

**German Environment Ministry,
COGEN Europe and Business Council e5**



Principles and Competitive Framework for the Allocation to Highest Efficient and CHP Power

Economical Benefits for all ET Participants

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- EUROPEAN BUSINESS COUNCIL FOR A SUSTAINABLE ENERGY FUTURE

⇒ **e⁵** (e to the power of five)

- ENERGY
 - EFFICIENCY
 - ENVIRONMENT
 - EMPLOYMENT
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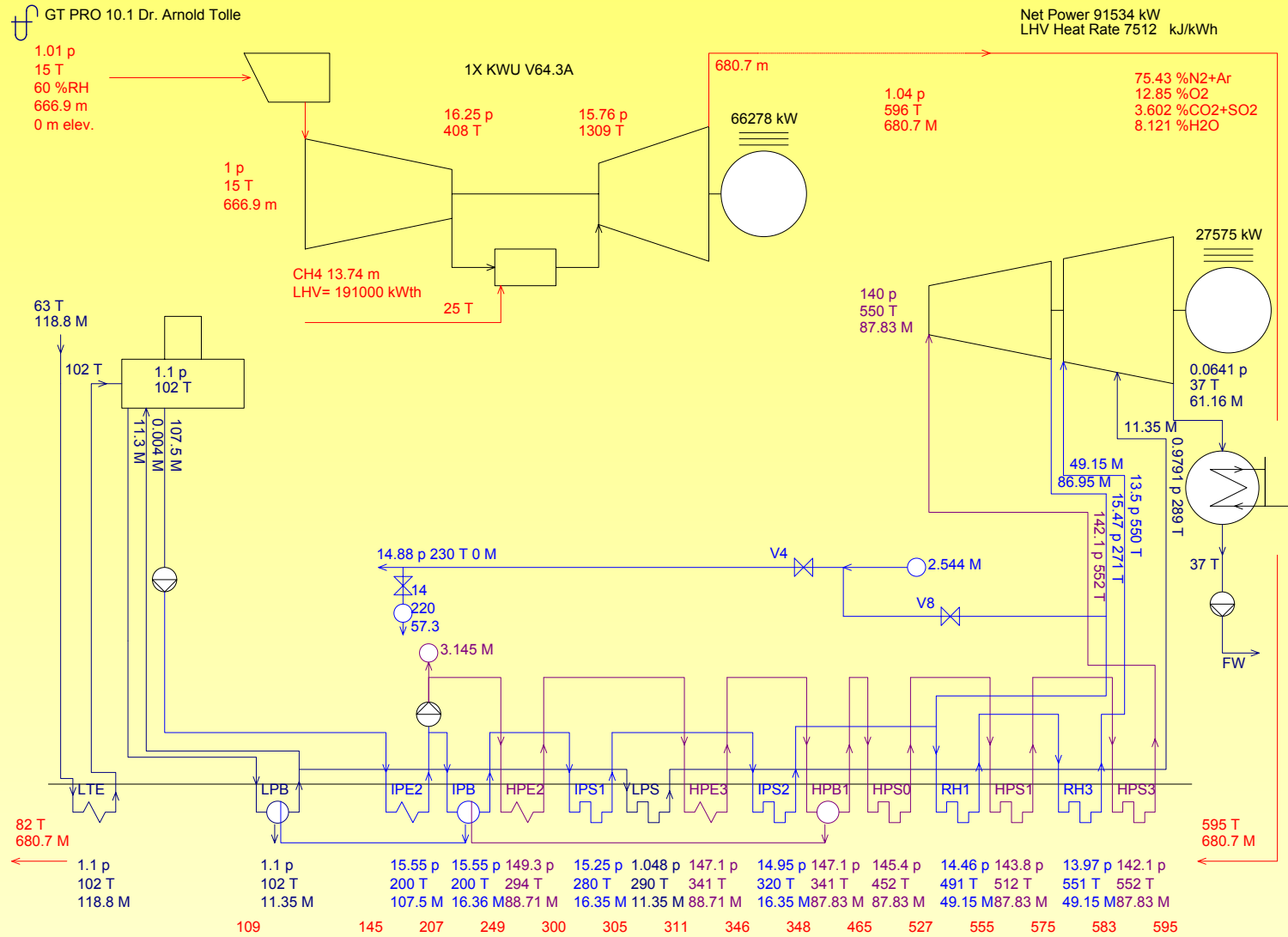
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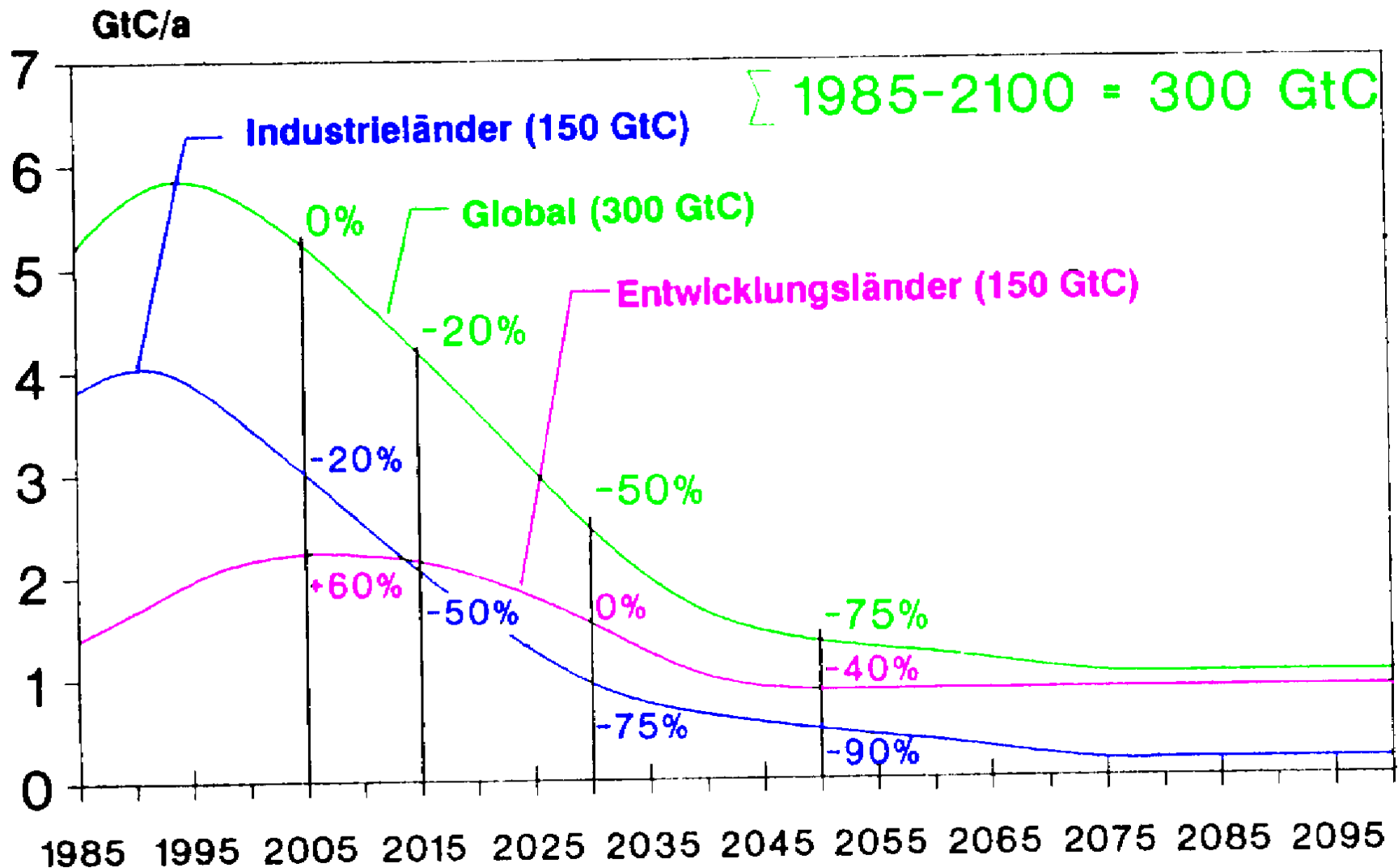
Prozeßsimulation

