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Wind and Solar PV Production in Germany in September 2013

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Content

- **Part 1: analysis of wind + PV production from 1 to 9/2013**
  - ⇨RE Electricity Production in the first 9 months of 2013
  - ⇨Comparison with 2012 production and productivity
  - ⇨Conclusions

- **Part 2: monthly wind and solar PV production in September 2013**
  - ⇨Hourly Wind power capacity factor and production: Germany compared to France
  - ⇨Detailed analysis of PV production and productivity, average, maximum and minimum production
  - ⇨Hourly Wind, PV, [Wind + PV] production in Germany
  - ⇨Hourly Wind, PV, [Wind + PV] % of [Wind + PV + Conv. > 100 MW] production
  - ⇨Daily Wind and PV production and % of [Wind + PV + Conv. > 100 MW] production
  - ⇨Impact on the common ELIX index of the kWh market price in Germany, Austria, Switzerland

Introduction

❑ Refer to preceding articles on renewables in Germany:

- ⇨ **“Wind and Solar PV Production in Germany in the first 8 months of the year, with a focus on August 2013“**, online and downloadable as pdf on September 9, 2013 at : http://www.renewablesinternational.net/power-production-data-updated-for-august/150/537/72620/ **“**
- ⇨ **“Diversity in PV Systems Sizes and Market Deployment Management from Prices: Two Strategic Lessons from the German PV Policies and Measures“**, online September 3, 2013 and downloadable as pdf at: http://www.renewablesinternational.net/two-strategic-lessons-from-distributed-pv/150/452/72521/
- ⇨ **“Renewable Electricity In Germany in July 2013“** , online on August 5, 2013 and downloadable as pdf at: http://www.renewablesinternational.net/german-green-power-2013-catching-up-with-2012/150/537/71732/
- ⇨ **“ Sunny or Cloudy weather: which impact on electricity from wind and solar?“** , online on June 4, 2013 and downloadable as pdf at: http://www.renewablesinternational.net/update-on-combined-wind-and-solar-power-production/150/537/63129/

❑ Production and market prices data from:

- ⇨ Production in Germany: EEX: http://www.transparency.eex.com/
- ⇨ Wind production in France: RTE: http://www.rte-france.com/fr/developpement-durable/eco2mix/telechargement-de-donnees
- ⇨ ELIX kWh market price: EPEX SPOT SE: http://www.epexspot.com/fr/donnees_de_marche/elix

❑ Analysis for electricity production:

- ⇨ Power, energy, penetration rates, productivity
- ⇨ Comparisons of wind production and capacity factors in Germany and France

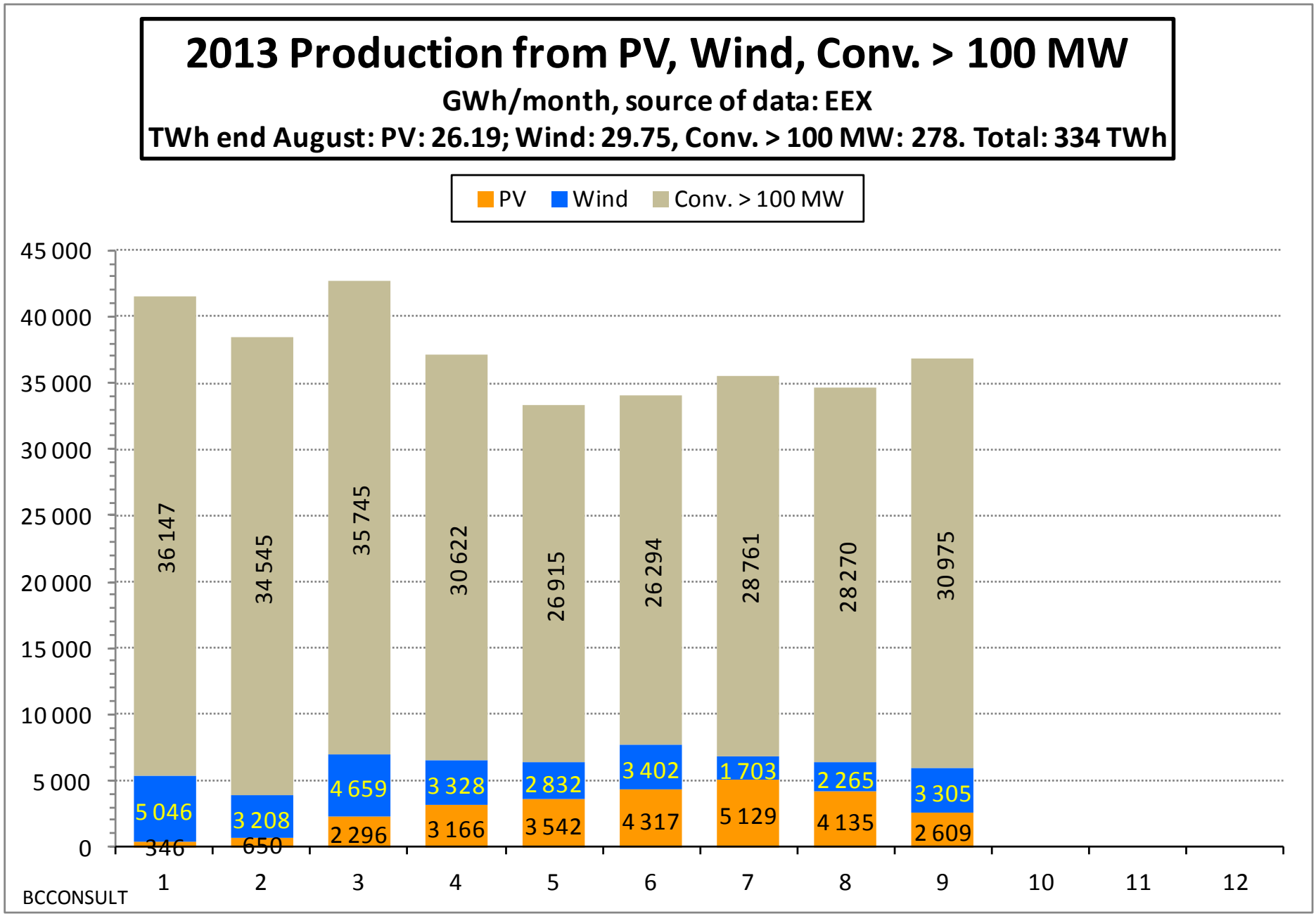
❑ Analysis of electricity market price:

- ⇨ ELIX index for Germany, Austria, Switzerland, France

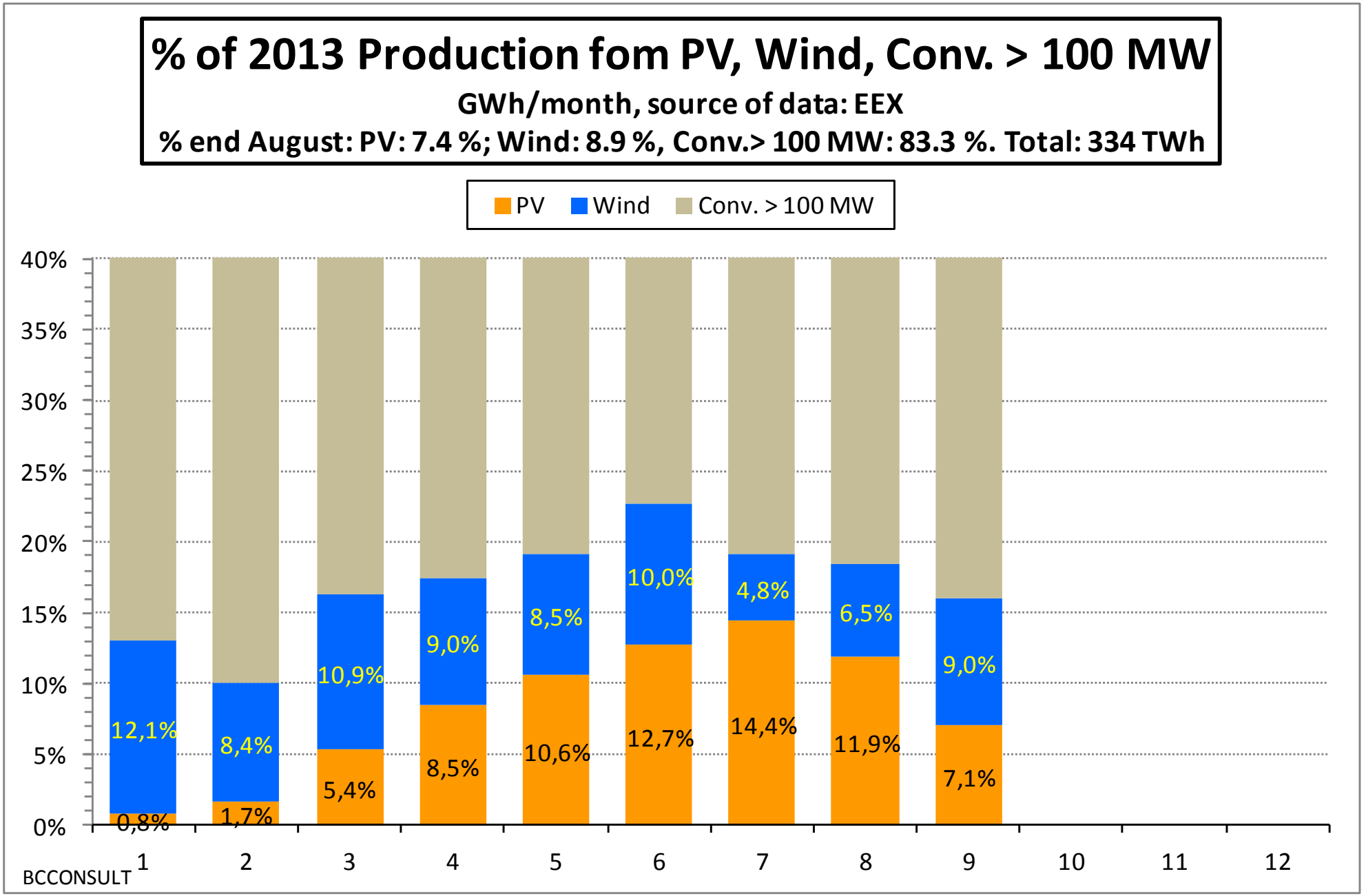
Part 1:

Analysis of the wind and PV production from January to September 2013

Monthly wind, PV and conventional production in 2013

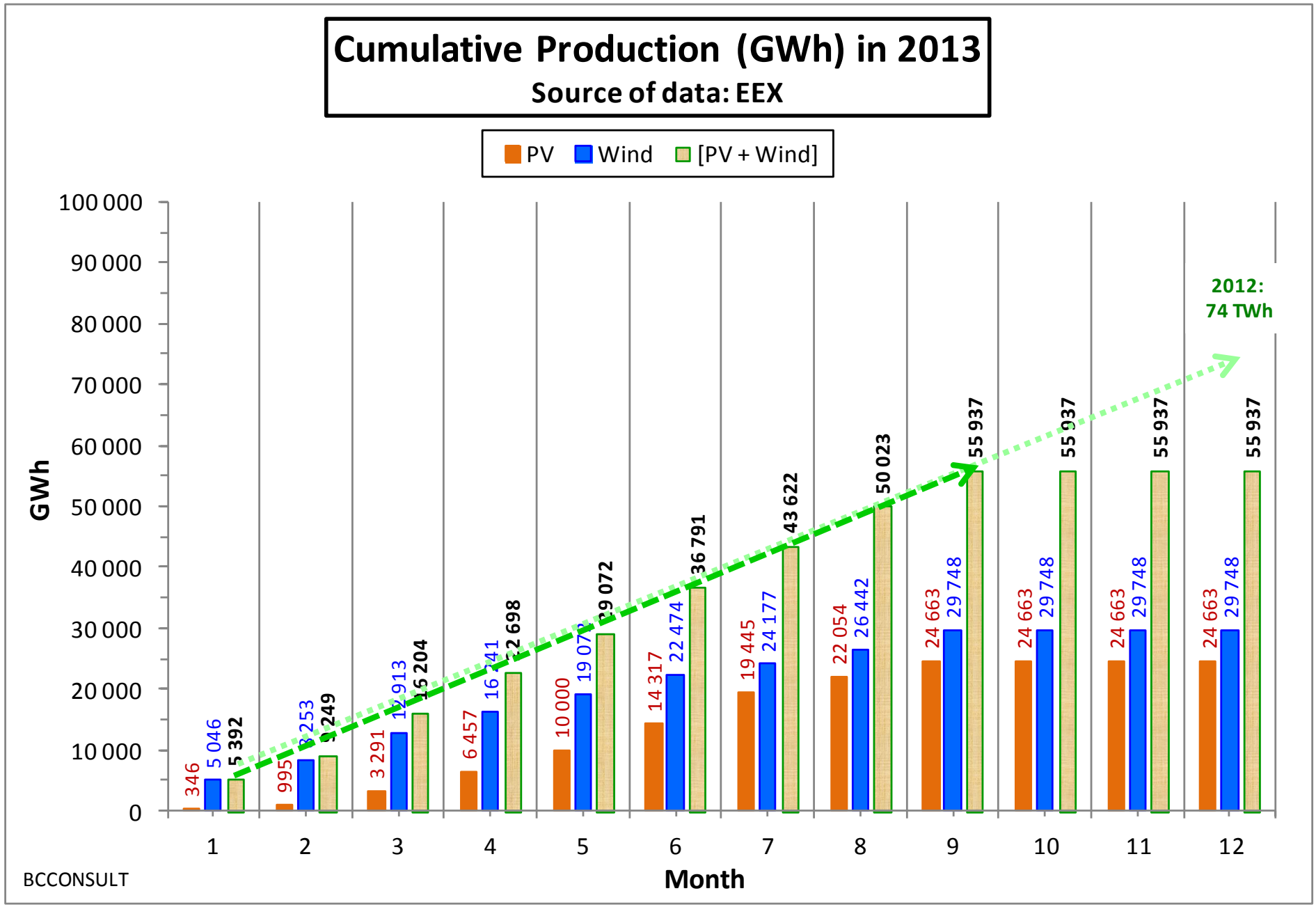


% of monthly wind and PV production in 2013



Analysis of the wind and PV monthly production changes in 2013 compared to 2012

Cumulative wind and PV production up to August 2013



Production in the first 9 months in 2012 and 2013

First 9 months: production and changes			
GWh	**1 to 9, 2013**	**1 to 9, 2012**	**2013/2012**
Wind	29 748	32 603	-8,8%
PV	26 189	24 967	4,9%
[Wind + PV]	**55 936**	**57 570**	**-2,8%**

