Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

Instruments for the Promotion of Wind Energy and its Grid Integration in Europe

Kai Schlegelmilch

Federal Ministry for the Environment,
Nature Conservation and Nuclear Safety (BMU), Germany

Beijing, 18th November 2008

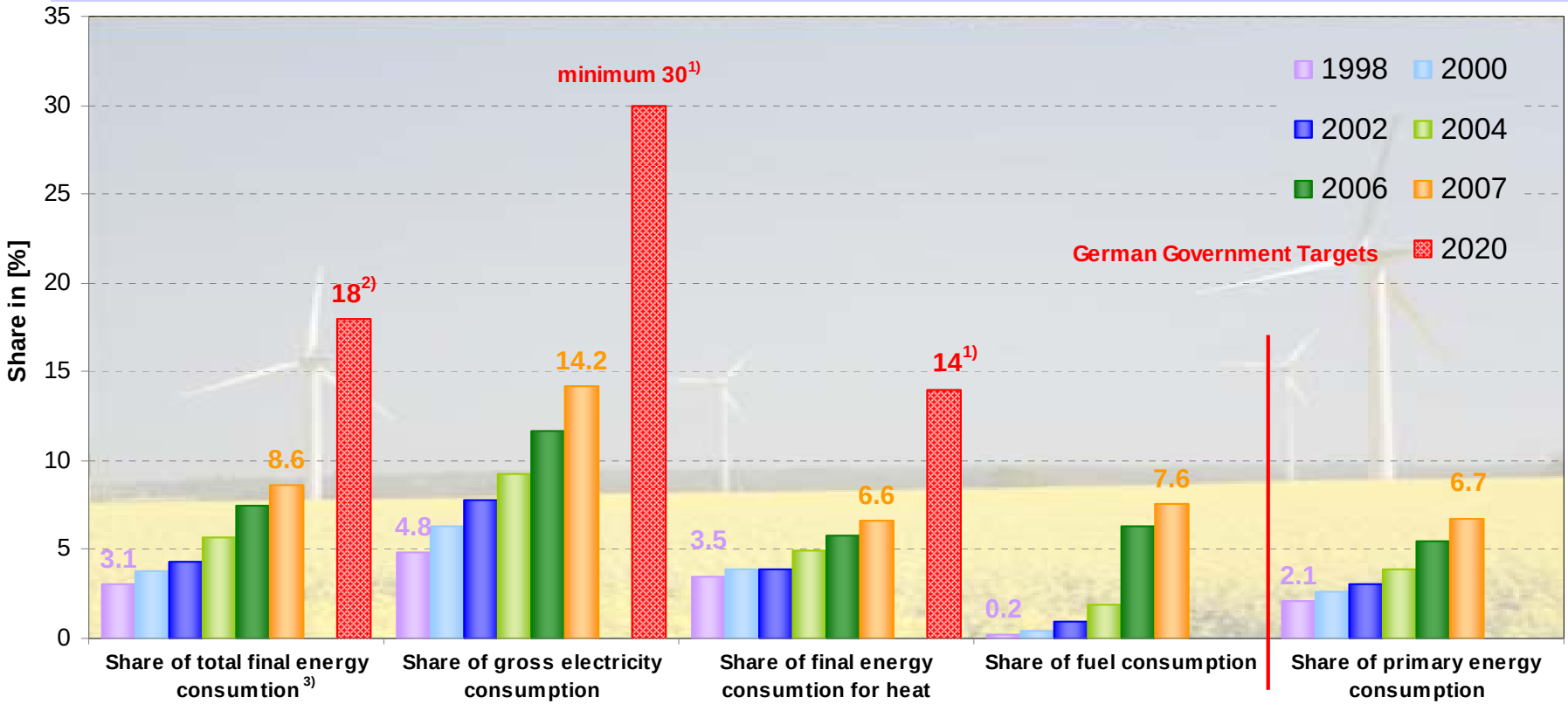
Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

Renewable Energy Sources Act

These first slides are NOT yet available in Chinese

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

Renewable energy sources as a share of energy supply in Germany



[1)] Resolution of the German Parlament, 6th June 2008;