Gasturbinenblock in KWK mit Zwischenüberhitzung



Necessary CO₂-Reductions

Source: Intergovernmental Panel on Climate Change

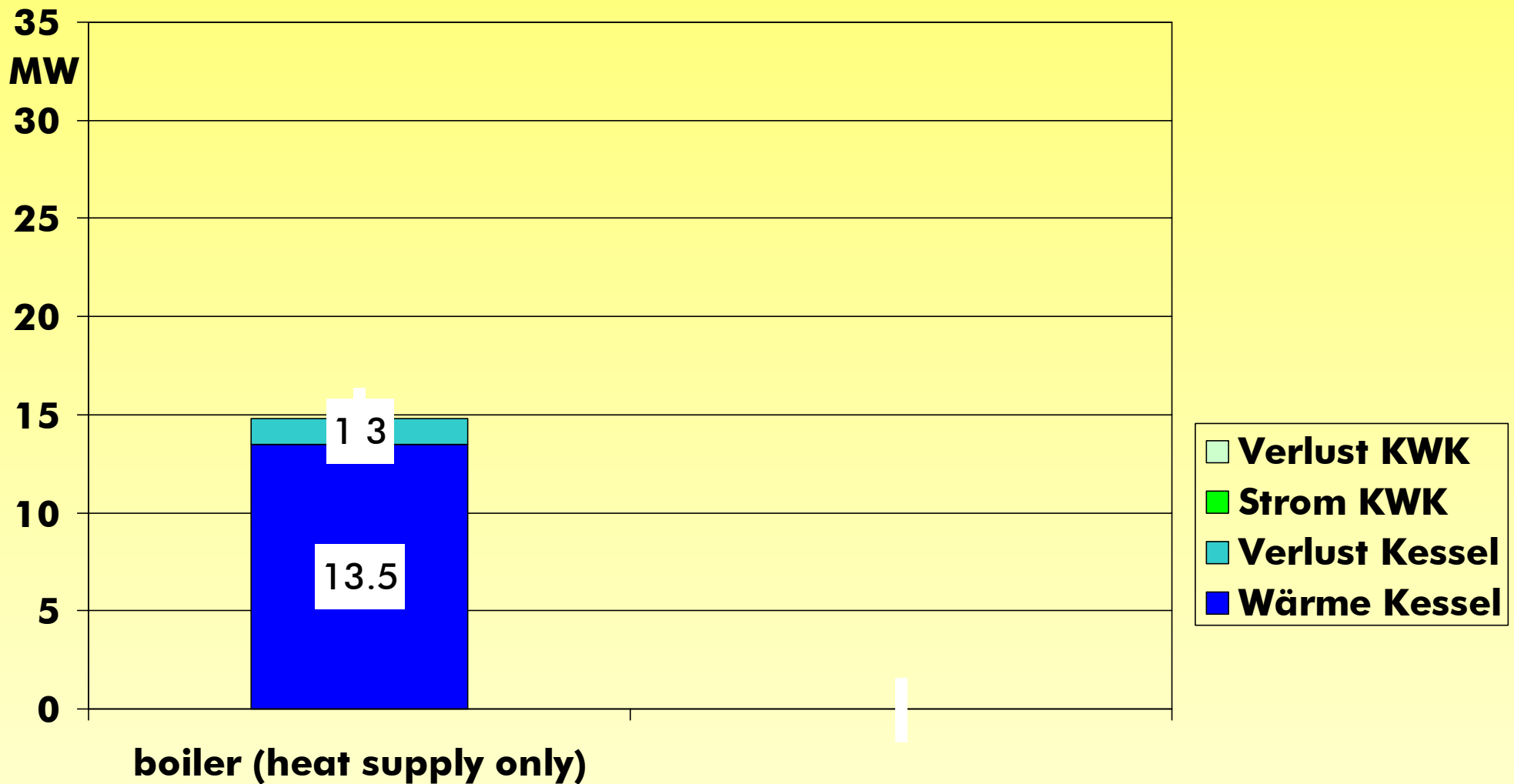


Combined Heat and Power Allowances for Emissions Trading

- Defining CHP Efficiency
 - ⇒ Efficiency of additional fuel
 - ⇒ CHP comparable to other Power Plants
- Allowances for
 - ⇒ Heat
 - ⇒ Power
- Additional Rules
- Discussion of Model
- (Potential of different CHP schemes)

