



Energy Efficiency in Electric Power Systems

EMAN 2007 Conference
24 May 2007



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5/25/2007



ABB today



ABB is a global leader in power and automation technologies that enable utility and industry customers to improve their performance while lowering environmental impact

ABB Group:

- Revenues 24 billion USD
- 108 000 employees in around 100 countries
- R&D investment around 1.1 billion USD

ABB Finland:

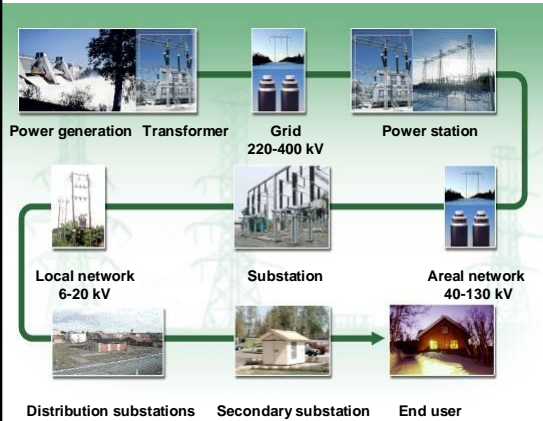
- Revenues 1.5 billion EUR
- Over 6000 employees on over 40 locations
- R&D investments 7 % of revenues
- Factories in Helsinki and Vaasa

Power and productivity for a better world



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Power Technologies overview



Reliability to power distribution

Products

- n Special Transformers
- n Power Transformers
- n Distribution Automation
- n Switchgear
- n MV-apparatus
- n HV-apparatus
- n Cables

Systems

- n Power Generation
- n Substations
- n Distribution Control and Protection Systems
- n Utility Communications
- n Substation Automation
- n AC and DC Systems

Service



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Automation Technologies overview



Energy savings and productivity

Products

- n Drives
- n Machines
- n Motors
- n Low Voltage Products
- n Low Voltage Systems
- n Robots
- n Instruments

Process Automation

- n Electrification and Automation Systems
- n Drive Systems
- n Electrical Propulsion Systems for Ships
- n Electrification and automation systems for ships

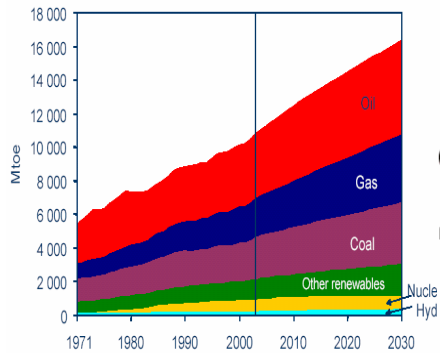
Service



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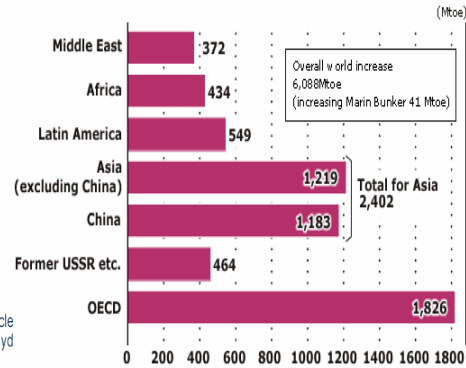
World energy demand increasing over 50 % by 2030

World primary energy demand



Majority of energy to be produced with fossil fuels still for a long time

Regional growth



2/3 of the increase in the energy demand is in the emerging markets

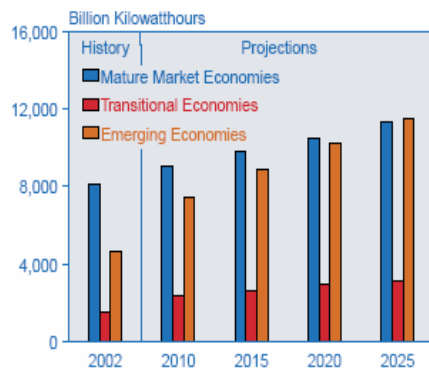
Source: IEA/World Energy Outlook



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Role of electricity increasing

World electricity demand 2002-2025



- Electricity is in key role in energy supply and welfare in the future
- Proportion of electricity is already 1/3 of world energy consumption
- Electricity demand is increasing faster than the growth of population

But there is still 1,6 billion people in the world without access to electricity

Lähde: IEA 2002



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What is energy efficiency & why does it matter?

