Promotion for CHP Berlin 2008

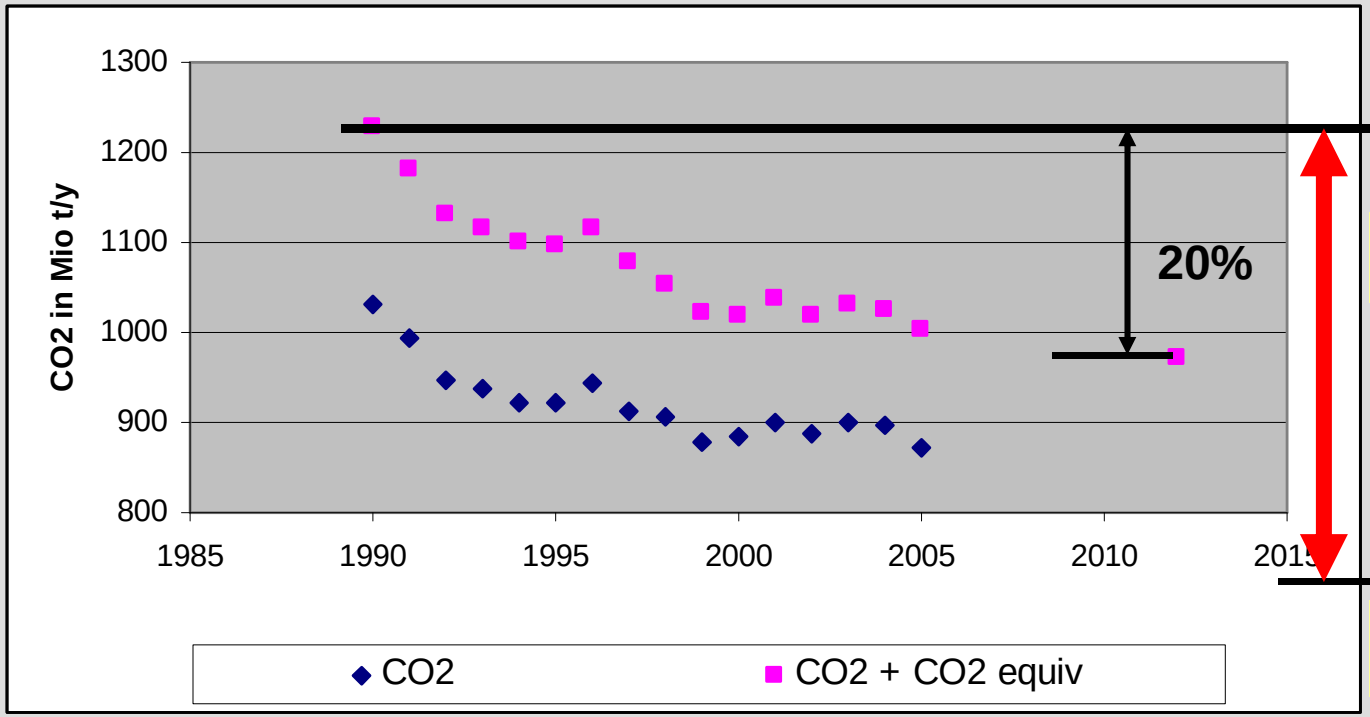
gtz

CHP – one Possibility to reduce CO_2

Karsten Brinkmann

Germany – CO_2 Reduction Targets

Following the Kyoto protocol and as a driver in EU German politics defined ambitious CO_2 reduction targets



German targets: Reduction based on 1990 values

40%

(if EU promises total 30%)

730 Mio t/y

2020

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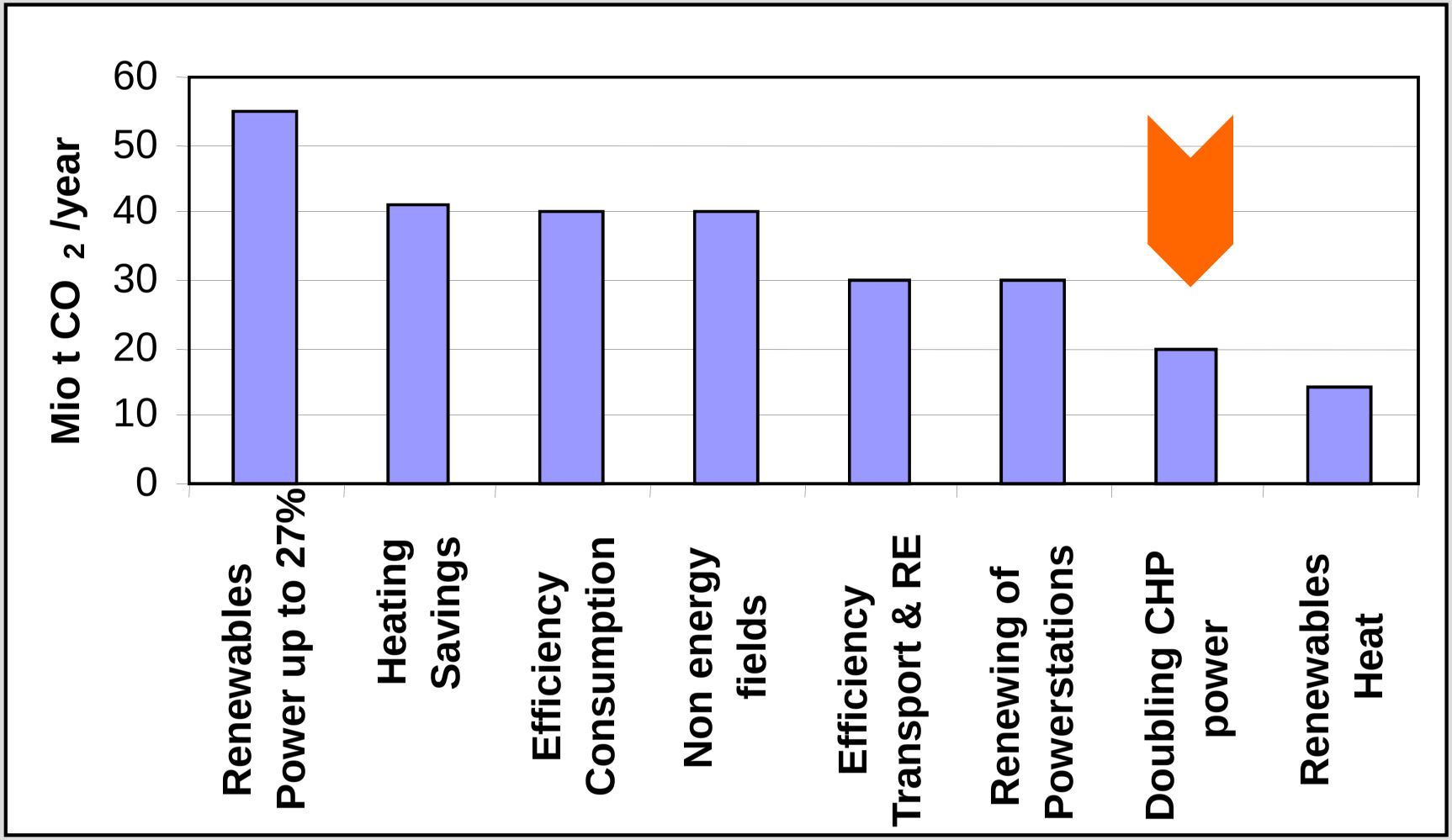
Germany – Reduction Subsectors 2020



