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Energy Efficiency - Made in Germany

Ways to energy efficiency for the metal and paper industry

18.05.2010
Exportinitiative Energy Efficiency in Sao Paulo

Dr. Kathrin Hesse
Fraunhofer-Institut für Materialfluss und Logistik
on behalf of the German Federal Ministry of Economics and Technology

www.efficiency-from-germany.info

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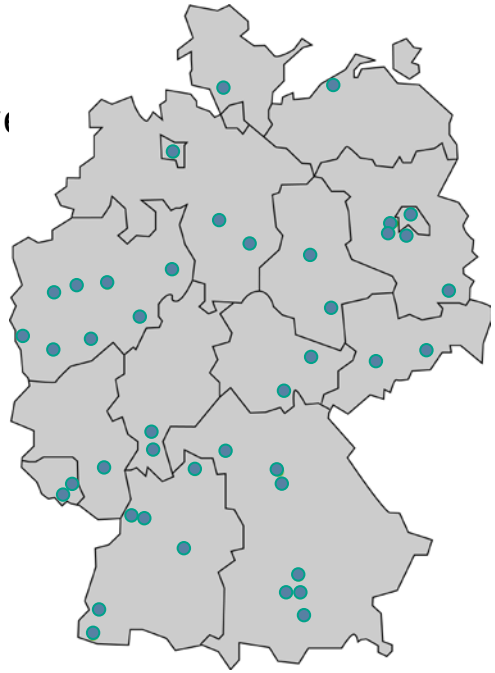
- Fraunhofer-Gesellschaft -

Joseph von Fraunhofer
researcher, entrepreneur
(1787 – 1826)

- 60 institutes in Germany
- approximately 17,000 employ
- turnover of 1,6 billion €
- more than 1,3 billion € from ordered research
- branches in Europe, USA and Asia



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- Fraunhofer Institute for Material Flow and Logistics -

- Founded 1981 in Dortmund
- More than 190 employees
- Approx. 250 student assistants
- Turnover of approx.18 million €,
  thereof more than 60% from industry, trade and services
- Branches and projects centers in Cottbus, Frankfurt on Main, Prien on Chiemsee
- Branches abroad in Lisbon (Portugal), Beijing (China)

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- Fraunhofer Institute for Material Flow and Logistics -

Section 1: Material Flow Systems
Quality Management and Organisational Systems, Planning of Material Flow Systems, Control Technology, Machines and Equipment, Packaging and Trade Logistics

Section 2: Enterprise Logistics
Enterprise Planning, Enterprise Modelling, Production Logistics, Maintenance Logistics

Section 3: Logistics, Traffic and Environment
Environment and Resource Logistics, Transportation Logistics, Health Care Logistics, Project Centre Airport, Project Centre Traffic, Mobility and Environment

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Contents

- Demand for energy in the industry
- Cleaner Production – a strategy for efficiency?
- Supply engineering – measures for energy efficiency
- Process engineering – measures for resource efficiency

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Demand for Energy in the industry

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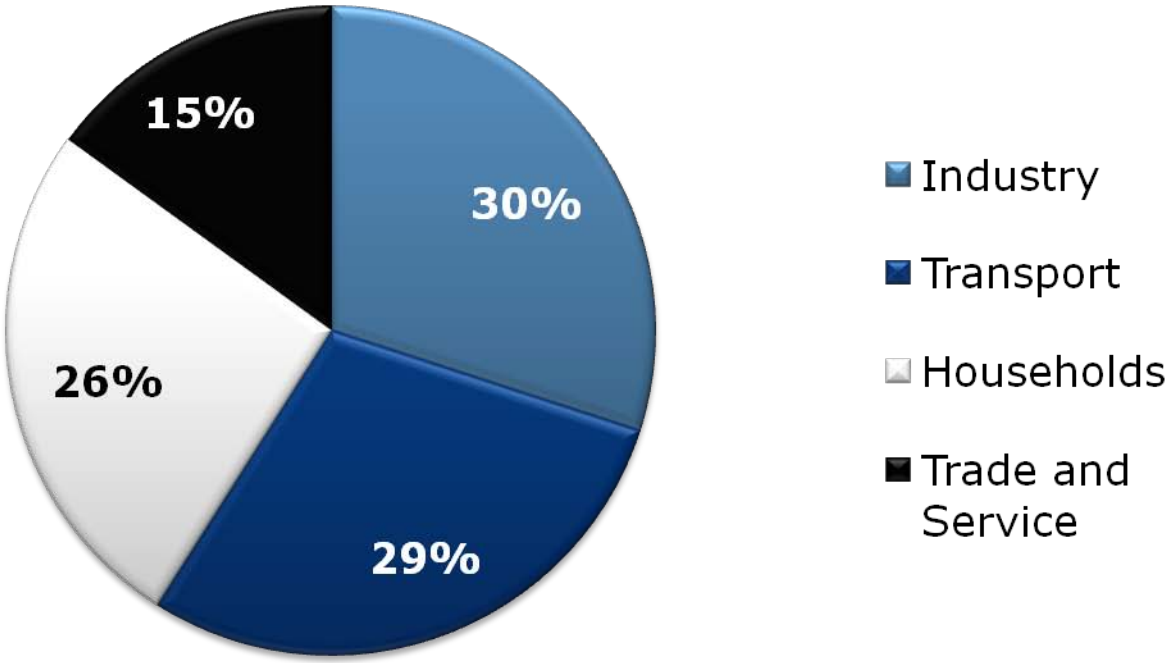
Energy demand in German economic sectors
Distribution of final energy consumption (2007)



