Developments in guaranteeing the safety of operating nuclear power plants
Overview

1. EnBW – Who we are
2. Electricity supply in Germany – Challenges for the future
3. EnBW’s strategy for plant operation:
   - Safety and competitiveness
   - Human resources
   - Continuous improvements and modernisation
EnBW – Who we are
## At a glance

### EnBW group

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<tr>
<th><strong>No. 3 in Germany (external sales)</strong></th>
<th><strong>2006</strong></th>
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<tr>
<td></td>
<td>13,219.4 m€</td>
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<th><strong>Main shareholders:</strong></th>
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<tr>
<td>EDF</td>
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<tr>
<td>Oberschwäbische Elektrizitätswerke</td>
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<td><strong>45,01</strong></td>
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<td><strong>45,01</strong></td>
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<table>
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<th><strong>Unit sales</strong></th>
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<tr>
<td><strong>119,4</strong> TWh</td>
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<th><strong>Installed power</strong></th>
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<tr>
<td><strong>14811</strong> MW</td>
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<th><strong>Installed nuclear power (incl. contracts)</strong></th>
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<td><strong>4843</strong> MW</td>
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<th><strong>Employees (annual average)</strong></th>
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<td><strong>20,259</strong></td>
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At a glance

EnBW

- Generation
  - EnBW Kraftwerke AG
  - EnBW Kernkraft GmbH

- Trading
  - EnBW Trading GmbH

- Transmission
  - EnBW Transportnetze AG
    - Gasversorgung Süddeutschland GmbH

- Distribution
  - EnBW Regional AG
    - EnBW Gas GmbH
    - Erdgas Südwest GmbH
    - Gasversorgung Süddeutschland GmbH

- Sales
  - EnBW Vertriebs- u. Service-Gesellschaft

EnBW Systeme, Infrastruktur, Support GmbH
EnBW Energy Solutions GmbH
EnBW Akademie GmbH
EnBW Kernkraft GmbH (EnKK)

- About 1.800 employees
- 4.624 MW installed electrical capacity
  - KKP 1: BWR 926 MW availability in 2006: 91,1% in operation since 1979
  - KKP 2: PWR 1.458 MW availability in 2006: 92,9% in operation since 1984
  - GKN I: PWR 840 MW availability in 2006: 94,2% in operation since 1976
  - GKN II: PWR 1.400 MW availability in 2006: 95,7% in operation since 1989
- KWO: in decommissioning process since 11th May 2005
- Production: about 37 TWh per year
Electricity supply in Germany – Challenges for the future
Germany – Electricity generation in 2006

Gross electricity generation in Germany 2006¹

- **Nuclear 26.3%**
- **Hard Coal 21.4%**
- **Lignite 23.9%**
- **Gas 11.6%**
- **Wind 4.8%**
- **Hydro 4.4%**
- **Others² 7.7%**

Electricity base load

**Nuclear 50.3%**

- **Lignite 44.3%**
- **Hydro: Running Water 5.4%**

¹ Preliminary data; partly estimated
² Bio mass, produced gases, waste, solar, mineral oil products

Source:
Kernenergie-Bilanz 2006, DATF, DIW, VDEW

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EUROSAFE
Development of installed power in Germany

Replacement of ~80,000MW until 2025, among them ~20,000MW due to nuclear phase-out

In 2020 there will be a lack of more than 40% of the actual power generation

How do we solve the capacity requirements?

Source: Prof. Voß, pres. IKET-Kolloq, 06/07
Electricity supply - competing aspects

Environmental aspects

“Climate pact” – reducing CO₂-emissions (40% by 2020)

Overall capacity replacement requirement

Nuclear phase-out

Role of coal?

Economical aspects

Security of supply

?
EnBW’s strategy for plant operation:

- Safety and competitiveness
- Human resources
- Continuous improvements and modernisation
Safety and competitiveness (1)
Definition of goals for nuclear generation activities -
Brochure outlining goals and objectives
Safety and competitiveness (2)
Safety management system of EnBW nuclear power plants

- EnBW was a pioneer in Germany in the introduction of a safety management system
- Safety management system meets the current international standard defined by the IAEA and the OECD/NEA
- Complex multi-year project
- Process-oriented approach (highly complex but ensures transparency/traceability)
- Process monitoring via indicators in the form of an early warning system
- Homogeneous procedure at all 3 sites – but taking into account of the special situation of Obrigheim nuclear power plant
- Start of the SMS means: the continuous improvement process has begun
Safety and competitiveness (3)
Ageing Management – Implementation

- Our AM covers the technical issues (mechanical engineering, I&C, structural engineering and operating supplies)
- The implementation is not finished for all issues. Mechanical engineering is the most advanced issue
- The AM is based on the Maintenance Management. Therefore the AM-relevant information and feedback of the operating experience (e.g. preventive maintenance programmes; in-service inspection, surveillance, corrective maintenance) is bundled
- Together with the information of transferable external events and research programmes the information are systematically and in detail analysed by experts
- The non-technical issues like AM of workforce or documents, which are required by the RSK-recommendation, are treated separately
Safety and competitiveness (4)
Outage optimisation

