

**Science Centre
North Rhine-Westphalia**

Institute of Work
and Technology



Institute for Culture
Studies

**Wuppertal Institute for
Climate, Environment and
Energy**

The German Renewable Energy Act - Success and ongoing Challenges -

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Bangalore (India)

January 2004



The Wuppertal Institute

Mission: “Sustainability Research” - exploring interdependencies between ecology, economy and society, and innovations to decouple resource use from wealth.

Profile: Practice and solution oriented research; policy advice on the regional, national and international level; issues: energy, transportation, climate protection, resource flows and sustainable production/consumption

Organisation: “Non-Profit” Organisation owned by the State and member of the Science Centre of North Rhine-Westphalia

Staff: 140 members (80 full time) from all disciplines working in 80 projects/a

Budget: 3,4 mil. Euro from the state of North Rhine-Westphalia; about 4 mil. Euro from different sources (International; EU, Ministries, Private Sector)

WI-Research Agenda

Research Groups – Focus Projects – Cross Cutting Projects

1. Future Energy and Transport Structure

- ♣ New Energy Carriers and Fuels
- ♣ Energy- and Transport Saving Spatial Patterns

2. Energy-, Transport- and Climate Policy

- ♣ Institutions and Actors in Multi-Level Governance
- ♣ Diffusion of Good Practice

Cross Cutting Projects

- ♣ Integrated Sustainability Scenarios
- ♣ Sustainable Globalisation
- ♣ Eco-Sufficiency and Quality of Life

3. Material Flows and Resource Management

- ♣ Increasing Resource Productivity without Problem Shifting
- ♣ Integrated Assessment of Land Use and Resource Flows

4. Sustainable Production and Consumption

- ♣ Resource Productivity and Employment
- ♣ Accountability along Product Chains

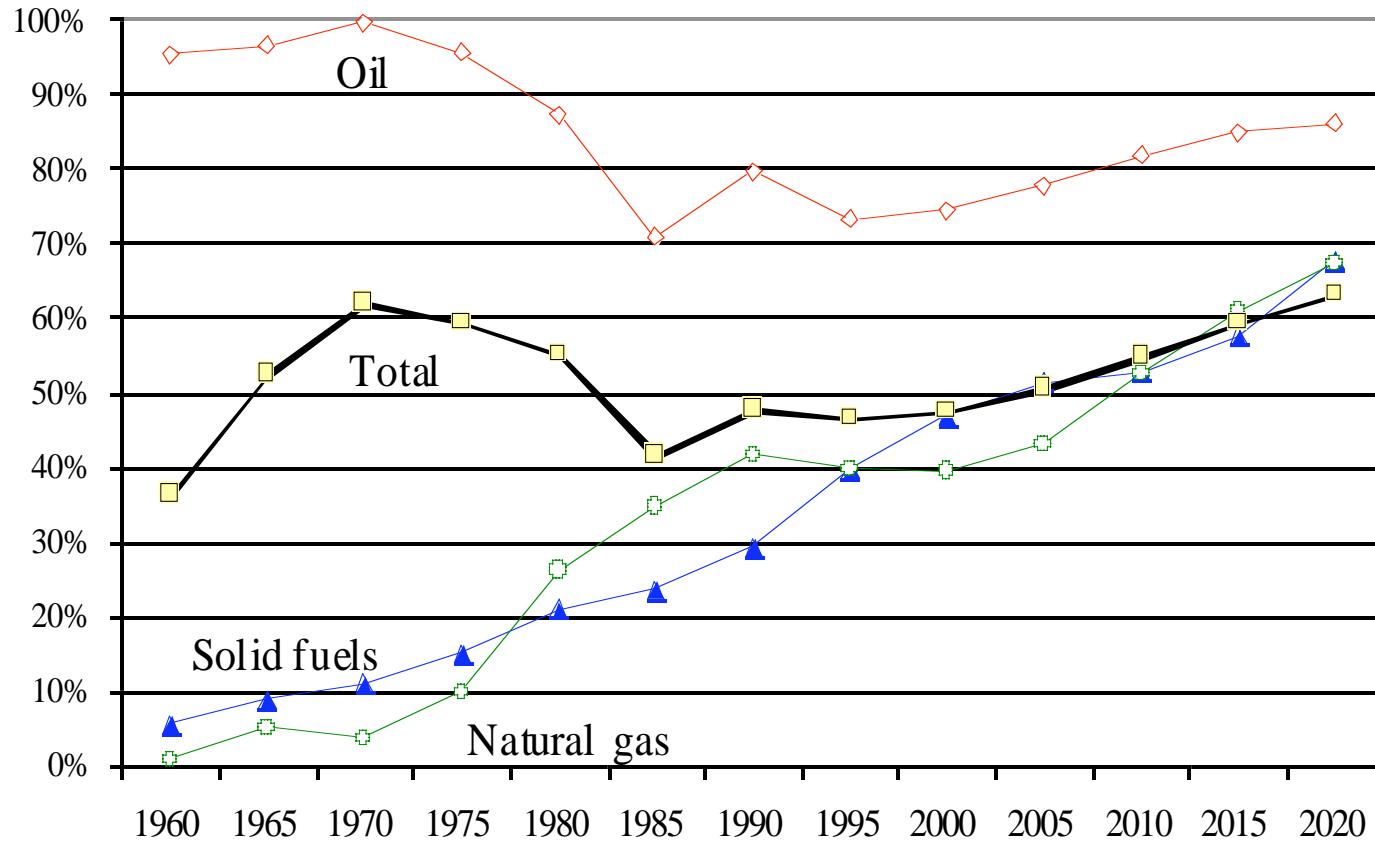
Overview

- **Introduction**
- **General incentives for energy supply based on renewable energies**
- **Meaning of renewable energies for the German energy system and for fulfilling ecological targets**
- **Policy targets for renewable energies**
- **The Renewable Energy Act as main pillar for extension electricity generation based on renewable energies**
 - **Successful story in the past**
 - **Perspectives**
 - **Ongoing challenges**

General incentives for energy supply based on renewable energies - why renewable energies should be used?

