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DFIC – Dr. Fromme International Consulting

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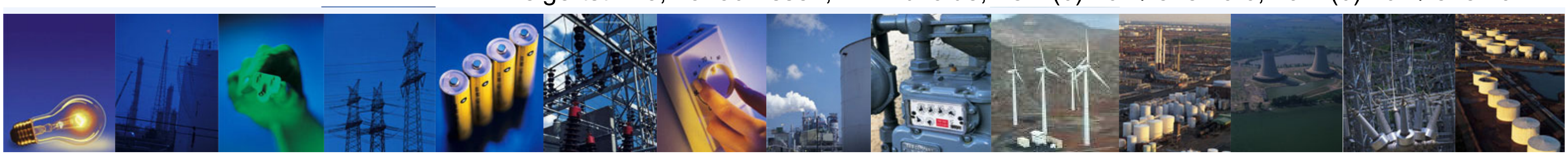


Presentation Overview

- Energy Scene in Germany
- Energy Efficiency in Germany
- Energy Management
- Co-generation and Tri-generation
- DFIC Experience

Sketch of the German Energy Situation

- Energy consumption in Germany is structurally high, as
  - it is a densely populated country
  - it has been highly industrialised for decades

- Availability of fossil energy resources is very limited / expensive

  => Hard coal mining is phasing out in 2018

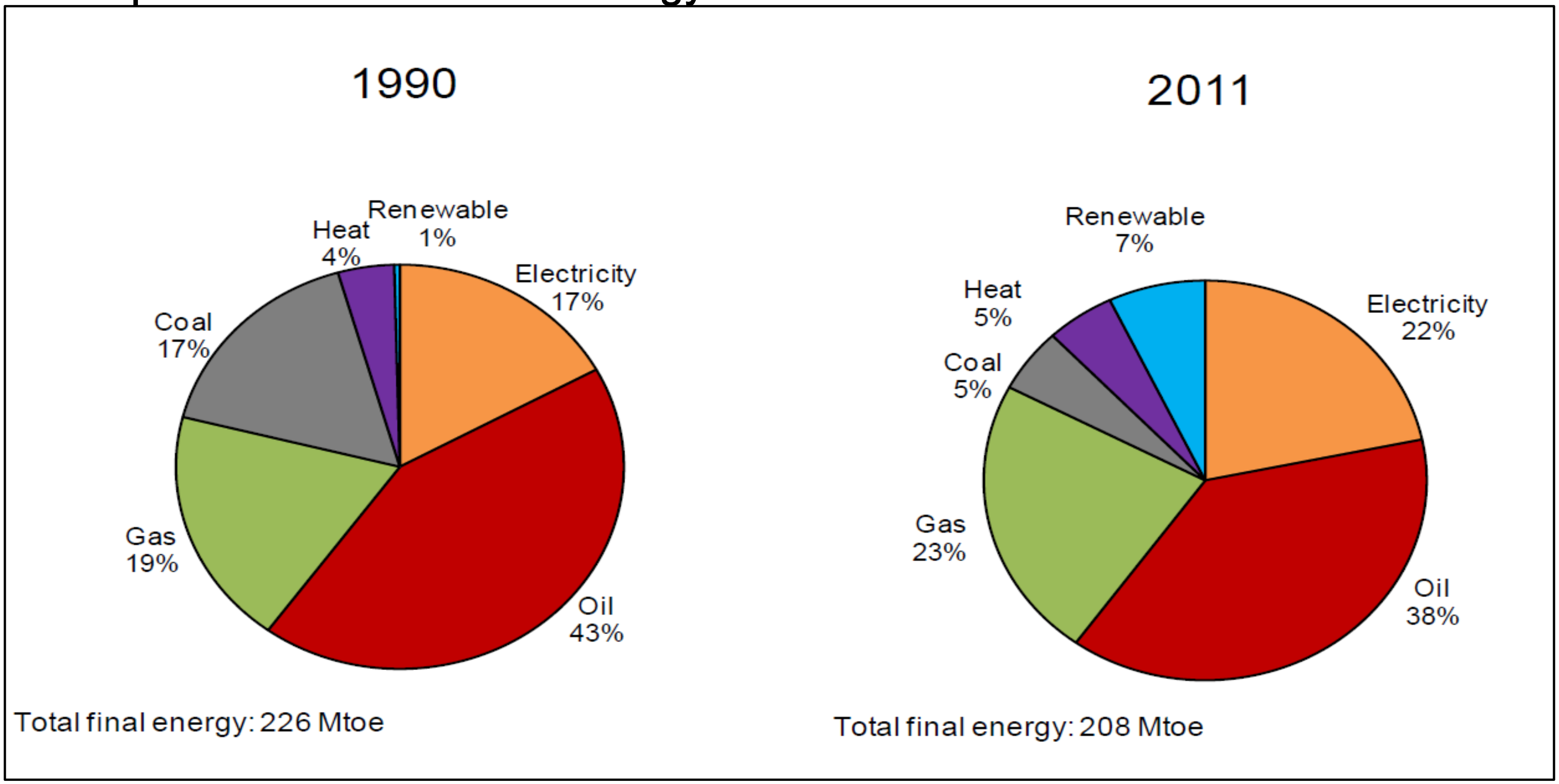
  => Energy has always been comparatively scarce / expensive

