Today’s topics

**Thomas Kusterer, CFO:**
Financial discipline linked to an evolving corporate strategy and a challenging capital markets environment

**Frank Mastiaux, CEO:**
EnBW Strategic Roadmap: Status and a look ahead.

**Lothar Rieth, Group Expert Sustainability:**
Sustainability as an integral part of the strategy

**Georgios Stamatelopoulos, Senior Vice President Generation:**
Sustainable generation at EnBW
Thomas Kusterer, CFO

Financial discipline linked to an evolving corporate strategy and a challenging capital markets environment.
Sustainable capital markets player with focus on debt capital markets

Permanent access to debt capital markets necessary

Permanent investor dialogue to underline capital markets positioning

High financial gearing
Strong creditworthiness is based on EnBW’s conservative financial policy.
Evolution of corporate strategy requires development of KPIs in order to manage financial discipline.

- Regaining corporate health
- Regaining financial strength
- Further profitable growth

- Dynamic leverage ratio until year-end 2015
- Internal financing capability 2016 - 2020
- Beyond 2020
Strategy 2020 to manage the portfolio transformation necessary due to Energiewende

<table>
<thead>
<tr>
<th>Category</th>
<th>2012</th>
<th>2020</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generation and Trading</td>
<td>1.2</td>
<td>0.3</td>
<td>-80%</td>
</tr>
<tr>
<td>Renewable Energies</td>
<td>0.2</td>
<td>0.7</td>
<td>+250%</td>
</tr>
<tr>
<td>Grids</td>
<td>0.8</td>
<td>1.0</td>
<td>+25%</td>
</tr>
<tr>
<td>Sales</td>
<td>0.2</td>
<td>0.4</td>
<td>+100%</td>
</tr>
</tbody>
</table>

Adjusted EBITDA in € bn

2012: 2.4
2020: 2.4

EnBW Capital Markets Day 2018
Accounting effects resulting from low-interest rate environment at high level

Increase of provisions at continuing low interest rate level

Pension provisions¹ in € million

Nuclear provisions

Share of interest rate effect

1,842

5,649

3.8% 3.75% 2.2% 2.3% 1.9% 6,849

5.4% 5.0% 4.8% 4.7% 0.5%³


Share of interest rate effect

7,222

2,072

991 excluding KFK

2,072 including real interest effect caused by law initiated by KFK²

10,972


Discount rate

Interest rate

KFK

¹ Before deduction of Contractual Trust Agreement (CTA)
² KFK: Commission to examine the financing of the phase-out of nuclear power
³ Average interest rate after implementation of law initiated by KFK
Further investments to implement 2020 Strategy limited to internal resources only

8.4 New financial framework for operating business

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Asset Liability Management Model
Timely coverage of pension and nuclear obligations

Operating business
Management of net financial debt

By managing the level of net financial debt EnBW maintains high level of financial discipline

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Internal financing capability new key performance indicator

Limitation of cash relevant net investments to retained cash flow of an average €1.3 bn p.a.

Further implementation of strategy can be executed by internal financial resources only

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By managing the level of net financial debt EnBW maintains high level of financial discipline
Stick to financial discipline in a phase of “growth”

Allocation of investment spending 2021 - 2025

- Growth: 80% (€12 bn)
- Existing business activities: 20% (€12 bn)
- Sustainable power infrastructure: 33% (€12 bn)
- System-critical infrastructure: 53%
- Smart infrastructure for customers: 14%

2025 adjusted EBITDA for the Group > €3 bn

1 Rounded figure
Further evolution in KPI mechanism will be required.

Internal financing capability:

\[ \text{FFO} - \text{Dividends paid} = \text{RCF} \]

Economic debt:

\[ \text{Net debt} = \text{Net financial debt} + \text{Net debt relating to pension and nuclear obligations} \]

Of at least 16% until 2025 will support our A ratings.
Evolution of corporate strategy and financial policy are closely linked

› KPI mechanisms are adopted accordingly to meet future challenges

› Creditworthiness plays a central role in defining strategy

› We deliver what we promise

› Strategy and finance are focused on sustainability

› This long-term approach makes EnBW a reliable partner for investors

EnBW maintains its A ratings

Moody’s
Investors Service
Long-term rating: A3    Outlook: stable

Standard & Poor’s Ratings Services
Long-term rating: A-    Outlook: stable

Fitch Ratings
Long-term rating: A-    Outlook: stable
Frank Mastiaux, CEO
EnBW Strategic Roadmap: Status and a look ahead.
Our business environment and our strategic response