Em	2013			2012		
GWh/month	**PV**	**Wind**	**[Wind+PV]**	**PV**	**Wind**	**[Wind+PV]**
September	2 608	3 305	5 913	2 912	3 021	5 933
August	4 135	2 265	6 400	3 885	2 157	6 042
July	5 129	1 703	6 832	3 750	2 644	6 394
June	4 317	3 402	7 719	3 727	2 894	6 621
May	3 542	2 832	6 374	4 127	2 912	7 039
April	3 166	3 328	6 494	2 634	3 354	5 989
March	2 296	4 659	6 955	2 347	4 023	6 370
February	650	3 208	3 857	1 047	4 565	5 612
January	346	5 046	5 392	537	7 034	7 571
January-Sept.	**26 189**	**29 748**	**55 936**	**24 967**	**32 603**	**57 571**

Changes in monthly production Em (GWh)			
2013/2012	**PV**	**Wind**	**[Wind+PV]**
September	-10,5%	9,4%	-0,3%
August	6,4%	5,0%	5,9%
July	36,8%	-35,6%	6,8%
June	15,8%	17,6%	16,6%
May	-14,2%	-2,8%	-9,4%
April	20,2%	-0,8%	8,4%
March	-2,2%	15,8%	9,2%
February	-37,9%	-29,7%	-31,3%
January	-35,6%	-28,3%	-28,8%
January-Sept.	**4,9%**	**-8,8%**	**-2,8%**

Source of data: EEX

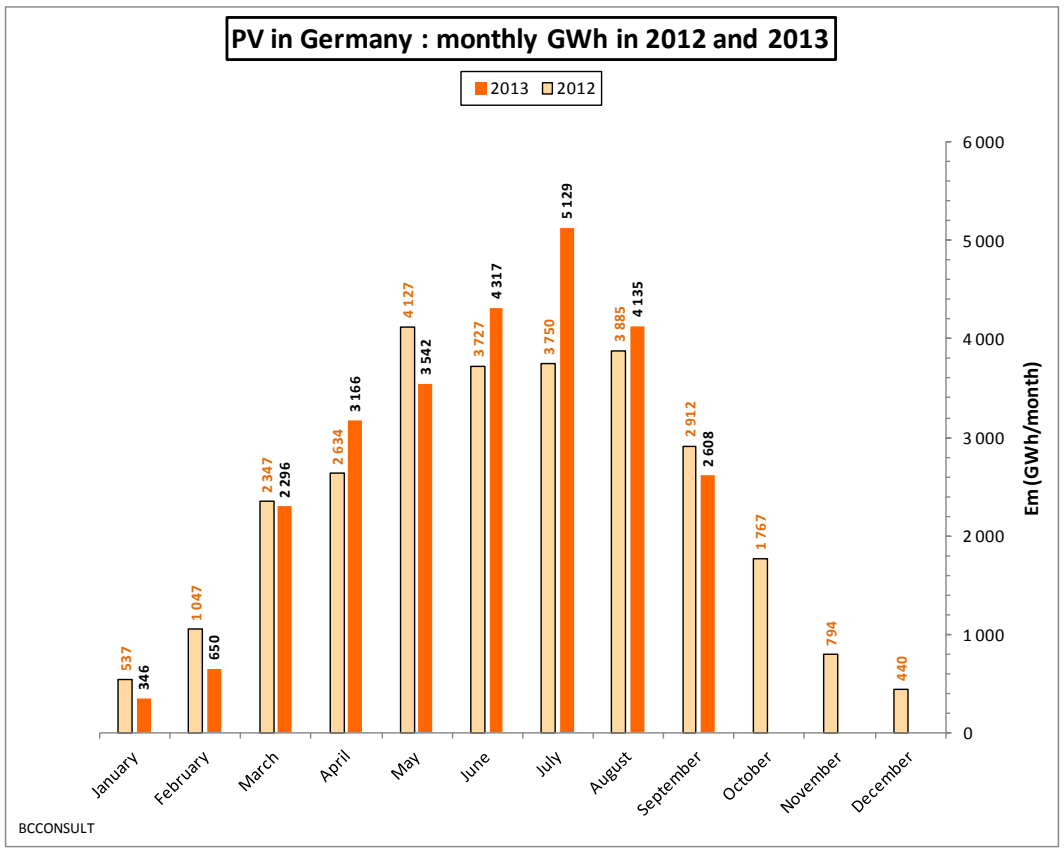
Productivity in the first 9 months in 2012 and 2013

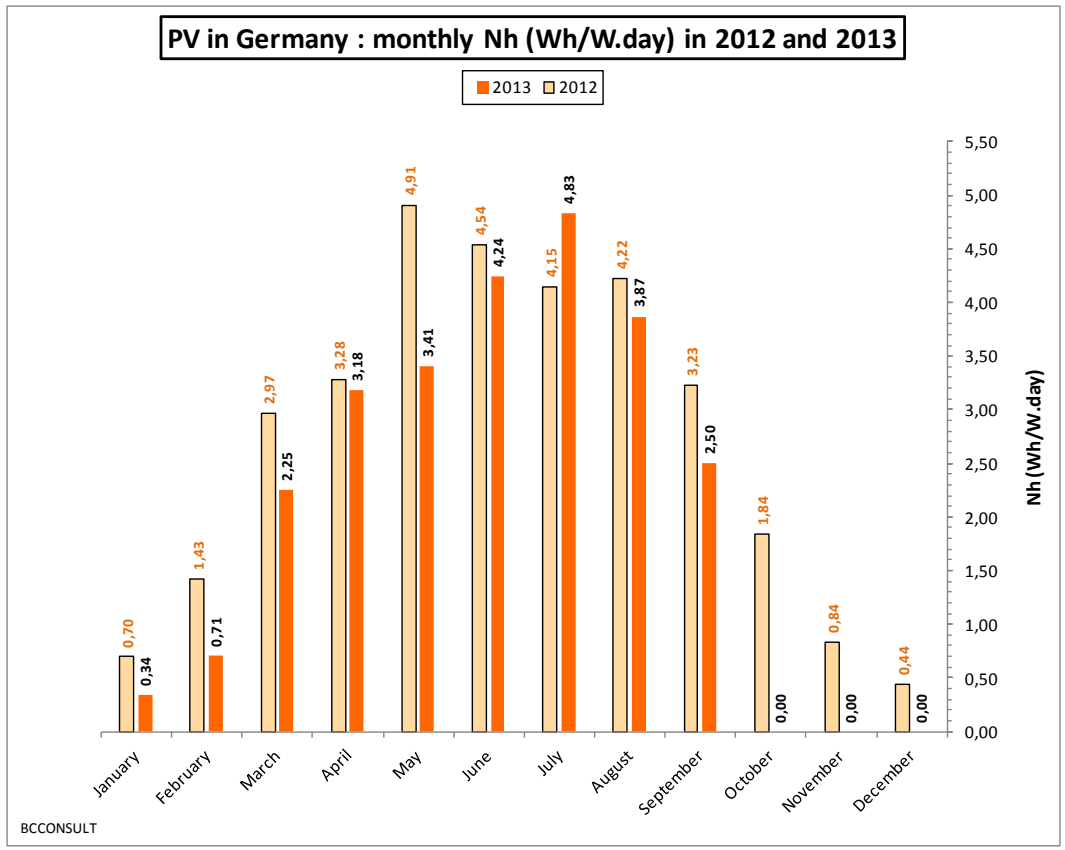
Nh	2013			2012		
Hour/day	PV	Wind	[Wind+PV]	PV	Wind	[Wind+PV]
September	2,50	3,39	2,93	3,23	3,31	3,27
August	3,87	2,24	3,08	4,22	2,30	3,25
July	4,83	1,69	3,31	4,15	2,84	3,49
June	4,24	3,51	3,89	4,54	3,23	3,86
May	3,41	2,85	3,13	4,91	3,16	4,00
April	3,18	3,48	3,33	3,28	3,79	3,55
March	2,25	4,75	3,48	2,97	4,42	3,74
February	0,71	3,64	2,15	1,43	5,39	3,55
January	0,34	5,21	2,73	0,70	7,80	4,53

Changes in mean daily productivity Nh (h/d)			
2013/2012	PV	Wind	[Wind+PV]
September	-22,7%	2,4%	-10,5%
August	-8,4%	-2,9%	-5,3%
July	16,5%	-40,5%	-5,2%
June	-6,6%	8,6%	0,8%
May	-30,6%	-10,0%	-21,6%
April	-3,0%	-8,0%	-6,1%
March	-24,0%	7,5%	-7,1%
February	-50,2%	-32,4%	-39,5%
January	-50,7%	-33,2%	-39,7%

Source of data: EEX

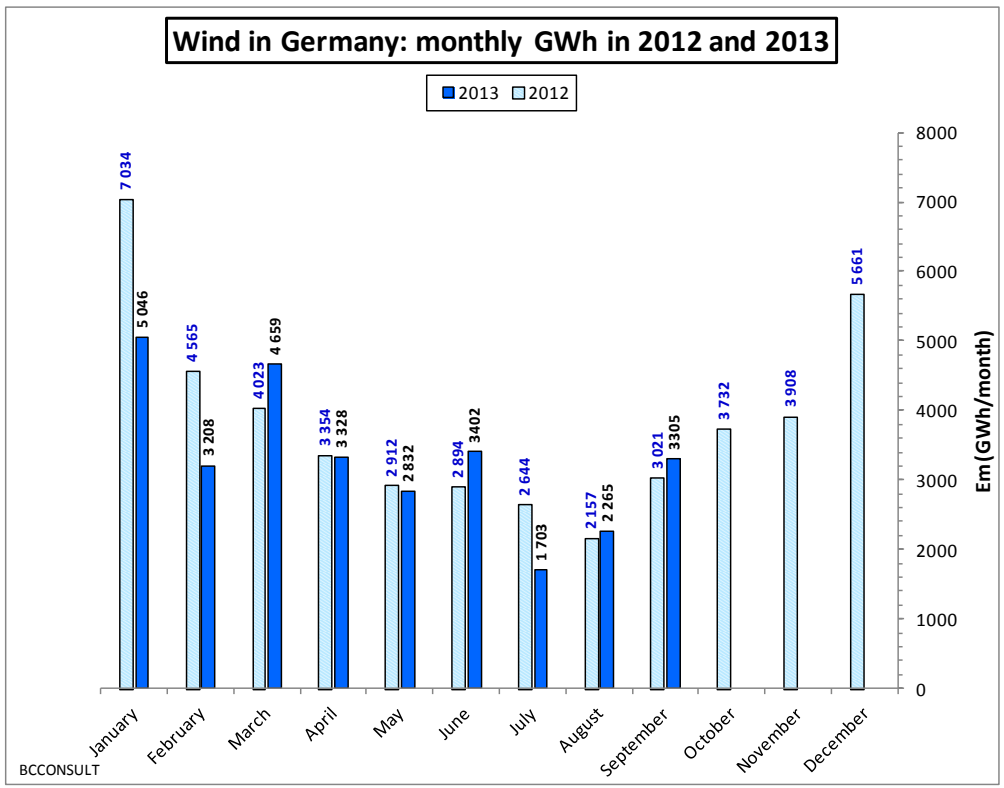
PV Production and productivity in 2012 and 2013

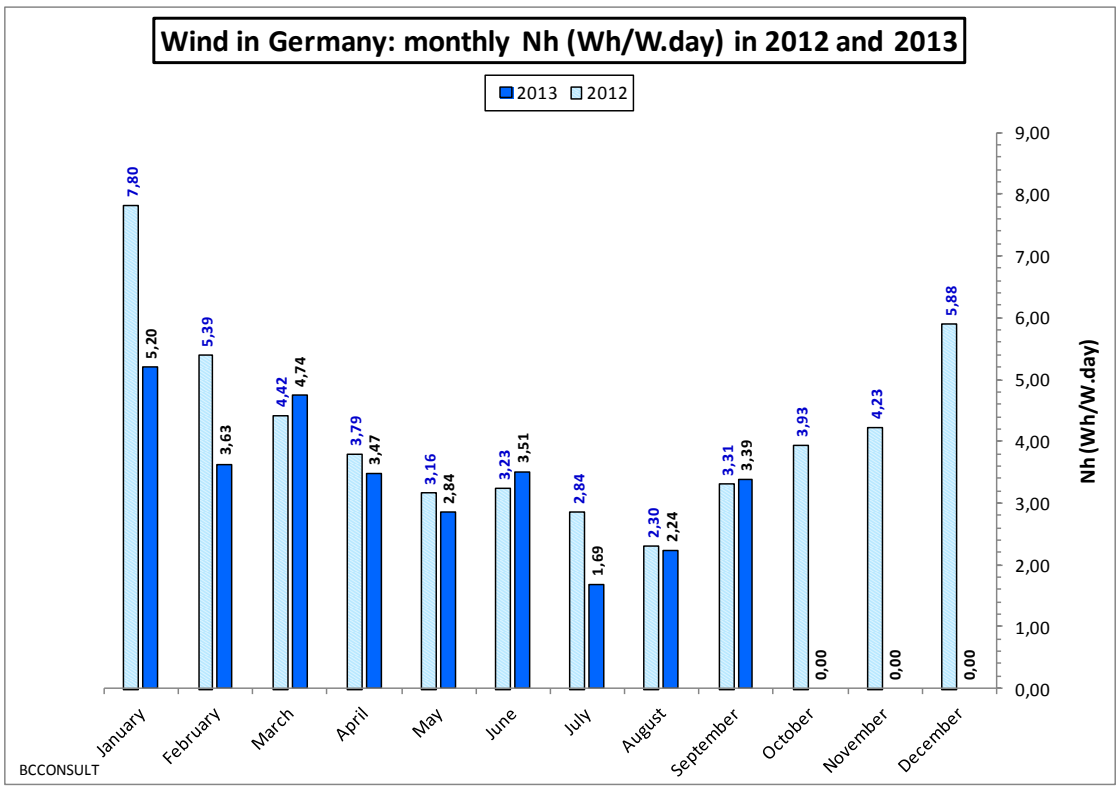




Source of data: EEX

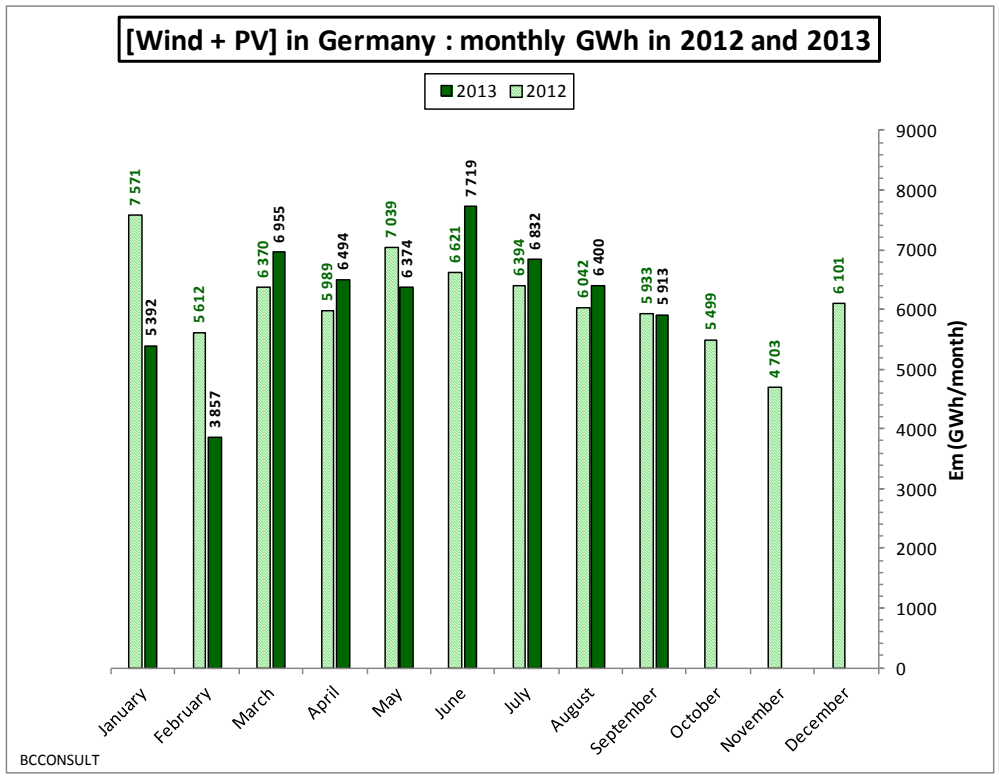
Wind production and productivity in 2012 and 2013

