



# ENERGIES. AT ITS BEST

Energies in North Rhine-Westphalia  
Facts. Figures.

## Energies in North Rhine-Westphalia

### Facts & figures

North Rhine-Westphalia (NRW) is Germany's leading energy location and the most important energy region in Europe. Around 30 percent of German electricity is generated and consumed here – more than in any other federal state. Production of German hard coal ended in 2018. Around 53 percent of German lignite is mined in NRW. In 2019, coal accounted for approx. 29 percent (2018: 36 percent) of Germany's electricity generation.

From a long tradition of utilizing natural resources, a broad expertise in energy technology has grown in NRW. The state is home to a dense network of research institutes as well as to numerous companies offering innovative energy products and services for increasing energy efficiency and utilizing renewable energies. For many future-oriented companies, NRW is therefore the ideal location – from the extraction of raw materials for energy to the end energy consumer.

In the field of renewable energies, around 46,000 employees work in more than 4,700 companies (2018).

To promote renewable energies and to achieve Germany's climate protection goals, NRW has introduced its own Climate Protection Law. The planned 25 percent reduction of greenhouse gas emissions by 2020 compared to 1990 was already exceeded in 2018 at 28 percent. The aim is to even achieve a reduction of at least 55 percent by 2030.

### Renewable energies – a brief overview

- **Biomass:** In North Rhine-Westphalia, 113 TWh (terawatt hours) of biomass is used to generate over 80 percent of regenerative heat and 51 TWh to generate just under 20 percent of regenerative electricity (2017). At the end of 2018, 1,732 biogas plants with 860 MW (megawatts) were in operation.
- **Geothermal energy:** As the chosen location of numerous market-leading companies, NRW occupies a key position in geothermal energy. Within the Ruhr Metropolis alone, there are approx. 230 companies with 4,000 to 5,000 jobs operating in this market. More than half of the heat demand can be met by using near-surface geothermal energy. A total of around 966,000 heat pumps have been installed in Germany, including more than 193,000 in North Rhine-Westphalia alone. Of the 86,000 new installations nationwide in 2019, North Rhine Westphalia alone accounted for 17,000.

- **Mine gas:** The use of mine gas as a source of energy is gaining more importance in NRW. In 2019 there were 87 mining permits to utilize mine gas. 106 block-type thermal power plants were operating in the state with electrical output totaling 167 MW at the end of 2019. The 498 million KWh of electricity produced in 2019 alone can supply approx. 110,600 households with power. The total mine gas potential used resulted in a CO<sub>2</sub> reduction of approx. 2.4 million tons in 2019.
- **Wood pellets:** Supported by state and federal subsidies, the number of wood pellet heaters installed in North Rhine-Westphalia has increased significantly in recent years: While only 660 subsidized systems were installed in 2003, over 36,000 households are now supplied with this climate-friendly heat; nationwide the figure is around 290,000.
- **Photovoltaics:** For North Rhine-Westphalia, too, solar energy is one of the most important pillars for energy system transformation. By the end of 2019, around 280,000 photovoltaic systems with an output of approx. 5,300 MWp had been installed, an increase of approx. 400 MWp compared to 2018. This puts the state in third place behind Bavaria and Baden-Württemberg nationwide.
- **Hydro energy:** The use of hydropower to generate energy is capable of helping to reduce climate problems worldwide. Hydropower is well developed in North Rhine-Westphalia. 2019 there are currently 438 plants in the state with an output of 187 MW connected to the grid.
- **Wind energy:** At the end of 2019, 3,767 wind turbines exactly with an installed capacity of 5,920 MW were in operation in North Rhine-Westphalia. This puts the state in fourth place nationwide in terms of installed capacity, behind Lower Saxony, Schleswig-Holstein and Brandenburg. On the other hand, in terms of new capacity, NRW ranks third in Germany, even though new capacity fell sharply here – as in Germany as a whole. The wind industry in North Rhine-Westphalia now secures more than 20,500 jobs, above all in the supply industry, in which the state is regarded as the leader throughout Germany.