The energy market

Phase 1
Mainly driven by energy policy and regulation

Phase 2
Increasingly market-driven: cost efficiency gains, technical innovation, changing customer needs, changing competitive landscape

The energy market

Our strategic roadmap

EnBW 2020
2012 → 2020
Transformation

EnBW 2025
2020 → 2025
Growth
Group restructuring and renewal continues according to plan

Phase 1

- Mainly driven by energy policy and regulation
- Expansion of renewable energies
- Exit from nuclear power
- Decline in economic importance of conventional power generation
- Expansion of electricity/gas grids

<table>
<thead>
<tr>
<th></th>
<th>2012</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generation and Trading</td>
<td>€1.2 bn</td>
<td>€0.3 bn</td>
</tr>
<tr>
<td>Renewable Energies</td>
<td>€0.2 bn</td>
<td>€0.7 bn</td>
</tr>
<tr>
<td>Grids</td>
<td>€0.8 bn</td>
<td>€1.0 bn</td>
</tr>
<tr>
<td>Sales</td>
<td>€0.2 bn</td>
<td>€0.4 bn</td>
</tr>
</tbody>
</table>

+250% 1.2% 100% 25% -80%

in Adjusted EBITDA

€ 2.4 bn  € 2.4 bn
### Development of energy industry and energy policy environment in line with strategic assumptions

#### Energy Business Environment
- Current CO₂ price development leads to rising electricity prices on wholesale market, opportunity for renewable energies, hard coal still under pressure
- Competitive environment undergoing change

#### Energy Policy Environment
- Commitment to renewables: Target raised from 55% to about 65% in 2030
- Special tenders for renewables from 2019 onwards with modified auction design
- Acceleration of electricity grid expansion plans
- Growth in e-vehicles and charging infrastructure

#### Commission for Growth, Structural Change and Employment
- Four chairpersons, 28 voting members from associations, trade unions, affected regions, academia and industry
- Commission to help regions affected by structural change, boost investment and set phase-out date for coal-fired electricity generation
- Ambitious timetable
### Implementation of EnBW 2020 strategy (I)

<table>
<thead>
<tr>
<th>Category</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Decarbonisation:</strong></td>
<td>9 power plant blocks in reserve/Retrofit at Gaisburg (coal to gas)</td>
</tr>
<tr>
<td><strong>Nuclear energy:</strong></td>
<td>Fourth and last decommissioning permit Obrigheim/Future approvals planned with 1-2 steps</td>
</tr>
<tr>
<td><strong>Shareholding in VNG:</strong></td>
<td>Completion of the sale of VNG Norge</td>
</tr>
<tr>
<td><strong>Offshore wind:</strong></td>
<td>Hohe See and Albatros under construction (610 MW)/Trailblazing award for He Dreih (900 MW)/Taiwan and US market entry</td>
</tr>
<tr>
<td><strong>Onshore wind:</strong></td>
<td>~500 MW in operation/First steps towards internationalisation with 11 MW in Sweden</td>
</tr>
<tr>
<td><strong>Photovoltaic:</strong></td>
<td>Increasingly significant with planned expansion to 200 MW by 2020 and 600-800 MW by 2025</td>
</tr>
</tbody>
</table>
### Implementation of strategy EnBW 2020 (II)

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-mobility:</td>
<td>Leading position in DC based charging</td>
</tr>
<tr>
<td>Distributed energy:</td>
<td>Entry into PV and home storage market with acquisition of senec</td>
</tr>
<tr>
<td>Performance and</td>
<td>Realignment of process and system landscape</td>
</tr>
<tr>
<td>efficiency:</td>
<td></td>
</tr>
<tr>
<td>Customer-facing</td>
<td>Stabilisation of the B2C contract portfolio</td>
</tr>
<tr>
<td>business:</td>
<td></td>
</tr>
<tr>
<td>Growth:</td>
<td>Central growth focus on grids, with €7 billion investment up to 2020</td>
</tr>
<tr>
<td>Broadband:</td>
<td>Continued 15% growth rate/7 new regional municipalities added in 2018</td>
</tr>
</tbody>
</table>
Heading towards target achievement in 2020: financial turnaround in 2017