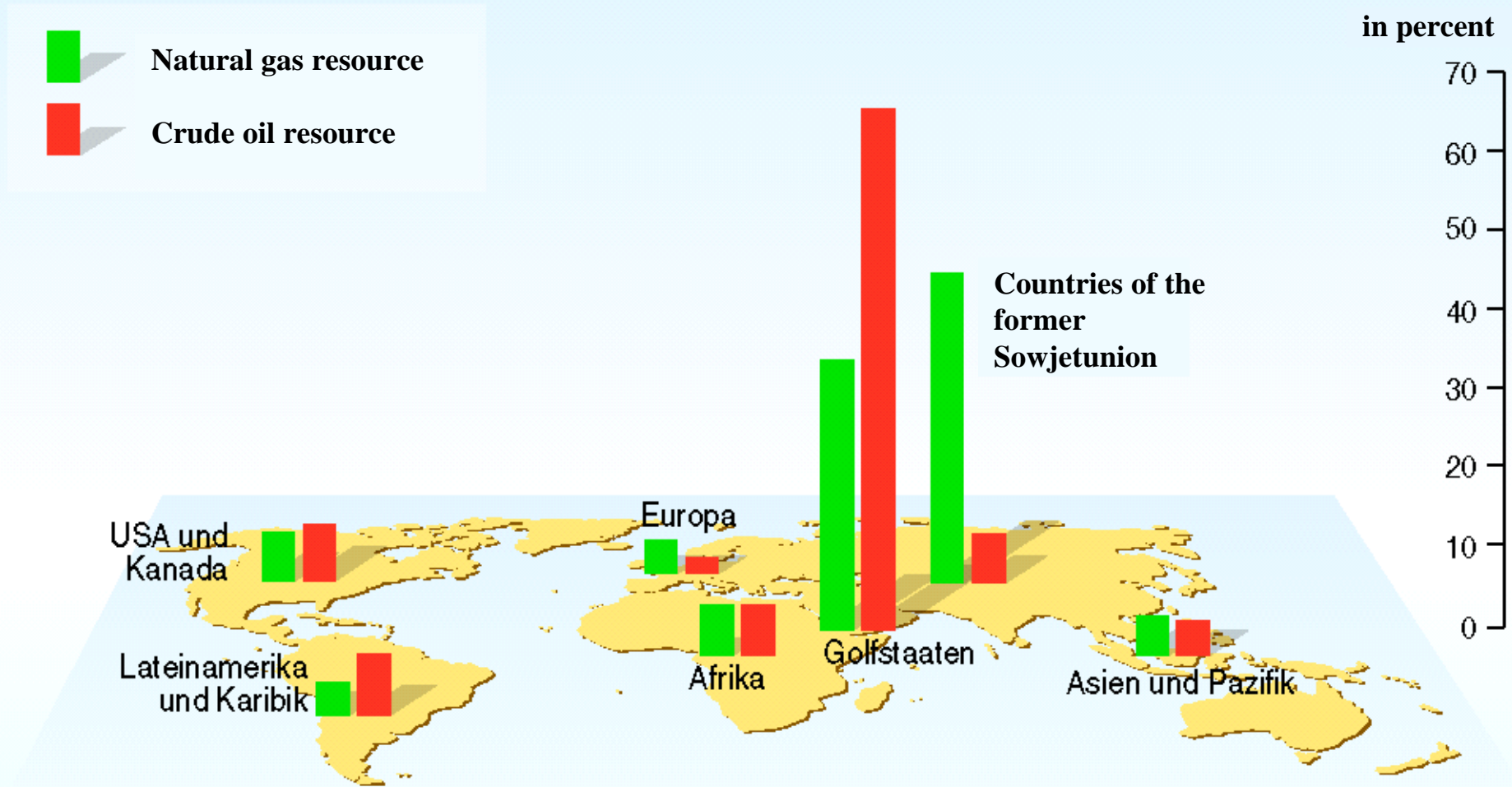
- **National energy resource (🍏 independent from import risks, contribution to a higher security of supply)**
- **Protection of limited fossil energy reserves**
- **Reduction of economic risks (🍏 high price volatility of fossil energy carrier)**
- **Contribution to environmental/climate requirements**
- **Innovation potential - technology developments (🍏 increasing export options, employment effects)**
- **Low risk potential (🍏 low accident potential, resistant to terrorist attacks and sabotage)**
- **International acceptability (🍏 resistant to policy crises)**

European Union : Import dependency



* Baseline for Shared Analysis from 2000 onwards

Crude oil and natural gas resources worldwide



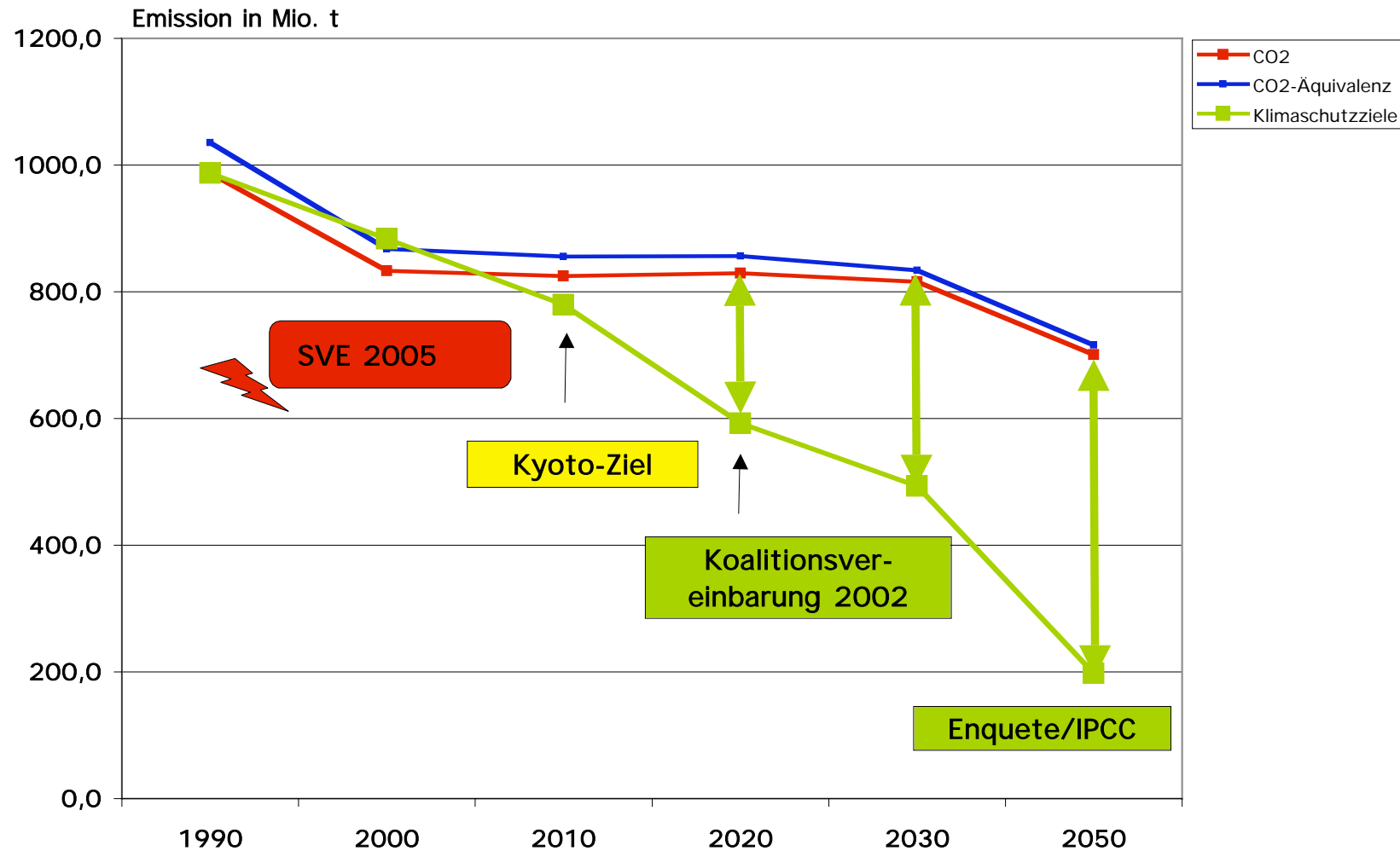
Quelle: BP Statistical Review of World Energy, *Oil and Gas Journal*, 1998.

Targets for a sustainable energy future

Climate protection goals

- **Kyoto-Protocol:**
 - **21% GHG (2008-2012)**
- **Agreement of government coalition:**
 - **40% (2020)**
 - if EU decides to decrease GHG emissions by 30%**
- **Recommendation of Enquête Commission of the German Parliament**
 - **80% (2050)**
 - comparable recommendations by: WBGU, SRU, IPCC**
(Governmental Advisory Boards)

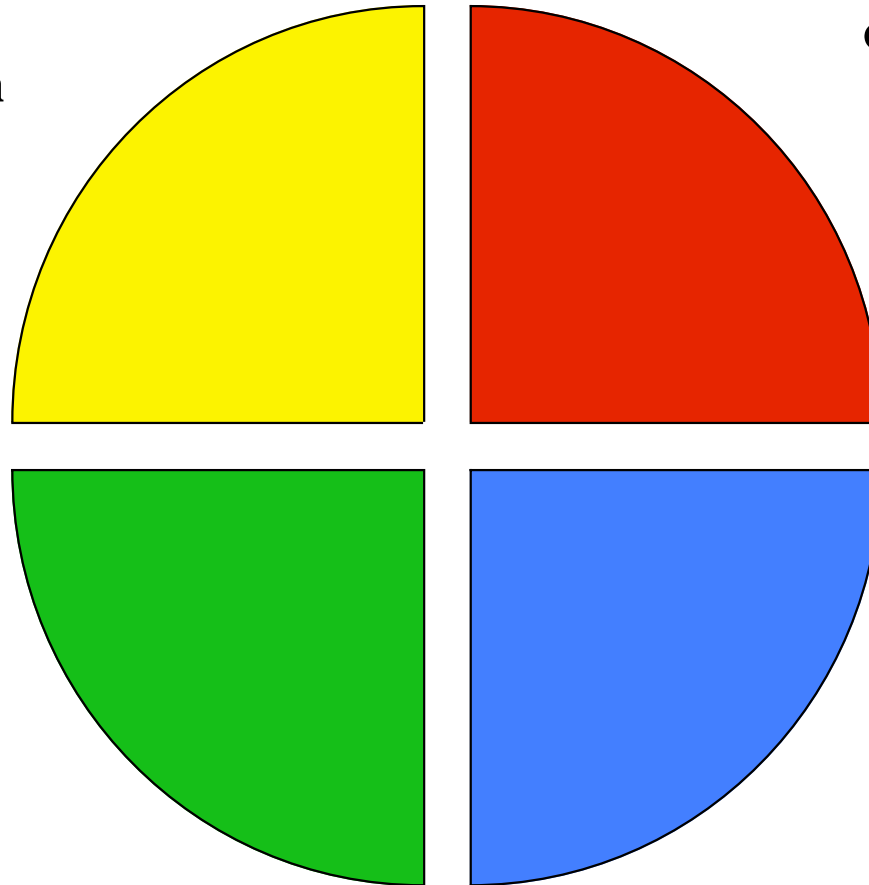
A gap between Business as Usual and sustainability goals