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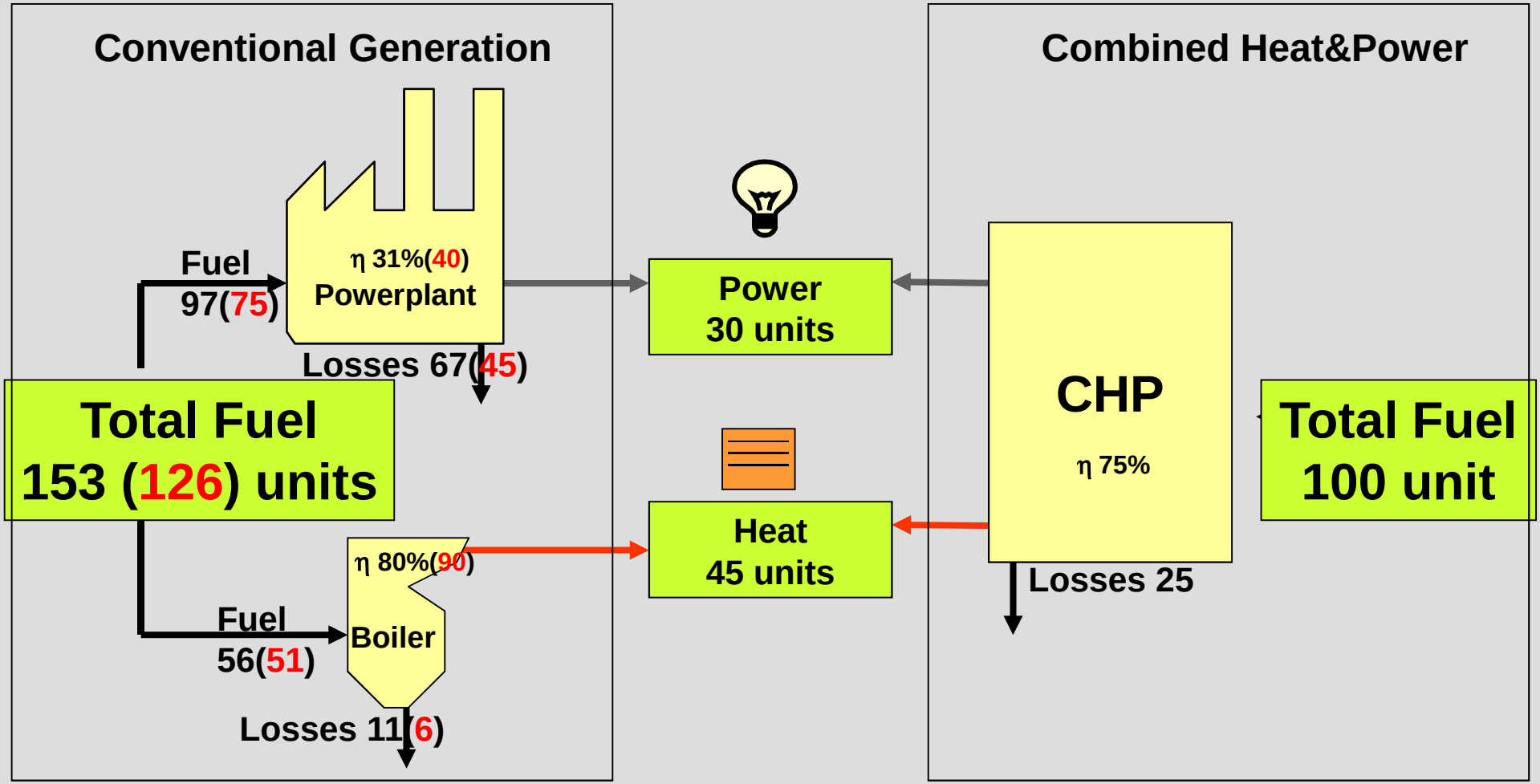
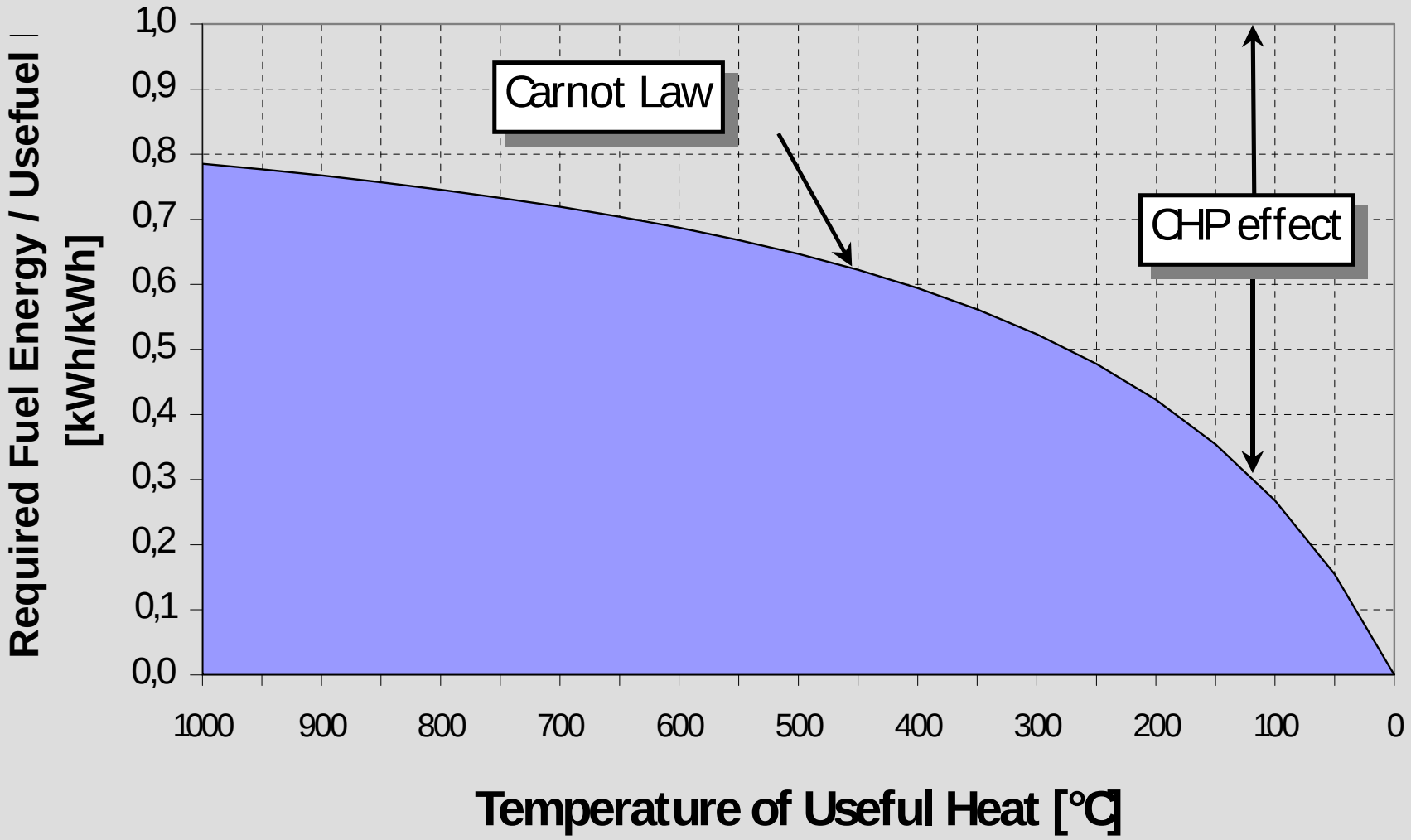
Efficiency Advantage of CHP