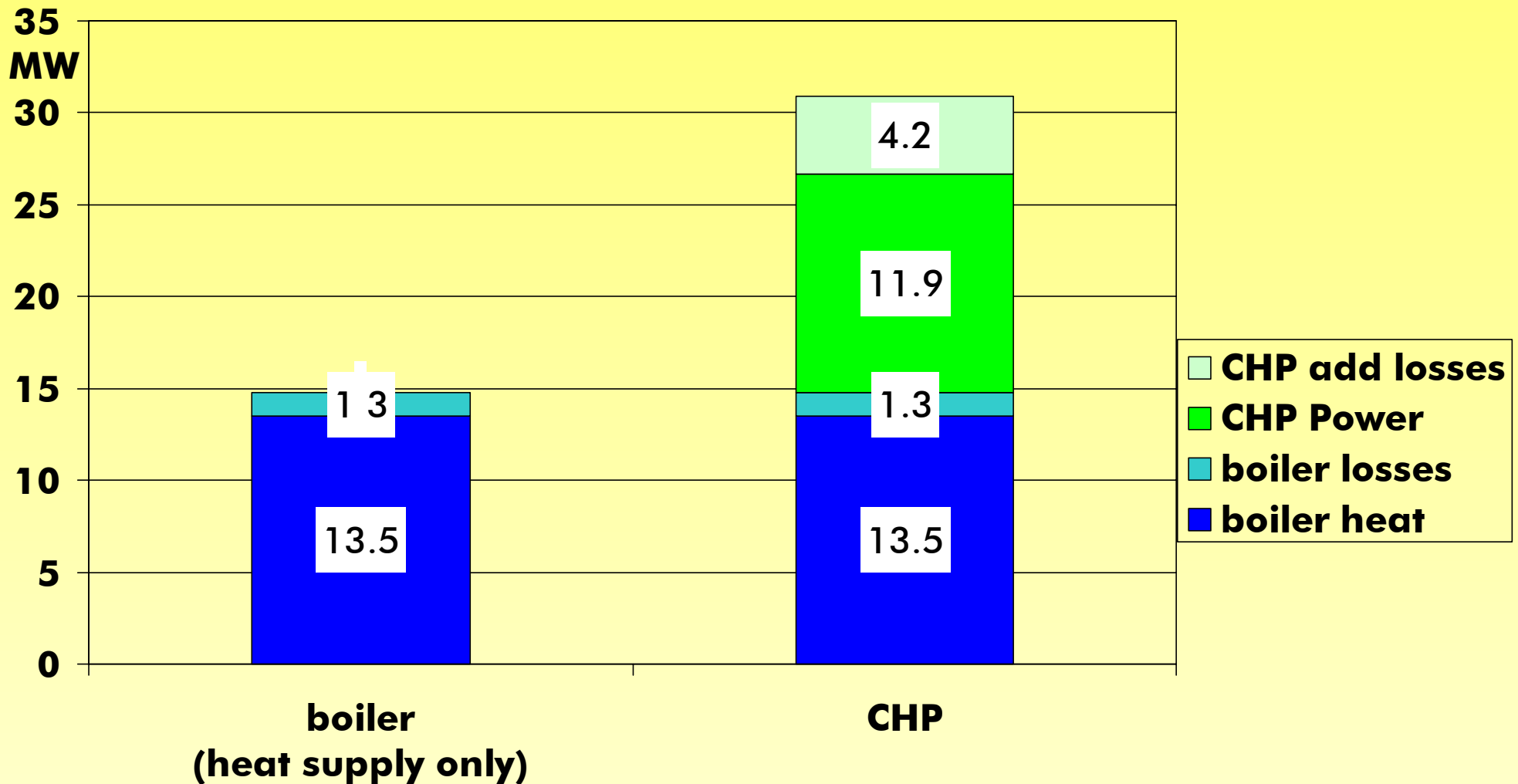
Definition CHP-Efficiency

Efficiency of additional fuel for CHP power generation



