

Det europeiske kraftmarkedet – på lang sikt

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Nordic power balance until 2020: increasing oversupply

1. Industrial consumption is reduced from 2008 on, due to recession. More cut to come?
 - Pulp & paper industry: - 14 TWh
 - Aluminium+solar industry: - 4 TWh
2. Renewable generation is increasing until 2020
 - Swedish-Norwegian elcert sceme: up 26 TWh (from 2012 level) – of which hydropower is up 10 TWh
 - Danish-Finnish feed-in schemes: up 14 TWh (from 2012 level) – of which hydropower is up 1 TWh
3. Nuclear generation is increasing until 2016, phase out starts in 2025
 - Swedish nuclear upgrading: up 15 TWh (from 2009-11 level)
 - Olkiluoto 3: up 13 TWh
 - Phase out: down 22 TWh, Ringhals 1+2 (2025-26), Oskarshamn 1 (2027), Loviisa (2027-28)
 - No investment signals for new nuclear units in spot prices (eventually capacity market may change conclusion)
4. Power consumption is increasing by 9 TWh until 2020 (from 2012 level)
 - Incl. some industrial recovery
 - Incl. cut to fulfill the Energy Efficiency Directive during 2016-20

Nordic power balance 2013-24 (generation available: up to SRMC coal)

Development of the Nordic power balance, all figures in TWh/year

Year	Hydro-power*	Nuclear	Wind power*	CHP bio elcert	CHP others	Thermal	Consumption*	Balance
2008	199,5	83,0	11,1	9,4	49,2	20,7	403,9	-31,0
2009	200,3	72,2	12,4	9,1	46,6	22,1	378,7	-16,0
2010	201,9	77,2	15,0	12,3	52,7	27,9	389,1	-2,1
2011	203,6	79,8	17,7	9,9	47,5	20,8	388,3	-8,9
2012	207,1	82,8	20,0	8,3	41,8	15,0	389,7	-14,7
2013	208,2	86,8	24,4	12,3	41,6	21,7	389,5	5,5
2014	209,7	84,7	27,6	12,9	45,1	18,7	394,4	4,3
2015	210,7	87,8	29,2	13,2	45,7	16,9	397,2	6,3
2016	211,8	104,1	30,8	14,1	46,4	13,5	399,7	21,0
2017	212,9	104,7	33,2	14,7	48,4	12,5	400,3	26,1
2018	214,3	104,7	36,7	15,3	50,6	12,0	399,7	33,9
2019	215,7	104,7	40,2	15,9	52,3	11,5	399,4	40,9
2020	217,1	104,7	43,4	16,3	53,7	11,3	399,2	47,3
2021	217,4	104,7	45,3	16,5	54,5	11,2	401,1	48,5
2022	217,7	104,7	46,7	16,7	55,0	11,1	403,1	48,9
2023	218,1	104,7	48,1	16,9	55,7	10,9	404,6	49,8
2024	218,4	104,7	49,5	17,1	56,2	10,9	405,9	50,8

*) Average for reference period: 1962-2006

Infrastructure – main Nordic grid

Year	Internal links	Capacity (MW)
2013	Sima-Samnanger	
2014	SouthWest-link Swe	1 400
2015	Norway-Jutland	700*
2016	Ørskog-Fardal	

Year	Cable links external	Capacity (MW)
2014	Finland-Estonia	650
2016	Sweden-Lithuania	700
2018	Jutland-Germany	1 000
2018	Norway-Germany	1 400*
2019	Sweden-Germany	700
2019	Jutland-Netherlands	700
2020	Norway-UK	1 400
2024	Norway-Netherlands	700

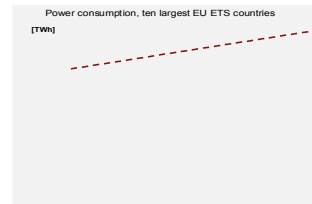
*) Grid limitations during first operational years