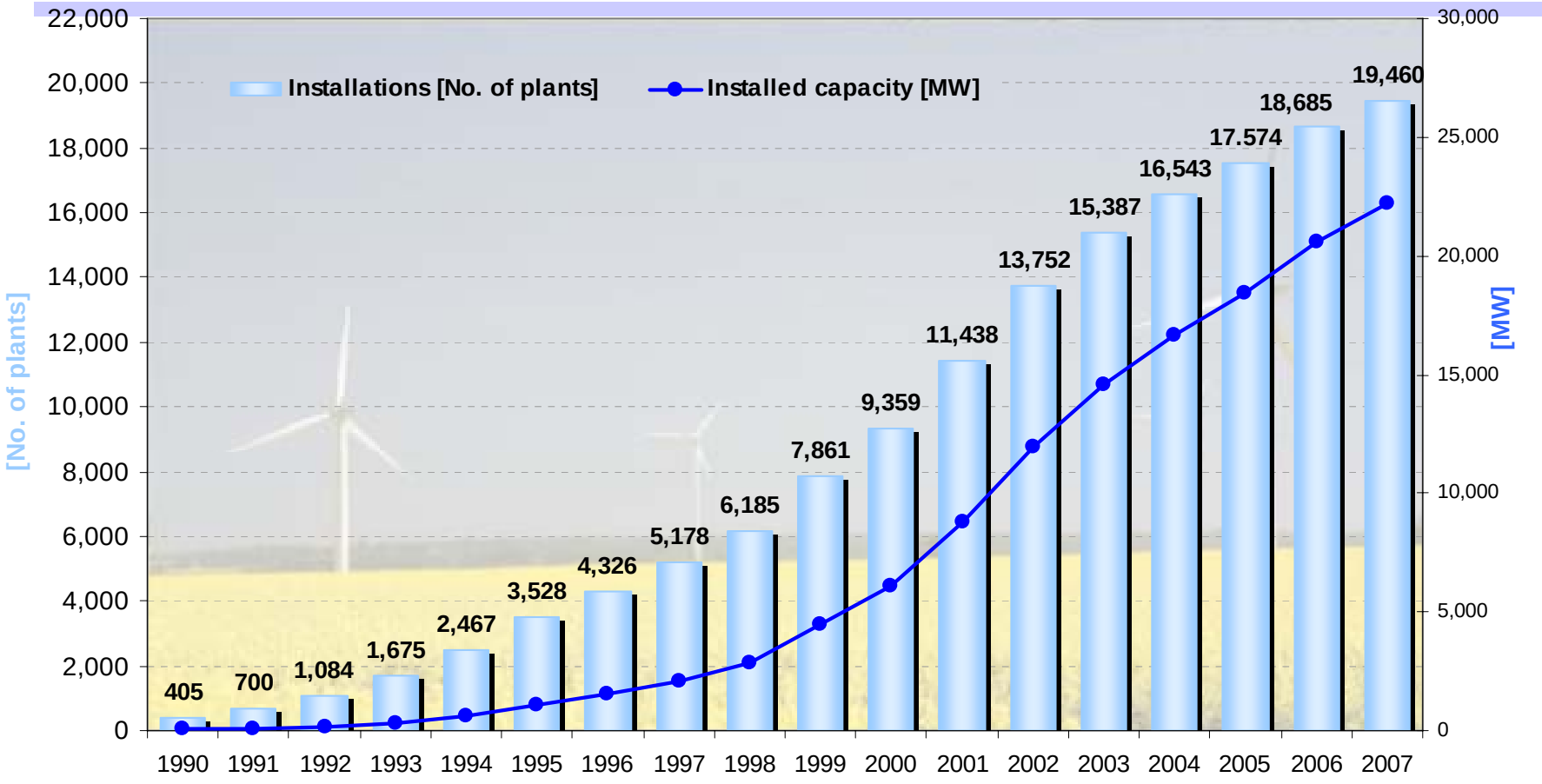
[2)] Directive of the Euopean Parlament and the Council on the promotion of the use of energy from renewable sources, 23 January 2008;

[3)] For calculating the share of primary energy consumption (PEC), the (official) physical energy content method has been used (acc. to the substitution method: 9.2 %)

RE - renewable energiy, Source: BMU-Brochure:"Renewable energy sources in figures – national and international development", KI III 1; Version: June 2008; all figures provisional

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

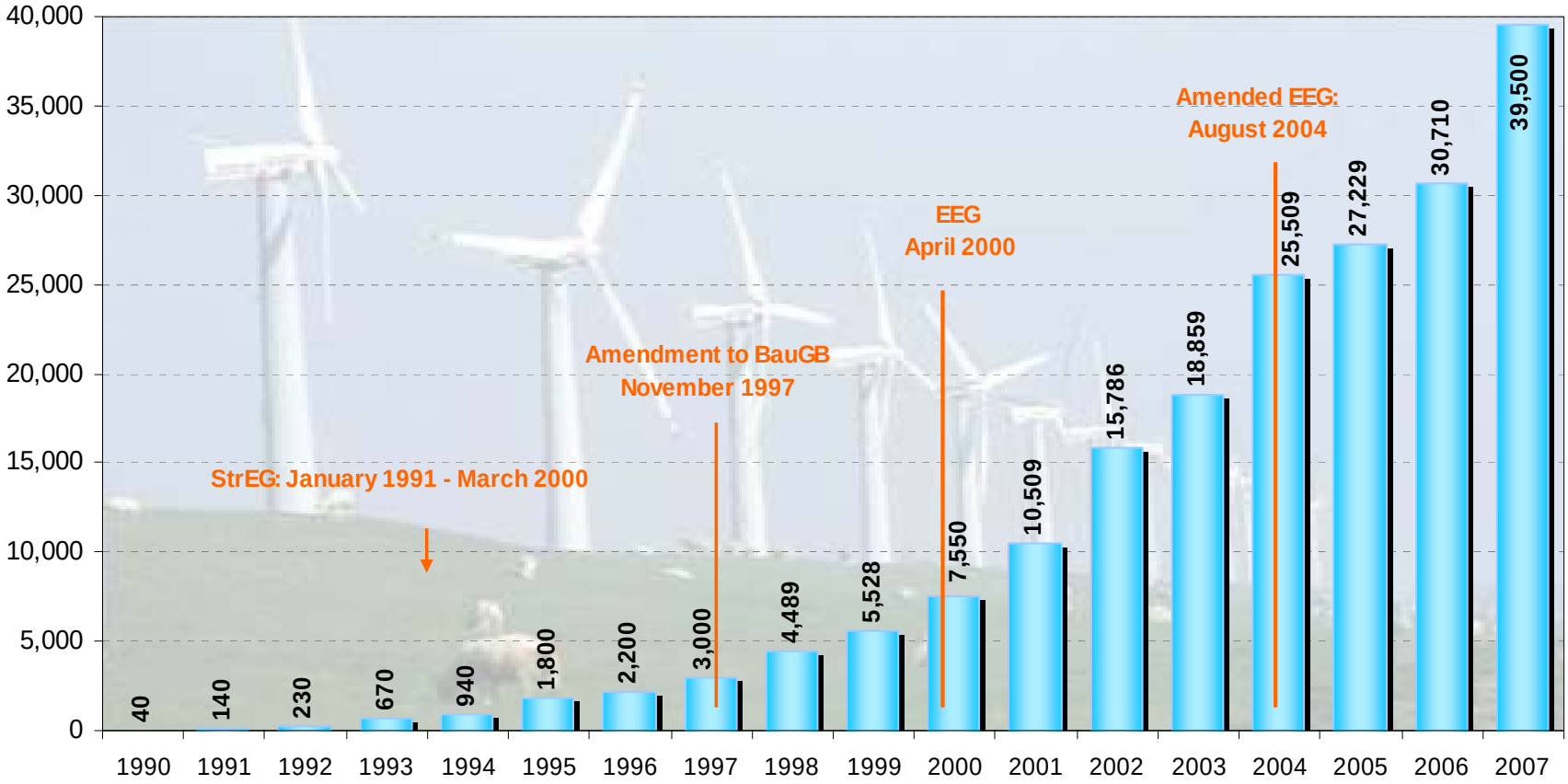
Number of wind energy plants and installed capacity in Germany, 1990 - 2007