  => High vulnerability from oil price shocks of the 1970s

- Since mid 1970s: Regulatory measures and incentives defining energy efficiency standards were implemented

- Not one major legal framework but a multitude of energy savings approaches, mainly in building and industrial sectors

Final Energy Consumption
Development of the shares of energy carriers



Source: Arbeitsgemeinschaft
Energiebilanzen 2012

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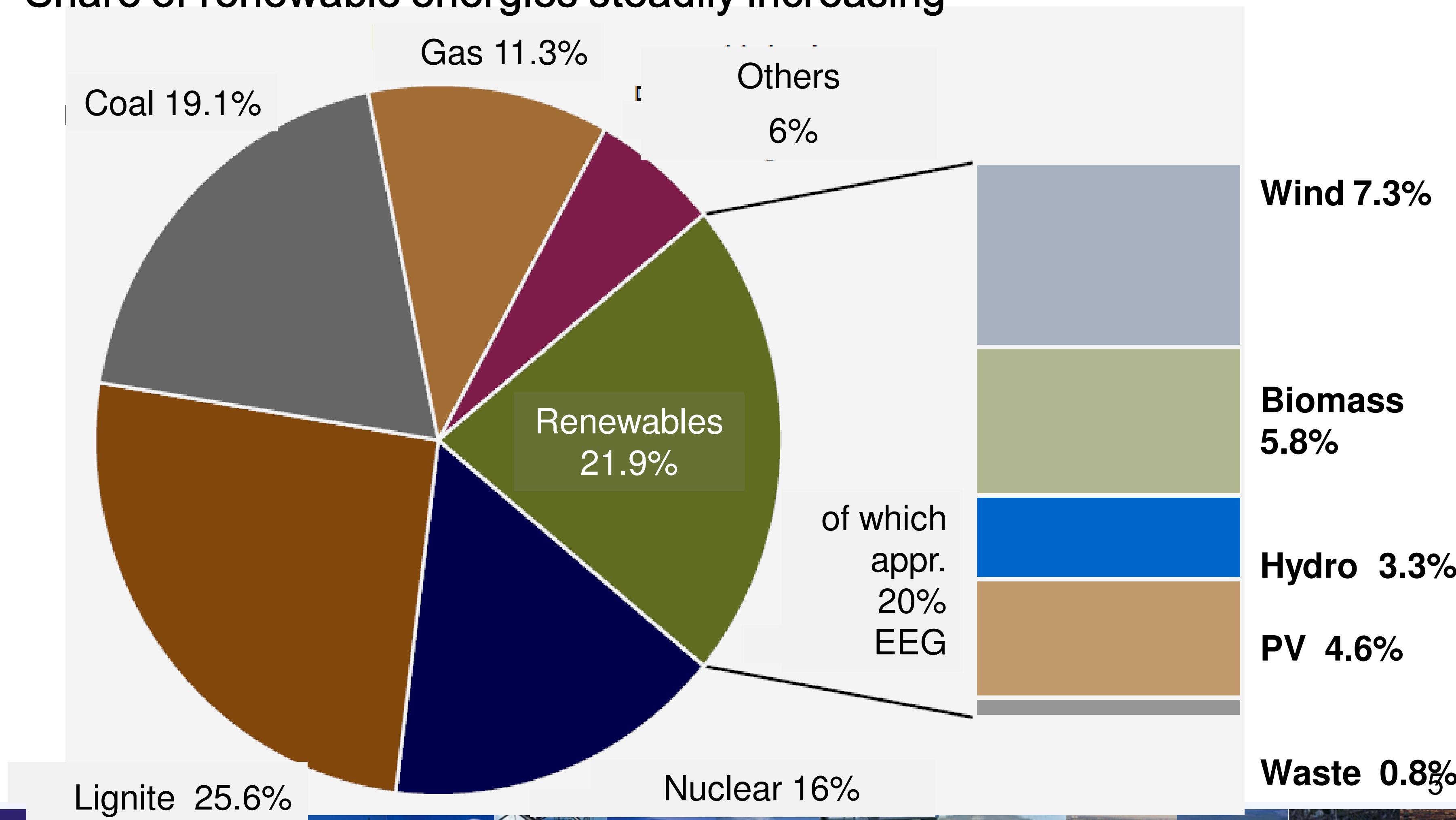
Power Generation 2012 : 617 bill. kwh
Share of renewable energies steadily increasing



Renewable Energies Act

Payment scheme EEG 2012

Wind energy

- **Onshore:** 5.02 – 9.2 €ct/kWh (according to duration of payment) + 0.5 €ct/kWh each for a system service bonus and/or a repowering bonus.
- **Offshore:** 3.5 – 13 €ct/kWh (according to duration of payment) + bonus of 2 €ct/kWh for systems commissioned prior to 1st January 2016.

