Enwex rulebook - version 2026

01.10.2025

for German indices

Enwex Energy Weather Indices are created to meet the optimized balance between (i) accuracy of represented weather development data and (ii) simplicity for a sufficient understanding by traders and markets. Enwex is registered a trademark (EUIPO reg. Nr. 018892447) and operates in accordance with the IOSCO Principles for Financial Benchmarks.

The indices are published in immutable yearly versions pursuant to the following methodology:

1.) Index basics

- Generally, any annual Enwex Index is representing a certain predefined territory (market region or countrywide).

- A predefined territory, if possible, the largest political unit, e.g. provinces or federal states, with their fraction of supply (wind, solar) or demand (via population for temperature products) determine the weighting of the representative grid point.

- These grid points per territory are determined as the nearest one to the middle of a territory. For each parameter the same grid point per territory is used.

- The spatial resolution of the grid is 0.25° Lat Lon, the temporal resolution is hourly with timestamps representing the hour begin.

- The temporal resolution will persist in case of markets allowing 15-minute resolution of prices, as weather models are decisive for Enwex. So for derivatives on Enwex, e.g. market values, the power prices will be averaged for the forecasted hour and then multiplied by the utilization figure of Enwex.

- Weather parameters currently translated into Enwex Indices:
  a) Temperature: by population weight per region.
  b) Wind: by installed capacity per region along transparent datasets as listed in **Appendix 1**. Wind indices from v26 available for onshore capacities and offshore separated and in total.
  c) Solar: by installed capacity per territory along sources as listed in **Appendix 1**

- Day ahead settlement data of Enwex Indices for Germany are published at 10:00 AM local time at www.enwex.com .

2.) Index update routine (yearly)

- Index weightings for renewables need a yearly versioning due to newly built installations. Therefore, total and regional installed capacities are based on most recent available figures at 1st of September of each year with maximum time lag accepted of eight months (= end of previous calendar year). If there is no update on regional installed capacities more recent than 31st of December of the previous year, the weighting will be done along the latest available publication.

- New yearly versions will be calculated on the back of published capacity and their spatial distribution data and published by Enwex at each 1st of October in its API with the new yearly ending, e.g. for 2026 named "…_v26".

- For Wind and Solar the underlying weightings are updated in a yearly routine, for Temperature in a 5-year routine with the next update for the version of 2030 (note: for reasons of consistency, actual temperature timeseries will also be named along the current trading years, e.g. v26).

- The day ahead settlement publications will change their underlying weighting with the change of each calendar year, so in this example from 1st of January 2026. The period in Q4 is used for the review by the market participants on the potential changes.

- For backtesting purposes, each yearly version has an updated backward calculation available for (a) from 1979 to present for reanalysis data and (b) from 2013 to present for EC oper day ahead data.
  - ⇨ For backtest data, the underlying weighting per timeseries stays unchanged through the years.

- For settlement data, each parameter & country combination has one curve ID in the API which is named "settlement" and continuously contains the current actual weighted capacity. So its underlying is shifting with the day ahead settlement for 1st of January to the next yearly version with its weighting.
  - ⇨ For settlement data, curve ID's stay unchanged through the years.

- Previous yearly versions (e.g. v24, v25) will continuously be calculated until no trade concluded is referring to it anymore with a maximum of ten years backward, e.g. in year 2035 the v25 timeseries will not be updated anymore.

- Territorial means and their actual weightings are calculated as regional MW installed divided by total MW installed in the territory. Current values for weighting within a country are listed in **Appendix 2.**

3.) Weather model specifications

- The weather model applied is the operational model of European center for medium range forecast (ECMWF; https://www.ecmwf.int/en/about/what-we-do; https://www.ecmwf.int/en/publications/ifs-documentation) in its 0.25 degree spatial resolution and the 00 UTC update.

- Model parameters used from ECMWF oper are:
  a) Temperature: 2m temperature
  b) Wind: windspeed in m/s out of 100m level of u-wind and v-wind
  c) Solar: Incoming shortwave radiation at surface

- Timesteps: Hourly resolution for the forecast period day ahead in local time (e.g. for Germany in wintertime H+25 to H+49).

- Fallback routine:
  In case of ECMWF model delay, fallback solution for index calculation is with identical method and parameters but using ECMWF operational with basis 12 hours before (12 UTC). This means for e.g. Germany (wintertime) then timesteps H+37 to H+61.

- Reanalysis data in API timeseries from 1979 onwards are calculated out of ERA5 models, https://cds.climate.copernicus.eu/datasets/reanalysis-era5-single-levels?tab=overview, using same weather parameters, spatial and temporal resolution as from EC oper.

- Historical data by EC oper and ERA5 for Enwex in the current and previous year's versions can be downloaded via Enwex API. For access and further information mailto info@enwex.com

- Handling of weather model generation switch:

  a) EC oper: Direct implementation of new model versions after official release by ECMWF with unchanged spatial (0.25°) and temporal (hourly) resolution. Historical Data in API stays unchanged and is always reflecting the latest state of EC oper model at day ahead settlement.
  b) ERA5: With planned new generation of ERA6, all historical timeseries will be published with the next year's version in ERA6 and ERA5 for comparability reasons. After twelve months of ERA6, the following yearly index version will just be available in the new ERA version.