20-35 % Primary Energy Consumption Reduction
+ Emission Reduction (depending on fuel)

Carnot's Law


Carnot Law
CHP effect
Required Fuel Energy / Usefuel
[kWh/kWh]
1,0
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0,0
1000
900
800
700
600
500
400
300
200
100
0
Temperature of Useful Heat [°C]

CHPs are not all alike

Type: Private
5 kW (electricity)

12 kW (heat)

Household CHP

Type: Industrial CHP
20.000 kW (electricity)

20.000 kW (heat)

Location: Bauernfeind

Type: Utility CHP
3.000.000 kW (electricity)

1.000.000 kW (heat)

Location: Scholven

Types of CHP processes

Steam turbine

- Extraction condensing
- Back pressure

Steam gas cycle

- Extraction condensing
- Back pressure

Organic Rankine Cycle

Gas turbine

- With heat recovery
- STIG
- Micro turbines

Engines

- Diesel and Gas engine
- Piston steam engine
- Steam screw engine
- Stirling engine

Fuel Cells

innovative

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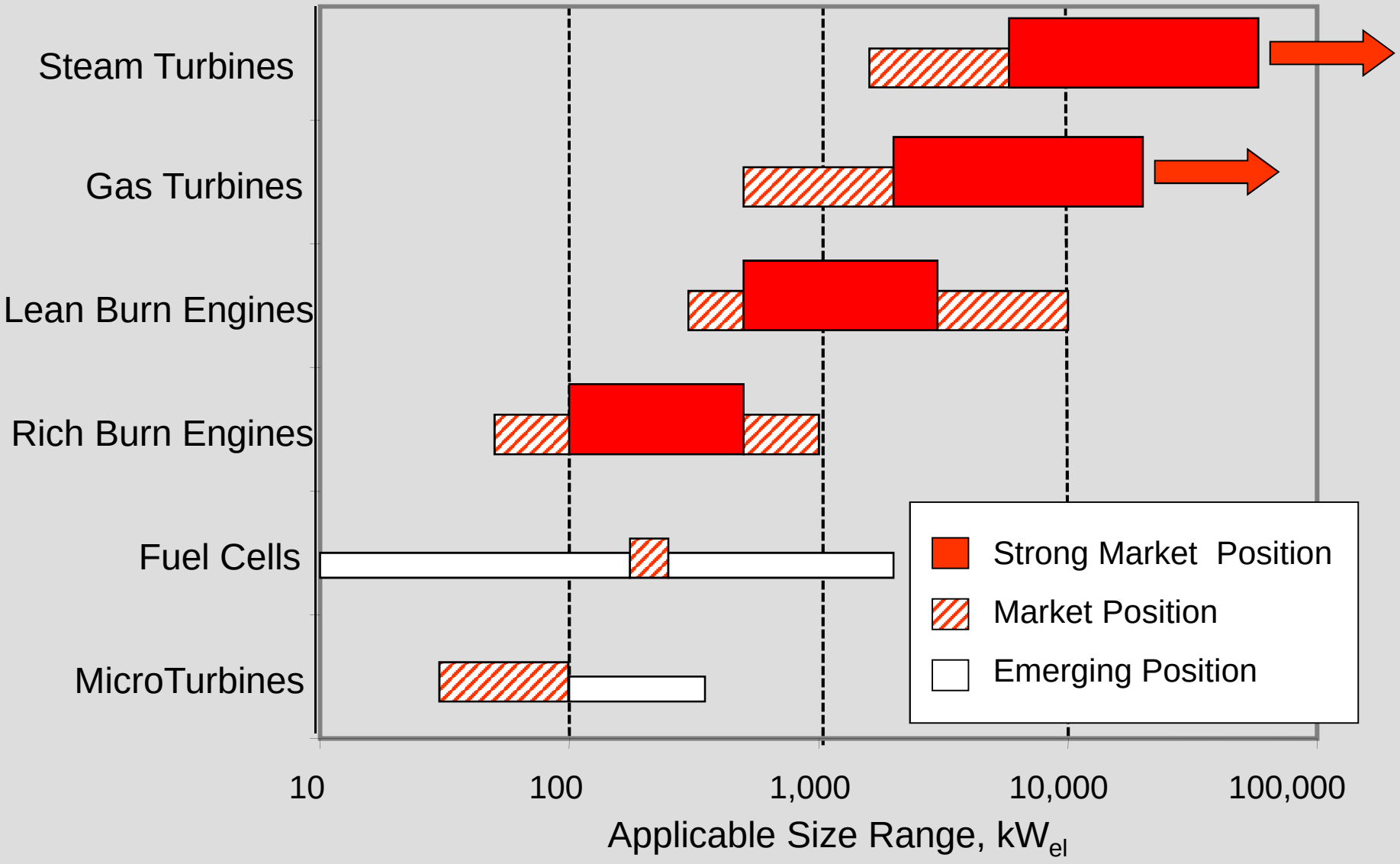
Characteristics of Different CHP technologies