Solar energy (2013)

- Monthly degression
- PV roof on 01.05.2013: 15.4 – 10.1 €ct/kWh (depending on system size).
- Own use replaces an average of appr. 28 €ct/kWh for households and 14 €ct/kWh for industry

Geothermal energy

- 10.5 – 16 €ct/kWh (according to system size)
- bonus of 4 €ct/kWh for systems commissioned prior to 1st January 2016
- heat use bonus of 3 €ct/kWh
- bonus for use of petro-thermal technology of 4 €ct/kWh.

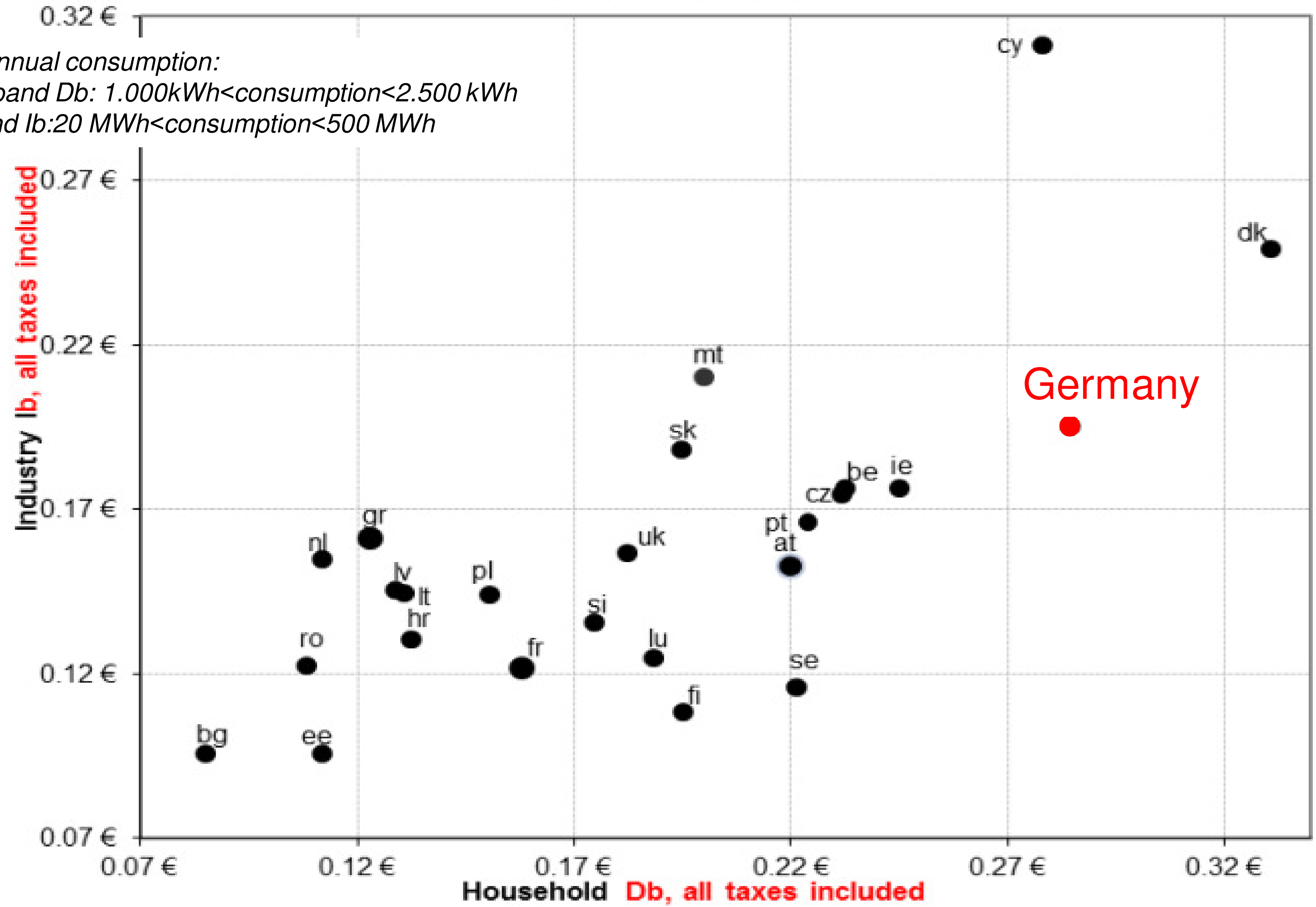
Post Fukushima Energy Policy in Germany

"Speedier Energiewende"

- June 2011: decision to abandon nuclear power until 2022 and
- Adjusted goals 2020:
  - Share of Renewables 35 %
  - Reduction of electricity consumption 10 %
  - Reduction of heat demand in buildings 20 %
- Goals 2050 still valid:
  - Reduction of CO_2-emissions at least 80%
  - Electricity production: Renewables 80%
  - Reduction of energy consumption 25%
- Strengthening the super grid
- Rising prices: Protecting the electricity intensive industry

