Wind energy statistics in Finland 2014

Version: Public

Foto: Puhuri Oy, Kopsa wind plant

Wind energy year 2014

- End of year capacity in Finland: 631 MW (268 turbines)*
  - Average size of turbine 2.4 MW, max 5 MW
- Total production: 1.1 TWh
- New capacity in 2014: 184 MW (59 turbines)
  - Average size of turbine 3.1 MW, max 5 MW
- Removed capacity in 2014: 6.3 MW (12 turbines)
  - Average size of turbine 524 kW (300 kW - 1 MW)
  - Age of turbine min 7 years, max 21 years

*Small or second-hand turbines may be missing

Wind energy year 2014

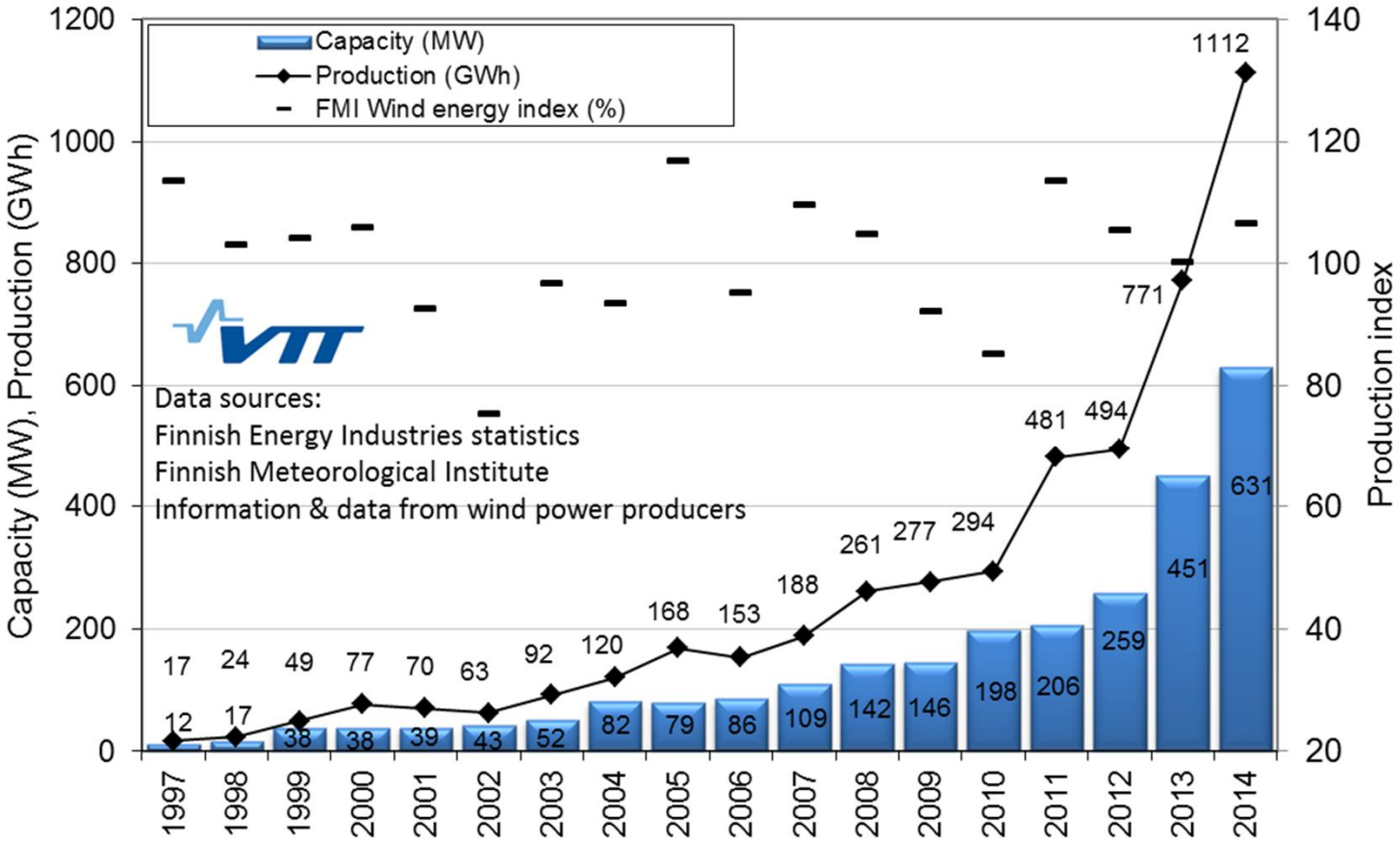
- Average capacity factor: total generation in Finland divided by total capacity (for turbines operating whole year) : 27 %
- Average capacity factor for turbines* operating the whole year: 26 % (173 turbines)
- Average capacity factor for turbines* >2 MW, operating the whole year: 29 % (112 turbines)

*Second-hand turbines installed inland and pilot plants are not included

- Wind production index ranged from 84% to 114% in different regions:
  - Simple averaged index 104%
  - Capacity weighted averaged index 106%
  - Production weighted averaged index 98%

Source: Finnish Meteorological Institute

Development of wind power capacity and production in Finland



Wind index is capacity weighted average

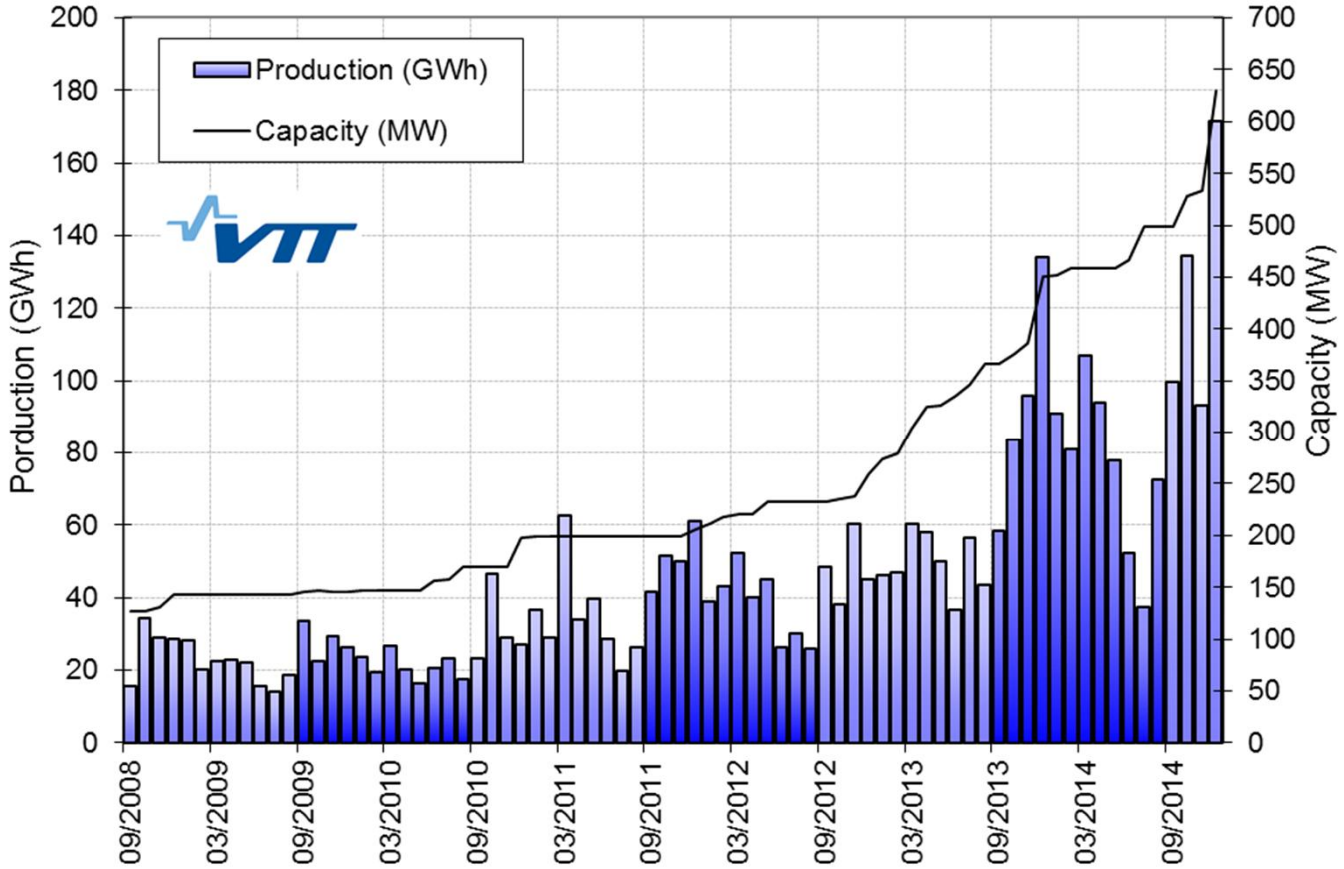
Source:

Finnish Energy Industries statistics

Finnish Meteorological Institute

Information & data from wind power producers

Monthly wind power production and capacity in Finland

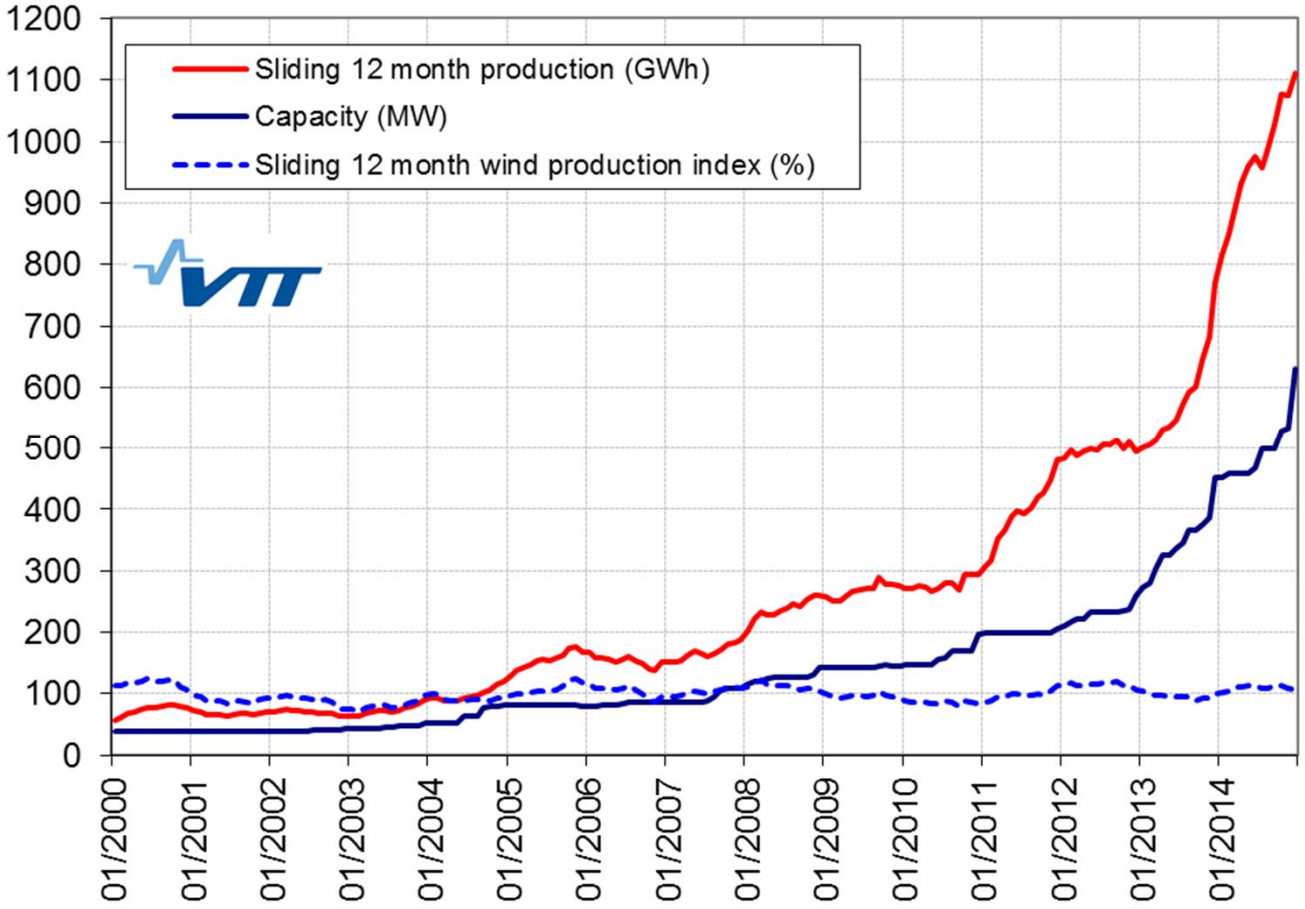


Source:

Finnish Energy Industries statistics

Information & data from wind power producers

Wind power production and production indices as 12 month sliding averages



Wind index is capacity weighted average

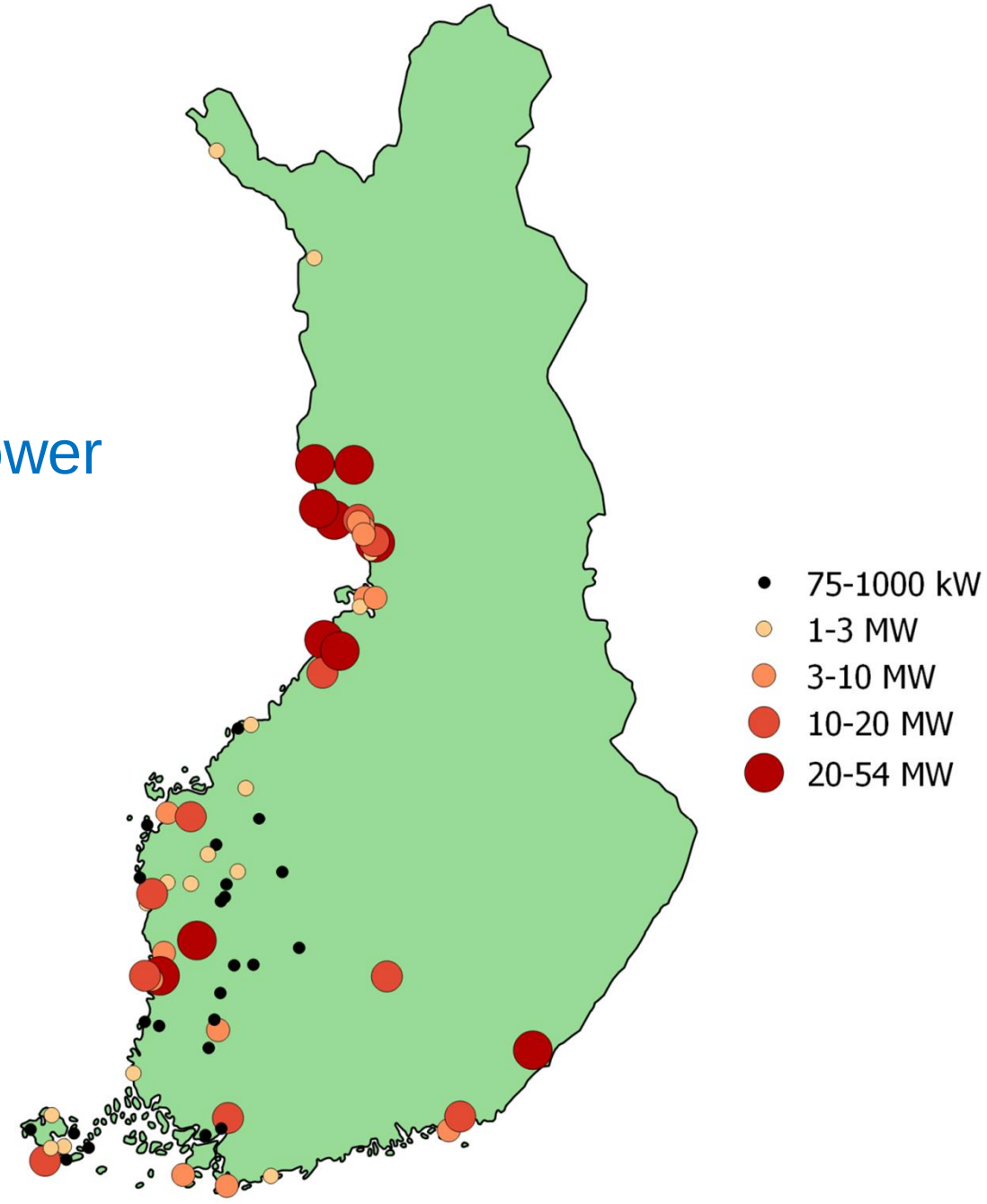
Source:

Finnish Energy Industries statistics

Finnish Meteorological Institute

Information & data from wind power producers

Location of wind power plants at the end of 2014



Wind turbines in Finland, end of 2014 (1/3)