Source: Molly, J.P.: Status der Windenergienutzung-Stand 31.12.2007; Deutsches Windenergie-Institut (DEWI); provisional figures

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

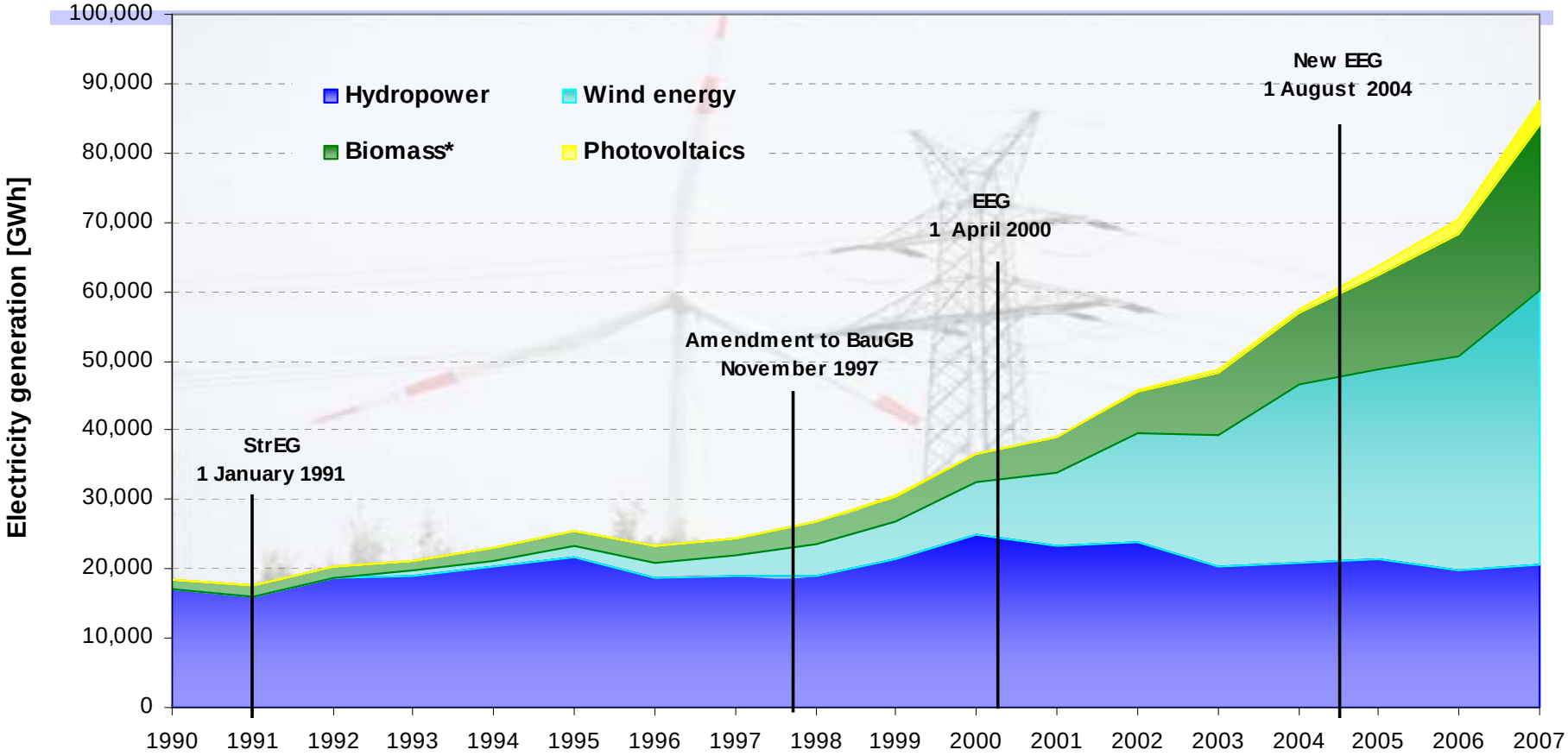
Development of wind energy use in Germany, 1990 - 2007



Source: BMU-Brochure "Renew able energy sources in figures – national and international development", KI III 1; Version: June 2008; provisional figures

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

Development of electricity generation from renewable energies in Germany, 1990 - 2007



