Enwex rulebook - version 2026

30.12.2025

for Global indices (except Europe)

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 a registered trademark (EUIPO reg. Nr. 018892447) and operates in accordance with the IOSCO Principles for Financial Benchmarks and the EU Benchmark Regulation (BMR).

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

1.) Index basics

- Generally, any 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 province. For each parameter the same grid point per province is used.

- The spatial resolution of the grid is 0,25° Lat Lon, the temporal resolution is hourly with timestamps representing the hour begin.

- This 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 province.
  b) Wind: by installed capacity per province along transparent datasets as listed in **Appendix 1**.
  c) Solar: by installed capacity per province along sources as listed in **Appendix1**.

- Day ahead settlement data of Enwex Indices are generally published at 10:00 AM local time (Berlin, GMT+1) at www.enwex.com. This means in local time:
    - U.S. – ERCOT: 03:00 (GMT-6)
    - U.S. – PJM: 04:00 (GMT-5)
    - Gas – East U.S.: 04:00 (GMT-5)
    - Japan: 18:00 (GMT+9)
    - Gas – East Asia: 17:00 (GMT+8)
    - AUS – S Australia: 21:30 (GMT+10:30)
    - AUS – Victoria: 22:00 (GMT+11)

2.) Index update routine (every 1 to 5 years)

- Index weightings for renewables from time to time need a versioning due to newly built installations. In such a case, 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 calender year). If there is no update on regional installed capacities more recent than 31st of December of previous year, the weighting for the affected country will be done along the latest available publication.

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

- For Wind and Solar the underlying weightings are updated in a 1 to 5 year routine, depending on newbuild. For Temperature there is 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 latest of any updates, e.g. currently v26).

- The day ahead settlement publications will change their underlying weighting with the change of a calender year, so in this example from 1st of January 2026. The period in Q4 can be used by market participants to review the implied differences of the new version.

- For backtesting purposes, each 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.
    ⇨ Within backtest files, the underlying weighting per timeseries stays unchanged through the years of the entire dataset.

- For settlement data, each parameter & territory 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 2026 from version v25 to v26 with its new weighting.
⇨ For settlement data, curve ID's stay unchanged through the years.

- Previous 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 2036 the v26 timeseries will not be updated anymore.

- Province 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 territory are listed in **Appendix 3.**

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 ERCOT in wintertime H+30 to H+54).

- 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. ERCOT (wintertime) then timesteps H+42 to H+66.

- 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 the 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 territory 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 (e.g. for U.S. it is the IEA), 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

In the USA there is an additional (inverting) term needed to meet the broader maximum observed for noon hours, which is used for radiations values >100 W/m² (below it stays as shown above for other territories):

S_{max} [W/m²] = maximum daily shortwave radiation at surface
y = weight of inverted term, remainder to 1 is as for other territories

Enwex solar utilization USA for S > 100 W/m² = $c * (f * ((1-y) * S + y * (S_{max} – S)) / S_0)$

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.

Coefficients for renewables per country can be found in **Appendix 2**.

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.

5.) Regulatory Governance Framework

Governance, Oversight and Methodology Control

Enwex applies a proportional governance structure suitable for a non-significant benchmark administrator.

- Benchmark Administrator: responsible for methodology approval and annual updates.
- Data Steward: validates input data and monitors data quality.
- IT Lead: oversees operational stability and fallback processes.
- Compliance Function: monitors adherence to BMR and IOSCO requirements.
- Oversight is implemented via structured annual self-assessments, with optional external review.

No discretionary judgement is applied outside predefined rules.

Complaints and Consultation Procedures

Users may submit methodology or benchmark-related complaints to info@enwex.com
All complaints are logged, evaluated and resolved according to the Enwex Complaints Procedure.
Material methodology changes follow a consultation process unless operational urgency requires immediate action. Criteria for materiality include parameter changes with >5% expected impact, sourcing changes, or fleet-model revisions.

Cessation and Transition Policy Overview

Enwex maintains yearly benchmark versions for up to 10 years or until no open contracts reference them.
Users will be notified at least six months prior to cessation. Transition guidance and alternative benchmark series are provided in the Benchmark Statement.

