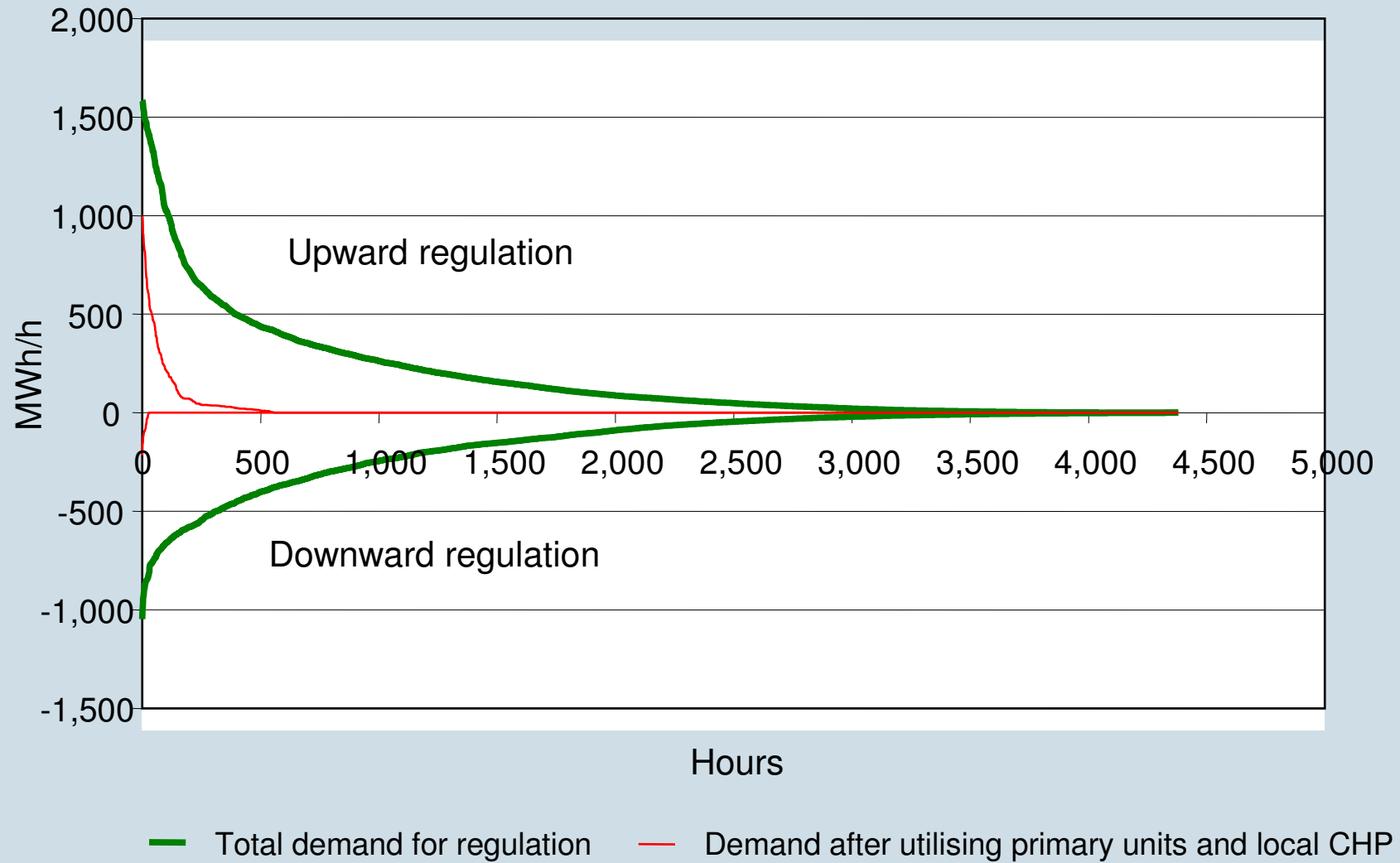
Regulating Need and Lack of Regulating Power in the Eltra Area, Year 2005

Small-scale CHP Facilities Run According to a Three-rate Tariff Model



Regulating Need and Lack of Regulating Power in the Eltra Area, Year 2005

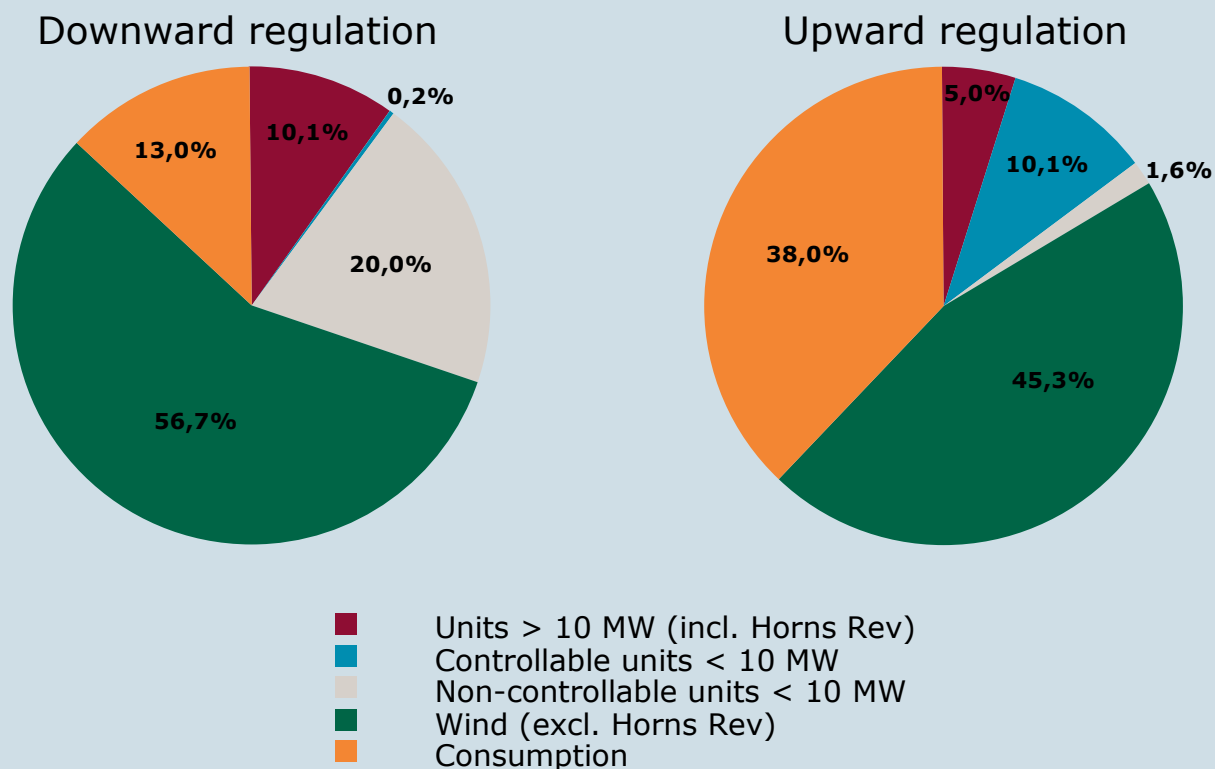
Small-scale CHP Facilities Run According to Market Signals