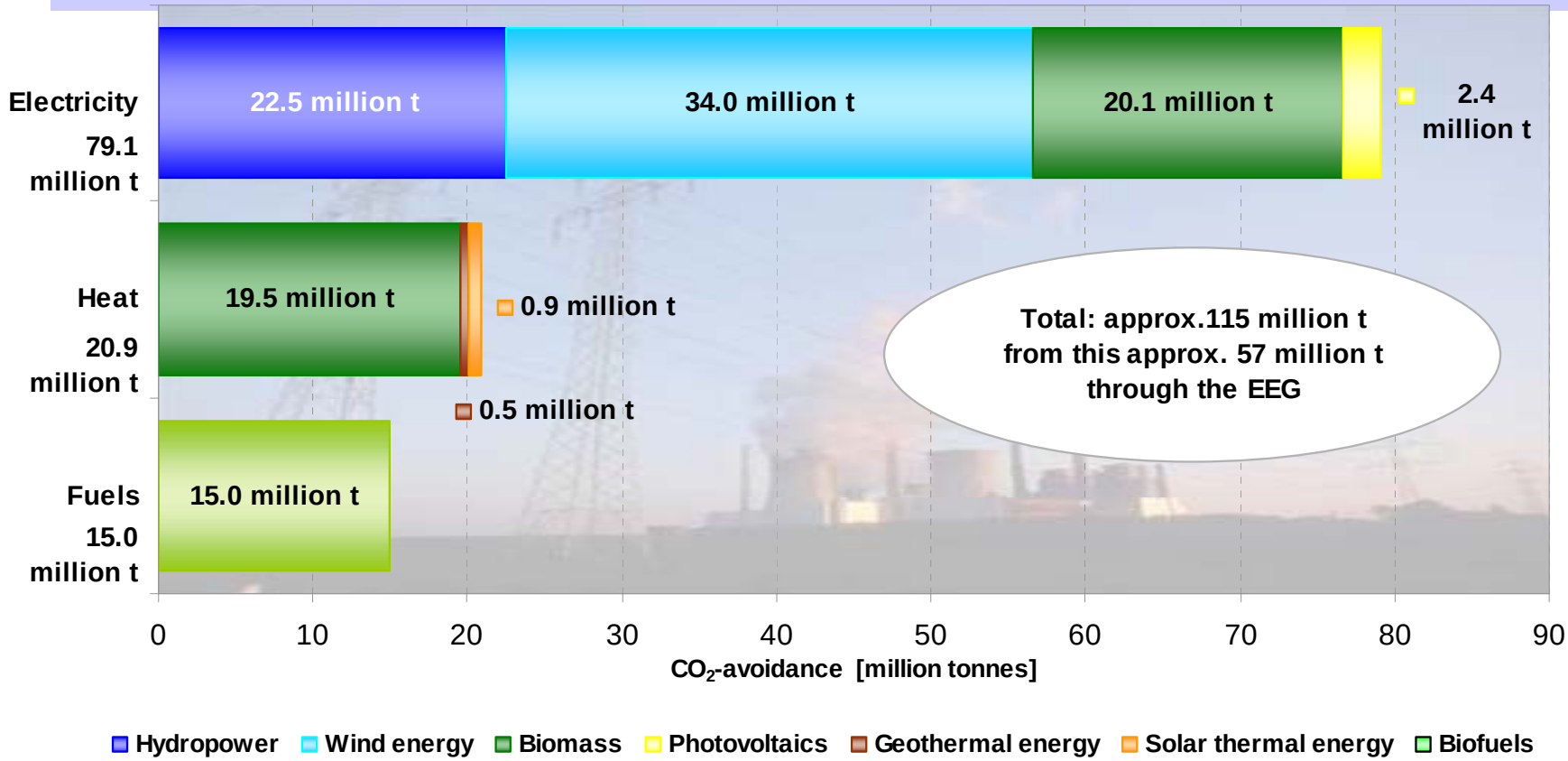
*solid, liquid, gaseous biomass, biogenic share of waste, landfill and sewage gas;

StrEG: Act on the Sale of Electricity to the Grid; BauGB: Constuction Code; Electricity from geothermal energy is not presented due to the negligible quantities of electricity produced;

Source: BMU-Brochure: "Renewable energy sources in figures – national and international development", KI III 1; Version: June 2008; provisional figures