Criteria for Choice and Design

Usual for CHP and non-CHP:

- **Output**
- **Fuel: availibility, price, safety**
- **Efficiency (load behaviour)**

Additionally for CHP:

- **Power/Heat ratio (load behaviour)**

CHP-Technologies: Suitable Fuels

	Plant size (MW)	Natural Gas	Light oil	Heavy fuel oil	Coal	Biogas	Solid biomass	Solid waste
Residential	< 0,015	x	x				x	x
Commercial	0,015 – 0.100	x	x			x	x	x
	0,1 - 1	x	x			x	x	x
	1- 5	x	x	x	x	x	x	x
Industrial	1- 5	x	x	x	x	x	x	x
	5 – 50	x	x	x	x	x	x	x
	> 50	x	x	x	x		x	

x Experienced
x Possible
Impossible

Example CHP with Steam Turbines

Fuels

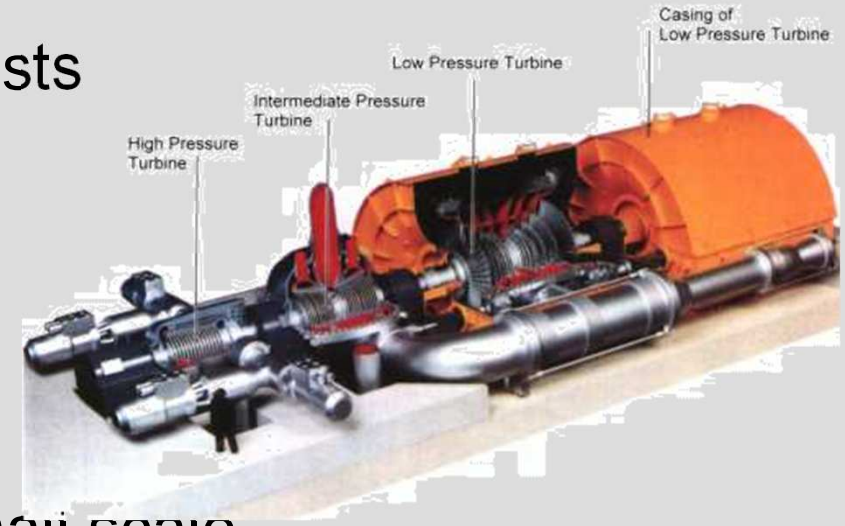
- coal, oil, municipal waste, biomass, in principle almost every fuel can be applied

Advantages

- largest capacities
- wide fuel range – low fuel costs
- mature technology

Disadvantages

- limited electrical efficiency
- expensive in operation in small scale



Example CHP with Gas Turbines

Fuels

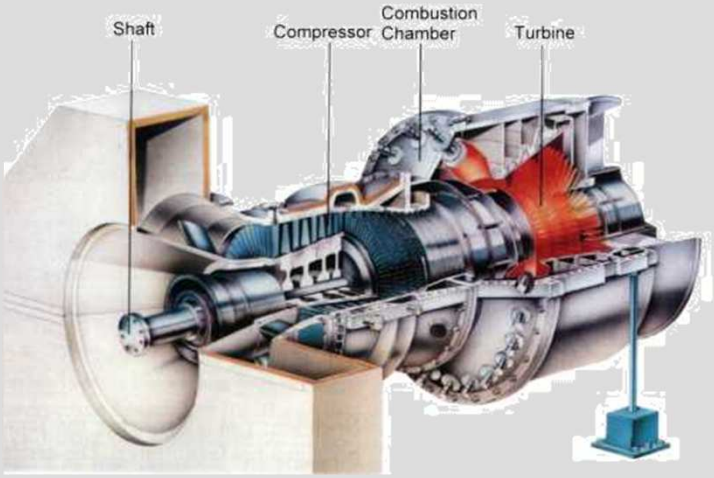
- liquid and gaseous fuels (oil, natural or synthesis gas)

Advantages

- low investment costs
- mature technology (> 1 MWel)