Appendix 1: Data sources on installed capacities & population

Australia – S Australia:
https://www.abs.gov.au/census/find-census-data/search-by-area (as of 10.7.2025)
http://www.thewindpower.net (as of 18.7.2025)
https://pv-map.apvi.org.au/historical#7/-32.445/136.626 (as of 22.9.2025)

Australia – Victoria:
https://www.abs.gov.au/census/find-census-data/search-by-area (as of 10.7.2025)
http://www.thewindpower.net (as of 18.7.2025)
https://pv-map.apvi.org.au/historical#7/-32.445/136.626 (as of 22.9.2025)

U.S. - ERCOT:
https://digital-vector-maps.com/state-maps-detail/4418/Texas-County-Populations-Map-Adobe-Illustrator.htm (as of 24.7.2025)
https://www.txrenewables.net/map (as of 24.7.2025)

U.S. - PJM:
https://www.monitoringanalytics.com/reports/PJM_State_of_the_Market/2024/2024q2-som-pjm-sec12.pdf (downloaded 30.6.2025)

Appendix 2: v26 coefficients for renewable utilization

Solar

Australia – S Australia:
Solar(SA) = 1,00 * (0,67 * radiation / 1000)

Australia - Victoria:
Solar(VIC) = 1,00 * (0,70 * radiation / 1000)

USA - ERCOT:
If radiation <100, then Solar(ERC) = 1,00 * (1,15 * radiation / 1000), else
Solar(ERC) = 1,00 * (1,15 * (0,8 * radiation + 0,2 * (radmax - radiation)) / 1000)

USA - PJM:
If radiation <100, then Solar(PJM) = 1,00 * (1,15 * radiation / 1000), else
Solar(PJM) = 1,00 * (1,15 * (0,8 * radiation + 0,2 * (radmax - radiation)) / 1000)

Wind onshore

Australia – S Australia:
Wind(SA) = 0,95 * ((0,91 + 0,02) / (1,0 + exp(3,0 – 0,59 * (wind – 2,2) – 0,0074)) – 0,02)

Australia – Victoria:

Wind(VIC) = 1,00 * ((0,90 + 0,02) / (1,0 + exp(3,0 – 0,565 * (wind – 2,5) – 0,0074)) – 0,02)

USA - ERCOT:
Wind(ERC) = 1,00 * ((0,65 + 0,00) / (1,0 + exp(3,0 – 0,64 * (wind – 2,2) – 0,0074)) – 0,00)

USA - PJM:
Wind(PJM) = 1,00 * ((1,0 + 0,00) / (1,0 + exp(3,0 – 0,63 * (wind – 2,2) – 0,0074)) – 0,00)

Appendix 3: Countrywide means and their actual weightings in % (v26)

Australia – South Australia

Province	latitude	longitude	temperature	solar
Giles	-29,00	134,75	2,6	5,2
Stuart	-30,50	138,50	2,6	9,2
Flinders	-32,50	134,50	2,6	1,5
Mackillop, Mount Gambier	-37,00	140,75	5,2	2,8
Hammond, Chaffey, Schubert	-35,00	140,00	8,2	17,7
Narungga, Frome	-33,50	138,25	5,2	5,0
Mawson, Finniss, Heysen	-35,50	138,50	8,0	5,6
Adelaide (=Rest)	-35,00	138,75	65,6	53,0

Latitude	Longitude	wind
-32,50	137,50	18,0
-33,00	138,50	23,2
-33,50	136,50	3,0
-33,75	138,00	18,2
-33,75	139,00	15,7
-34,75	135,50	2,8
-35,00	137,50	5,2
-37,75	140,50	13,9

Australia - Victoria

Province	Latitude	Longitude	temperature	solar
Mildura (N Victoria)	-35,00	142,25	1,2	11,2
SW coast, Lowan (W Victoria)	-36,75	142,25	2,8	1,6
Ripon (W Vic), Polwarth	-38,25	143,50	2,6	2,6
Gippsland East (E Vic)	-37,75	148,50	1,4	1,1
Ovens Valley, Benambra	-36,50	146,75	2,6	3,0
Shepparton, Murray plains (N Vic)	-35,75	144,00	2,8	8,8
Bendigo E/W, Macedon, Euroa	-37,00	144,75	5,6	11,9
Eildon, Narracan, Morwell, Gippsland S	-38,25	146,00	5,4	4,4
Melbourne (=Rest)	-37,50	145,00	75,6	55,4