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

Total CO_2 avoidance via the use of renewable energy sources in Germany, 2007

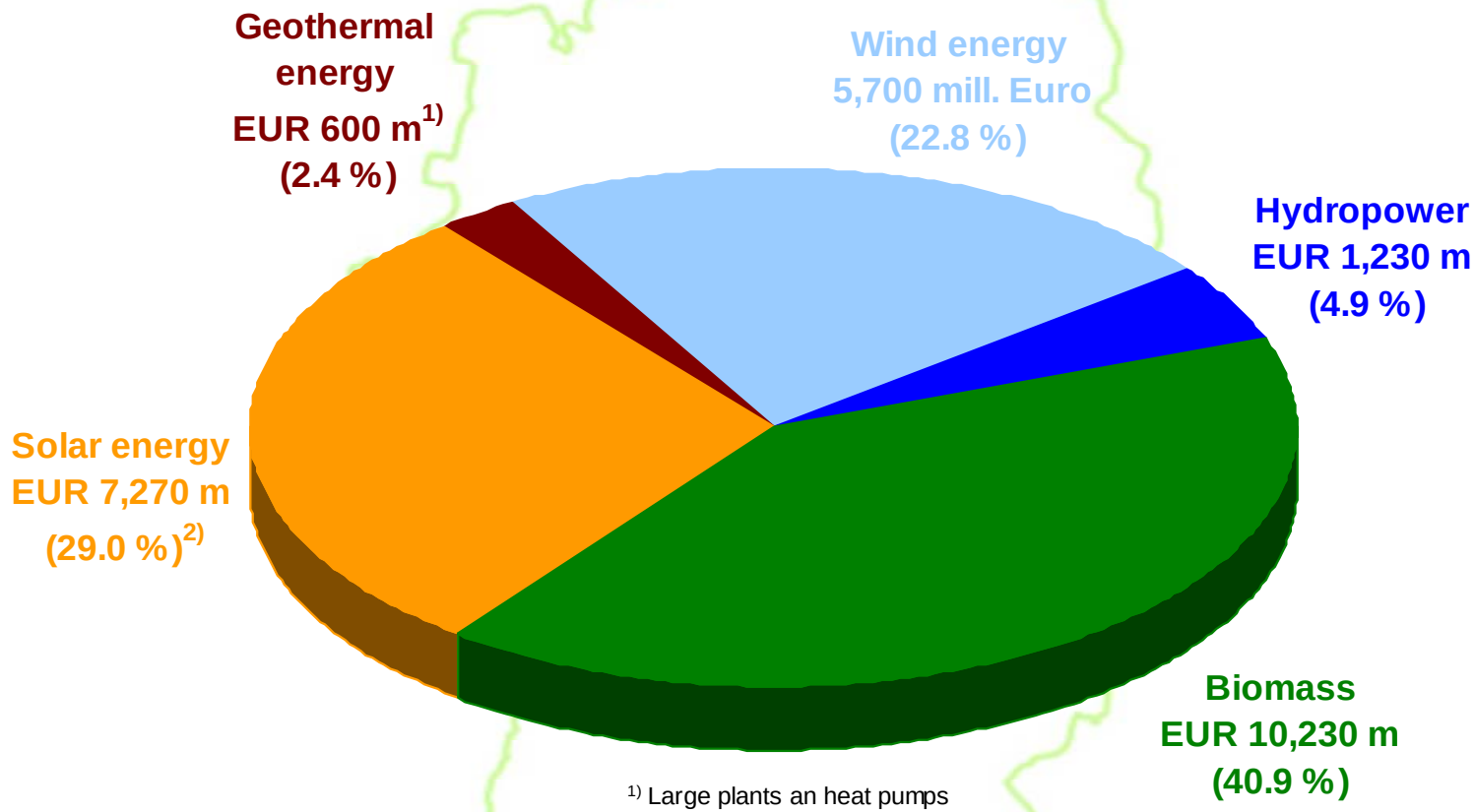


Deviations in the totals are due to rounding

Source: BMU-Brochure: "Renew able energy sources in figures – national and international development", KI III 1; Version: June 2008; provisional figures

Total Turnover from Renewable Energy Sources in Germany, 2007

Total: approx. € 25 billion



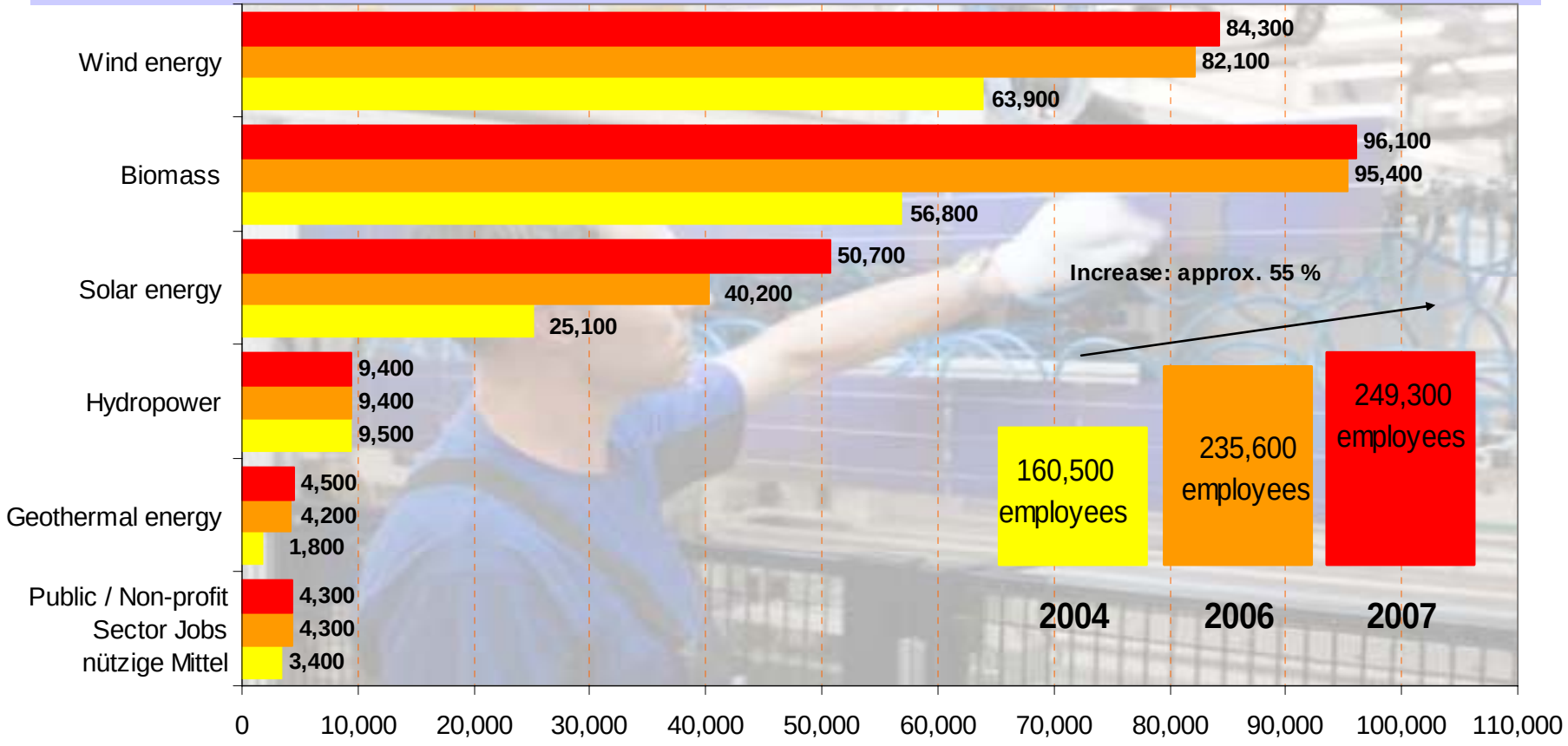
[1)] Large plants an heat pumps

[2)] Photovoltaics and solar thermal energy; Version: June 2008; all figures provisional

Source: BMU-Brochure: "Renew able energy sources in figures – national and international development", KI III 1; Version: June 2008; provisional figures

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

Employees in the German renewable energy sector 2004, 2006 and 2007



Source: BMU Projekt "Kurz- und langfristige Auswirkungen des Ausbaus der erneuerbaren Energien auf den deutschen Arbeitsmarkt", KI III 1; interim report March 2008

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

Now, the likely most important slide follows:

Please remember it.

We are most willing to share our experiences with our Chinese friends

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

The major reason for this renewable energy success story is the Renewable Energy Sources Act (EEG) which provides for:

1. **Priority grid access and transmission of electricity from renewables**
2. **Grid access costs are borne by grid owner**
3. **Legal guarantee of a fixed tariff for 20 years for every kilowatthour that is fed into the grid**

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

The following slides are available in Chinese.

They give ADDITIONAL information on the political and economic framework for renewables in Germany

Hence, please ensure that NOW the slides in Chinese are also displayed.

