PRIMARY ENERGY

1 WIND TURBINE

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

Technical info

5.5 MW	rated power
20 GWh	annual production
2021	commissioning
>25 years	service life
161 m	hub height
158 m	rotor diameter
10–15 m/s	nominal wind speed
25 m/s	maximum wind speed

How it works

Wind turbines use the power of the wind, in order to drive rotor blades which drive a generator. As a result, electricity is generated.

Role in the Verbundkraftwerk

- Large quantities of electricity are generated sustainably
- Production 24/7 is possible
- In combination with battery and H_2 production storable

WHY ENERTRAG IS DIFFERENT

Due to the large number of wind turbines and photovoltaic systems in the ENERTRAG Verbundkraftwerk, the different and fluctuating generation patterns balance each other out. This means that consistent electricity generation is guaranteed.

2 PHOTOVOLTAIC SYSTEM


Kreuz Uckermark photovoltaic system

Technical info

20 MW	rated power
20 GWh	annual production
2023	commissioning
24 ha	space
36,300	modules installed

How it works

Incident solar radiation is used to generate electricity in solar cells.

Role in the Verbundkraftwerk

- Consistent generation of clean electricity during the day
- In combination with battery and H_2 production storabl

STORAGE SYSTEM

3 BATTERY STORAGE SYSTEM


Cremzow battery storage system

Technical info

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

How it works

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

Role in the Verbundkraftwerk

- Batteries compensate for fluctuations in the electricity grid and provide extra power
- Services such as black starts and balancing energy are provided
- Peak loads are covered

WHY ENERTRAG IS DIFFERENT

ENERTRAG's Cremzow battery storage system has black-start capabilities and can restore the grid in the event of a power failure.

4 WIND HEAT STORAGE FOR THERMAL ENERGY


Nechlin wind-based thermal energy storage facility

Technical info

2,000 kW	rated power
780 MWh	annual production
2020	commissioning
35	homes

How it works

The wind heat storage for thermal energy converts electricity into energy for heating. To do so, it heats water with a heating rod. The hot water is stored and supplies consumers with heat as necessary.

Role in the Verbundkraftwerk

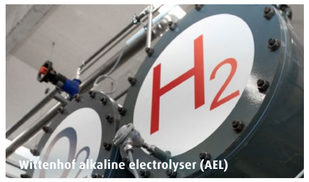
- Surplus wind power is stored
- Clean energy for heating is provided
- Energy for heat and electricity is coupled (power-to-heat)

WHY ENERTRAG IS DIFFERENT

The Nechlin wind heat storage for thermal energy is partly operated with surplus electricity from wind turbines so that the turbines don't have to be curtailed.

CONVERSION AND DISTRIBUTION

5 ELECTROLYSER



Wittenhof alkaline electrolyser (AEL)

Technical info

560 kW	rated power
94,000 kg H_2/a	annual production
2011	commissioning
21 million euros	investment

How it works

Electrolysers use electric current to split water into hydrogen and oxygen. The gas generated is easy to store and transport.

Role in the 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
- Stabilization of the power grid through hydrogen reconversion

WHY ENERTRAG IS DIFFERENT

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

6 TRANSFORMER STATION


Bertikow transformer station

Technical info

20–30 kV	medium-voltage level
110–380 kV	high-voltage level
2003	commissioning
605 MW	connected power

How it works

Transformer stations collect electricity from producers and transfer it to the national electricity grid. They also increase or decrease the voltage with the aid of transformers.

Role in the Verbundkraftwerk

- Collects electricity
- Acts as a link to the electricity grid
- Transforms/regulates between different voltage levels

WHY ENERTRAG IS DIFFERENT

To control power, the Bertikow transformer station uses its own power plant controller to control flexi-type power plants and those subsidised under the German EEG Renewable Energy Act efficiently and to help keep the electricity grid stable. The transformer station is coupled with a large battery storage system, an electrolyser and an H_2 reconversion plant to create a central power hub. From here, hydrogen is fed centrally into the EUGAL pipeline nearby.

CONTROL

7 CONTROL ROOM


Dauerthal control room

Technical info

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

How it works

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

Role in the Verbundkraftwerk

- It's a central control unit
- It monitors and enhances performance
- It launches and monitors technical services

WHY ENERTRAG IS DIFFERENT

ENERTRAG's own PowerSystem software is responsible for monitoring and analysing incoming information.

USAGE

Hydrogen is fed into the gas grid/ in future in H_2 pipelines and derivatives

Electricity used in homes and industry

Local heat extraction from surplus electricity

ENERTRAG
One energy ahead

Uckermark VERBUNDKRAFTWERK

"WE PRODUCE RENEWABLE ENERGY SUSTAINABLY **TO KEEP THE WORLD A PLACE WORTH LIVING IN."**

880 MW
of wind/solar from own portfolio

> 2 TWh
OWN ANNUAL ELECTRICITY PRODUCTION

> 1,000
employees

1,800 MW
of wind/solar installed

> 6.9 GW
OF POWER CONNECTED TO THE POWERSYSTEM SOFTWARE

> 450
million euros revenue annually from electricity sales and project business

UCKERMARK **VERBUNDKRAFTWERK**

		Installed power 2023		Goal 2028		Goal 2040
	Wind power	**622 MW**	>>>	+509 MW	>>>	+720 MW
	Photovoltaics	**24 MW**	>>>	+200 MW	>>>	+400 MW
	Electrolysis	**560 kW**	>>>	+200 MW	>>>	+700 MW
	Battery	**22 MW**	>>>	+300 MW	>>>	+500 MW
	Feed-in grid (in length of cable)	**>600 km**	>>>	+111 km	>>>	+70 km

Replacing conventional power plants completely.