Source: Arbeitsgemeinschaft Energiebilanzen, Stand April 2010

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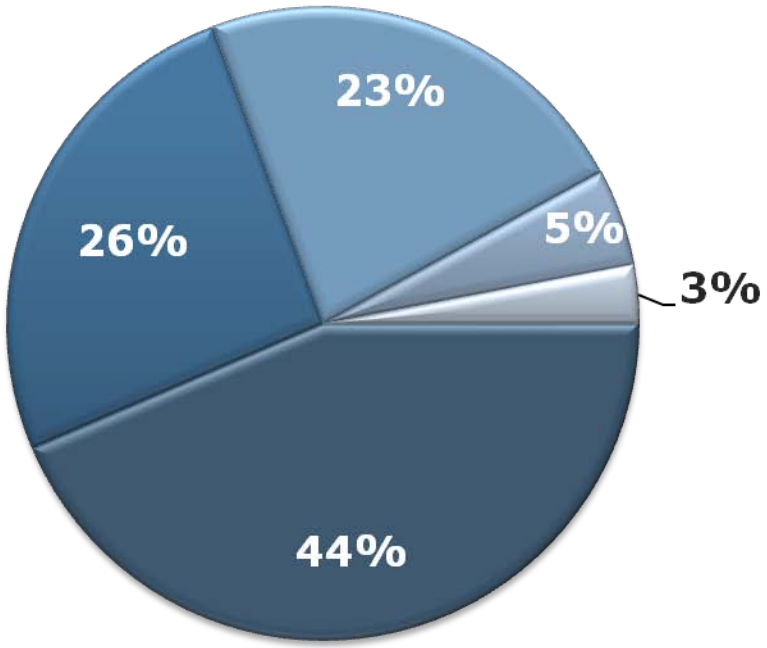
Energy demand in the German Industry (2007)*
Final energy consumption for industrial applications



* *without considering stock effects*

Source: Arbeitsgemeinschaft Energiebilanzen, Stand April 2010

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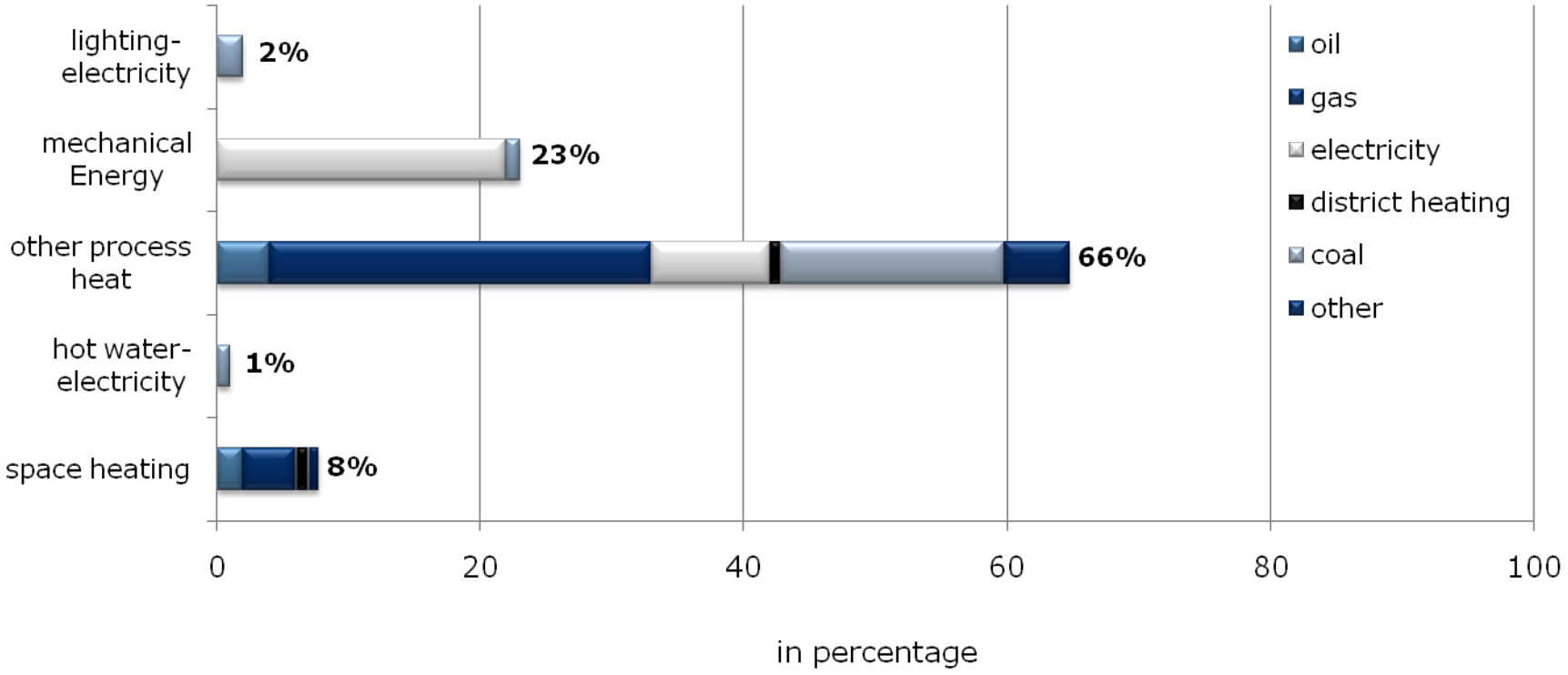
Energy demand in the German industry (2007)
Energy sources by fields of application