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

Contents:

A. Improving the grid integration of wind farms under the 2009 Renewable Energy Sources Act (EEG)

(system service bonus and technical requirements)

B. 2009 Power Grid Expansion Act

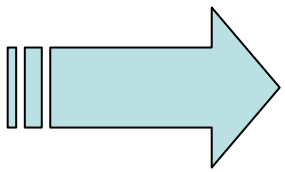
Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

I. Improving the grid integration of wind farms under the 2009 Renewable Energy Sources Act (EEG)

System service bonus and Medium Voltage Directive

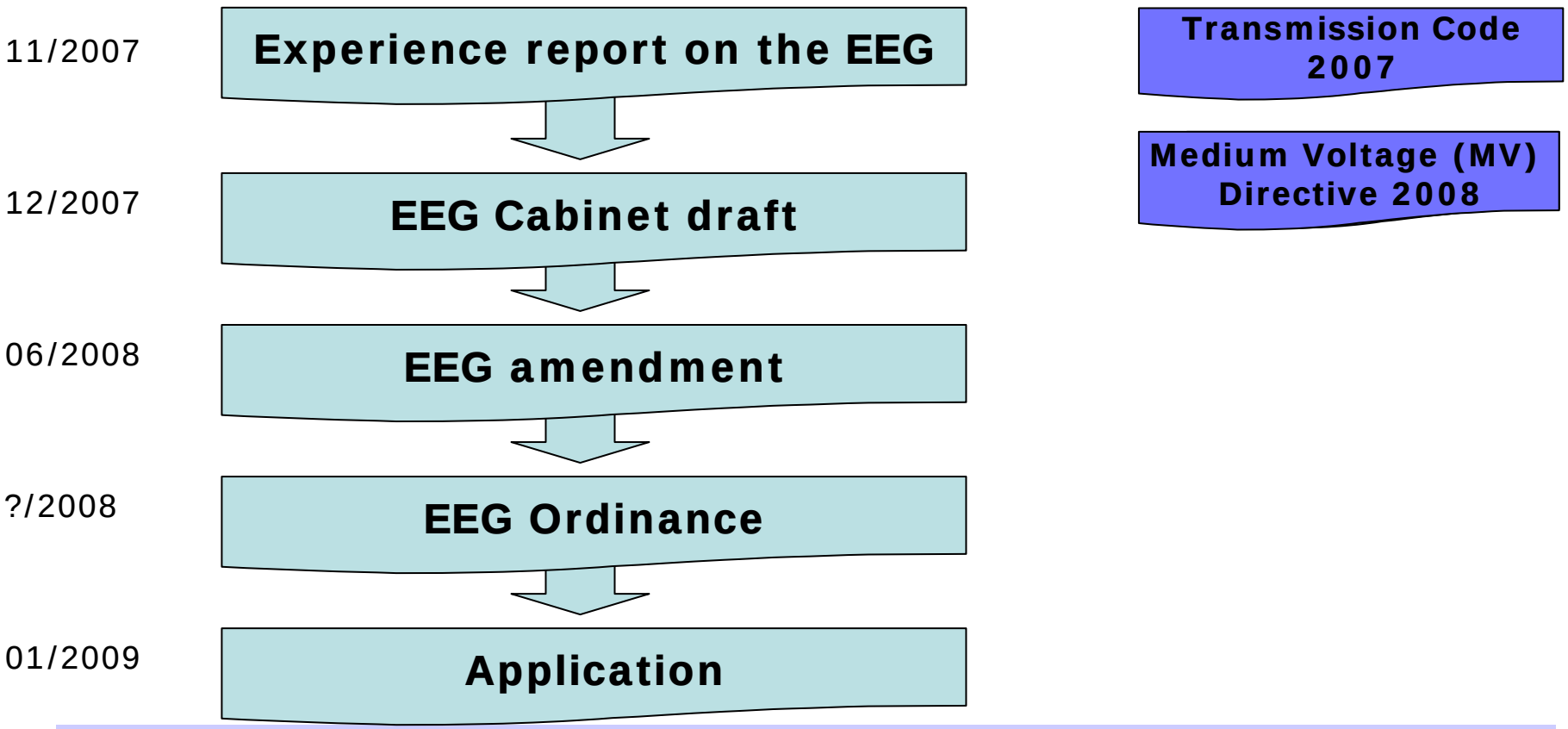
Introduction (I)
Background

- Long-term maintenance of grid reliability
- Performance capabilities of modern wind farms
- Nationwide compliance with connection conditions
- Extra costs for plant technology



EEG
system service
bonus

Introduction (II)



Introduction (III)
New provisions in the 2009 EEG

• Connection requirements (from 1 January 2009)	§ 6 No. 2
• System service bonus for new plants before 1 January 2014 → plus 0.5 Ct/kWh, initial tariff	§ 29 para. 2 sentence 4
• System service bonus for existing plant voluntarily upgraded in 2009/2010 → plus 0.7 Ct/kWh, for 5 years	§ 66 No. 6
• Regulatory powers	§ 64 para. 1 No. 1

Technical requirements (I)

Particular requirements

- As in the 2008 Medium Voltage Directive
- Extended reactive power range, 3 variants
- Run-through of asymmetrical errors

Analysis: Transmission Code 2007 needs to be defined more precisely!