ENERTRAG's Uckermark Verbundkraftwerk generates wind-based and solar electricity, green hydrogen, and heat. Hydrogen reconversion and battery storage systems also stabilise the electricity grid. This combination enables ENERTRAG to supply renewable energy predictably and in line with demand, just like conventional power plants do. The Verbundkraftwerk can replace these completely. It is a blueprint for modern CO_2 free power plants.

Energy locally and for Europe. And reliably.

We feed electricity generated in the Uckermark Verbundkraftwerk directly into the synchronous grid of Continental Europe. The hydrogen is fed into the public H_2 grid and, in turn, supplies areas and buildings in the region with heat. 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. The Verbundkraftwerk provides all the key energy system functions required to do so and guarantees grid stability.

A pioneer supplying fossil-free energy. Worldwide.

Since the first wind farm 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 from renewables reliable. Countries and regions worldwide are already reaping the benefits because the Verbundkraftwerk can be implemented globally.

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As of: 11/2024

VERBUNDKRAFTWERK –

ENERGY SYSTEM OF THE FUTURE

PRIMARY ENERGY

100% FROM RENEWABLES
GLOBALLY: 120 000 TWh/a

HIGH-VALUE ELECTRICITY

approx. 75 000 TWh/a

Battery storage system

- Electronics
- Engines
- Lighting
- Indoor heating/cooling
- Process heat
- Cars, buses
- Ships, trains

LOW-VALUE ELECTRICITY

approx. 45 000 TWh/a

Four functions of electrolysis to hydrogen

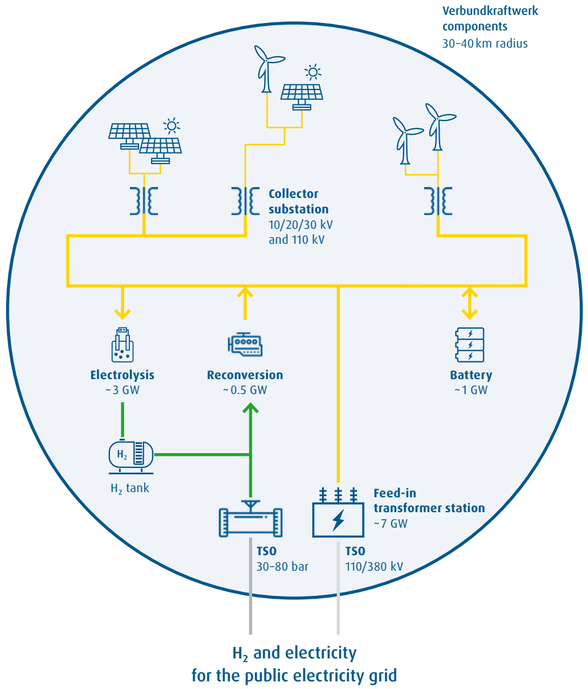
1. Evens out feed-in
2. Storage system
3. Sector coupling
4. Transport

Hydrogen (H_2)

500–600 Mt/a
(today: <100 Mt/a)

- **Long-haul transportation** + N_2 = ammonia
- **Fertilizers, explosives** + CO_2 = methanol
- **Long-haul flights** + CO_2 = kerosene
- **Steel production** + Ores = raw metal
- **Lorries, short-haul flights**
- **Chemicals, cement, industry**
- **Reconversion**

FOCUS ON H_2 + ELECTRICITY –
VERBUNDKRAFTWERK



ENERTRAG owned
10/20/30 and 110 kV cable

ENERTRAG owned
H_2 pipeline

TSO owned
380 kV overhead line
200–300 gas pipeline

COMPONENTS OF THE ENERTRAG UCKERMARK VERBUNDKRAFTWERK

- Wind turbine
- Photovoltaic system
- Battery storage system
- wind heat storage for thermal energy
- Hydrogen plant
- Central transformer station
- Collector substations
- Control room

VKW Uckermark
10/20/30 kV earth cables
110 kV earth cables

Transformer sta. Vierraden
10/20/30 kV earth cables
110 kV earth cables

Schönfeld
Göritz
Brüssow
Cremzow
Trampe
Dauerthal
Carmzow-Wallmow
Wallmow
Brandenburg Mecklenburg-Western Pomerania
Prenzlau
Drense
Grünow
Randowtal
Nadrensee
Uckerfelde
Penkun
Tantow
Bertikow
Luckow
Petershagen
Gramzow
Hohenselchow-Gross Pinnow
Gartz (Oder)
Casekow
Zichow
Woltersdorf
POLAND
Briest
Passow
Vierraden
PCK refinery Schwedt

20
109
11
113
2
198
166

DAUERTHAL
ENERTRAG SE

Transmission grid
50 Hertz cable

EUGAL/OPAL pipeline
(existing gas and future hydrogen pipelines)