

Primary Energy

1 Wind turbine



WT GE 5.5/158/5500 (Falkenwalde wind field)

2 Photovoltaic system



Kreuz Uckermark photovoltaic system

Collection Grid and Infrastructure

3 Feed-in and collector substation



Bertikow feed-in substation

Conversion and Storage

4 Wind heat storage



Nechlin wind-based thermal energy storage facility

5 Battery storage system



Cremzow battery storage system

6 Electrolyser



Wittenhof alkaline electrolyser (AEL)

Control

7 Control room



Dauerthal control room

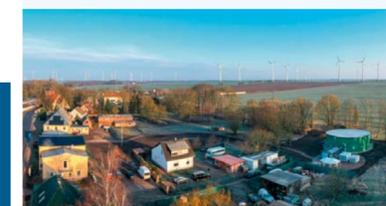
Usage



Hydrogen is fed into the gas grid plus, in future, into H₂ pipelines and used to produce H₂ derivatives



Electricity generated for homes and industry



Local heat extraction from surplus electricity

Technical info
5.5 MW rated power
20 GWh annual production
2021 commissioning
>25 years service life

How it works
 Wind turbines use the power of the wind to move rotor blades, which run a generator and thus generate electricity.

Role in the ENERTRAG Verbundkraftwerk®
 • Large quantities of electricity are generated sustainably
 • 24/7 production is possible
 • Energy can be stored in combination with battery and H₂ production

Technical info
20 MW rated power
20 GWh annual production
2023 commissioning
24 ha space

How it works
 Incident solar radiation is used to generate electricity in solar cells.

Role in the ENERTRAG Verbundkraftwerk®
 • Generation of clean electricity during the day
 • Energy can be stored in combination with battery and H₂ production

Technical info
20-30 kV medium-voltage level
110-380 kV high- to extra-high-voltage level
2003 commissioning
605 MW connected power

How it works
 Collection grids collect electricity from wind turbines and photovoltaic systems on a large scale (i.e. within a 20-30 km radius). Collector substations then transfer it to the feed-in substation, which feeds reliable electricity into the public transmission system. The collector and feed-in substations also increase or decrease the electrical voltage with the aid of transformers.

Role in the ENERTRAG Verbundkraftwerk®
 • Collecting electricity (ENERTRAG collection grids)
 • Providing a link to the electricity grid (feed-in substation)
 • Transforming/regulating between different voltage levels (collector and feed-in substations)

Technical info
2 MW rated power
780 MWh annual production
2020 commissioning
35 homes

How it works
 When a very large amount of wind power is being generated, the wind-based thermal energy storage facility converts electricity into energy for heating. It does this by using a tankless water heater to heat water, which is then stored in order to supply consumers with heat as necessary.

Role in the ENERTRAG Verbundkraftwerk®
 • Surplus wind power is stored
 • Clean energy for heating is provided
 • Energy for heat and electricity is coupled (power-to-heat)

Technical info
22 MW rated power
34.8 MWh storage capacity
2019 commissioning
17 million euros investment

How it works
 A battery stores the power from the generating facilities by converting electrical into chemical energy and converting it back again when required.

Role in the ENERTRAG Verbundkraftwerk®
 • Batteries compensate for fluctuations in the electricity grid
 • Services such as black starts and balancing power are provided
 • Peak loads are covered

Technical info
0.56 MW rated power
94,000 kg H₂/a annual production
2011 commissioning
21 million euros investment

How it works
 Electrolysers use electric current to split water into hydrogen and oxygen. The hydrogen can be stored over the long term in large quantities and transported long distances in pipelines.

Role in the ENERTRAG Verbundkraftwerk®
 • Renewable energy can be stored in the coupled hydrogen storage system
 • Greater flexibility and grid stability because surplus electricity is obtained from wind turbines and photovoltaic systems

Technical info
1,100 plants monitored
1999 commissioning
24/7 operation
2.6 GW monitored power

How it works
 The control room constantly monitors and controls operation of the whole Verbundkraftwerk and its components, including energy generation, conversion, distribution and connection to the grid.

Role in the ENERTRAG Verbundkraftwerk®
 • Central monitoring and control unit
 • Monitoring and enhancing plant performance
 • Launching and monitoring technical services

Why ENERTRAG makes a difference
 The large number of wind turbines and photovoltaic systems in the ENERTRAG Verbundkraftwerk® means that the different and fluctuating generation patterns balance each other out, thus guaranteeing consistent electricity generation and improving the capacity utilization of grid connections.

Why ENERTRAG makes a difference
 To control power, the Bertikow feed-in substation uses its own power plant controller to control flexi-type power plants and those subsidised under the German Renewable Energy Sources Act (EEG) efficiently and to help keep the electricity grid stable.

Why ENERTRAG makes a difference
 The Nechlin wind-based thermal energy storage facility is partly operated with surplus electricity from wind turbines so that the turbines do not have to be curtailed.

Why ENERTRAG makes a difference
 ENERTRAG's Cremzow battery storage system will have black-start capabilities in the future and can help to restore the grid in the event of a power failure.

Why ENERTRAG makes a difference
 At ENERTRAG, we only generate green hydrogen because we operate the electrolyser with renewable energy.

Why ENERTRAG makes a difference
 ENERTRAG's very own "Powersystem" software is responsible for monitoring and analysing incoming information.



“We produce renewable energy sustainably to keep the world a place worth living in.”