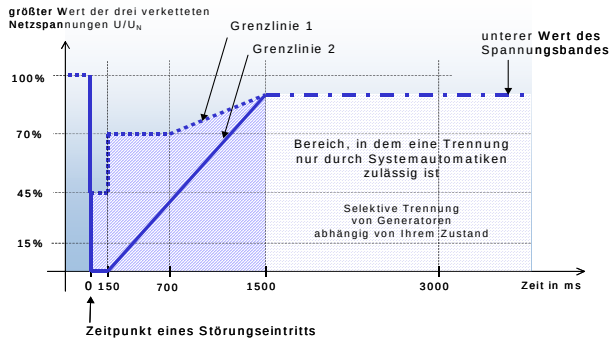
→ More precise definitions including

- Active power infeed
- Reactive power supply
- Behaviour in case of malfunction

Technical requirements (II)
Requirements for existing plants

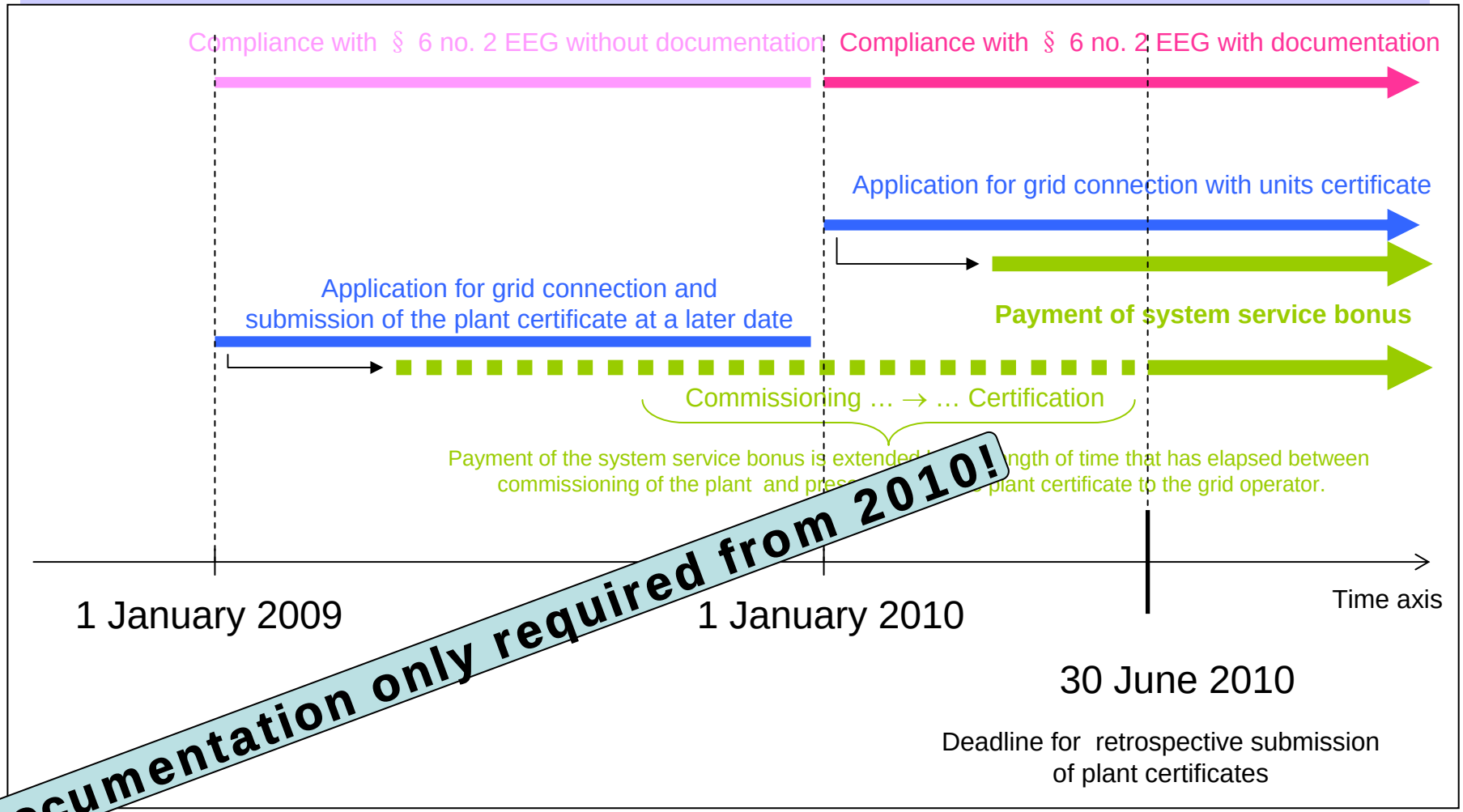
TC2007

- Run-through of errors in accordance with Fig. 3.5 in TC2007 above limit line 1



- Reactive power undervoltage protection (Q➔ & U<) must be provided.
- Disconnection from the grid between 47.5 Hz & 51.0 Hz inadmissible.
- Active power reduction in case of overfrequency
- At the request of the grid operator, the automatic reconnection function to the grid must be blocked.

Provisional regulations



Conclusions

on the system service bonus and technical requirements

- **Within the framework of the Renewable Energy Sources Act (EEG), explicit reference is made to the connection conditions for the first time.**
- **Connection conditions consistently refer to the grid connection point.**
- **Compliance with the connection conditions must be documented in the form of certificates.**
- **Regulations should be incorporated into the planned EEG Ordinance.**
- **Consideration of more precise definitions of the 2007 TransmissionCode in the next revision.**
- **Review of EEG requirements within the context of the next experience report on the EEG.**

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

Contents:

A. Improving the grid integration of wind farms under the 2009 Renewable Energy Sources Act (EEG)

(system service bonus and technical requirements)