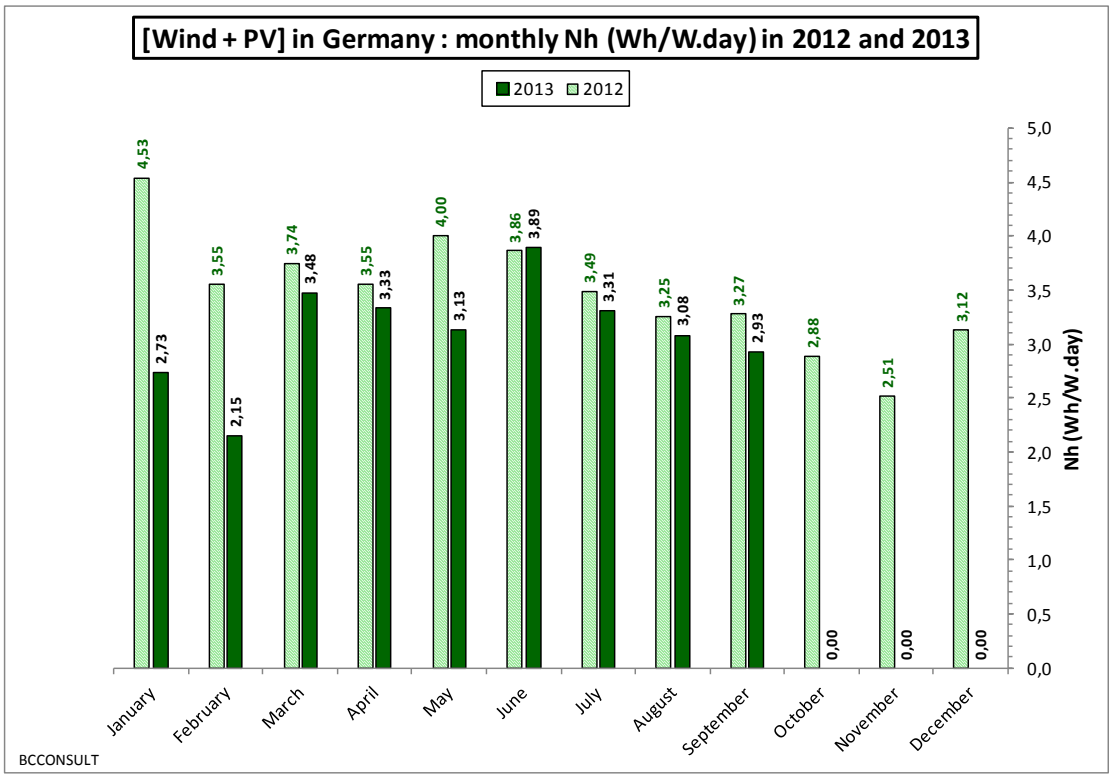




Source of data: EEX

[Wind + PV] production and productivity in 2012 and 2013





Source données: EEX

Conclusions on Part 1

- **[Wind + PV] contribution in Germany in the first 9 months was less in 2013 compared to 2012 due to meteorological conditions:**
  - ⇨ 8.8 % less for wind
  - ⇨ 4.9 % more for PV
  - ⇨ 2.8 less for [wind + PV]
  - ⇨ Total [wind + PV] production : 55.936 TWh from 1 to 9/2013 compared to 57.571 in 2012

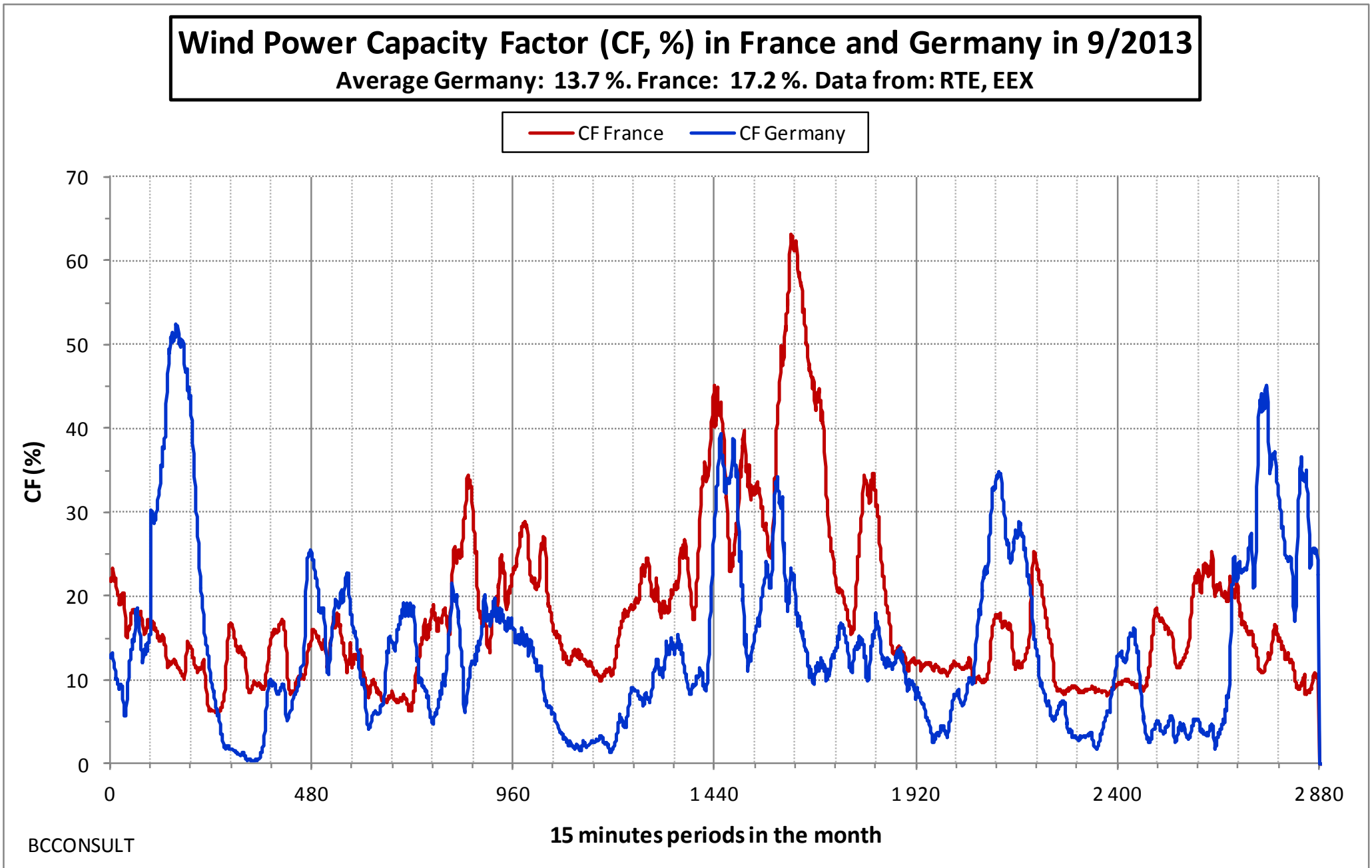
- **Decrease in productivity was not fully compensated by increases in wind and PV installed power**

- **The mix of wind and PV is an advantage for monthly demand following, but future mix should be more optimal:**
  - ⇨ Higher capacity factor for onshore wind from incentives to use new high specific area (Su = S/P > 4 m2/kW) IEC3 wind turbines for light wind areas
  - ⇨ More total installed wind than PV to increase winter [Wind + PV] production

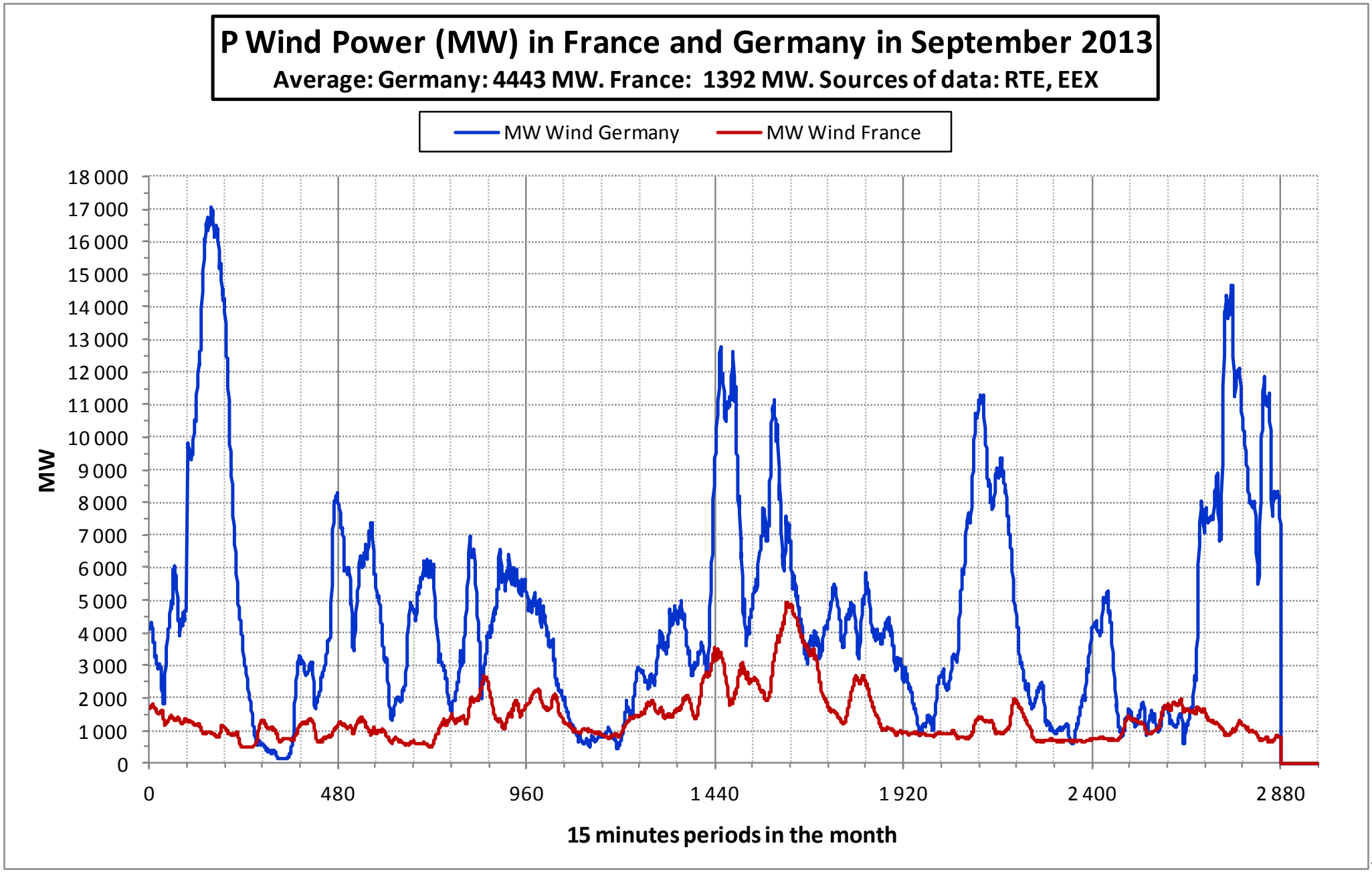
Part 2:

Analysis of monthly production and ELIX market prices in September 2013

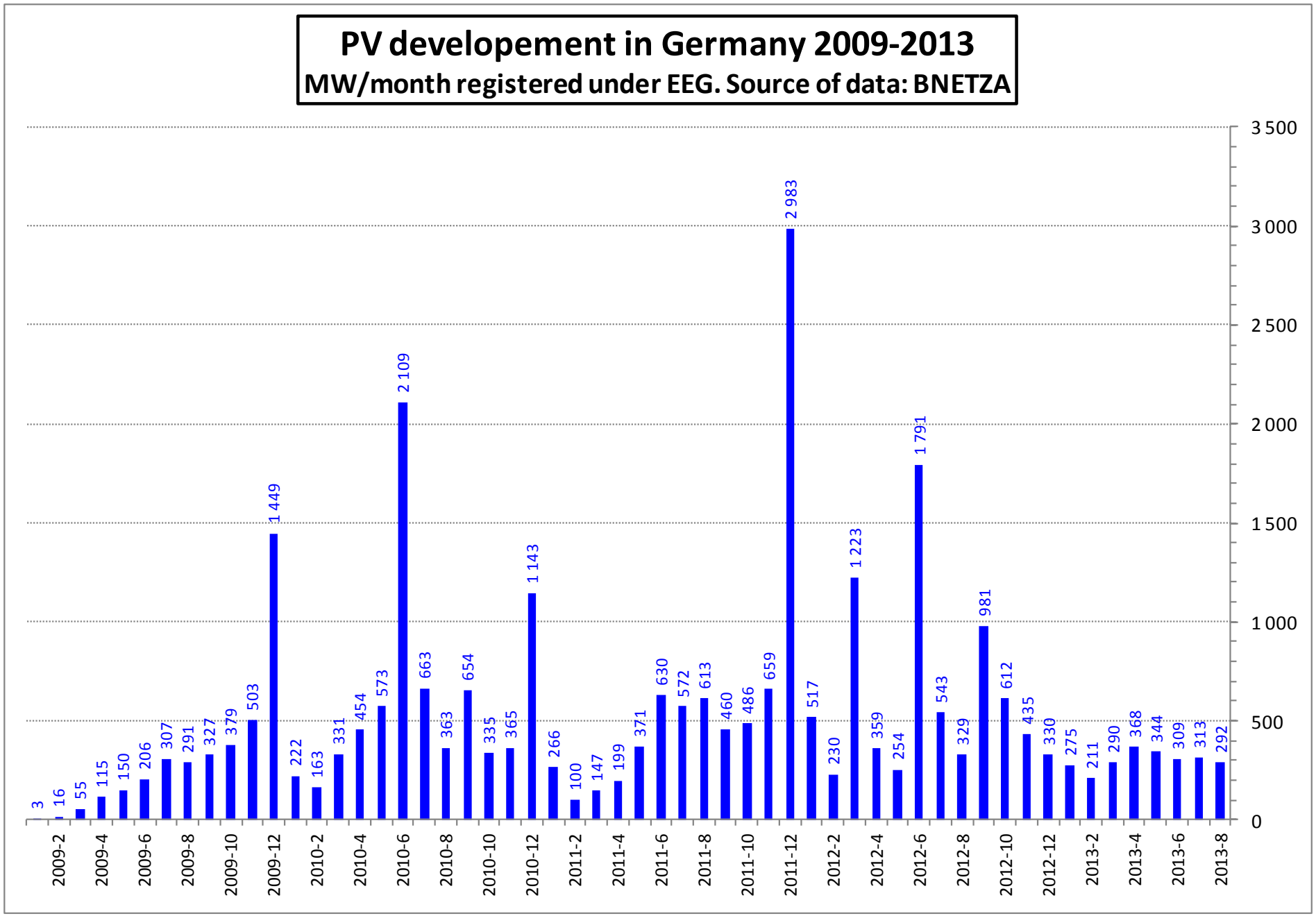
Wind power capacity factors in Germany and France in 9/2013



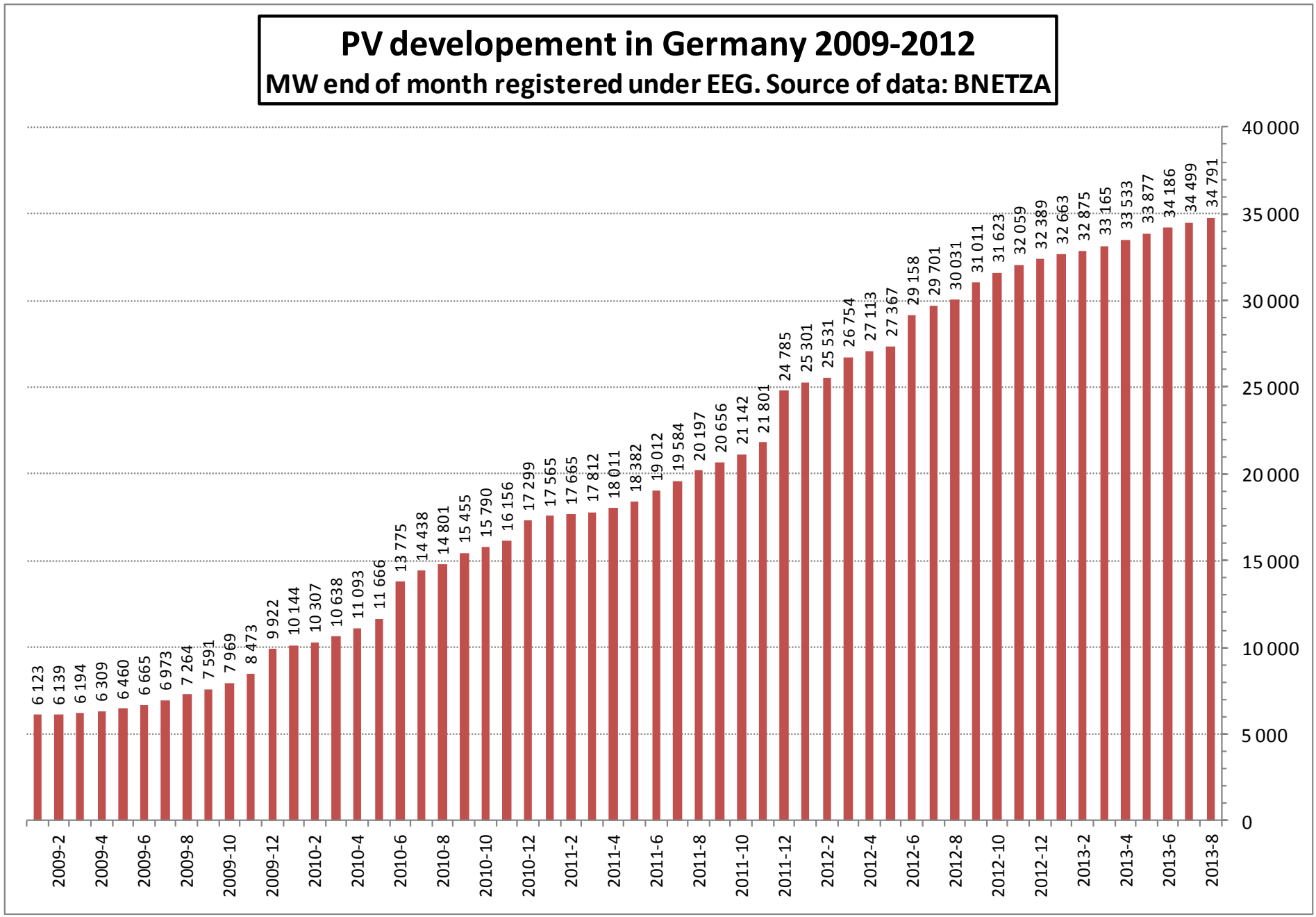
Wind power production in Germany and France in 9/2013



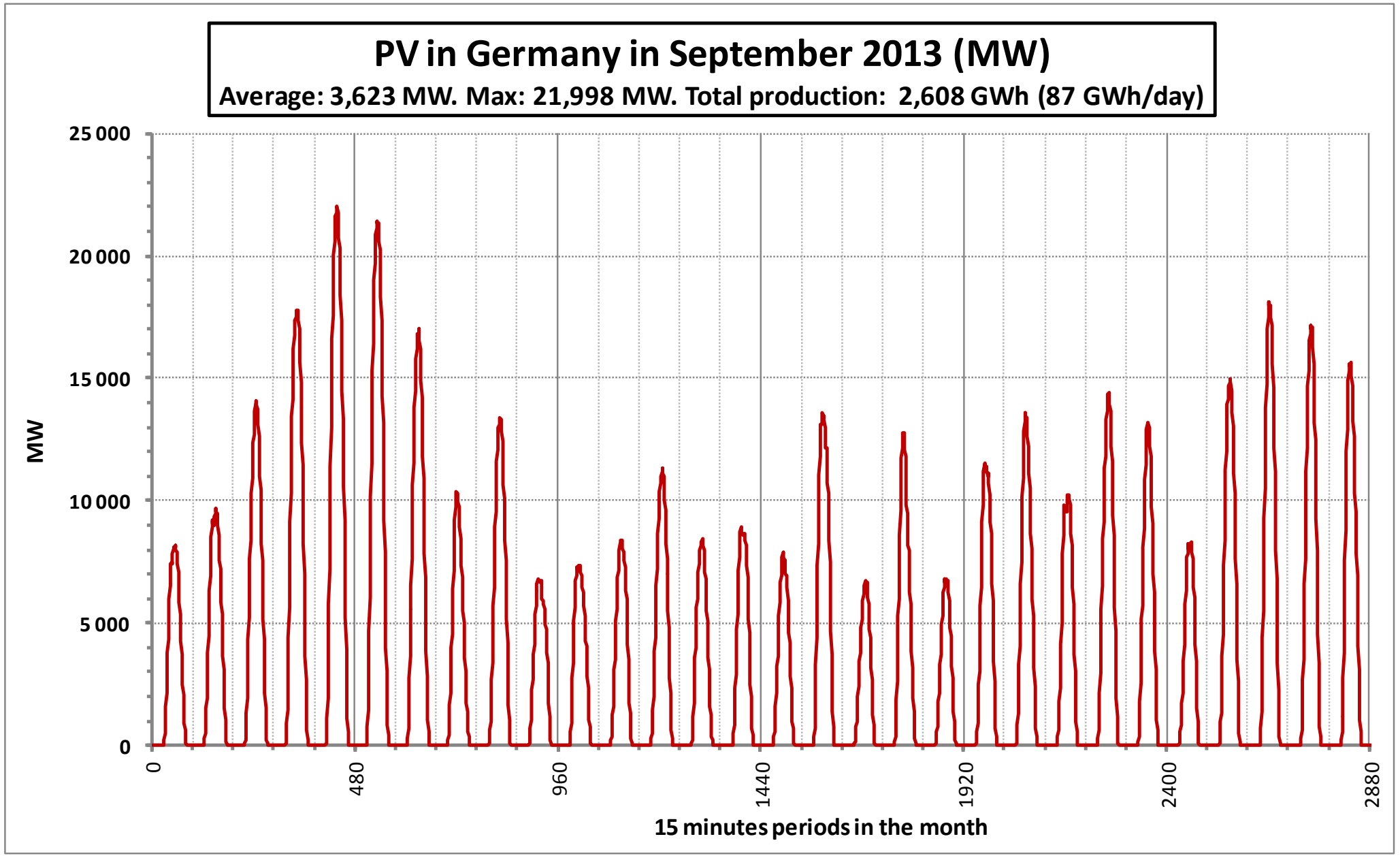
Monthly Solar PV in Germany 1/2009 to 9/2013



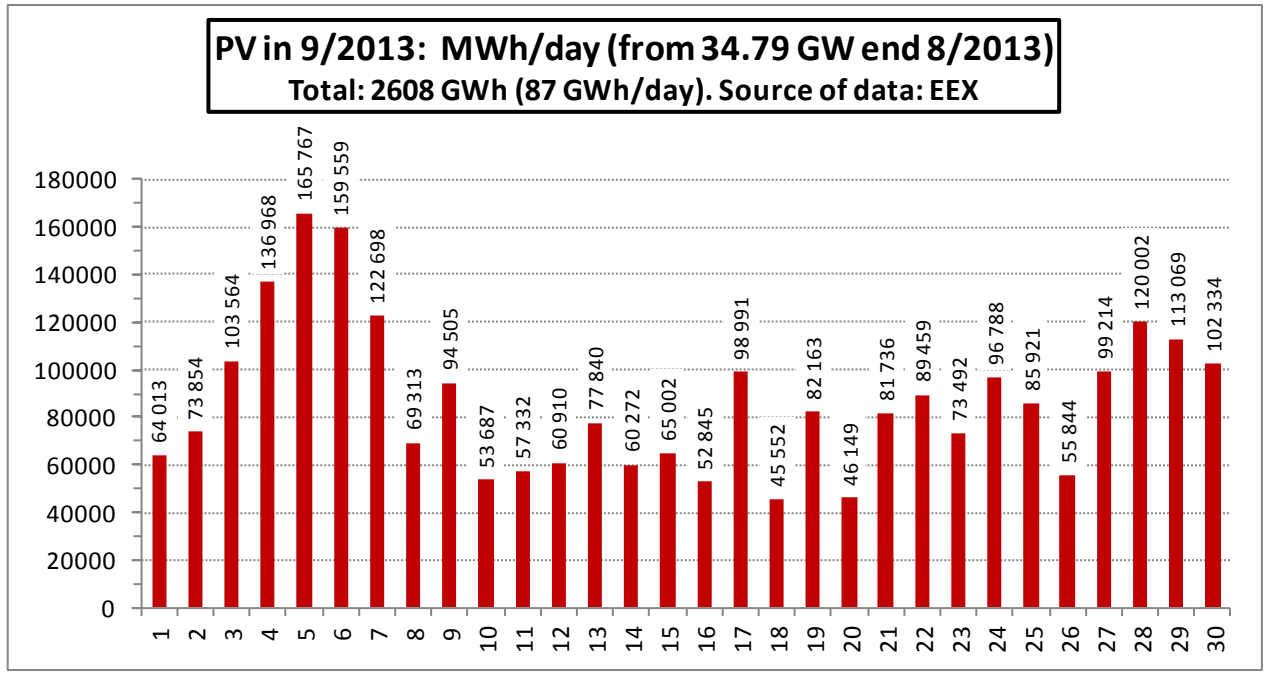
Total Solar PV in Germany 1/2009 to 9/2013