Strategy options for climate protection

**awareness
energy
consumption**

**rational use
of energy**



**renewable
energy**

**substitution
coal to gas**

Renewable Energies in Germany - Status Quo

- comparable low supply share

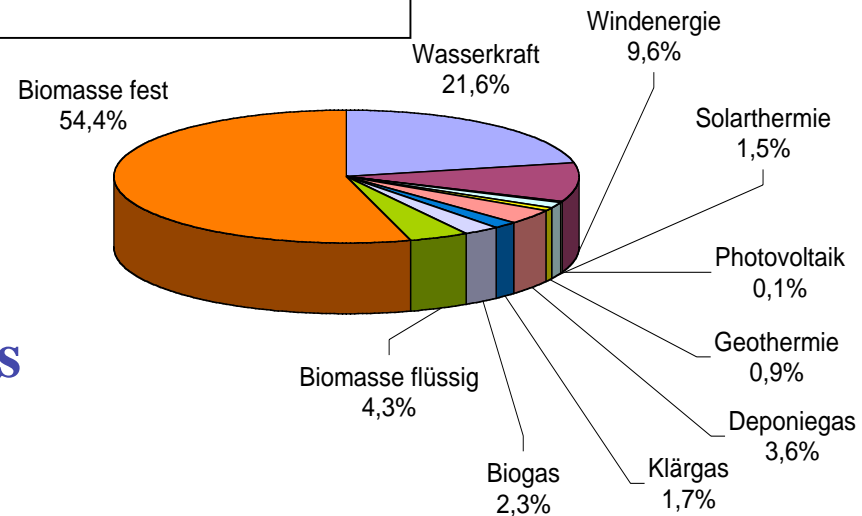
RE - heat:	3,9 %
RE - electricity:	7,8 %
RE - fuels:	0,8 %



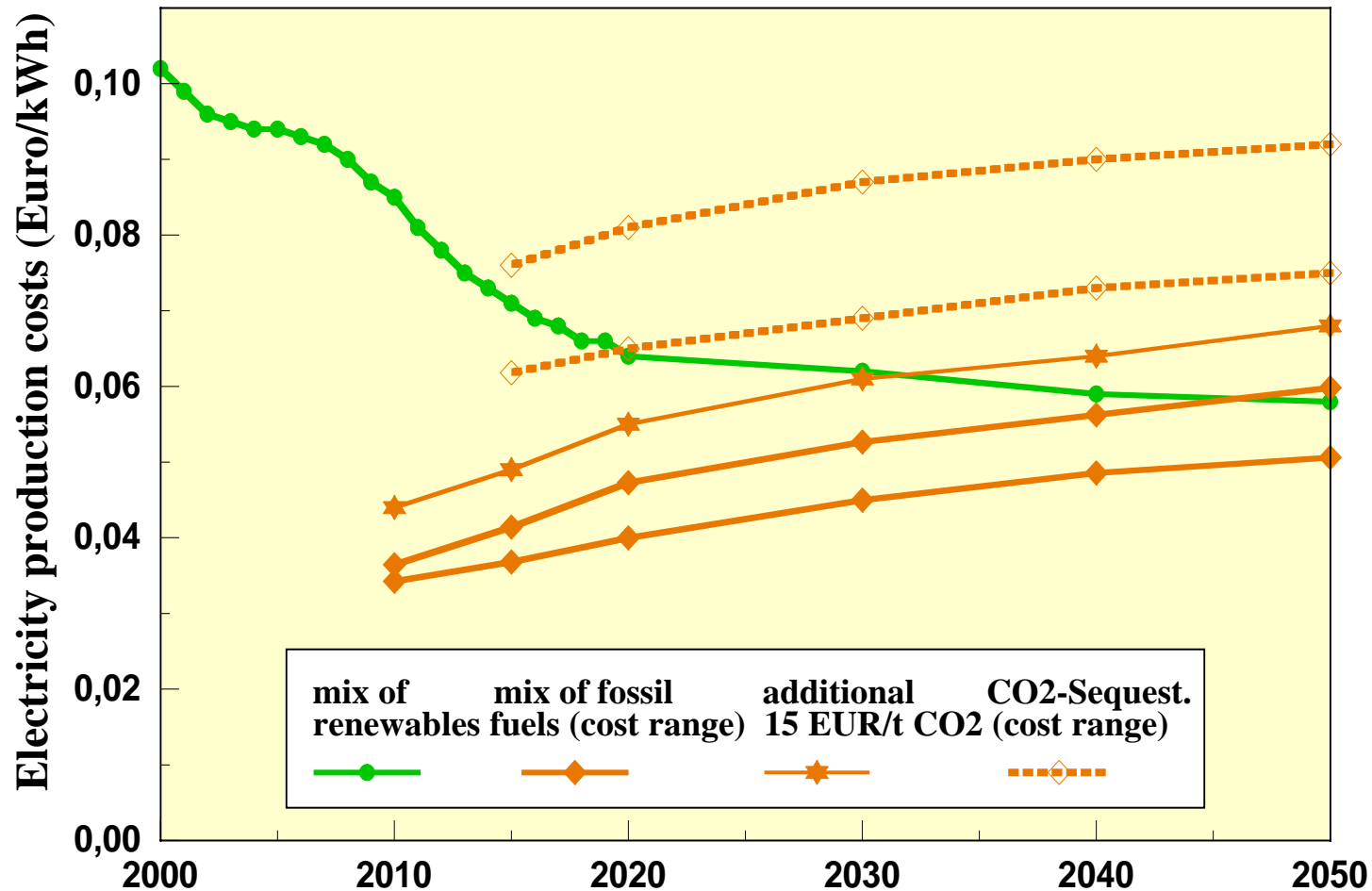
- dynamic increase rates
- technological progress
- high technical potential
- but: still higher costs than conventional options

