



DISTRIBUTED GENERATION

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E.ON Energie AG, Munich

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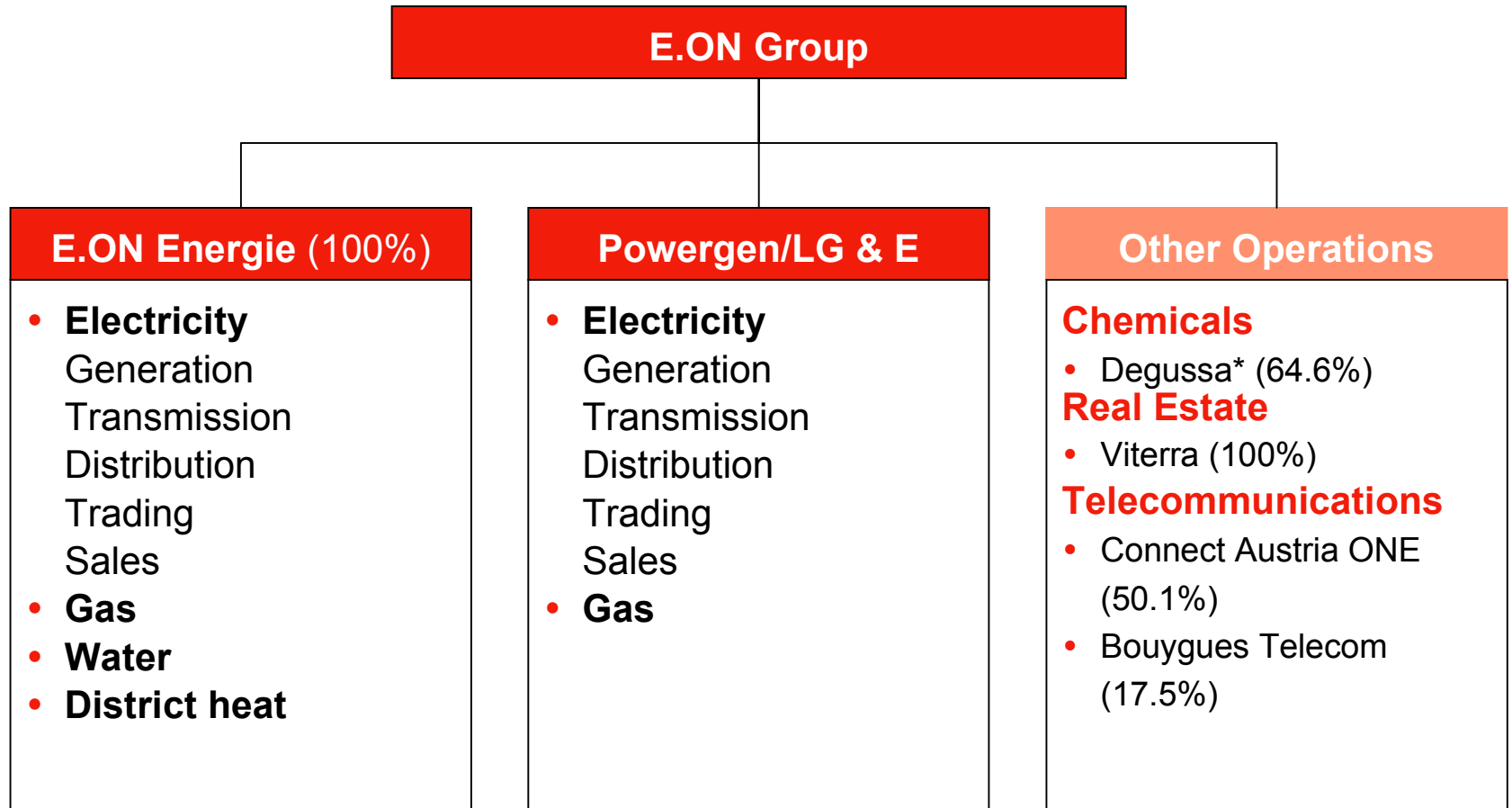
AGENDA

- Introduction of E.ON Energie
- Situation in Power Business
- DG Technologies & Markets
- E.ON Energie's DG Strategy
- Summary

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THE E.ON GROUP



* Divestment initiated

FINANCIAL HIGHLIGHTS

E.ON Energie AG ■
Munich

Sales (excl. electricity tax) €17.8 bn

Employees 39,560

Net power supplied 318 bn kWh

Generation capacity 33,638 MW

Grid length (380/220/110 kV) 37,000 km

Gas supplied* 96 bn kWh

Water supplied* 236 mn m³

* Reflects companies in which direct and indirect stakes equaling or exceeding 20 % were held

** Reflects companies in which direct and indirect stakes equaling or exceeding 50 % were held
As of December 31, 2001

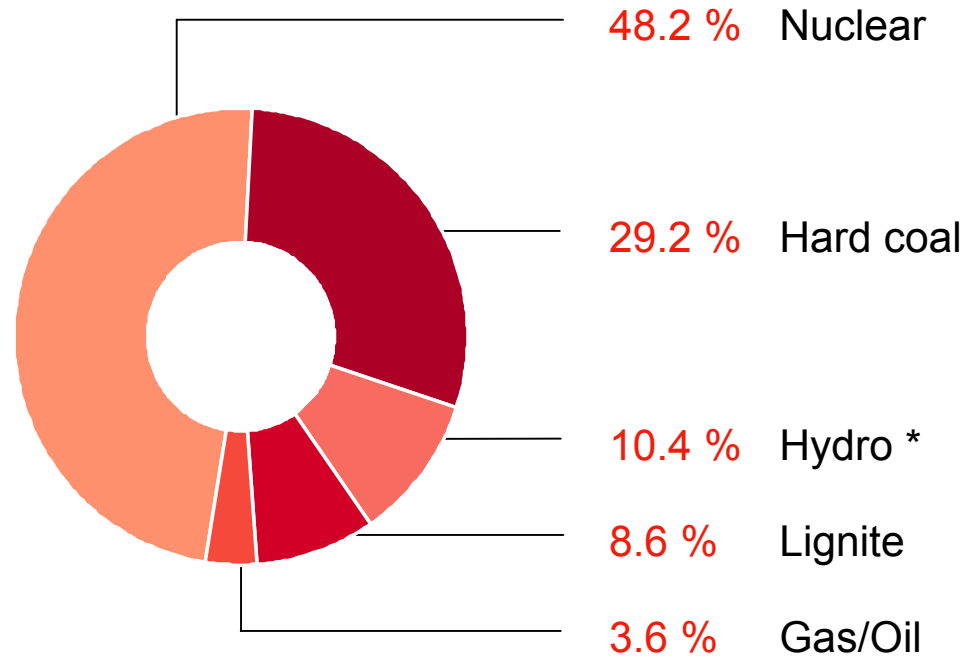
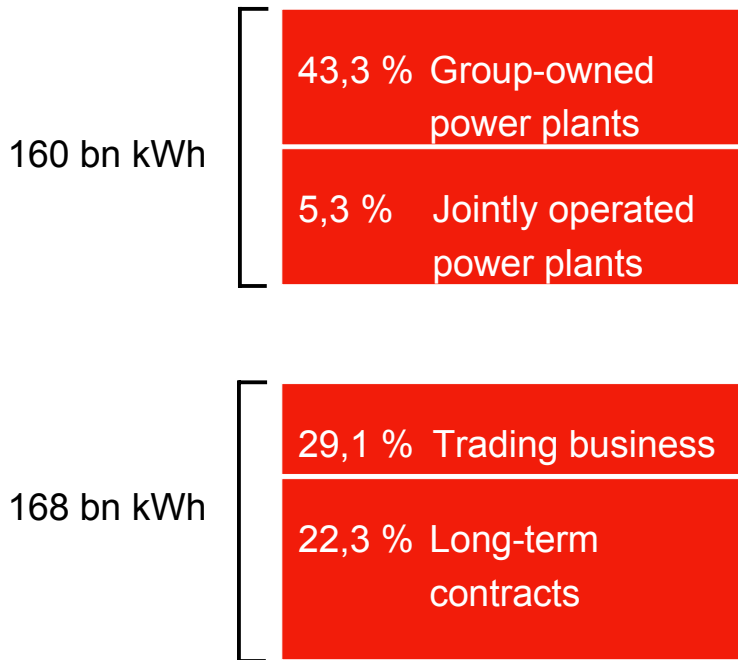
POWER GENERATION BY ENERGY SOURCE