4.) Index calculation per parameter

Weather parameters used and the formula per country for calculation of wind and solar utilization are part of the yearly update routine. To handle potential biases driven e.g. by technological improvements on the efficiency factor or the other way round, by aging effects, there is a technology coefficient.
For biases exceeding 0,5% in backtesting of the previous period from July$_{(year-1)}$ until June$_{(year)}$ observation data (for Germany: Netztransparenz, Link: https://www.netztransparenz.de/de-de/Erneuerbare-Energien-und-Umlagen/Freiwillige-Veröffentlichungen/Wind-und-Solarenergie-Hochrechnung), it will be modified by full % figure, e.g. +1,6% bias will lead to a technology coefficient of 1,02.
A review of the complete formula for each parameter and its coefficients is scheduled for the Enwex version v30, valid in 2030.

a) Temperature:

Enwex temperature = 2m temperature in ° Celsius

b) Solar:

Enwex solar = Utilization of installed solar capacity $= c * ((f * S * A) / (S_0 * A)) = c * (f * S / S_0)$

with:
c = technology coefficient = 1,00 (for neutralizing possible general biases)
f = factor depending on mean module efficiency and module orientation, varying per country (e.g., Germany 0,71)
S [W/m²] = shortwave radiation at surface = ECMWF operational model output for incoming radiation at surface
A [m²] = Area of installed solar modules
S_0 [W/m²] = Order of magnitude of the maximum possible solar radiation at the surface = 10^3 W/m² = 1000 W/m²

current formula for Germany:
Solar(GER) = 1,00 * (0,63 * S / 1000)

c) Wind:

Enwex wind = Utilization of installed capacity $= c * ((U_0 + u_a) / (1{,}0 + \exp(v_s - s * (w - xs) - c)) - u_a)$

with:
c = technology coefficient = 1,00 (for neutralizing possible general biases)

U_0 = Maximum utilization: Max average power output per installed capacity, usually below 1,00 due to e.g., outages, revisions
u_a = Util addition: modifies slope, subtracted at end of formula to avoid influence on maximum
v_s [m/s] = Start wind speed: average turbine start speed
s = Slope: Steepness of exponential function
w [m/s] = Windspeed: Calculated from the ECMWF operational model output for u- and v-wind components in 100m height
xs = X-axis shift: Shift to avoid negative values with low wind
c = average roughness length of landscape

Note:
windspeed values smaller than start wind speed of turbines in this formula providing negative results, therefore need to be replaced by 0.

Formula for Germany wind onshore:
Wind(GER) = 1,00 * ((0,92 + 0,05) / (1,0 + exp(3,2 – 0,529 * (wind – 2,5) – 0,0074)) – 0,05)

Formula for Germany wind offshore:
Wind(GER) = 1,00 * ((0,86 + 0,06) / (1,0 + exp(3,2 – 0,48 * (wind – 3,0) – 0,001)) – 0,06)

Ratio for Germany wind total: 87,6% onshore, 12,4% offshore

A general note on curtailments:

Enwex does not adjust for curtailments, since the indices are designed to represent weather-driven potential supply rather than actual realized feed-in. This methodological choice may result in a temporary positive utilization bias compared with reported figures for solar and wind production, such as those published by ENTSO-E.

Appendix 1: Data sources on installed capacities

Germany:

- https://www.bundesnetzagentur.de/DE/Fachthemen/ElektrizitaetundGas/ErneuerbareEnergien/EE-Statistik/start.html (wind & solar, update from 18.8.25 including July 2025. Note: Possible changes of installed capacities in later updates do not get considered.)

Appendix 2: Countrywide mean and its actual weightings (v26)

			Version 2026 (v26)			Version 2025 (v25)	
Province	**Latitude**	**Longitude**	**temperature**	**wind**	**solar**	**wind**	**solar**
Baden-Württemberg	48,50	9,00	**13,4**	**3,0**	**12,6**	2,9	12,6
Bavaria	49,00	11,50	**15,9**	**4,2**	**26,7**	4,3	26,9
Brandenburg & Berlin	52,50	13,50	**7,5**	**14,1**	**8,2**	14,2	8,0
Hesse	50,50	9,00	**7,6**	**4,1**	**4,7**	4,2	4,6
Lower Saxony & Bremen	52,50	9,00	**10,5**	**20,7**	**9,1**	20,7	8,9
Mecklenburg-Vorpommern	53,75	12,50	**1,9**	**5,9**	**4,2**	6,1	4,3
North Rhine-Westphalia	51,50	7,50	**21,5**	**12,8**	**12,2**	12,1	12,1
Rhineland-Palatine & Saarland	50,00	7,25	**6,1**	**7,3**	**6,0**	7,4	6,3
Saxony	51,00	13,50	**4,8**	**2,1**	**4,8**	2,2	4,7
Saxona-Anhalt	52,00	11,75	**2,6**	**8,6**	**4,7**	8,7	4,8
Schleswig-Holstein & Hamburg	54,25	9,75	**5,7**	**14,3**	**4,0**	14,3	3,9
Thuringia	51,00	11,00	**2,5**	**2,9**	**2,8**	2,9	2,9

Offshore Wind

Region	**Latitude**	**Longitude**	**offshore**
Borkum1	54,00	6,50	29,0
Borkum2	54,50	6,00	23,2
North1	54,50	7,75	17,6
North2	55,00	7,00	9,8
BalticSea	55,00	13,75	20,4