🍏 RE-extension is not going by its own, policy support is necessary

Primary energy 390 PJ in 2001



Comparison of electricity costs of new power plants fossil mix: 50% coal, 50% natural gas



oeko/kost-kw.pre; 15.09.03

Policy Framework I: Setting Extension Targets for the future

- **doubling supply share until 2010 compared to 2000 status, following**

- **EU White book**

- **EU Directive Renewable Energies**

RE-Electricity > 12,5% in 2010

RE-Primary Energy > 4.2% in 2010

- **Amendment Renewable Energy Act**

RE-Electricity > 20% in 2020

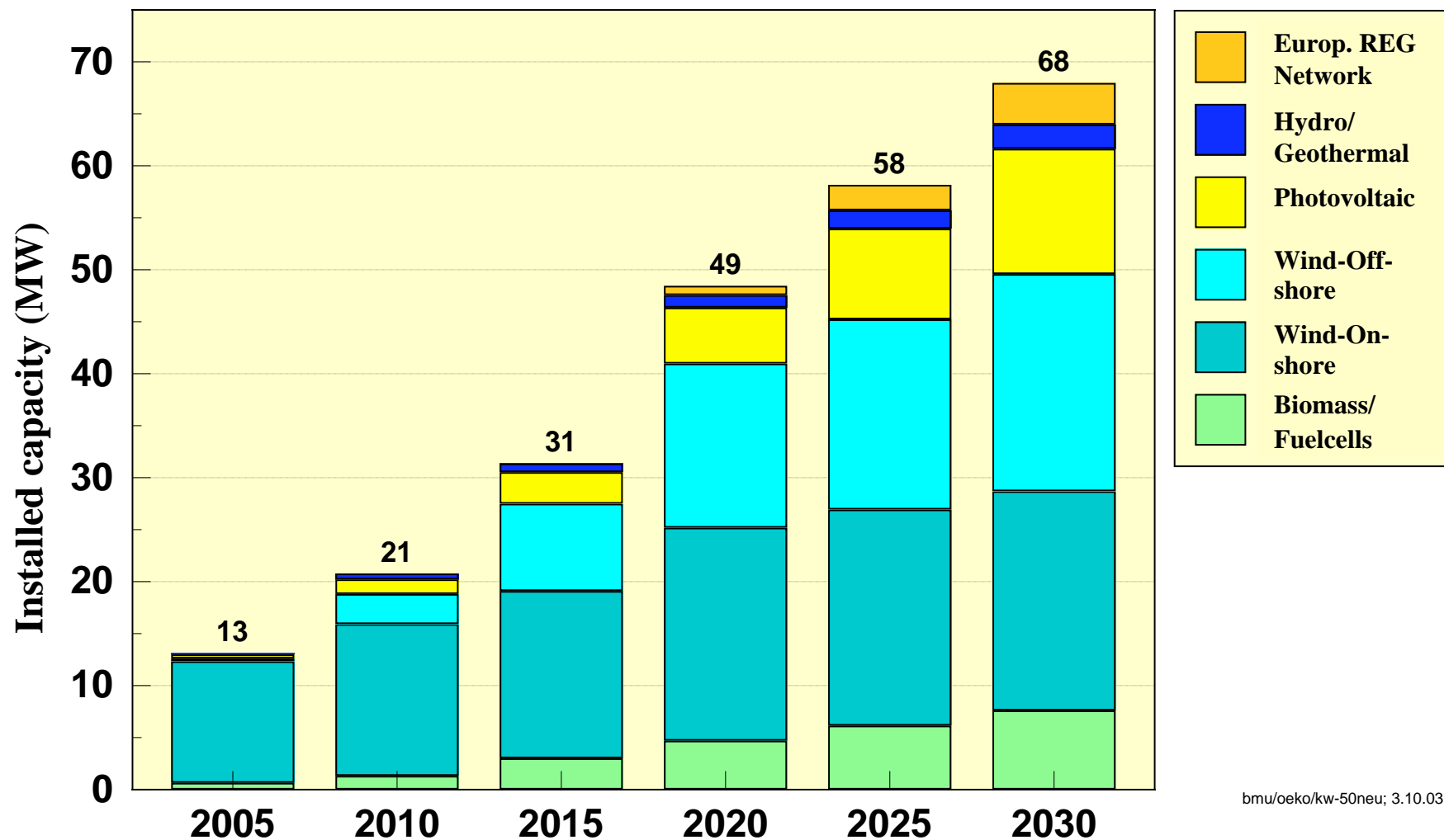
RE-Primary Energy > 10% in 2020

- **Long Term Goal Ministry for Environment**

RE-Primary Energy > 50% in 2050

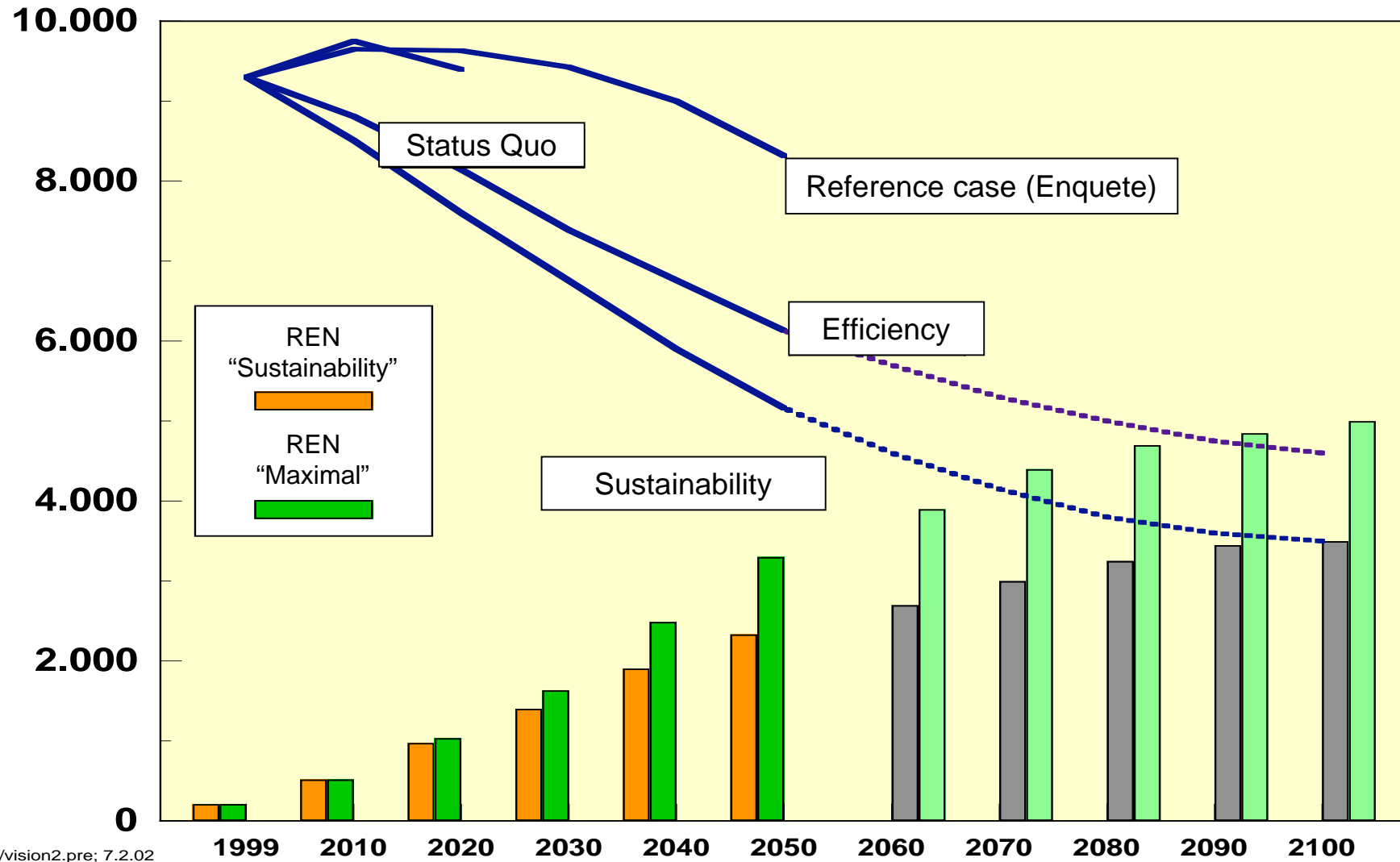


Necessary capacity extension for renewable electricity generation for fulfilling long term policy targets



Perspectives: Two Indispensable Pillars for Sustainability

Only the combination of Energy Efficiency and Forced Market Introduction of Renewable Energies can lead to a carbon free energy system