328 billion kWh

Total power procurement

160 billion kWh

Own generation incl. jointly operated power stations

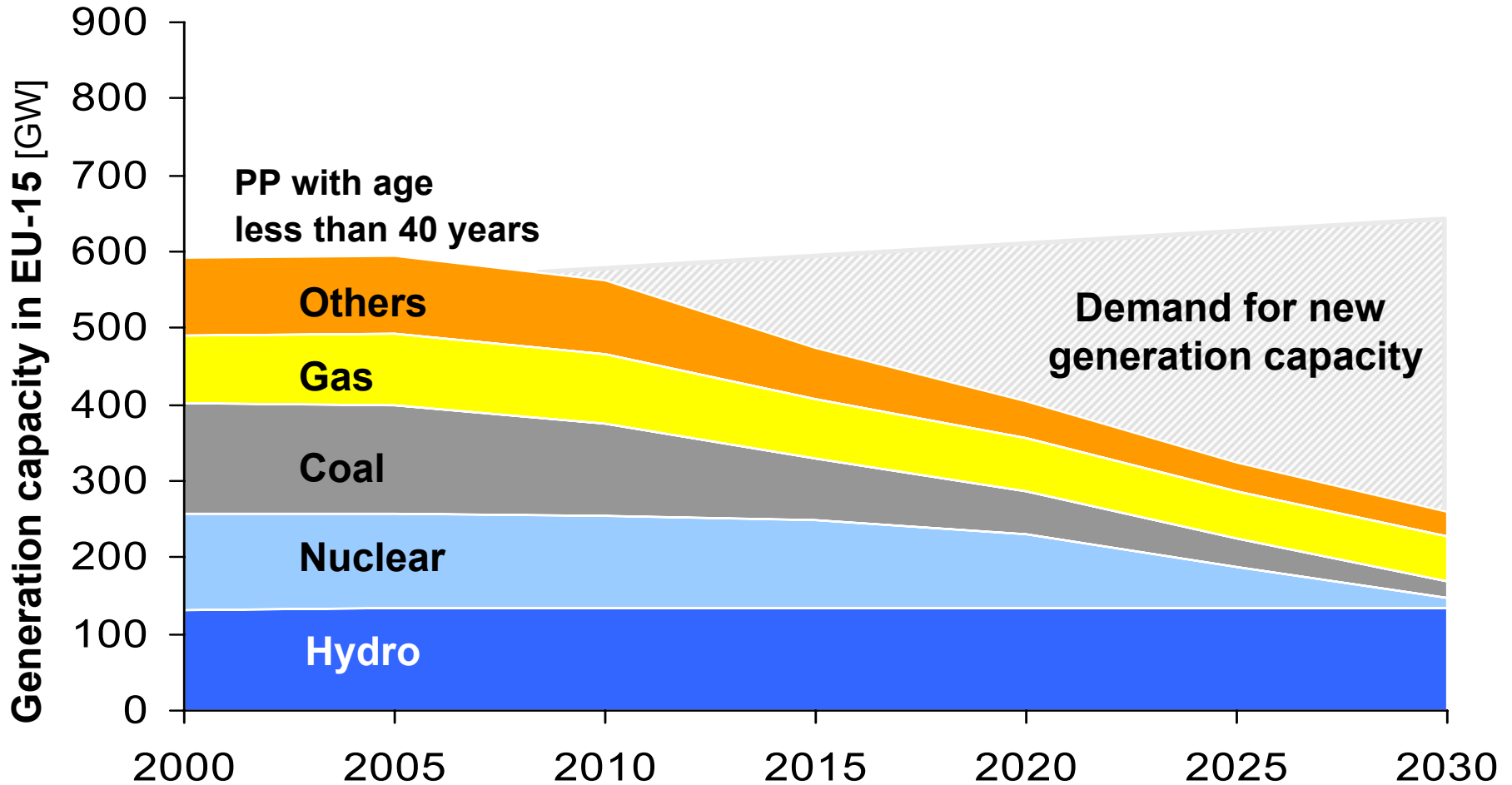


* Run-of-river, storage, pumped storage power plants and others
As of September 2002

