

Operating results 2021

In 2021 the six (6) German nuclear power plants generated 69.13 billion kilowatt hours (kWh) of electricity gross. The three plants Brokdorf KBR (1,480 MWe gross), Grohnde KWG (1,430 MWe gross) and Gundremmingen KRB C (1,344 MWe gross) with an total capacity of 4,254 MWe gross ceased operation at the end of 2021, on 31 December 2021 24:00 h at latest, due to the revision of the German Atomic Energy Act in the political aftermath of the accidents in Fukushima, Japan, in 2011. The six nuclear power plants in operation during the year 2021 contributed to electricity production with an electric gross output of 8,545 MWe.

All six nuclear power plants in operation in 2021 achieved results with a gross production greater than 11 billion kilowatt hours, two power plants produced more than 12 billion kilowatt hours.

Additionally the Isar 2 and the Brokdorf unit achieved two of the world's ten best production results of gross generation in 2021 ("Top Ten", Isar 2: third place, Brokdorf: fourth place. First place: Grand Gulf 1, USA, 12.2 billion kWh, second place: Palo Verde 1, USA, 12.1 billion kWh).

Worldwide, again, as in 2020, 43 nuclear power plant units achieved production results of more than 10 billion kilowatt hours gross in the year 2021.

At the end of 2021, 438 reactor units were in operation in 33 countries worldwide and 54 were under construction in 16 countries. The share of nuclear power in world electricity production was around 10 %. German nuclear power plants have been occupying top spots in electricity production for decades thus providing an impressive demonstration of their efficiency, availability and reliability.

Additionally German nuclear power plants are leading with their lifetime electricity production. The Brokdorf, Emsland, Grohnde, Gundremmingen C, Isar 2 and Neckarwestheim II nuclear power plant have produced more than 360 billion kilowatt hours since their first criticality, the Grohnde plant even is the first nuclear power plant that generated more than 400 billion kilowatt hours.

Operating results of nuclear power plants in Germany 2020 and 2021

Nuclear power plant	Rated power in 2021		Gross electricity generation in MWh		Availability factor* in %		Energy availability factor** in %	
	gross in MWe	net in MWe	2020	2021	2020	2021	2020	2021
Brokdorf KBR	1,480	1,410	10,552,306	12,032,352	90.72	100.00	80.86	92.59
Emsland KKE	1,406	1,335	11,410,500	11,356,583	95.44	95.44	93.76	95.37
Grohnde KWG	1,430	1,360	10,485,503	11,093,346	94.80	92.70	94.50	92.50
Gundremmingen KRB C	1,344	1,288	9,154,214	11,428,585	79.40	99.90	77.70	99.70
Isar KKI 2	1,485	1,410	11,666,574	12,068,285	93.16	94.79	92.99	94.62
Neckarwestheim GKN II	1,400	1,310	11,113,300	11,151,300	92.68	92.36	92.62	92.32
Total (in 2020 and 2021)	8,545	8,113	64,382,397	69,130,451	90.61	95.85	88.63	94.50

* Availability factor (time availability factor) $kt = tN/tV$: The time availability factor kt is the quotient of available time of a plant (tV) and the reference period (tN). The time availability factor is a degree for the deployability of a power plant.

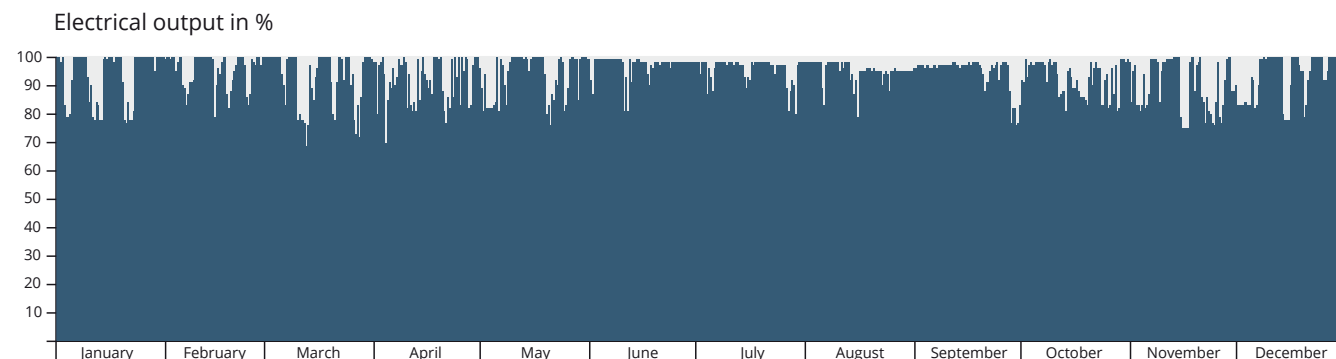
** Energy availability factor $kW = WV/WN$: The energy availability factor kW is the quotient of available energy of a plant (WV) and the nominal energy (WN). The nominal energy WN is the product of nominal capacity and reference period. This variable is used as a reference variable (100 % value) for availability considerations. The available energy WV is the energy which can be generated in the reference period due to the technical and operational condition of the plant. Energy availability factors in excess of 100 % are thus impossible, as opposed to energy utilisation.

*** Inclusive of round up/down, rated power in 2021.

**** The Philippsburg KKP 2 nuclear power plant was permanently shutdown on 31 December 2020 due to the revision of the German Atomic Energy Act in 2011.

Brokdorf

Operating sequence in 2021



The Brokdorf nuclear power plant (KBR) was online for a total of 8,760 operating hours in 2021 with a capacity factor of 99.4 %. Gross generation for the reporting year was 12,032 GWh. No plant overhauls or refuelling took place in the 2021 operating year.

Planned shutdowns

On 31 December 2021 24:00 hrs, KBR's authorisation for power operation, as stipulated in the revised Atomic Energy Act (2011), expired. At the same time, the 33rd operating cycle ended after 434 operating days with the shutdown of the plant. The turbo generator set was taken off the grid at 23:59 on 31 December 2021.

Unplanned shutdowns and reactor/turbine trip

None.

Power reductions above 10 % and longer than for 24 h

None.

Delivery of fuel elements

None.

Waste management status

By the end of the year 2021 35 loaded CASTOR[®] cask were located at the on-site intermediate storage Brokdorf.