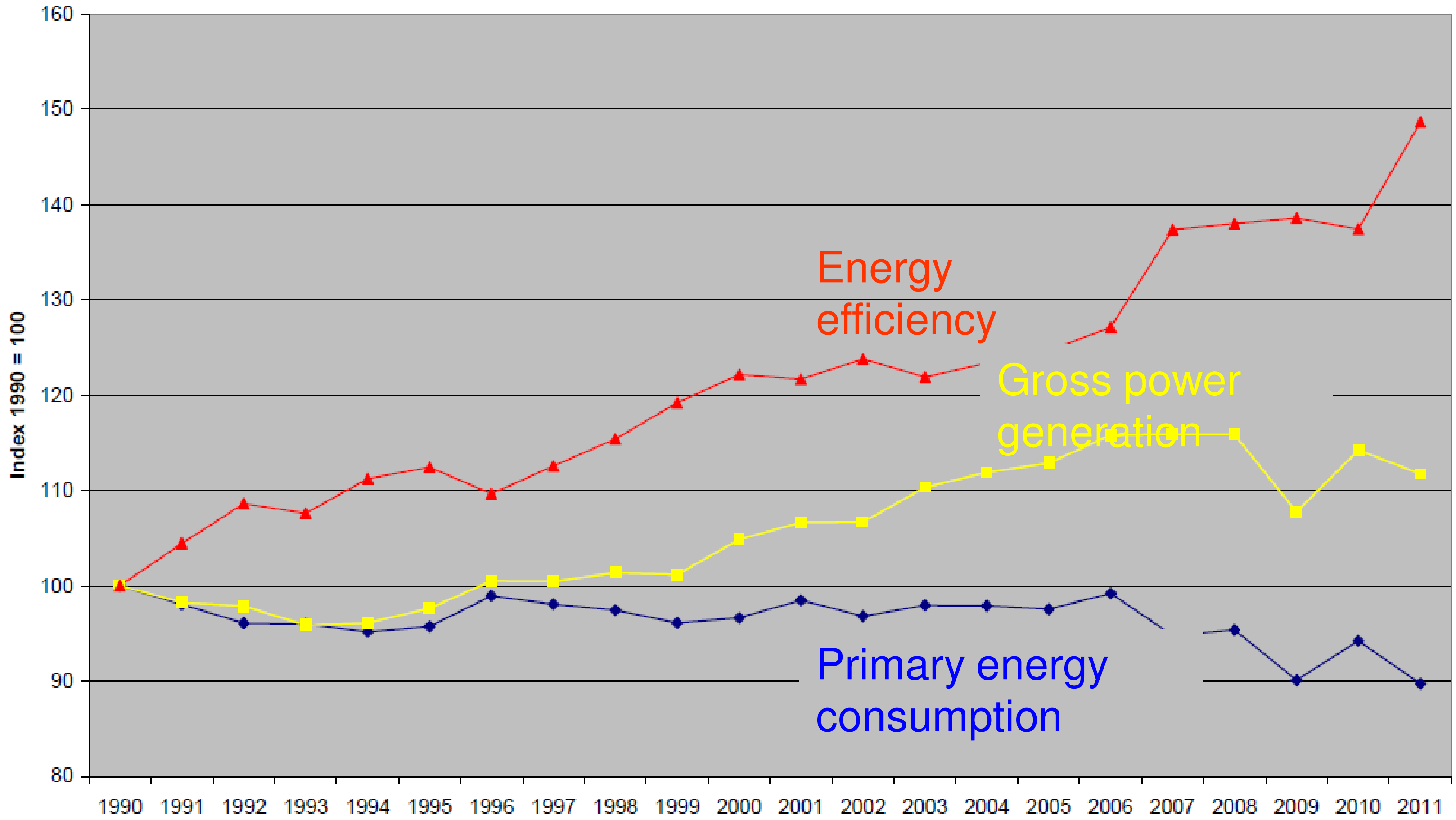
Electricity Prices in Europe (1st semester 2012)

Range for annual consumption:
Household band Db: 1.000kWh<consumption<2.500 kWh
Industry band Ib:20 MWh<consumption<500 MWh



