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Inspiration to a common EU data base for energy data time series

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European power systems in transition

- Wind power and PV have gained a considerable role in Europe
  - The technical and commercial properties of the interconnected power systems are changing
  - There is a need to understand the new situation

- In 2009 the Renewable Energy Foundation in London asked me to analyse the impact of wind power on the electricity spot market in Denmark.
  - Observation period: 2006-2008
  - Necessary data: time series for wind power and spot prices for three years
  - Available from Energinet.dk, the Danish TSO
- But the correlation between wind power and spot prices was poor
  - Other factors than Danish wind had significant influence
  - The interrelations are much more complex

- Analysing the interaction between European power systems takes:
  - data for several countries
  - a wide range of data - time series with hourly steps or shorter

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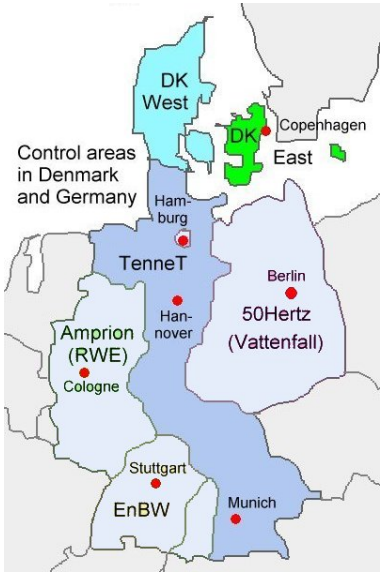
Wind power studies must cover a large area

- Germany also had a considerable wind power penetration in 2006-2008
- One of the four German control areas, namely E.ON Netz (now TenneT), was added to the study
- A high correlation between Danish and German wind power was found.
  - The two countries will have simultaneous power shortage and power overflow
- Therefore European wind power studies should include an even larger grid.



- but collecting European time series meets obstacles

- Different selections of data in different countries
- Different data formats require troublesome conversion of data
- Different time resolutions
- In some cases poor data quality requires data check and repair
- Different rules for the change to and from daylight-saving-time

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Demonstrating an international data base

- Minimum requirements:
  - Easy access to one site with high quality time series
  - The same format for all data and all countries
  - Should include wind power, other production, load and market data

- The demonstration was initially based on data for the spot price study
  - Now including the following countries:

	2006	2007	2008	2009	2010	2011	2012	2013	2014	Collected by
Denmark										P.F.Bach
Germany	TenneT	area	only							P.F.Bach
Ireland										P.F.Bach
Great Britain										P.F.Bach
France										H. Flocard
Belgium										H. Flocard
Spain										H. Flocard

- Hubert Flocard (France) has collected French, Belgian and Spanish data
- Spanish data is important for understanding wind power in Europe
  - Collecting Spanish data has been particularly laborious
  - Therefore collecting hourly Spanish data could not continue

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The data collection at http://pfbach.dk/

Download Hourly Time Series

- 2006
- 2007
- 2008
- 2009
- 2010
- 2011
- 2012
  - Denmark
  - Germany
  - Ireland
  - Great Britain
    - Wind MW (download)
    - Load MW (download)
    - Net export MW (download)
    - System prices £/MWh (download)
  - France - Updated 31.07.2013
  - Spain
  - Belgium
- 2013
- 2014 (incomplete)

	A	B	C
1			
2			GB
3	Date	Hour	Wind Power
4			MWh
5	01.01.2012	1	2820
6	01.01.2012	2	3050
7	01.01.2012	3	2903
8	01.01.2012	4	2960
9	01.01.2012	5	3000
10	01.01.2012	6	2938
11	01.01.2012	7	3004
12	01.01.2012	8	2818
13	01.01.2012	9	2672
14	01.01.2012	10	2641
15	01.01.2012	11	2718
16	01.01.2012	12	2680
17	01.01.2012	13	2690
18	01.01.2012	14	2704
19	01.01.2012	15	2425
20	01.01.2012	16	2338
21	01.01.2012	17	2326
22	01.01.2012	18	2305
23	01.01.2012	19	2341
24	01.01.2012	20	2187
25	01.01.2012	21	2336
26	01.01.2012	22	2442
27	01.01.2012	23	2521
28	01.01.2012	24	2545
29	02.01.2012	1	2575
30	02.01.2012	2	2680