Operating data

Review period 2021



Plant operator: PreussenElektra GmbH
 Shareholder/Owner: PreussenElektra GmbH (80 %),
 Vattenfall Europe Nuclear Energy GmbH (20 %)
 Plant name: Kernkraftwerk Brokdorf (KBR)
 Address: PreussenElektra GmbH, Kernkraftwerk Brokdorf,
 25576 Brokdorf, Germany
 Phone: 04829 752560, Telefax: 04829 511
 Web: www.preussenelektra.de
 First synchronisation: 10-14-1986
 Date of commercial operation: 12-22-1986
 Design electrical rating (gross): 1,480 MW
 Design electrical rating (net): 1,410 MW
 Reactor type: PWR
 Supplier: Siemens/KWU

The following operating results were achieved:

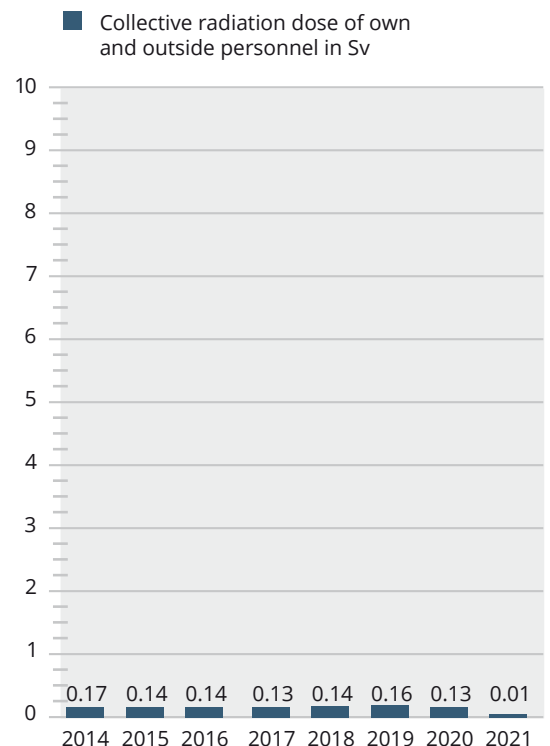
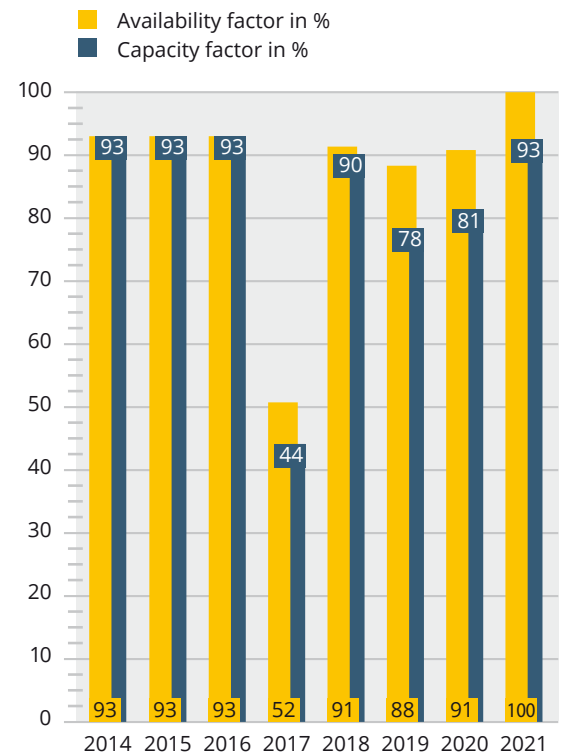
Operating period, reactor:	8,760 h
Gross electrical energy generated in 2021:	12,032,352 MWh
Net electrical energy generated in 2021:	11,436,585 MWh
Gross electrical energy generated since first synchronisation until 12-31-2021:	383,305,680 MWh
Net electrical energy generated since first synchronisation until 12-31-2021:	364,336,660 MWh
Availability factor in 2021:	100.00 %
Availability factor since date of commercial operation:	90.09 %
Capacity factor 2021:	92.59 %
Capacity factor since date of commercial operation:	85.98 %
Downtime (schedule and forced) in 2021:	0.00 %
Number of reactor scrams 2021:	0

Licensed annual emission limits in 2021:

Emission of noble gases with plant exhaust air:	$1.0 \cdot 10^{15}$ Bq
Emission of iodine-131 with plant exhaust air:	$6.0 \cdot 10^9$ Bq
Emission of nuclear fission and activation products with plant waste water (excluding tritium):	$5.55 \cdot 10^{10}$ Bq

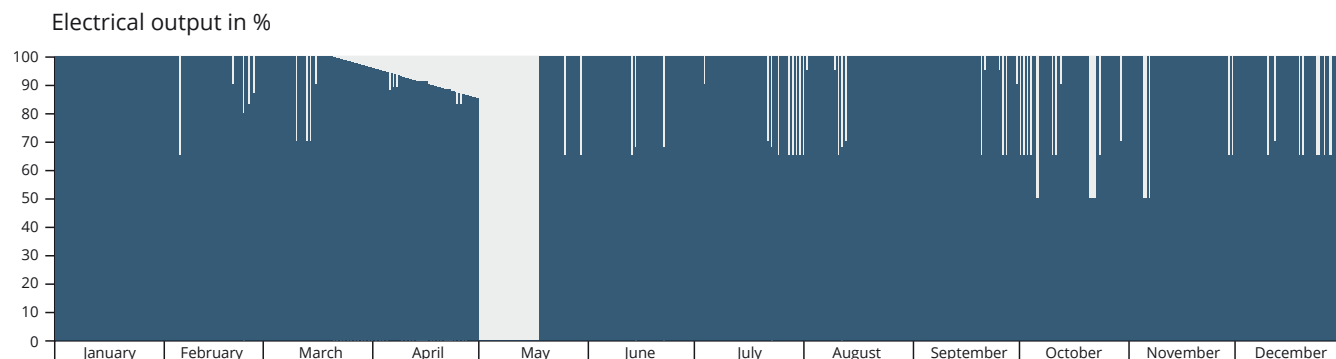
Proportion of licensed annual emission limits for radioactive materials in 2021 for:

Emission of noble gases with plant exhaust air:	0.06 %
Emission of iodine-131 with plant exhaust air:	0.00 %
Emission of nuclear fission and activation products with plant waste water (excluding tritium):	0.0000 %
Collective dose:	0.006 Sv



Emsland

Operating sequence in 2021



Apart from the 16.6 days refueling outage the Emsland nuclear power plant had been operating uninterrupted and mainly at full load during the review period 2021. Producing a gross power generation of 11,356,583 MWh with a capacity factor of 95.37 % the power plant achieved a very good operating result.