ENERTRAG in figures

- 945 MW** of wind, solar and biogas from own portfolio
- 1,800 MW** of power for all turbines constructed
- > 6,900 MW** of power connected to the Powersystem software
- > 1.7 TWh** own annual electricity production
- > 450 million euros** revenue annually from electricity sales, project business and services
- > 1,200 employees**

The ENERTRAG Verbundkraftwerk® Uckermark

	Installed power 2023	Target 2030	Target 2040
Wind power	622 MW	1,100 MW	1,800 MW
Photovoltaics	20 MW	224 MW	624 MW
Electrolysis	0.56 MW	760 MW	1,400 MW
Battery	22 MW	322 MW	822 MW
Collector and feed-in grid (length of cable)	> 600 km	> 700 km	~ 800 km
H₂ reconversion to electricity	-	-	up to 1,000 MW

Replacing conventional power plants.
 ENERTRAG's Verbundkraftwerk Uckermark generates wind-based and solar energy, green hydrogen and heat. Future hydrogen reconversion and battery storage systems will also stabilize the electricity grid. This combination enables ENERTRAG to supply renewable energy predictably and in line with demand, just like conventional power plants do. The ENERTRAG Verbundkraftwerk® can replace these completely. It is a role model for modern CO₂-free power plants.

Energy locally and for Europe. And reliable.
 We feed electricity generated in the Verbundkraftwerk Uckermark directly into the synchronous grid of continental Europe. The hydrogen will be fed into the public hydrogen core network in the future and will supply the fertilizer and steel industries, refineries, other industrial users and hydrogen power plants with CO₂-free hydrogen that is generated in Germany from the wind and sun. Coupling electricity from wind and solar power with green hydrogen production and the supply of heat enables the provision of predictable output in the gigawatt range. Additionally, the ENERTRAG Verbundkraftwerk® provides all necessary system stability services to guarantee grid stability.

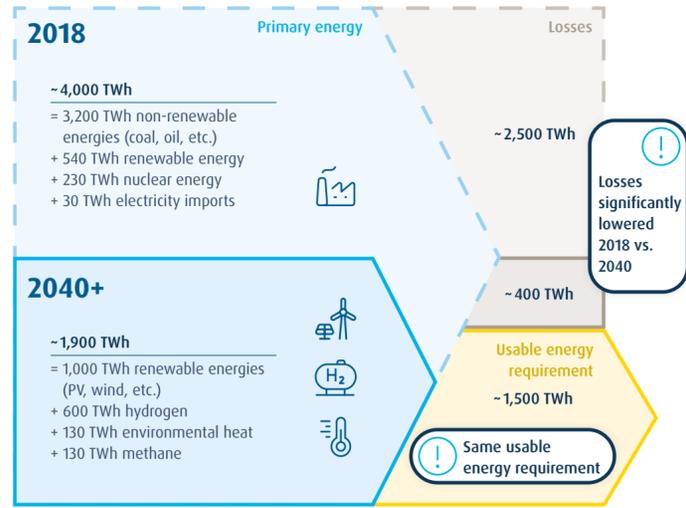
A pioneer supplying fossil-free energy. Worldwide.
 Since the first wind fields in 1998 and the construction of the world's first hybrid power plant in Uckermark in 2011, ENERTRAG has gained valuable experience in supplying energy reliably from renewables. Countries and regions all over the world will be reaping the benefits in future, because the ENERTRAG Verbundkraftwerk® can be implemented globally.

The ENERTRAG Verbundkraftwerk® Uckermark

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Energy Systems of the Future

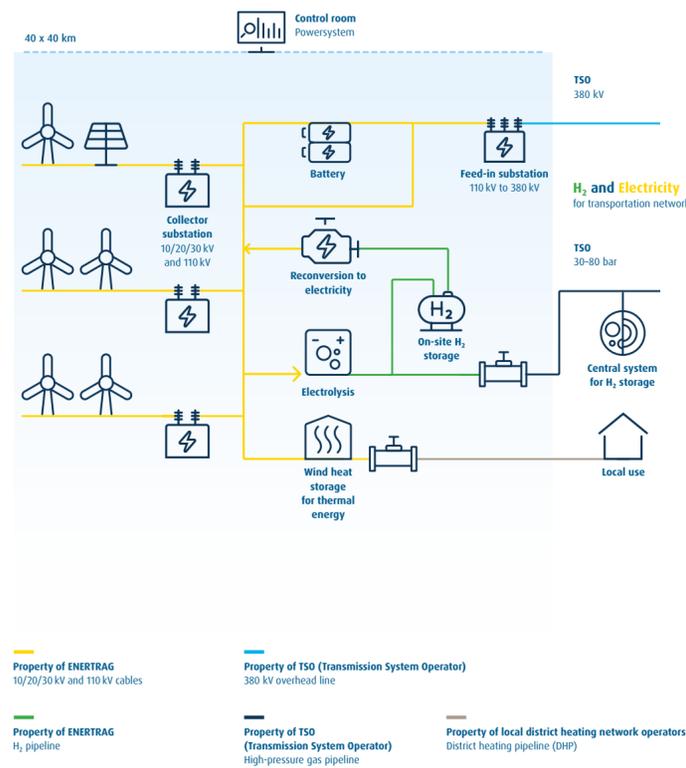
Energy flows in Germany



Conclusion:

In the future, we will not have to give up anything when it comes to electricity, heat and transport while also halving our primary energy requirements.

Focus on H₂ + Electricity – The ENERTRAG Verbundkraftwerk®



Components of the ENERTRAG Verbundkraftwerk® Uckermark

- Wind turbine
- Photovoltaic system
- Battery storage system
- Wind heat storage for thermal energy
- Electrolyser
- Feed-in substation
- Collector substation
- Control room
- VKWK Uckermark: 10/20/30 kV earth cables, 110 kV earth cables
- Vierraden Feed-in Substation: 10/20/30 kV earth cables, 110 kV earth cables
- Transmission System Operator: 380 kV overhead line, High-pressure gas grid