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NEED FOR NEW GENERATION CAPACITIES IN EUROPE



TRENDS IN GERMAN ENERGY POLICY

- Climate Protection
- Sustainability
- Innovation

Political interests

focus more and more on

Technologies

IN

„Small is beautiful.“

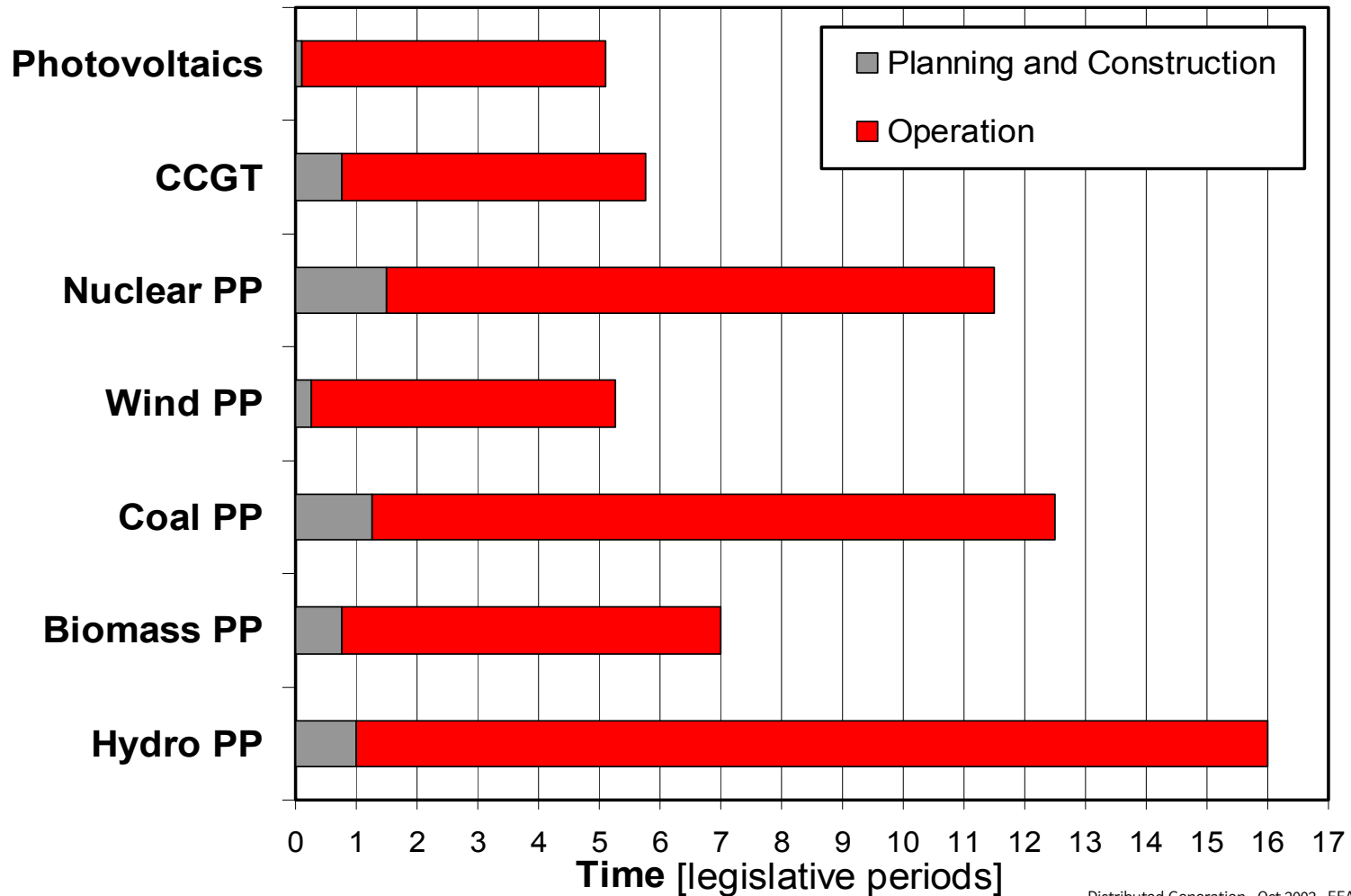
- + Renewables
- + Fuel cell
- + Virtual power plant
- + **Distributed generation**

OUT

- Nuclear power plants
- Coal combustion plants
- Central plant technology

„Big is out.“

TIME HORIZONS IN THE ELECTRICITY BUSINESS



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DISTRIBUTED ELECTRICITY GENERATION VARIOUS DEFINITIONS

“Distributed power generators are connected to the low or medium voltage grid.”

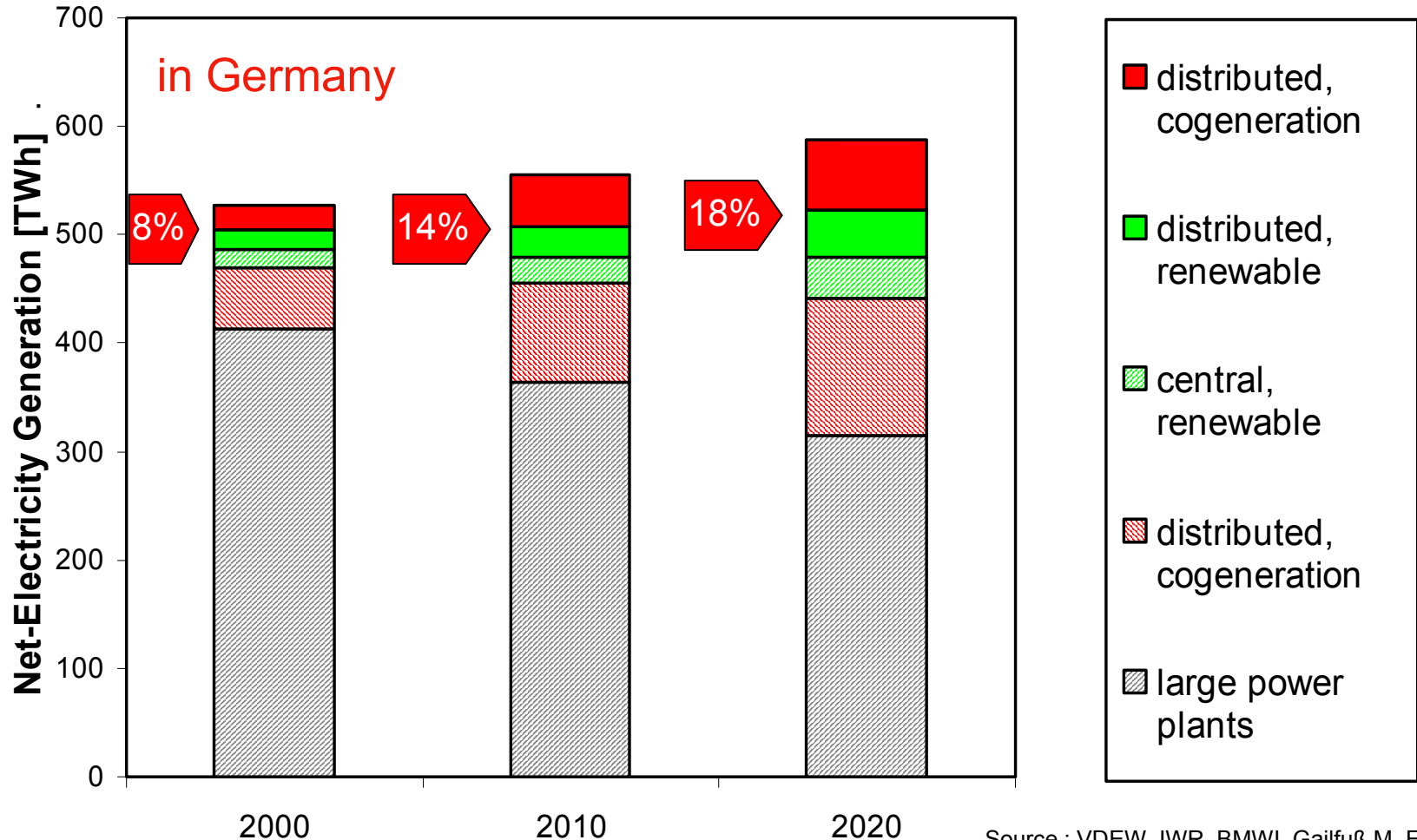
“Local, high efficient, demand oriented and infrastructurally motivated supply with thermal and electrical energy.”