Planned shutdowns

34th Refueling and 33rd overall maintenance outage:

The annual outage was scheduled for the period 30 April to 17 May. The outage took 16.6 days from breaker to breaker. In addition to the replacement of 52 fuel elements the following major maintenance and inspection activities were carried out:

- Inspection of core and reactor pressure vessel internals.
- Inspection of pressurizer valves.
- Inspection of a reactor coolant pumps.
- Pressure test on different coolers and tanks.
- Inspection on main condensate pump.
- Maintenance works on different transformers.
- Different automatic non-destructive examination.

Unplanned shutdowns and reactor/turbine trip
None.

Power reductions above 10 % and longer than for 24 h
26 March to 30 April: Stretch-out operation.

Delivery of fuel elements

In 2021 no fuel elements were delivered.

Waste management status

No CASTOR[®] cask loading was carried out during the review period 2021.

At the end of the year 47 loaded casks were stored in the local interim storage facility, operated by BGZ.

General points

In the year 2021, the surveillance audit of the quality management system (ISO 9001:2015) and the recertification of the environmental management system (ISO 14001:2015) were successfully carried out.

Operating data

Review period 2021



Plant operator: Kernkraftwerke Lippe-Ems GmbH
 Shareholder/Owner: RWE Power AG (87,5 %),
 PreussenElektra GmbH (12,5 %)
 Plant name: Kernkraftwerk Emsland (KKE)
 Address: Kernkraftwerk Emsland,
 Am Hilgenberg, 49811 Lingen, Germany
 Phone: 0591 806-1612
 Web: www.rwe.com
 First synchronisation: 04-19-1988
 Date of commercial operation: 06-20-1988
 Design electrical rating (gross): 1,406 MW
 Design electrical rating (net): 1,335 MW
 Reactor type: PWR
 Supplier: Siemens/KWU

The following operating results were achieved:

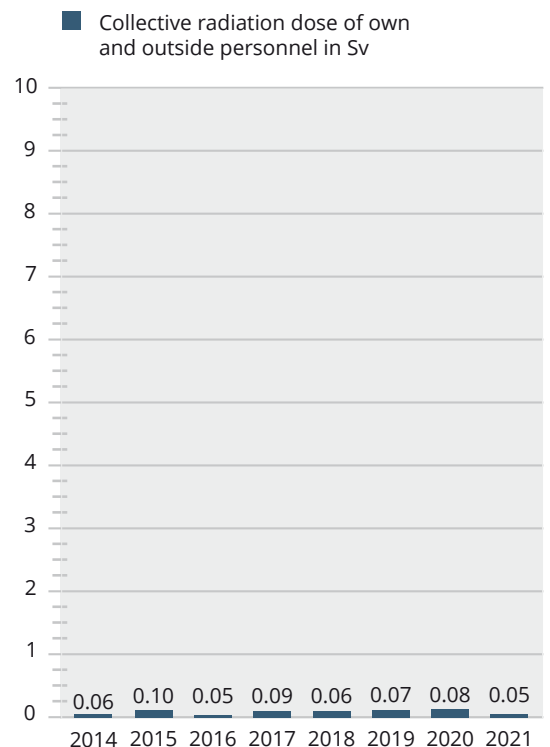
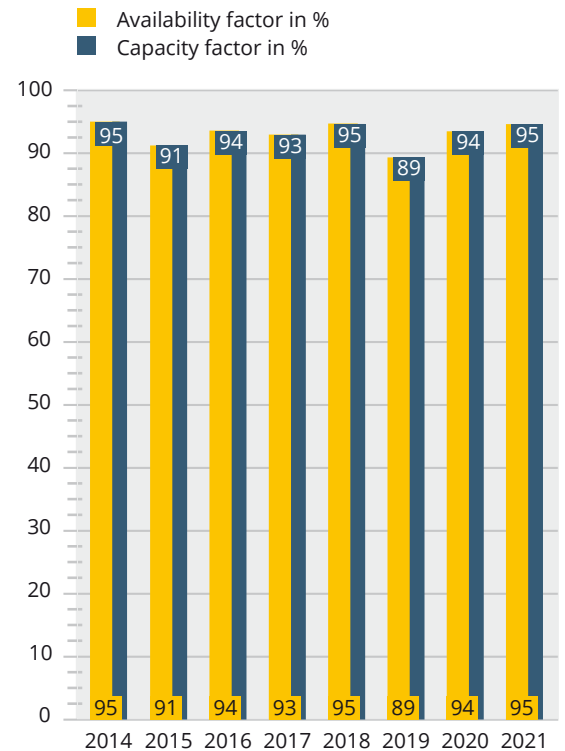
Operating period, reactor:	8,368 h	
Gross electrical energy generated in 2021:	11,356,583	MWh
Net electrical energy generated in 2021:	10,779,479	MWh
Gross electrical energy generated since first synchronisation until 12-31-2021:	380,367,284	MWh
Net electrical energy generated since first synchronisation until 12-31-2021:	360,682,929	MWh
Availability factor in 2021:	95.44 %	
Availability factor since date of commercial operation:	93.96 %	
Capacity factor 2021:	95.37 %	
Capacity factor since date of commercial operation:	93.82 %	
Downtime (schedule and forced) in 2021:	4.56 %	
Number of reactor scrams 2021:	0	

Licensed annual emission limits in 2021:

Emission of noble gases with plant exhaust air:	$1.0 \cdot 10^{15}$ Bq
Emission of iodine-131 with plant exhaust air: (incl. H-3 and C-14)	$5.0 \cdot 10^9$ Bq
Emission of nuclear fission and activation products with plant waste water (excluding tritium):	$3.7 \cdot 10^{10}$ Bq

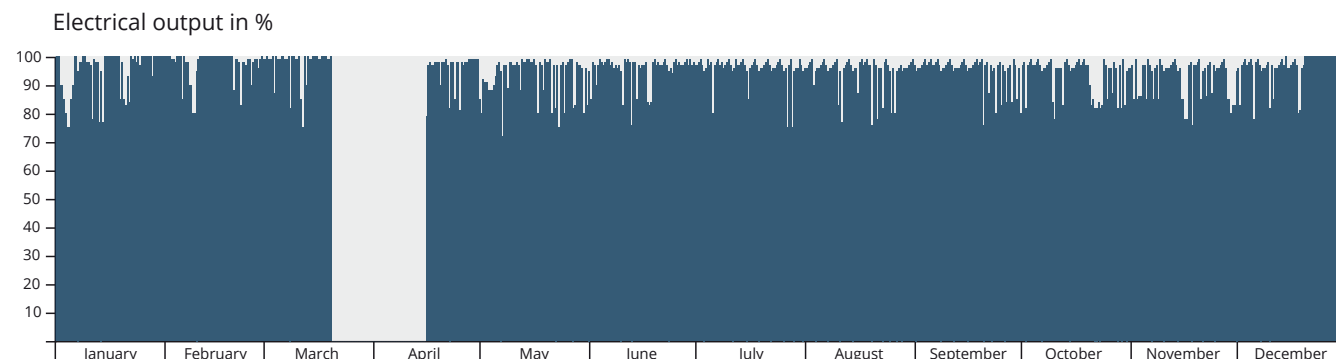
Proportion of licensed annual emission limits for radioactive materials in 2021 for:

Emission of noble gases with plant exhaust air:	0.11 %
Emission of iodine-131 with plant exhaust air: (incl. H-3 and C-14)	0.00 %
Emission of nuclear fission and activation products with plant waste water (excluding tritium):	0.00 %
Collective dose:	0.046 Sv



Grohnde

Operating sequence in 2021



The Grohnde nuclear power plant was off the grid for a 26.7-day overhaul with refuelling in the 2021 reporting year and achieved a time availability of 92.7 %. Gross generation amounted to 11,093,345.5 MWh.

The 2021 revision was also carried out with an elaborate protection concept against Corona-19 for the personnel working in the KWG. The last revision ended 13 hours earlier than originally planned when the grid was switched off on 15 April 2021.

According to the specifications of the load dispatcher, 6 load reductions took place in 2021 for a total of 134 hours, as well as 151 grid and 108 primary controls for a total of 4,940 hours.

Planned shutdowns

20 March to 15 April 2021: 38th Refuelling and major annual revision:

Nuclear power plant Grohnde was shut down as scheduled. The main planned works during this year's revision were:

- Unloading and loading with the replacement of 28 fresh fuel elements.
- Full inspection of 19 fuel elements.
- Eddy current test of 28 control elements.
- Visual inspection of 15 flow restrictor assemblies.
- Start-up inspection of the fuel element centring pins of the UKG and OKG.
- TF40 B001 Cleaning the nuclear intercooler.
- TF40 D001 Inspection of the intercooler pump.
- TF20/30 S013/014 Screw replacement on the quick-acting dampers.
- Pressure test of the recuperative heat exchanger TA00B001,
- Internal and pressure inspection of HP cooler TA11/12 B001 and volume compensation tank TA20 B001.
- TH40/48 D001 Inspection of aftercooling and pool pump,
- Internal and pressure test of the feed water HP preheating section.
- XA Leak rate test.
- GY40/80 Maintenance level W5 incl. visual inspection of cylinder liners.

- Main redundancy 4/8 with rail inspection, branch inspections, capacity inspections, valve and actuator inspections, tank inspections.
- VC10/30 D001 Engine revision/engine replacement.
- Special inspection programme of 55 storage assemblies in the reactor protection system.
- During the inspection of the fuel assemblies, 2 fuel assemblies with slight corner damage were located. These fuel assemblies were replaced by fuel assemblies with similar burn-up behaviour.

Unplanned shutdowns and reactor/turbine trip
None.

Power reductions above 10 % and longer than for 24 h
In the months of January, February, March, May, November and December, load-following operation due to requirements of the load of the load dispatcher.

Delivery of fuel elements

In January 2021 28 U-/U-Gd-fuel elements were delivered.

Waste management status

Between September and November 2021, a total of three CASTOR®-V/19 containers were dispatched to the ZL-KWG.

General points/management systems

In September 2021, the monitoring audit of the quality management system (ISO 9001) and the recertification of the environmental management system (ISO 14001) and the occupational health and safety management system (OHSAS 18001) were successfully carried out.

Operating data

Review period 2021



Plant operator: Gemeinschaftskernkraftwerk Grohnde GmbH & Co. OHG

Shareholder/Owner: PreussenElektra GmbH (83,3 %),

Stadtwerke Bielefeld (16,7 %)

Plant name: Kernkraftwerk Grohnde (KWG)

Address: Gemeinschaftskernkraftwerk Grohnde GmbH & Co. OHG,

P.O. bx 12 30, 31857 Emmerthal, Germany

Phone: 05155 67-1

E-mail: kwg-kraftwerksleitung@preussenelektra.de

Web: www.preussenelektra.de

First synchronisation:

09-05-1984

Date of commercial operation:

02-01-1985

Design electrical rating (gross):

1,430 MW

Design electrical rating (net):

1,360 MW

Reactor type:

PWR

Supplier:

Siemens/KWU

The following operating results were achieved:

Operating period, reactor:

8,121 h

Gross electrical energy generated in 2021:

11,093,346 MWh

Net electrical energy generated in 2021:

10,492,412 MWh

Gross electrical energy generated since

first synchronisation until 12-31-2021:

409,853,683 MWh

Net electrical energy generated since

first synchronisation until 12-31-2021:

387,484,616 MWh

Availability factor in 2021:

92.70 %

Availability factor since

date of commercial operation:

91.80 %

Capacity factor 2021:

92.50 %

Capacity factor since

date of commercial operation:

91.40 %

Downtime

(schedule and forced) in 2021:

7.30 %

Number of reactor scrams 2021:

0

Licensed annual emission limits in 2021:

Emission of noble gases with plant exhaust air:

$9.0 \cdot 10^{14}$ Bq

Emission of iodine-131 with plant exhaust air:

$7.5 \cdot 10^9$ Bq

Emission of nuclear fission and activation products

with plant waste water (excluding tritium):

$5.55 \cdot 10^{10}$ Bq

Proportion of licensed annual emission limits

for radioactive materials in 2021 for:

Emission of noble gases with plant exhaust air:

0.0 %

Emission of iodine-131 with plant exhaust air:

0.0 %

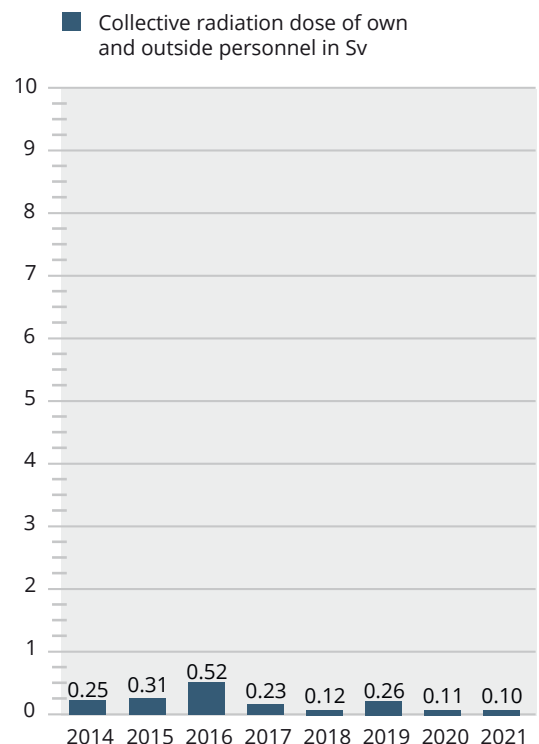
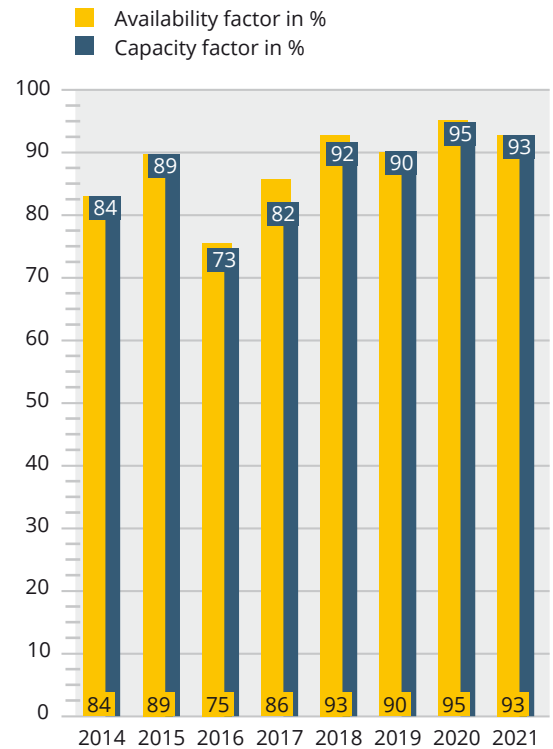
Emission of nuclear fission and activation products

with plant waste water (excluding tritium):

0.000 %

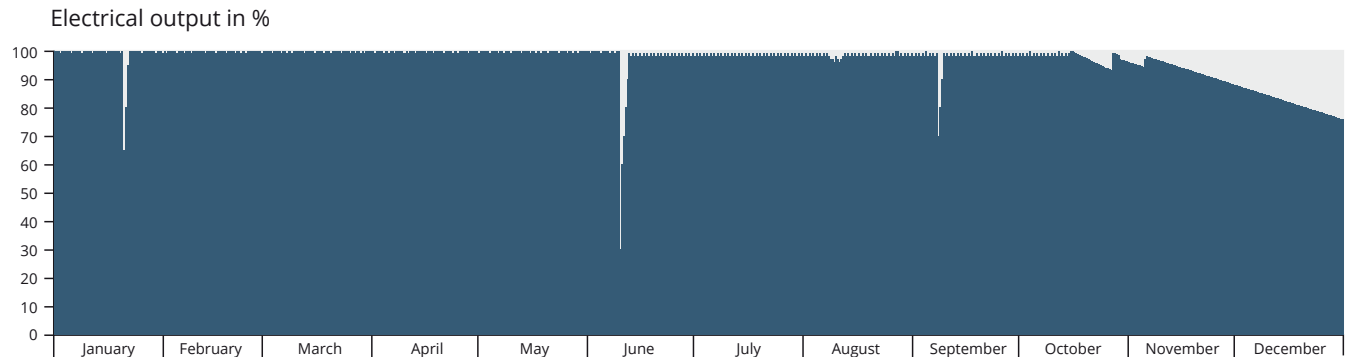
Collective dose:

0.096 Sv



Gundremmingen C

Operating sequence in 2021



In the review period 2021, unit C of Gundremmingen nuclear power plant was operated at full load. A gross total of 11,428,585 MWh of electricity was produced in 2021. This was the best-ever operating result achieved since date of commercial operation.

On 9 March 2021 the plant location achieved 700 billion kWh of gross generation.

From 16 October 2021 unit C was in stretch-out operation because of its permanent shutdown.

On 31 December 2021, unit C was permanently shut down due to the revision of the German Atomic Energy Act in 2011. Since the beginning of commercial operation in 1985, unit C produced, with a time availability of up to 89 %, a gross total of up to 360,000,000 MWh of electricity.

Planned shutdowns

31 December: Permanent shutdown.

Unplanned shutdowns and reactor/turbine trip
None.

Power reductions above 10 % and longer than for 24 h

24 – 25 January: period tests (35.3 h).

6 – 9 June: period tests and maintenance work (67.3 h).

5 – 6 September: period tests (36.0 h).

16 October – 31 December: Stretch-out operation.

Delivery of fuel elements

In 2021, no fresh fuel elements were delivered.

Waste management status

In 2021, a total of 23 CASTOR® casks were loaded. Thus, at the end of 2021, 103 CASTOR® casks with each 52 spent fuel elements out of units B and C are stored in the local interim storage.

General points

On 5 May 2021, a recertification audit according to OHRIS was successfully carried out.

Operating data

Review period 2021



Plant operator: Kernkraftwerk Gundremmingen GmbH
 Shareholder/Owner: RWE Power AG (75 %),
 PreussenElektra GmbH (25 %)
 Plant name: Kernkraftwerk Gundremmingen C (KRB C)
 Address: Kernkraftwerk Gundremmingen GmbH,
 Dr.-August-Weckesser-Straße 1, 89355 Gundremmingen, Germany
 Phone: 08224 78-1, Telefax: 08224 78-2900
 E-mail: kontakt@kkw-gundremmingen.de
 Web: www.kkw-gundremmingen.de
 First synchronisation: 11-02-1984
 Date of commercial operation: 01-18-1985
 Design electrical rating (gross): 1,344 MW
 Design electrical rating (net): 1,288 MW
 Reactor type: BWR
 Supplier: Siemens/KWU,
 Hochtief

The following operating results were achieved:

Operating period, reactor:	8,756 h
Gross electrical energy generated in 2021:	11,428,585 MWh
Net electrical energy generated in 2021:	10,855,376 MWh
Gross electrical energy generated since first synchronisation until 12-31-2021:	361,906,351 MWh
Net electrical energy generated since first synchronisation until 12-31-2021:	344,647,805 MWh
Availability factor in 2021:	99.90 %
Availability factor since date of commercial operation:	89.20 %
Capacity factor 2021:	99.70 %
Capacity factor since date of commercial operation:	87.60 %
Downtime (schedule and forced) in 2021:	0.10 %
Number of reactor scrams 2021:	0