Source: Arbeitsgemeinschaft Energiebilanzen, Stand April 2010

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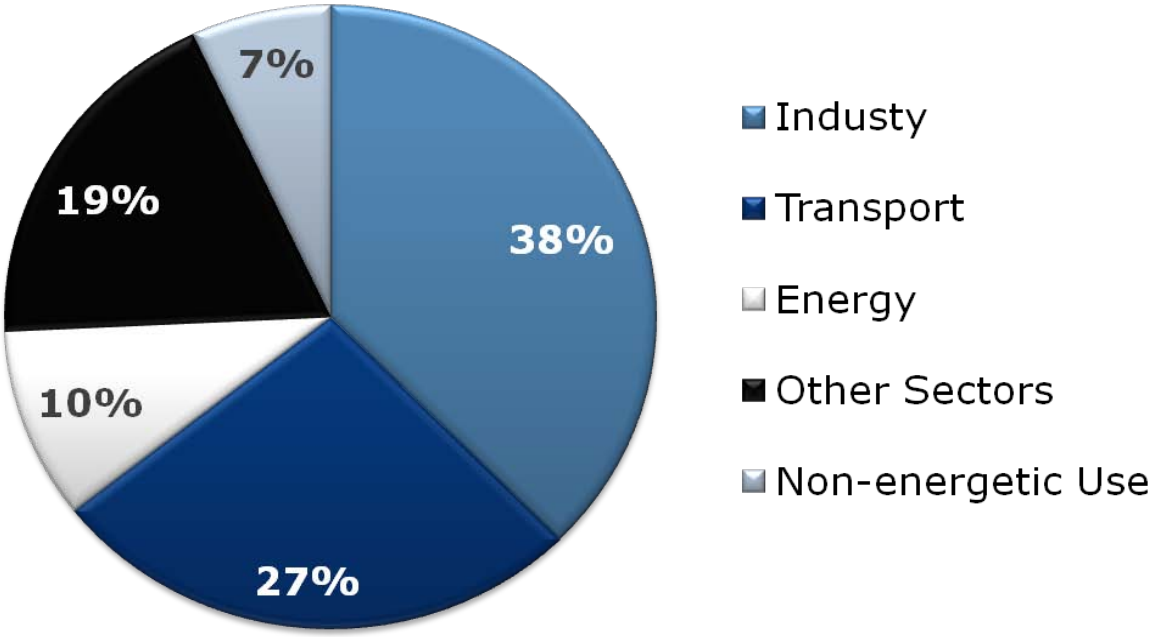
Energy demand in Brazilian economy sectors
Distribution of final energy consumption (2007)



Source: Economia & Energia, No.69

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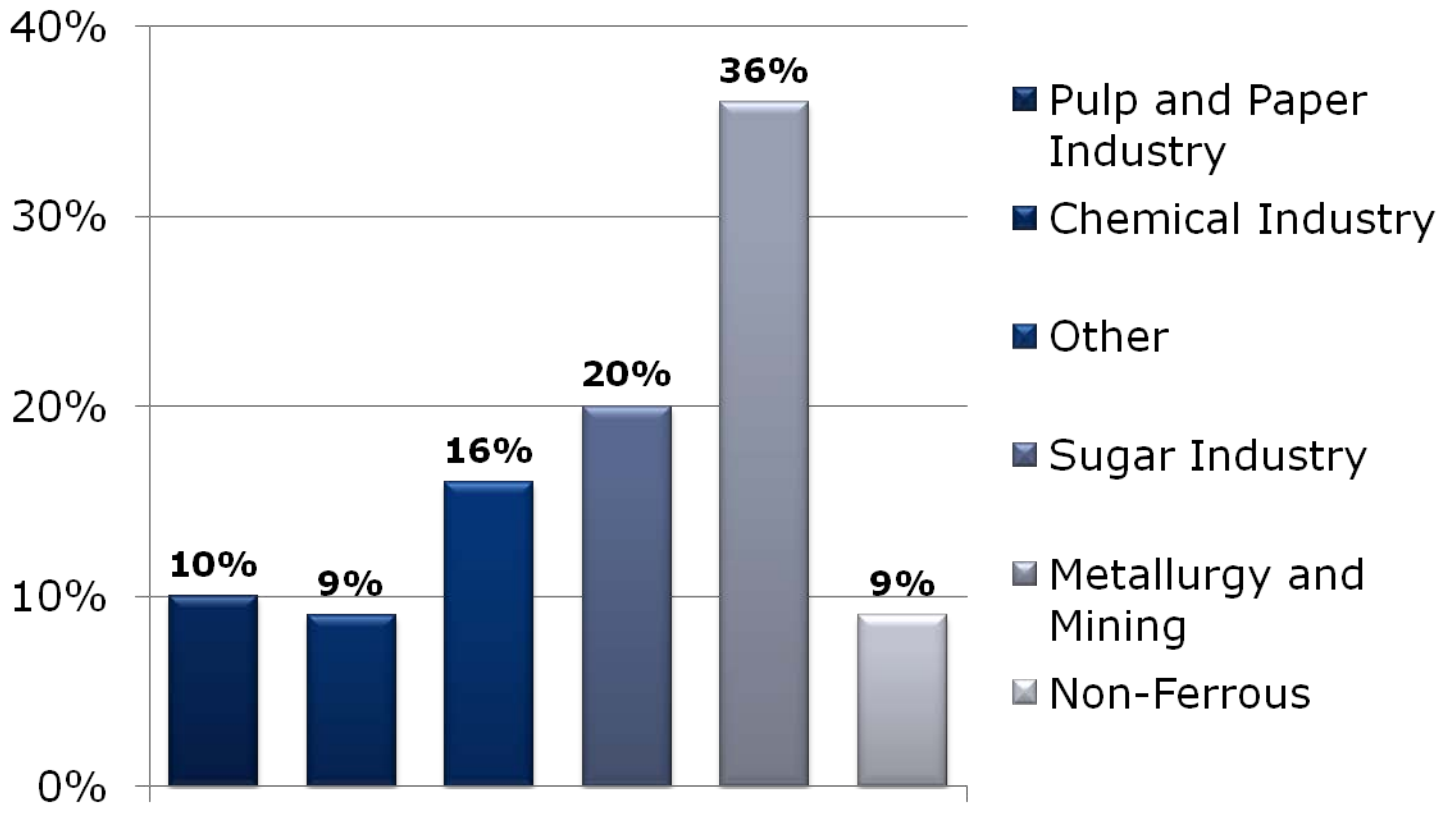
Energy consumption in the Brazilian industrial sector (2007)



