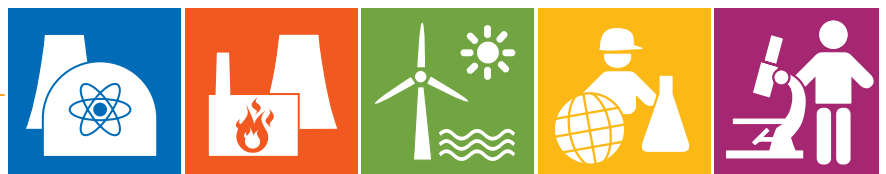


**Technical-Scientific  
Reports**

**Availability  
of Thermal Power Plants  
2001 – 2010**

**TW 103 V e**

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VGB Technical-Scientific Reports  
"Availability of  
Thermal Power Plants 2001-2010"  
- VGB-TW-103 V e-

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The development of the KISSY data base was financed by the data providers and VGB PowerTech e.V. The report is free of charge for all data providers.

Further development and software extensions of the KISSY Database will be financed by allocations from the KISSY community.

For members either Eurelectric or VGB the price is: 60 €

For non-members the price is: 120 €

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# VGB Technical-Scientific Reports “Thermal Power Plants”

Availability  
of  
Thermal Power Plants  
2001 - 2010

- VGB-TW-103 Ve -

Published by  
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Editorial: S. Prost, VGB-Office Essen as soon as  
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## I. Preliminary Remark

Since 1970 VGB has been collecting data according to standardised uniform definitions and recording procedures. On the basis of the co-operation between Eurelectric and VGB it was decided to merge data collection for the availability and unavailability of power plants. With the liberalisation of the energy markets, the technical and economic assessment of power plants has gained more and more in importance. Since 2008 the data of Eurelectric's TherPerf-Report and VGB's KISSY-Report have been presented in one common report. These data provide information about the availability and utilisation of thermal power plants in order to compare the quality of power plants and to assess plants' behavior in daily operation. Reasons for unavailability have also been collected since 1988 in order to identify and assess the root cause (systems and main components).

According to the suggestions of the VGB Working Panel "Performance Indicators" (WPPI) the database system KISSY is being retrofitted and upgraded in order to be able to draft technical benchmark reports in real time. The European utilities which provide data are able to analyse the data online within their companies. Currently the German, English, French, Italian, Dutch and Portuguese languages are offered. Apart from the existing parameters, it will also be possible with the new online analysis tool to evaluate the parameters that were newly defined by the WPPI. Commercial background information (e.g. EEX data) will also be involved in the KISSY system.

In addition to upgrading the KISSY database, the associated guidelines will also be published in the German, English, French and Portuguese language. The former VGB Guidelines "Availability of Thermal Power Plants", "Unavailability of Thermal Power Plants" and "EMS Event Criterion Key Systems" were updated by the newly defined parameters and merged into one, completely revised guideline. The German and English versions were placed on the VGB Homepage ("Member information") and can be downloaded. The French version will be published in autumn 2011.

As well as the online evaluations, the annual evaluations - as published in the standard report for the operating period from 2001 to 2010 - will be continued and published in an annual report. Compared to last year's report data, were collected from an additional 39 power plant units from 9 utilities. The new participations which are participate are in Belgium, Czech Republic, Germany, The Netherlands and Portugal. Currently, VGB is intensively preparing the participation of Irish and Polish utilities.

The current report provides performance indicators for 606 power plant units. All data were considered that had been fed into KISSY online upto 30<sup>th</sup> of June 2011 for the period under review, i.e. until the end of 2010. The average energy utilisation dropped from 57.8 % (2009) to 57.2 % (2010). The average energy utilisation in the decade under review (2001 to 2010) of all fossil-fired units increased from 49.2 % to 57.2 %, i.e. by 8.0 % points. The average value for that decade is around 57.0 %.