Disadvantages

- constant power to heat ratio
- partload behaviour



Example CHP with Diesel- and Gas Engines

Fuels

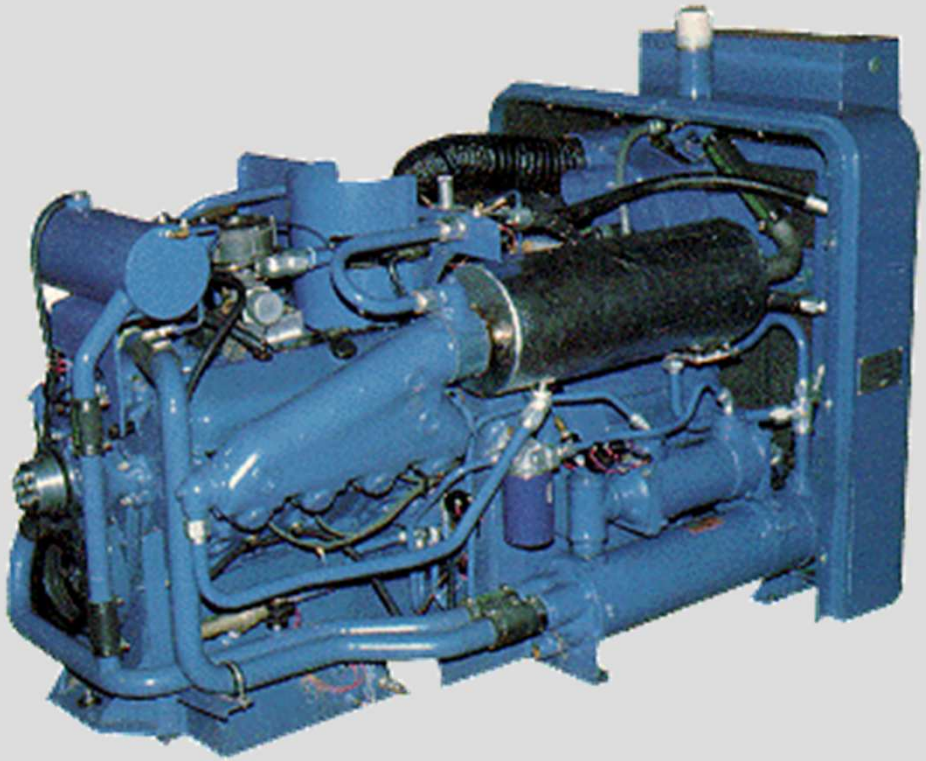
- gas, biogas, oil, methanol

Advantages

- mature technology
- easy handling
- two heat sources

Disadvantages

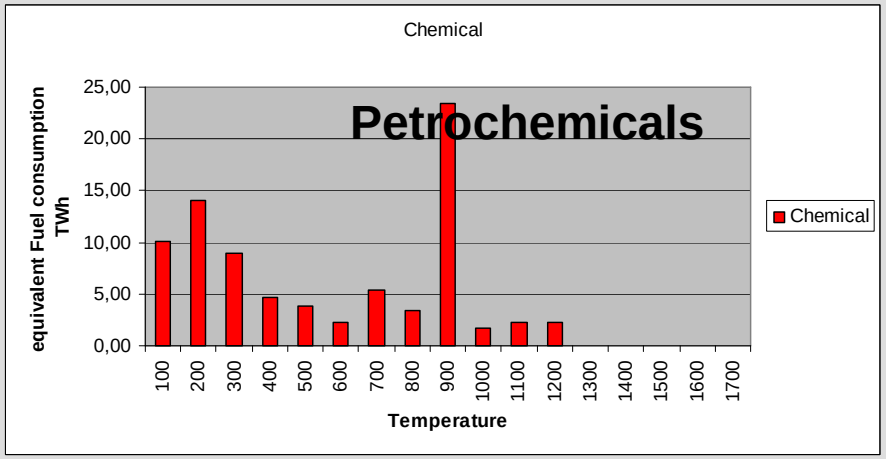
- limited temperature
- higher investment

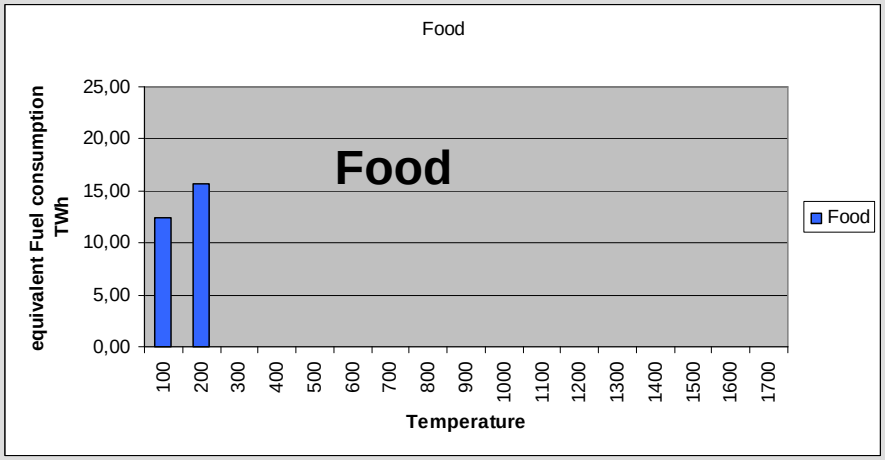


Energy Consuming Industries

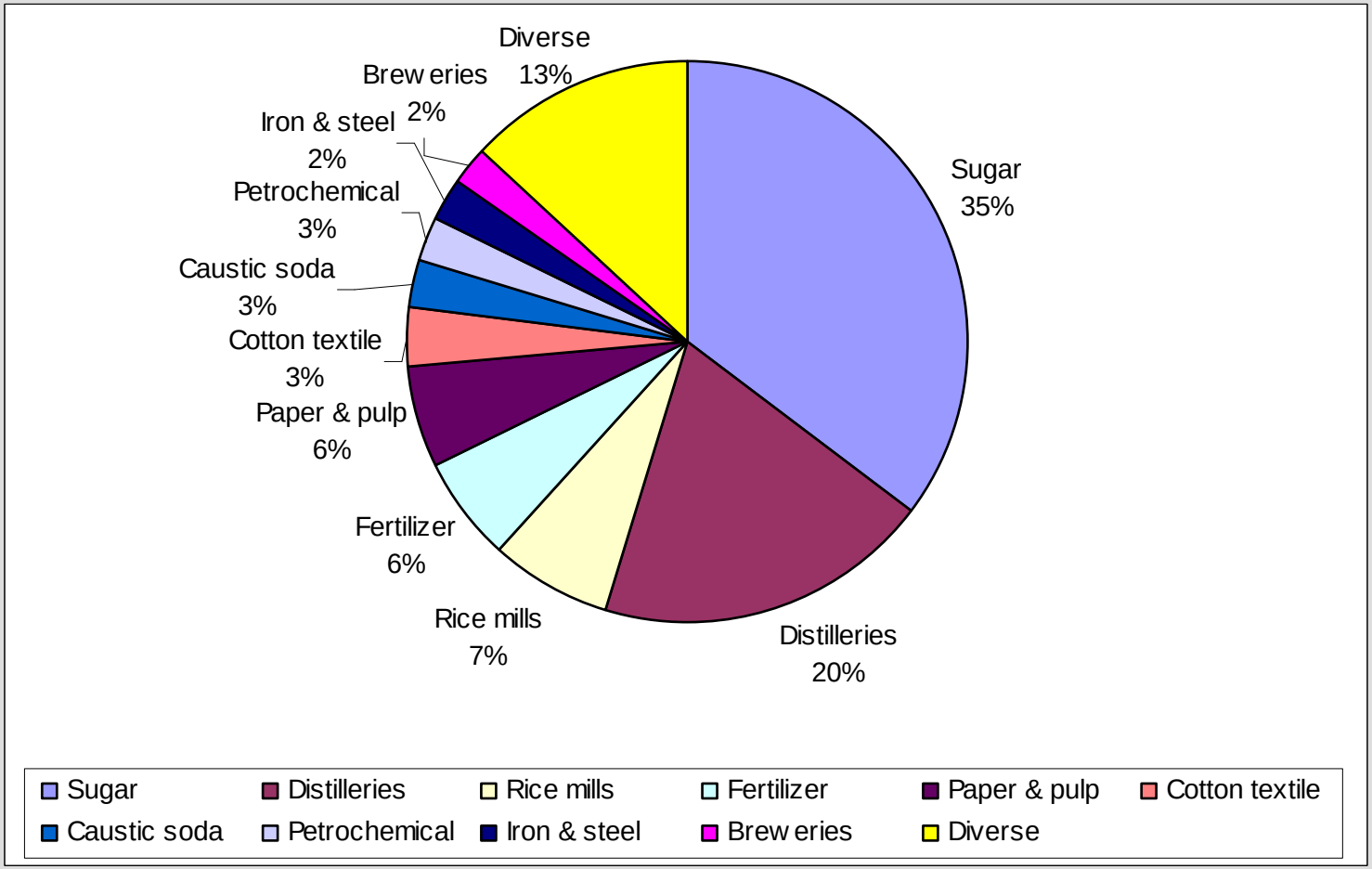
Significant energy consuming industries are e.g. :