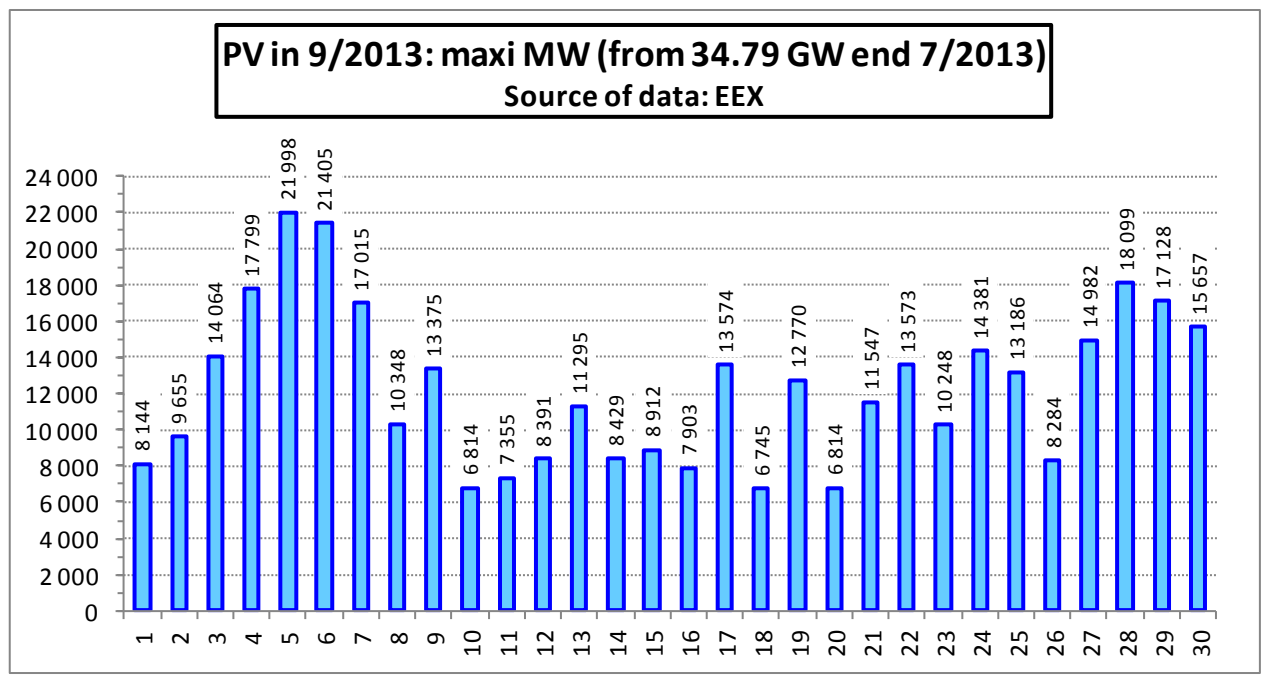


Solar PV in Germany in 9/2013

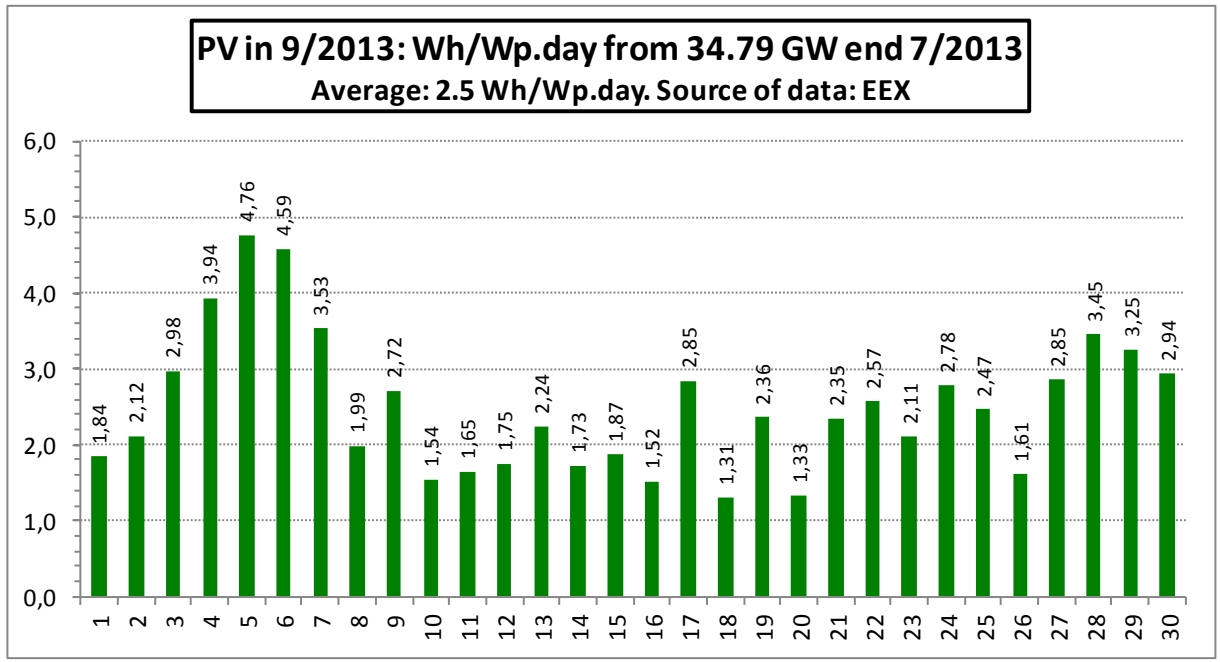


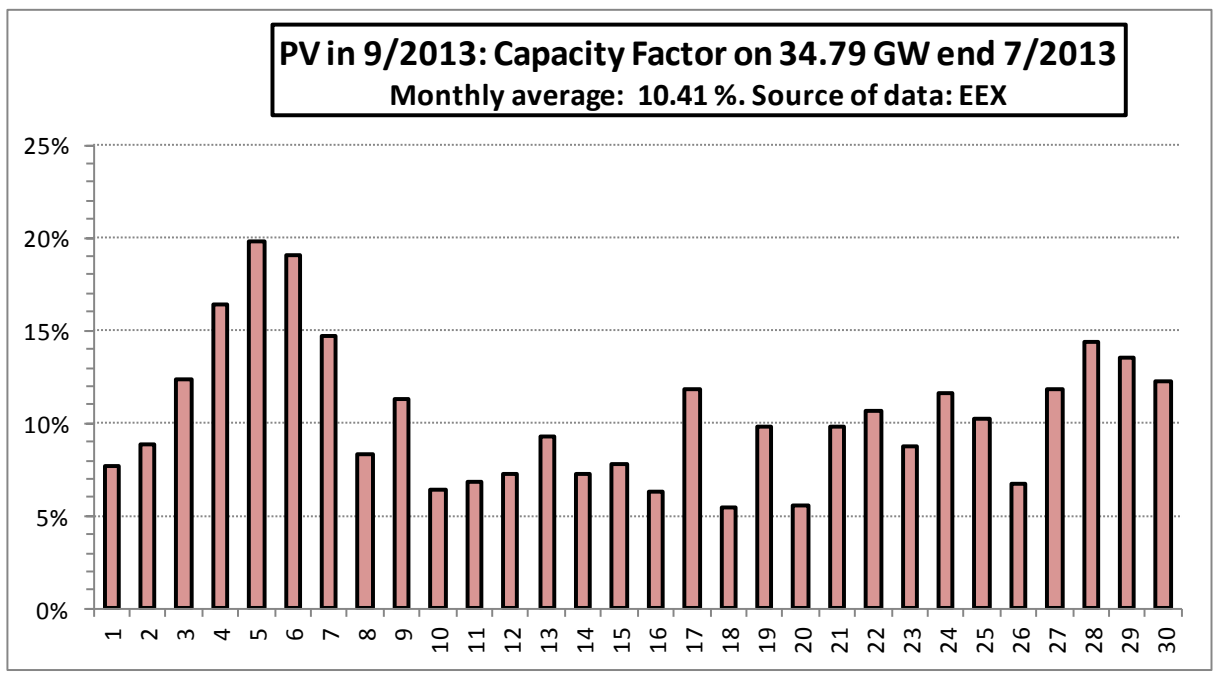
PV in 9/2013: daily production (GWh) and maximum MW



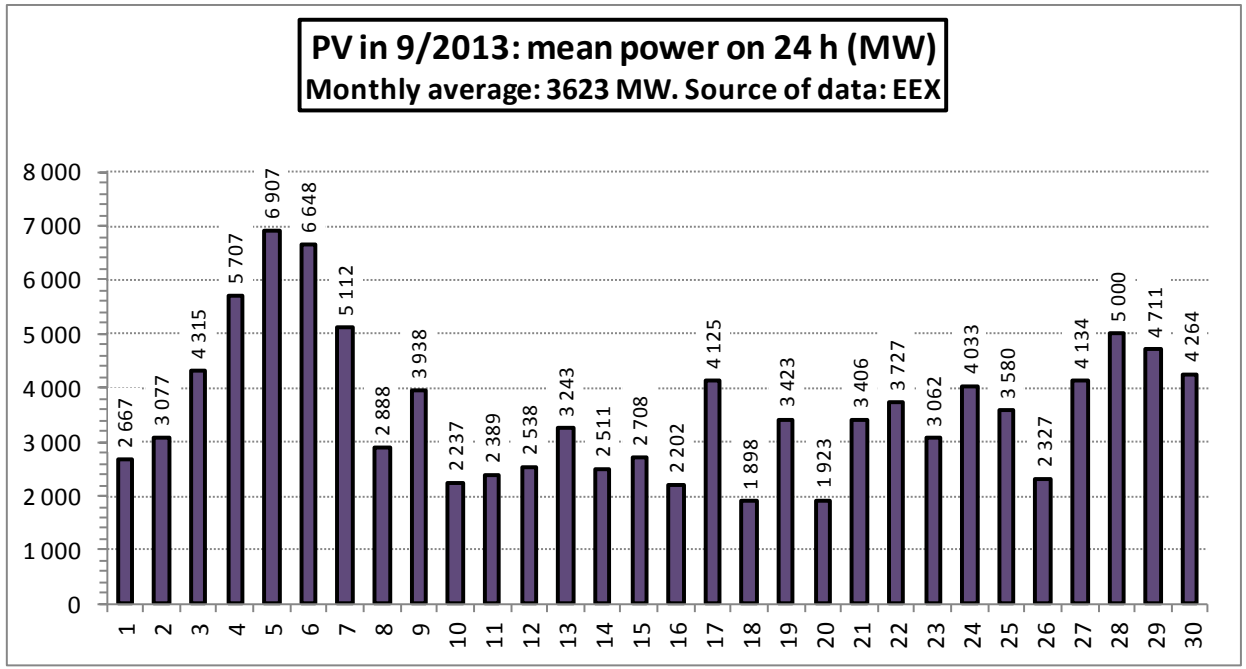


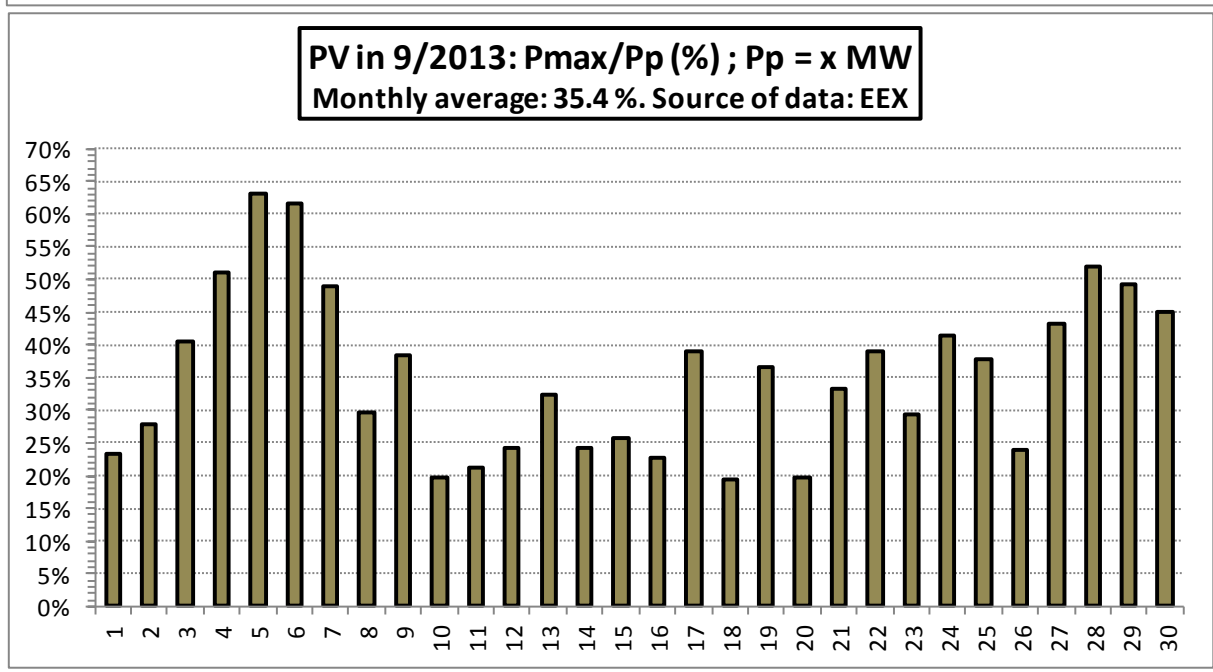
PV in 9/2013: daily productivity (Wh/W.day, Capacity Factor in %)