Adjusted EBITDA in €bn

<table>
<thead>
<tr>
<th>Year</th>
<th>Adjusted EBITDA in €bn</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>2.40</td>
</tr>
<tr>
<td>2013</td>
<td>2.23</td>
</tr>
<tr>
<td>2014</td>
<td>2.17</td>
</tr>
<tr>
<td>2015</td>
<td>2.11</td>
</tr>
<tr>
<td>2016</td>
<td>1.94</td>
</tr>
<tr>
<td>2017</td>
<td>2.11</td>
</tr>
<tr>
<td>2018</td>
<td>0%–+5%</td>
</tr>
<tr>
<td>2019</td>
<td>0%–+5%*</td>
</tr>
<tr>
<td>2020</td>
<td>≥2.40</td>
</tr>
</tbody>
</table>

* according to forecast 2018
Forecast 2018: further increase in earnings targeted

Adj. EBITDA 2017 in €m
- Group: 2,113
- Sales: 330
- Grids: 1,046
- Renewable Energies: 332
- Generation and Trading: 377

Forecast 2018 in %
- Group: 0 to +5
- Sales: -5 to -15
- Grids: +5 to +15
- Renewable Energies: +10 to +20
- Generation and Trading: 0 to -10
A look ahead: strategic development towards 2025

Phase 1
- Mainly driven by energy policy and regulation
- Expansion of renewable energies
- Exit from nuclear power
- Decline in economic importance of conventional power generation
- Expansion of electricity/gas grids

Phase 2
- Increasingly market-driven: cost efficiency gains, technical innovation, changing customer needs, changing competitive landscape
- Increased competitiveness and market integration of renewable energies
- Technical innovations driving new business models (e.g. e-mobility)
- Digitalisation and network energy solutions (e.g. smart grids)
- Customer needs: individualisation and transaction simplicity
Reminder: Core competence meets future market for critical infrastructure

EnBW core competence

Safe and reliable in the planning, construction and operation of complex infrastructures

German infrastructure market*

in €bn

<table>
<thead>
<tr>
<th>Year</th>
<th>Value (€bn)</th>
<th>Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>2025</td>
<td>150</td>
<td>+50%</td>
</tr>
</tbody>
</table>

* Source: Macquarie/Oxford Economics, own calculations
Reminder: Implementation of EnBW 2020 towards 2025: balanced portfolio with three strategic areas

2020

Generation & Trading
Renewable Energies
Grids
Sales

€2.4 bn

2025

Sustainable power infrastructure
System-critical infrastructure
Smart infrastructure for the customer

Adjusted EBITDA
Strategic implementation of EnBW 2025 (I)

**E-mobility**
- Leading position in DC based charging
- Half of the planned 1000 quick charging stations acquired
- EnBW mobility+ App first in line with 120k downloads and 19k charging options
- Success through partnerships

**Broadband**
- 15 percent growth rate
- 7 new local municipalities added in 2018
- 11,000 km high-speed network with 43k customers
- Expansion of infrastructure via GasLINE (VNG)
- Next steps: expansion of 5G mobile network

**Security infrastructure**
- Piloted security solutions for public spaces
- AI solutions for hazard detection
- Smart barrier access protection
- Flood detection sensors
- EnBW full crisis service:
  - Goal: Leading IT security total solution provider
  - Rapidly increasing order volume

GasLINE (grey) and NetCom (blue)
Strategic implementation of EnBW 2025 (II)

Corporate early stage
- AI for better road conditions
- Real-time monitoring of road condition via sensors
- AI algorithms analyse the road surface image by image
- Optimisation of road maintenance via web GIS
- Market size (EU): €400 m

Corporate late stage
- From hardware to data and services
- E-mobility, traffic management and safety in the smart city
- Sales target 2018: €8 m
- 23 employees/11 countries/230 customers

New ventures
- Delivers real-time parking data to simplify parking management
- Ideal for applications in cities, stadiums, airports, schools and more
- Less search time, less emissions, increased efficiency
- Realised already over 40 projects in over 15 countries