Name	Municipality	Owner	Manufacturer	Number of Turbines	*Power KW*	Start month	End month	second hand	Data source
Korsnäs Bredskäret	Vaasa	Korsnäsin Tuulivoimapuisto Oy	Nordtank	2	200	11/1991			
Varessäikkä	Siikajoki	Spawer Voima Oy	Nordtank	2	300	04/1993	01/2014		ET
Pori 1	Pori	Pori energia	Nordtank	1	300	09/1993			
Mellanön	Eckerö	Ålands Vindenergiandelslag	Vestas	1	500	08/1995			VTT & ET
Vatunki 1	Kuivaniemi	Leppäkosken Energia Oy	Nordtank	1	500	08/1995			VTT & ET
Lammasoaivi 1-2	Enontekiö	Tunturituuli Oy	Siemens	2	450	10/1996			
Tauvonniemi	Siikajoki	Spawer Voima Oy	Nordtank	2	600	04/1997	01/2014		ET
Kökar	Lemland	Ålands Vindenergiandelslag	Enercon	1	500	10/1997			VTT & ET
Knutsboda	Lemland	Ålands Vindenergiandelslag	Vestas	4	600	11/1997			VTT & ET
Listersby	Vårdö	Ålands Vindenergiandelslag	Enercon	1	500	09/1998			VTT & ET
Pettböle	Finström	Ålands Vindkraft Ab	Enercon	2	500	10/1998			VTT & ET
Vatunginnokka	Kuivaniemi	Leppäkosken Energia Oy	NEGMicon	6	750	10/1998			VTT & ET
Lammasoaivi 3	Enontekiö	Tunturituuli Oy	Siemens	1	600	11/1998			
Olos	Muonio	Tunturituuli Oy	Siemens	5	600	11/1998			
Reposaaren pengertie	Pori	Suomen Hyötytuuli Oy	Siemens	7	1000	06/1999			VTT & ET
Meri-Pori 4	Pori	Suomen Hyötytuuli Oy	Siemens	1	1000	06/1999	04/2014		VTT & ET
Kotka 1	Kotka	Kotkan energia	Siemens	1	1000	09/1999			ET
Öskata	Närpiö	Ab Öskata Vind Närpes Oy	NEGMicon	1	750	09/1999			ET
Kotka 2	Kotka	Kotkan energia	Siemens	1	1000	09/1999	06/2013		
Bråttö	Föglö	Ålands Vindenergiandelslag	Enercon	1	600	09/1999			
Pettböle 3	Finström	Ålands Vindkraft Ab	Enercon	1	600	10/1999			VTT & ET
Hankosaari	Uusikaupunki	Propel Voima	Nordex	2	1300	10/1999	01/2015		VTT & ET
Vihreäsaari 1	Oulu	Innopower Oy	WinWinD	1	1000	09/2001			VTT
Meri-Pori 9	Pori	Suomen Hyötytuuli Oy	Siemens	1	2000	07/2002			VTT & ET
Vatunki 6	Kuivaniemi	Leppäkosken Energia Oy	Vestas	1	2000	12/2002			VTT & ET
Huittinen	Huittinen	Nordeco Oy	Nordtank	1	75	03/2003		x	
Kokkola syväsatama	Kokkola	Innopower Oy	WinWinD	2	1000	06/2003			VTT & ET
Vaasantie	Jalasjärvi	Hannu-Pekka Kivistö	Windworld	1	220	07/2003		x	VTT
Riutunkari 4-6	Oulunsalo	Innopower Oy	WinWinD	3	1000	08/2003	11/2015		VTT & ET
Krogstad	Lumparland	Ålands Vindenergiandelslag	Enercon	2	600	08/2003			VTT & ET
Karhusaari	Kristiinankaupunki	Innopower Oy	WinWinD	3	1000	12/2003			VTT & ET
Kuljunniemi	Raahe	Suomen Hyötytuuli Oy	Siemens	5	2300	06/2004			VTT & ET
Barösund 3	Inkoo	SABA Wind Oy Ab	Enercon	1	2000	09/2004			

VTT = data from producers (turbine specific), ET = Data from Energiateollisuus (wind plant specific),
EV = data from Energy Authority, 3 month averages

Wind turbines in Finland , end of 2014 (2/3)

Name	Municipality	Owner	Manufacturer	Number of Turbines	*Power KW*	Start month	End month	second hand	Data source
Sandö	Hanko	SABA Wind Oy Ab	Enercon	4	2000	09/2004			ET
Olkiluoto	Eurajoki	Teollisuuden Voima Oy	WinWinD	1	1000	10/2004			ET
Koppelo	Vammala	Maatalousyritys Pertti Tuori	Vestas	1	225	12/2004		x	
Vihreäsaari 2	Oulu	Innopower Oy	WinWinD	1	3000	12/2004			VTT & ET
Sottunga	Sottunga	Ålands Vindkraft Ab	Vestas	1	660	01/2005		x	VTT & ET
Marjamäenvuori	Sastamala	Oittisen tila Oy	Vestas	1	225	09/2005		x	VTT
Kemi Ajos	Kemi	Haminan Energia Oy	WinWinD	11	3000	12/2005			ET
Krisantie	Eurajoki	Ari-Matti Väkiparta	NEGMicon	1	250	12/2005	06/2013	x	
Fränsviken	Luoto	Ab Larsmo Vindkraft Oy	WinWinD	1	1000	06/2006			ET
Meri-Pori 10-11	Pori	Porituuli Oy	WinWinD	2	3000	06/2006			VTT & ET
Nyhamn Båtskär	Lemland	Leovind Ab	Enercon	6	2300	08/2007			VTT & ET
Högsåra	Dragsfjärd	ViaWind Oy	Harakosan	3	2000	09/2007			ET
Riutunkari 1-2	Oulunsalo	Innopower Oy	WinWinD	2	3000	02/2008			VTT & ET
Laitakari 2	Ii	Iin Energia Oy	WinWinD	1	1000	02/2009			VTT
Jylisevä	Jalasjärvi	Kauppilan autohajottamo Oy	Südwind	1	750	06/2009		x	
Riihontie	Töysä	Koneurakointi Terho Riiho	NEGMicon	1	600	06/2009		x	
Vuorensyrjänkallio	Kauhava	HP-Energia	NEGMicon	2	250	06/2010			
Kuljunniemi	Raahe	Suomen Hyötytuuli Oy	Siemens	4	2300	06/2010			VTT & ET
Pori Offshore 1	Pori	Suomen Hyötytuuli Oy	Siemens	1	2300	07/2010			VTT & ET
Summan tehdasalue	Hamina	Haminan Energia Oy	WinWinD	4	3000	08/2010			ET
Röyttä	Tornio	Rajakiiri Oy	Siemens	8	3600	12/2010			VTT & ET
Ilvesjoki	Jalasjärvi	Pramia Oy	Südwind	1	750	01/2011		x	VTT
Teiharju	Ikaalinen	Ilkka Klinga	Nordex	1	1000	10/2011		x	
Simo Putaankangas	Simo	Tuuliwatti Oy	Vestas	3	3000	12/2011			VTT & ET
Simo Onkalo	Simo	Tuuliwatti Oy	Vestas	3	3000	01/2012			VTT & ET
Vaasa Sundom	Vaasa	Wasa Wind Oy	Mervento	1	3600	03/2012			VTT
Huittinen Pahkionvuori	Huittinen	Lännen Lintu Oy	Enercon	2	1800	05/2012		x	ET
Mäkelänkangas	Hamina	Suomen Voima Oy	Hyundai	4	2000	05/2012			VTT & ET
Aljovuori	Ikaalinen	Ilkka Klinga	Siemens	1	600	10/2012		x	
Sumi 1	Kemi	Sumituuli Oy	Hyundai	1	2000	10/2012			ET
Ii Olhava	Ii	Tuuliwatti Oy	Vestas	8	3000	12/2012			VTT & ET
Ilmajoki Kiikerinkylä	Ilmajoki	Hautala Power	Enercon	1	200	01/2013		x	VTT
Kytövuori	Ruovesi	Martti Pöytäniemi	Siemens	1	600	01/2013		x	
Merijärvi Ristivuori	Merijärvi	Perhonjoki Oy	Siemens	6	2300	01/2013			ET

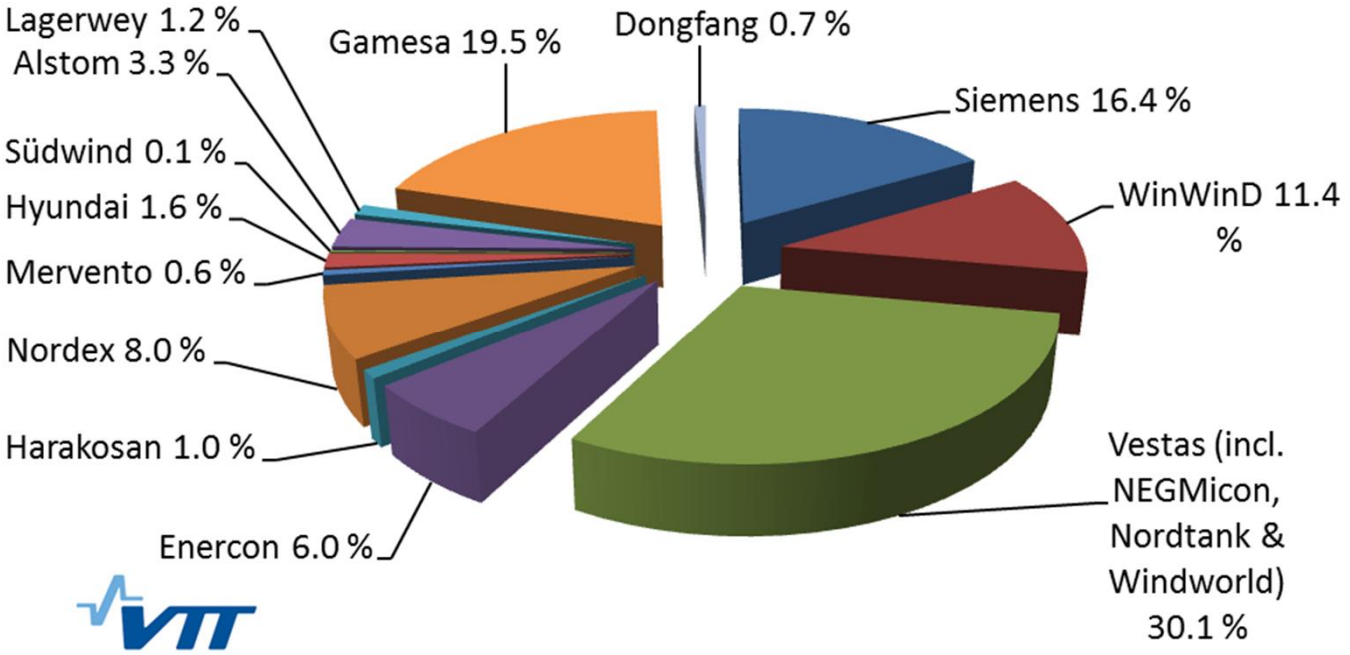
VTT = data from producers (turbine specific), ET = Data from Energiateollisuus (wind plant specific),
EV = data from Energy Authority, 3 month averages