„Distributed generators are new market players; cross-business newcomers. They participate in the business of selling energy and use the service of the electrical grid without being involved in its costs.“

CIGRE-Definition:

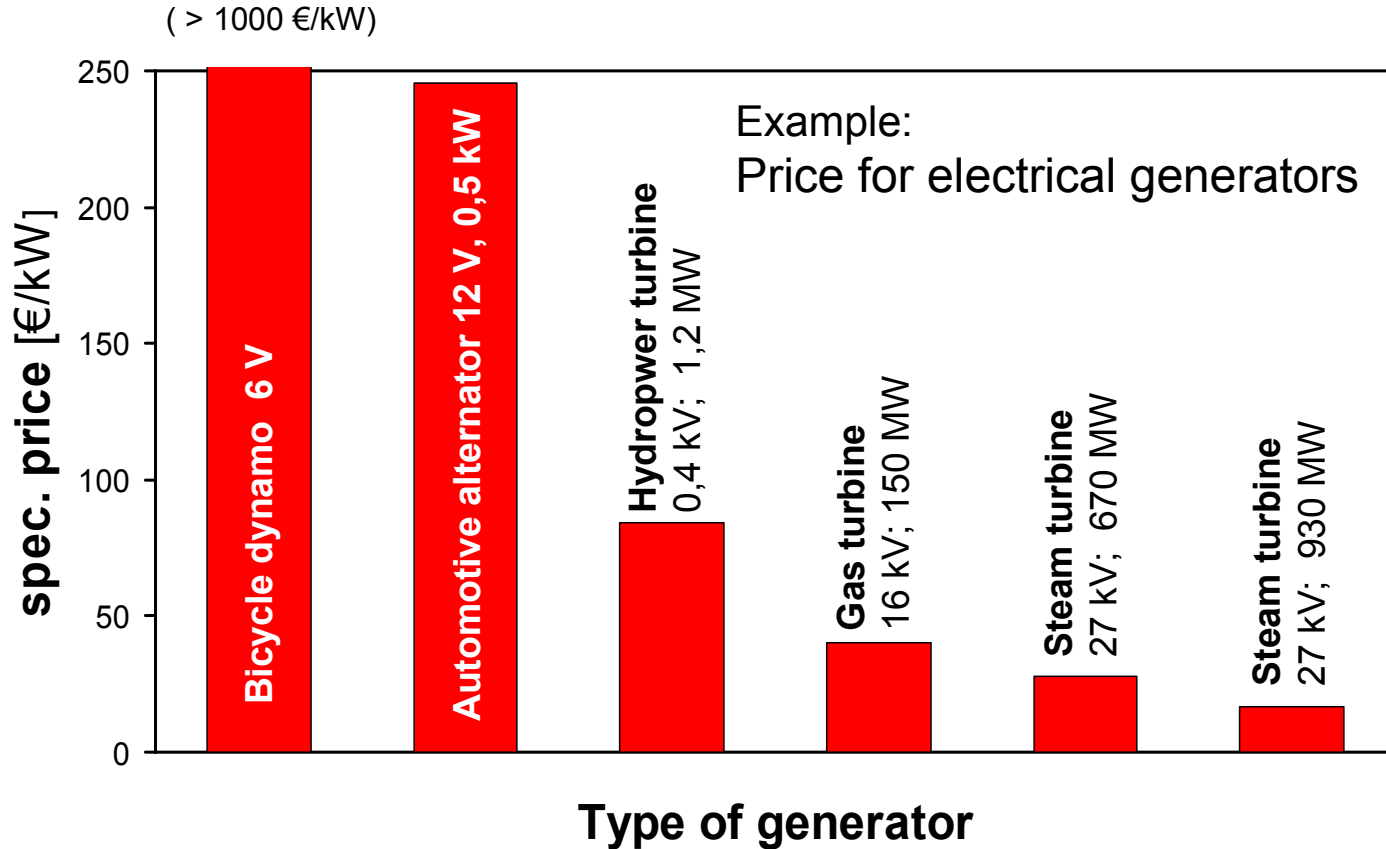
- not centrally planned,
- today not centrally dispatched,
- usually connected to the distribution network,
- smaller than 50 - 100 MW_{el}