- Sugar
- Pulp&Paper
- Food
- Fertilizers
- Petrochemicals





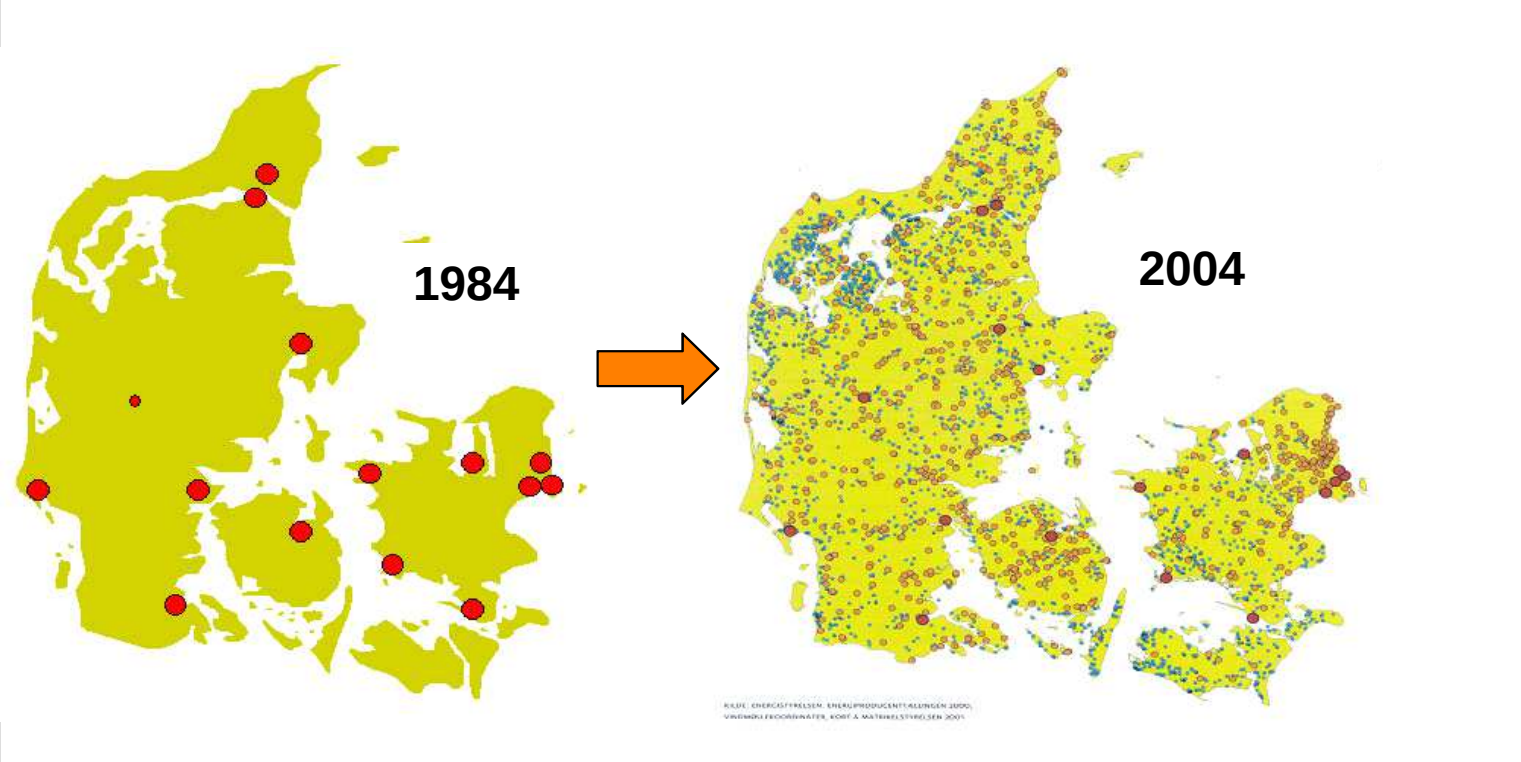
CHP - Potentials in Indian Industry



Decentralisation Production Structure

Distance of Heat transport limited to some km.

Extremely decentralised CHP (example Denmark)



CHP Fuel structure – Example Netherlands

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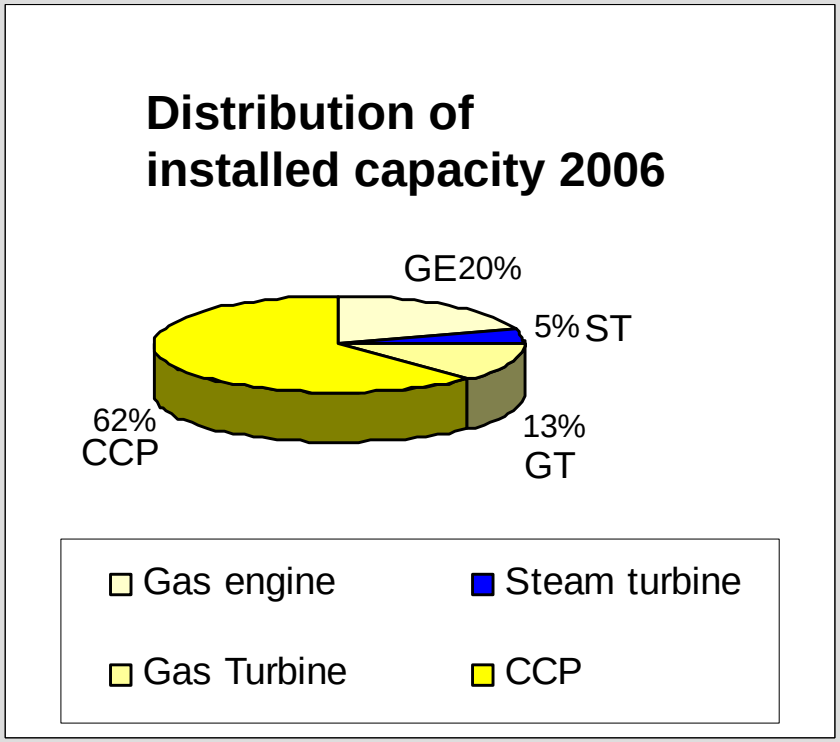