Wind turbines in Finland , end of 2014 (3/3)

Tervola Varevaara	Tervola	Tuuliwatti Oy	Vestas	10	3000	03/2013			VTT & ET
Lpr Muukon teollisuusalue	Lappeenranta	Tuulisaimaa Oy	Alstom	7	3000	04/2013			ET
Krisantie 2	Eurajoki	Ari-Matti Väkiparta	Enercon	1	500	06/2013		x	
Naapala	Salo	Halikon Tuulienergia Oy	Siemens	1	600	06/2013		x	
Raitniemi	Sauvo	Tommi Heininen	Siemens	1	600	06/2013		x	
Honkajoki Kirkkokallio	Honkajoki	Honkajoen Tuulipuisto Ky	Nordex	9	2400	07/2013			EV
Raahe Kopsa	Raahe	Puhuri Oy	Siemens	7	3000	08/2013			VTT & ET
Vampula	Huittinen	Nordeco Oy	Nordtank	3	300	09/2013		x	
Simo Leipiö	Simo	Tuuliwatti Oy	Gamesa	4	4500	10/2013			VTT & ET
Ii Olhava jatko	Ii	Tuuliwatti Oy	Vestas	3	3300	11/2013			VTT & ET
Pettumäki	Teuva	Kari Komsi, Jaakko Niemi	LAGERWEY	1	2600	11/2013			ET
Peittoo	Pori	Tuuliwatti Oy	Gamesa	12	4500	12/2013			VTT & ET
Kotka 3-4	Kotka	Kotkan energia	Enercon	2	2350	01/2014			VTT & ET
Raahe 10-11	Raahe	Raahen Energia Oy	Nordex	2	3000	02/2014			EV
Laitakari 3	Ii	Lumituuli Oy	Enercon	1	800	04/2014			VTT
Niemenvuori	Seinäjoki	Manni Mika	Dongfang	1	1500	06/2014			EV
Mansikkavuori	Ilmajoki	Koskenkorvan Tuulivoima Oy	Dongfang	2	1500	06/2014			EV
Kitkiäisvaara	Tornio	Tuuliwatti Oy	Gamesa	8	4500	07/2014			VTT & ET
Märynummi	Salo	Tuuliwatti Oy	Gamesa	2	5000	10/2014			VTT & ET
Märynummi 3	Salo	Restuuli Oy	Gamesa	1	5000	10/2014			
Svalskulla	Närpiö	VindIn Svalskulla Ab/Oy	Vestas	5	3000	10/2014			ET
Hilskansaari	Pori	Pohjantuulen Voima Oy	Vestas	1	2000	11/2014			ET
Isonnevanmäki	Kauhava	Tuuliveikot Oy	Lagerwey	1	2500	11/2014			
Sysimäki	Kauhajoki	Sysituuli Oy	Lagerwey	1	2500	11/2014			ET
Kopsa II	Raahe	Puhuri Oy	Vestas	10	3300	12/2014			ET
Latamäki	Luhanka	Ilmatar Luhanka Oy	Vestas	6	3000	12/2014			VTT
Nyby	Ii	Nybyn Tuulipuisto Ky	Nordex	8	2400	12/2014			ET
Routunkari	Lumijoki	Lumituuli Oy	Vestas	1	2000	12/2014			VTT
Jäneskeidas	Siikainen	Tuuliwatti Oy	Vestas	3	3300	12/2014			ET
Torkkola	Vaasa	EPV Tuulivoima Oy	Vestas	4	3300	12/2014			ET

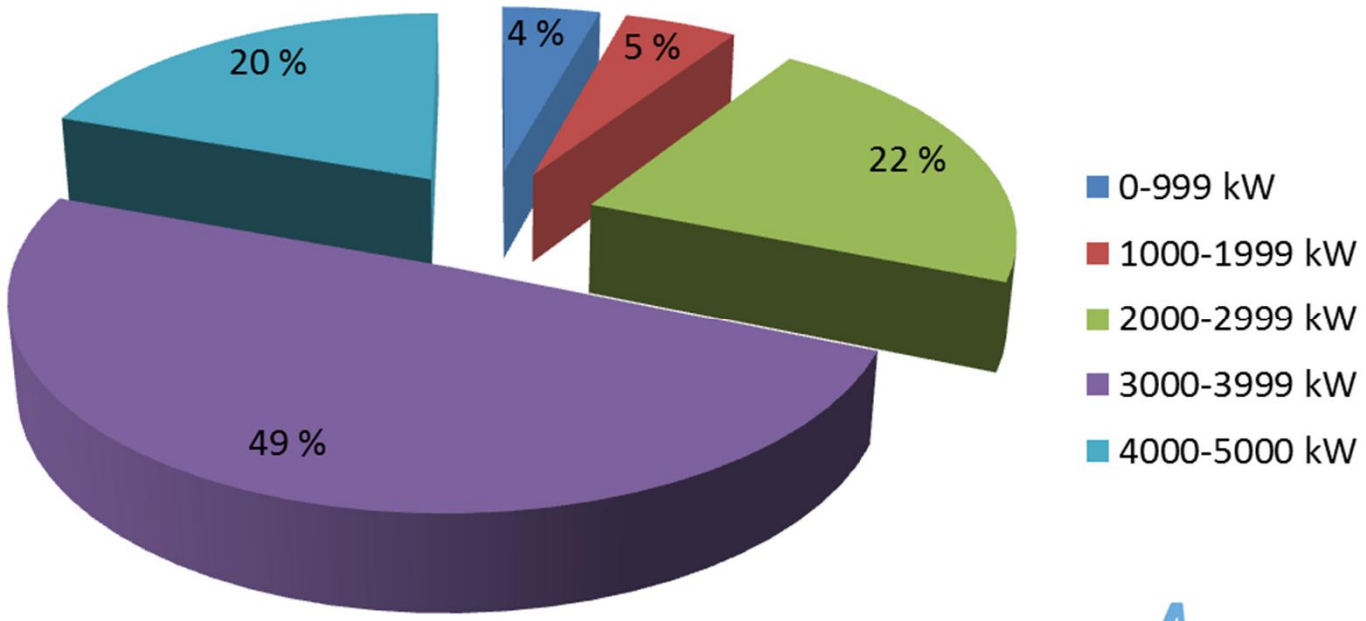
VTT = data from producers (turbine specific), ET = Data from Energiateollisuus (wind plant specific),
EV = data from Energy Authority, 3 month averages

Manufacturer shares of wind energy capacity in Finland at the end of 2014 (total 631 MW*)

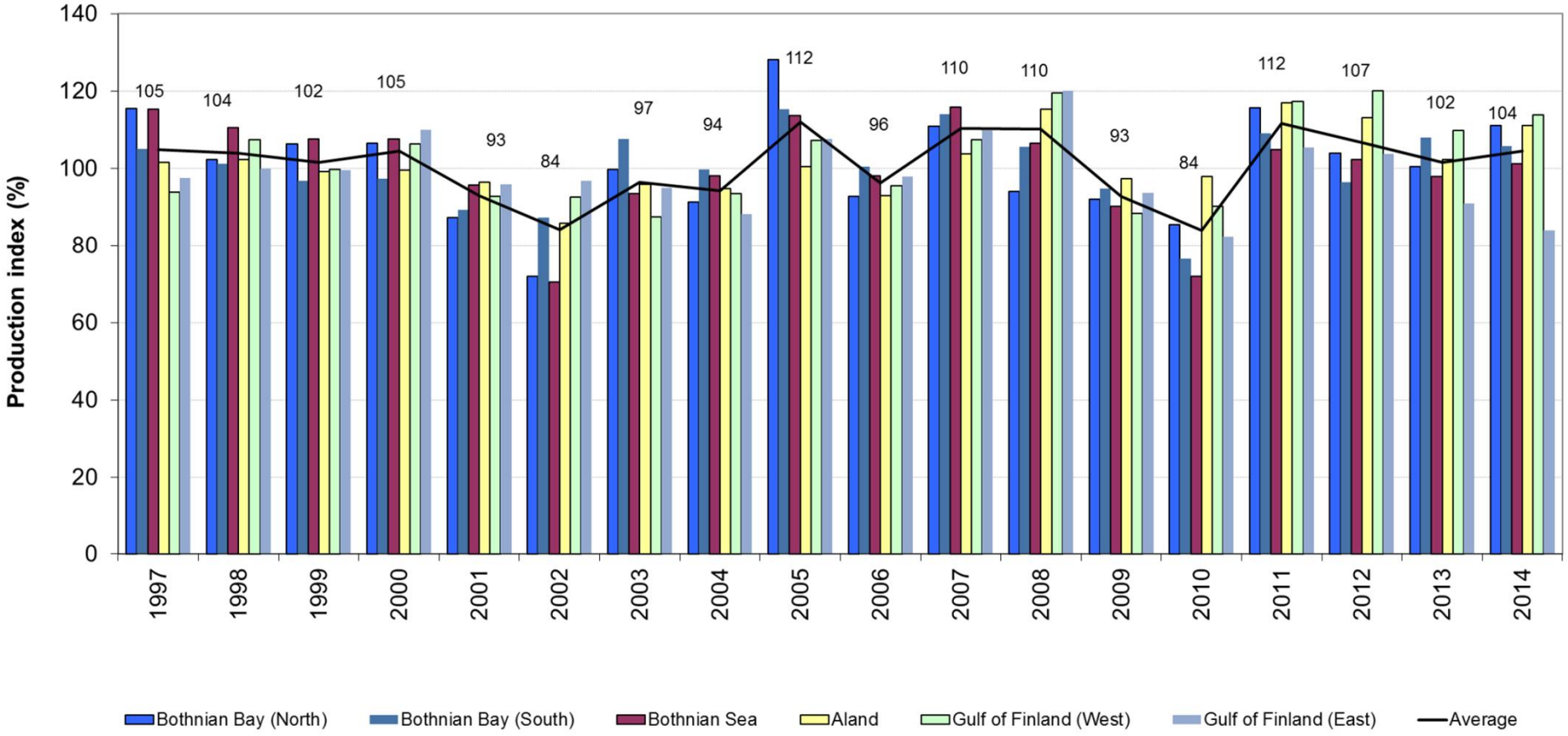


(*small/used turbines may be missing)

Size of turbines installed in Finland at the end of 2014 (total 631 MW, average 2.4 MW)



Wind resource was close to the long time average in 2014, except in eastern Gulf of Finland where wind resource was lower than average.