The percentage of planned unavailable energy increased from 6.6 % (2001) to 10.0 % (2010) with a simultaneous increase of unplanned unavailable energy from 6.0 % (2001) to 6.9 % (2010). As a result energy availability fell, from 2001 to 2010, by 4.4 %.

When considering the average differences between energy availability and energy utilisation, it is obvious that the reserve capacity has continuously decreased. In 2001 the average difference value for all fossil-fired power plants amounted to 38.2 %. Today, it only amounts to 25.8 %.

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## II. Definition of Performance Indicators

### **Time availability**

$$k_t = \frac{t_v}{t_N}$$
$$= \frac{t_N - t_{nv}}{t_N}$$

The time availability is the quotient of the available time and the reference period (calendar time).

The available time is the difference between the reference period and the unavailable time.

### **Energy availability**

$$k_w = \frac{W_v}{W_N}$$
$$= \frac{W_N - W_{nv}}{P_N \cdot t_N}$$

The energy availability is the quotient of the available energy and the nominal energy.

The available energy is the difference between the nominal energy and the unavailable energy.

The nominal energy is the product of the nominal capacity and the reference period (calendar time).

### **Time utilization**

$$n_t = \frac{t_B}{t_N}$$

The time utilization is the quotient of the operating time and the reference period (calendar time).

The time utilization is a measure for the real temporal use of a plant. It is independent of the level of the corresponding operating capacity.

**Energy utilization**

$$n_W = \frac{W_B}{W_N}$$

$$= \frac{W_B}{P_N \cdot t_N}$$

$$t_{aN} = \frac{W_B}{P_N}$$

$$t_{aN} = n_W \cdot t_N$$

The energy utilization is the quotient of the energy generated and the nominal energy.

The nominal energy is the product of the nominal capacity and the reference period (calendar time). The energy generated is the product of operating capacity and operating time (numerator).

The energy utilization is a measure for the energy which a plant has really generated.

Frequently used are also the equivalent definitions "utilization duration" or "full load utilization hours"

The correlation between energy utilization and utilization duration

**Start-up reliability**

$$z = \frac{s_e}{s_e + s_n}$$

The start-up reliability is the quotient of the number of successful start-ups ( $s_e$ ) and the sum of successful ( $s_e$ ) and unsuccessful start-ups ( $s_n$ ) (see chapter 16).

The start-up reliability is used for the evaluation of units whose service life depends essentially on the number of start-ups, e.g. gas turbines, emergency aggregates.

**Classification of unavailability (NV)****planned unavailability**

*The beginning and duration of the unavailability have to be determined more than 4 weeks before commencement.*

**Unplanned unavailability**

*The beginning of unavailability cannot be postponed or only up to 4 weeks.*

**Postponable**

*The beginning of unavailability can be postponed more than 12 hours up to 4 weeks.*