Source: Economia & Energia, No.69

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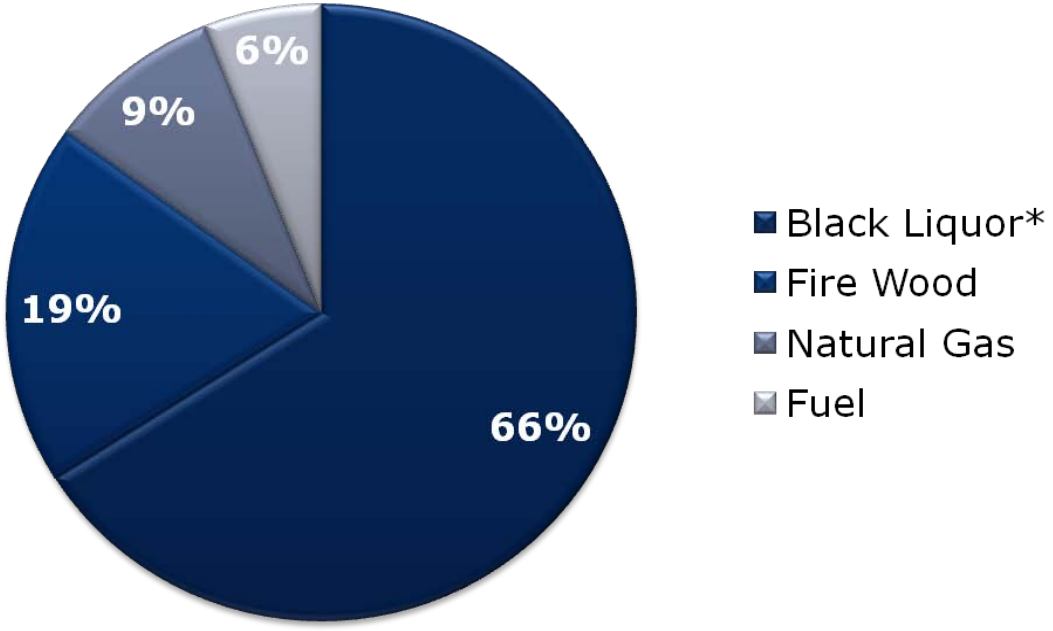
Energy Matrix of Brazilian Pulp and Paper Industry (2008)



* Sub Product (Firewood)
Source: Brazilian National Energy Balance

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German metal industry – key facts

- Initial situation
  - Energy costs in the metal industry are in the order of about 0.3% to 6% of the annual turnover
- Processes
  - Large range of processing methods and their combinations
  - Wide spectrum of various companies regarding processing steps, manufacturing facilities, production types, degree of mechanization
- Strategy for increasing energy efficiency
  - Reduction of energy demand
  - Optimization of energy application

Source: energieagentur.nrw

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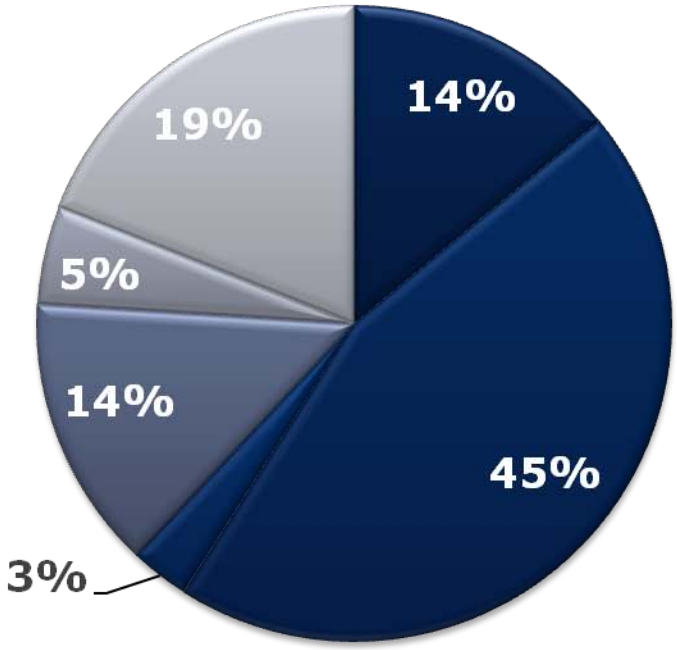
Energy expenditure in the German metal industry (2008)