DISTRIBUTED GENERATION - FORECASTS



Source : VDEW, IWR, BMWI, Gailfuß M, EWI, BET

ECONOMIES OF SCALE IN POWER TECHNOLOGY

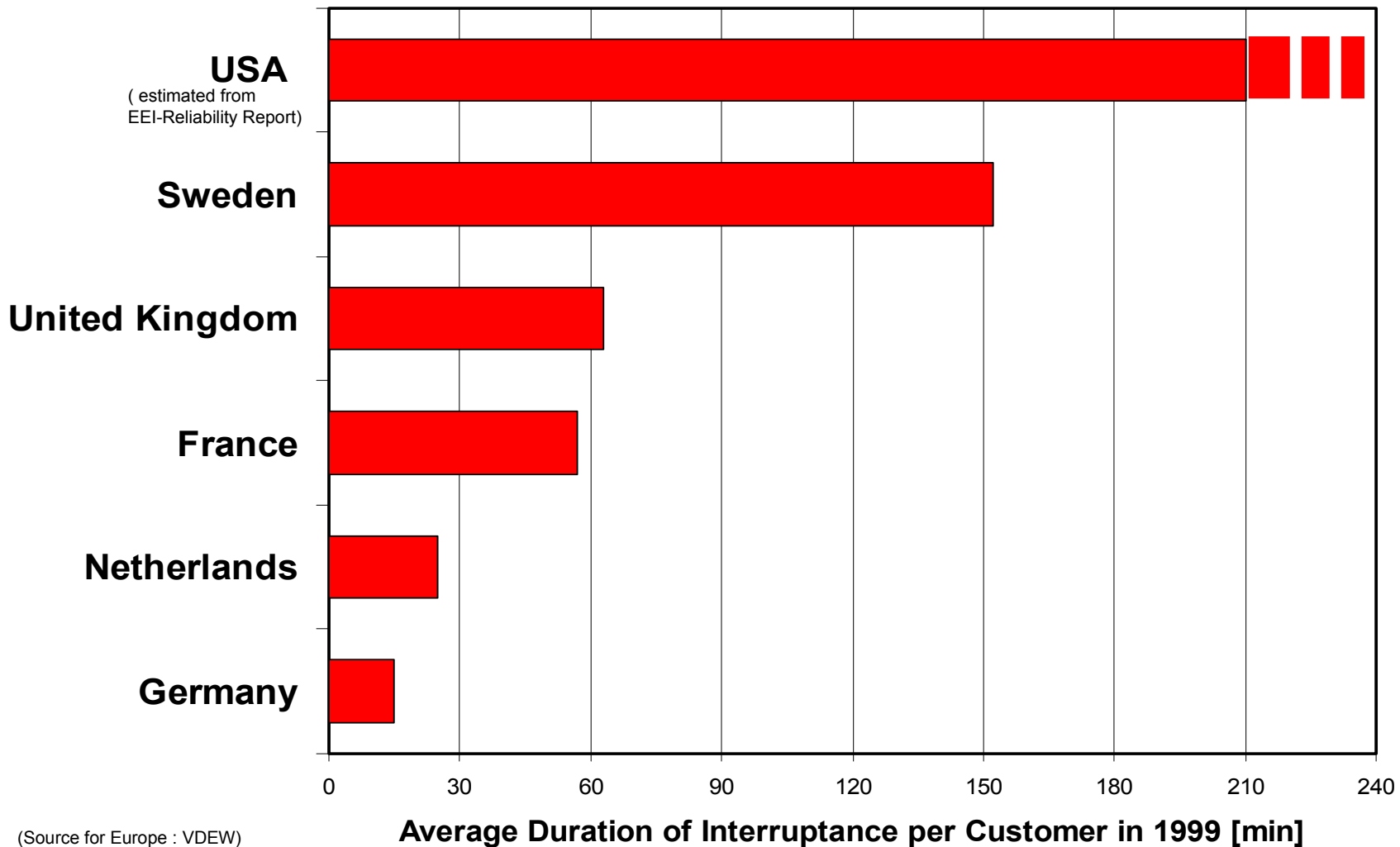


➔ „Size“ = Cost advantage in power technology

REASONS FOR DISTRIBUTED GENERATION

- **Security of supply**
by independence of grid failures
- **Reduction of greenhouse gas emissions**
by use of renewable energies
- **Cost and environmental benefits through fuel savings**
by use of combined heat and power production

SECURITY OF ELECTRICITY SUPPLY

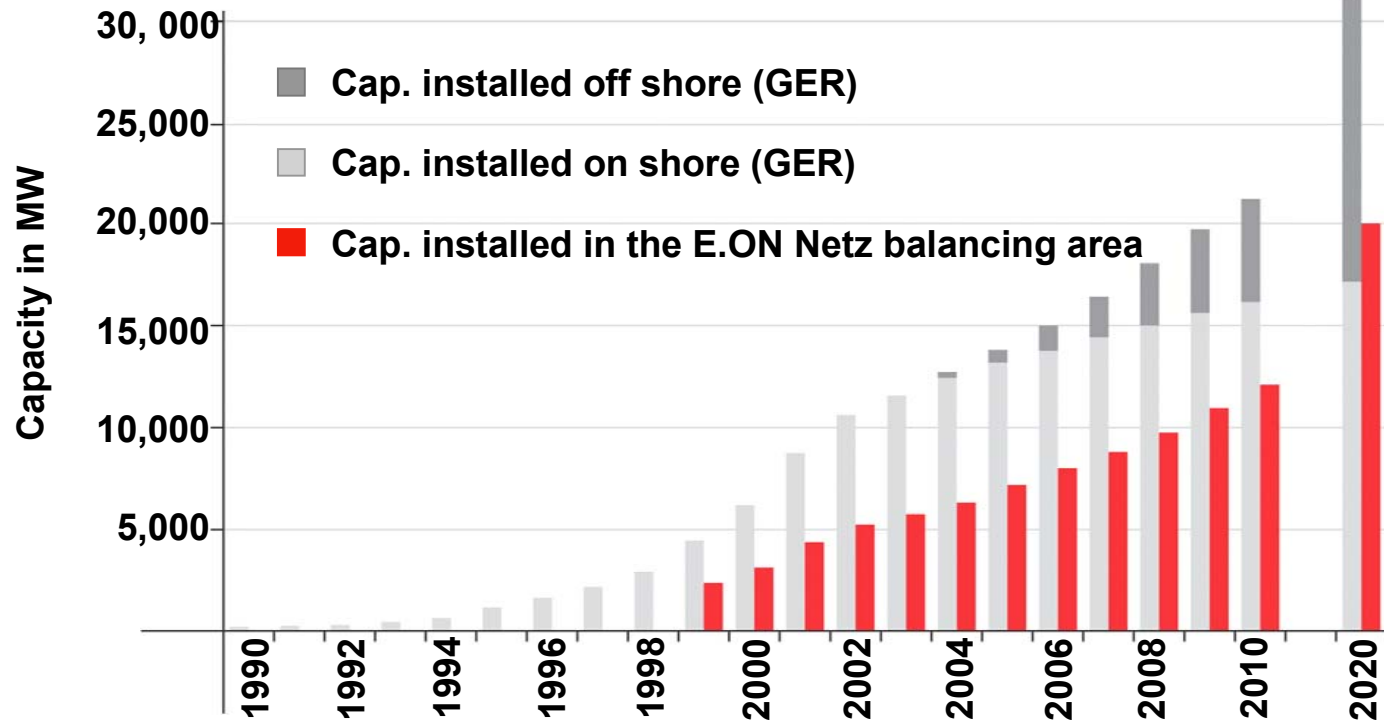


(Source for Europe : VDEW)