**Not postponable**

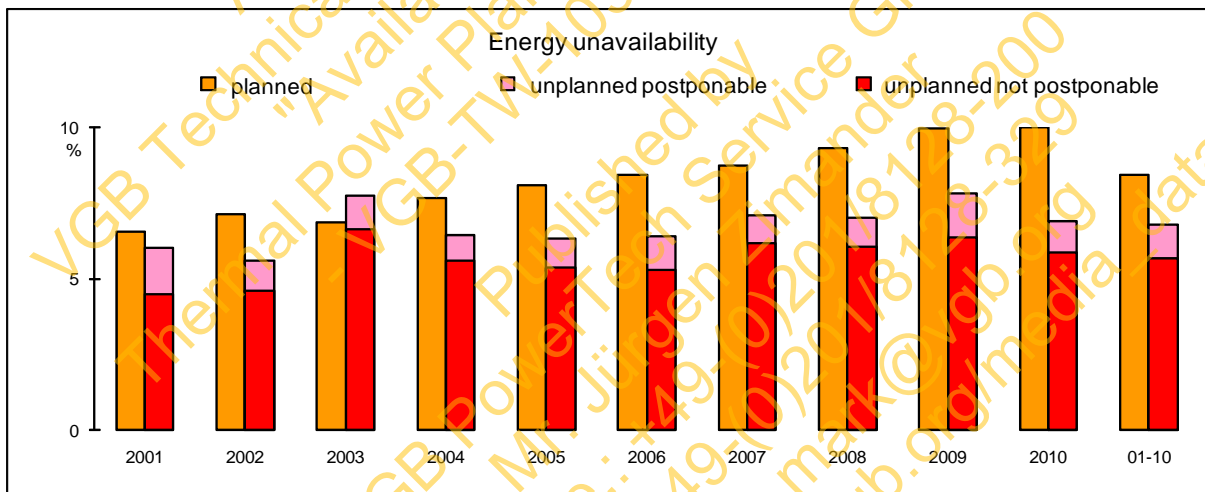
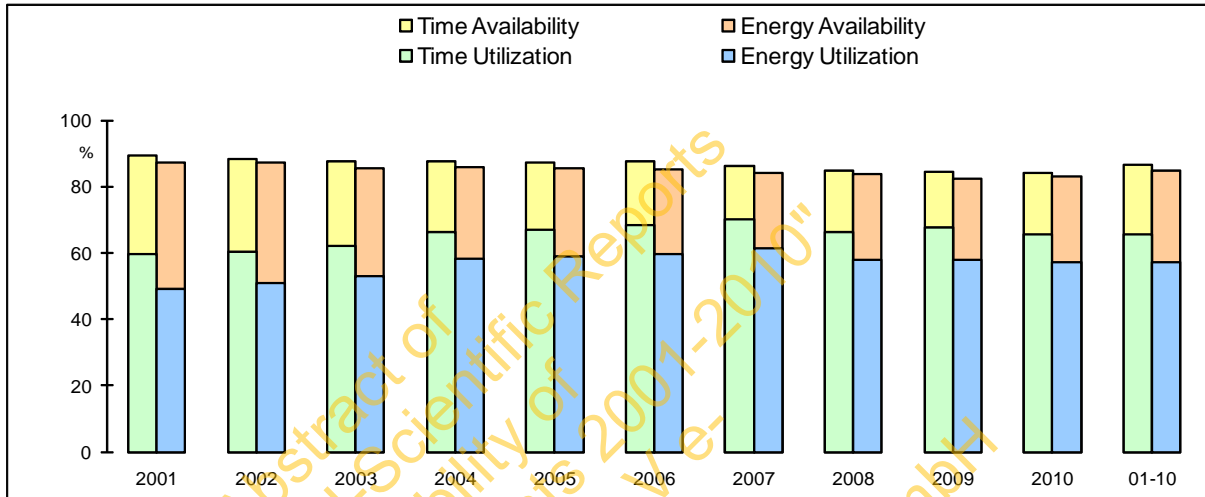
*The beginning of unavailability cannot be postponed or only up to 12 hours.*