Other examples
- ChargeHere
- NOYSEE
- BINANDO
- energybase
- WTT Campus ONE
- LIV-T
- replex
- Lumenaza
- DZ4
EnBW on plan to meet 2020 strategic targets

New phase of energy market development has already started

First steps towards EnBW 2025 strategy taken successfully
Questions & Answers
Lothar Rieth,
Group Expert Sustainability
Sustainability as an integral part of the strategy
Sustainability as an integral part of the corporate strategy
Conversion of EnBW into a sustainable and innovative infrastructure partner

Our understanding of sustainability

- Creation of economic as well as ecological and social added value for our customers, shareholders, employees, partners and society as a whole - today and in the future.

- “We associate sustainable management with the claim to conduct all our business activities responsibly”

Strategy 2025 - Vision

“We are makers and designers of tomorrow’s infrastructure world - sustainable, innovative and reliable”

Stakeholder focus
Agenda

1. Integrating sustainability at EnBW

2. Selected sustainability issues - Group and core business

3. Reporting
Organisational and strategic anchoring of sustainability at EnBW

Organisation

- Frank Mastiaux
  - Corporate Strategy*

Responsibilities Team Sustainability:
- Impulse generator for sustainability at EnBW
- Contact and driving force for sustainability issues
- Internal sparring partner for sustainability issues (lightning rod, devil’s advocate and lucky charm)

Strategic Approach

- Strategy
- Stakeholder-Expectations
- ESG-Ratings
- Sustainability Concept
- Action-plan
- Disclosures
- Targets

Sustainability Concept
- Starting Point: Integral part of corporate strategy
- Vision: EnBW transforms into sustainable infrastructure partner
- Ambition level: Embedding sustainability in core business operations
- Logic of action: Stakeholder-based dialogue (internally / externally)

Sustainability Action Plan
- Operationalization of sustainability concept
- Determination of material areas of activity
- Identification of TOP activities including KPIs and target-setting
- Establishment of monitoring process

*Corporate Development, Strategy & Energy Economics
EnBW’s performance management system includes non-financial key performance indicators and targets

### Non-financial key performance indicators and targets

1. **Customers and society goal dimension**
   - Reputation Index: 2016 - 50.0, 2017 - 52.1, Trend to 55.4 by 2020
   - SAIDI (electricity) in min./year: 2016 - 16, 2017 - 19, Trend to <25 by 2020

2. **Employees goal dimension**
   - Employee Commitment Index (ECI): 2016 - 59, 2017 - 60, Trend to 65 by 2020
   - LTIF (occupational safety): 2016 - 3.9, 2017 - 3.0, Trend to <previous year

3. **Environment goal dimension**
   - Installed output of RE in GW: 2016 - 3.1, 2017 - 3.4, Trend to 5.0 by 2020
   - Share of generation capacity (by RE in %): 2016 - 23.1, 2017 - 25.9, Trend to >40 by 2020
   - CO₂ intensity in g/kWh: 2016 - 577, 2017 - 556, Trend to -15% to -20% by 2020

**Financial indicators and targets**

- **Strategy 2020** to manage the portfolio transformation necessary due to Energiewende.
TOP KPI CO₂ intensity: EnBW is committed to Energy Transition ("Energiewende")

- EnBW’s long-term strategy is in line with the Paris Agreement and the goals of the EU and the German government
- EnBW has introduced a **TOP KPI** in 2013, covering expansion of RE, and in 2016 a **TOP KPI**, focusing on CO₂ intensity*
- Long-term forecasts includes **scenarios with ambitious climate protection targets** (see TCFD recommendations)
- **TOP KPI CO₂ intensity** reflects the great importance of climate protection as an economic and ecological goal of EnBW
- EnBW strives for greatest possible CO₂-free power generation – with grid expansion, we support climate-friendly energy supply
- EnBW strongly advocates a **price floor for CO₂** of 25 EUR/t in 2020 and 30 EUR/t in 2025

*The calculation basis for the key performance indicator CO₂ intensity is the amount of CO₂ emissions from own generation of electricity for the Group, as well as the quantity of electricity generated by the Group without the contribution made by the nuclear power plants. By excluding the electricity generated by nuclear power plants, the performance indicator will not be influenced by the phasing out of nuclear energy in the coming years.
1. Integrating sustainability at EnBW