Source: Rheinisch-Westfälisches Institut für Wirtschaftsforschung, Monitoringbericht 2008

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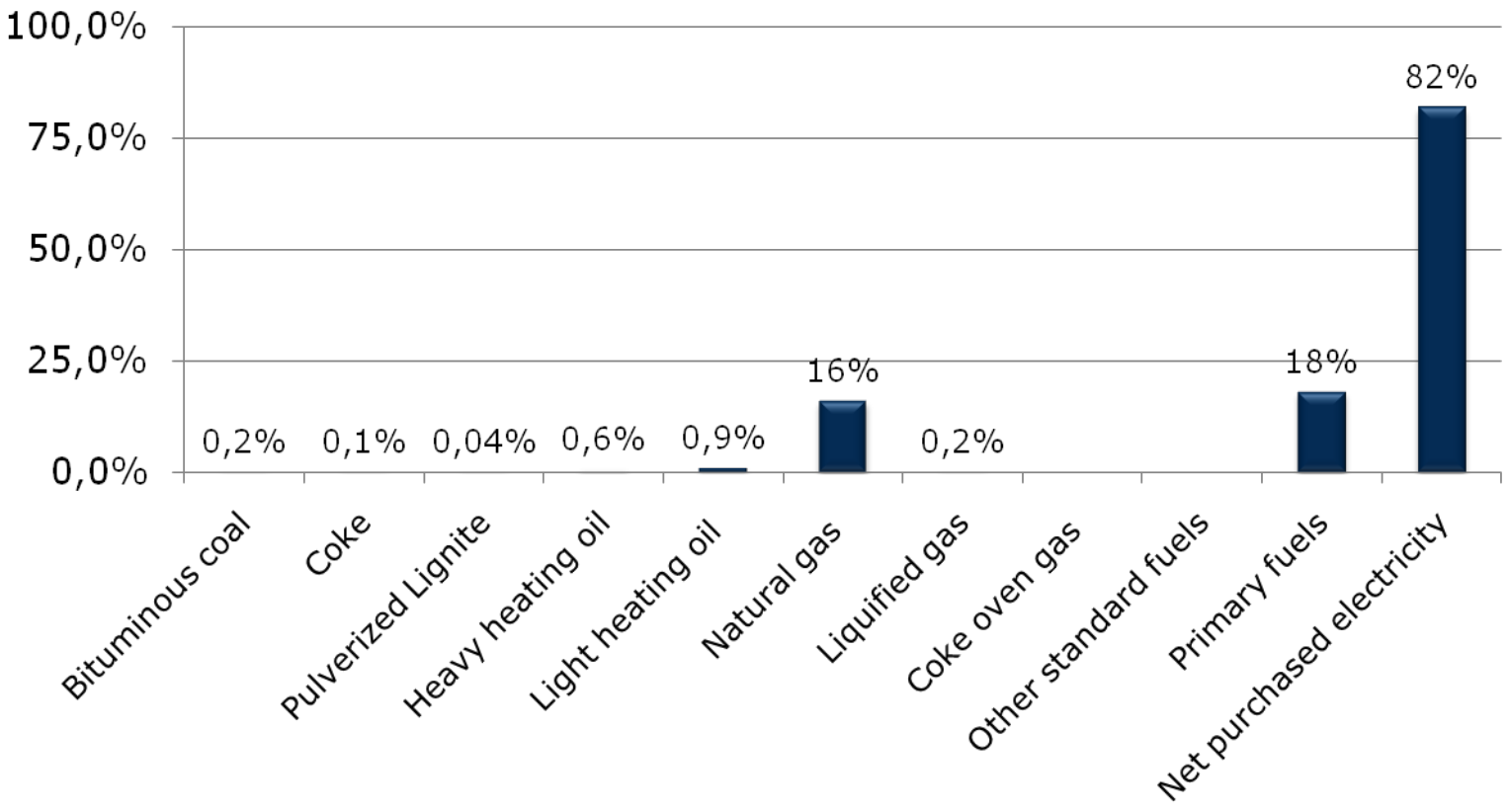
Energy expenditure in the German non-ferrous metal industry (2008)



Source: Rheinisch-Westfälisches Institut für Wirtschaftsforschung, Monitoringbericht 2008