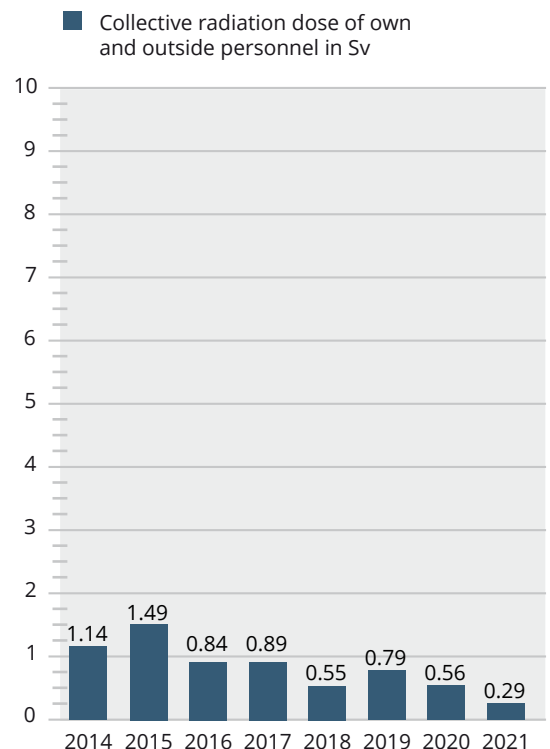
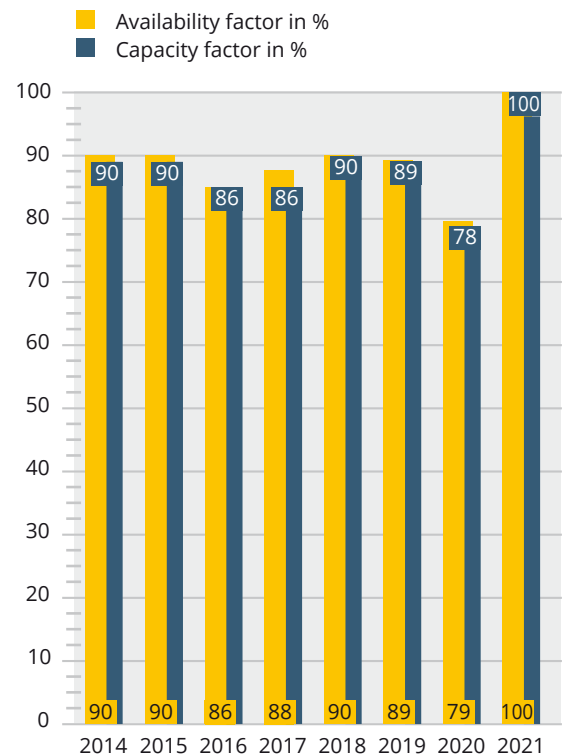
Licensed annual emission limits in 2021

(values added up for Units B and C, site emission):

Emission of noble gases with plant exhaust air:	$1.85 \cdot 10^{15}$ Bq
Emission of iodine-131 with plant exhaust air:	$2.20 \cdot 10^{10}$ Bq
Emission of nuclear fission and activation products with plant waste water (excluding tritium):	$1.10 \cdot 10^{11}$ Bq

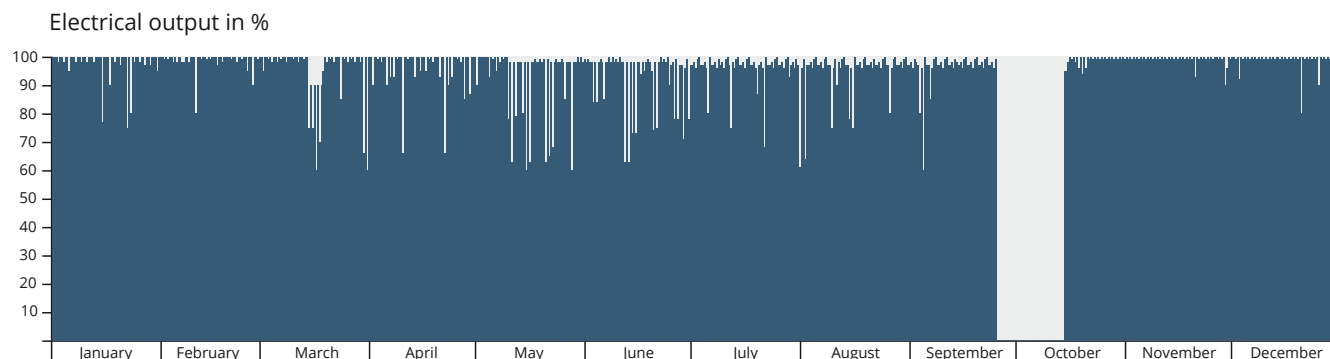
Proportion of licensed annual emission limits for radioactive materials in 2021 for (values added up for Units B and C):

Emission of noble gases with plant exhaust air:	0.34 %
Emission of iodine-131 with plant exhaust air:	0.30 %
Emission of nuclear fission and activation products with plant waste water (excluding tritium):	0.06 %
Collective dose:	0.29 Sv



Isar 2

Operating sequence in 2021



With a gross electricity generation of 12.068 TWh and a work capacity factor of 94.62 %, unit Isar 2 achieved an excellent operating result in the second last operation year 2021. Due to the increased load-following and control operation, the unit also made an important contribution to grid stability, which, however, reduced the net work that could be generated by 287.354 GWh. The highest generator capacity was reached on 9 February 2021 and amounted to 1,512 MW.

Planned shutdowns

The refuelling with plant revision took place from 25 September 2021 to 14 October 2021 with a duration of 19.02 days. During the revision, 48 new fuel assemblies were used. This is the last scheduled plant overhaul of KKI 2, i.e. no more scheduled shutdowns are planned for the subsequent cycle until 31 December 2022.

Unplanned shutdowns and reactor/turbine trip
None.

Power reductions above 10 % and longer than for 24 h
None.

Safety Reviews

16 – 17 February: Special audit “Work planning for works and services by service companies”.
25 February: Management evaluation KKI.
18 March: Operations review.
20 – 27 April: Internal audit “Project management and implementation”.
24 June: Status discussion on the management system.
28 June – 7 July: Surveillance audit by DNV GL, Business Assurance Zertifizierung und Umweltgutachter GmbH according to ISO 9001/14001/45001 and EMAS.
Due to the Corona pandemic, this audit was carried out in several stages, partly as a remote audit.
8 July: Inspection in accordance with §16 of the Major Accidents Ordinance – fire protection and immission control.
15 – 29 October: Management system audit – Part 3
27 – 28 October: Process review “Monitoring of laws and regulations”.
28 October and 2 November: Inspection of “Integrated Management System” by TÜV-Süd experts.