Low spot power prices in EU, now and for coming years

- **Recession and years after recession:** Lower industrial power demand, lower demand for coal and EUAs
- **Energy efficiency directive:** Low growth in power consumption in coming years
- **Renewable energy:** 20% renewable target in EU (Germany goes for 35% renewable power generation)
- **Capacity markets:** Always sufficient generation capacity to meet demand
- **Coal versus gas prices:** Variable costs for coal-fired generation is half of variable costs for gas-fired generation
- **Result: Oversupply and low prices in EU spot power markets to continue**

European power consumption (10 largest countries*)

- Before recession: Stable, positive growth in EU
- After recession started in 2008: 6.5% decrease
- Three industrial sectors have initiated the fall: Car manufacturing, construction sector and pulp & paper
- Deviation between 2013 prognosis and 2013 previous prognosis: 9% (230 TWh)



*) Germany, Poland, UK, Italy, Spain, France, Greece, Netherlands, Czech R and Belgium

European power consumption (10 largest countries*)

- We expect industrial output to improve slightly year-by-year
- But energy efficiency effects in mainly household and service sectors will dampen increase in power consumption
- Same effects also in the Nordic area and in Norway



*) Germany, Poland, UK, Italy, Spain, France, Greece, Netherlands, Czech R and Belgium

EU ETS: Comparable emissions and caps 2008-2020

[Mt CO₂] Emissions and avg. annual 2008-20 carbon credit supply



The chart shows emissions and available carbon credits relevant for the 2008-2020 period. Aviation and new ETS sectors are not included in the figures.

Comparable emissions 2008-2020 for EU-27+Norway (aviation and new ETS3 sectors not included) and caps (EUAs+CERs+ERUs). In all three scenarios, it is assumed average annual CER/ERU imports of 123 Mt. Some assumptions have been made for making the emissions comparable, due to the EU ETS scope expanding for certain years.

- Weak industrial output has lowered emissions considerably during latest years
- Little emission growth in sight for 2014. Combination of EU directives (renewable, energy efficiency, combustion) and recession will dampen emission growth
- Difficult politically to find suitable cut levels for ETS4

“Backloading”: EU ETS quick-fix proposal

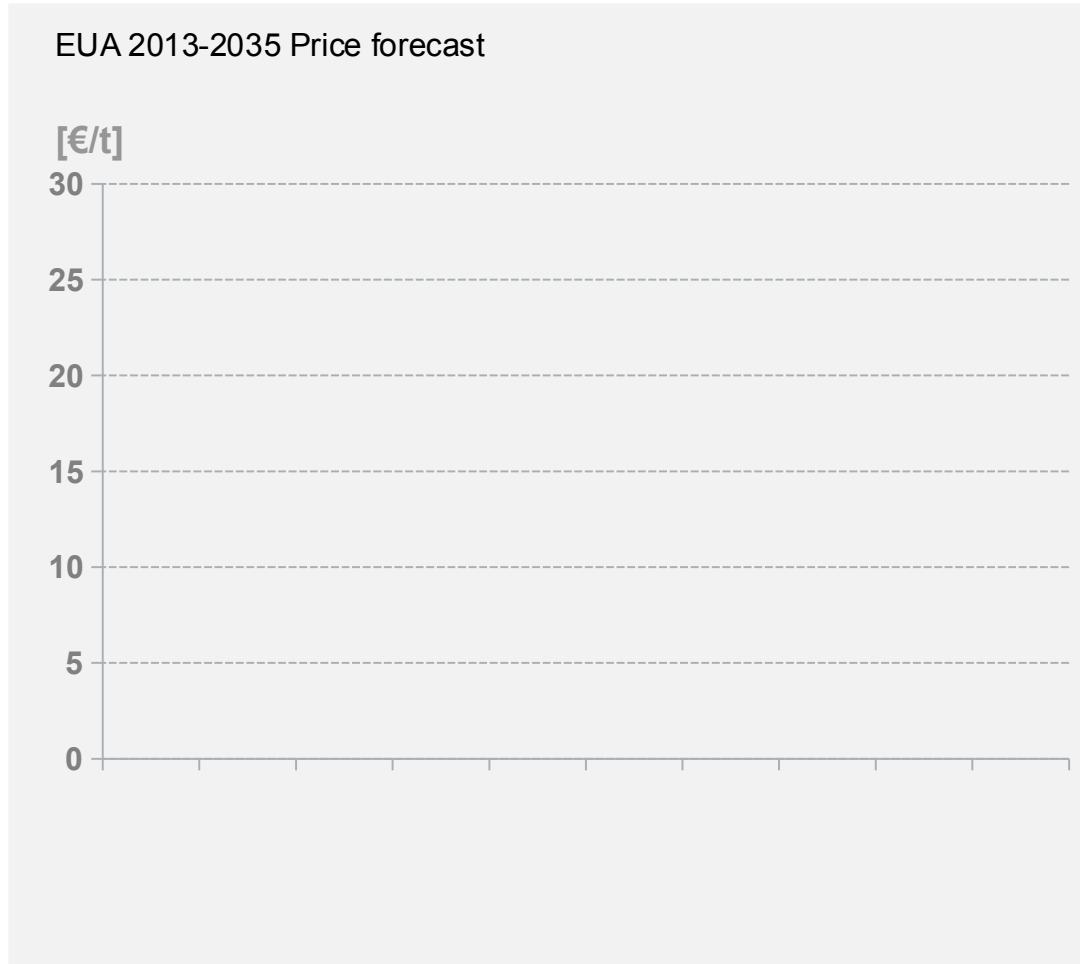
- Fundamentally -> should have no effect on long term pricing
- Chart updated per January 2014
- As per January 2014 the curve ends at 1680 mt oversupply (+500 mt since April 2013)