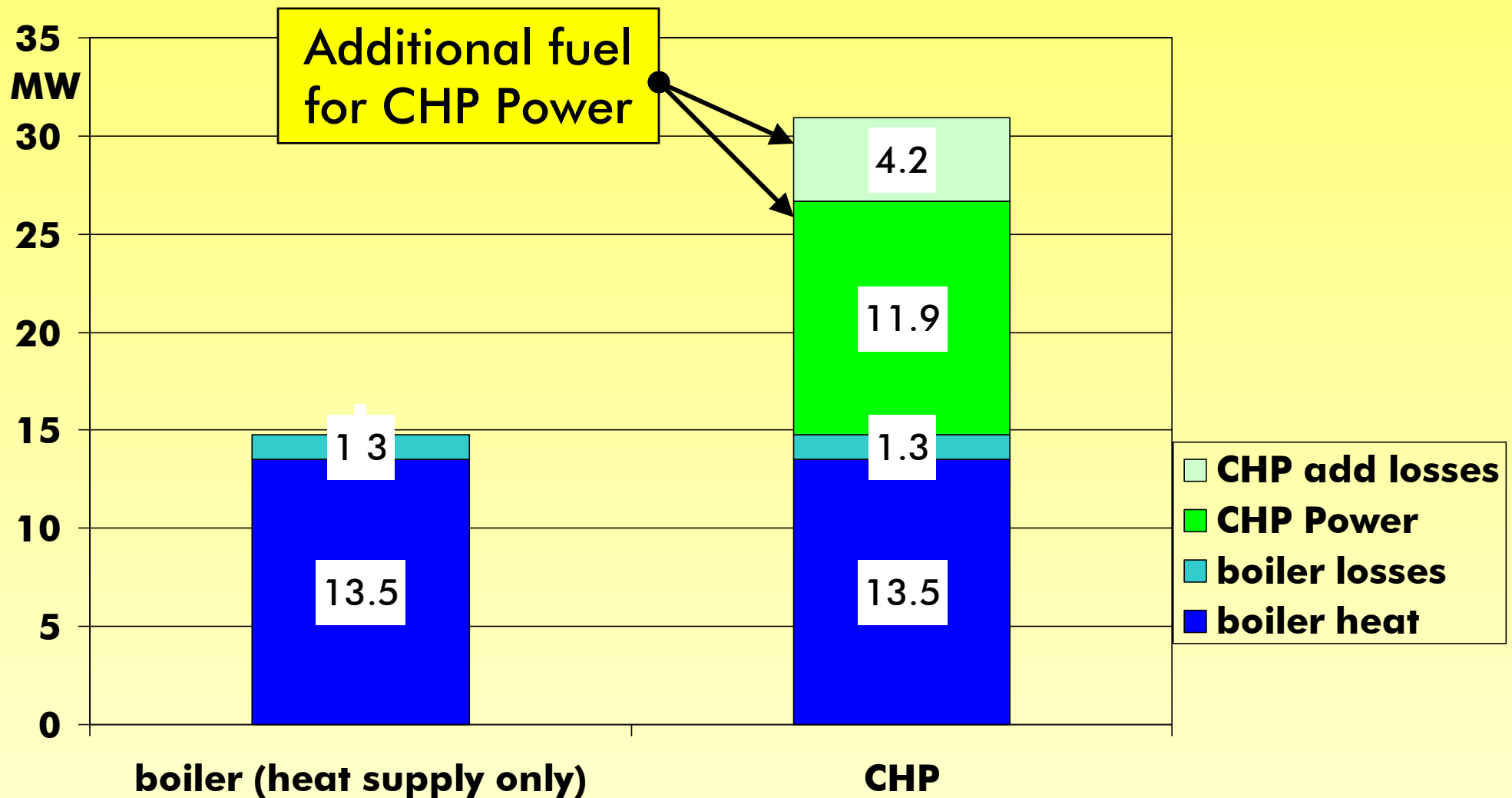
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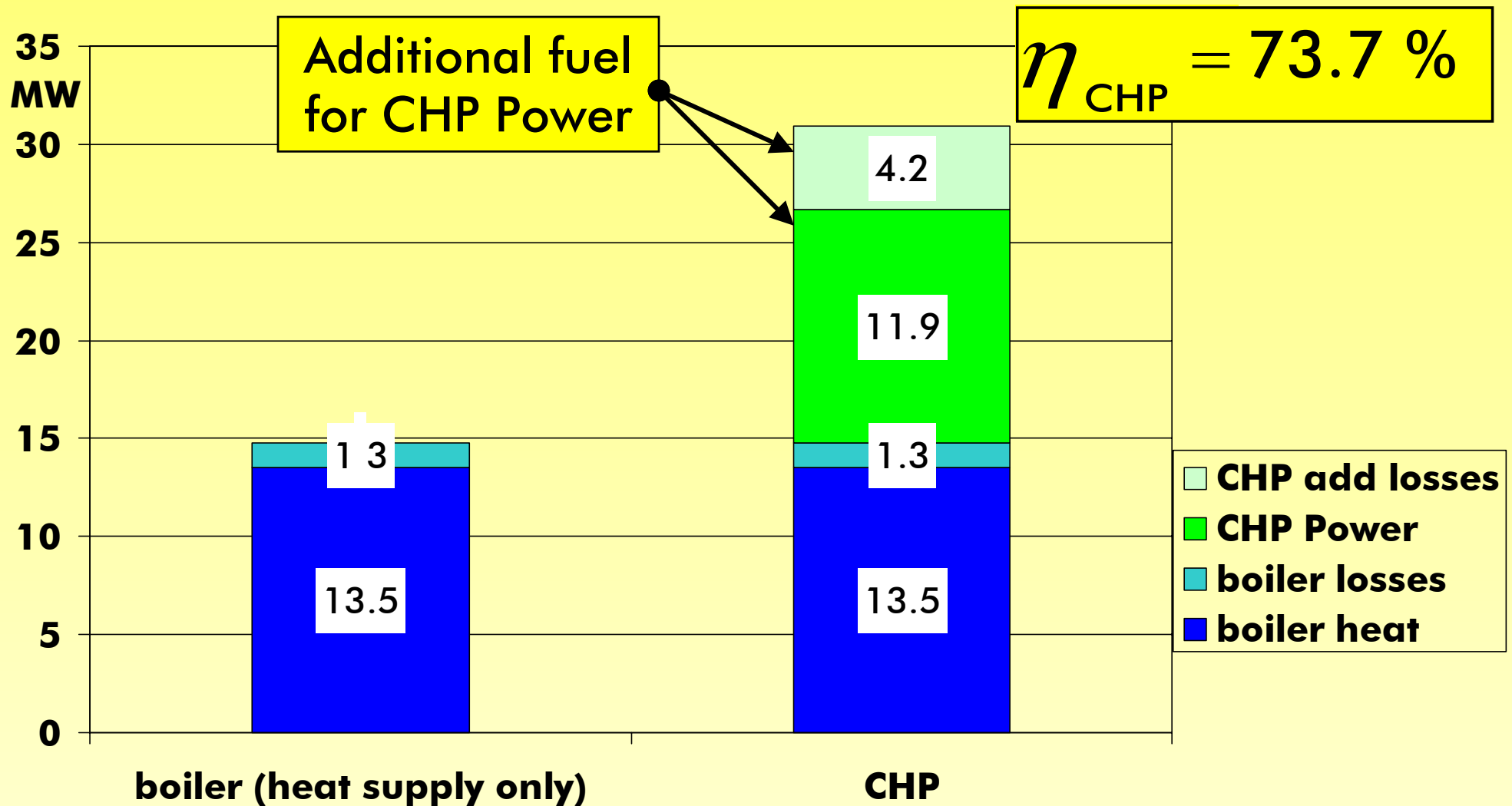
Definition CHP-Efficiency

