Germany • Renewable energy • Geothermal, Hydrogen, Solar, Wind

Gross electricity generation from renewable sources by 2021, TWh (%)

- Bioenergy 46.91(20.3)
- Hydropower 19.66 (8.5)*
- Solar PV energy 49.34 (21.4)
- Wind energy 114.65 (49.7)
- Geothermal energy 0.24 (0.1)

Total: 230.80 (100)

Source: Renewable Energy Statistics 2023 © IRENA
**excluding pumped storage*

Binary type geothermal power plants over 1 MWe, MWe:

1. Dürrnhaar, 7.0
2. Kirchstockach, 7.0
3. Traunreut, 5.5
4. Sauerlach, 5.0
5. Insheim, 4.8
6. Oberhaching-Laufzorn/Grünwald, 4.3
7. *Holzkirchen, 3.4**

** under construction*

Key wind turbine manufacturers in Germany:

1. Enercon in Aurich and Emden (Lower Saxony), Magdeburg (Saxony-Anhalt)
2. Nordex SE in Rostock (Mecklenburg-Vorpommern)
3. Senvion in Bremerhaven (Bremen)
4. Vensys in Neunkirchen (Saarland) and Diepholz (Lower Saxony)
5. Vestas Deutschland in Lauchhammer (Bradenburg) and Travemünde (Lübeck)
6. GE Renewable Energy in Salzbergen (Lower Saxony)
7. eno energy Group in Rostock (Mecklenburg-Vorpommern)
8. Siemens Wind Power (production factories are outside Germany)

Sources: German Wind Energy Association; Enercon; Nordex SE; Senvion; Vensys; Vestas; GE Renewable Energy; eno energy Group; Wikipedia.

List of some largest electrolysis plants, power-to-gas, energy storage and gas into the natural gas grid projects, MW:

1. *ITM Power/Shell Rhineland refinery, 10.0**
2. Audi Gas Plant, Werlte, 6.0
3. Hamburg-Neuhof PEM, 5.0
4. Energiepark Mainz, 3.8
5. E.ON Falkenhagen Pilot Plant, 2.0
6. Windgas Reitbrook, Hamburg, 1.5
7. Windgas Haßfurt GmbH, 1.3
8. Hydrogenics Grapzow, 1.0
9. Prenzlau Hybrid Power Plant, 0.5

** announced*

Binary (Kalina Cycle) type geothermal power plants over 1 MWe, MWe:

1. Taufkirchen / Oberhaching, 4.0
2. Unterhaching, 3.4

Solar PV power plants over 60 MWe, MWe:

1. Meuro (Senftenberg), 166.0
2. Neuhardenberg, 145.0
3. Templin (Groß Dölln), 128.0
4. Jocksdorf, 103.9
5. Brandenburg-Briest, 91.0
6. Finow Tower, 84.7
7. Eggebek, 83.6
8. Finsterwalde, 80.7
9. Lieberose, 70.8
10. Alt Daber, 67.8

List of some underground hydrogen storage facilities:

1. *HYPOS Bad Lauchstädt**
2. *Hähnlein***
3. *Uelsen***
4. *Rheden***
5. *Bernsdorf***

** under construction // ** perspective*

Key Compressed Hydrogen Plants over 1000 Nm³/hr:

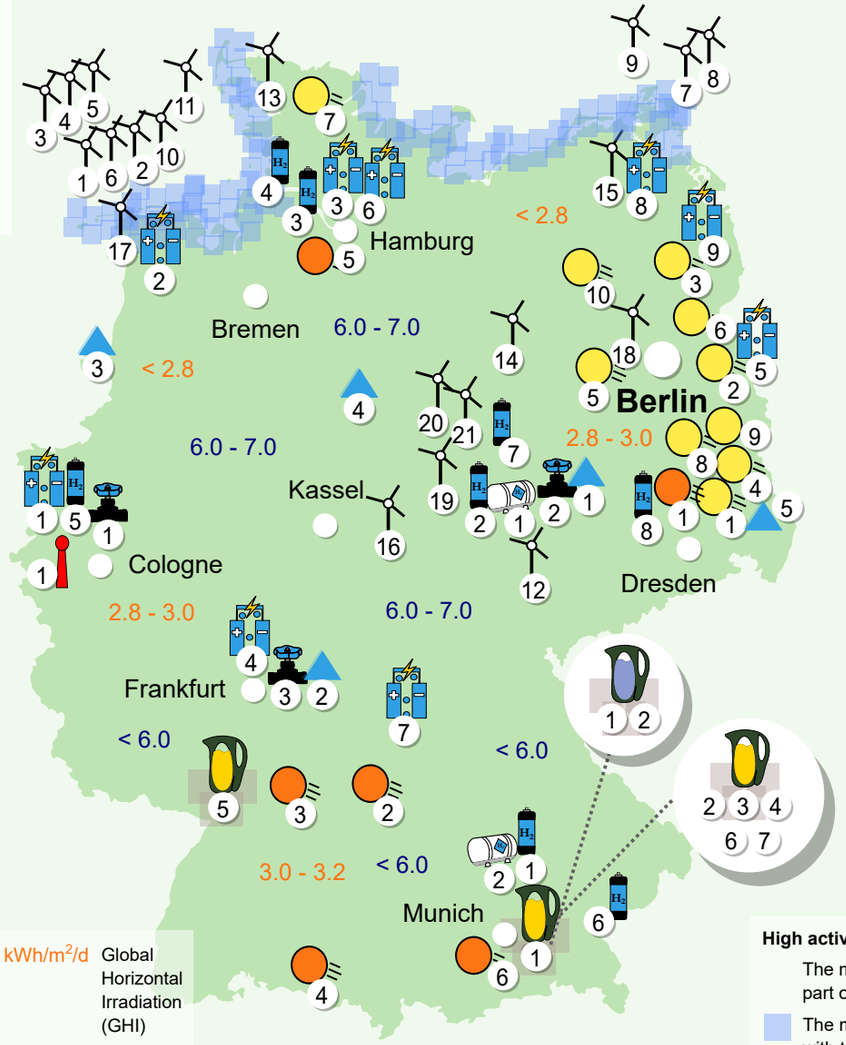
1. Ingolstadt, Linde
2. Luena, Linde
3. Stade, Air Liquide
4. Brunsbuttel, Linde
5. Dormagen, Linde
6. Burghausen, Linde
7. Bernburg, Air Liquide
8. Nunchritz, Air Liquide

Major Cryogenic Liquid Hydrogen Plants:

1. Leuna, Linde
2. Ingolstadt, Linde

Hydrogen pipelines, km:

1. Rhine/Ruhr, Air Liquide, 240
2. Leuna-Bitterfeld, Linde, 135
3. Frankfurt-Hoechst, Linde, 2



Hydrogen fueling stations:

According to available data for March 2019, Germany had 57 operating hydrogen fueling stations.

Source: Hydrogen Tools

CSP Tower type with thermal storage plants over 1 MW, MW:

1. Jülich, 1.5

Solar district heating plants over 2 MWth:

1. Senftenberg, 5.8
2. Crailsheim, 5.1
3. Neckarsulm, 3.9
4. Friedrichshafen, 2.8
5. Hamburg Bramfeld, 2.1
6. München, 2.0

Major offshore wind parks over 300 MW, MW:

1. *Borkum Riffgrund 1-2, 762.0**
2. Gode Wind 1-2, 582.0
3. Veja Mate, 402.0
4. BARD Offshore 1, 400.0
5. Global Tech I, 400.0
6. *Merkur, 396.0**
7. *Arkona, 385.0**
8. Wikinger, 350.0
9. EnBW Baltic 1-2, 336.3
10. Nordsee One, 332.1
11. Amrubank West, 302.0

** under construction*

Major onshore wind parks over 110 MW, MW:

12. Stößen-Teuchern, 177.1
13. Reußenköge, 160.9
14. Hüselitz, 152.0
15. RH2-WKA (Werder-Kessin-Altentreptow), 143.9
16. Wangenheim-Hochheim-Ballstädt-Westhausen, 125.8
17. Krummhörn, 123.4
18. Havelland, 122.8
19. Esperstedt-Obhausen, 122.1
20. Druxberge, 116.4
21. Sülzetal, 111.4

High activity areas:

The most common solar GHI intensity is is 3.0 - 3.2 kWh/m² per day, distributed in the southern part of country, Bavaria, Baden-Württemberg and Hesse states.

The most common wind speed is over 7.0 m/s per year at 50 m are distributed along coastline with the North Sea, in the northwestern part of country and the Baltic Sea, in the northeast.

Source: Energydata.info

www.aenert.com