Volt Power Analytics

Power Market Forecasts

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24th May 2024

We are a team with broad industry experience, including 5 power market analysts

Katinka Bogaard, Managing Director and Co-Founder
Master's degree in Industrial Economics, NTNU 2017.
Expertise in European power market analysis and modelling.
Previous work experience: Volue, EnBW, Refinitiv.

Olav Johan Botnen, Power Market Expert and Co-Founder
Master's degree in Electrical Power Engineering, NTNU 1986.
One of the leading Nordic power market experts.
Expert in European power market analysis and modelling.
Previous work experience: Markedskraft, Wattsight, Volue, Sintef Energy Research.

Eivind Samseth, Lead Continental Analyst and CSO
Master's degree in Industrial Economics, NTNU. 2012.
Expert in European power market analysis and modelling.
Previous work experience: McKinsey & Company.

Børge Bogaard, CCO and Co-Founder
MBA from Stanford 1994.
Start-up expert with over 30 years of experience building up companies. Previous guest lecturer on start-ups at Harvard Business School. Previous work experience: CEO of US operation for a Norsk Hydro company, C- roles in startups.

Odd Gunnar Jakobsen, Senior Nordic Market Analyst
Over 15 years of Nordic power market analysis experience.
Previous work experience: Markedskraft, Wattsight, Volue.

William Bjønness, Power Market Analyst
Dual master's degree in Energy Systems and Markets, NTNU/TU Berlin 2022.
Expertise in power market modelling and data analysis.
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Tom Donnelly, Head of Marketing
Master's degree in Renewable Energy from the University of Hull
Expertise in building and developing SaaS businesses and marketing.
Previous work experience: Fugro Satellite Positioning, Wattsight, Volue.

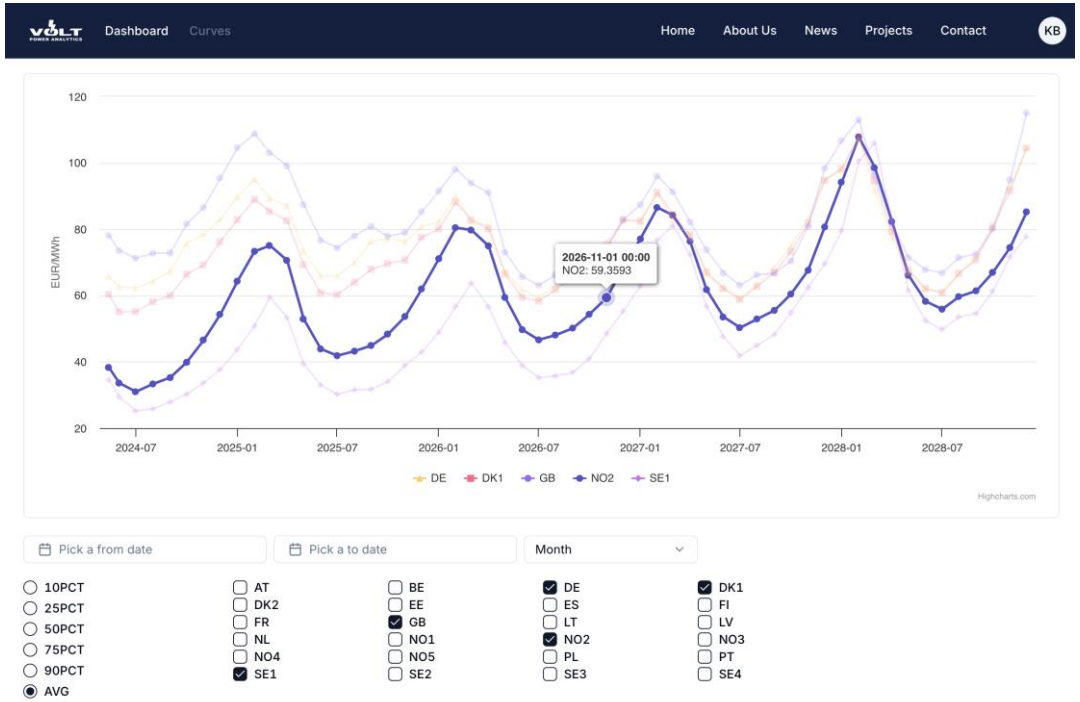
We provide clients with leading Nordic power market models and forecasting tools