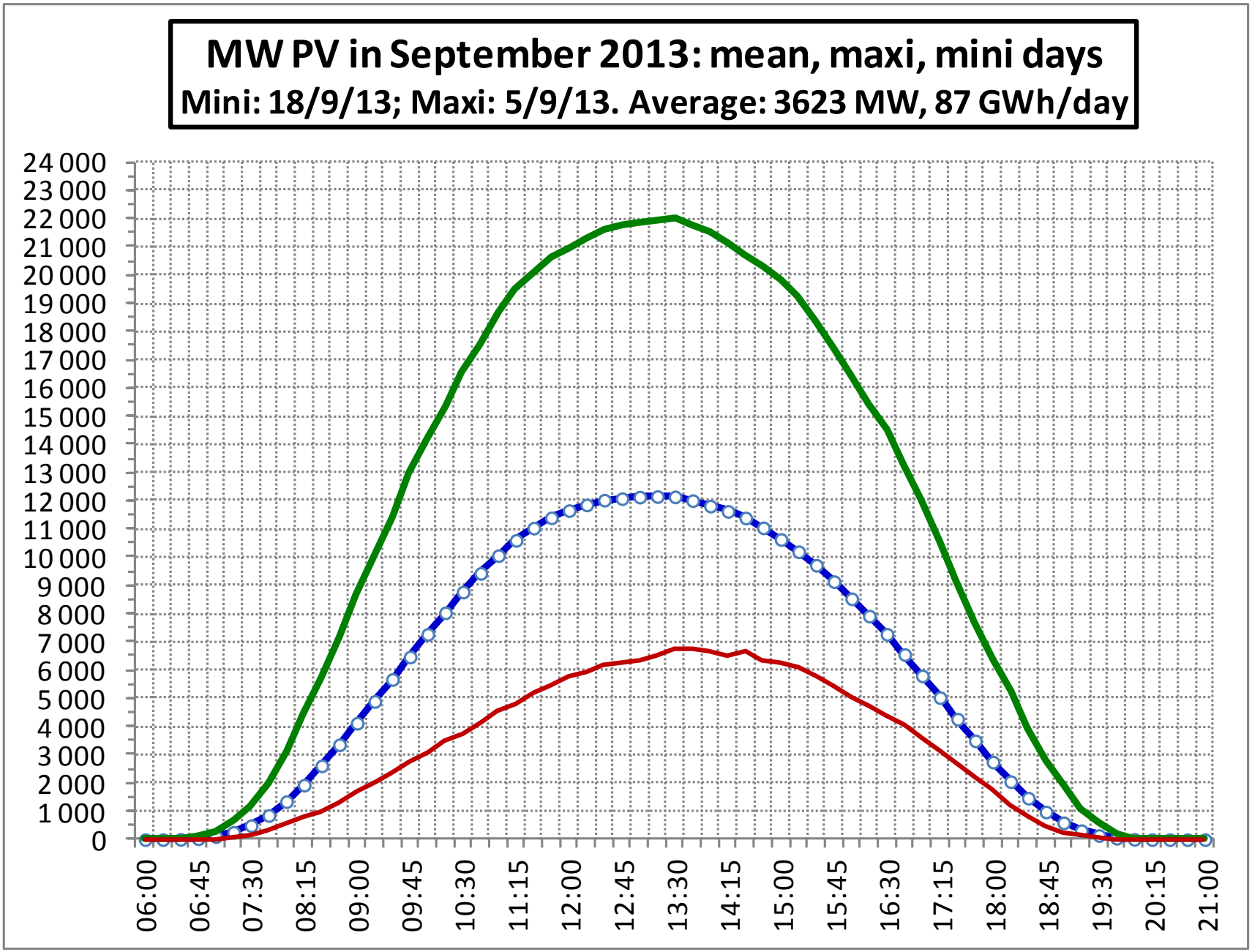


PV in 9/2013: mean daily power (MW) and ratio Pmax/P



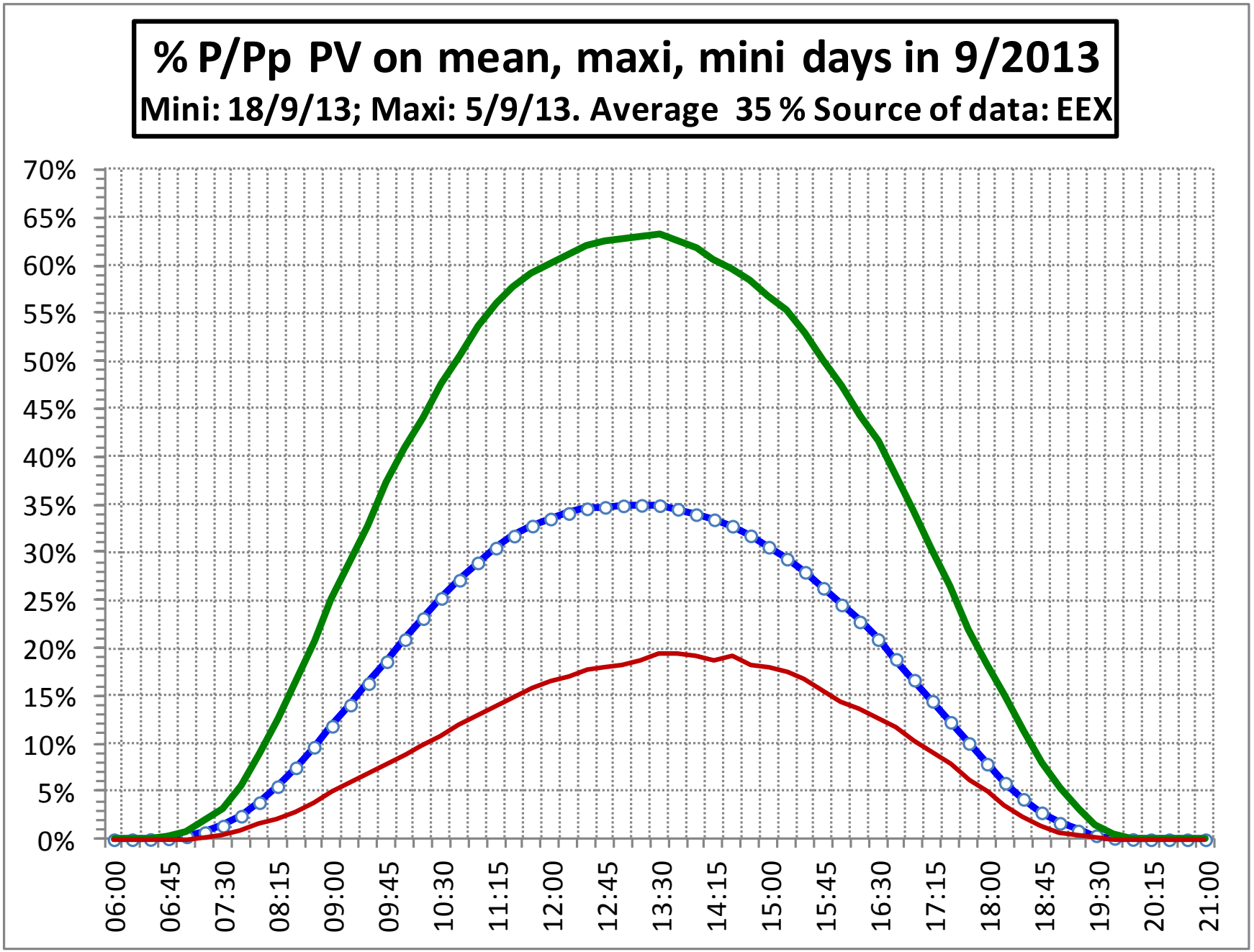


PV in 9/2013: averaged, maximum and minimum production days

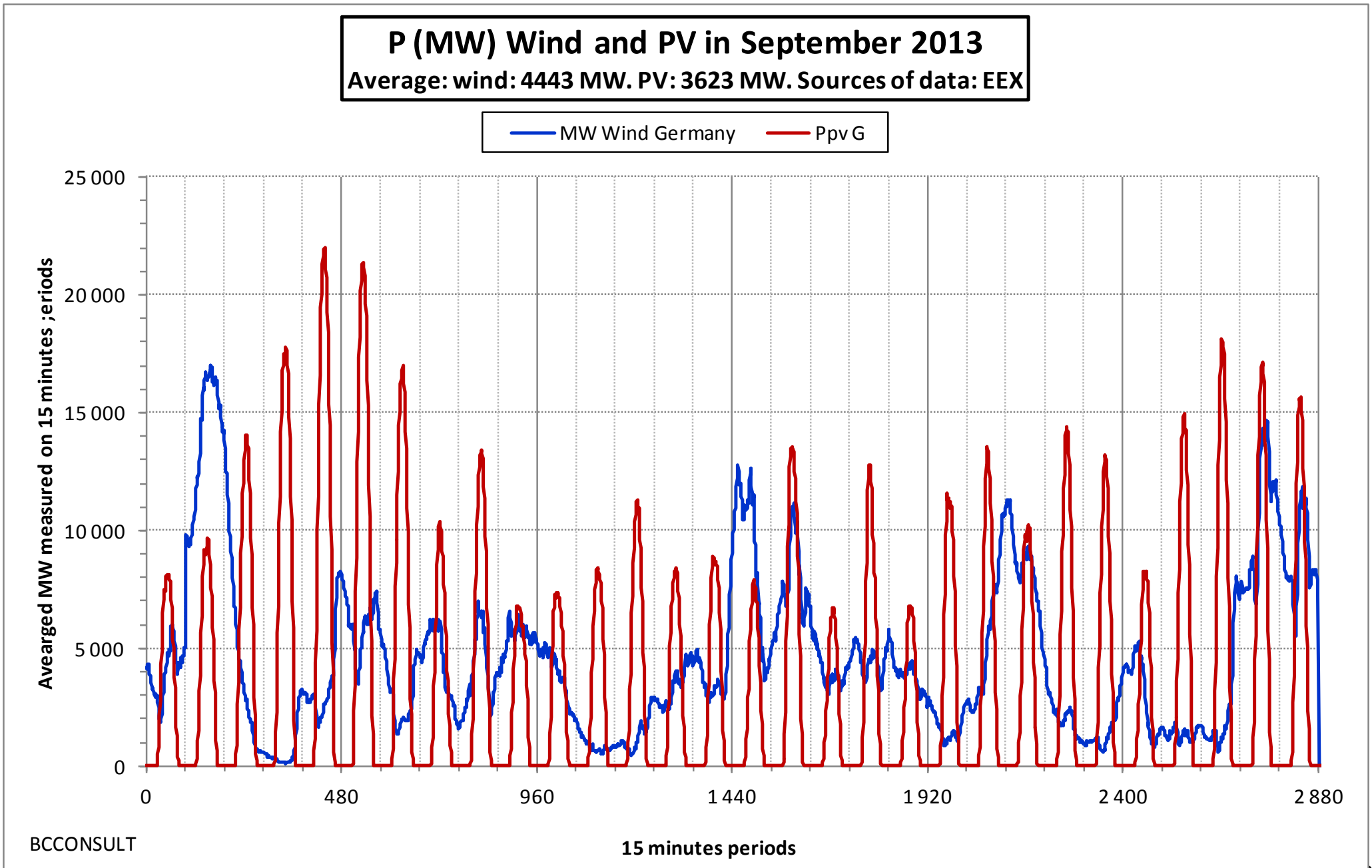


PV in 9/2013: averaged, maximum and minimum P/Pp ratios

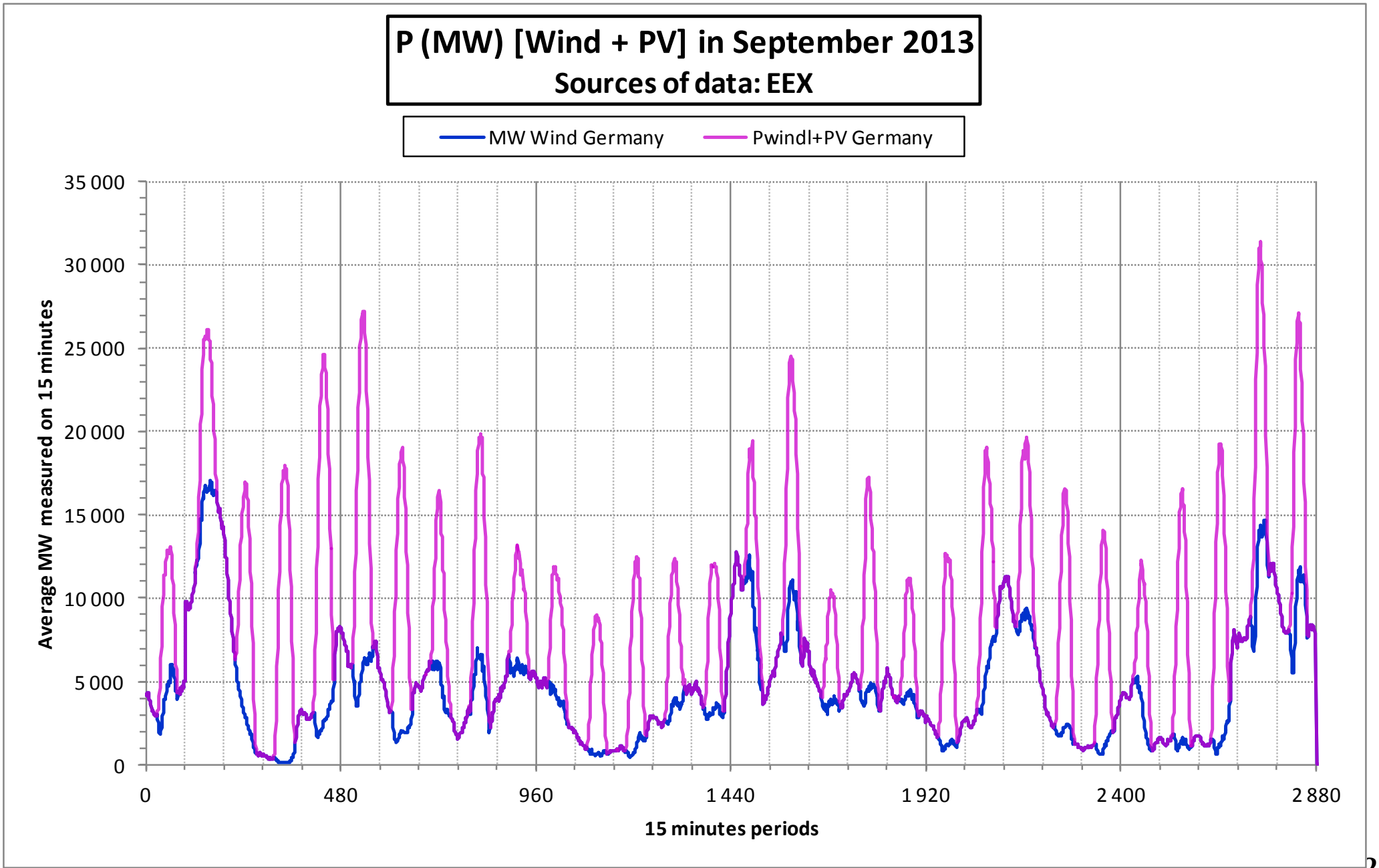
Pp = installed peak power = 34791 MW end of August 2013