2. Selected sustainability issues - Group and core business

3. Reporting
### Examples

<table>
<thead>
<tr>
<th>Hohe See and Albatros under construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>~ 500 MW in operation</td>
</tr>
<tr>
<td>Steady expansion until 2025</td>
</tr>
</tbody>
</table>

### Relevance of sustainability

#### Economic aspects

- Investment in sustainable business models
- Active shaping of decarbonisation in relation to coal-based conventional generation

#### Environmental aspects

- Further expansion of low-carbon electricity generation
- Positive contribution to climate protection – saving of CO$_2$ emissions

#### Social aspects

- Principle of partnership – chance for potential investors (e.g. local authorities, private citizens) to participate in projects
- Citizen turn from consumer to prosumer, thereby playing an active role in shaping the “Energiewende”, producing energy and consuming it (bi-directional flow of energy)
Examples

“Ultranet” and “SuedLink” (transmission grid)

Development of the distribution grid (Smart Grid)

Provision of grid-related services for customers

Relevance of sustainability

Economic aspects

› Maintaining supply reliability in Baden-Württemberg – reliable energy supply for the economy and health care

Environmental aspects

› Grid business enables integration of renewable energies (and E-mobility), that contributes (also through sector coupling) to the success of the energy turnaround

Social aspects

› Expansion of (transmission) grids is gaining attention amongst general public – early stakeholder involvement of citizens provides transparency and creates trust
Sustainability in the core business – Smart infrastructure for the customer

Examples

- E-mobility: Charging stations, EnBW mobility app etc.
- Urban infrastructure and public security
- Development of intelligent products, e.g. SMIGHT

Relevance of sustainability

Economic aspects
› Contributes to the success of the mobility shift
› Contributes to economic attractiveness of industrial zones and industrial estates

Environmental aspects
› Green electricity supply (reducing and avoiding emissions)
› Reduction of emissions (particulate matter) in cities/municipalities

Social aspects
› Cities/municipalities will become more attractive
› Cities and municipalities become more livable and safety
Selected group-wide sustainability highlights focusing on the most relevant resource – our employees

„Mobility & Staff“

➤ Project „New Mobility“ (mobility solutions for employees)

➤ Targets:
  – Enabling flexible solutions
  – Creating enthusiasm for sustainable mobility
  – Contributing to climate protection and reduction of traffic

➤ Employee offerings:
  – BMW i3 - Leasing
  – Bike - Leasing
  – Jobticket

„Diversity & Staff“

➤ Motto: “Diversity generates added value”

➤ Diverse workforce, different criteria – gender, age, disability, sexual identity...

➤ Goal: Respond to needs of market, accelerate speed of innovation, be an attractive employer

➤ Events (2018):
  – Initiative “Chefsache”

➤ Upcoming Chief Personnel Officer (in 2019): Colette Rückert-Hennen

„Transformation & Staff“

Selected Events across EnBW:

➤ Strategy Dialogue Workshops [2017/2018]

➤ “Next level” – Workshops (2018)

➤ “Leadership Forum” [October 2018]

➤ Regular employee meetings “EnBW Aktuell” – e.g. Focus digitization” [April 2018]
1. Integrating sustainability at EnBW

2. Selected sustainability issues - Group and core business

3. Reporting
Evolutionary development of EnBW’s annual corporate reporting – being a driving force in international initiatives
Regular external evaluation by sustainability rating agencies – far above average score

- **ISS-Oekom**
  - Prime Status: B- (2017)
- **Sustainalytics**
  - Outperformer: 73/100 (2018)
- **Carbon Disclosure Project**
- **Ecovadis**
  - Silver Recognition Level: 48/100 (2018)
Sustainable finance – towards a new paradigm?
EnBW has published Green Financing Framework

Why Sustainable Finance?