- As short as possible – as long as necessary
- Safety always prior to economy
  - IT-based outage planning tool
  - Improvement of safety and optimization of the scheduling of tasks with time-critical dependencies
  - Long-term outage planning: time-consuming or extensive periodic inspections, maintenance or changes are adapted to the outage strategy
  - Optimization of isolation of redundancies
  - Improvement of the duration for fuel assembly loading and unloading
Safety and competitiveness (5)
Retention of research expertise

Coordinated support and cooperation activities on the part of German utilities, the nuclear industry and associations within the framework of an expert network for nuclear techniques

- E.ON
- RWE
- EnBW
- VENE
- GNS
- VGB
Human resources (1)
Prospective personnel planning and job overlaps

Concept for medium- to long-term personnel planning developed and implemented

→ Retention of expertise as well as long-term securing of desired workforce level

Overlap phases during personnel changes

Retention of know-how and transfer of know-how for all planable personnel changes (retirement, partial retirement, early retirement etc.)

Supplementation of training for new employees during the overlap phase

Overview of medium- to long-term personnel requirements (scope, qualification)

Prospective planning of job appointments and prospective recruitment policy
Human resources (2)
Prospective translocational personnel planning and job overlaps

- Examples of overlap times:
  - Shift supervisors/Shift engineers: 4.5-5 years
  - Deputy shift supervisors/Reactor operators: 4-4.5 years
  - System engineers: 2-3 years
  - Technicians/Master tradesmen: 1-3 years
  - Skilled blue-collar (also shift): 1-2 years
Human resources (3)

Cross border training of future key personnel -
Common recruitment and training program of EDF/EnBW

- EnBW and EDF have developed a joint recruitment and training program in the field of nuclear techniques
- Name of the program: “We offer a future” (WOAF)
- Goal: to recruit and train future key personnel as nuclear energy experts who:
  - possess intercultural and language skills to permit employment in both Germany and France
  - possess the required technical expertise in the nuclear field for Germany and France
  - are integrated in a good international network
Continuous improvements and modernisation (1)

State-of-the-art safety features were included in the plant design. Continuous developments concerning safety aspects were taken into account by backfitting and modernisation.

Examples
(Improvement of barriers, improved reliability of normal operation):
- Exchange of piping/piping material
- Leak before break behaviour
- Improvement of main steam valves
- Digital I&C (instrumentation and control)
- Ageing management measures
- Optimized fuelling strategy
- Continuous improvements in the field of radiation protection and radiochemistry
- Continuous education of staff

Based on: Drucksache 15/3650 - Deutscher Bundestag
Continuous improvements and modernisation (2)

Examples “design basis accidents“
(decreasing the effects of possible fire, improving efficiency and reliability of safety techniques):
- Exchange of components
- Optimisation of sump suction strainers
- Improved fire protection concept

Examples “beyond design accidents“
(controlling of design-exceeding emergency cases, internal emergency management):
- Controlled containment venting
- Pressure relief of primary circuit
- Aircraft impact actions
- Autocatalytic hydrogen recombiners
Continuous improvements and modernisation (3)

Safety status and reliability of German NPPs

Example: probability of „Overall core damage frequency“ for GKN I
(in operation since 1976)

1 \cdot 10^{-4} \quad \text{IAEA-value for existing plants}

1 \cdot 10^{-5} \quad \text{IAEA-value for new built plants}

2 \cdot 10^{-6} \quad \text{Factor } \sim 100

1 \cdot 10^{-6} \quad \text{Factor } \sim 10

Residual risk

PSA value

2007
Continuous improvements and modernisation (4)
Safety assessments – regular national and international reviews

Goals:

- National and international feedback, based on neutral benchmarking
- National and international exchange of knowledge and experience
- Transparency
- Improvements according to national and international standards or best practices
- Assuring best quality in operating nuclear power plants on worldwide accepted and international guidelines
Continuous improvements and modernisation (5)
EnBW’s strategy on national and international reviews

Regular reviews:
- National peer review (by German NPP operators) once a year on each site
- International OSART/WANO peer reviews every 6-8 years on each site
  - GKN, WANO: 10/2001, follow-up 2005
  - GKN, OSART: 10/2007
- National „VGB-Sicherheitskultur-Bewertesystem“ (SBS, „safety culture self assessment“) every 2-3 years:
  - KWO: 02/2005
  - GKN: 06/2007
  - KKP: 12/2007
Summary

- Nuclear energy in Germany today is important, safe, reliable, sustainable and competitive
- German NPPs have a high safety level
- Modernisation is part of the daily business
- Ageing Management is implemented
- No matter how challenging the situation in Germany is, we keep our plants in an excellent condition to assure safe and competitive operation today - and for the future
- National and international reviews guarantee continuous improvements and high safety levels, based on actual guidelines
- EnBW is actively promoting and lobbying for a modernisation of today’s German phase out law with the goal to extend the lifetime of the existing plants