Our key goals:

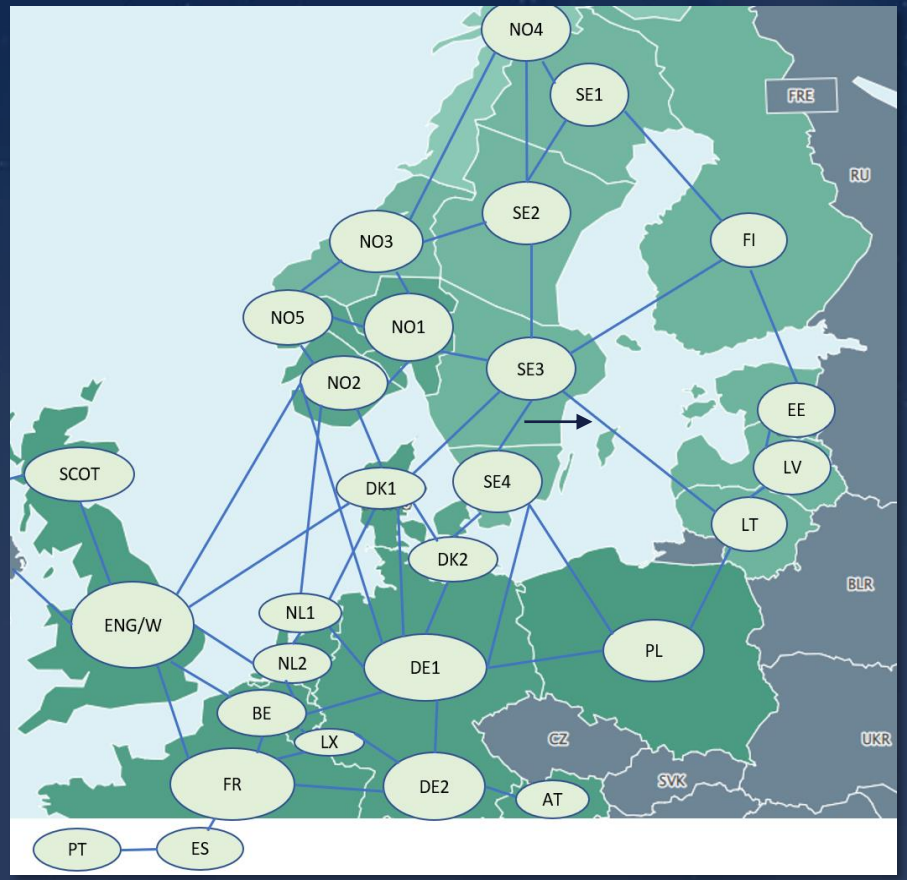
- Develop unique simulation tools for the forecasting of hourly spot prices in the Nordics and Continental power markets
- Tailored consultancy for power utilities, investors and traders: power price development, investment analysis
- Offer unique insight into the Nordic power market through our subscription-based analysis products

Volt's Offering:

- A “one-stop-shop” of the Nordic power market through our dashboard and portal for trading, production planning and investment analysis:
  - Easy access through APIs, dashboard
  - Daily simulations of Nordic power market, 30 weather scenarios. Updated each business day
- Long-term power price outlook until 2050, ‘hourly resolution’ simulations
- Direct access to Volt's Pan-European power market model based on the EMPS engine, including license costs for Sintef's EMPS model



Volt's EMPS Model For Hourly Price Simulations



- Detailed modelling of hydropower plants in Norway and Sweden, incl. 30 years of inflow series
- Modelling of thermal power plants in European countries
- Forecasts for development of generation sources and power consumption included
- Hourly time series for onshore/offshore wind and solar power, power consumption
- Hourly simulation for forward/long-term horizon (2024-2050) in latest version of the EMPS software (API/Python version)
- Calculation of capture prices for renewable investments, utilization of electrolysers