Wind production index (simple average), yearly

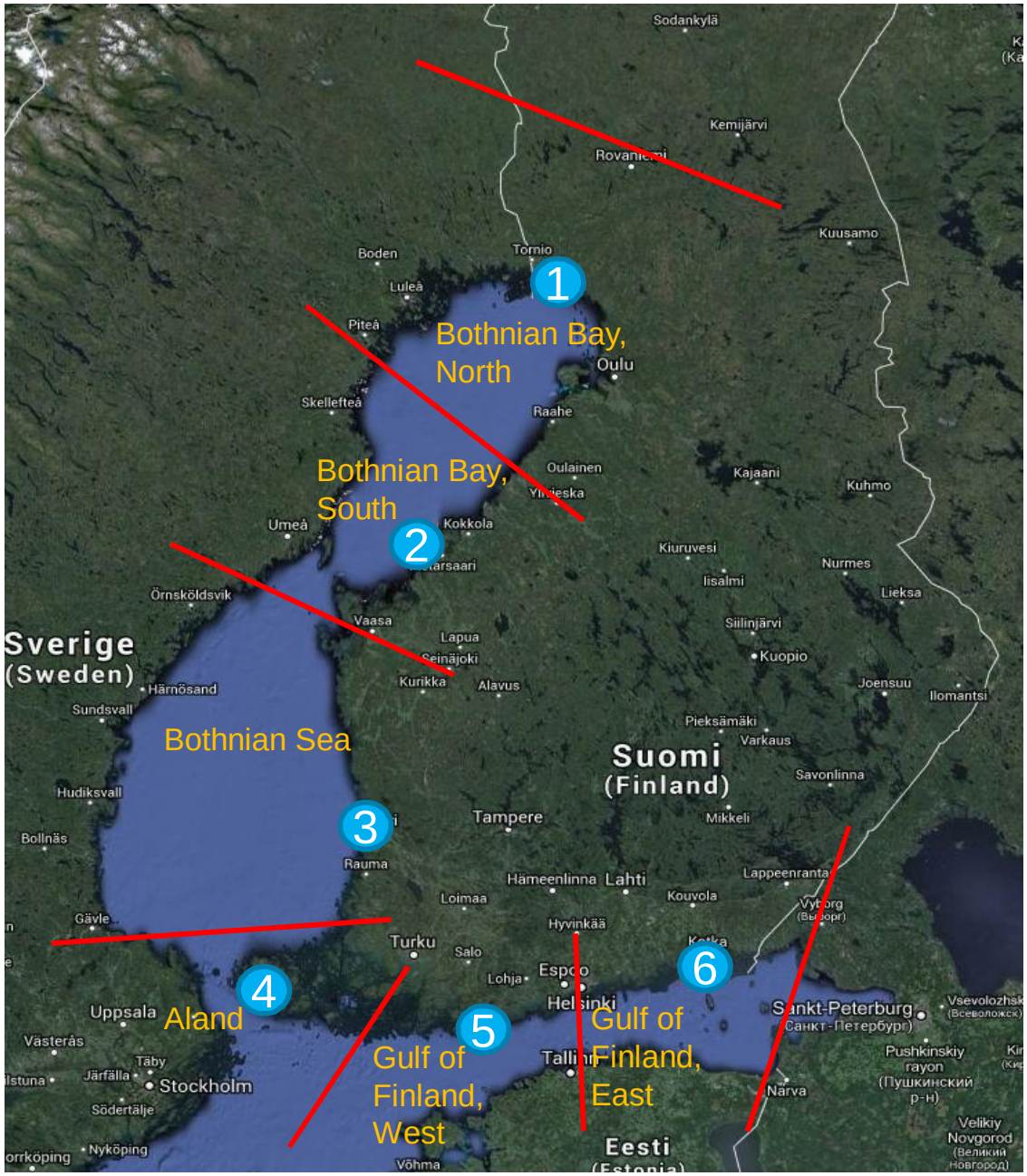
(100% means average production 1997–2011). Average of four indices is marked with line and label. (Perämeri: Bothnian Bay, Selkämeri: Bothnian Sea, Ahvenanmaa: Aland, Suomenlahti: Gulf of Finland.)

Source:

Finnish Meteorological Institute

Weather stations - locations

1. Kemi, Ajos
2. Pietarsaari, Kallan
3. Pori, Tahkoluoto
4. Lemland, Nyhamn
5. Raasepori, Jussarö
6. Kotka, Haapasaari



Weather stations - details

Weather station	LAT	LON	Station altitude*	Wind sensor altitude**	Wind sensor type
Kemi Ajos	65.6729	24.5153	2	33/35	Thies 2-D
Pietarsaari Kallan	63.7515	22.5229	2	29/31	WAA15/WAV15
Pori Tahkoluoto	61.6304	21.3759	2	16/18	WAA15/WAV15
Lemland Nyhamn	59.9591	19.954	8	16/25	Thies 2-D
Raasepori Jussarö	59.8206	23.5764	14	20/34	Thies 2-D
Kotka Haapasaari	60.2866	27.1853	4	25/29	WAA15/WAV15

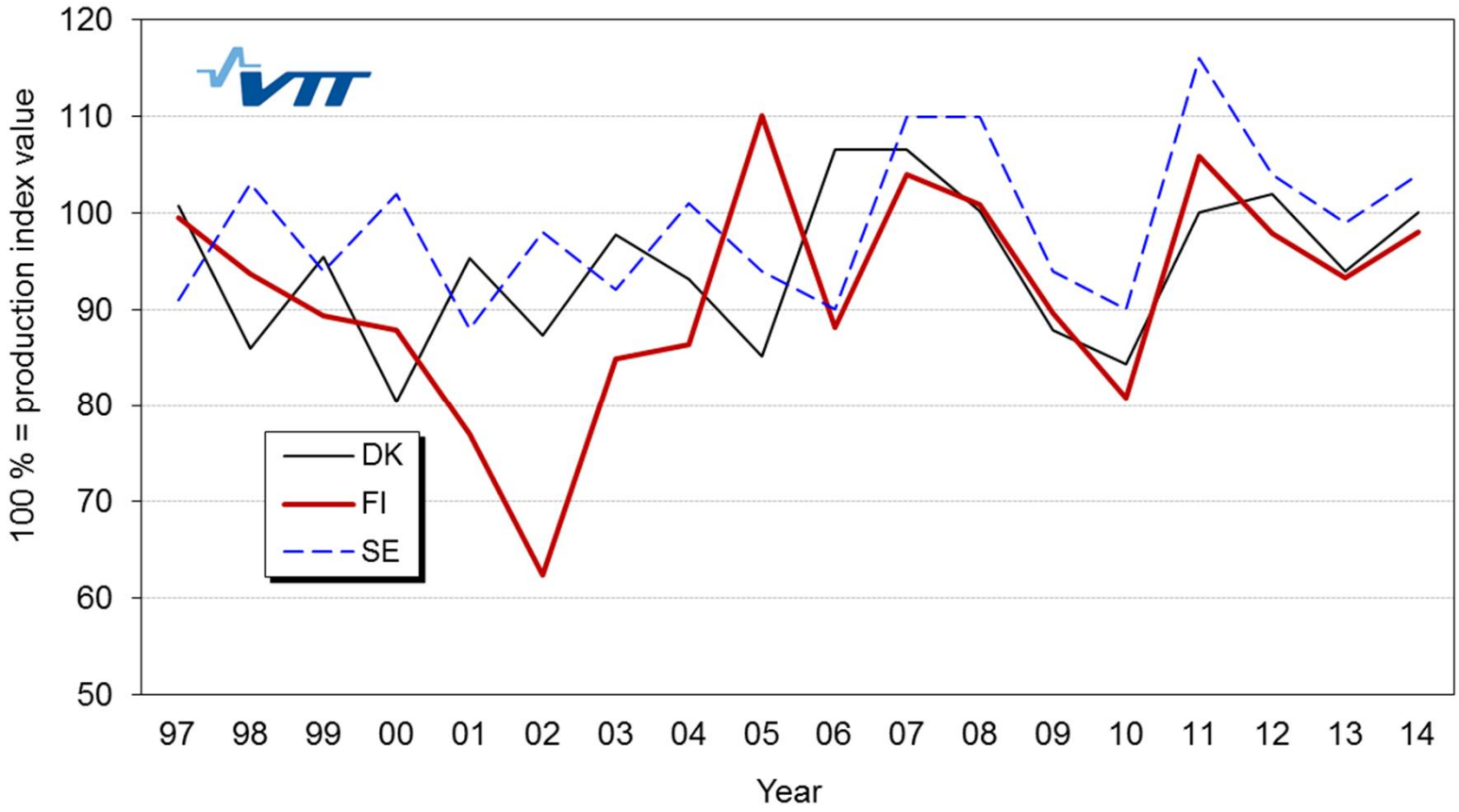
*rain sensor or visibility sensor height from sea level