» Financing of green investments in line with EnBW corporate strategy 2020/2025

» Underlines credibility of EnBW’s ESG approach and commitment to climate protection

» Expanding investor base, meeting expectations of investors with particular sustainability requirements

» “Green Bonds are the future”, very often heard these days

Publication of EnBW’s Green Financing Framework

» The net proceeds of future green financing instruments will be used to finance or refinance Eligible Green Projects

» Under the Green Financing Framework EnBW is able to issue Green Bonds

» EnBW’s framework is inspired by, and intends to follow the Green Bond Principles

Possible asset categories

The Green Financing Framework lists eligible asset categories:

» Renewable energy projects

» Energy efficiency projects

» Clean transportation projects

Contribution to TOP KPIs & SDGs
Contribution of EnBW to Sustainable Development Goals (SDGs)

Relevant SDGs for EnBW

- EnBW Strategy 2020/2025
- EnBW Sustainability Concept

Selected business activities

- Construction/operation of renewable energies
- Development of smart grids
- ... (more to come)

Further SDGs:

4 Quality Education
5 Gender Equality
6 Clean Water and Sanitation
7 Clean Energy
8 Caring Jobs and Economic Growth
12 Responsible Consumption

Further selected business activities for EnBW:

- Expansion of E-mobility
- Further expansion of broadband networks
- ... (more to come)

- Smart city solutions for cities/municipalities
- Research and development, innovation campus
- ... (more to come)

- Sustainable operational mobility
- New risk maps including climate protection
- ... (more to come)
Looking ahead – possible next sustainability actions

- Social urban infrastructure
- Sustainable operational mobility
- Sustainable Finance
- “EnBW cafeteria of tomorrow – sustainable, creative and healthy”
Georgios Stamatselopoulous, Senior Vice President Generation

Sustainable generation at EnBW
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➢ Overview EnBW’s Generation Portfolio

➢ Challenges linked with the conventional generation

➢ Challenges linked with the renewables generation

➢ Dominating Trends: Decarbonisation, Digitalisation, Security (of Supply)

➢ Way forward for a sustainable generation business
Overview over EnBW’s Generation Portfolio
Renewable and conventional generation

### Power generation [gross values]:

<table>
<thead>
<tr>
<th>Type</th>
<th>Installed output</th>
<th>Sites/Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hard coal</strong></td>
<td>3,848 MW</td>
<td>5 sites</td>
</tr>
<tr>
<td><strong>Gas/Oil</strong></td>
<td>1,282 MW</td>
<td>5 sites</td>
</tr>
<tr>
<td><strong>Pump storage/ storage plants</strong></td>
<td>133 MW</td>
<td>2 sites</td>
</tr>
<tr>
<td><strong>Thermal waste treatment</strong></td>
<td>Capacity: 480,000 t/a (≈30% of waste in Ba-Wü)</td>
<td>one site</td>
</tr>
<tr>
<td><strong>Operational participations</strong></td>
<td>2,237 MW</td>
<td>GKM, Lippendorf, Schluchseewerke, VIW</td>
</tr>
<tr>
<td><strong>Offshore</strong></td>
<td>336.3 MW</td>
<td>2 wind farms</td>
</tr>
<tr>
<td><strong>Onshore</strong></td>
<td>492 MW</td>
<td>47 wind farms</td>
</tr>
<tr>
<td><strong>Hydropower</strong></td>
<td>377 MW</td>
<td>61 run-of-river power plants</td>
</tr>
<tr>
<td><strong>Photovoltaics</strong></td>
<td>77 MWp</td>
<td>21 solar farms</td>
</tr>
<tr>
<td><strong>Biomass</strong></td>
<td>0.75 MW</td>
<td>3 sites</td>
</tr>
</tbody>
</table>
Challenges linked with the conventional generation Climate protection goals for the energy sector

Greenhouse gas emissions for the energy industry
[in m t CO₂ equivalent]

- Two main reasons for target achievement in the energy sector:
  - Decommissioning of hard coal power plants
    (approx. 11 GW)\(^1\)
  - Development of renewable energy
    (currently 36% of electricity generation)\(^2\)

- Further decommissioning of coal-fired power plants would be an additional contribution in anticipation of a more ambitious reduction for 2030 (61-62% target reduction in the energy sector vs. 55% in total for Germany).

\(^1\) BNetzA – Power plant shutdown declarations
\(^2\) ZSW und BDEW to the share of renewable energies in electricity consumption in 2017

Energy sector will successfully implement its reduction targets by 2020
Challenges linked with the conventional generation
EnBW’s contribution to the climate protection goals

The CO₂ intensity of the in-house generation decreases despite the compensation of the decommissioning of KKP2 and higher redispacht assignments for the conventional generation.