Development of Primary Energy Consumption

Development and comparison with power generation and energy efficiency



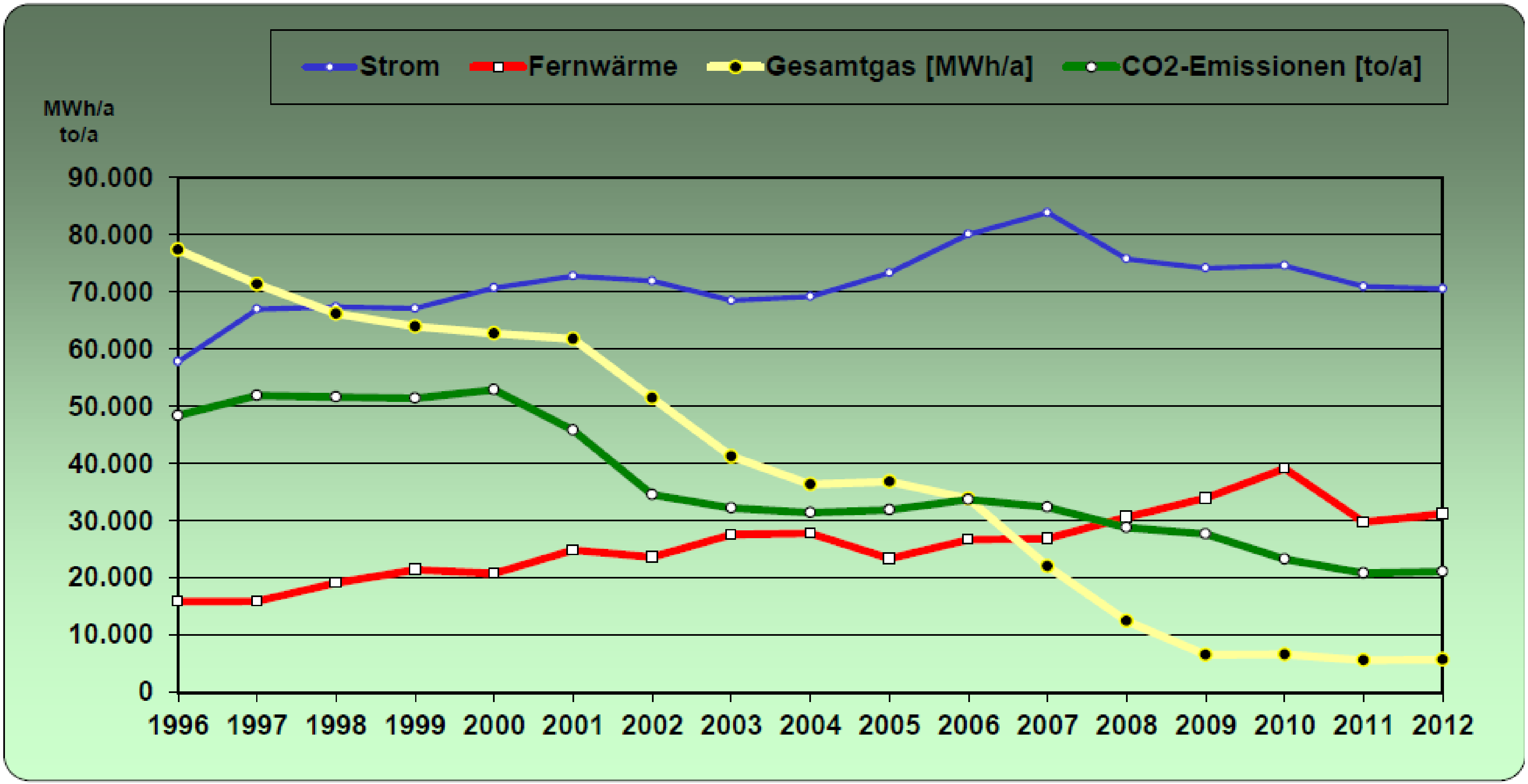
Source: AGEB, StBa

How to achieve progress in energy efficiency

The case of Miele

- A „normal“ German company in household appliances
- 5,000 employees and workers at headquarters / main factory
- Highly integrated production (foundries, etc.)
- Energy consumption at site ca. 120 GWH
- High space heating demand (1/3)

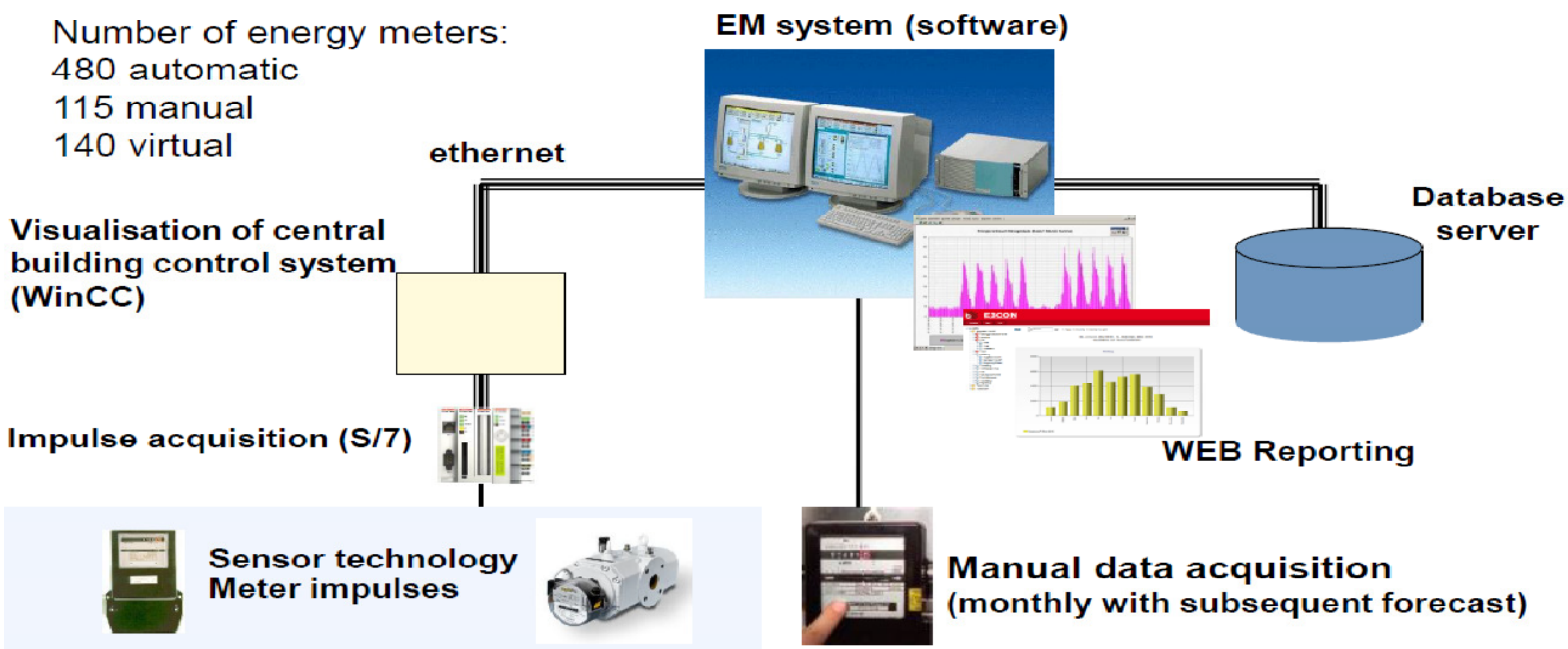
Development of energy consumption at Miele