New Landscape For Renewable Investments

- **Strong inflation rate, increased interest rates, bottlenecks in supply chains:** 30-40% increase of investment costs (CAPEX) over latest 2-3 years
- **Onshore wind projects:** Licensing processes slower/more difficult, increased taxes in Norway
- **Offshore wind projects:** Auctions fail, some investment decisions cancelled/on hold/delayed: more subsidies needed
- **Solar projects:** Healthy progress recently, weakening capture prices may put the brakes on? Falling battery costs may boost investments again. German 2030 target: too ambitious?
- **Grid projects:** Slow licensing, slow progress, hindering some large-scale renewable/industrial projects, split to price zones?
- **Electrolyser projects:** Strong need for subsidies, slow progress so far, difficult to find long-term off-take agreements

Offshore Wind Projects – Delayed/Scaled Down In Long-term Analysis

- **Slower development of offshore wind in European** supply over late 2020s/early 2030s, compared to targets. Higher speed expected over mid 2030s, assuming falling LCOE's
- **Companies announced plans to scale back** their green transitions recently: Orsted, Iberdrola, ENEL, EDP (Portugal). Statkraft now reviewing its green targets
- **Norwegian projects**: deep sea, high grid costs, high need for subsidies – significantly delayed/cancelled?

Higher Costs Stall Development Of Green Hydrogen

- More than 50% cost increase for electrolysers over recent 2 years - delays in FIDs
- No significant progress worldwide
- Two projects identified in Europe Jan-Sep 2023: 8 MW in Spain, 17 MW in Sweden
- The challenge: Finding long-term offtake agreements to secure cash flow for banks to be able to finance
- **The EU not on track to reach its 40 GW target by 2030**
- EU's Hydrogen Bank provided €720 million to 7 renewable hydrogen projects in Europe in April 2024 (ES, PT, FI, NO)
- Large-scale industrial electrolyser projects in Sweden/Finland: developed by 2026-2027?

Development of Electrolysis in 'Optimistic' Scenario

Assumed Power Consumption from electrolysers in Europe (TWh/a)

Region	2025	2030	2035
Nordic	4	65	89
Rest of Europe	5	40	80
Total Europe	9	105	169

Assumed electrolyser capacity in Europe (GW)

Region	2025	2030	2035
Nordic	1	13	18
Rest of Europe	1	10	20
Total Europe	2	23	38

* assuming utilisation of 5000 h/a in Nordic and 4000 h/a for rest of Europe

- Weak performance over front years 2024-2026
- Stronger performance over 2027-2030 to a level of 23 GW, compared with EU target of 40 GW
- Rather strong performance over early 2030s

Norwegian Renewable Projects Faces Headwind

- **30-40% increase of costs** (CAPEX) for hydropower, onshore/offshore wind, electrolyser projects
- **Few licenses available for new hydropower/onshore wind**, except small-scale hydropower plants (<10 MW)
- **New Norwegian tax regime cap income.** Increased resource tax ('ground rent tax') for hydropower from 37 to 45%, total marginal tax level lifted from 59% to 67% (for >10 MW). Introduction of resource tax for onshore wind of 35%. Extra tax of 23% on 'superprofit' (spot prices > 70 øre/kWh) 2022-2023, for hydropower and onshore wind
- **Onshore wind tax: 'Will scare away investors to other European countries'** (Aneo to Montel)
- **Many small-scale hydropower projects in pipeline. Nearly no other projects under construction work/new FID's**
- **Offshore wind:** to be delayed to post 2030 (our view)

Norwegian Power Balance Development (In TWh)

Power Balance South of Norway (NO1, NO2 and NO5)

Year	Hydro	Onshore	Offshore	Solar	Thermal	Total production	Consumption	Balance
2022	93	7	0	0	1	101	84	17
2025	94	7	0	1	1	103	89	14
2030	95	9	0	3	1	109	108	1
2035	97	9	9	4	1	120	112	8

Power Balance North of Norway (NO3 and NO4)

Year	Hydro	Onshore	Offshore	Solar	Thermal	Total production	Consumption	Balance
2022	43	10	0	0	1	55	47	8
2025	44	11	0	0	1	56	51	4
2030	44	13	0	0	0	58	66	-8
2035	45	18	5	0	0	68	69	-1

Weak development of renewables until 2030

Some offshore wind expected over mid 2030s

Healthy development of consumption until 2030

Swedish Power Balance Development (In TWh)