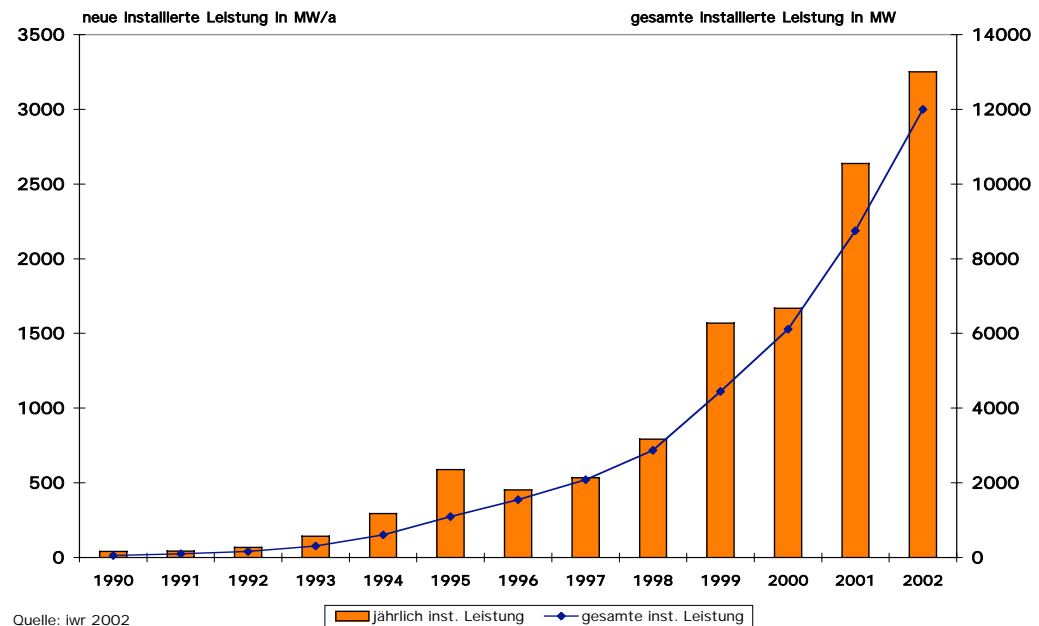
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Policy Framework II: Policy Supporting Scheme for Renewable Energies

- ♣ Policy supporting scheme started in the early 1990's
 - Feed in Law in 1991
 - Grants for Wind energy (250 MW Program)
 - information program
 - etc
- ♣ Renewable Energy Act Came into Force in April 2001

🍏 Resulting in a significant market increase

**For example:
Development of wind energy in Germany since the beginning of the 90s (VDEW- and IWR-statistics) following the policy supporting scheme**



The German Renewable Energy Act

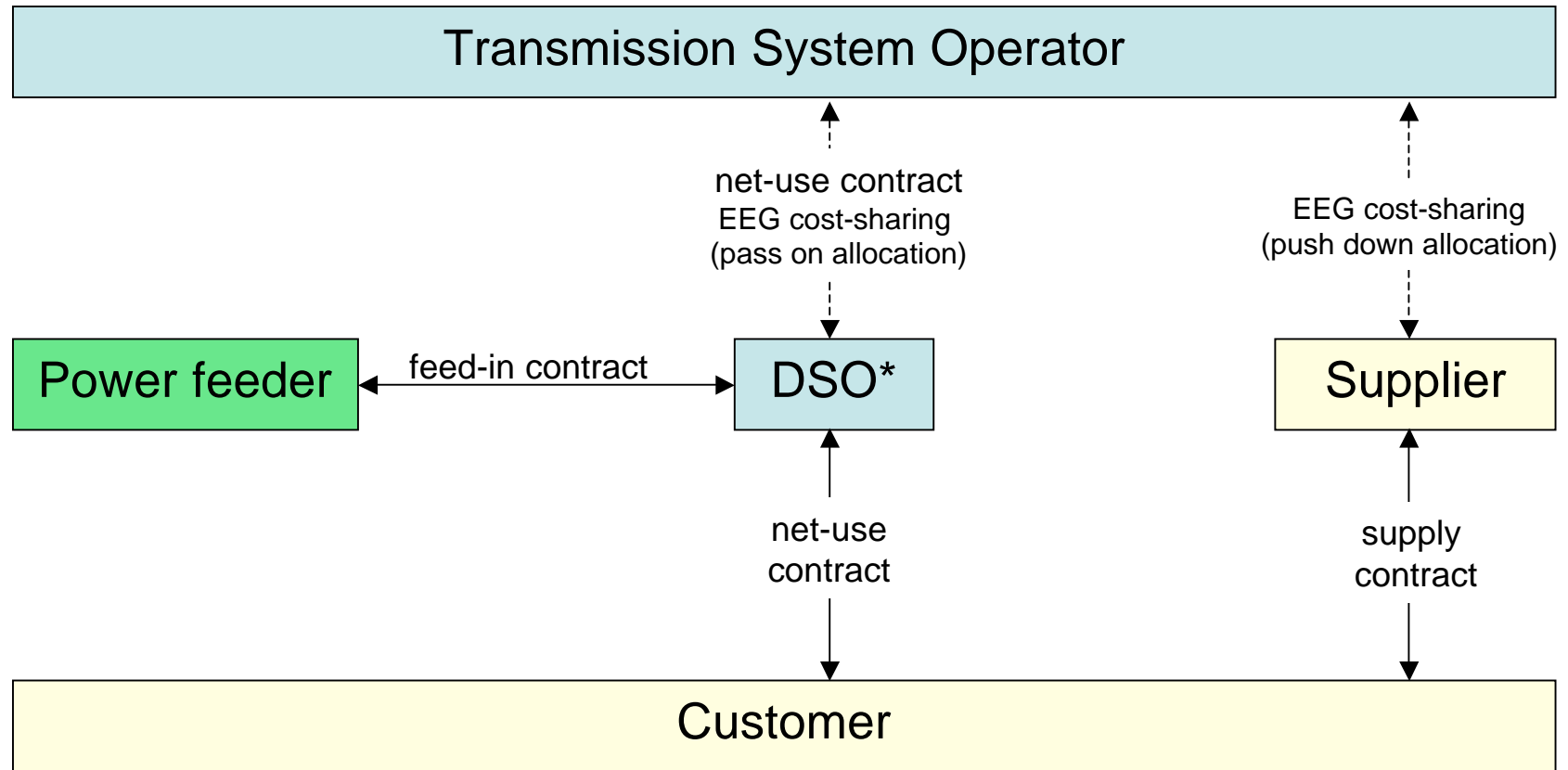
General Principles and Advantages

- ♣ Fix remuneration for electricity feed in, e.g. per kWh (depending from plant size)
 - 54 to 57.4 cent for solar electricity (photovoltaic)
 - 5.5 to 8.7 cent for electricity from wind energy
 - 8.95 to 15 cent for geothermal electricity
 - 6.65 to 7.67 cent for hydro power
 - 8.4 to 11.5 cent for electricity based on biomass

gives incentives following the specific market conditions for each technology

- ♣ Simple and transparent structure
- ♣ Incentives for a continuous cost reduction (yearly cost depression factor for remuneration of new plants)
- ♣ High security for investors (long term remuneration guarantee) compared to quota systems
- ♣ No dependence from public budgets
- ♣ Financed by Energy Utilities according to their electricity sale to electricity users
Implementation of a nation wide compensation scheme - indirectly financed by electricity users
- ♣ First step for an internalisation of external costs
- ♣ Evaluation of principles and remuneration scheme every two years