The decline is due to the consistent development of renewable energies and due to the larger share of electricity generation by more efficient fossil-fueled power plants, like in particular through the operation of RDK 8 in Karlsruhe.

The reduction target of -15 to -20%, which was set for the base year 2015, will be reached in 2020.
Challenges linked with the conventional generation
Development of wholesale prices in Germany

Development of wholesale prices for electricity since 2011

Development of the Clean Dark Spread (Peak) since 2011
Challenges linked with the conventional generation
Economic efficiency and decommissioning of older plants

› Reduction of employees
Employee capacity reduction in the power plant field of EnBW

› Optimisation of availability and maintenance
  – Cost reduction for one hour power plant availability
  – Safety and environmental aspects are mandatory elements and excluded from the cost reduction.
  – Condition monitoring and risk modelling allow a better estimation of downtime costs and the efficiency of maintenance measures.

› Decommissioning + Divestment of non-economic units
Transfer of 9 units to the Reserve Capacity + Divestment of two coal-fired power plants

<table>
<thead>
<tr>
<th>Year</th>
<th>Capacity</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>433 MW</td>
<td>HC</td>
<td>Mar 2017</td>
</tr>
<tr>
<td>2013</td>
<td>125 MW</td>
<td>HC</td>
<td>Apr 2014</td>
</tr>
<tr>
<td>2013</td>
<td>148 MW</td>
<td>HC</td>
<td>Jul 2013</td>
</tr>
<tr>
<td>2013</td>
<td>96 MW</td>
<td>HC</td>
<td>Jul 2013</td>
</tr>
<tr>
<td>2014</td>
<td>159 MW</td>
<td>Lignite</td>
<td>Jan 2014</td>
</tr>
<tr>
<td>2014</td>
<td>125 MW</td>
<td>HC</td>
<td>Apr 2014</td>
</tr>
<tr>
<td>2013</td>
<td>125 MW</td>
<td>HC</td>
<td>Apr 2014</td>
</tr>
<tr>
<td>2014</td>
<td>96 MW</td>
<td>HC</td>
<td>Jul 2013</td>
</tr>
<tr>
<td>2015</td>
<td>721 MW</td>
<td>HC</td>
<td>Jan 2015</td>
</tr>
</tbody>
</table>

RDK 4S (GAS, 353 MW, Dec 2016)
MAR GT II (Fuel oil, 77 MW, Jul 2013)
MAR GT III (Fuel oil, 85 MW, Jul 2013)
MAR DT III (Fuel oil, 262 MW, Jul 2013)

BEX (HC, 721 MW, Jan 2015)
BUS (Lignite, 159 MW, Jan 2014)
Challenges linked with the renewables generation
EnBW’s installed wind onshore and PV capacity

The installed wind onshore and PV capacity have almost doubled since 2016

*... including plants under construction
Challenges linked with the renewables generation
Outlook: Wind on- and offshore in Germany

Onshore: New “BImSchG” permits (full year)

<table>
<thead>
<tr>
<th>Year</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>3,640</td>
<td>9,177</td>
<td>2,800</td>
<td>1,423</td>
</tr>
</tbody>
</table>

Target of growth EEG2017

Offshore: Extension p.a. (actual state)

<table>
<thead>
<tr>
<th>Year</th>
<th>2017</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>2,289</td>
<td>1,471</td>
</tr>
</tbody>
</table>

Extension p.a. (Target of EEG)

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>1,275</td>
<td>849</td>
<td>500</td>
<td>500</td>
<td>700</td>
<td>700</td>
<td>700</td>
<td>700</td>
<td>700</td>
</tr>
</tbody>
</table>

Source: Bundesnetzagentur 08 2018

Source: Umwelt-Bundesamt/AGEE 03 2018, EEG
Challenges linked with the renewables generation
Renewables meet the market, e.g. Wind Offshore

Note: Without taking into account regulatory differences; Bids in national currencies converted to €
Challenges linked with the renewables generation
New markets beyond Germany

Source: GWEC, Bloomberg Offshore Wind market outlook
Challenges linked with the renewables generation
New markets beyond Germany