WIND POWER IN GERMANY

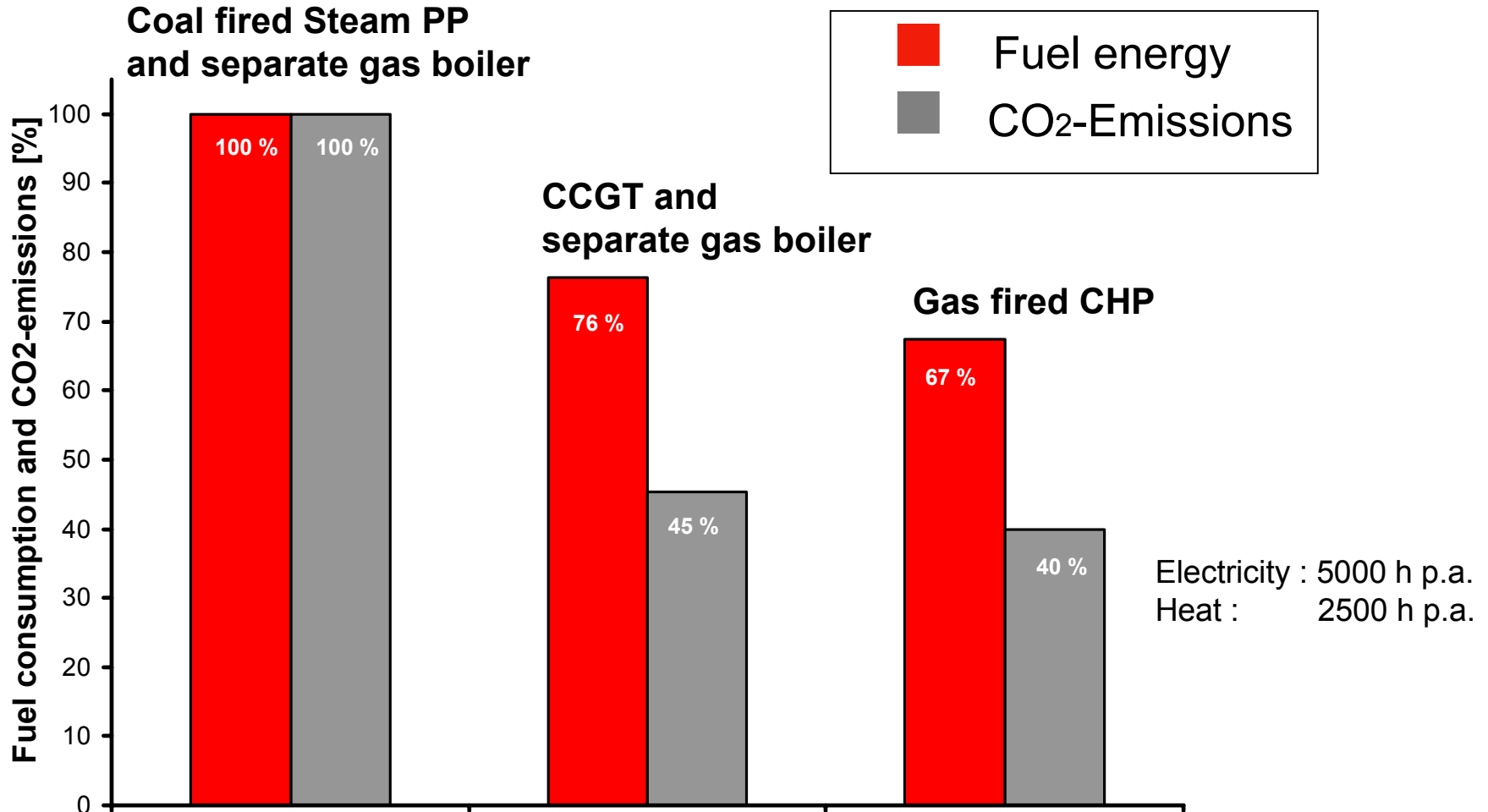
fixed price
+ no market risk
+ no consideration of additional costs

= subsidies

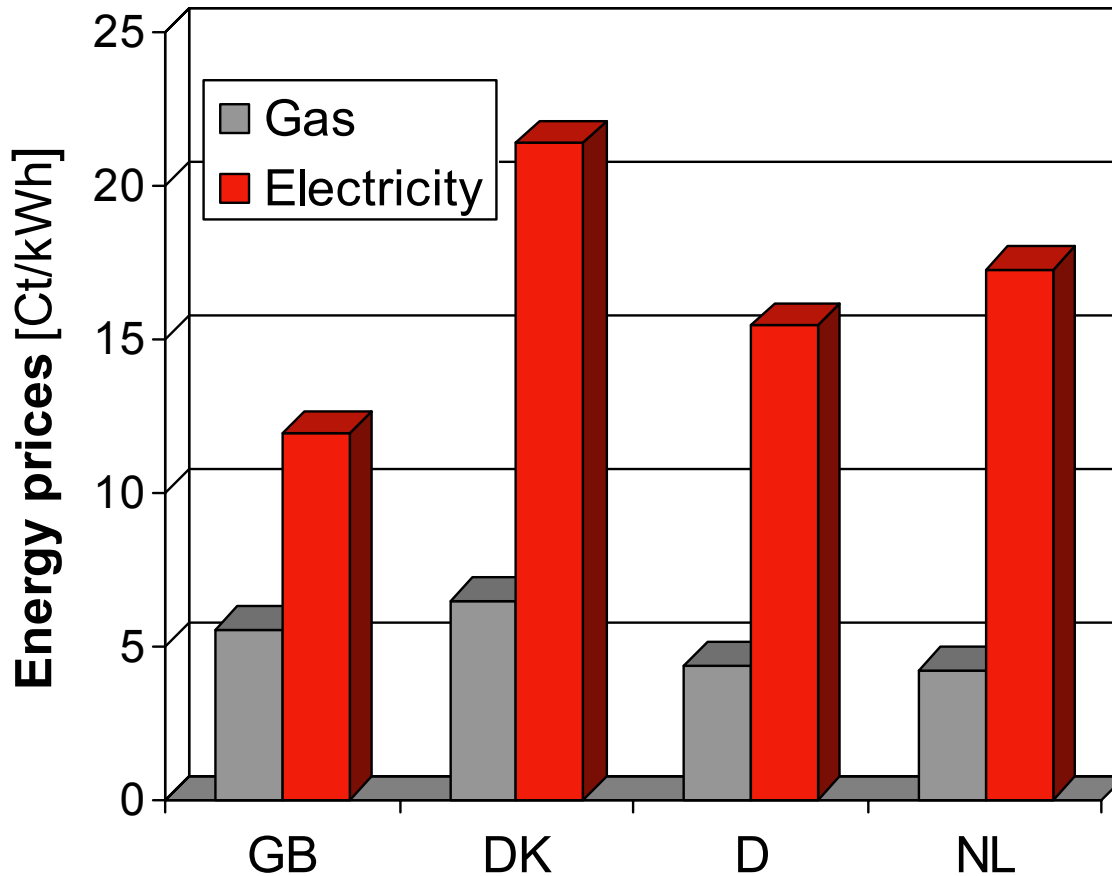


Growth of wind power is directly linked to extensive financial support and independent from the mechanisms of the open electricity market.