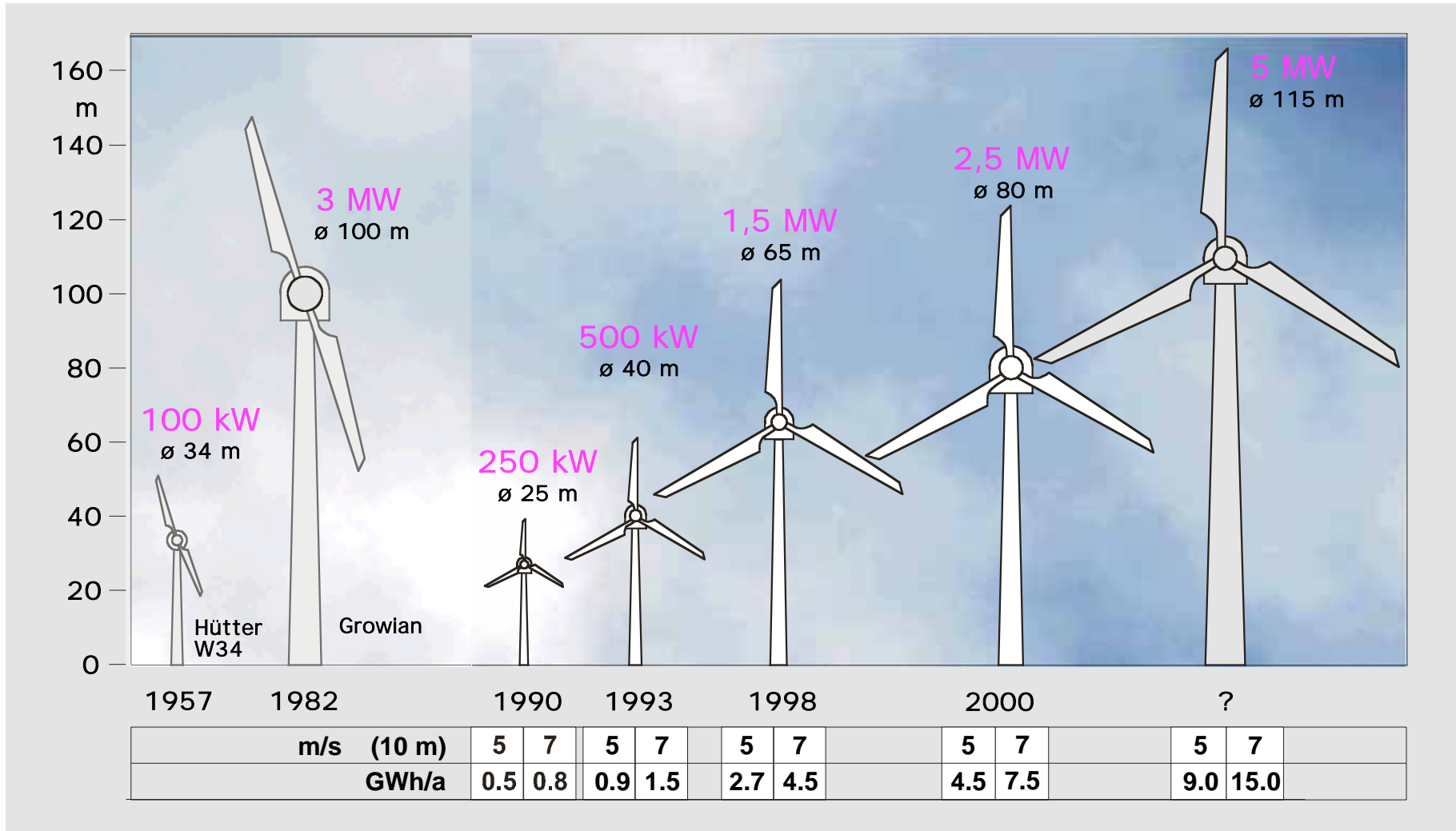
Legal Interrelationships of German Renewable Energy Sources Act („EEG“)



Source: Mahn, U. (BWK 1/2-2001, 36); own presentation

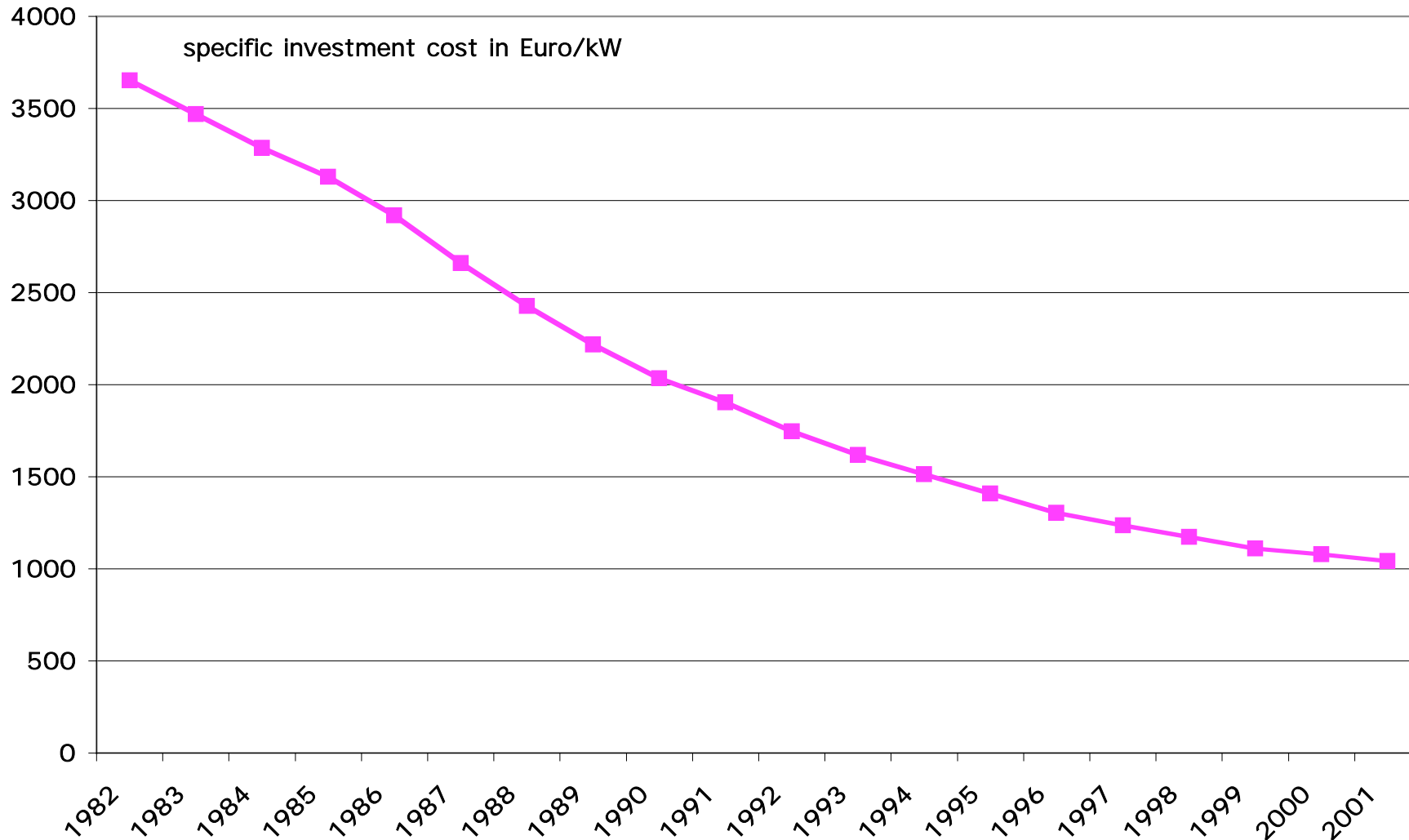
* Distribution System Operator

Implication of the German Renewable Energy Act I Incentives for Technology development of wind energy