WANO Review/Technical Support Mission

Due to the pandemic-related restrictions, the WANO review planned from 8 to 12 November 2021 had to be cancelled.

Delivery of fuel elements

In the reporting year 40 uranium fuel elements were delivered. No fuel elements are in stock at the dry storage.

Waste management status

In 2021, no fuel elements were stored in the on-site interim storage facility, operated by BGZ.

General points

In the year under review, the plant was mainly used in secondary control operation and occasionally in primary control operation.

There was only one technical malfunction that led to a reduction in output: On 8 July 2021, the plant output was briefly reduced to fix a fault in the condensate discharge control system.

The deviation in capacity factor, related to the net electrical rated output (1,410 MW), amounted to 7.71 % in the reporting year. The revision accounted for approx. 5.21 %, power reductions at the request of the grid dispatcher contributed approx. 2.33 %. Repairs, malfunctions and operational power reductions, such as the start-up and shut-down process for the revision, only accounted for approx. 0.17 % of this.

The Corona pandemic had no impact in terms of power generation in 2021. However, the establishment and application of an effective infrastructure for the best possible protection against Covid 19 infections posed considerable challenges for the operating team.
Impacts on the safety of the plant were avoided at all times.

Operating data

Review period 2021



Plant operator: PreussenElektra GmbH
 Shareholder/Owner: PreussenElektra GmbH (75 %),
 Stadtwerke München GmbH (25 %)
 Plant name: Kernkraftwerk Isar 2 (KKI 2)
 Address: PreussenElektra GmbH, Kernkraftwerk Isar,
 Postfach 11 26, 84049 Essenbach, Germany
 Phone: 08702 38-2465, Telefax: 08702 38-2466
 Web: www.preussenelektra.de
 First synchronisation: 01-22-1988
 Date of commercial operation: 04-09-1988
 Design electrical rating (gross): 1,485 MW
 Design electrical rating (net): 1,410 MW
 Reactor type: PWR
 Supplier: Siemens/KWU

The following operating results were achieved:

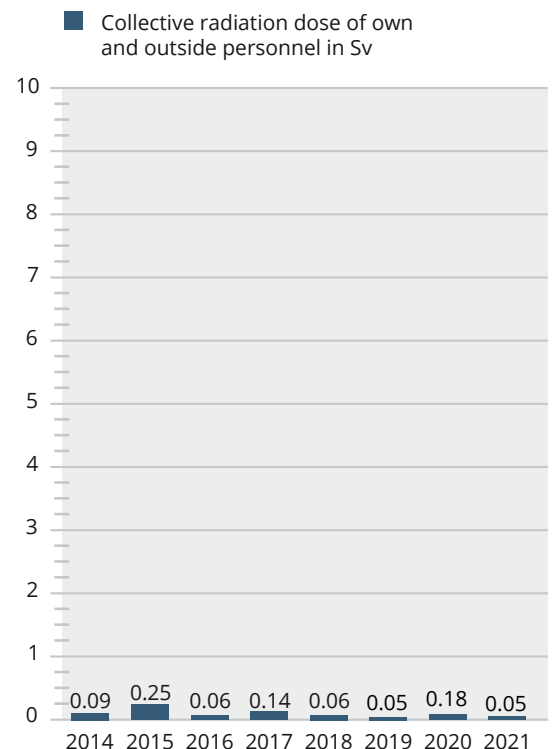
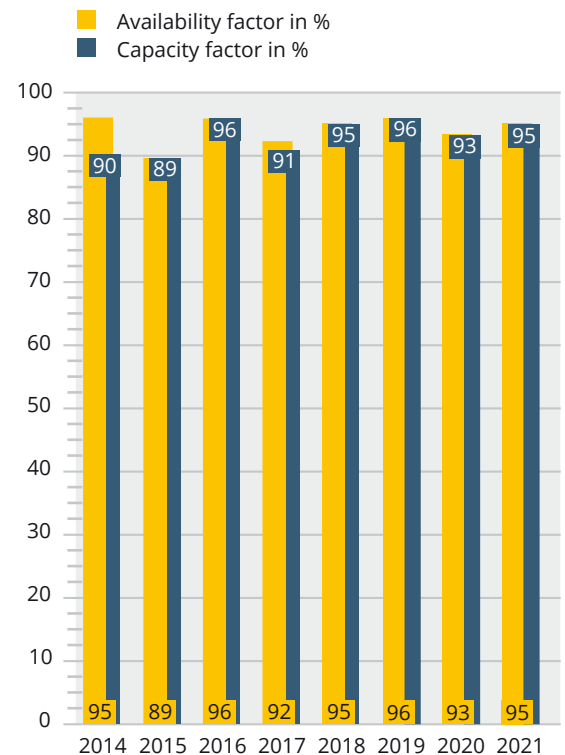
Operating period, reactor:	8,304 h
Gross electrical energy generated in 2021:	12,068,285 MWh
Net electrical energy generated in 2021:	11,410,695 MWh
Gross electrical energy generated since first synchronisation until 12-31-2021:	389,497,328 MWh
Net electrical energy generated since first synchronisation until 12-31-2021:	367,781,944 MWh
Availability factor in 2021:	94.79 %
Availability factor since date of commercial operation:	93.40 %
Capacity factor 2021:	94.62 %
Capacity factor since date of commercial operation:	92.56 %
Downtime (schedule and forced) in 2021:	5.21 %
Number of reactor scrams 2021:	0

Licensed annual emission limits in 2021:

Emission of noble gases with plant exhaust air:	$1.1 \cdot 10^{15}$ Bq
Emission of iodine-131 with plant exhaust air:	$1.1 \cdot 10^{10}$ Bq
Emission of nuclear fission and activation products with plant waste water (excluding tritium):	$5.5 \cdot 10^{10}$ Bq