REDUCTION OF CO₂-EMISSIONS BY CHP



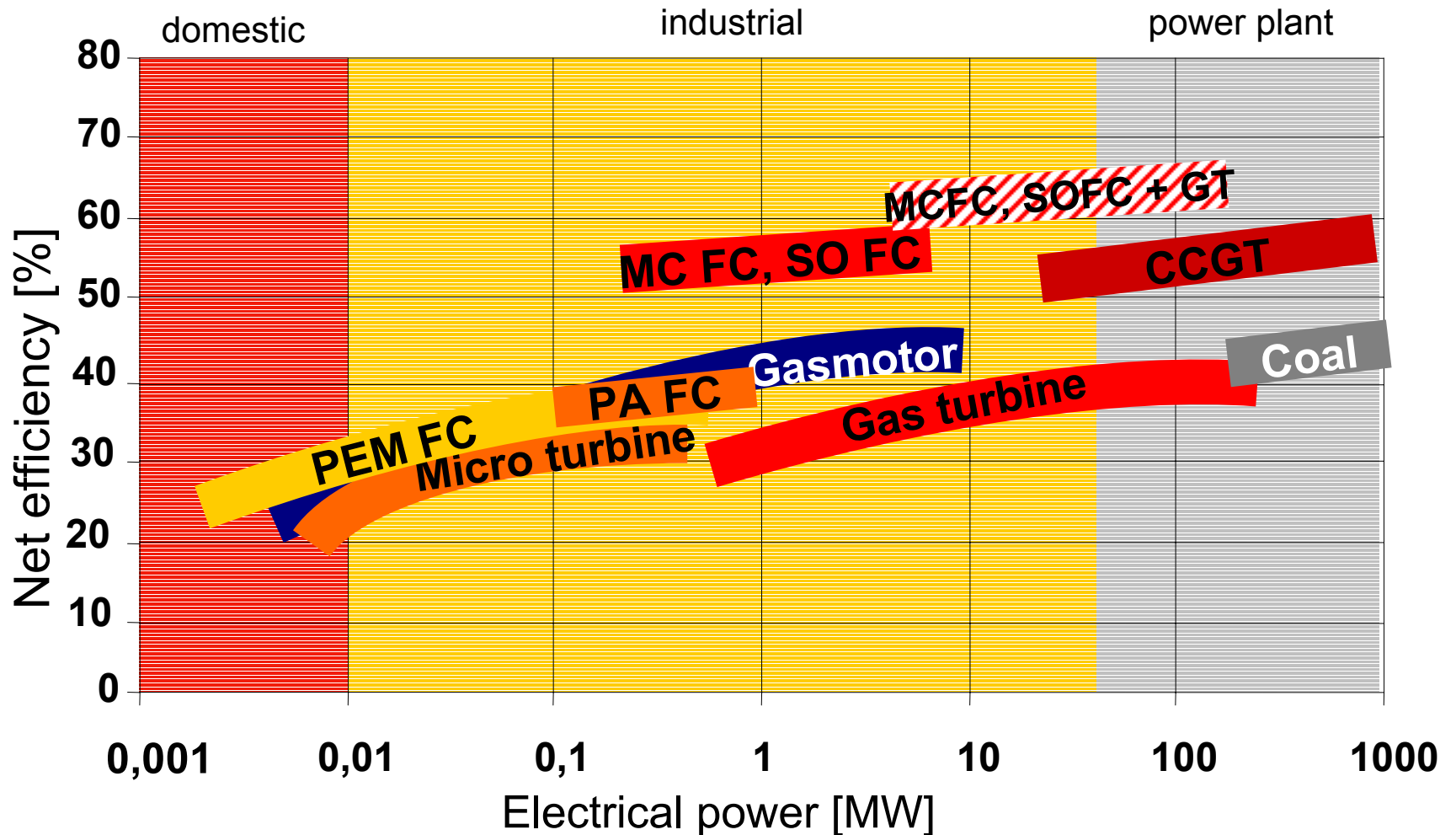
ENERGY PRICES FOR PRIVATE CUSTOMERS (01/2002)



Difference between gas and electricity price (spark spread)

= indicator for economical benefits of domestic CHP

ELECTRICAL EFFICIENCY OF CHP-TECHNOLOGIES



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PROs AND CONs OF ENGAGEMENT IN CHP BASED DG

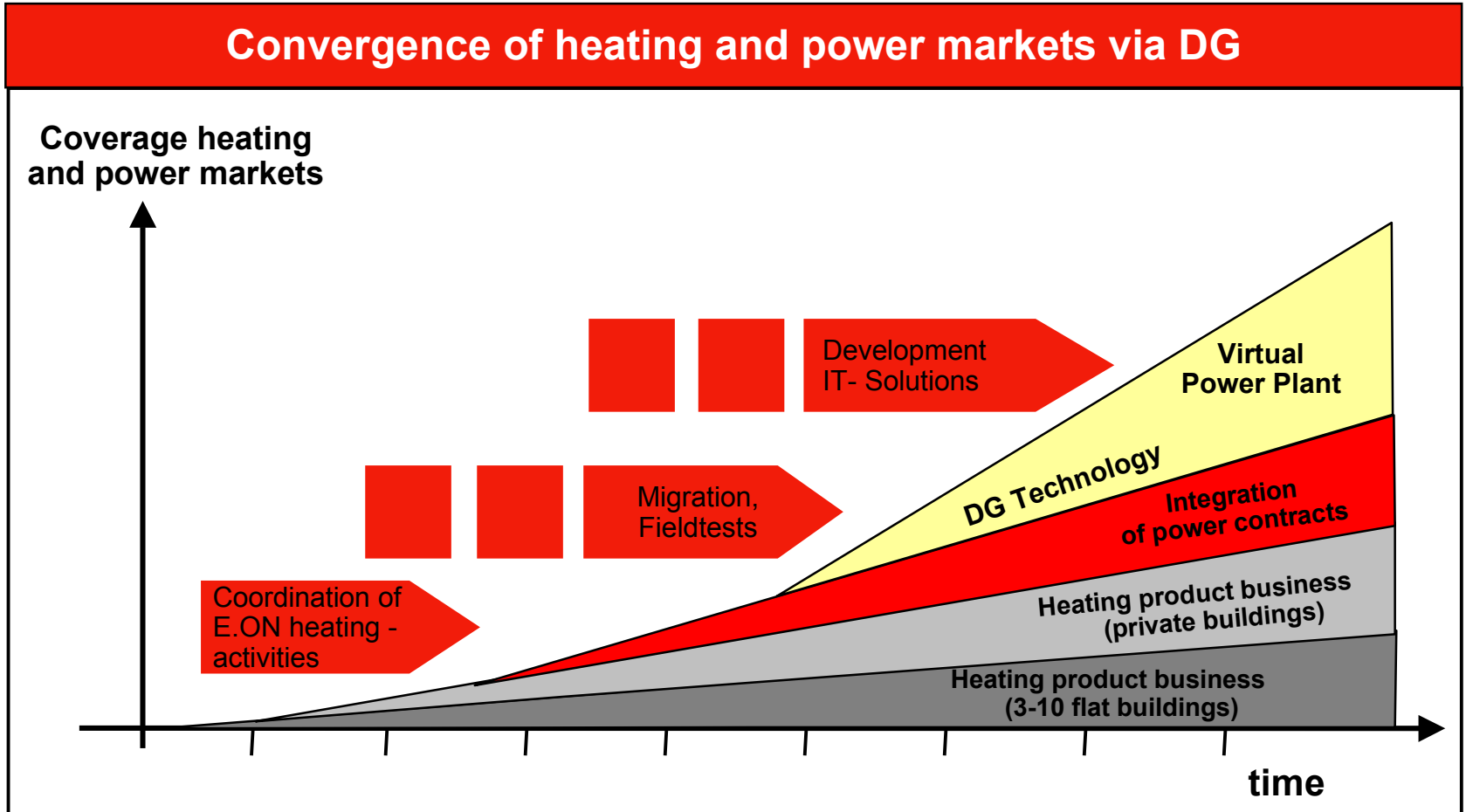
DG MIGHT BE AN ATTRACTIVE OPTION FOR THE FUTURE