Power Balance South of Sweden (SE3 and SE4)

Year	Hydro	Onshore	Offshore	Solar	Nuclear	CHP	Total production	Consumption	Balance
2022	8	14	0	2	50	12	86	110	-24
2025	8	18	0	5	52	12	95	112	-17
2030	8	21	3	7	52	12	103	125	-22
2035	8	21	18	9	60	12	128	130	-2

Power Balance North of Sweden (SE1 and SE2)

Year	Hydro	Onshore	Offshore	CHP	Total production	Consumption	Balance
2022	61	18	0	4	83	27	56
2025	58	25	0	4	87	30	57
2030	58	33	5	4	101	62	39
2035	58	41	8	4	112	65	46

- Healthy development of renewables, later also nukes
- Offshore wind in south post 2030
- New nukes by mid 2030s
- More development of new consumption than new supply in north
- Industrial demand in north to go potentially higher?

Finnish Power Balance Development (In TWh)

VOLT POWER ANALYTICS

Power Balance of Finland

Year	Hydro	Onshore	Offshore	Solar	Nuclear	Thermal	CHP	Total production	Consumption	Balance
2022	14	12	0	0	24	4	16	70	82	-12
2025	14	23	0	2	35	3	15	92	84	8
2030	14	28	3	4	35	1	13	97	106	-9
2035	14	31	10	5	35	1	13	109	109	0

- Healthy development of renewables and consumption
- Onshore wind licenses available
- Large wind projects under construction work or with (potential) FID's

Danish Power Balance Development (In TWh)

Power Balance (DK1)

Year	Solar	Onshore	Offshore	Central Power Stations	Decentral Power Stations	Industrial Autoproducers	Total production	Consumption	Balance
2022	1	13	5	6	2	1	28	26	3
2025	5	14	7	5	2	1	33	32	2
2030	16	21	12	4	1	1	55	53	2
2035	21	22	24	1	1	0	69	66	3

Power Balance (DK2)

Year	Solar	Onshore	Offshore	Central Power Stations	Decentral Power Stations	Industrial Autoproducers	Total production	Consumption	Balance
2022	1	3	4	3	1	1	12	13	1
2025	2	3	4	3	1	1	13	15	2
2030	6	4	10	3	0	1	24	22	3
2035	8	4	28	2	0	1	44	36	8

- Very healthy development of renewables and consumption
- Nearly shut-down of thermal plants

Inflation/Increased Interest Rates Lift LCOEs

Nordic LCOE indications: Based on figures from NVE converted to Euro/MWh, adjusted to 2023 levels

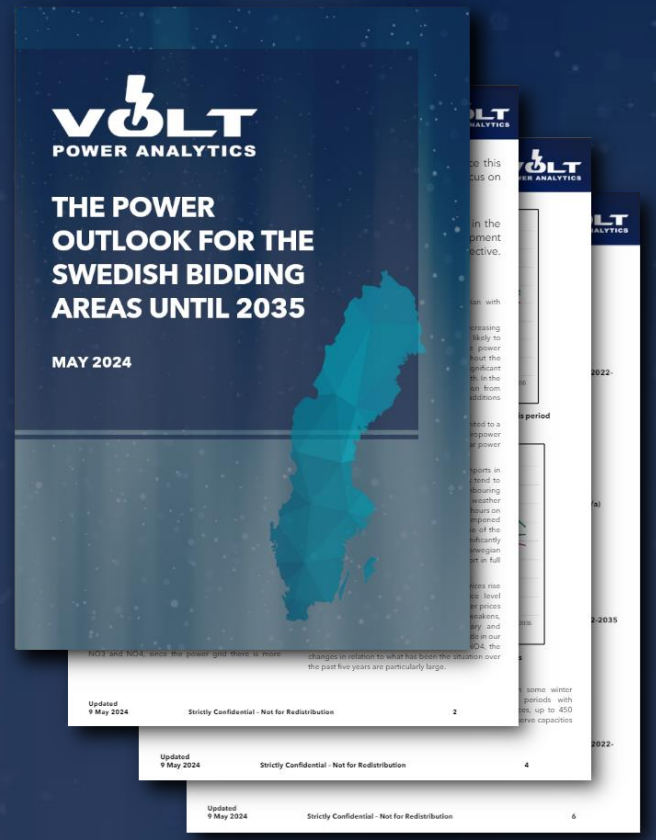
LCOE indications	jan.21	jan.23
Hydropower		35-40
Onshore wind	~35	40-45
Solar ground		~55
Solar flat roof		~65
Nuclear		~75
Offshore wind	~60	~85
Solar rooftop		~100
Floating wind	~100	~140
Gas-fired		~150