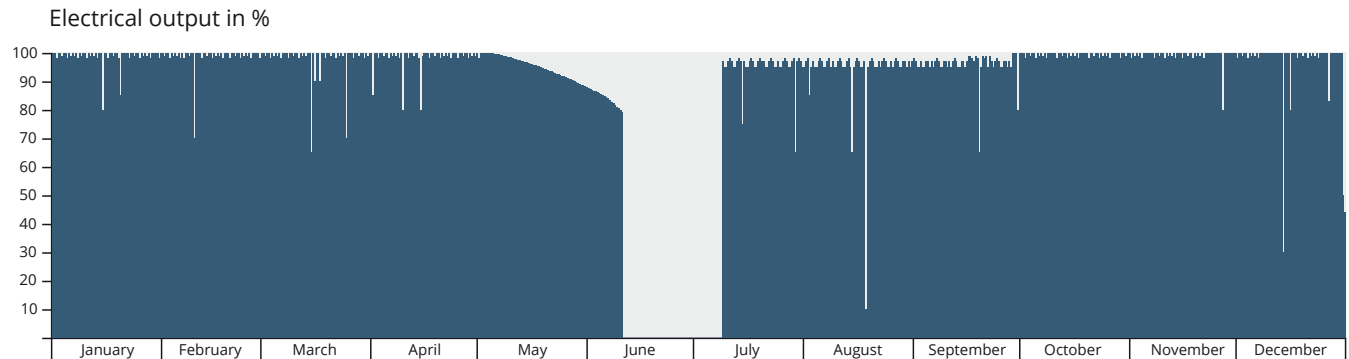
Proportion of licensed annual emission limits for radioactive materials in 2021 for:

Emission of noble gases with plant exhaust air:	0.145 %
Emission of iodine-131 with plant exhaust air:	< limit of detection
Emission of nuclear fission and activation products with plant waste water (excluding tritium):	< limit of detection
Collective dose:	0.054 Sv



Neckarwestheim II

Operating sequence in 2021



During the reporting year 2021 the Neckarwestheim II nuclear power plant (GKN II) generated gross energy of 11,151,300 MWh. The net electrical generation was 10,459,253 MWh, of which 10,131,305 MWh went into the public three-phase grid and 1,019,995 MWh to the static converter plant of Deutsche Bahn AG. The plant was on the grid for 8,090.5 hours. This results in a time utilisation of 92.36 %.

Since the commissioning of the three-phase-machine machine, 362,506,184 MWh gross and 339,049,716 MWh net have been generated.

Planned shutdowns

11 June to 9 July: 38th fuel reloading and annual major inspection:

- Refuelling with exchange of 40 new fuel elements.
- Tube sheet inspection on the steam generators JEA20/30.
- Major overhaul of the primary-side safety and blow-off valves on the pressuriser JEF10.
- Major overhaul of the shaft and standstill seals of all 4 main coolant pumps.
- Internal inspection of the volume compensation container KBA20-BB001.
- Inspection of the nuclear intercoolers KAA30/40-BC001.
- Major overhaul of the main coolant pump LAC30 and partial overhaul of the main coolant pump LAC 20.
- Major overhaul of pilot valves of main steam valves LBA30/40.
- Maintenance and testing in the main redundancy 4/8.
- Maintenance on transformers and both main grid connections.

Unplanned shutdowns and reactor/turbine trip
None.

Power reductions above 10 % and longer than for 24 h
10 May to 11 June: Stretch-out operation.
January to May
and
July to December: Load sequence operation.

Integrated management system (IMS)

EnKK (NPP P, GKN, KWO)

The integrated management system (IMS) of the EnBW Kernkraft GmbH (EnKK) according to KTA 1402 with its partial system for

- nuclear safety (SMS),
- quality management (QMS/QSÜ),
- Occupational Safety Management (AMS) as well as
- environmental and energy management (UMS, EnMS, Umwelt- und Energiemanagementsystem)

were also in 2021 continuously further developed. Scope and content of each process descriptions were gradually adapted to the different internal requirements and related approval criteria. The completeness and effectiveness (conformity) of the process-oriented IMS, including the quality management measures (QM), were confirmed by corresponding internal and external audits as well as by an inspection by the assessor (ESN) and the supervisory authority over several days at the GKN (Neckarwestheim) and KKP (Philippsburg) sites.

EnKK's energy management system was converted to the 50001:2018 standard and successfully certified from 4 – 6 May 2021.

The IMS was adapted to the site-specific requirements in operation/residual operation in accordance with KTA1402. Dismantling-specific adaptations (process dismantling and process logistics) have been made and will take into force in the next year.

Waste management status

In 2021, 4 TN24E casks with 84 GKN II fuel elements and 1 CASTOR® V/19 cask with 13 GKN I fuel assemblies were loaded and transported to the Neckarwestheim interim fuel storage facility (BZN). At the end of 2021, there were 665 GKN II fuel assemblies (dry storage, wet storage and reactor) in the GKN II plant.

Operating data

Review period 2021



Plant operator: EnBW Kernkraft GmbH (EnKK)
 Shareholder/Owner: EnBW Erneuerbare und Konventionelle Erzeugung AG (98,45 %), ZEAG Energie AG, Deutsche Bahn AG, Kernkraftwerk Obrigheim GmbH
 Plant name: Kernkraftwerk Neckarwestheim II (GKN II)
 Address: EnBW Kernkraft GmbH, Kernkraftwerk Neckarwestheim, Im Steinbruch, 74382 Neckarwestheim, Germany
 Phone: 07133 13-0, Telefax: 07133 17645
 E-mail: poststelle-gkn@kk.enbw.com
 Web: www.enbw.com
 First synchronisation: 01-03-1989
 Date of commercial operation: 04-15-1989
 Design electrical rating (gross): 1,400 MW
 Design electrical rating (net): 1,310 MW
 Reactor type: PWR
 Supplier: Siemens/KWU

The following operating results were achieved:

Operating period, reactor:	8,097 h
Gross electrical energy generated in 2021:	11,151,300 MWh
Net electrical energy generated in 2021:	10,459,253 MWh
Gross electrical energy generated since first synchronisation until 12-31-2021:	362,506,184 MWh
Net electrical energy generated since first synchronisation until 12-31-2021:	339,049,716 MWh
Availability factor in 2021:	92.36 %
Availability factor since date of commercial operation:	92.90 %
Capacity factor 2021:	92.32 %
Capacity factor since date of commercial operation:	92.55 %
Downtime (schedule and forced) in 2021:	7.64 %
Number of reactor scrams 2021:	0

Licensed annual emission limits in 2021:

Emission of noble gases with plant exhaust air:	1.0 · 10 ¹⁵ Bq
Emission of iodine-131 with plant exhaust air:	1.1 · 10 ¹⁰ Bq
Emission of nuclear fission and activation products with plant waste water (excluding tritium):	6.0 · 10 ¹⁰ Bq

Proportion of licensed annual emission limits for radioactive materials in 2021 for:

Emission of noble gases with plant exhaust air:	0.0112 %
Emission of iodine-131 with plant exhaust air:	< limit of detection
Emission of nuclear fission and activation products with plant waste water (excluding tritium):	< limit of detection
Collective dose:	0.093 Sv