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Definition CHP-Efficiency

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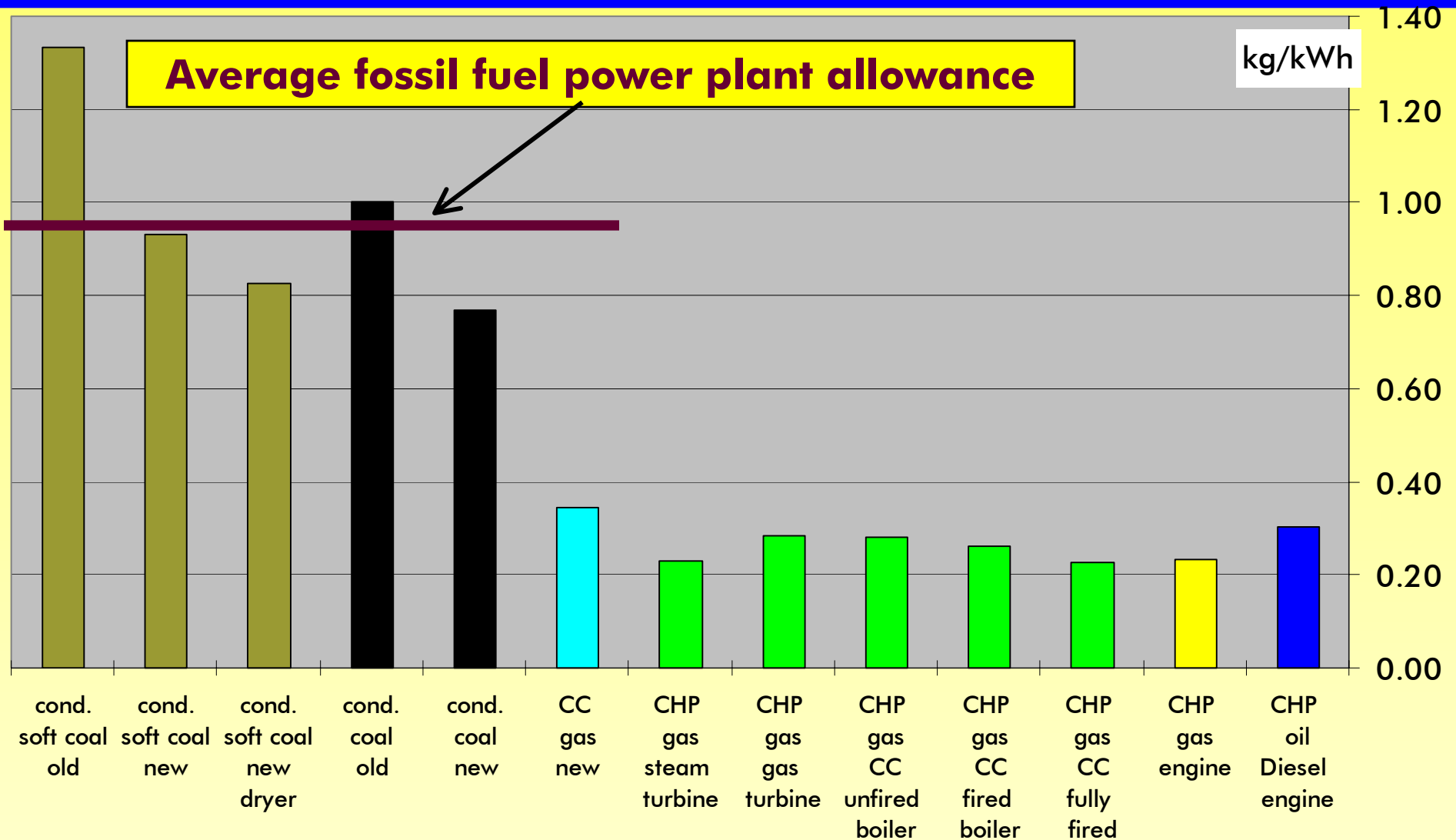
CHP Additional Fuel Efficiency

efficiency of additional fuel required for generated CHP power

$$\eta_{\text{CHP}} = \frac{\dot{P}_{\text{el CHP}}}{\dot{F}_{\text{CHP}} \frac{\dot{Q}_{\text{net}}}{\eta_{\text{heat}}}}$$