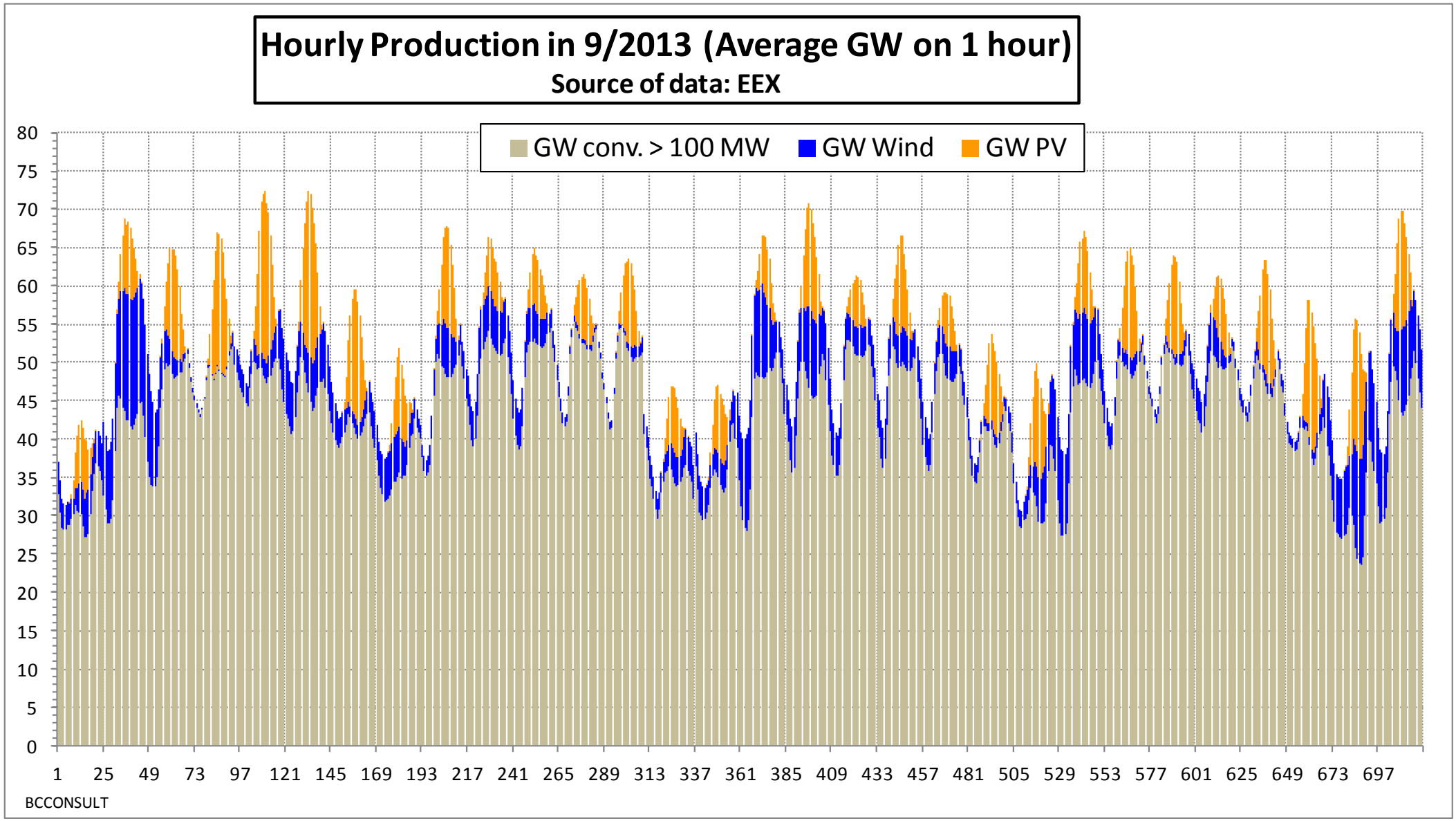
Wind and PV production in Germany in 9/2013



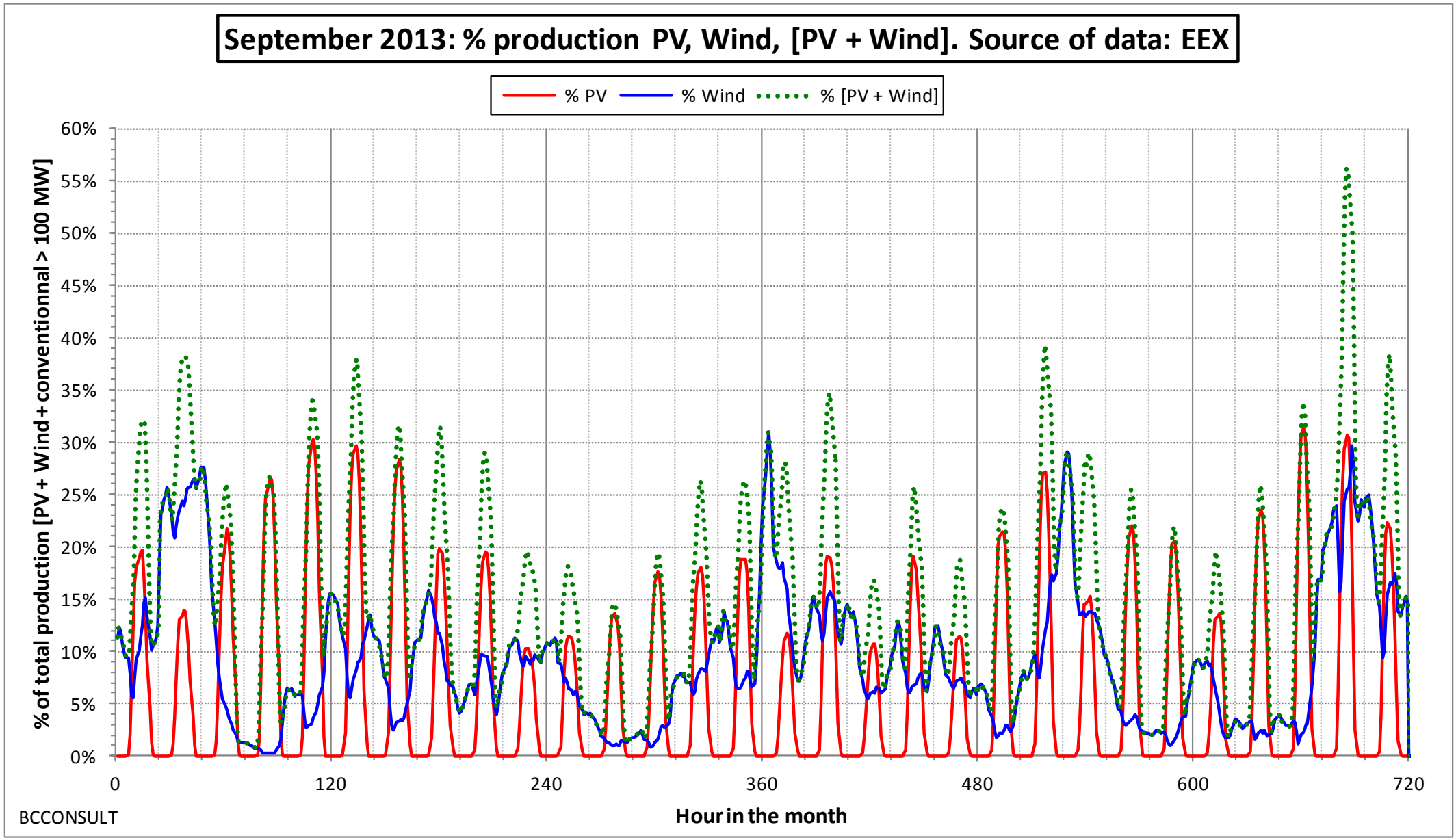
[Wind + PV] production in Germany in 9/2013



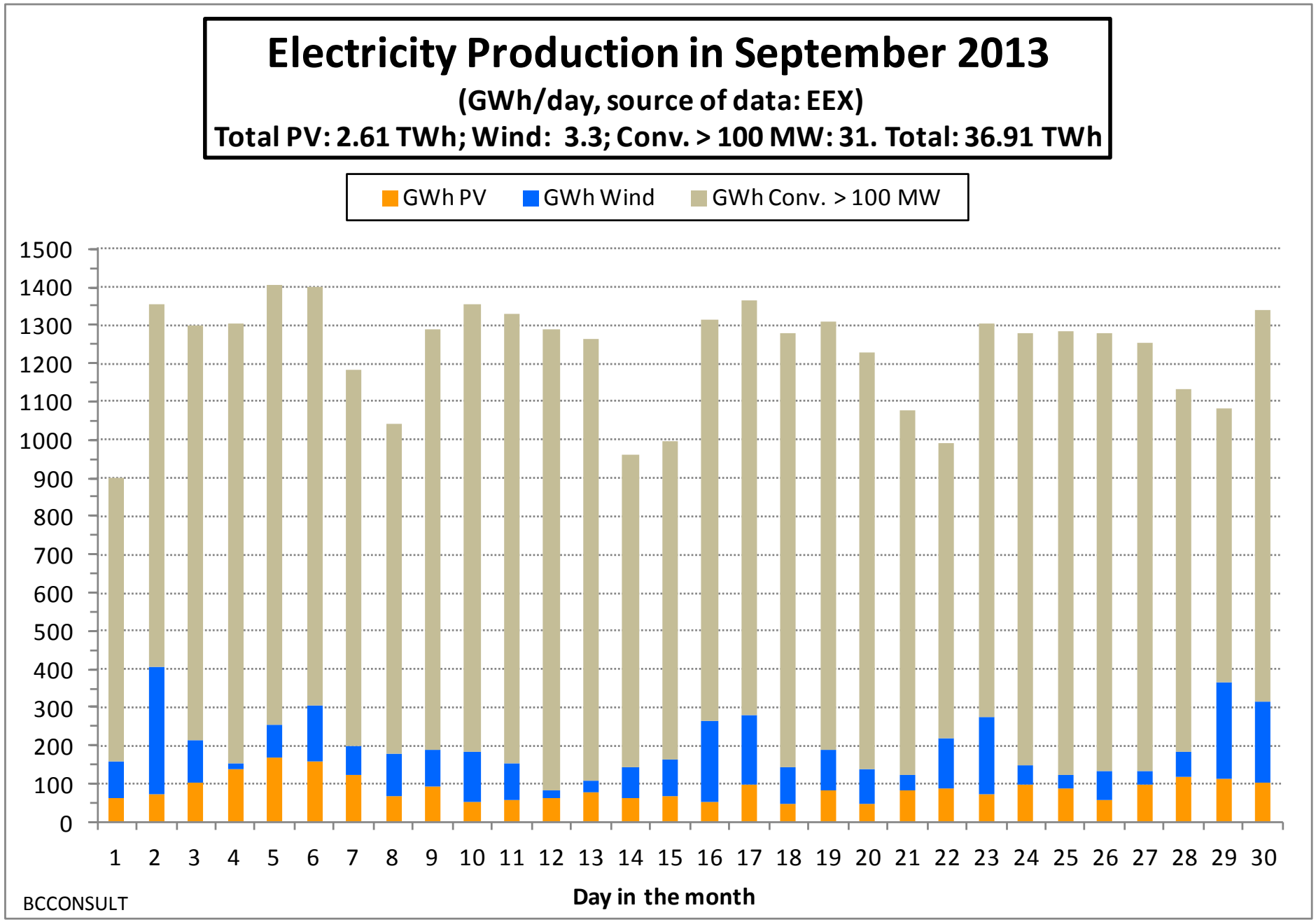
[Wind + PV + Conv. > 100 MW] production in Germany in 9/2013