### III. Results

#### A. Fossil-fired Units (without combined cycle units)

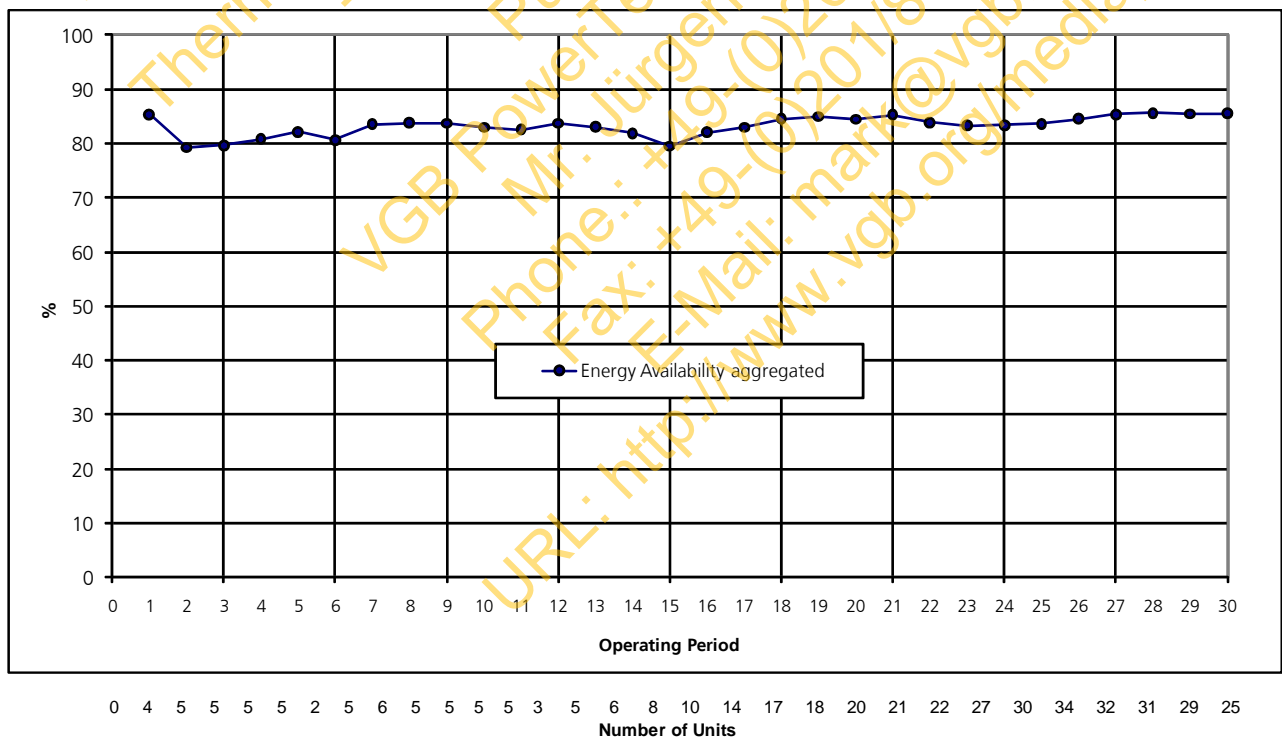
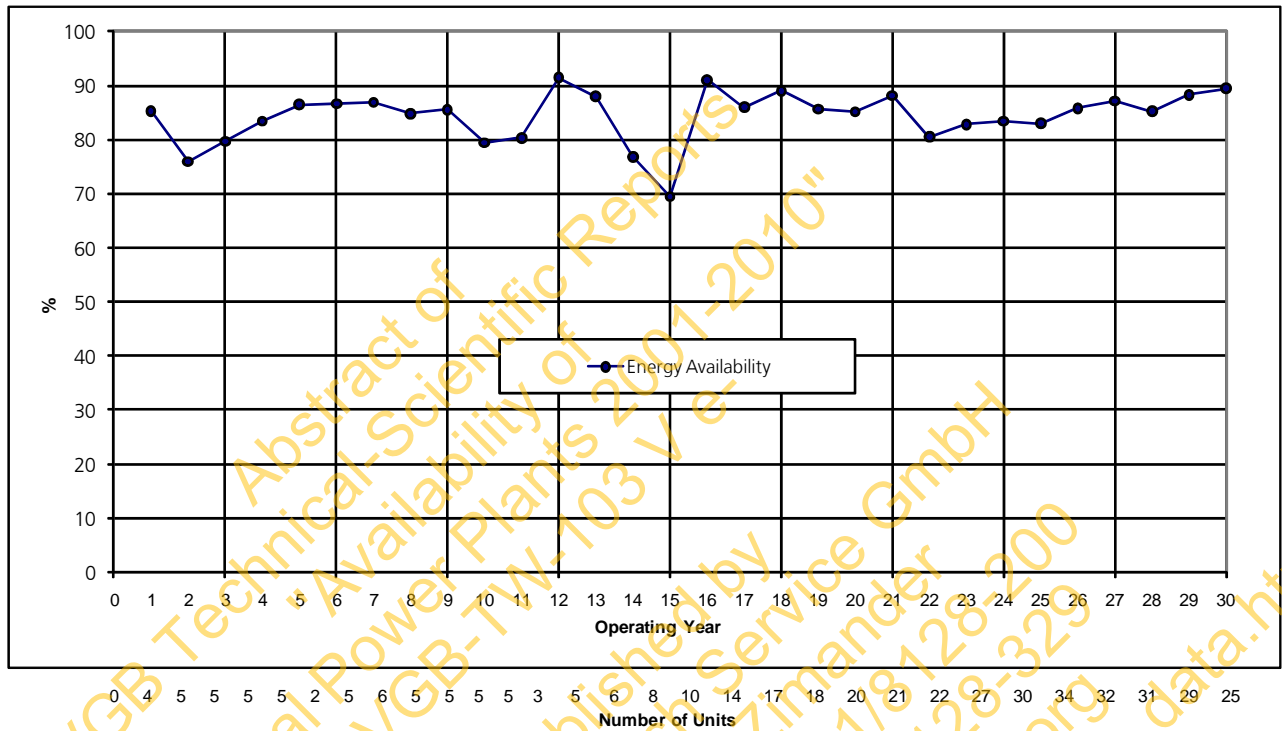
##### A.1 Total