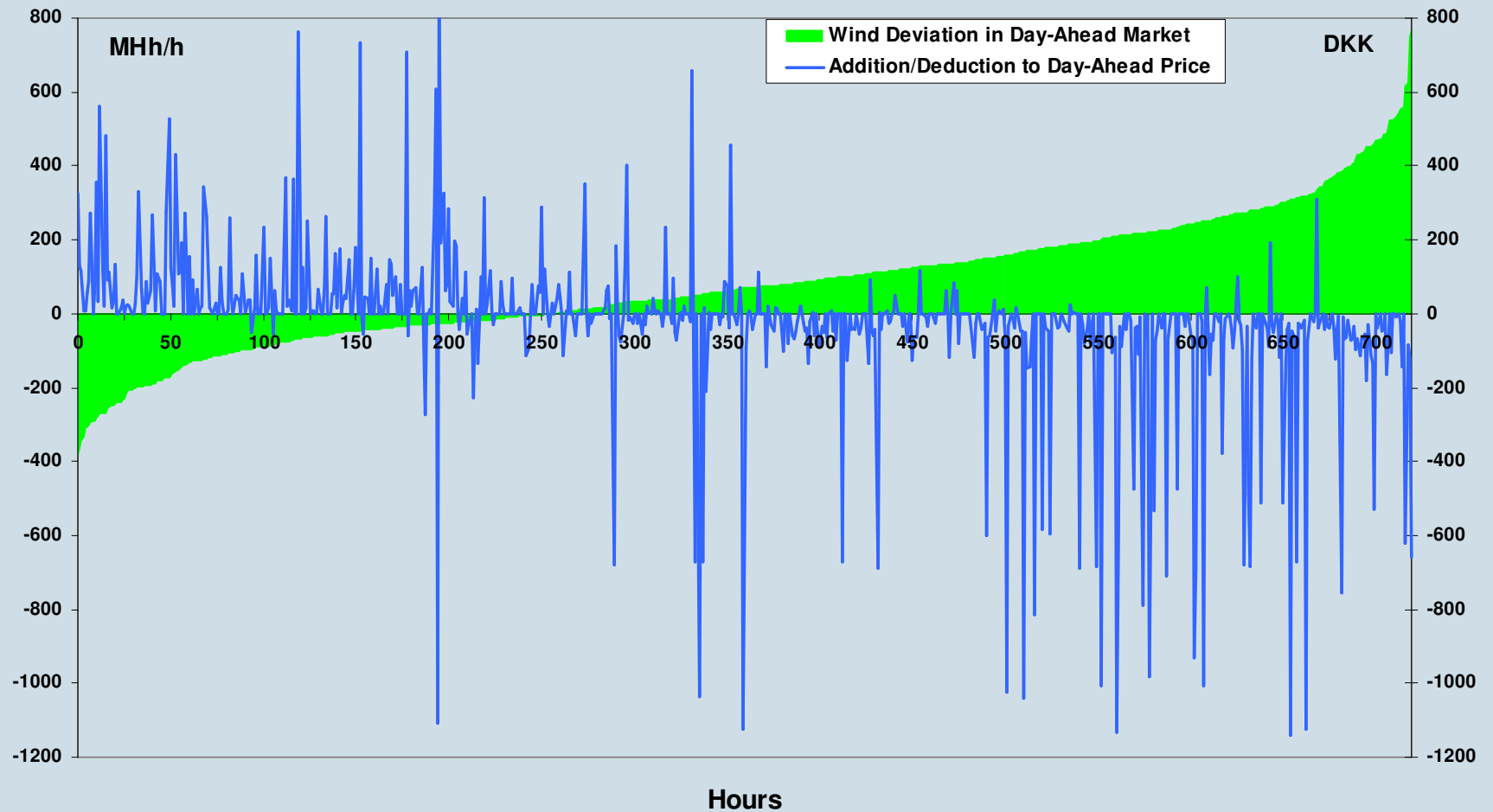
Wind Production is the largest contributing cause

of imbalances

- More than half of the imbalances are caused by Wind Power
- Wind prediction errors set the trend of the system imbalance in approx. 70 % of all hours.



Wind Deviation and Addition/Deduction to Day-Ahead Price November 2006 in Western Denmark



Thank you for your
attention!