#### Alternative technologies – a brief overview

- **Fuel cells:** Hydrogen and fuel cell technology as well as electric battery mobility are regarded as core components of a regenerative energy landscape. North Rhine-Westphalia has so far funded over 140 fuel cell and hydrogen projects to the tune of almost 170 million euros. A growing network of H<sub>2</sub> filling stations is being created for fuel cell vehicles, including buses in public transport. The state activities are coordinated by the Fuel Cell, Hydrogen and Electromobility Network.
- **Electric mobility:** Numerous universities, research institutions and research-based companies are working on electromobile infrastructure, network expan-

sion, battery technology issues and new vehicle concepts. North Rhine-Westphalia wants to be a pioneer in electric mobility. The number of newly registered battery electric vehicles doubled from around 6,000 (2018) to 12,400 (2019), putting North Rhine-Westphalia in second place in a state comparison, as well as in terms of the total number of vehicles, in each case behind Bavaria. All of the state's electromobility activities are bundled under the umbrella brand Elektromobilität.NRW.

- **Fuels and drive systems:** North Rhine-Westphalia is not only an important energy state, but also an important fuel state. Domestic refineries produce about 25 percent of the crude oil consumed in Germany. The amount consumed by road traffic in the state is about 9 million tons of mineral oil per year. This corresponds to 20 percent of German sales. In order to reduce CO<sub>2</sub> emissions and protect the climate, the use of alternative fuels and drives with regenerative energy is an obvious option. The biodiesel producers in North Rhine-Westphalia are among the largest in Germany.
- **Power plant technologies:** With a power plant capacity of around 29,770 MW, North Rhine-Westphalia is the most important power plant location in Germany, if not in Europe. However, with the increase in renewable energies, the required power plant capacity is steadily decreasing. And as part of the Coal Phase-Out Act, which aims to end coal-fired power generation by the end of 2038, power plant capacities in the Rhine mining region are also being shut down.
- **Combined heat and power generation:** CHP is characterized by a particularly high degree of fuel efficiency. This significantly reduces CO<sub>2</sub> emissions compared to the separate generation of electricity and heat. The NRW state government underlines the importance of CHP as an essential element of the energy system transformation process and intends to reduce existing investment barriers in the expansion of CHP and further expand and consolidate the economically viable district heating infrastructure. With *progres.nrw*, the state government has provided a subsidization program for the expansion of CHP. Among other things, the program supports the construction, expansion and conversion of heating networks and investment in district heating connections. In addition, NRW.BANK provides various low-interest loans with long maturities.

#### Pilot projects

- The **100 Climate Protection Housing Estates in NRW** project coordinated by the EnergyAgency.NRW combines energy efficiency and the use of renewable energies in an exemplary manner and develops innovative solutions for both new buildings and the refurbishment of existing buildings. The 46 completed housing estates are home to approx. 9,000 citizens. A further housing estates are under construction and in the planning stage.
- The model of energy-efficient urban redevelopment, **InnovationCity Ruhr – model city Bottrop**, has been tested since 2010. Within ten years, CO<sub>2</sub> emissions in a part of the Ruhr region city are to be reduced by 50 percent through the energetic upgrading of existing buildings, the increase in energy efficiency in

the public sector and in industry, and the promotion of electromobility and renewable energy sources.

## Companies (examples)

- **E.ON SE, Essen**

Established: 2016; sales: €42.0 billion; employees: 79,000 (worldwide)

With the takeover of innogy SE by RWE at the end of 2019 as the fourth business area, the "new E.ON" presents itself as an international energy company that consciously focuses on smart grids, customer solutions and renewable energies and thus on the building blocks of the new energy world. The new E.ON intends to manage its grid and customer solutions business in numerous European countries and Turkey from its base in Essen. The generation of electricity from renewables is returning to the RWE Group.



- **Vaillant Deutschland GmbH & Co. KG, Remscheid**

Established: 1874; sales: €2.64 billion; employees: 3,300 (worldwide 13,000)

Vaillant is one of the market and technology leaders in the field of heating technology. The company provides energy-saving and environmentally-friendly systems for heating, cooling and hot water – primarily on the basis of renewable energies. The Vaillant Group is represented in six European countries and in China with ten production and development sites.