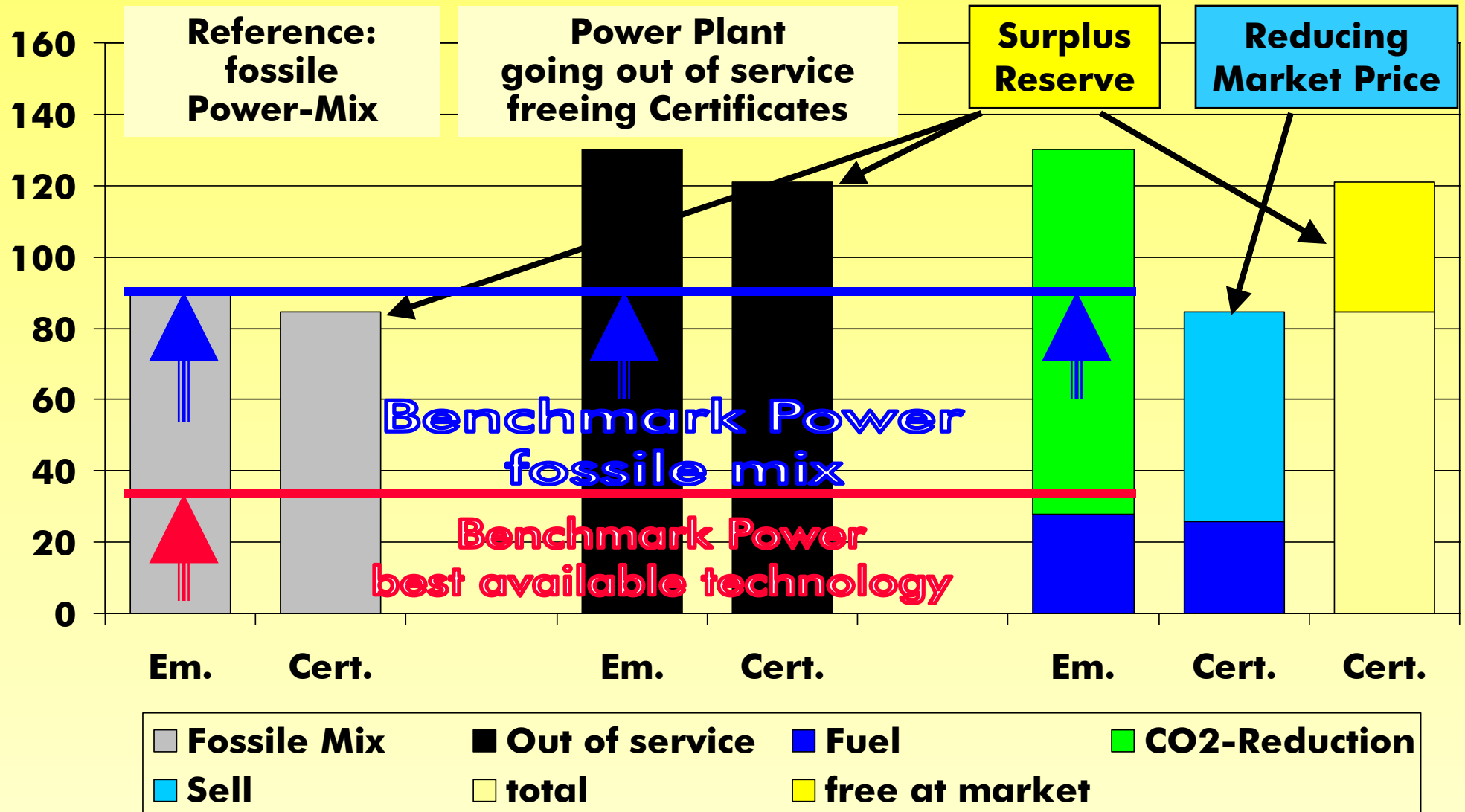
Allowances CHP Power

Average allowance fossil fuel power plants



Allocation of Highest Efficient Power

Substitution Model; Attractive Incentive; Free Certificates



German CHP law 2002

Grants for different Plants

Jahr	Alte Bestands-Anlagen	Neue Bestands-Anlagen	KWK-Moder-nisierung	neue Klein-KWK 50 bis 2000 kW	neue Klein-KWK 50 kW Inb. bis 2005
	Cent/kWh	Cent/kWh	Cent/kWh	Cent/kWh	Cent/kWh
2002	1.53	1.53	1.74	2.56	5.11
2003	1.53	1.53	1.74	2.56	
2004	1.38	1.38	1.74	2.40	
2005	1.38	1.38	1.69	2.40	
2006	0.97	1.23	1.69	2.25	für 10 Jahre ab Inbetrieb-nahme
2007	0	1.23	1.64	2.25	
2008	0	0.82	1.64	2.10	
2009	0	0.56	1.59	2.10	
2010	0	0	1.59	2.10	

Substitution Model CHP

Supposed and necessary incentives for fossile power mix

- Supposed to have nearly competitive incentives
- Example 10 € / t CO₂
 - ⇒ CHP in Germany about 5 € / MWh
 - ⇒ about one third of actual German CHP law incentives
 - but on a probably longer period

Substitution Model CHP

Advantages of proposed CHP Substitution Model

- **Efficient Economy**
 - For consumers: lower consumption costs
 - For operators: more flexible and economic operation
- **Efficient Ecology**
 - More reduction for lower total costs
- **Easy to handle and communicate**
 - ⇒ Simple and technology independent
 - ⇒ Comparable to conventional power plants
- **Compatible to liberalized Market**
- **Supposed to have nearly competitive incentives**
 - ⇒ Example shown: 5 € / MWh
- **Automatically adopts to more sustainable power plant park**

CHP: Potentials for CO₂ Reductions

By far highest in Industry

- Utilising the Potentials

- ⇒ in many cases feeding power to the grid

- produced CHP power exceeding own power demand

- Example Netherlands

- ⇒ CHP could share 50 % of total power generation

- strategic view to 2000 in 1994

- ⇒ 80 % of this potential in industry

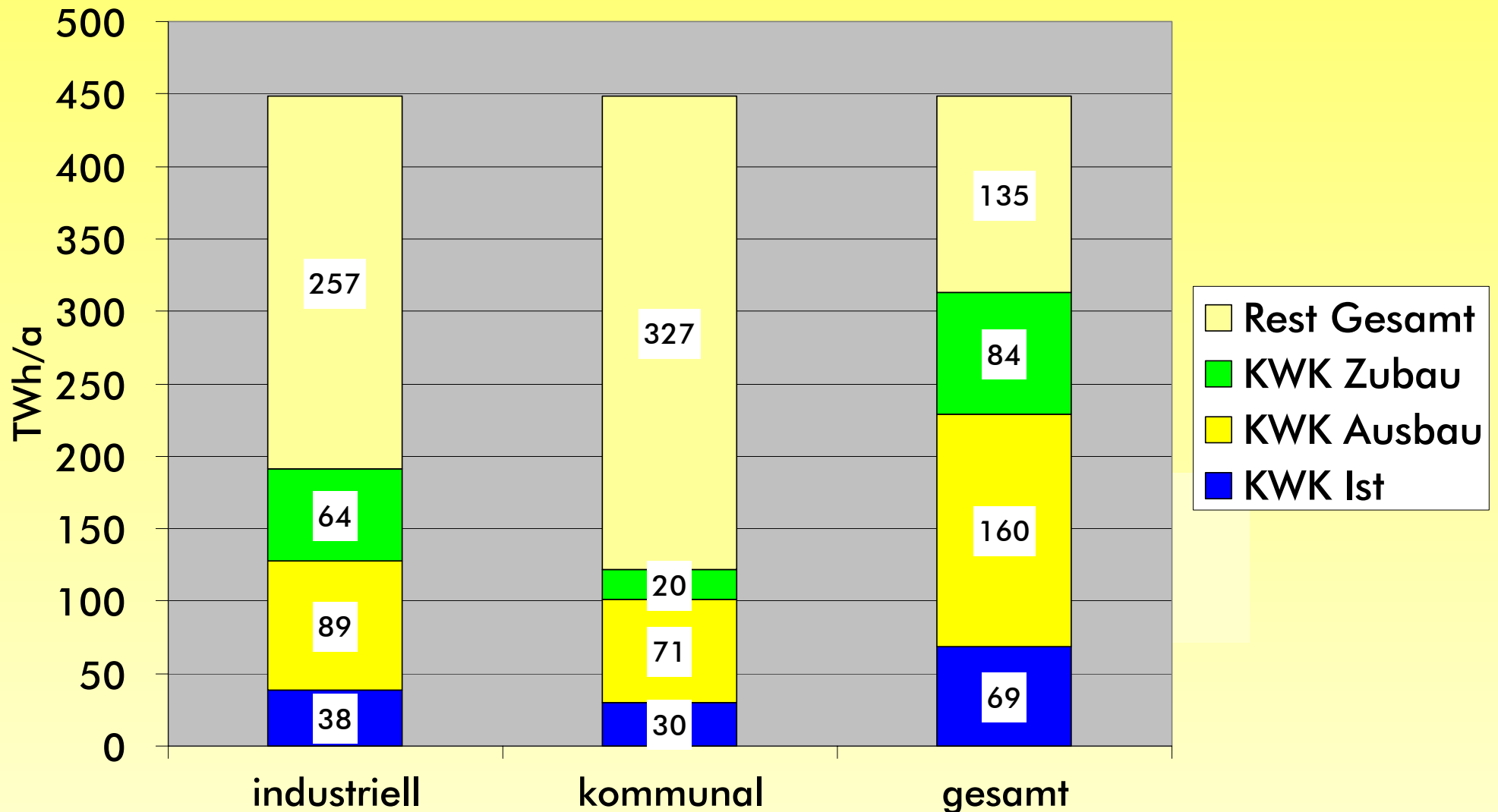
- maps with all industrial heat demand

- Bercelcentrale (Milk production)