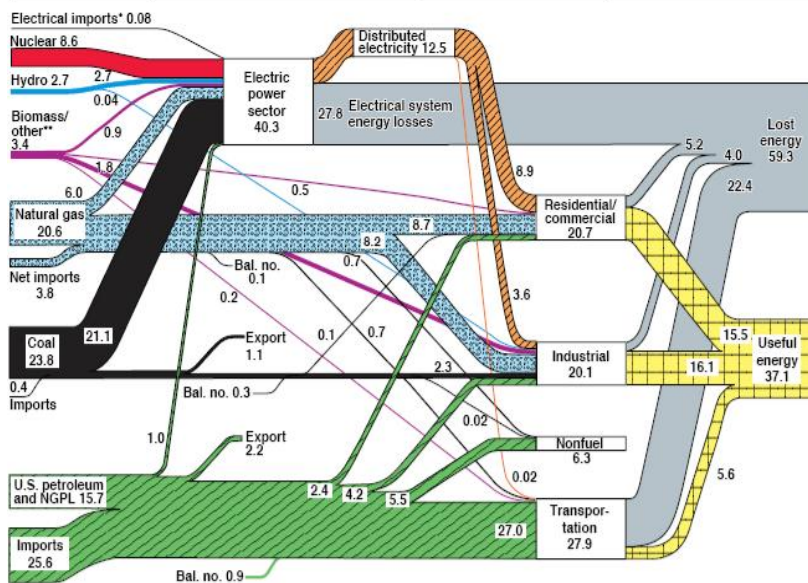
- è Concerns over climate change
- è Concerns over economic availability

$$\text{Energy efficiency} = \frac{\text{Useful energy output}}{\text{Energy input}}$$

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U.S. Energy Flow Trends – 2002 Net Primary Resource Consumption ~103 Exajoules



Source: Production and end-use data from Energy Information Administration, Annual Energy Review 2002.
*Net fossil-fuel electrical imports.
**Biomass/other includes wood, waste, alcohol, geothermal, solar, and wind.

June 2004
Lawrence Livermore
National Laboratory
<http://eesd.llnl.gov/flow>

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Energy efficiency: eliminate losses & waste

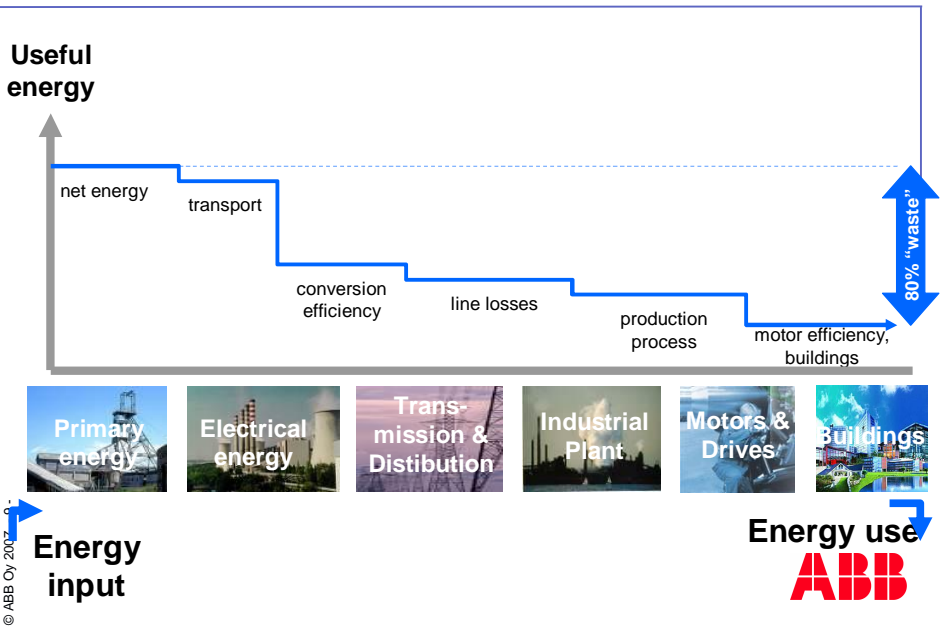
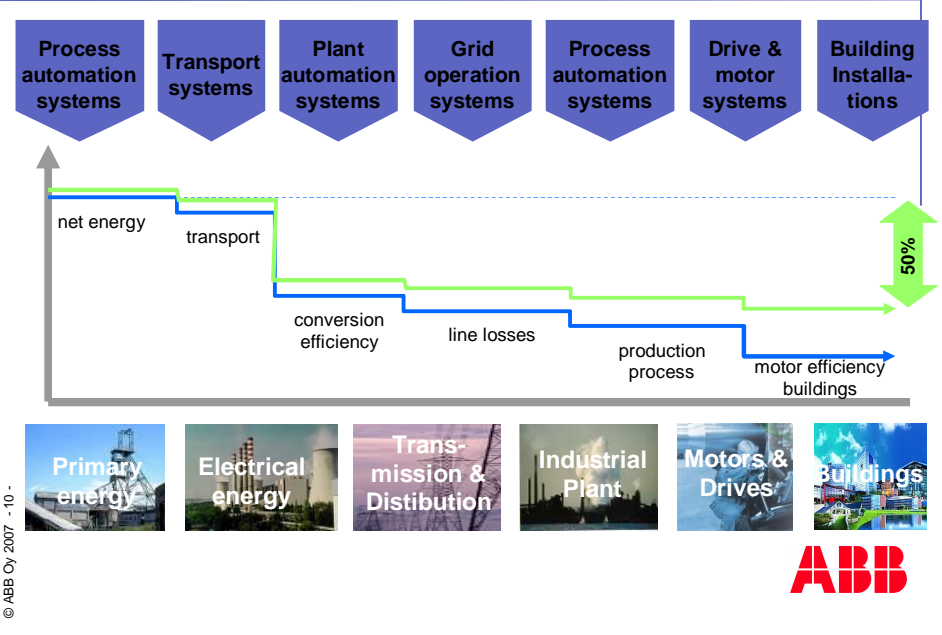


