



Energies in North Rhine-Westphalia
Facts. Figures.

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Facts & figures

North Rhine-Westphalia (NRW) is Germany's leading energy location and the most important energy region in Europe. Around 30 percent of Germany's electricity is produced and 32 percent consumed here – more than in any other federal state. 100 percent of German coal and 52 percent of German lignite is produced here, with coal accounting for 40 (2016) and 42 (2015) percent of electricity generated in Germany.

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.

Around 26,000 employees work on the development and utilization of renewable energy technologies in 3,600 companies, generating total sales of more than 6.6 billion euros. With more work places in the maintenance area and in the operation of renewable energies, the total number rises to more than 50,000 (2013).

To promote renewable energies and to achieve Germany's climate protection goals, NRW has introduced its own Climate Protection Law. This provides for a reduction of greenhouse gas emissions by the year 2020 of at least 25 percent and by the year 2050 of at least 80 percent compared to 1990.

Renewable energies – a brief overview

- **Biomass:** In NRW, more than 80 percent of regenerative heat was generated from biomass producing 10.3 billion kWh (kilowatt hours), and nearly 40 percent of regenerative electricity at 5.9 billion kWh (2013). In the field of agricultural biogas plants alone, approx. 620 plants were operating with capacity of 295 MW (megawatts) at the end of 2016.
- **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. In 2016, approx. 67,000 new heat pumps were installed in Germany, including 13,000 in NRW.

- **Hydro energy:** Against the background of the European Water Framework Directive, NRW is committed to the freshwater-ecologically sustainable expansion of hydroelectric power by reactivating and optimizing plants as well as by using hydroelectric technology in existing storage and infrastructure facilities. The state government has so far subsidized 180 plants with total output of more than 16 MW. Subsidies totaling 8 million euros triggered further investments of more than 35 million euros.
- **Mine gas:** The use of mine gas as a source of energy is gaining more and more importance in NRW. In 2016 there were 86 mining permits to utilize mine gas. 107 block-type thermal power plants were operating in the state with electrical output totaling 167 MW at the end of 2016. The 756 million KWh of electricity produced in 2016 alone can supply approx. 168,000 households with power. The total mine gas potential used resulted in a CO₂ reduction of approx. 3.6 million tons in 2016.
- **Photovoltaics:** Solar energy is also one of the main pillars of the energy transition for NRW. Up the end of 2016 about 238,000 photovoltaic systems were installed with a capacity of approx. 4,300 kWp. This puts the state in 3rd place in Germany behind Bavaria and Baden-Wuerttemberg.
- **Wind energy:** In NRW there were nearly 3,400 wind turbine generators turning with an installed capacity of approx. 4,600 MW at end of 2016. This means that the state remains in 5th place in terms of installed performance on a nationwide scale. Approx. 16,500 people in the Rhine and Ruhr region earn their living with the construction and operation of wind power technology, especially in the supplier areas gears/gearboxes, electrical components, steel towers and anti-friction bearings, and they generate sales of around 2.2 billion euros.
- **Wood pellets:** Supported by state and federal grants, the number of wood pellet heating systems installed in NRW has risen considerably in recent years. In 2003 just 644 of these systems were installed; now over 30,000 households are supplied with this climate-friendly heat.

Alternative technologies – a brief overview

- **Combined heat and power generation:** There is major and not yet fully exploited potential in combined heat and power (CHP) generation. Industrial CHP in particular has attained relatively high fuel utilization ratings and use hours. The state government of North Rhine-Westphalia therefore intends to increase the proportion of power generation accounted by CHP as a central bridging technology to over 25 percent by 2020. To this end, a comprehensive CHP incentive program has been launched which will run for several years.
- **Electric mobility:** Numerous universities, research facilities and research-based companies are working on the electromobile infrastructure, grid expansion, questions relating to battery technology and new vehicle concepts. NRW has the political goal of being a pioneer when it comes to electromobility. A quarter of the electrified vehicles registered throughout Germany are to drive

here, and a large proportion of the relevant systems and components are to be produced at the economic location of NRW. As the most populous federal state, NRW focuses on sustainable development and pursues a technology-oriented approach.