##### A.1.1 Fossil-fired Units, Total



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	01-10
Number/Unit Years	245	237	239	311	313	313	317	315	308	316	2,914
Capacity (gross)	MW 75,961	73,585	75,543	114,050	114,870	113,466	114,760	114,456	110,905	115,603	1,023,198
Time Availability	% 89.5	88.3	87.7	87.5	87.2	87.5	86.1	84.9	84.3	84.0	86.6
Time Utilization	% 59.6	60.3	61.9	66.1	66.9	68.4	70.3	66.4	67.6	65.4	65.6
Energy Availability	% 87.4	87.2	85.4	85.8	85.6	85.1	84.2	83.6	82.2	83.0	84.8
Energy Unavailability	% 12.6	12.8	14.6	14.2	14.4	14.9	15.8	16.4	17.8	17.0	15.2
planned part	% 6.6	7.2	6.9	7.7	8.1	8.5	8.7	9.3	10.0	10.0	8.4
unplanned part	% 6.0	5.6	7.7	6.5	6.3	6.4	7.1	7.0	7.8	6.9	6.8
postponable	% 1.5	1.0	1.1	0.8	1.0	1.1	0.9	1.0	1.5	1.0	1.1
not postponable	% 4.5	4.6	6.7	5.6	5.4	5.3	6.2	6.1	6.4	5.9	5.7
Energy Utilization	% 49.2	51.0	53.1	58.2	58.9	59.6	61.5	57.8	57.8	57.2	57.0

### A.3.2 Service Life: Fossil-fired Units up to 99 MW Germany (period 1982-2010)



## V. Reference

VGB-Guideline **Fundamentals and systematics of availability determination for Thermal Power Plants**, (VGB-RV 808), 7<sup>th</sup> Edition 2008.

This edition was published as part of the series „Begriffe der Versorgungswirtschaft“, Part B, Booklet 3.  
VGB PowerTech Service GmbH, Essen.

### Note:

The mentioned below guidelines were revised and taken over in the above VGB Guideline:

1. VGB-Guideline Availability of Thermal Power Plants - Fundamentals and Determination, (VGB-RV 808), 6<sup>th</sup> Edition 1999.  
This edition was published as part of the series „Begriffe der Versorgungswirtschaft“, Part B, Booklet 3.  
VGB PowerTech Service GmbH, Essen, und VWEV-Verlag, Frankfurt (Main).
2. VGB-Guideline Analysis of the Unavailability of Thermal Power Plants (VGB-R 140 e), 2<sup>nd</sup> Edition 1999,  
VGB PowerTech Service GmbH, Essen
3. VGB-Guideline EMS event-criterion-key-system (VGB-B 109), 1<sup>st</sup> Edition 2003,  
VGB PowerTech Service GmbH, Essen