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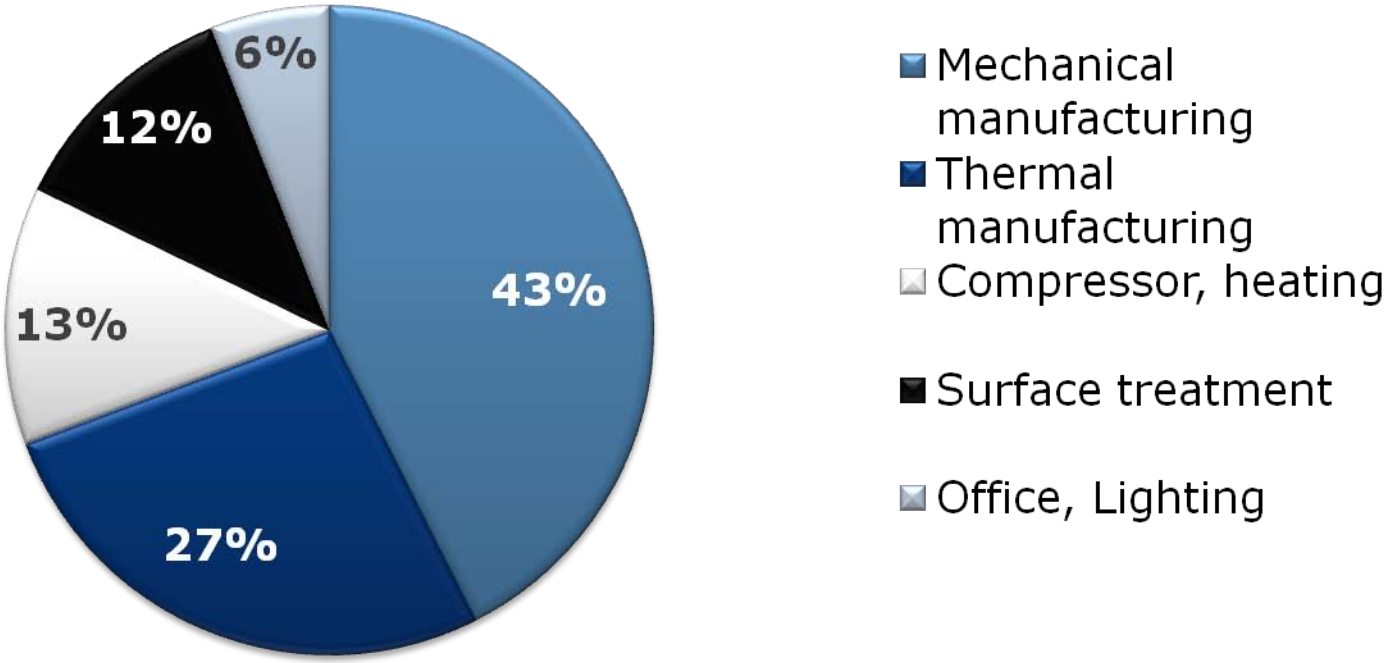
Electricity demand in the German metal industry for selected processes



Source: energieagentur.nrw

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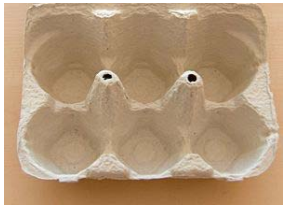
German Pulp and Paper Industry – key facts

- Initial situation
  - The pulp and paper industry belongs to Germany's fifth largest industrial energy consumers
  - During the last years the share of energy costs relating to the turnover was approx. 10%

- Processes
  - Half-stock production
    (pulp, mechanical pulp or recycled fiber)
  - Stock preparation
  - Paper machine (Fourdrinier machine)
  - Finishing

- Strategy for increasing energy efficiency
  - Reduction of energy demand
  - Optimization of energy application



Source: energieagentur.nrw

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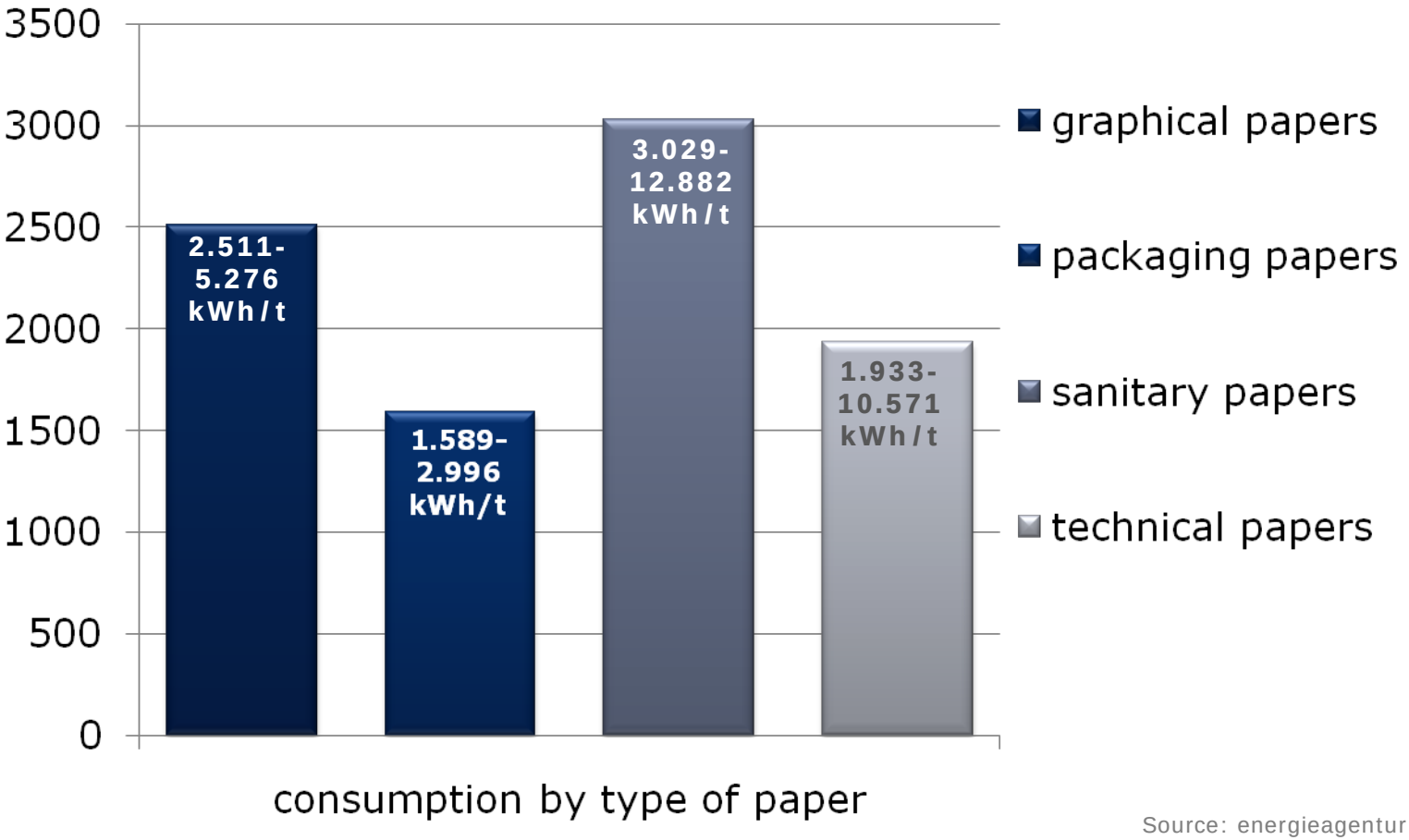
Energy consumption in the German paper industry for different paper products