- **Fuel cells:** Through the "Network Fuel Cell and Hydrogen NRW", founded in 2000, the state government promoted around 125 fuel cell and hydrogen projects up to the end of 2016. The aim of this undertaking is to establish hydrogen and fuel cell technology as an integral part of the future energy supply, while at the same time exploiting the economic opportunities the technology offers the business location of NRW.
- **Fuels and drive systems:** NRW is not only an important significant energy region, but also a major region for fuel. Domestic refineries produce about 25 percent of the crude oil consumed in Germany. The amount consumed by road traffic in the state is approx. 9 million tonnes of oil annually. This is the equivalent of 20 percent of national sales in Germany. One possibility for lowering CO₂ emissions and protecting the climate is the use of alternative fuels and drive systems with renewable energy. The North Rhine-Westphalian biodiesel producers are among the largest in Germany.
- **Power plant technologies:** With a power plant capacity of approx. 32,350 MW, NRW is the most important power plant location in Germany, if not in Europe. 28 percent of the German energy requirement is generated and 24 percent consumed here. In Düsseldorf, for example, the world's most modern gas and steam power plant (combined cycle power plant) with an efficiency of more than 61 percent started operating in early 2016. For the first time, 300 MW of district heating can be extracted from a single power plant block with only one gas turbine, which is then fed into the district heating grid of Düsseldorf's municipal utilities.

Pilot projects

- The purpose of the project **100 Climate Protection Housing Estates in NRW** is to show how, with a combination of renewable energy sources, high insulation standards, modern heating technology and heat recovery in ventilation, the levels stipulated by the current Energy Saving Ordinance can be undercut by more than half and CO₂ emissions reduced further.
- The **50 solar housing settlements in NRW** also demonstrate the possibilities of active and passive solar energy usage for heat and power production and support a broad introduction of solar and energy-efficient construction.
- A model of efficient urban redevelopment, known as **InnovationCity Ruhr – Modellstadt Bottrop**, has been tested in Bottrop since 2010. Within ten years the CO₂ emissions in a part of the Ruhr region city are to be reduced by 50 percent through the energy-related improvement of existing building stock, increasing energy efficiency in the public sector and in industry, and promoting electromobility and renewable energy sources.

Company examples

- **E.ON SE, Düsseldorf**

Established: 2016; sales: €38 billion; employees: 43,000 (worldwide)

E.ON is an international private energy company focusing on renewable energies, energy grids and customer solutions and thus on the building blocks of the new energy world. As of January 1, 2016, the conventional generation business and energy trading were transferred to a separate company, Uniper.



- **innogy SE, Essen**

Established: 2016; sales: €44 billion; employees: 41,000 (worldwide)

innogy, a listed subsidiary of the German energy supplier RWE, was launched in early April 2016. It generates electricity from renewable energies, operates distribution grids and sells energy. innogy currently supplies electricity and gas to some 16 million electricity customers and 7 million gas customers in eleven European markets.



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

Established: 1874; sales: €2.4 billion; employees: 12,300 (worldwide)

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 20 countries with its own sales outlets and exports its products to 60 other countries.



- **Winergy AG, Voerde**

Established: 1981; sales: €6.0 billion; employees: n/a

Winergy is the world's leading component manufacturers for wind energy turbines with more than 125,000 MW of gearbox output. With over 35 years of experience, Winergy provides wind turbine manufacturers and wind farm operators with gear units, hybrid drives, clutches and services. The production and service locations are to be found in Europe, China, India and the USA.



University & research landscape

With around 120 institutes at more than 30 university sites, about 20 non-university research institutions and the research departments of numerous companies which concern themselves with all relevant areas of energy technology in research and education, NRW has a decisive location advantage.

Of the funds that are spent Germany-wide for energy research at universities, around 168 million euros is accounted for by North Rhine-Westphalia annually. That is about a quarter of the total. This makes the state the frontrunner among all the federal states (Bavaria: 18 percent, Baden-Württemberg: 9 percent).