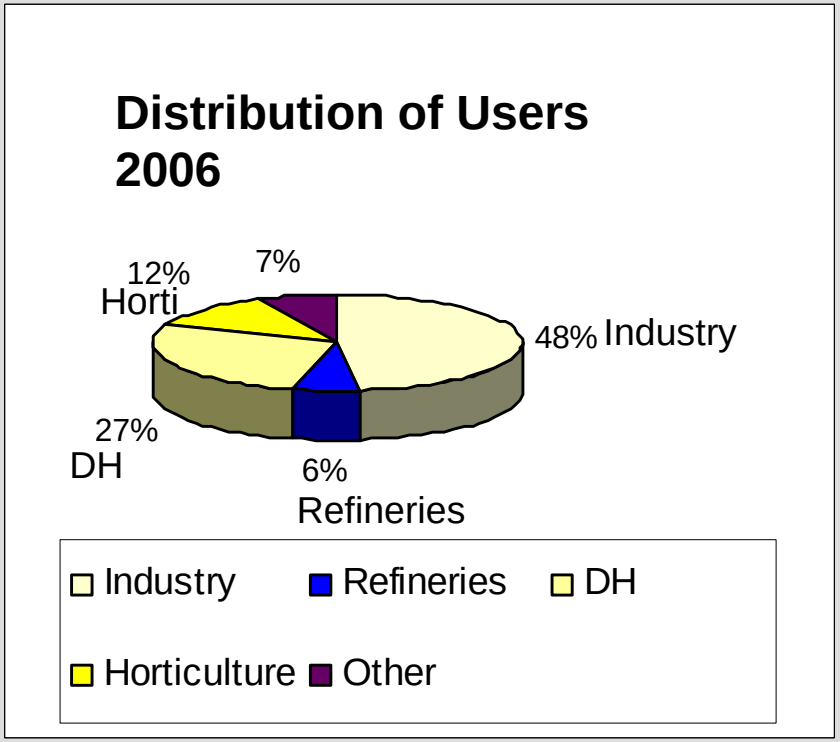

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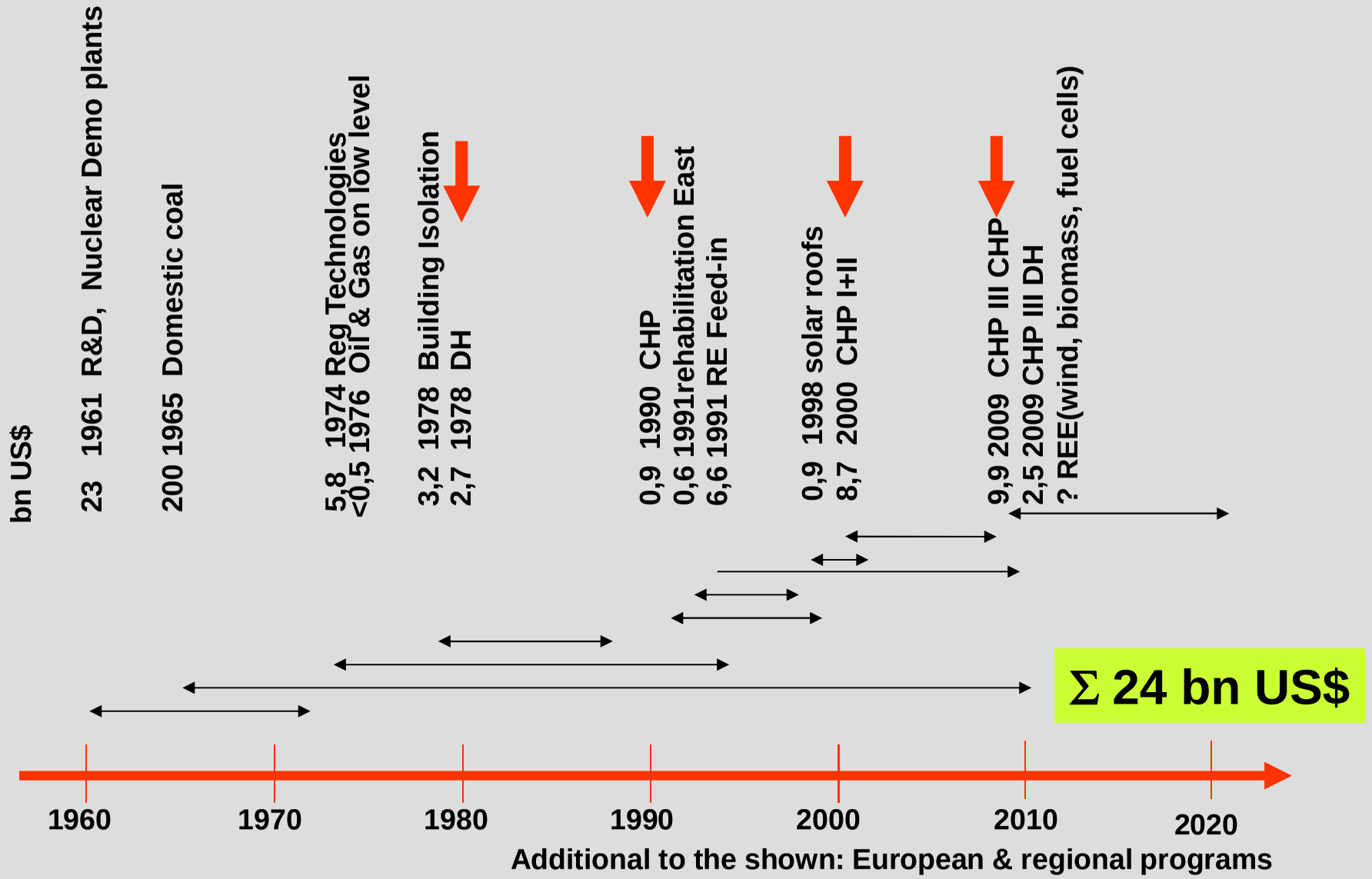
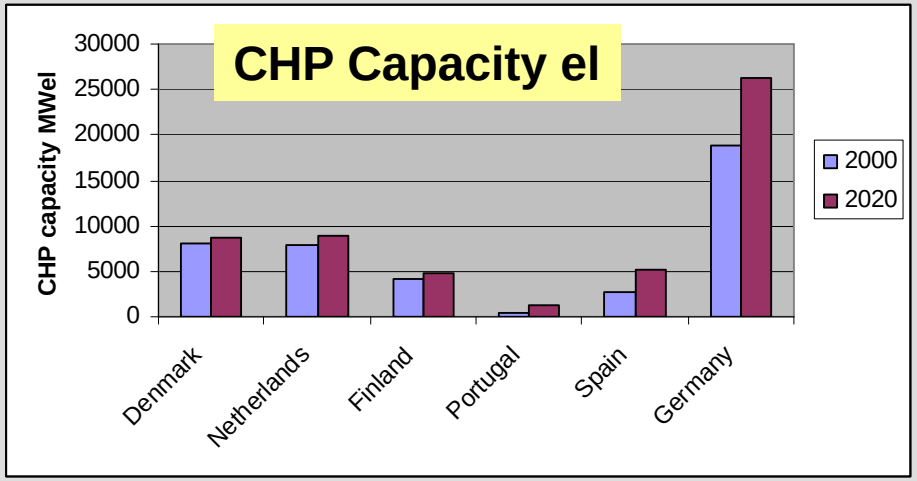
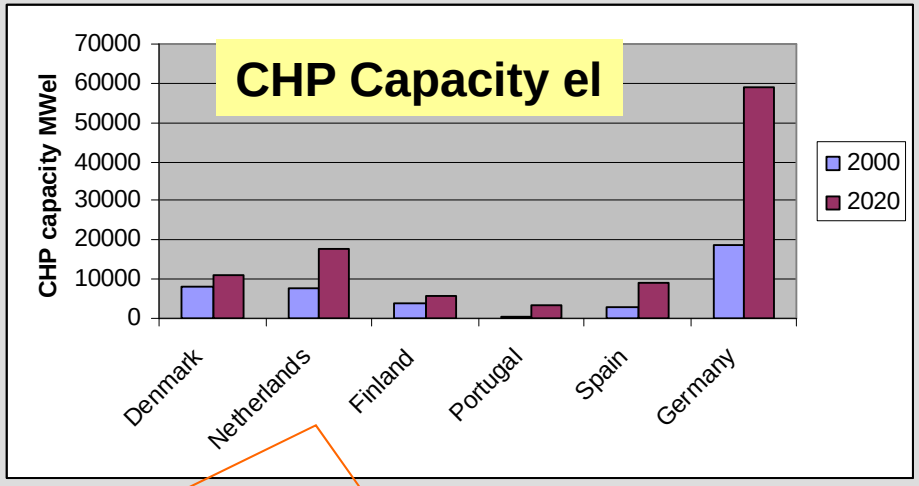
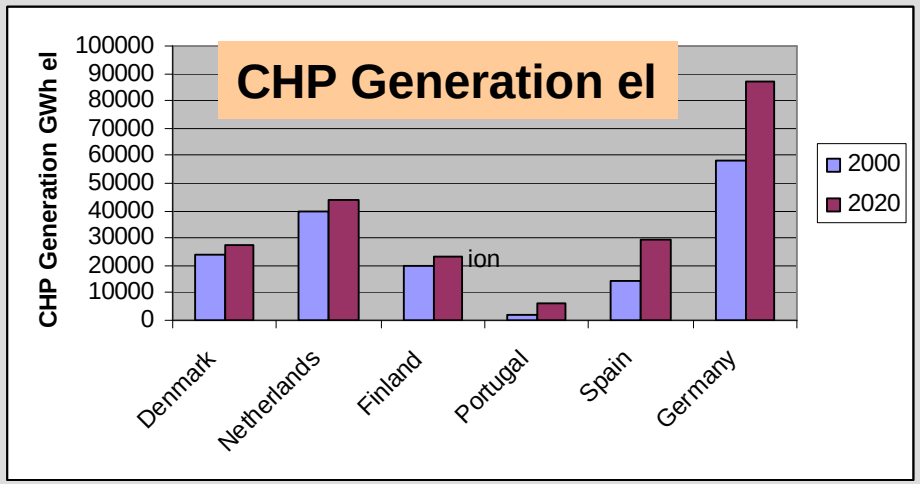
Germany – Funding in Energy Sector