EUA 2014-2035 price forecast

2013

1st of December



Prices will remain low for a few more years

- We expect EUAs at 10 €/t as an average over the 2014-2035 period
- Without any structural changes to the system, prices will collapse towards 0-1 €/t. Carbon costs relevant for power producers may be slightly higher

MK Coal price scenarios December 2013

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- Base prognosis based on Perret Associates «Long Term Price Forecast 2013-30, October 2013»
- Tightening global perspectives for fundamental balance

German “Energiewende”: Seven targets

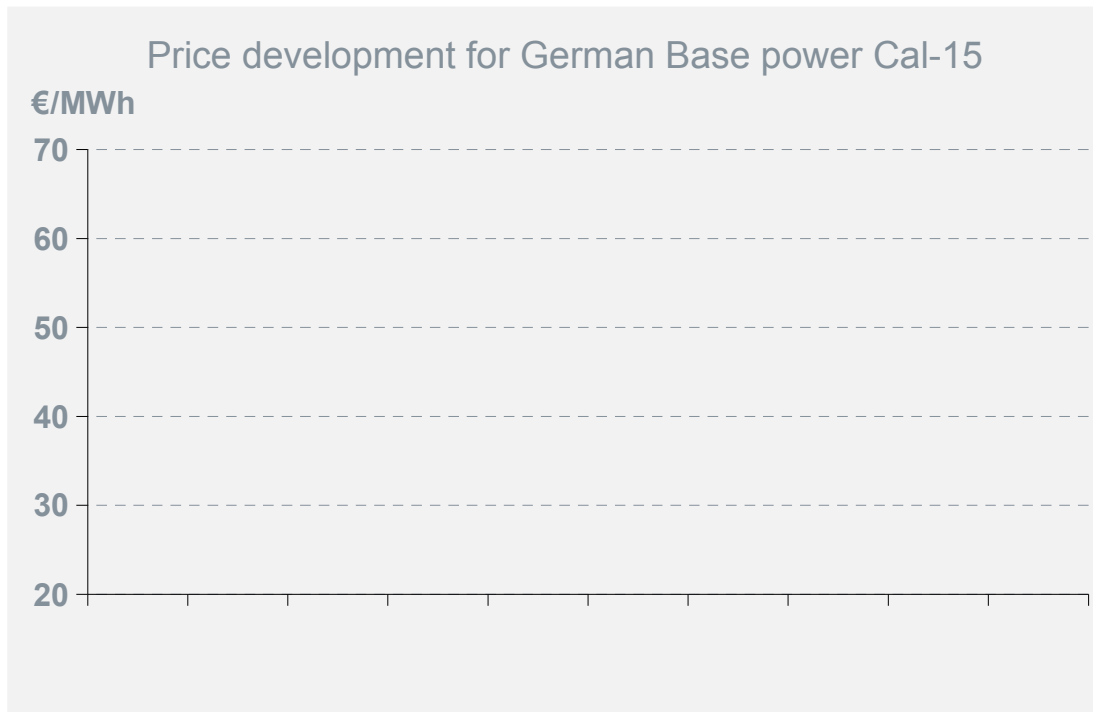
Until 2020:

- Power consumption: 10% reduction from 2008 to 2020, from 618 to 556 TWh
- Renewable electricity: 35% of power consumption in 2020, 192 TWh (2013: 25% reached, 148 TWh)
- Ghg emission target: 40% cut in emissions from 1990 to 2020 (cut: 750 mill. t)
- CHP law: 25% of power generation in 2020
- Renewable heat: 14% of demand for heating and cooling in 2020 (10% in 2012), total consumption: 1083 TWh in 2020

Beyond 2020:

- Total nuclear phase-out until 2021
- Renewable electricity: 40-45% in 2025, 50% in 2030

German power prices have been falling...



- German Cal-products have fallen approx. 40% since mid 2011
- Coal, EUAs, and German power balance are the main price drivers

“Energiewende”: Some effects for German power market

Until 2020:

- Renewable generation and CHP power generation increase step by step, power consumption reduces slightly
- Thermal generation: New hard-coal capacity to come online (base-load 46% efficiency rate), old hard-coal capacity loose profit-margins and utilization time, existing gas-fired capacity nearly squeezed out of the spot market
- New transmission capacities to other countries => net exports more than 50-60 TWh/y as German spot prices are lower than in neighbouring countries => disturbs Energiewende targets
- Capacity market to come (?): always sufficient capacity available, spot market to be oversupplied nearly all hours?

Beyond 2020:

- Nuclear phase-out, more thermal capacity needed for security of supply
- More renewable electricity in operation: 40-45% in 2025, 50% in 2030

German power balance development (TWh/y)

Recent development

	Hydro Power	Nuclear	Wind power	Solar power	Bioelectricity	Hard coal	Lignite	Gas	Other production, including oil	Net exchange	Consumption
2008	20	149	41	4	28	125	151	89	34	-23	618
2009	19	135	39	7	31	108	146	81	32	-14	581
2010	21	141	38	12	34	117	146	89	35	-18	615
2011	18	108	49	20	38	112	150	86	33	-6	607
2012	22	100	51	26	45	116	161	76	33	-23	607
2013	21	97	51	28	48	123	162	66	33	-33	596
2014	20	96	57	30	49	127	162	69	35	-47	598
2015	20	96	59	32	50	123	161	69	35	-47	598