ABB contributes to each stage



Oil & Gas



Optimized control of multiphase flow from oil wells can enhance production rates by up to 30% and save exploitation energy

New HVDC light electricity supply to oil platforms and use of high voltage motors saves energy to operate the production site



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Power Generation



Optimized control of the start-up of the boiler in a power plant can save as much as 10 percent of energy per year



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Transmission



HVDC and HVDC light with cables offer significant reduction of losses already for short transmission lines compared to traditional HVAC overhead lines.



FACTS systems compensate reactive power and make installed HVAC installations more efficient and flexible.



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Transport

A podded propulsion unit which rotates through 360 degrees, incorporating an electric motor and frequency converter. On a recently launched cruise liner, an **8% reduction in fuel consumption** was achieved, equivalent to 40 tons per week.



Turbochargers boost diesel engine output by up to 300 % and save fuel



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Industrial Process Optimization



Better control systems for production speed in cold rolling steel mills can increase throughput up to 40% and reduce thickness variation by 50%



Production optimization and energy management in cement plants can reduce production cost by 5%

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Electric motors: A key opportunity

- n 60% of industrial energy is used by electric motors
- n Higher efficiency spells lower energy consumption
- n For each 1 EUR spent to purchase a motor, 100 EUR are spent for energy cost during its lifetime

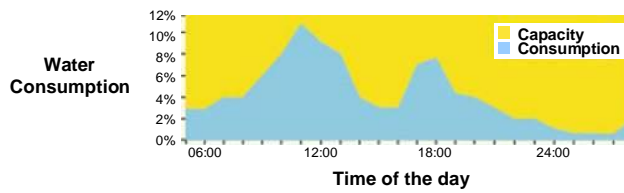


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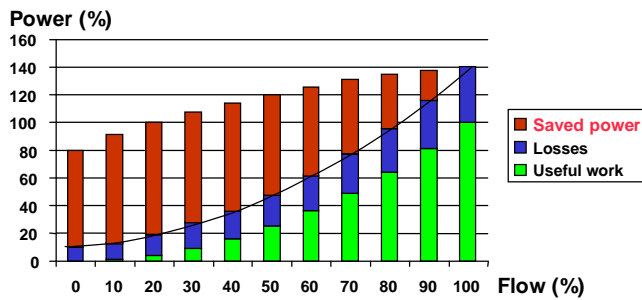
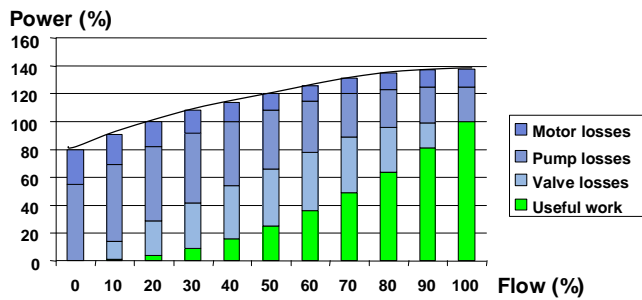
Even higher savings with variable-speed drives