Source: energieagentur.nrw

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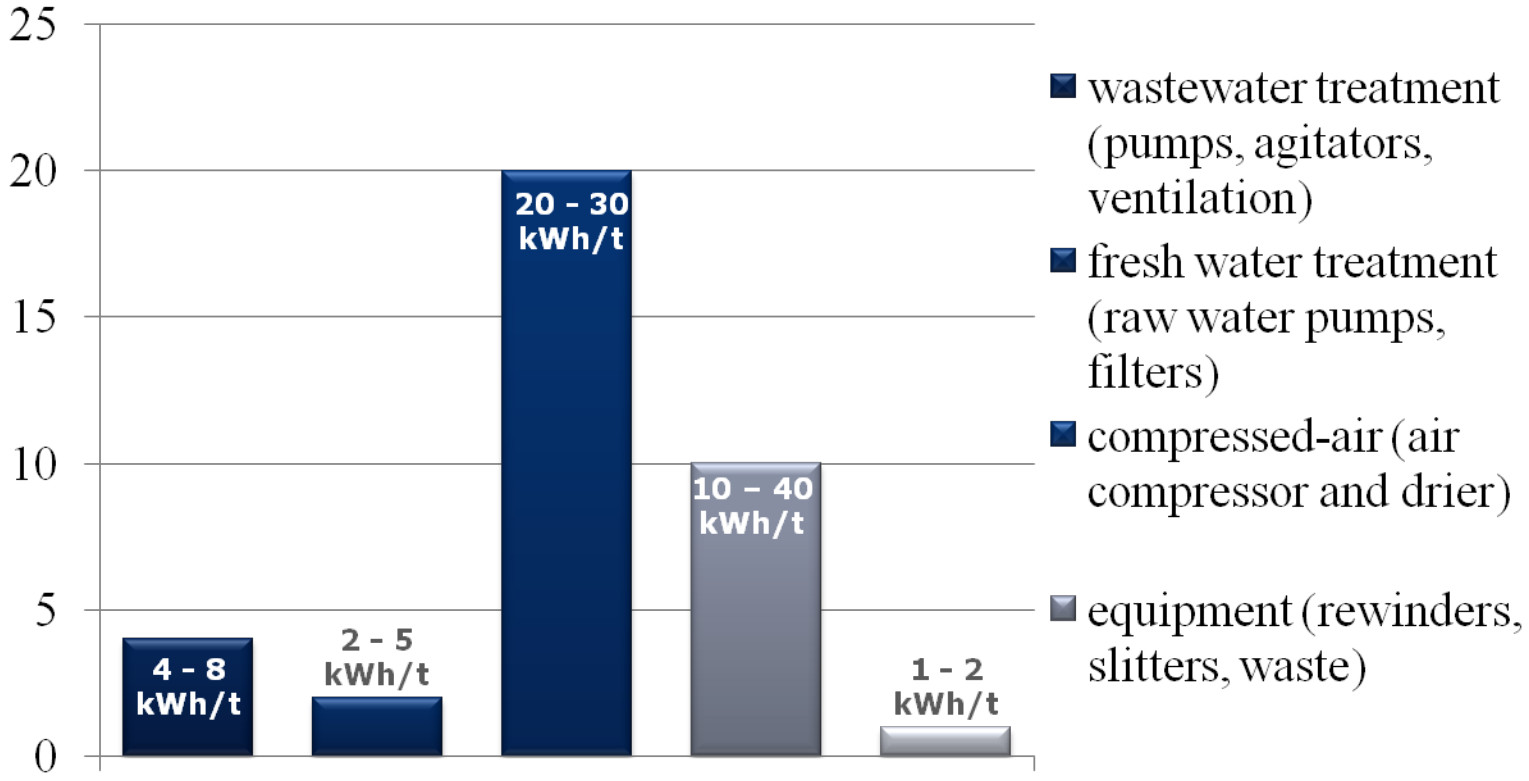
Energy consumption in the German paper industry for supply engineering



Source: energieagentur.nrw

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Cleaner Production – a strategy for efficiency?