- ➔ – low risk with small investments
- many small investments instead of a huge one for large power plants
- continuous growth over long time period
- excellent combination of existing business areas (power, gas, services)
- opportunity for a closer customer relationship
- positive customer perception and innovative branding

... BUT

- ➔ – no economically viable technology available for domestic applications today
- fundamental disadvantage in generation costs in comparison to big PPs
- profit depending on political subsidies
- environmental benefits mostly overestimated

IMPLEMENTING DG CONTRACTING STRATEGY



DG ACTIVITIES AT E.ON ENERGIE

■ **Assessment of potential business models**

- market research
- simulation of different scenarios in long term planning
- SWOT-Analysis of E.ON Energie
- sharing of DG-knowledge in the E.ON-group

■ **Assessment of technologies**

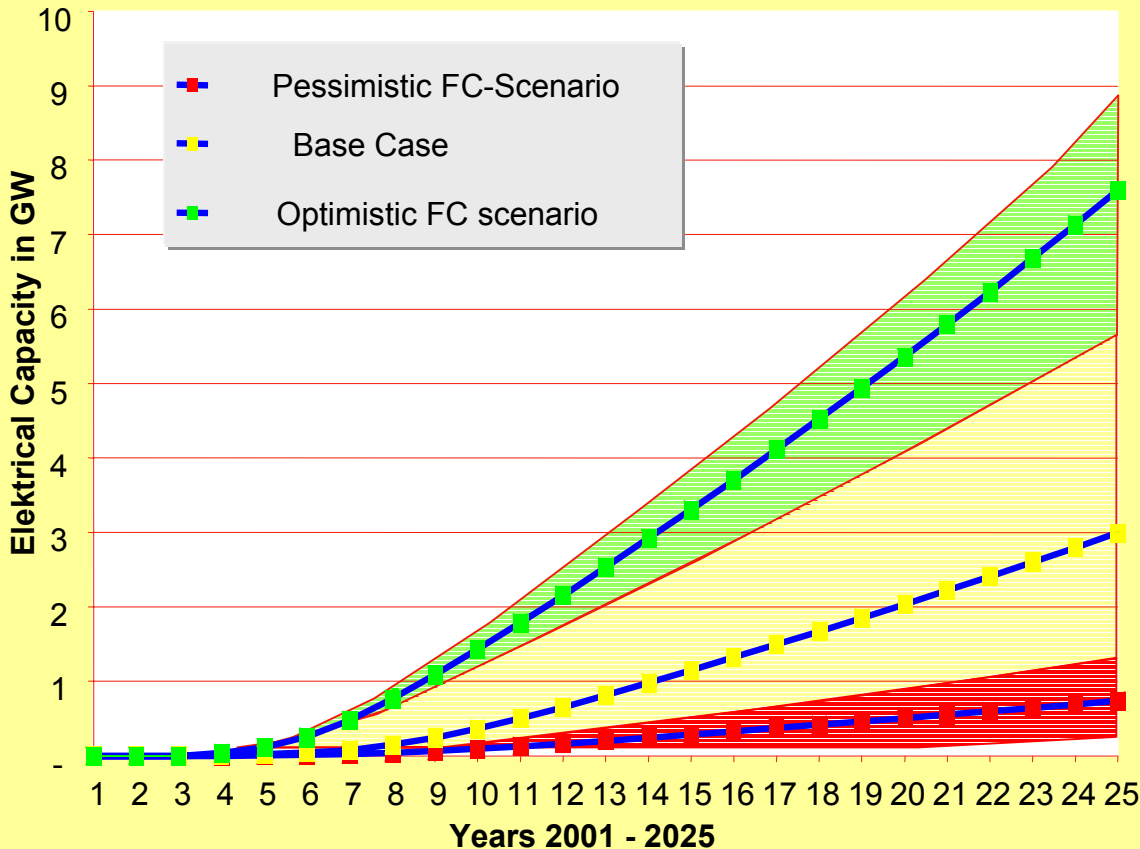
- continuous discussions with manufacturers
- valuation of operation experience
- participation in demonstration projects
- field testing of technologies (fuel cells)
- assessment of consequences for the grid

■ **No basic R&D - no manufacturing - no exclusive cooperation** but use of competition between manufacturers

MARKET ANALYSIS OF FUEL CELL TECHNOLOGY

HIGH POTENTIAL - HIGH UNCERTAINTY

Cumulated installed capacity of fuel cells in the domestic sector in Germany



Base Case 2025 (Germany)

- ➔ **ca. 3000 MW installed in ca. 2,3 Mio buildings on low voltage level (30% of gas supplied buildings)**
- ➔ **Electricity production by FC ca. 20 TWh (15% of annual household demand)**
- ➔ **heatproduction by FC ca. 110 TWh (30% of heat demand of households with gas-supply)**

Appealing options but no fundamental change of the electricity business

LESSONS LEARNED

e.g. ASSESSMENT OF FUEL CELL TECHNOLOGY

- **Publications and advertising brochures differ from binding offers.**
- **Costs for installation and maintenance are usually underestimated.**
- **Performance of components differs from performance of systems.**
- **Many problems occur in standardised components of BOP.**
- **Practical applications showed faults never seen in the laboratory.**



The most important basis for assessment of new technologies is field testing under real conditions.

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SUMMARY

- Despite actual overcapacities in the European power market there will be a huge demand for new capacities in the next decade.
- Share of distributed generation in electricity supply will probably increase - depending on energy prices and energy policy.
- Besides highly subsidised renewables CHP applications will be the most interesting DG technologies in Europe.
- Success of DG in the domestic sector depends on achievable cost reduction to compete with large scale power plants - w/o subsidies.
- Practical experiences from operation of complete systems are the most relevant basis for evaluation of new technologies.