Universities (selection)

- **Aachen University of Applied Sciences**
Established: 1971; students: 13,700; courses: 65
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: 9,900; courses: 52
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: 41,600; courses: 187
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.
- **University of Cologne**
Established: 1388; students: 51,700; courses: 335
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: 33,200; courses: 77
The institute is one of Germany's leading institutes of higher education in the field of energy systems, energy efficiency and energy economics with the emphasis on electrical grids. The research areas include flexible electrical transport and distribution networks, system integration of regenerative energy sources and efficient energy use.
- **University Duisburg-Essen**
Established: 2003; students: 42,700; courses: 123
In the Faculty of Engineering there are numerous chairs which concern themselves with research and teaching in the fields of energy, energy technology, the environment and electrical engineering, such as the chairs for energy economics, energy transport and storage, as well as for environmental process engineering and plant engineering.

- **University of Münster**

Established: 1780; students: 43,900; courses: 280

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: 21,600; courses: 143

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

Research institutes (selection)

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

Established: 2013; employees: 55; 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

The research center was founded within the framework of a public-private partnership between E.ON and RWTH Aachen University, and unites the pillars of energy research: generation, conversion, distribution and storage of energy – linked to behavior-oriented social and economic questions.



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

Established: 2001; employees: 100; www.zbt-duisburg.de

ZBT supports industrial enterprises with the aim of achieving the market penetration of fuel cells and innovative energy technologies.



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

Established: 1943; employees: 3; 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.



- **Institute of Solar Research, Cologne**

Established: 2011; employees: 140; 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.



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

Established: 2012; employees: 200; 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.



- **Max Planck Institute for Coal Research, Mülheim a. d. Ruhr**

Established: 1912; employees: 300; 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: 130; 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.



- **Wuppertal Institute for Climate, Environment and Energy**

Established: 1990; employees: 225; 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
The cluster works on behalf of the Ministry for Innovation, Science and Research of the State of North Rhine-Westphalia on implementing the energy economy and climate policy objectives of the state government in the field of energy research.
- **Cluster EnergyRegion.NRW**, 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 nine networks: biomass, fuel cells and hydrogen, energy-efficient and solar construction, geothermal energy, fuels and drive systems of the future, power plant technology, grids and storage, photovoltaics and wind power.
- **EnergyAgency.NRW**, 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 energy consultancy to continuous vocational training. It manages the clusters EnergyResearch.NRW and EnergyRegion.NRW.
- **ef.Ruhr Forschungs-GmbH**, 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 co-operation with approx. 40 chairs and institutes of the three universities.
- **JARA-ENERGY**, www.jara.org
Nearly 60 institutes of RWTH Aachen University and the Forschungszentrum Jülich are organized in JARA-ENERGY, with the aim of researching a sustainable, i.e. efficient, resource-conserving, environmentally compatible and safe energy generation, use and optimization.
- **Rhein Ruhr Power – Power Plant of the Future**, www.rhein-ruhr-power.net
In Rhein Ruhr Power e.V., leading companies and research institutes in the field of energy and power plant technology have pooled their resources to meet technological challenges – high efficiency, low exhaust emissions, high flexibility, high cost effectiveness – with the "power plant of the future".



Trade fairs & events (selection)

- **E-world energy & water, Essen**; www.e-world-essen.com; next dates: February 6-8, 2018
Europe's leading trade fair for the energy industry proves itself every year to be the central meeting place for decision-makers looking for solutions for the energy sector. The topics, which attracted around 25,000 trade visitors and



710 exhibitors in 2017, range from the generation of energy, through trade, transport and storage to efficiency and smart energy.

- **Energy Storage Europe, Düsseldorf;** www.energy-storage-online.de; next dates: March 13-15, 2018

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*. Compared with the previous year, the trade fair grew by around 35 percent to approx. 4,200 visitors from over 55 countries. More than 160 exhibitors presented themselves.



- **Battery Conference NRW;** www.battery-power.eu; next dates: April 9-11, 2018 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.



- **Industry Day Wind Power NRW;** www.nrw-windenergie.de; next dates: June 28-29, 2017 in Düsseldorf

The event is the industry gathering of the wind power sector in the most important supplier country in the industry. About 50 exhibitors present themselves at Industry Day Wind Power NRW, providing information on the prospects of wind power utilization as well as on current trends in the industry.



Imprint



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