**height from ground level / sea level (m)

Source:

Finnish Meteorological Institute

Wind resource variability in Nordic countries

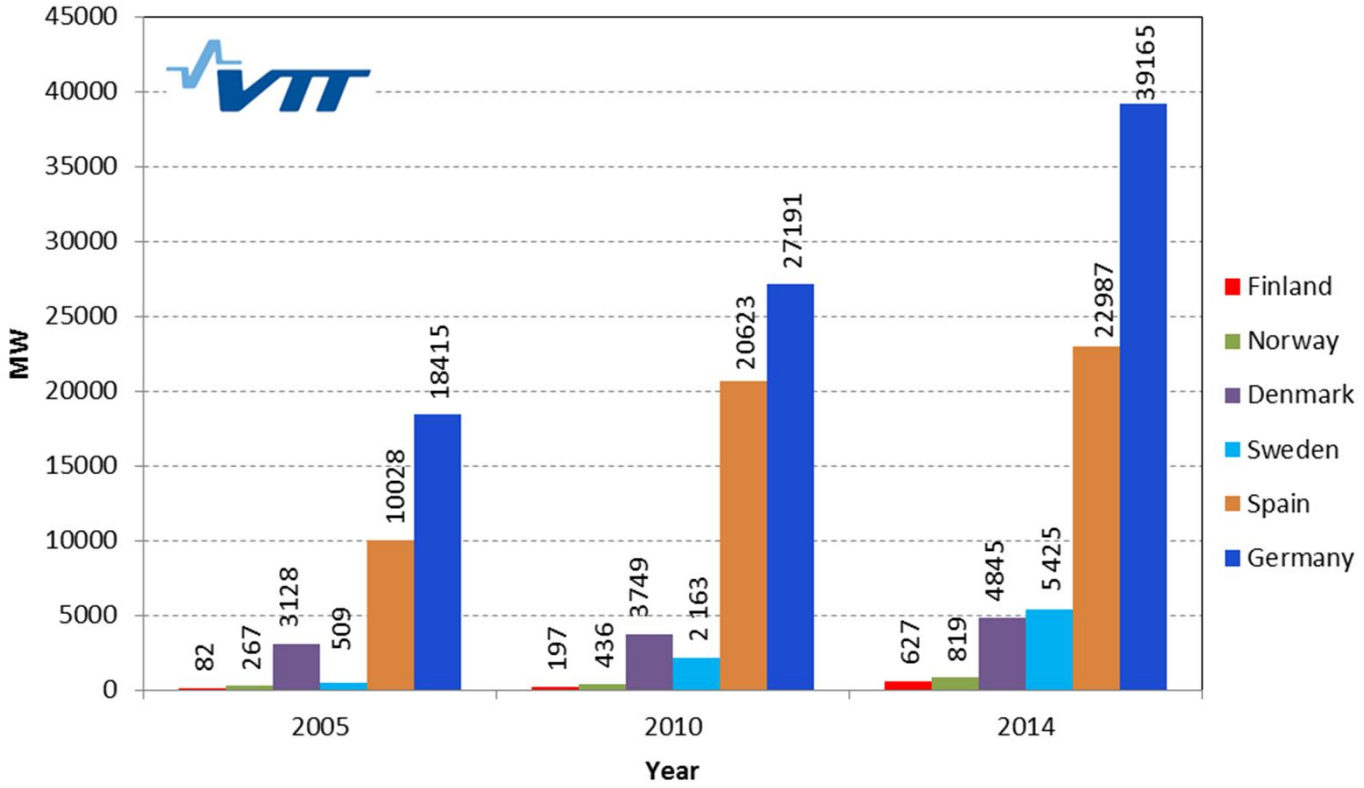


Wind resource variations in Finland, Sweden and Denmark. Production index, yearly.

Wind index of Finland is production weighted average

Source:
Finnish Meteorological Institute
http://vindstat.com/files/%C3%85rsrapport-2012-.pdf
http://www.vindstat.dk

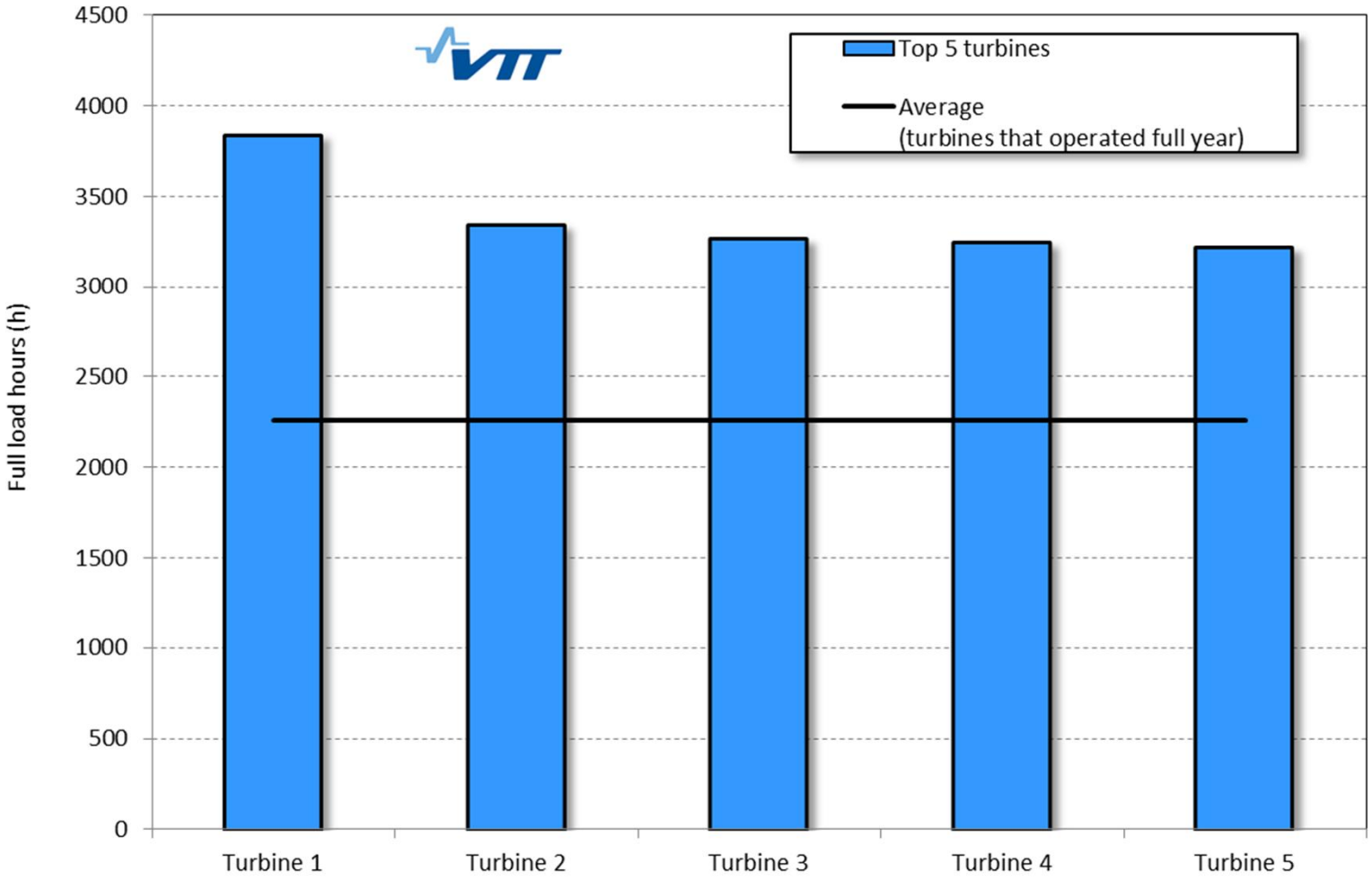
Wind Power capacity development in Finland and Europe