- **Winergy AG, Voerde**

Established: 1981; sales: n/a; employees: n/a

Winergy, part of the Flender Group since 2010, is the world's leading component manufacturers for wind energy turbines with more than 125,000 MW of gearbox output. With 40 years of experience, Winergy provides wind turbine manufacturers and wind farm operators with gear units, hybrid drives and services. The production and service locations are to be found in Europe, China, India and the USA and are being continuously expanded worldwide with service partners.



## University & research landscape

With around 120 institutes at more than 30 universities, some 20 non-university research institutions and the research departments of numerous companies, which are all involved in energy technology in research and teaching, North Rhine-Westphalia has a decisive location advantage.

### Universities (selection)

- **Aachen University of Applied Sciences**

Established: 1971; students: 14,400; courses: 94

In close cooperation with the Forschungszentrum Jülich, the institutes of the

Aachen University of Applied Sciences, the NOWUM Energy and Solar Institute Jülich (SIJ), as well as strong partners from business and industry, the Energy Technology department offers extra-occupational and internationally oriented variants in addition to the traditional Bachelor's degree course.

- **Bielefeld University of Applied Sciences**

Established: 1971; students: 10,200; courses: 57

The main emphasis of the Bachelor's degree course in Regenerative Energies is on the generation, distribution and effective utilization of electrical energy on the basis of regenerative energies, as well as on the generation, distribution and effective utilization of bioenergy from renewable raw materials and biological waste material.

- **Ruhr University Bochum**

Established: 1962; students: 42,700; courses: 173

Incorporated in the Institute of Energy Technology, the Chair for Power Systems and Energy Economics is part of the Faculty of Engineering. Its work focuses on resource-conserving energy economics and reactor simulation and safety. The Chair of Energy Systems and Energy Process Technology also offers subject-specific lectures.

- **University of Cologne**

Established: 1388; students: 51,500; courses: 320

The Institute for Economic Policy at the University of Cologne (iwp) conducts research in the fields of energy and environmental policy. The focus of the Institute for Energy Economics at the University of Cologne (ewi) is on the liberalization of international electricity and gas markets.

- **Technical University Dortmund**

Established: 1968; students: 33,700; courses: 232

The Institute of Energy Systems, Energy Efficiency and Economics is one of the leading German university institutes focusing on electrical grids. The research topics include flexible electrical transport and distribution networks, system integration of renewable energy sources and efficient energy application.

- **University Duisburg-Essen**

Established: 2003; students: 42,300; courses: 279

The goal of the Faculty of Engineering is to contribute to solutions in research and teaching by means of new scientific approaches and technologies utilizing existing energy conversion and resource use technologies as well as the analysis of current and foreseeable problems.

- **University of Münster**

Established: 1780; students: 44,700; courses: 268

The Chair of Microeconomics, in particular energy and resource economics (CERES), is concerned with the economic analysis of energy, climate and resource policies regulation.

- **University of Wuppertal**

Established: 1972; students: 22,400; courses: 244

The Chair for Electrical Power Supply Engineering, one of the leading chairs in the energy sector, has five research groups, including groups for intelligent grids and systems, as well as for grid structures and planning.

#### Courses (selection)

University	Courses
Aachen University of Applied Sciences	<ul style="list-style-type: none"> <li>• Electrical Engineering, B.Eng. Electrical Engineering B.Eng.</li> <li>• Engineering Physics, B.Eng.</li> <li>• Energy System, M.Sc.</li> <li>• Energy Management and Informatics, M.Sc.</li> </ul>
Bielefeld University of Applied Sciences	<ul style="list-style-type: none"> <li>• Regenerative Energies, B.Sc.</li> </ul>
Ruhr University Bochum	<ul style="list-style-type: none"> <li>• Mechanical Engineering, B.Sc., M.Sc.</li> <li>• Environmental Technology and Resource Management, B.Sc.</li> </ul>
University of Cologne	<ul style="list-style-type: none"> <li>• Economics, B.Sc.</li> <li>• Business Information Systems, B.Sc., M.Sc.</li> </ul>
Technical University Dortmund	<ul style="list-style-type: none"> <li>• Electrical Engineering and Information Technology, B.Sc., M.Sc.</li> <li>• Information and Communications Technology, B.Sc.</li> </ul>
University of Duisburg-Essen	<ul style="list-style-type: none"> <li>• Energy Technology, B.Sc.</li> <li>• Energy Science, B.Sc., M.Sc.</li> </ul>
University of Münster	<ul style="list-style-type: none"> <li>• Economics, B.Sc., M.Sc.</li> </ul>
University of Wuppertal	<ul style="list-style-type: none"> <li>• Industry Engineering Energy Management, M.Sc.</li> <li>• Electrical Technology and Information Technology, B.Sc., M.Sc.</li> </ul>