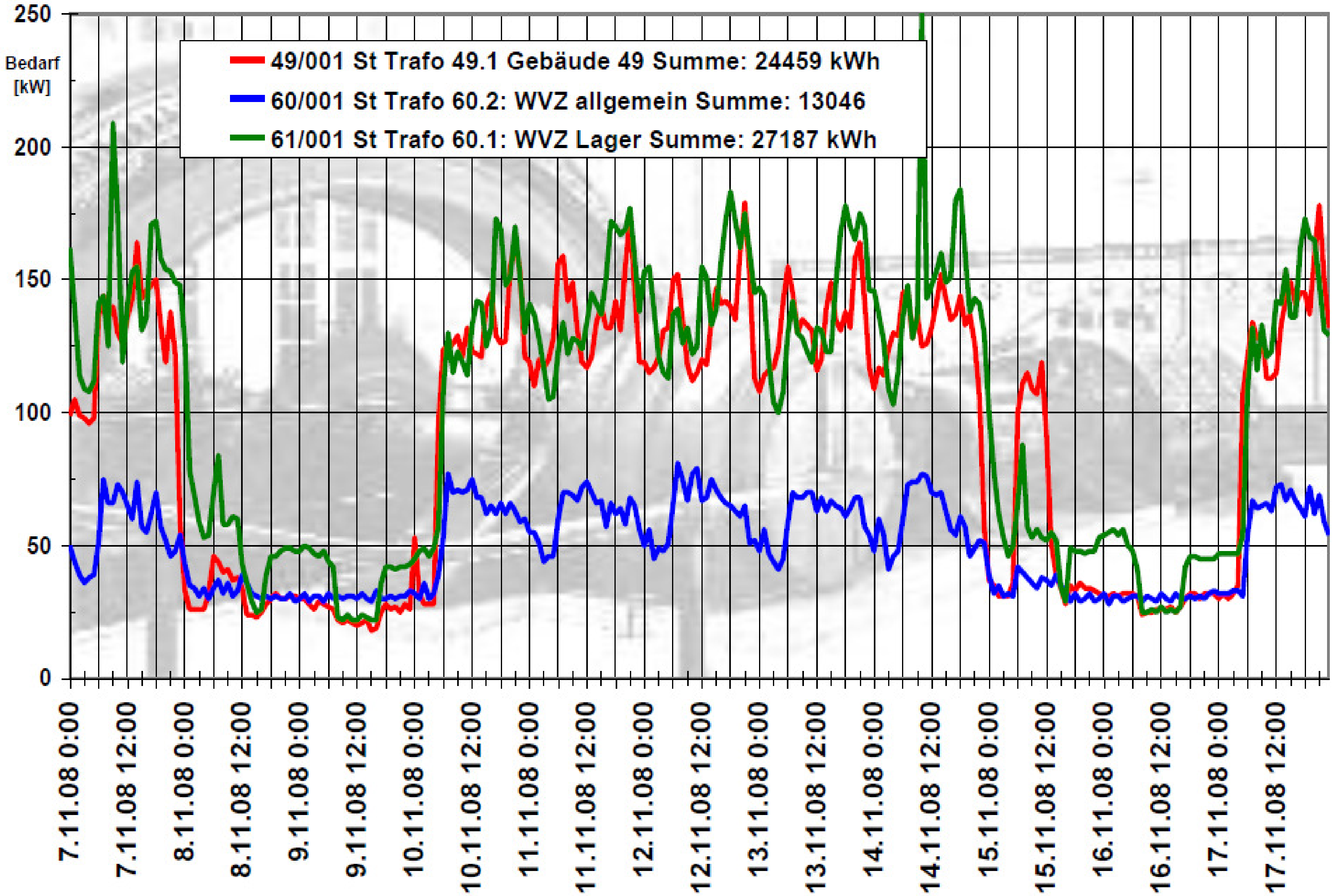
Changes over past 20 years: Volume of buildings +82%, Heat energy -44%

Make departments accountable for energy consumption detailed submetering

Stationary acquisition of energy data - System structure



Measurement of power consumption to reduce energy requirements



A systematic and continuous analysis of waste heat recovery potentials based on kpi