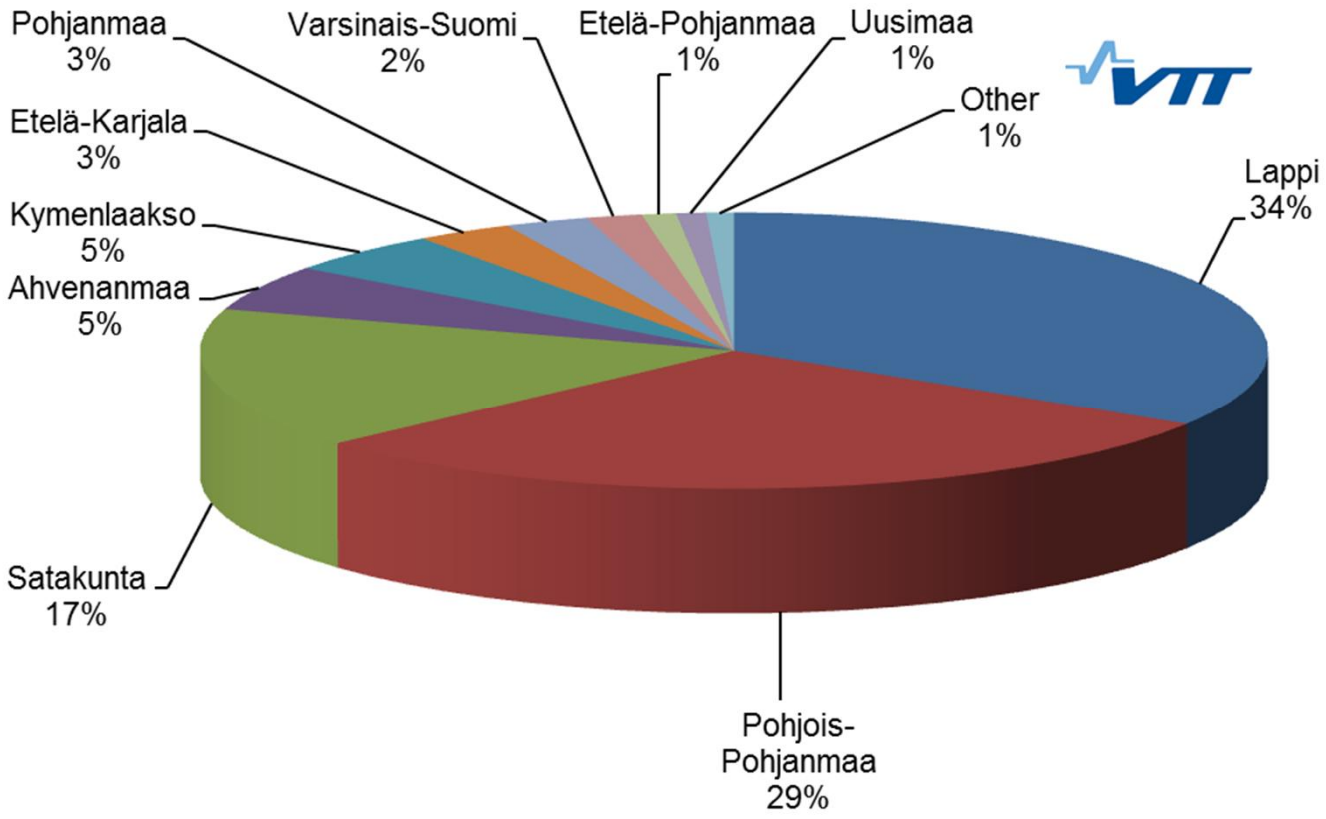
Cumulative total capacity in Europe at the end of 2014: 133 968 MW
Cumulative global capacity at the end of 2014: 369 553 MW

Source:
WIND IN POWER: 2014 EUROPEAN STATISTICS, EWEA
GLOBAL WIND STATISTICS 2014, GWEC

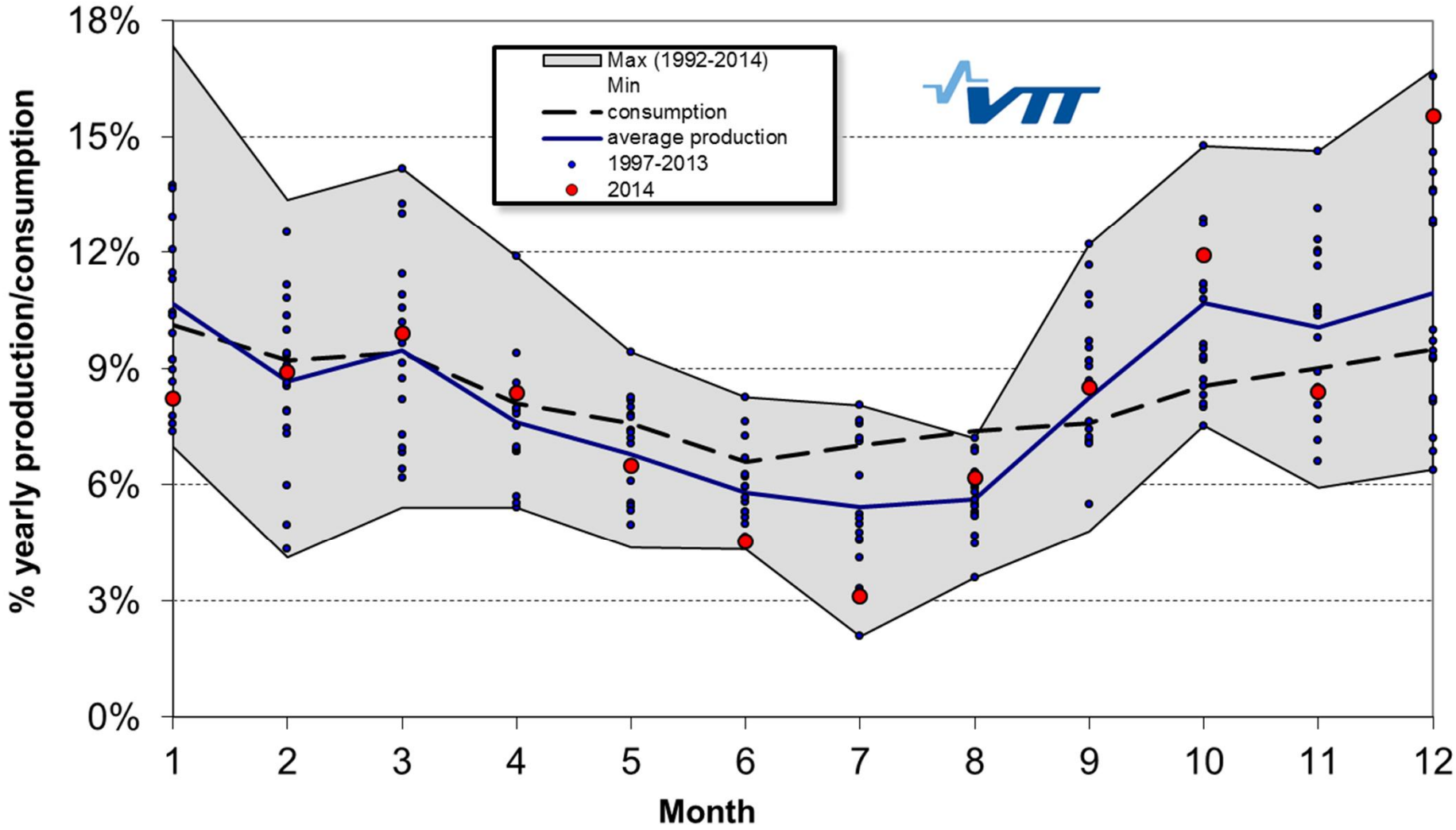
The best 5 wind turbines according to full-load hours



Regional distribution of wind energy production in Finland



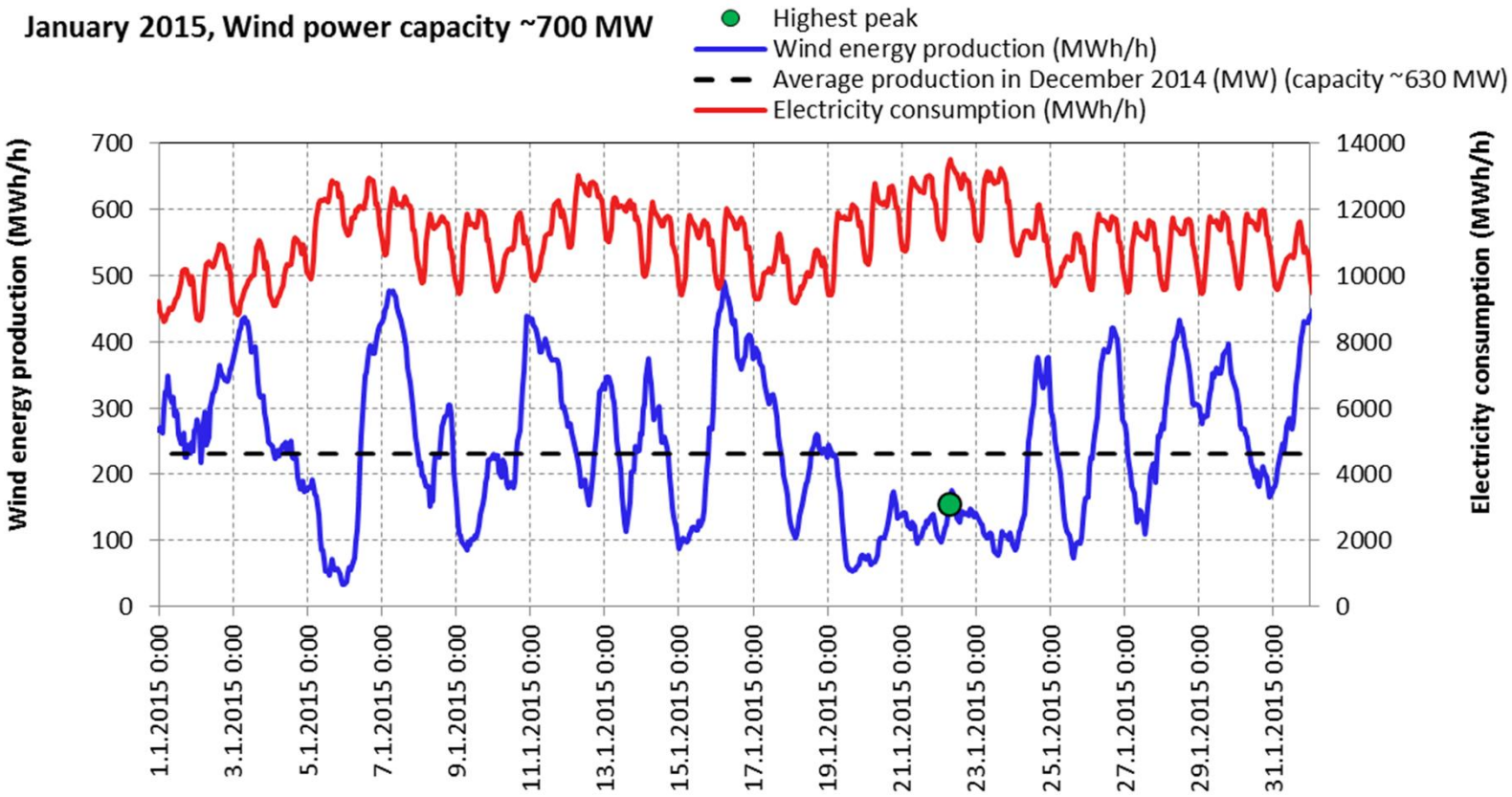
Seasonal variation of wind power production in comparison to average electricity consumption in Finland