### Research institutes (selection)

- **Center for Wind Power Drives (CWD), Aachen**

Established: 2013; employees: 55; [www.cwd.rwth-aachen.de](http://www.cwd.rwth-aachen.de)

The CWD controls and organizes the interdisciplinary research activities of RWTH Aachen University in the field of wind turbine power drive systems. In addition to basic scientific research, these research activities also include pre-competitive research and development projects.



- **E.ON Energy Research Center, Aachen**

Established: 2006; employees: 30; [www.eonerc.rwth-aachen.de](http://www.eonerc.rwth-aachen.de)

The research center was founded as part of a public-private partnership between E.ON and RWTH Aachen University. In line with its mission statement, the E.ON ERC focuses its research on energy conservation, energy efficiency and sustainable energy supply.



- **Hydrogen and Fuel Cell Center ZBT GmbH, Duisburg**

Established: 2001; employees: 100; [www.zbt-duisburg.de](http://www.zbt-duisburg.de)

ZBT supports industrial enterprises with the aim of achieving the market penetration of fuel cells and innovative energy technologies. The focus here is on production technology and certification.



- **Institute for Energy Economics at the University of Cologne (ewi)**

Established: 1943; employees: 3; [www.ewi.uni-koeln.de](http://www.ewi.uni-koeln.de)

The institute is dedicated to energy economics research and teaching as well as the creation of scientifically based studies for energy economics and energy policy practice. It sees itself as a knowledge factory with the aim of creating, disseminating and utilizing new knowledge about increasingly complex energy markets.



- **Institute of Solar Research, Cologne**

Established: 2011; employees: 150; [www.dlr.de/sf](http://www.dlr.de/sf)

As the leading and trend-setting German research facility on concentrating solar systems, the institute assumes an architect's role in the development and qualification of related technologies in Europe and on a global scale. The institute's clients include public clients, national and international scientific institutions as well as German and international industry partners. The Institute for Solar Research sees itself as a bridge-builder from basic research to large-scale technical implementation and application in industry.



- **Max Planck Institute for Chemical Energy Conversion, Mülheim a. d. Ruhr**

Established: 2012; employees: 270; [www.cec.mpg.de](http://www.cec.mpg.de)

The institute's mission is to explore the basic chemical processes involved in energy conversion, thereby contributing to the development of new and efficient catalysts in order to make renewable energies usable independent of time and place.



- **Max Planck Institute for Coal Research, Mülheim a. d. Ruhr**  
Established: 1912; employees: 350; [www.kofo.mpg.de](http://www.kofo.mpg.de)  
 Activities focus on the exploration of energy-saving and resource-conserving chemical conversions, with catalysis in all its aspects at the center of the work.
- **Münster Electrochemical Energy Technology (MEET)**  
Established: 2011; employees: 140; [www.uni-muenster.de/meet](http://www.uni-muenster.de/meet)  
 MEET works on the research and development of innovative electrochemical energy storage systems with higher energy density, longer durability and maximum safety. There is currently a focus on research into lithium-ion batteries.
- **Wuppertal Institute for Climate, Environment and Energy**  
Established: 1990; employees: 225; [www.wupperinst.org](http://www.wupperinst.org)  
 The institute researches and develops models, strategies and instruments for transitions to sustainable development at regional, national and international level. The focus is on resource, climate and energy challenges in their interactions with the economy and society.