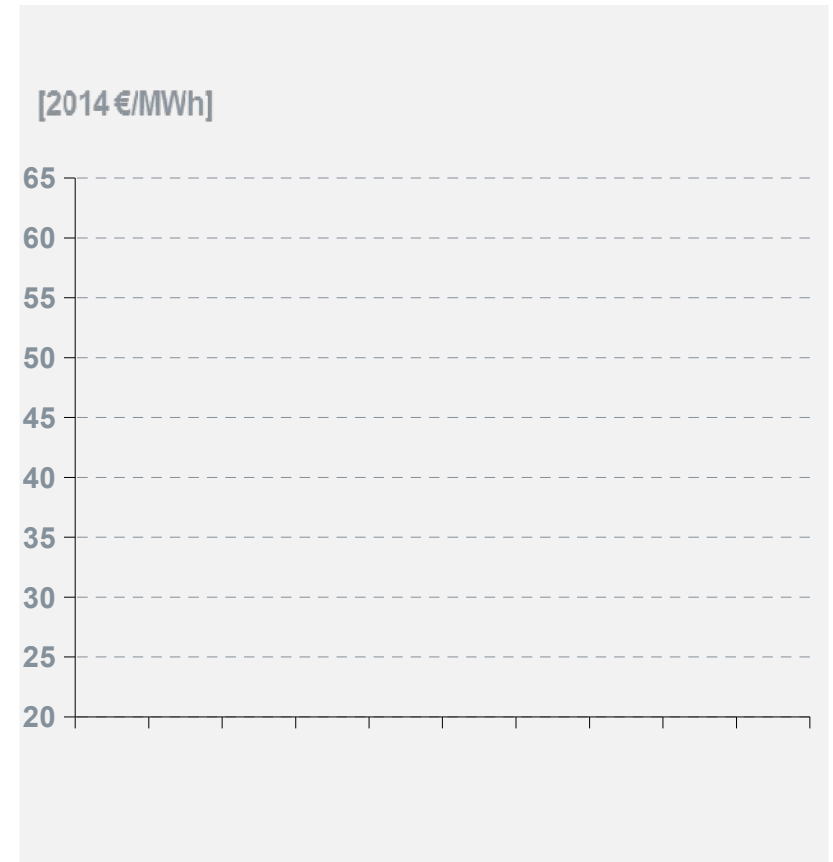
Our wind power targets 2020 and 2025: 70 and 80 TWh/y

Our solar power targets 2020 and 2025: 46 and 51 TWh/y

Our consumption targets 2020 and 2025: 583 and 574 TWh/y

Our net exports: 50-60 TWh/y 2016-2030

“Energiewende”: Base scenario for German power price



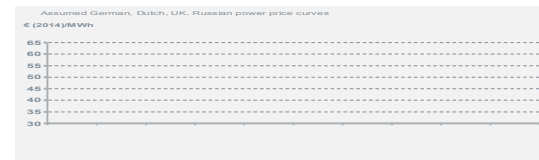
Netherlands – influenced by Germany

- **Previously:** Gas-fired generation at peak hours – 60 €/MWh, coal-fired generation at off-peak hours – 38 €/MWh incl. 5.6 €/MWh Dutch taxation
- **Now:** Netherlands imports 25% (of the consumption level) from Germany
- **From 2016 on:** Transmission capacity Netherlands-Germany increase from 4200 to 6200 MW – import may rise to 35% (of the consumption level)
- **Result: Low German spot prices hit Dutch power market and reduce Dutch generation. Dutch spot price level: 3-4 €/MWh above German level**

UK – at high gas-fired generation costs

- Now: Variable costs for gas-fired generation set the spot price level
- Gas-fired plants will increase generation when coal-fired plants shut down
- **Result: UK spot power price will be close to gas-fired generation costs nearly all hours – close to 60 €/MWh in 2013-16 and probably at this level also in the long term**

Power price curves for our neighbouring countries



Simulated power flow from Nordic area in 2020



Year	Cable links external	Annual Power flow (TWh)
2020	Finland-Estonia/Russia	7
2020	Sweden-Lithuania	4
2020	DK-Germany	2
2020	Norway-Germany	2
2020	Sweden-Germany	3
2020	DK-Netherlands	5
2020	Norway-UK	11
2020	Norway-Netherlands	1
2020	Sweden-Poland	2
2020	Total	37

Simulated power flow from Russia/Baltic areas to Nordic area

Nordic Power price 'Base' scenario vs. SRMC coal

Forecasted Nordic power price (annual avg.) and costs of coal-fired generation (SRMC)