Implication of the German Renewable Energy Act II

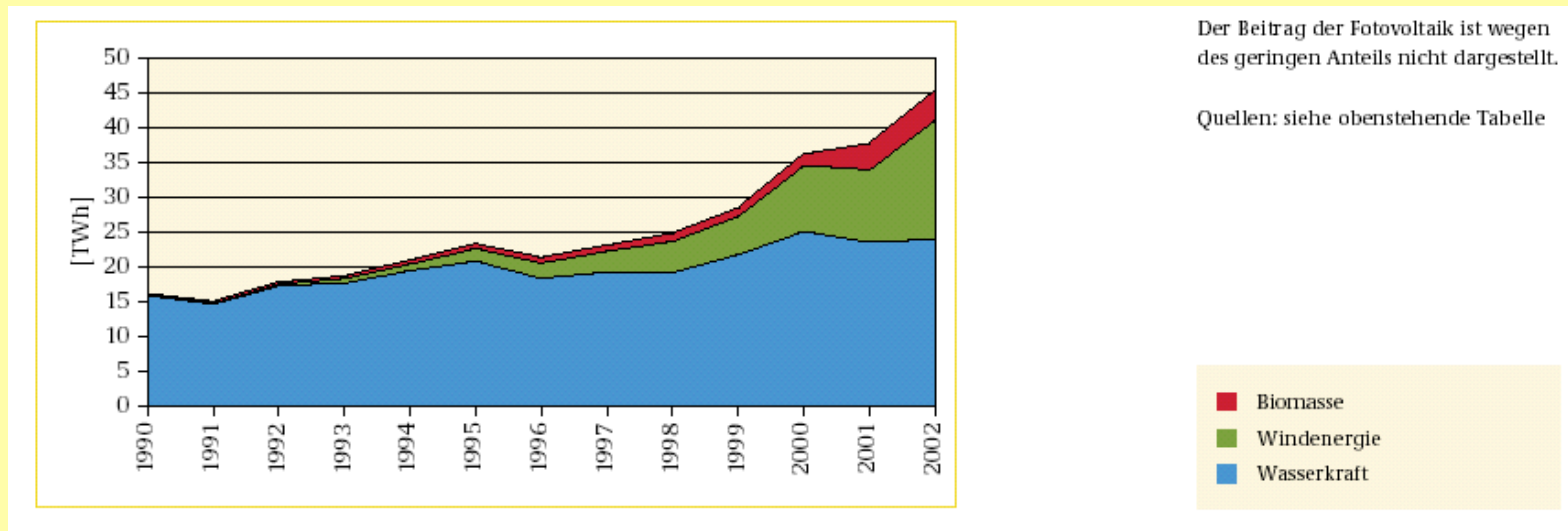
Cost reduction of wind energy following market success



Implication of the German Renewable Energy Act III

Market success, employment and ecological effects

- ♣ Significant increase of electricity generation based on renewable energies (4.6% in 1998 - 24.8 TWh and 6.3% in 2000 - 36.3 TWh up to more than 8% in 2002 - 45.6 TWh = +83% compared to 1998)

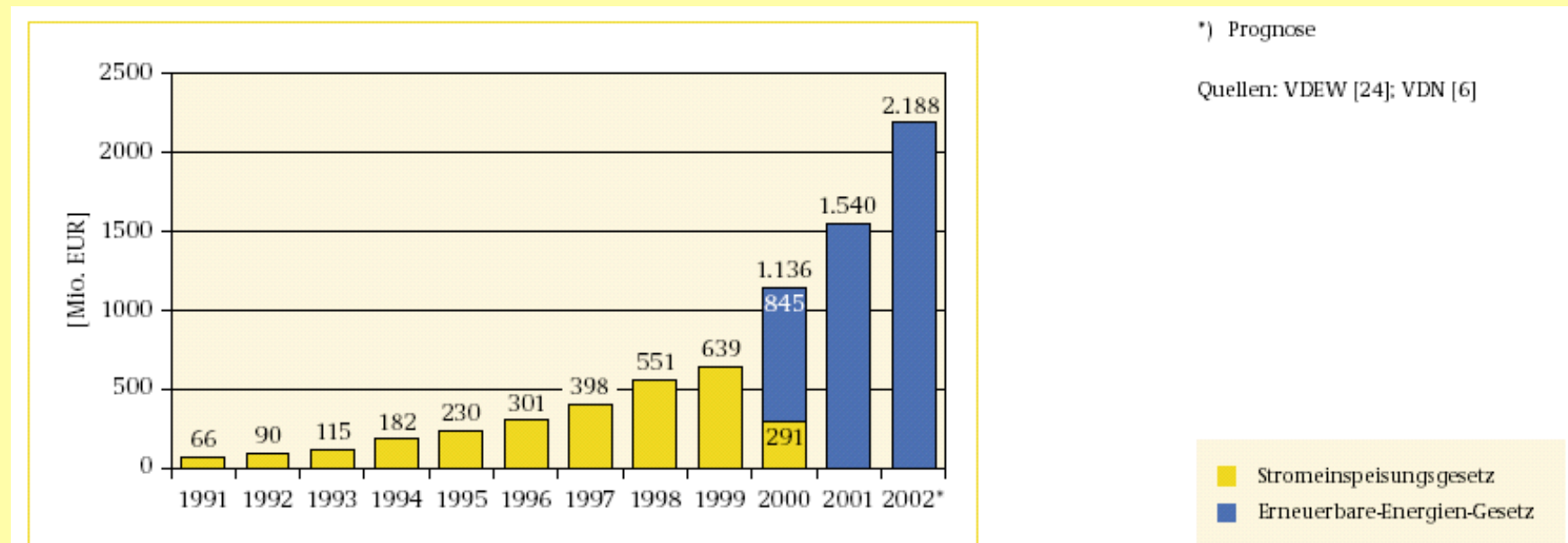


- ♣ Market volume by more than 8.1 billion Euro per year
- ♣ Creation of more than 80.000 jobs (now: 130.000 people are working in the field of renewable energies, more than in the nuclear industry and mining) - creation of a successful manufacturer structure
- ♣ Reduction of CO₂-emissions by more than 30 Million tons per year through additional electricity contribution (e. g. 3.6% of overall annual emissions)

Implication of the German Renewable Energy Act IV

Development of overall remuneration

- ♣ Increasing remuneration since implementation of the renewable energy act



- ♣ Compared to the market price of electricity the difference cost result to 1.35 Billion Euro in 2002 (e. g. 0.29 cent per kWh - ca. 2.2% of tariff for private customers resp. 1 Euro per household a month)
- ♣ Until 2008 and the annual remuneration might increase to 4.8 billion Euro and the specific costs to more than 0.6 cent per kWh
 - 🍏 exemptions for industrial customers with high electricity demand might be necessary to guarantee competitiveness

Implication of the German Renewable Energy Act V

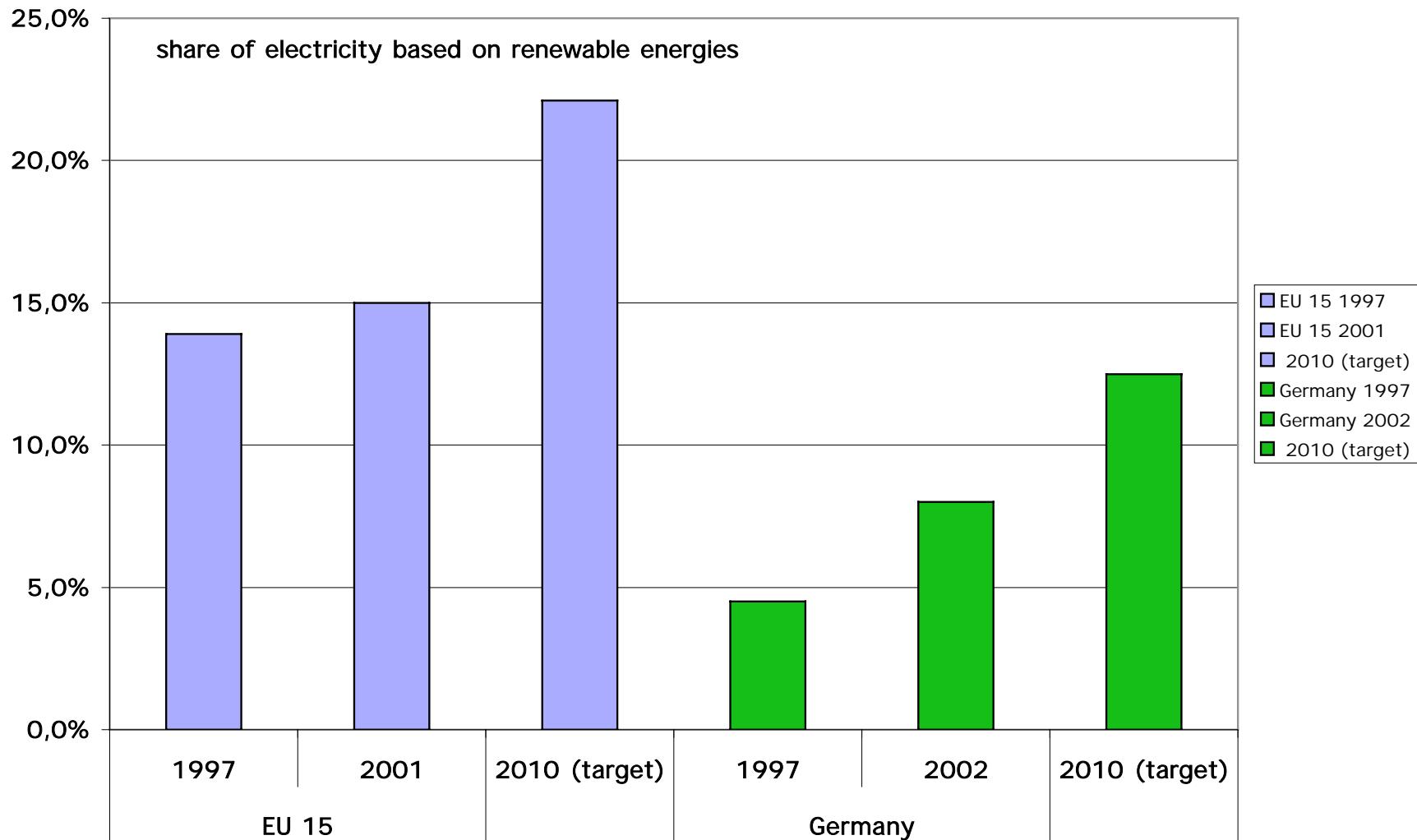
Market success compared to other countries