## Clusters & networks (selection)

- **Cluster EnergyResearch.NRW, [www.cef.nrw.de](http://www.cef.nrw.de)**  
 The cluster works on behalf of the Ministry of Economic Affairs, Innovation, Digitization and Energy of the State of North Rhine-Westphalia and sees itself as the point of contact for all questions regarding energy research in NRW. The cluster promotes the coordinated cooperation of research and science institutions with industry and contributes to ensuring that technological and socio-economic advances in knowledge find their way to application faster than before.
- **Cluster EnergyRegion.NRW, [www.energieregion.nrw.de](http://www.energieregion.nrw.de)**  
 The main task of cluster is the networking of the actors in the energy industry sector over the entire value added chain. The work of the cluster concentrates on eight networks: biomass, fuel cells and hydrogen, energy-efficient and solar construction, geothermal energy, fuels and drive systems of the future, power plant technology, photovoltaics and wind power.
- **EnergyAgency.NRW, [www.energieagentur.nrw](http://www.energieagentur.nrw)**  
 The EnergyAgency.NRW works on behalf of the state government of North Rhine-Westphalia as an operative platform with broad expertise in the field of energy: From energy research, technical development, demonstration, market launch and initial consultation to continuous vocational training. It manages the clusters EnergyResearch.NRW and EnergyRegion.NRW.
- **North Rhine-Westphalia State Renewable Energy Association (LEE NRW), [www.lee-nrw.de](http://www.lee-nrw.de)**  
 The LEE NRW is a network of associations, companies and individuals for the promotion of the expansion of renewable energies in NRW. At the North



Rhine-Westphalian state level it represents the renewable energy industry to politicians, the media and the public and is committed to producing an environmentally compatible, safe, cost-effective and decentralized energy supply in the long term that is based 100 percent on renewable energies.

- **ef.Ruhr Forschungs-GmbH**, [www.ef-ruhr.de](http://www.ef-ruhr.de)  
As a consultancy and research company founded by the university alliance Ruhr Metropolis, which comprises the three universities of Dortmund, Bochum and Duisburg-Essen, it conducts scientific transfer projects, studies and appraisals for private and public clients in the field of energy research and in cooperation with approx. 40 chairs and institutes of the three universities.
- **JARA-ENERGY**, [www.jara.org](http://www.jara.org)  
JARA-ENERGY is home to almost 60 institutes with approx. 4,800 employees and 190 professors from RWTH Aachen University and Forschungszentrum Jülich. The aim is to research efficient, resource-saving, environmentally compatible and safe energy generation, use and optimization. The budget is around 500 million euros.
- **Rhein Ruhr Power – Power Plant of the Future**, [www.rhein-ruhr-power.net](http://www.rhein-ruhr-power.net)  
The Rhein Ruhr Power e.V. is an association of leading companies and research institutions in the field of energy and power plant technology. Rhein Ruhr Power supports them in their realignment for the energy supply of the future, brings together the expertise of its member companies and thus creates synergies and added value for all.



## Trade fairs & events (selection)

- **E-world energy & water, Essen**; [www.e-world-essen.com](http://www.e-world-essen.com); next dates: February 09-11, 2021  
Every year, Europe's leading trade fair for the energy industry proves to be the central meeting place for decision-makers looking for solutions for the energy sector. From energy generation, trading, transport and storage to efficiency and smart energy, the range on offer in 2020 was used by more than 25,000 trade visitors and more than 800 exhibitors from 25 nations.
- **Energy Storage Europe, Düsseldorf**; [www.energy-storage-online.de](http://www.energy-storage-online.de); next dates: March 16-18, 2021  
Energy Storage Europe is the trade fair with the world's largest conference program on energy storage. It features, among other things, the *Energy Storage Conference* and the *International Renewable Energy Storage Conference*. Around 4,000 visitors from 60 countries visited the fair in 2019. There were 160 exhibitors.



- **Battery Conference NRW;** [www.battery-power.eu](http://www.battery-power.eu); next dates: March 27-29, 2021 in Münster

The Battery Conference is a showcase for the companies and institutions from NRW active in the market for battery technology and applications. On the first day the Battery Day takes place and on the two following days an international symposium on the topic of Advanced Battery Power. More than 200 experts from the energy sector participate regularly in this conference.



- **12th Industry Day Wind Energy NRW;** [www.nrw-windenergie.de](http://www.nrw-windenergie.de); next dates: August 27-28, 2020 in Cologne

For around 500 trade visitors, the event is the industry meeting place for the wind sector in the industry's most important supplier state. 100 speakers will provide information on topics along the value chain, from research to maintenance, from tendering procedures to financing, from legal bases to municipal topics. In addition, around 50 exhibitors will be presenting themselves at the Industry Day.



## Imprint



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