CHP – Scenarios Europe







Assumed:

- **All benefits of CHP internalised into costs**
- **Micro generation feasible**
- **Fuel cells are a possibility**
- **Politics focussed on decentralisation**
- **Increased efficiencies**

with present policy

Conclusions

- Behind Renewables and maybe nuclear energy CHP will play the most important CO_2 reduction role
- CHP share will grow in all countries
- Each country will have unique CHP solutions regarding domestic fuels, industry structure, climate
- Large CHP will participate in development of large units where possible
- Decentralisation will increase

Thank you very much for your attention

CWA 45547
CEN/CENELEC WORKSHOP AGREEMENT
Manual for Determination of Combined Heat and Power (CHP)

Purpose:
to distinguish between CHP parts and non-CHP parts of power plants to allow separate evaluation of these parts in terms of primary energy savings etc.

CWA 45547 is NOT a design guideline!

CEN/CENELEC

WORKSHOP

AGREEMENT

CWA 45547

September 2004

ICS 27.100

English version

Manual for Determination of Combined Heat and Power (CHP)

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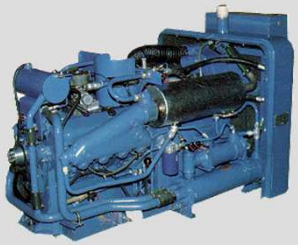
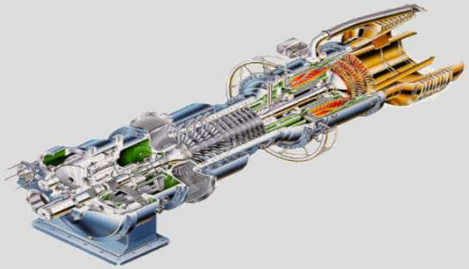
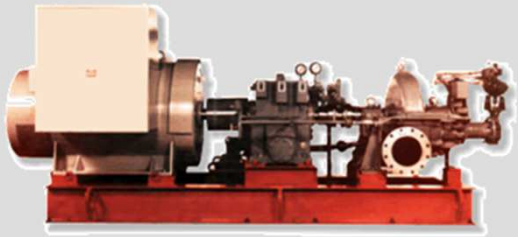
Existing and upcoming CHP Technologies



Combustion engine



Gas turbine



Steam turbine

Micro turbine

Stirling engine

Fuel cell

Mature	Latest	Emerging