- Too many motors still run at fixed speeds
- Drives can control the speed of the motor to match output with the driven load or process all the time
- In a city water supply, for example, this can save up to 50% of the energy used compared to fixed-speed motors and throttling



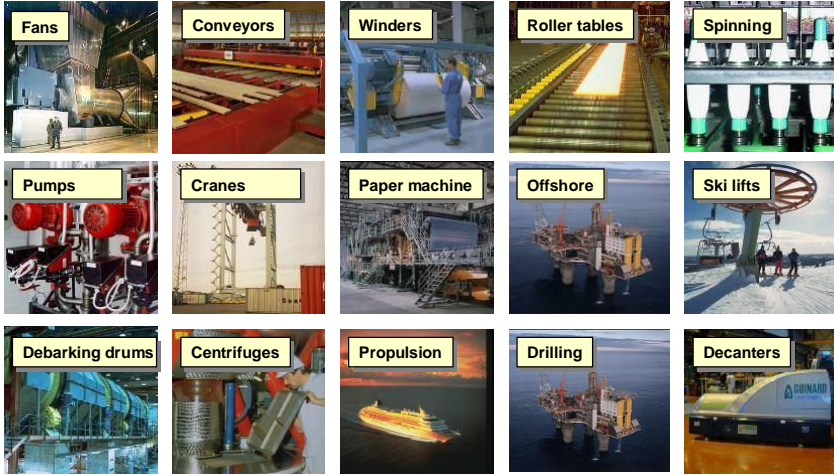
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Throttling vs. variable motor speed



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Where can motors and drives save energy?



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Saving potential

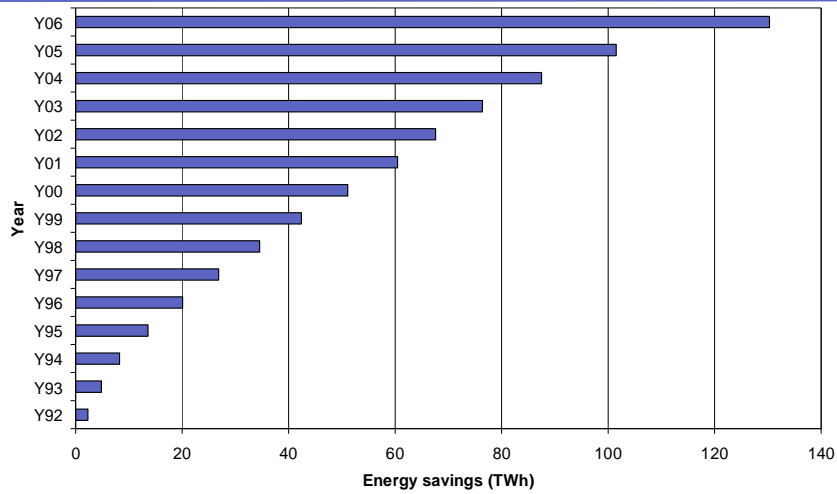
- n By improving the efficiency of industrial motors in
 - n China 19 TWh/year
 - n Europe 5 TWh/year
- n By using variable-speed drives in economically sound applications in
 - n China 134 TWh/year
 - n Europe 43 TWh/year
 - n USA (incl. high-efficiency motors) 85 TWh/year

according to expert studies 2005



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ABB drives save energy



- The installed base of ABB drives saved about 130 TWh in 2006, equivalent to the consumption per year of more than 32 million families.
- ABB's installed base of ABB low voltage drives reduced CO2 emissions in 2006 by 109 million ton, more than the yearly emission of Finland.



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Sustainability: areas of focus 2007



Continued and broader integration with our businesses

- n Ongoing training programs to improve health and safety performance
- n Two year program underway to cut ABB's energy use by five percent
- n Further phasing out of hazardous substances in manufacturing
- n Management of social, environmental and human rights risks being tightened
- n Strengthening of security, crisis and pandemic planning
- n Work with international organizations, including World Business Council for Sustainable Development, UN Global Compact, Business Leaders Initiative on Human Rights
- n Access to Electricity program expanding in India and Tanzania



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Energy efficiency – the other alternative energy



- n Climate change is a big challenge for everyone in global society
- n Majority of energy will be produced with fossil fuels still for a long time
- n Worlds energy demand is increasing over 50% from now to 2030
 - n Electricity demand is increasing even faster
- n Price of energy has reached permanently a high level
- n **We should**
 - n **stop “wasting” energy**
 - n **continue investing in further development of energy efficient technology and knowhow**

Energy efficient technologies are available to be exploited today – often with short payback period



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