- ⇒ generating 60 MW in CHP

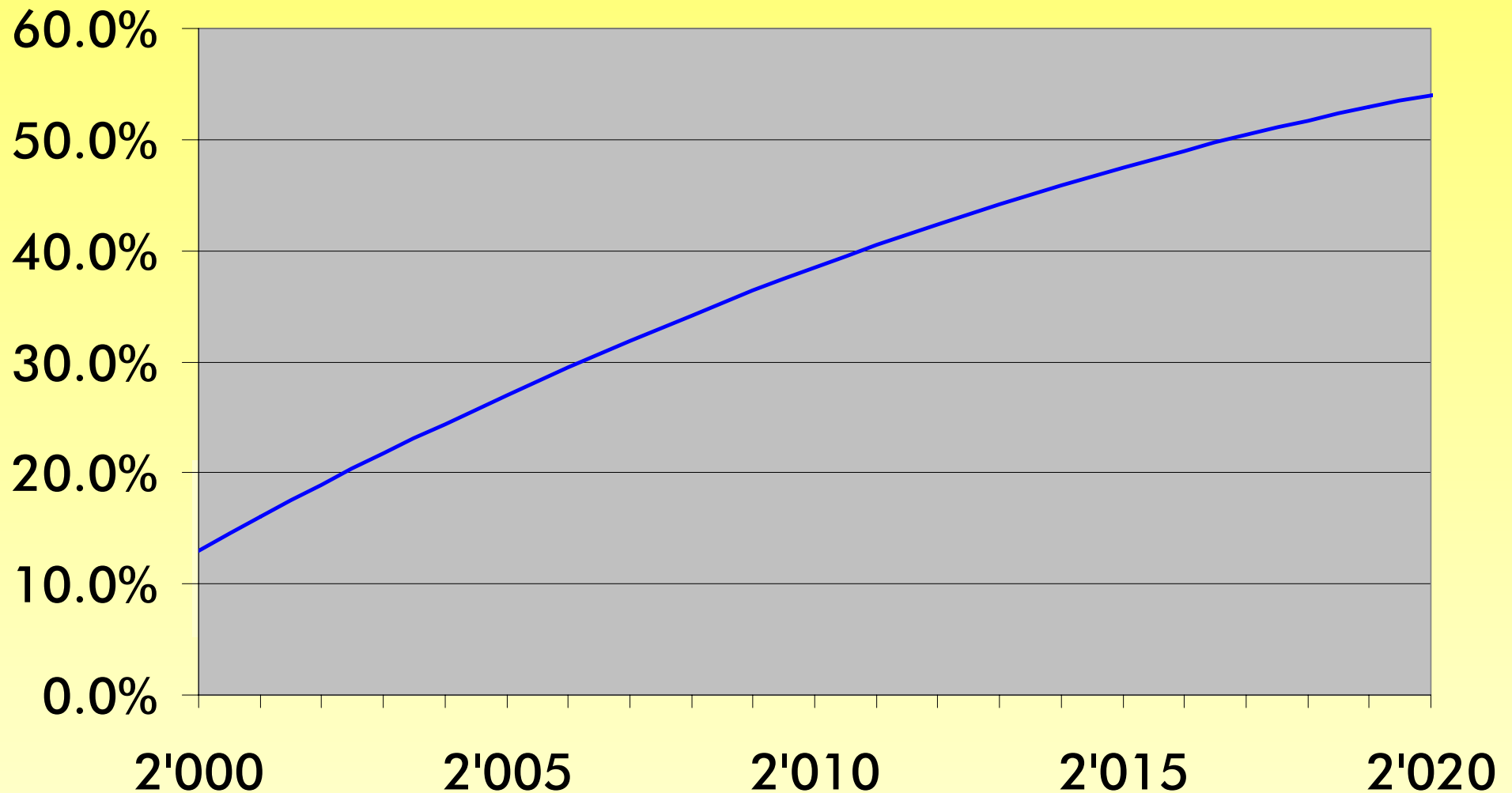
- ⇒ feeding 52,5 MW to the grid

CHP: sharing of total power production here: total German annual work load



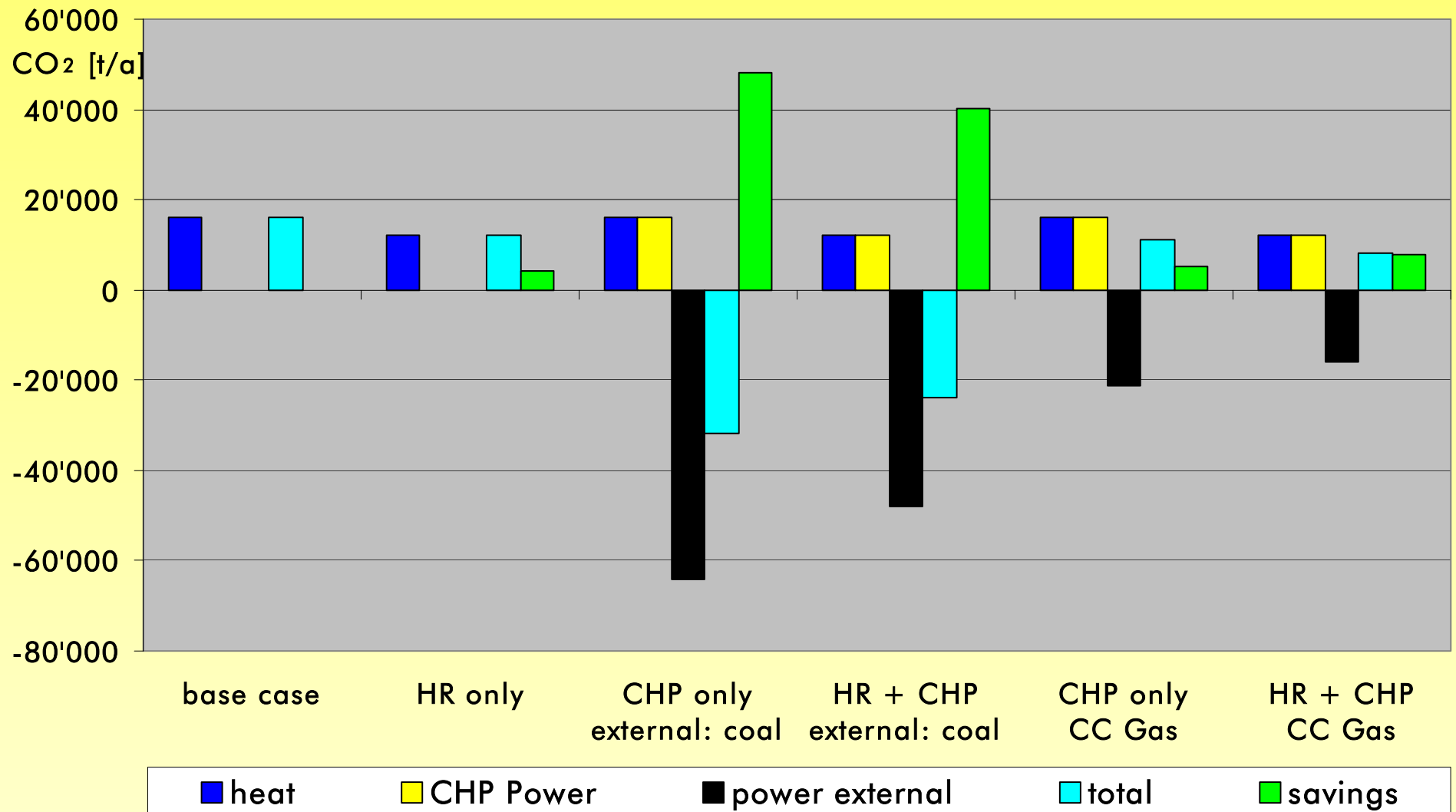
CHP share on total Power Production

primary slope 3%/a, annual decrease 0.1%/a



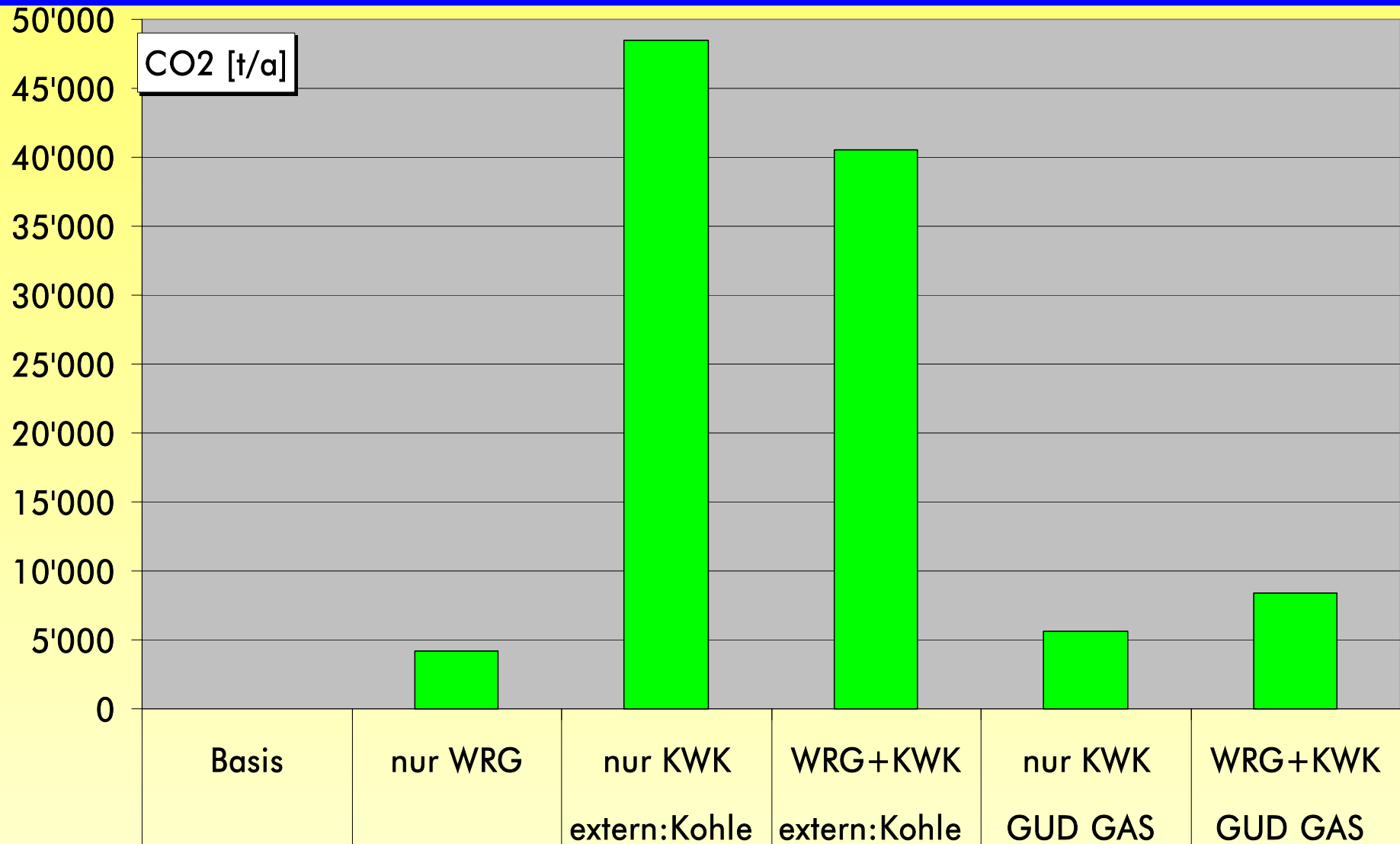
Heat Recovery (HR) and CHP

Multiple potential (up to 12-times) for reduction of CO₂ by CHP



Heat recovery and CHP

Multiple CO2 Reductions by CHP compared to heat recovery



Substitution Model CHP

The Advantages

- Moderate and appropriate Incentives
 - ⇒ Automatic adapting to power plant park
- Releasing the Market for Certificates
 - ⇒ Lower costs for all ET market participants
- Independent from used fuel: same incentives per reduced ton of CO₂
- Flexibility leads to Economy and Supply Security
- Clear and sharp Efficiency Criteria already integrated
- Easy handling
 - ⇒ s. Excel Sheet
- Equal Chances for old and new Market Participants
 - ⇒ More Competition, lower prices

Substitution Model CHP

Advantages for Industrial Companies

- Companies buying power
 - ⇒ Lower power prices
- Companies generating and selling CHP power
 - ⇒ Sharing value added benefits
- All Industrial companies
 - ⇒ Risk limiting of the strong Power Oligopoly

Substitution Model CHP

The Principles

- Treat Heat and Power as different “Products”
- Determine efficiency of Power
 - ⇒ CatA, CatB and CatC
- Use Substitution Principle for highest efficient Power
 - ⇒ Flags to avoid double incentives
- Modified Grandfathering for reduced load Power Plants
 - ⇒ Feed back not used certificates to the reserve

Substitution Model CHP

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