B. Power Grid Expansion Act 2009

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

Contents

I. The current situation

II. Action options

III. Evaluation

IV. Outlook

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

I. The current situation

The transmission capacity in the 380 kV grid must be expanded in the near future

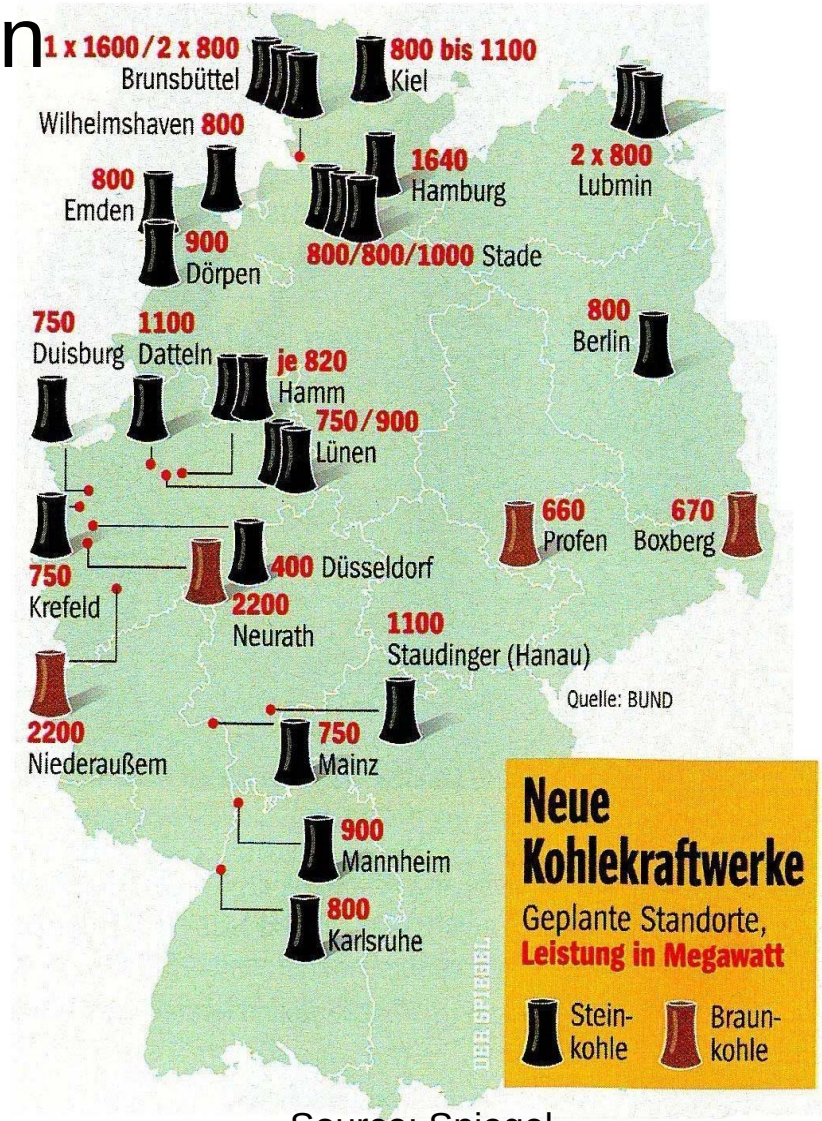
Reasons:

- Construction of new power plants on the North German coast
- Expansion of wind power (by 2020)
  onshore: 27,000 – 30,000 MW
  offshore: 10,000 MW
- Growing trade in electricity

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

I. The current situation

Construction of new power plants



Source: Spiegel 16/2008

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

I. The current situation

Implementation periods of 10 years or more for new ultra-high voltage overhead powerlines are clearly too long

Reasons:

- Resistance from local and regional policy-makers
- Resistance from environmental and nature conservation groups
- Resistance from citizens' initiatives
- Protracted regional planning, planning approval and legal proceedings
- Planning delays with the project initiator

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

I. The current situation

- **The expansion of the 380 kV grid identified as essential by Part 1 of the dena grid study cannot be achieved until 2015 under the current framework conditions**

Consequences:

- The German Government's expansion targets for renewables and CO_2 reduction targets will not be met
- Grid stability will be impaired
- The construction of new coastal power plants will be threatened
- Old power plants will remain on the grid for longer
- Electricity trading will continue to be restricted

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

2. Action options

1. **Streamlining of the licensing procedure and shortening of legal protection**
   (Infrastructure Planning Acceleration Act, Power Grid Expansion Act)

2. **Optimisation and reinforcement of the existing grid**
   (e.g. upgrading of old 220 kV transmission routes, thermistor cables, rewiring with high-temperature conductors, dynamic line rating with temperature monitoring, intelligent control etc.)

3. **Creation of new transmission capacity using innovative technologies**
   (e.g. including high-voltage DC transmission cables from the north to demand centres in the south)

4. **Partial cabling in sensitive areas**
   (residential areas, bird sanctuaries, valuable landscapes)

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

3. Evaluation

1. **Streamlining the licensing procedure and shortening legal protection will not produce a substantial acceleration**

- The German Government is already approaching the limits of constitutional and European law in this regard

- At best, the implementation periods for the construction of new ultra-high voltage overhead powerlines could be shortened by one or two years

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

3. Evaluation

2. Optimisation and **reinforcement** of the existing grid:

- Thermistor cables
- Temperature monitoring
- Upgrading of old 220 kV transmission routes etc.
- Developing new transmission capacity
- Some savings with grid expansion
- Time gains for essential grid expansion

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

3. Evaluation

3. Overlay DC grid

- A few transmission routes from north to south could largely solve the transport problems in the 380 kV grid (concept by Prof. Haubrich and Prof. Erlich)
- Expansion requirements in the 380 kV overhead powerline grid can be minimised
- Acceptance can be increased

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

3. Evaluation

4. Partial cabling in sensitive areas

- The remaining expansion requirement in the 380 kV overhead powerline grid can be met with partial cabling where appropriate to protect residential areas, valuable landscapes etc.
- Acceptance can be increased

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

4. Outlook

1. Act to Accelerate Expansion of the Grid

- Ensure openness of technologies during grid expansion
- Reinforce grid optimisation
- Ensure adequate financial framework conditions for investments

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

4. Outlook

2. Feasibility study

- Cooperation between utility companies and Professors Haubrich and Erlich
- Analysis of the grid expansion requirements with the use of optimisation and innovative technologies based on data from the utility companies (utilise the dena II process and a BMU-study for the IEA: http://www.erneuerbare-energien.de/inhalt/41043/36356/)
- Analysis of costs
- Completion of the study by the end of 2008

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

4. Outlook

3. Identify the most urgent projects

- Based on the results of the feasibility study, the most urgent projects can be identified in early 2009 within the framework of a requirement plan

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

Thank you very much for listening.

谢谢!

Thank you!

Contact:

Kai.Schlegelmilch@bmu.bund.de

Tel.: +49-30-18305-3631

Many thanks also to my colleagues Julia Rufin and Jens Boemer for their valuable contributions to this presentation.