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Energy efficiency by Cleaner Production

- Objective
  - Prevention or reduction of harmful environmental impacts by choice and optimization of a suitable production method
- Ecological AND economical benefits
  - Improvement of process flows
  - Optimization of the use of resources
  - Improvement of the emission situation
  - Reduction of production costs
  - Decreasing the quantities of waste and wastewater
- Proceeding
  - Coarse analysis = assessment of the actual state
  - Macro analysis = identification of potentials for improvement
  - Micro analysis = preparation of cleaner production measures

Source: Fraunhofer IML

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Cleaner Production in electroplating industry

- Initial situation
  - High water and energy consumptions for realizing optimum surfaces
- Proceeding
  - Examination of all relevant material flows and processes in a electroplating plant
- Results
  - Reduction of surface losses of the heating boilers by the installation of heat exchangers (reduction of energy use by 10%)
  - Optimization of a production line by improved process organization in the procedure of rinsing water (reduction of water and chemical use by 20%)
  - Reduction of the fresh water supply by rain water exploitation (coverage of fresh water share up to 80% by rain water)

Source: Fraunhofer IML

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supply engineering – measures for energy efficiency

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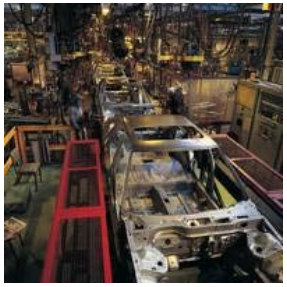
Measures in the field of supply engineering I

- Lighting
  - Raise of the lights degree of effectiveness
  - Change of the geometric arrangement in the room
  - Adjustment of the lighting intensity and duration
- Compressed air
  - Check and removal of leakages
  - Optimal sizing of the compressors and pipes
  - Adapted processing of the compressed air
- Ventilation plants
  - Orientation towards actual requirements
  - Accomplishment of the plants
  - Geometric arrangement of airflow



Source: Deutsche Energieagentur dena

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Measures in the field of supply engineering II

- Cooling systems and air condition plants
  - Check of the required temperature level
  - Generation of process cooling with cooling towers or groundwater
  - Elimination of heat sources from air-conditioned areas

- Heating systems and thermal insulation
  - Measures for the heat recovery
  - Automatic regulation of heaters
  - Insulation of plants and buildings

- Electric motor
  - Choice of engines of a higher efficiency class
  - Use of speed regulated drives

Source: Deutsche Energieagentur dena

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Technology:
Lighting in a production hall in the metal sector

- Initial situation
  - Lights with white-coated trapezoid metal reflectors
  - Equipped with T8 lamps, 58W and conventional electrical ballast

- Energy efficiency measures
  - Lights with highly efficient reflectors
  - Daylight dependent lighting regulation
  - Replacement of conventional electrical ballast (KVG) by electronic (EVG)

- Saving potential
  - Energy: 970.000 kWh/a (72%)
  - Costs: 78.000 €
  - Invest: 142.000 €

Source: Deutsche Energieagentur dena

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Technology: leakage reduction in the compressed-air system

- Initial situation
  - 28% of the produced compressed-air was used in the compensation of leakage losses

- Energy efficiency measures
  - Reduction of leakages in the distribution networks, in the mountings and in the connecting pipes by 5% to 23%
  - Use of speed regulated compressors
  - Reduction of electricity consumption of the compressed-air supply due to a better utilisation of the compressors
- Saving potential
  - Energy: 1.386.325 kWh/a (20%)
  - Reduction of emissions: 762 t CO_2/a

Source: Deutsche Energieagentur dena

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Technology: ventilation and air-conditioning

- Initial situation
  - An energy analysis detected a clear over-dimensioning as well as an improvement needy regulation at a building services installation

- Energy efficiency measures
  - Adjustment of supply and exhaust air quantities of the ventilation systems
  - Requirements on heating, air conditioning and hygiene
  - Reduction of the supply and exhaust air quantities
  - Control of the supply and exhaust air levels

- Saving potential
  - Energy: 2.566.000 kWh/a
  - Costs: 198.000 €
  - Invest: 227.500 €

Source: Deutsche Energieagentur dena

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Technology: Optimization of process heat

- Initial situation
  - Alunorte – Alumina do Norte do Brazil S.A. – energy efficiency in aluminum production
- Energy efficiency measures
  - Reducing the fine dust circulation through cyclone optimization thus reducing pressure losses and improving heat utilization
  - Optimization of process operation
- Saving potential
  - Energy: 56.095.000 kWh/a (6%)
  - costs: 1.360.000 €
  - Invest: 100.000 €
  - Reduction of emissions: 18.000 t CO_2/a

Source: Deutsche Energieagentur dena

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process engineering – measures for resource efficiency

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Technology: Optimization of a manufacturing method in the product development

Near net shape casting / forming

Machining from the solid

Material input 1400 g | Swarf 1070 g | Prefabricated part 330 g

Manufacturing from a pre-formed blank

Material input 450 g | Blank 390 g | Press waste 60 g | Swarf 60 g | Prefabricated part 330 g

Source: demea (2010)

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Technology: Optimization of a manufacturing method in the product development

- Initial situation
  - High share in machining waste
  - High tool wear
- Energy efficiency measures
  - Use of preformed blanks instead of solid materials
- Saving Potential
  - 50% lesser material waste
  - Lesser tool wear due to lower machining forces
  - Gain of efficiency by reducing the handling times
  - 2.370.000 € saving potential

Source: demea (2010)

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Conclusions

- Demand for energy in the industry
- Method for establishing efficiency:
  Cleaner Production
- Examples for energy efficiency
  in the field of supply engineering
- Example for resource efficiency
  in the field of process engineering

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Thank you

Thank you for your attention!

Dr. rer. nat. Kathrin Hesse

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