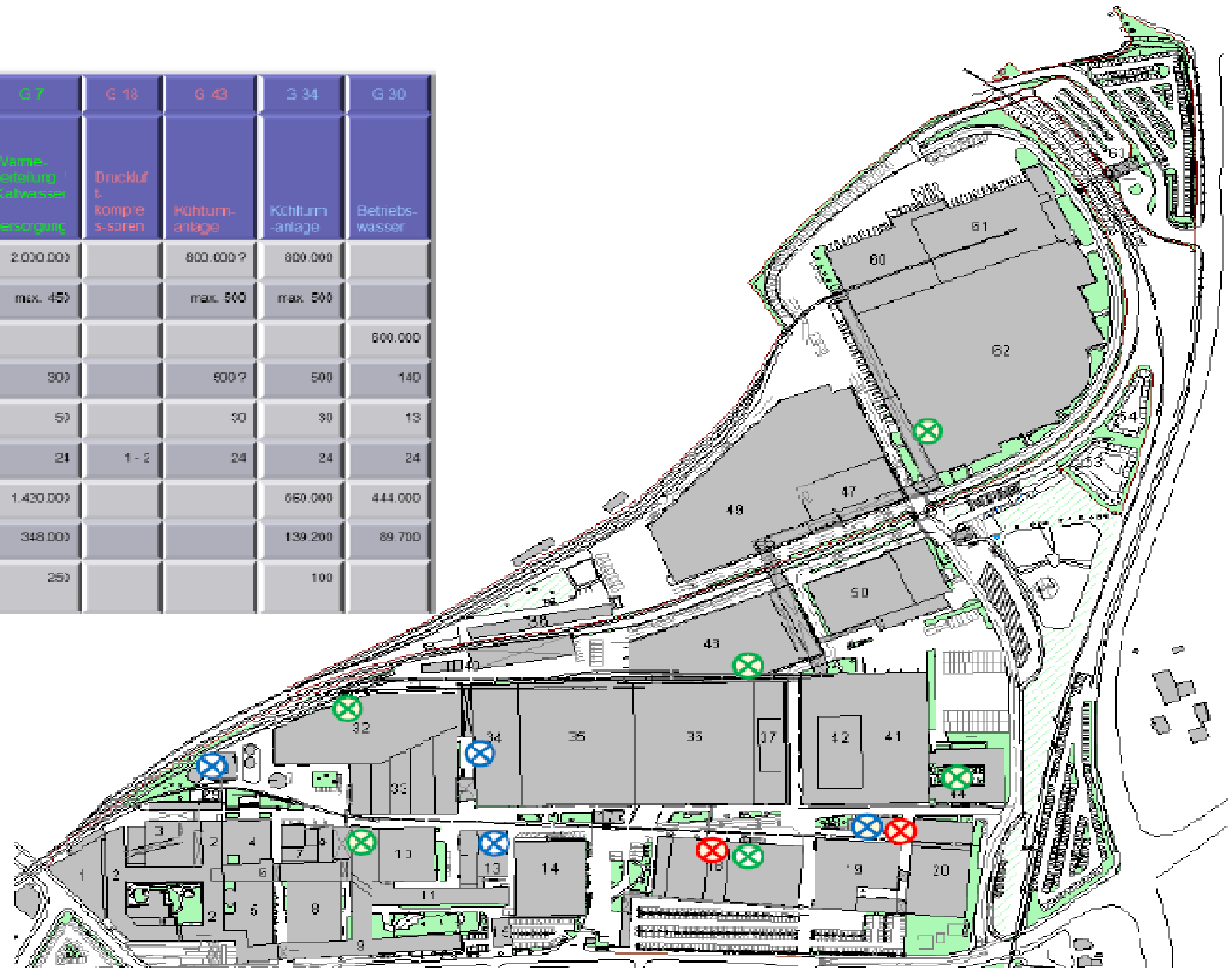
Example: Waste heat records

Übersicht der Anlagen und Kennzahlen

Gebäude	G 16	G 44	G 48	G 52	G 32	G 7	G 18	G 43	G 34	G 30
Anlage / Kennzahl	Kühlung Elektro-schmelz-ofen	Kalt-wasser-anlage	Druckluft-kompres-soren	Druckluft-kompres-soren	Kalt-wasser-anlage Pulver-beschich-tung	Wärme-verteilung / Kaltwasser-versorgung	Druckluft-kompre-s-soren	Kühlturm-anlage	Kühlturm-anlage	Betriebs-wasser
Abwärmeenergie in kWh/a	960.000	353.000	2.000.000	33.600	300.000	2.000.000		800.000 ?	800.000	
Abwärmeleistung in kW	max. 580	max. 200	max. 600	max. 120	max. 180	max. 450		max. 500	max. 500	
Kälteenergie in kWh/a										800.000
Kälteleistung in kW		160			140	300		500 ?	500	140
Wassertemperatur in °C	45	43	75	75		50		30	30	13
Betriebsdauer in Std./Arb.tag	24	24	24	3 - 5	24	24	1 - 2	24	24	24
Primärenergieeinsparung in kWh/a	630.000	247.100	1.420.000	23.520	210.000	1.420.000			560.000	444.000
CO_2-Reduzierung in kg/a	156.600	61.400	348.000	5.646	52.200	348.000			139.200	89.700
Energiepotenzial in Erdwärmesonden	112	45	250	4	38	250			100	

Thermal energy recovery

- ⊗ Implemented
- ⊗ Not possible
- ⊗ Planned



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Re-design of heating and cooling includes tri-generation of electicity heat and cold as well as circulation pumps

Rebuilding of heat circulation systems

- Connection of a cooling unit to heat supply network
- Recuperation of heat losses

Energy management : a systematic approach

Requirements of ISO 50001

Incorporating German experience from DIN / ISO 9001, ISO 14001, as well as from emissions trading.