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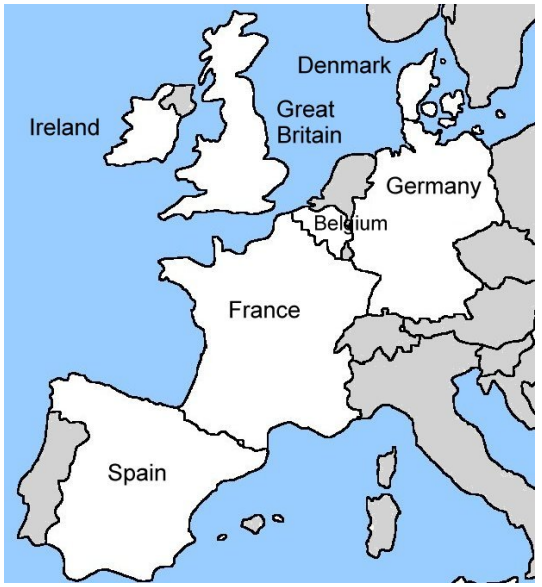
Examples of statistical results on wind power

Average wind power output for all 7 countries

2013	Consecutive hours	All 7	
		MW	%
Mini-mum	1	1,803	3.38
	12	2,783	5.22
	24	3,098	5.81
	48	4,188	7.86
	96	5,186	9.73
Maxi-mum	1	53,304	100.00
	12	52,191	97.91
	24	50,364	94.48
	48	44,385	83.27
	96	41,505	77.86



Wind power correlation

Correlation coefficients	2013	Belgium	Spain	France	Great Britain	Ireland	Germany
	Denmark	0,329	0,115	0,265	0,385	0,198	0,658
Hourly wind power	Germany	0,584	0,121	0,488	0,465	0,260	
	Ireland	0,314	0,039	0,275	0,645		
	Great Britain	0,616	0,150	0,458			
	France	0,746	0,299				
	Spain	0,121					

Similar correlations
High correlation
Low correlation

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The ENTSO-E Data Portal

https://www.entsoe.eu/data/data-portal/Pages/default.aspx

- Essential data:
  - Production: Annual production per country by fuel
  - Consumption: Hourly load per country for one year
  - Exchange: Annual exchange between countries
- Traditionally operators exchange detailed data on the 3rd Wednesday of each month
- **Only consumption data available per hour for a full year**
- ENTSO-E cannot meet the demand for European data for power system analysis.
- ENTSO-E has the role and the capacity to develop a more comprehensive database

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Call for a better European data base

- Two retired persons cannot create and maintain a data base of reasonable quality and quantity
- A new data base for European energy analyses is desirable
- Design considerations for discussion:
  - The types of energy analyses to be supported by the data
  - Ambition regarding selection of types of data (some countries offer a very large range of power system and electricity market data)
  - Data quality requirements (data errors are disturbing and time consuming)
  - Data sources
  - A common data format for time series
  - Should date and hour be one variable (for use in charts)?
  - Time step: 5, 15, 30 or 60 minutes?
  - Common rules regarding time changes twice a year (all ‘my’ days have 24h)
  - Should essential grid data be included?
  - Should normal annual statistical data be included?

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Conclusion

- The purpose of my work was to demonstrate the potential of a European power system data base
- My data collection will not be extended. Sooner or later access to the data will be closed
- A way forward:
  - A discussion on the design criteria among professional energy analysts
    - For instance at the Energy Group Meeting
    - Target: Outline of a data base satisfying the needs for a broad range of energy analyses
  - A body with vision and capacity to undertake
    - Design and construction of the new data base
    - Continuous collection and maintenance of data
    - Provide free and easy access to data

Thank you for the attention!