€/MWh

45

40

35

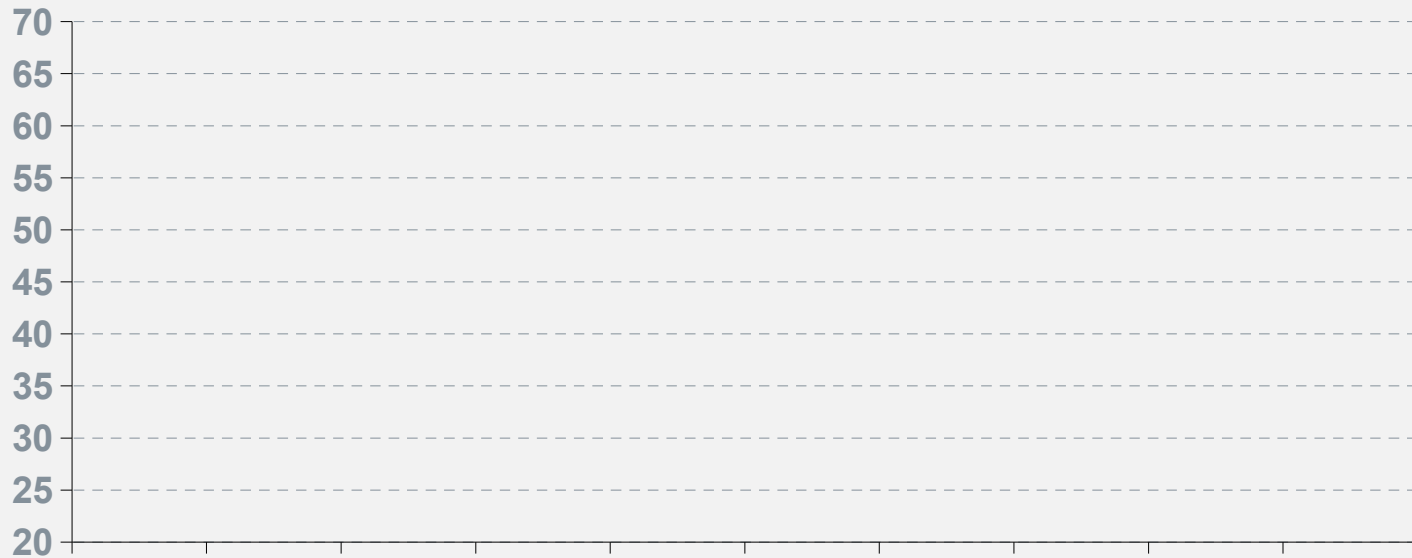
30

Nordic Power price scenarios 2014-2024:

Markedskrafts three price scenarios of December 2013

Forecasted Nordic spot price of base load power, in real 2013 euros

€ (2013)/MWh



Simulated Nordic Area prices. 'Base' scenario

Area Prices in the base scenario 2014-2026 [2013 €/MWh]. December 2013 edition

Year	System	S-Norway	Tr.heim	Tromso	SE1	SE2	SE3	SE4	Finland	Jutland	Zealand	Germany	Holland	UK	Russia
2014	33,7	32,7	34,2	32,9	33,2	33,4	34,2	34,5	37,9	35,4	37,0	37,1	46,2	65	45,0
2015	33,7	33,2	34,2	32,8	32,5	32,7	33,4	33,8	39,1	34,2	35,4	35,9	42,0	63	44,8
2016	32,0	32,3	32,4	31,3	31,2	31,4	32,1	32,5	32,3	33,8	34,8	36,5	41,8	62	44,1
2017	35,3	36,4	35,7	33,3	34,3	34,3	34,6	34,4	34,2	35,3	35,8	36,5	42,0	60,1	44,0
2018	34,6	35,3	35,1	33,6	33,7	33,7	33,8	33,8	34,0	36,7	37,0	37,4	42,1	61,0	44,1
2019	34,4	35,0	34,9	33,3	33,4	33,4	33,4	33,5	33,6	38,0	37,8	38,5	42,2	60,5	44,4
2020	36,4	37,7	36,2	34,2	34,6	34,6	34,7	34,9	34,8	39,2	38,7	39,7	42,6	60,3	44,6
2021	37,1	39,1	37,1	34,6	34,9	35,0	35,0	35,2	35,1	39,6	38,9	40,2	43,0	59,9	44,7
2022	37,7	40,1	37,9	34,9	35,3	35,3	35,4	35,6	35,4	40,1	39,2	40,8	43,4	61,3	45,0
2023	38,4	41,1	38,6	35,2	35,6	35,6	35,7	35,9	35,7	40,7	39,5	41,3	43,4	61,4	45,0
2024	38,6	41,6	39,0	35,2	35,5	35,6	35,6	35,9	35,6	40,9	39,7	41,5	43,5	61,4	45,0
2025	38,9	42,1	39,4	35,2	35,6	35,7	35,7	36,1	35,7	41,3	39,8	42,0	43,6	62,3	45,2
2026	39,8	42,8	40,2	36,1	36,9	36,9	37,0	37,2	36,9	41,8	40,4	42,5	44,1	62,4	45,6