These norms describe requirements applicable to an energy management system (EnMS) that enables a company to continuously improve its energy performance by adopting a systematic approach to energy management and at the same time to meet legal requirements and other obligations.

Introducing energy management systems

Continuous improvement as the EnMS' driving force

Plan

- ***Energy strategy*** **(policy)** ***of the management***
- ***Management programme and energy saving targets***
  (based on data and cost analyses)

Do

- **Energy organisation**
  (Officer, management representative, energy team)
- **Regular communication among all parties involved, Documentation**
- **Tracking objectives and activities**

Check

- ***internal (energy) audits***
  - visits/inspections,
  - data, facts, documents
  - talks with staff members
- ***(if required, external assessment and further recommendations)***

Act

- ***Management assessment***
  (incl. discussion of data and results)
- ***Making decisions to:***
  - improve organisation and communication
  - set up new objectives and implement new measures

The DFIC approach to energy management

- Make energy efficiency a top management concern
- Energy management must englobe the entire organization
- It‘s about people : awareness and training
- Make people responsible
- Attribute energy cost to each department
- Let people compete
  - Ideas competition
  - EE achiever of the month

DFIC Approach to Energy Management

Energy audit

- Involve client's team
- No cost
- Low cost
- Investive
- International best practice

Energy Management

- Metering
- Monitoring
- Organisational structure
- Definition of core processes
- Awareness and training

Certification and rewarding

- BEE energy manager
- ISO 50001
- PR
- EE awards
- Internal
- External

Project Example Energy Efficieny
Example Coal India

- Indepth analysis of energy situation
- International benchmarking
- Identificaiton of most advanced technologies and suppliers
  - Efficiency increase from 34 % to 90 % for fans
  - VSD and modern control technologies
  - Submetering
- Economic and financial analysis with ROI and cost of ownership
- Development of energy management
  - energy management organisation
  - installation of software for energy monitoring and software

Example on renewable energies
Solar City Madhyamgram

- One of the few Municipalities selected by MNRE
- An integrated approach for energy effcinecy and renewable energies
- PV for public buildings
- Street lighting
- Energy efficiency in pubiic buildings
- Solat based infromation system
- Use of organic waste for biogas production

= > masterplan and then implementation of investment

DFIC experience in energy management and efficiency projects

DFIC Germany

- Co-operation with German governmental organisations => access to funding
- Experience with energy effciency and auditing projects in Germany and many other countries
- Co-operation with Germany‘s world leading manufacturing and engineering firms

DFIC India

- Established in Kolkatta at BCCI
- Focus on energy and management issues
- Cooperatiion with leading universities
- Co-operation with German co-operation GIZ / BEE

BACKUP

Promoting Cogeneration

New CHP Act 2012 (1)

- Target: doubling CHP share in electricity production to 25% in 2020
- Bonus system again; paid finally by the electricity consumers (max. 5.41 Cent/kWh over stock exchange revenue)
- Grant on electricity fed into the public grid or directly used
  - > 2 MW el -> 1.8 ct/kWh over max. 30,000h
  - 250 kW to 2 MW -> 2.4 ct/kWh over max. 30,000h
  - 50 kW to 250 kW -> 4.0 ct/kWh over max. 30,000h
  - ≤ 50 kW -> 5.41 ct/kWh over 10 years or. max. 30,000h
- Grants for small CHP-plants < 20 kW (from 2014 decreasing subsidy rate by 5% p.a.)
  - [0 - 1 kW el]: 1,500 € [4 - 10 kW el]: 100 €/kW
  - [1 - 4 kW el]: 300 €/kW [10 - 20 kW el]: 50 €7kW

24

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Promoting Cogeneration
New CHP Act 2012 (2)

- Grant for modernization of CHP plants (same bonus increments as listed above)
  - Modernization rate at least 25% -> bonus over 10 years or max. 30,000h
  - Modernization rate at least 25% -> bonus over 5 years or max. 15,000h
- Participation in emission trading: additional bonus of 0.3 ct/kWh
- In total fpr CHP plants: Max. 750 Mil €/a for CHP plants
- Max. 150 Mil €/a for district heating grid investments if at least 60% CHP heat share; max. 10 Mil €/project.
  - Grant of 100 €/m or max. 40% subsidy for diameter ≤ 100 mm
  - Subsidy of max. 30% for diameter > 100 mm
- Max. 5 Mil €/project for heat/cold storages
  - Subsidy max. 250 €/m³ water equivalent for storages up to 50 m³
  - Max. 30% of investment costs for storages > 50 m³ water equivalent


25

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