https://www.nve.no/energi/analyser-og-statistikk/kostnader-for-kraftproduksjon/

- German LCOE indications: Onshore wind 73.4 €/MWh, Solar rooftop 89.2 €/MWh

2035 Swedish Power Outlook

Volt Power Analytics has created their power outlook for Sweden covering until the mid-2030s. Power traders or portfolio managers can use this report to enhance their trading strategies. The report provides a comprehensive overview of the drivers affecting electricity prices.



HOURLY SIMULATION

- Fully modelled Northern Europe (e.g. Germany, GB)
- Price volatility from combination of hydro, wind and solar generation and consumption fully included
- Development trends and their simulated price effects explained in detail.

SIMULATION RESULTS

- Power balances presented for Norwegian and Swedish areas
- Simulated area prices presented for each Swedish price zone year-by-year
- Explanation of effects on winter seasons

Price simulations North Sweden (SE1+SE2)

Nominal
Euro/MWh

Neutral for rest 2024, upside potential thereafter

Product	Market 22/5	Our simulation 22/5	10 %	90 %
Jun-24	32	35	14	65
Jul-24	28	31	13	45
Q3-24	33	32	15	51
Q4-24	43	39	25	72
Q1-25	48	58	29	78
Q2-25		48	22	64
Q3-25		34	17	52
Yr-2025	33	45	18	75
Yr-2026	29	51	19	78
Yr-2027	32	64	23	84
Yr-2028	36	74	29	95

Price simulations SE3

Nominal Euro/MWh

Neutral for rest 2024, upside potential thereafter

Product	Market 22/5	Our simulation 22/5	10 %	90 %
Jun-24	31	39	19	66
Jul-24	30	33	14	51
Q3-24	45	35	18	57
Q4-24	53	50	29	80
Q1-25	66	78	40	111
Q2-25		59	25	66
Q3-25		37	20	59
Yr-2025	43	57	20	77
Yr-2026	37	62	24	84
Yr-2027	41	70	29	90
Yr-2028	45	79	33	97

Price simulations SE4

Nominal
Euro/MWh

Downside for rest 2024, upside potential thereafter

Product	Market 22/5	Our simulation 22/5	10 %	90 %
Jun-24	52	41	19	66
Jul-24	40	34	14	51
Q3-24	47	36	19	59
Q4-24	63	57	36	83
Q1-25	79	85	45	115
Q2-25		62	27	78
Q3-25		38	22	62
Yr-2025	56	62	23	80
Yr-2026	47	66	28	87
Yr-2027	48	74	30	91
Yr-2028	51	83	38	102

Price simulations South of Norway NO1

Nominal Euro/MWh

Downside rest 2024, upside 2025-2027

Product	Market 22/5	Our simulation 22/5	10 %	90 %
Jun-24	48	42	20	60
Jul-24	47	37	15	55
Q3-24	53	38	14	48
Q4-24	68	53	27	77
Q1-25	81	81	46	98
Q2-25		60	36	77
Q3-25		38	22	59
Yr-2025	59	59	36	69
Yr-2026	52	63	40	78
Yr-2027	51	70	45	88
Yr-2028		81	48	94

Price simulations Finland (FI)

Nominal
Euro/MWh

Downside rest 2024, upside 2025-2027

Product	Market 22/5	Our simulation 22/5	10 %	90 %
Jun-24	36	35	22	65
Jul-24	39	27	19	55
Q3-24	51	31	19	55
Q4-24	61	54	37	88
Q1-25	79	92	45	119
Q2-25		63	35	94
Q3-25		35	20	58
Yr-2025	52	61	34	77
Yr-2026	44	63	42	79
Yr-2027	43	69	52	84
Yr-2028	47	78	57	95

Thank you for your time!

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