Income prognosis for elcert projects 2015-20

Updated early in December 2013

Real Euro	<i>Nordic Power price</i>	Assuming LRMC windpower= 65 €/MWh	Total income green projects
Year	<i>Base forecast</i>	<i>Elcert base forecast</i>	<i>power+elcert</i>
2015	34	28	62
2016	32	31	63
2017	35	33	68
2018	35	35	70
2019	35	36	71
2020	36	34	70

Nordic Power price scenarios

Markedskrafts base scenario calculations 2008-2013

Year	"Base 2013" Sept	"Base 2010"	"Base 2009"	"Base 2008"	"Base 2007"	"Base 2005"	"Base 2000"
2012		44,5	40,6	67,7	49,8	27,8	23,7
2013	37,2	44,8	42,0	66,3	49,9	27,9	23,7
2014	33,9	42,3	44,7	64,8	49,9	28,7	23,7
2015	34,2	42,4	46,5	64,4	50,6	29,9	23,7
2016	32,9	43,6	47,3	63,3	51,0	31,1	23,7
2017	34,1	44,5	47,3	62,2	50,7	32,3	23,7
2018	34,2	45,4	47,9	61,3	50,5	33,5	23,7
2019	33,8	45,5	47,2	61,3	50,5	34,1	23,7
2020	33,9	45,6	47,4	61,4	50,6	35,5	23,7
2021	35,9	45,8	47,6	61,5	50,8	35,4	
2022	37,2	46,0	47,8	61,8	51,1	35,4	
2023	38,5	46,2	48,0	62,1	51,6	35,2	
2024	39,3	46,4	48,2	62,5	52,2	35,2	
2025	39,9	46,6	48,4	63,0	52,9	35,1	
2026	40,7	46,8	48,6	63,5	53,7		
2027	41,5	47,0	48,8	64,2	54,7		
2028	42,0	47,2	49,0	64,9	55,8		
2029	42,2	47,4	49,2	65,7	57,1		
2030	42,4	47,6	49,4	66,6	58,4		
2031	42,6	47,8	49,6	67,5	59,7		
2032	42,8	48,0	49,8	68,4	61,0		
2033	43,0	48,2	50,0	69,3	62,3		
2034	43,2	48,4	50,2	70,2	63,6		
2035	43,4	48,6	50,4	71,1	64,9		
2036	43,6	48,8	50,6	72,0	66,2		
2037	43,8	49,0	50,8	72,9	67,5		
2038	44,0	49,2	51,0	73,8	68,8		
2039	44,2	49,4	51,2	74,7	70,1		
2040	44,4	49,6	51,4	75,6	71,4		
2041	44,6	49,8	51,6	76,5	72,7		
2042	44,8	50,0	51,8	77,4	74,0		
2043	45,0	50,2	52,0	78,3	75,3		
2044	45,2	50,4	52,2	79,2	76,6		
2045	45,4	50,6	52,4	80,1	77,9		
2046	45,6	50,8	52,6	81,0	79,2		
2047	45,8	51,0	52,8	81,9	80,5		
2048	46,0	51,2	53,0	82,8	81,8		
2049	46,2	51,4	53,2	83,7	83,1		
2050	46,4	51,6	53,4	84,6	84,4		