EnBW business segments and markets in 2025

services for third parties
In-house generation portfolio (onshore / offshore)
Home market
New developed markets
Perspective markets
informative: Turkey

Rational

› Engagement in new markets in neighboring European countries and entering selective global markets stabilizes the growth path and achieves diversification of the regulatory risk
  - Focus on offshore project development in Europe (depending on the market development and attractiveness of tenders) and in global markets, such as North America and Asia (especially USA and Taiwan)
  - Onshore: Entering selective foreign markets (in 2018: market entry France + Sweden), ideally for the entire value chain

› Expansion of the service business (in-house portfolio, services for third parties), thus adding more assets in O&M and fulfilling the increasing importance of plant operation, maintenance, marketing and repowering / dismantling in the target markets
Dominating Trends
Decarbonisation

Objectives and key data
› Improving efficiency by reducing maintenance and personnel costs as well as increasing the efficiency of electricity and heat generation
› Improvement of climate protection and emissions
› 5 hot water boilers (210 MWth)
› Pressure-free heat storage (300 MWth)
› 3 gas engines (30 MWe/30 MWth)

Current project status and outlook
› Start of construction in January 2017 with pile foundation
› Foundations / floor panels for the main building as well as walls / ceiling for the gas engine building are completed
› Main assembly activities started in November 2017
› Commissioning since end of May 2018
› Overall plant optimization in November 2018
› Commercial Commissioning December 2018
Initiatives for cost reduction:

- Condition monitoring for the identification of emerging failures
- Predictive Maintenance for estimation of future maintenance costs and planning of resources and budget
- Savings through in-house operation (Baltic 1 since 2016) and optimisation of offshore wind farms
Temperature forecast of \(-9^\circ\text{K}\) compared to long-time average:
- France, Italy and Belgium are announcing possible supply shortages.

Low water and ice formation in the rivers:
- Restrictions in the generation of hydropower.
- Coal shortages at power plant locations in southwest Germany due to shipping restrictions.

Non-availability of nuclear power plants:
- Refuelling in connection with nuclear fuel taxation in southern Germany
- Unavailability in France due to audit by “Autorité de Sûreté Nucléaire (ASN)” and planned downtime.

Very low feed-in of renewable energy to the grid:
- Wind energy between 3 GW - 4 GW (<10% of the installed output of 50 GW).
- Maximum solar feed below 10 GW (<25% of the installed output of 41 GW)

EnBW contributed significantly in securing grid stability by operating its power plants. In peak, every available rotating machine was in operation.
Dominating Trends
Security of supply – An example from a realistic future

**Tuesday, 30.3.2027**

Weather forecasts for today and for tomorrow are confirmed ... 15 m/s wind speed.

Wind farm runs with the capacity of 900 MW

Forward market prices and trading volumes of the electricity exchange are advantageous

Trading sells 900 MW in the period from 6 - 8 pm on the forward market for the day after

**Wednesday, 31.3.2027**

Weather forecast from the previous day not met (sudden weather change) ... only 5 m/s wind speed

Wind farm runs at 5:45 pm with the capacity of 450 MW

Shortfall of the sold trading quantity

Options:
- Trading buys missing quantity on the on the energy stock exchange for 1000 €/MWh
- Trading calls for two gas turbine from its own portfolio to start up.
- Checking option not to deliver: Height of penalty?

The availability of in-house adjustable generation is favorable and advantageous
Dominating Trends
Security of supply: What can be adjustable generation?

CONVENTIONAL
- Gas
- Coal

STORAGE TECHNOLOGY
- Pumped-storage
- Battery storage

ADJUSTABLE GENERATION

RENEWABLES
- Biomass/ Biogas
- Bioenergy
- Green gases (H₂, CH₄)
Way forward for a sustainable generation business

Keep restructuring the conventional generation
› Cost consolidation
› Fuel switch to gas, or biomass
› Flexibility of operation
› Flexibility of response

Realise the project pipeline in Renewables

Optimisation of Renewables operation
› Cost reduction, especially in Wind Offshore
› Scale effects
› Participate at all stages of the value chain

Establish load adjustable generation:
› Seek opportunities for gas turbines installation
› Using batteries for primary regulation
› Use of biogas, or other green gases in generation
Questions & Answers
Important note

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