Consumption is average of years 1999-2014

Source for consumption:
Finnish Energy Industries statistics

The hourly time series of wind power production and electricity consumption during the time of peak load in winter 2014-15



Source:
Finnish Energy Industries statistics
Fingrid electricity consumption time series

Wind power production during the highest peak load in Finland

Winter	National peak	Wind power [MWh/h]	Wind power/Capacity [%]	Wind power capacity [MW]
1993-94	11.2.94 at 20-21	0.5	**13 %**	4.0
1994-95	31.1.95 at 20-21	1.4	**36 %**	3.8
1995-96	9.2.96 at 20-21	0.0	**1 %**	5.3
1996-97	19.12.96 at 08-09	1.7	**35 %**	4.8
1997-98	2.2.98 at 08-09	1.1	**16 %**	6.5
1998-99	29.1.99 at 08-09	3.4	**20 %**	17.4
1999-00	25.1.00 at 08-09	9.1	**26 %**	35.4
2000-01	5.2.01 at 08-09	1.5	**4 %**	35.4
2001-02	2.1.02 at 16-17	3.9	**14 %**	28.3
2002-03	3.1.03 at 17-18	0.9	**4 %**	24.3
2003-04	11.2.04 at 18-19	7.1	**19 %**	36.6
2004-05	28.1.05 at 18-19	11.6	**14 %**	80.6
2005-06	20.1.06 at 08-09	15.3	**20 %**	76.6
2006-07	8.2.07 at 07-08	3.3	**4 %**	83.6
2007-08	4.1.08 at 17-18	47.9	**46 %**	104.4
2008-09	16.1.09 at 9–10	12.3	**9 %**	139.8
2009-10	28.1.10 at 8–9	81.2	**57 %**	142.8
2010-11	18.2.11 at 9–10	4.8	**2 %**	193.3
2011-12	3.2.2012 at 18-19	35.9	**17 %**	211.8
2012-13	18.1.2013 at 9-10	52.2	**17 %**	301.1
2013-14	24.1.2014 at 8:00	183.2	**41 %**	448.9
2014-15	22.1.2015 at 7:00	154.5	**22 %**	695.4

Average of all years: **20 %**

Average of last 10 years: **24 %**

Source:
Finnish Energy Industries statistics
Fingrid electricity consumption time series

Wind power production during the highest peak load hours in Finland has been between 2-70 % of installed capacity (during 10 largest peaks during all the years in the table)

Year	Whole year	During 10 peaks	During 50 peaks	During 100 peaks
	Average (min–max)	Average (min–max)	Average (min–max)	Average (min–max)
2005	23 % (0–82 %)	12 % (2–22 %)	13 % (1–37 %)	12 % (1–44 %)
2006	21 % (0–81 %)	30 % (19–45 %)	28 % (3–61 %)	28 % (3–69 %)
2007	23 % (0–86 %)	11 % (2–27 %)	10 % (1–27 %)	10 % (1–28 %)
2008	25 % (0–86 %)	36 % (15–54 %)	37 % (12–77 %)	40 % (4–79 %)
2009	22 % (0–80 %)	23 % (18–29 %)	24 % (11–37 %)	23 % (7–61 %)
2010	22 % (0–79 %)	46 % (5–70 %)	32 % (4–71 %)	30 % (4–71 %)
2011	28 % (0–84 %)	4 % (2–5 %)	8 % (1–25 %)	12 % (1–56 %)
2012	25 % (0-81 %)	16 % (10-23 %)	16 % (3-32 %)	15 % (3-37 %)
2013	25 % (0-80 %)	22 % (17-27 %)	14 % (3-41 %)	13 % (1-45 %)
2014	25 % (0-81 %)	26 % (10-44%)	27 % (3-44%)	24 % (2-49%)

Average and range of production all year and during 10, 50 and 100 highest peaks

Source:
Finnish Energy Industries statistics
Fingrid electricity consumption time series

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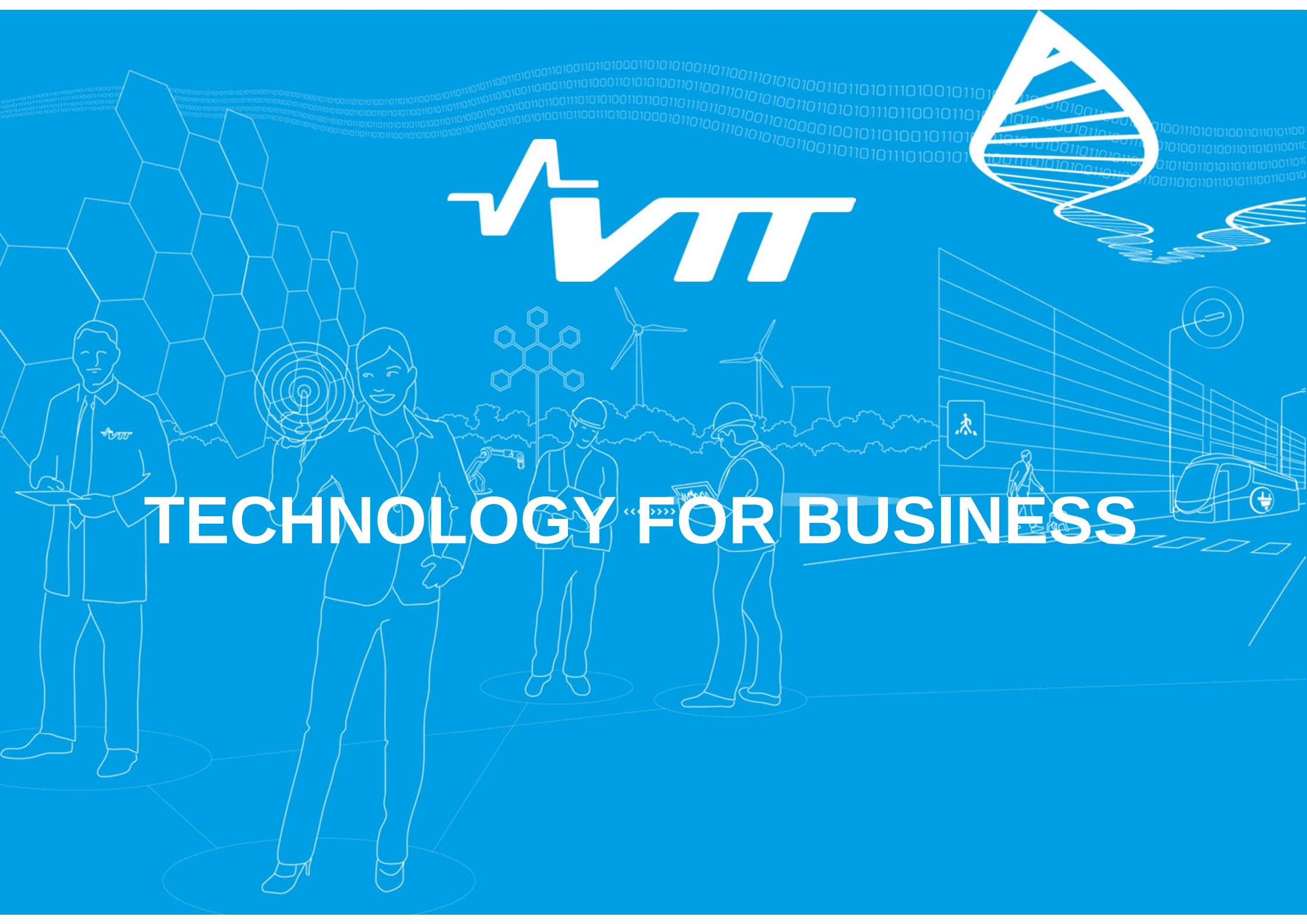
This report is based on information provided from the wind power producers in Finland as well as Energy Technologies Finland (ET), Energy Authority and Finnish Meteorological Institute (FMI), who are gratefully acknowledged. If there are any mistakes in the data please contact Simo Rissanen.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