Norwegian power balance until 2024

Central grid losses and pumping now included in total balance, Statoil Melkøya included in power int. industry

TWh/year

Year	Hydro-power*	Wind power*	CHP bio	Thermal*	El boilers	Residential consumption*	Power int. industry	Central grid losses/pump	Total consumption	Balance
2008	121,8	0,7	0,0	1,5	3,9	90,6	33,4	3,8	131,7	-7,7
2009	122,5	0,8	0,0	1,8	4,0	89,5	26,6	3,2	123,3	1,8
2010	123,4	0,9	0,0	3,3	3,6	91,9	28,9	2,2	126,6	1,0
2011	124,6	1,3	0,0	3,3	3,2	91,5	28,1	3,8	126,6	2,7
2012	127,9	1,4	0,0	3,3	3,5	93,9	28,4	4,1	129,9	2,7
2013	128,9	2,1	0,0	3,8	3,8	94,4	29,5	3,0	130,7	4,1
2014	130,2	2,2	0,0	4,0	3,7	95,8	29,5	3,5	132,5	3,9
2015	131,0	2,5	0,0	4,0	3,5	96,7	29,5	3,7	133,4	4,1
2016	131,8	2,9	0,1	4,0	3,5	97,5	29,5	3,7	134,2	4,6
2017	132,7	3,4	0,1	4,0	3,3	98,2	29,5	3,7	134,7	5,5
2018	133,8	4,4	0,1	4,0	3,0	98,4	29,5	3,8	134,7	7,6
2019	134,9	5,4	0,2	4,0	3,0	98,7	29,5	3,8	135,0	9,5
2020	136,0	6,1	0,2	4,0	3,0	99,2	29,5	3,8	135,5	10,8
2021	136,2	6,4	0,2	4,0	3,0	100,4	29,5	3,8	136,7	10,1
2022	136,4	6,4	0,2	4,0	3,0	101,7	29,5	3,8	138,0	9,0
2023	136,6	6,4	0,2	4,0	3,0	102,4	29,5	3,8	138,7	8,5
2024	136,8	6,4	0,2	4,0	3,0	103,1	29,5	3,9	139,5	7,9

Swedish power balance – our base scenario

TWh/year

Year	Hydro-power*	Nuclear	Wind power*	CHP bio	CHP others	Consumption*	Balance
2008	65,0	61,1	2,1	9,4	6,2	147,5	-3,7
2009	65,2	49,7	2,8	9,1	6,1	138,9	-6,0
2010	65,7	55,4	3,7	12,3	6,6	140,1	3,6
2011	66,0	57,6	5,2	9,9	6,3	141,8	3,2
2012	66,1	60,9	6,7	8,3	6,6	140,5	8,1
2013	66,1	63,9	8,9	12,3	5,8	140,7	16,3
2014	66,2	62,1	11,0	12,9	6,0	142,3	15,9
2015	66,3	66,2	11,5	13,2	6,2	143,2	20,2
2016	66,5	69,1	11,9	14,0	6,4	144,1	23,8
2017	66,6	69,4	12,4	14,6	6,6	143,6	26,0
2018	66,8	69,4	13,0	15,2	6,8	142,7	28,5
2019	67,0	69,4	13,3	15,7	7,0	141,9	30,5
2020	67,2	69,4	13,5	16,1	7,2	141,2	32,2
2021	67,2	69,4	14,0	16,3	7,2	141,5	32,6
2022	67,2	69,4	14,5	16,5	7,2	141,7	33,2
2023	67,3	69,4	15,0	16,7	7,2	141,9	33,6
2024	67,3	69,4	15,5	16,9	7,2	142,1	34,2

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