installed capacity
MW

	1995	1996	1997	1998	1999	2000	2001	2002
Germany	1.132	1.545	2.080	2.874	4.443	6.113	8.754	12.001
Spain	133	249	512	834	1.225	2.538	3.337	4.830
Denmark	637	857	1.116	1.450	1.761	2.364	2.534	2.880
Netherlands	249	299	325	363	411	449	483	686
Italy	33	71	100	180	283	427	697	785
UK	200	270	320	334	353	406	474	552
Sweden	69	105	117	150	215	241	290	328
Greece	28	29	29	39	82	226	299	276
Ireland	7	11	51	63	73	129	153	137
Portugal	9	20	38	60	60	99	125	194
Austria		3	20	30	42	79	95	139
France	3	10	10	19	22	62	116	148
Finland	6	8	12	17	38	38	39	41
Turkey		0	0	9	9	19	19	19
Luxembourg		2	2	5	10	15	15	16
Norway		4	4	9	13	13	17	97
Belgium		7	7	8	9	13	31	44
Czech Republic		7	7	7	12	12	12	12
Russia		5	5	5	5	5	5	7
Poland		1	3	3	5	5	28	28
Switzerland		2	2	3	3	3	3	3
Latvia		1	1	1	1	1	1	1
Romania		0	0	1	1	1	1	1
Sum	2.506	3.506	4.761	6.464	9.076	13.258	17.528	23.225

Implication of the German Renewable Energy Act VI

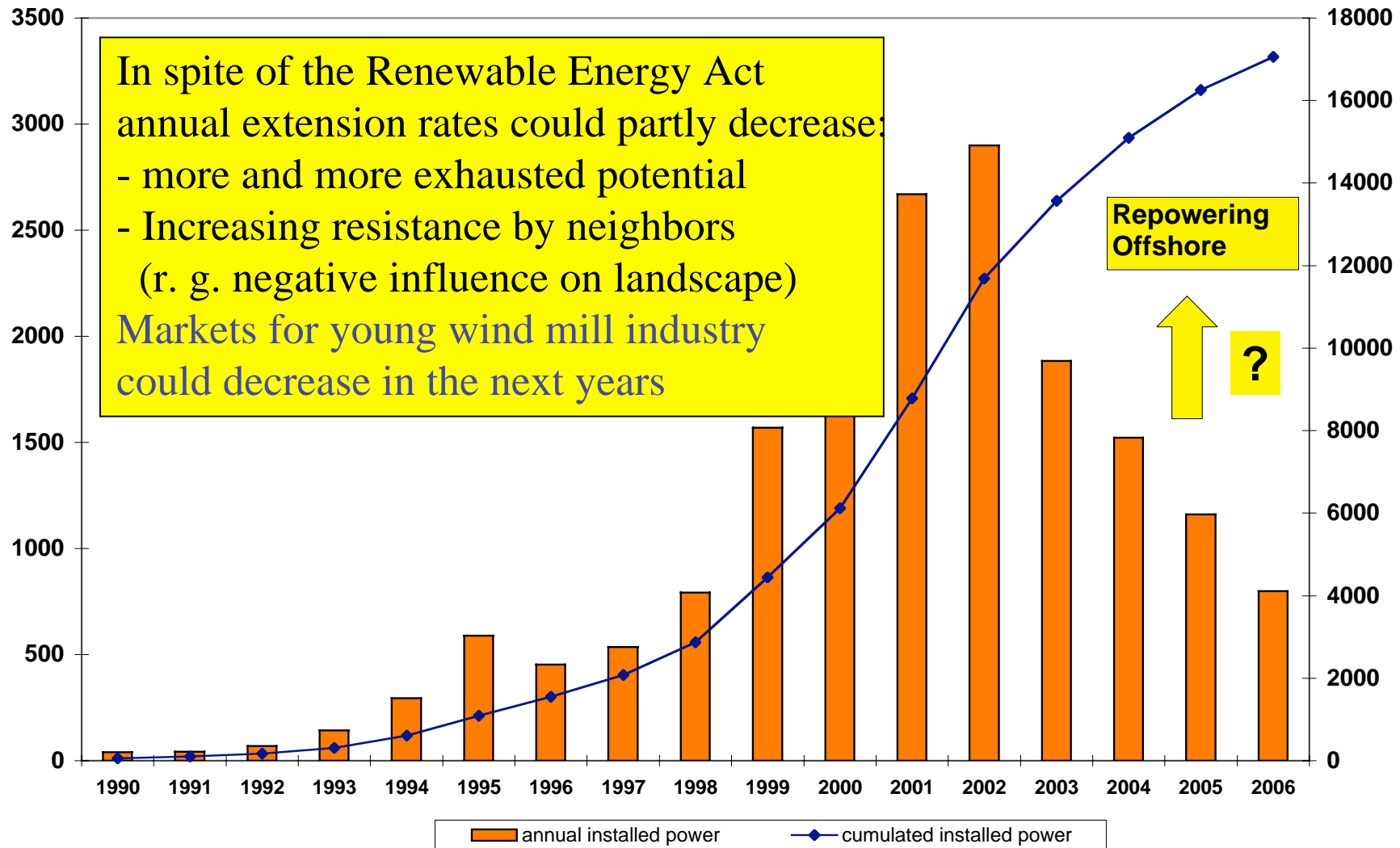
Germany is on a good way to fulfill 2010 doubling target



Implication of the German Renewable Energy Act VII

- **Transfer of principles of The Renewable Energy Act as success factor in other countries, like**
 - √ **Spain**
 - √ **France**
 - √ **Greece**
 - √ **Austria**
 - √ **Japan**
 - √ ***Brazil, Argentina, Taiwan (in the process of establishing)***
 - √ **etc.**

Perspectives for wind energy in the near future - ongoing challenges for policy measures



The German Renewable Energy Act Amendment Requirements

- ♣ Integration of bigger hydropower plants (> 5 MWe)
- ♣ Increase of remuneration for small biomass power plants to strengthen technology development activities in this area
- ♣ Modification of the incentives for wind mills as response to increasing opposition against wind energy
 - General reduction of specific remuneration for wind mills following the cost depression which could be achieved in the last years
 - Exclusion of places with comparable low wind velocity (in average) from remuneration scheme
 - Additional incentives for repowering through extension of period with higher remuneration rate
 - Higher remuneration rates for offshore wind projects
- ♣ Implementation of an additional bonus system for the employment of innovative technologies (e. g. biomass gasification) or cogeneration
- ♣ Limitation of charge to 0.05 cent/kWh for industrial customers with specific electricity costs which are higher than 15% of the annual value added

Conclusions

- **Renewable Energies are a growing market in Germany**
- **The Renewable Energy Act is the most important success factor, but**
 - **following the market dynamic it must be proofed continuously to guarantee the right incentives**
 - **embedded in further policy support measures, in Germany like**
 - √ information programs
 - √ R&D programs
 - √ Specific grants for projects outside electricity sector
 - √ tax exemptions for bio fuels

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Thank you for your attention!