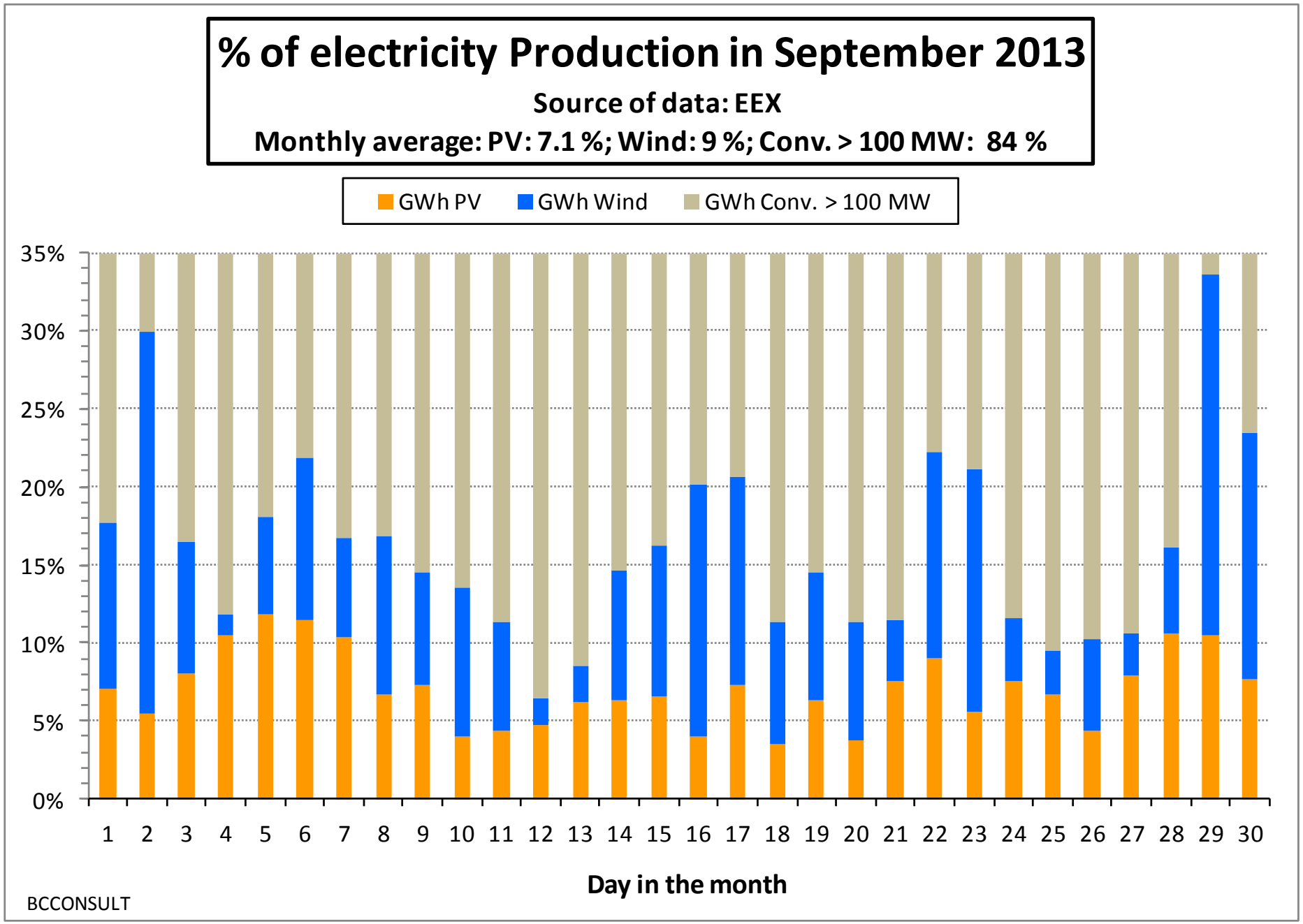
% of wind, PV, [Wind + PV] in 9/2013



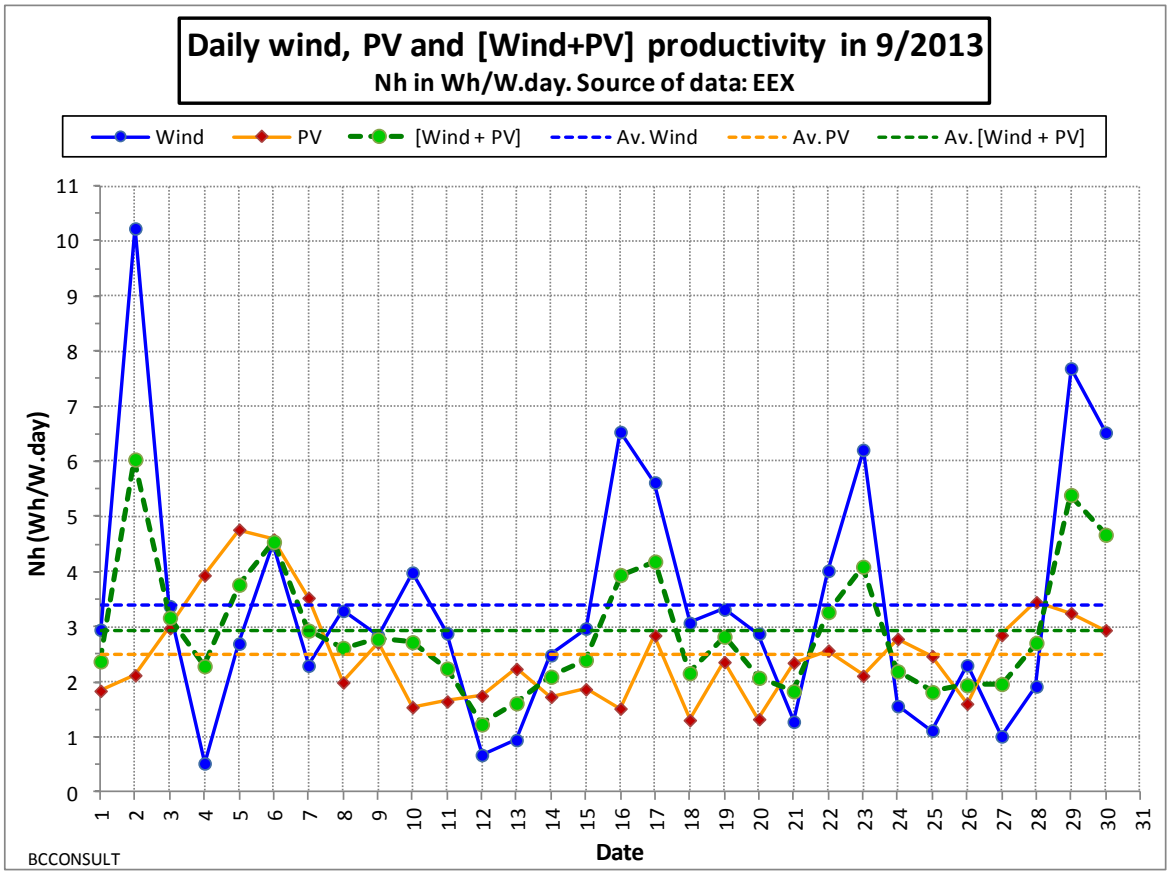
Wind, PV and conv. > 100 MW daily production in 9/2013



% of wind and PV in daily [Wind+PV+Convent.] production in 9/2013

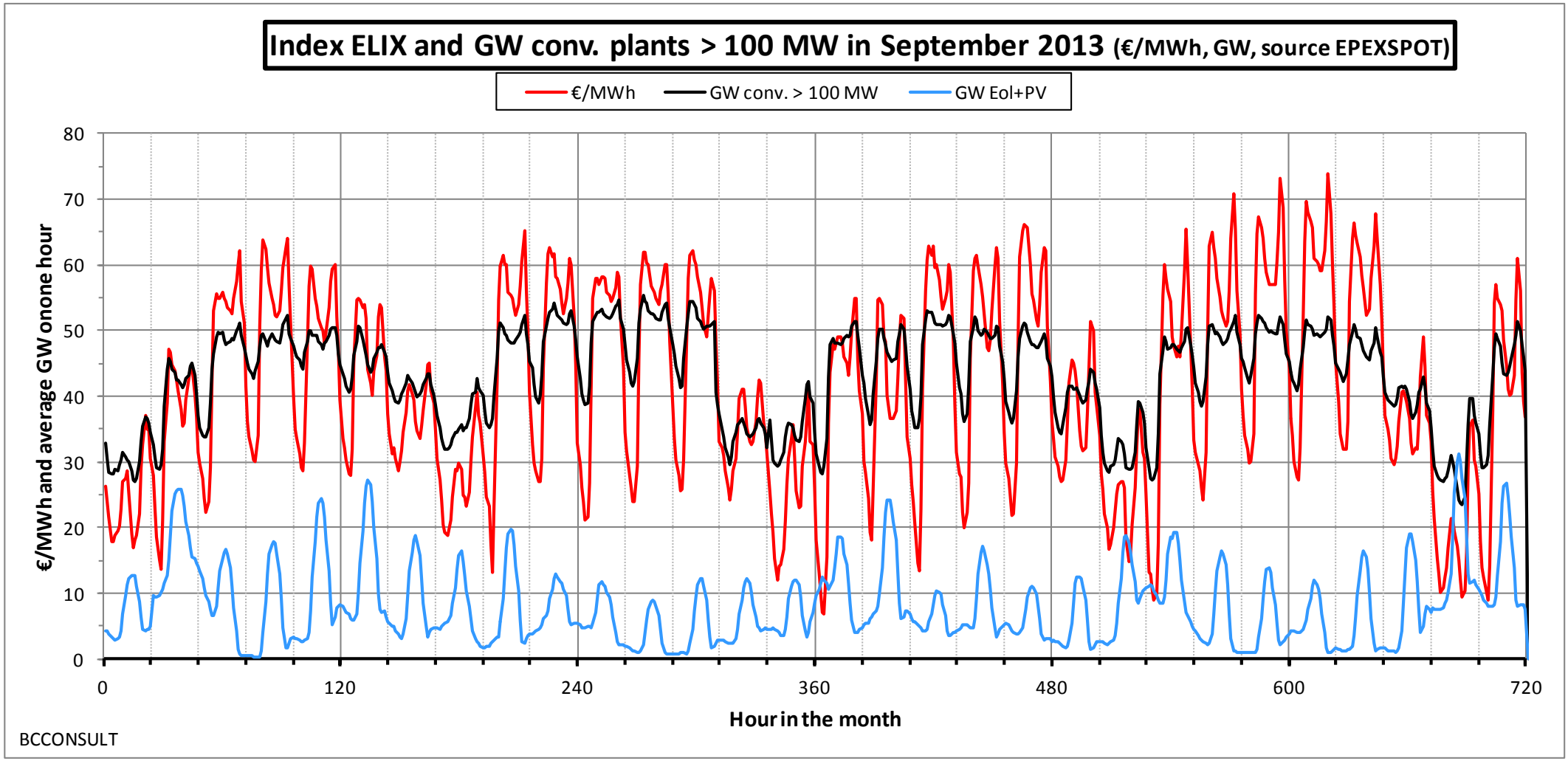


Wind, PV and [Wind + PV] Productivity in 9/2013

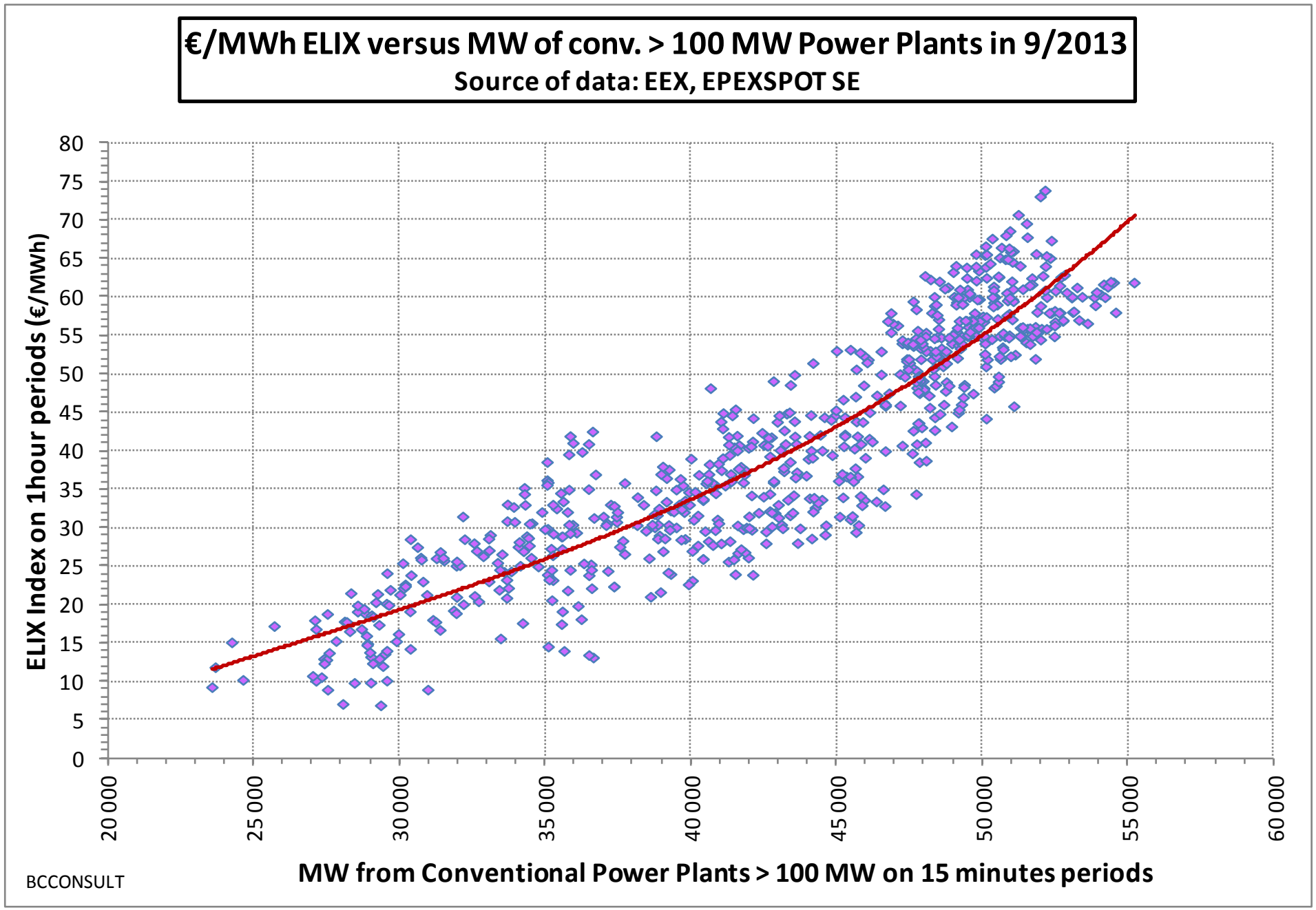


September 2013 Germany	Daily Productivity (Wh/W.day)		
	Wind	PV	[Wind + PV]
Maximum	10,23	4,76	6,04
Average	**3,391**	**2,500**	**2,930**
Minimum	0,52	1,31	1,23
Median	**2,92**	**2,36**	**2,66**
Stand. Dev.	2,22	0,98	1,15
Rel. Stand. Dev.	65%	39%	39%

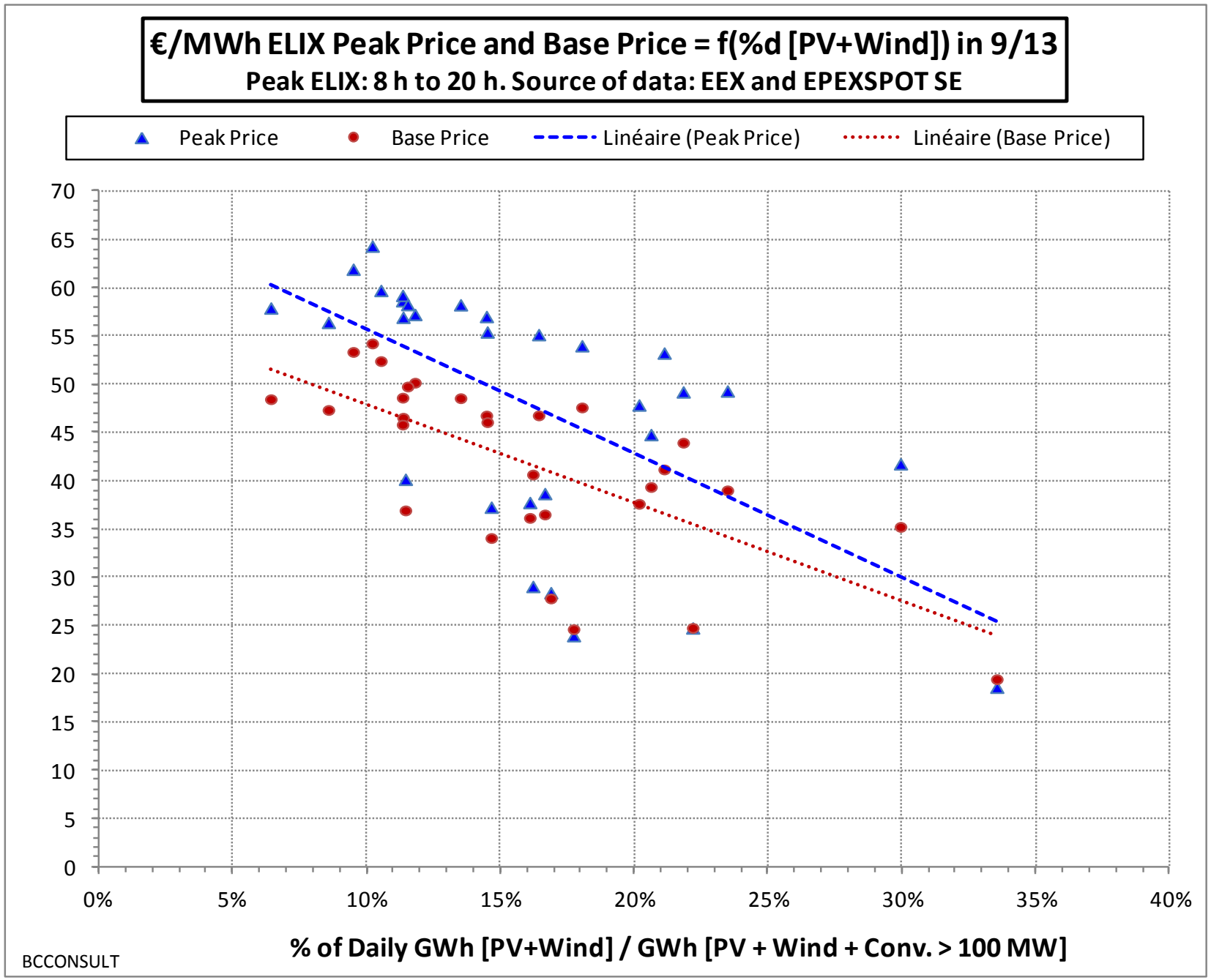
Impact on the market electricity price index ELIX in 9/2013



Impact on the market electricity price index ELIX in 9/2013



Impact on the market electricity price index ELIX in 9/2013



Impact on the market electricity price index ELIX in 9/2013