Latitude	Longitude	wind
-36,25	142,00	12,0
-37,00	143,00	14,7
-37,00	145,00	1,4
-37,50	143,50	14,9
-37,75	143,00	13,8
-37,75	144,00	13,6
-38,00	142,00	11,5
-38,25	143,00	10,7
-38,50	141,50	4,0
-38,75	146,00	3,4

USA - ERCOT

ERCOT weather zone	Latitude	Longitude	temperature	wind	solar
Coast (Houston)	29,75	-95,50	26,7	0,8	20,0
East (Tyler)	32,25	-95,25	5,0	0,0	9,6
North (Wichita Falls)	33,75	-98,50	2,3	17,2	8,2
North Central (Waco)	31,50	-97,25	33,5	16,6	17,8
South (Corpus Christi)	27,75	-97,50	10,1	22,2	5,6
South Central (San Antonio)	29,50	-98,50	18,0	0,0	6,6
West (Abilene)	32,50	-99,75	2,6	28,1	8,8
Far West (Midland)	32,00	-102,00	1,8	15,1	23,4

USA – PJM

Province	Latitude	Longitude	temperature	wind	solar
Delaware	39,00	-75,50	1,5	0,0	0,5
Illinois	40,25	-89,00	13,8	45,4	0,6
Indiana	40,00	-86,25	1,8	19,7	5,7
Kentucky	37,75	-84,25	2,5	0,0	1,0
Maryland	39,00	-76,75	9,5	2,5	4,8
Michigan	44,25	-84,75	0,8	0,0	0,0
N Carolina	35,50	-80,00	1,5	1,7	11,5
New Jersey	40,00	-74,50	14,3	0,1	7,0
Ohio	40,25	-82,75	18,2	9,6	25,6
Pennsylvania	41,00	-77,75	20,0	14,3	7,1
Virginia	37,50	-78,75	13,3	0,1	35,2
West Virginia	38,75	-80,75	2,8	6,6	1,0

Gas demand region East Asia (JKM)

Share within E Asia region: Japan 70,9%, Korea 29,1%

Japan

Province	latitude	longitude	weights
Chubu (Toyama)	36,50	137,25	18,0
Chugoku (Hiroshima)	34,50	132,50	5,7
Hokkaido (Sapporo)	43,00	141,50	4,1
Kansai (Osaka)	34,75	135,50	17,8
Kanto (Tokyo)	35,45	139,45	34,0
Kyushu & Okinawa (Fukuoka)	33,50	130,50	11,0
Shikoku (Kochi)	33,50	133,50	2,8
Tohoku (Sendai)	38,25	140,75	6,6

Korea

Province	latitude	longitude	weights
1,4,8 (Seoul)	37,50	127,00	50,0
9 (Gangneung)	37,75	128,75	2,9
6,10,11,17 (Daejeon)	36,25	127,25	10,8
3,14 (Daegu)	36,00	128,50	9,6
5,12,13,16 (Gwangju)	35,25	126,75	11,3
2,7,15 (Busan)	35,25	129,00	15,4

Gas demand region East USA (Henry Hub)

State	Latitude	Longitude	weights
Alabama	32,75	-86,75	3,0
Connecticut	41,75	-72,75	2,1
Delaware	39,00	-75,50	0,6
Georgia	32,75	-83,50	6,4
Illinois	40,25	-89,00	7,6
Indiana	40,00	-86,25	4,0
Kentucky	37,75	-84,25	2,7
Maine	45,25	-69,25	0,8
Maryland	39,00	-76,75	3,7
Massachusetts	42,25	-72,00	4,2
Michigan	44,25	-84,75	6,0
Mississippi	32,75	-89,75	1,8
N Carolina	35,50	-80,00	6,2
New Hampshire	44,00	-71,50	0,8
New Jersey	40,00	-74,50	5,5
New York	43,00	-76,00	12,0
Ohio	40,25	-82,75	7,0
Pennsylvania	41,00	-77,75	7,7
Rhode Island	41,75	-72,50	0,7
S Carolina	34,00	-81,00	3,0
Tennessee	35,75	-86,25	4,1
Vermont	44,00	-72,50	0,4
Virginia	37,50	-78,75	5,1
West Virginia	38,75	-80,75	1,1
Wisconsin	44,75	-89,75	3,5

Gas demand Region Europe (TTF & NBP)

Country	weights
Belgium	5,44
France	15,76
Germany	39,07
Netherlands	8,32
United Kingdom	31,41

for weightings within the countries compare “Enwex rulebook Europe