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Chief Technology Officer



ABB's vision of the future electricity

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IEEE July 2001

Carnegie Mellon Electricity Industry Center
March 20, 2002



Agenda

- ABB in brief
- Trends in future electricity
- Future grid
- How do we in ABB cope with that
- Concluding remarks

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ABB in brief




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A global technology leader

Market position




1

- Drives
- Robotics
- Analytics
- Electrical Machines
- Line protection
- Force Measurement
- Power Electronics
- Switches & fusegear

2


- Instruments
- Motors
- Metering
- Control products

Source - Automation Research Corporation, AMR Research, Goldman Sachs, CSFB and others



A global knowledge leader

Market position




1

- Power plant automation
- Power transmission
- Upstream Oil & gas
- Flexible automation
- High voltage DC

2

- Substation automation
- Metals automation
- Pulp & paper automation
- Pharmaceutical biotech automation

Source - Automation Research Corporation, AMR Research, Goldman Sachs, CSFB and others



Power technology – global leadership

- Global presence with 28,600 employees in over 170 factories in 42 countries
- The world's leader in power technology products with the largest product portfolio and the highest market share



High voltage technology



Medium voltage technology



Power transformers



Distribution transformers

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Trends in Power Transmission and Distribution



- Increased competition due to deregulation
- Customers interested in solutions, not only products
- Strong focus on environmental issues
- More intelligent networks

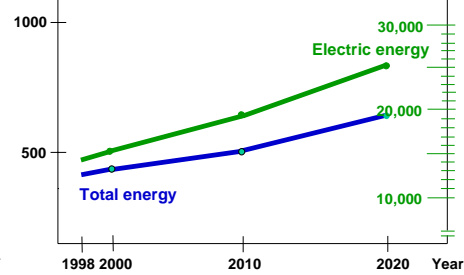


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Continuous growth of energy consumption

Total energy consumption, EJ

Electric energy consumption, TWh

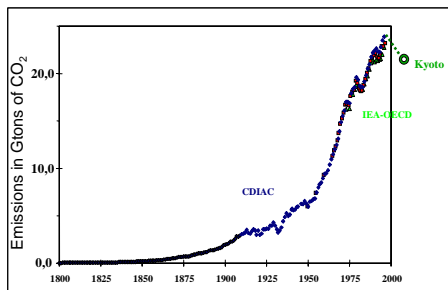


Source: Forecast by IEA



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World CO₂ Emission



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Sustainable development: Driving forces

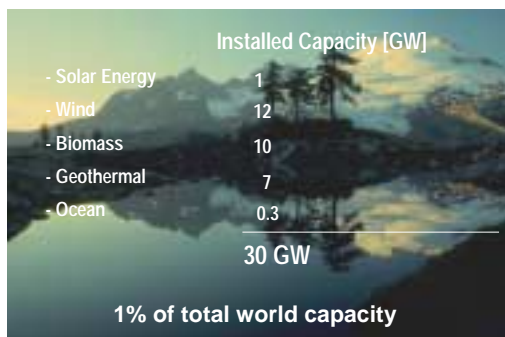


- Environment a growing concern
- Reduction of greenhouse gases
- Growth in alternative energy solutions
- More distributed power - fuel cells, wind power, combined heat and power, microturbines



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Renewable Energies*



* excluding hydro energy



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Vision of a bright future

The Silk Road Genesis Project*

*proposed by Sanyo



Vision of solar farms in China along the historic silk road to cover 1/3 of China's energy demand in 2030



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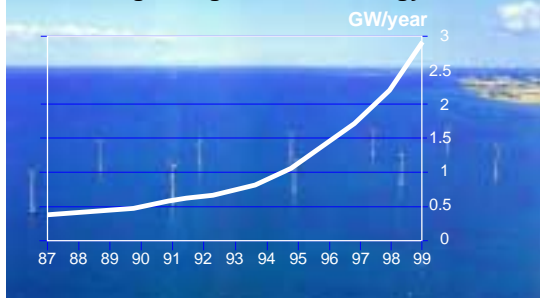
Towards a hydrogen based society

example Iceland

- 2040 Hydrogen society completed
- 2000 Start of a hydroelectric hydrogen economy
- 1940 Geothermal space heating
- 1800 Importing liquid fossil fuels
- 1700 Importing coal and coke
- 874 Settlement of Iceland

Windpower -

the fastest growing renewable energy



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Wind Energy: Global availability

Available wind energy

= 4 X

Global installed capacity of conventional electrical energy



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Windpower Generation Gotland /Sweden

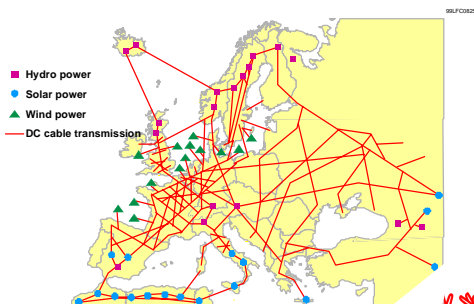


- Already today about 18% of the energy supply is based on wind power
- The goal is to increase this share to 30%

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Vision: Remote renewable energy sources

connected to loads by DC grid



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Visibility : a growing environmental concern



No longer accepted



Invisible grids

- water
- oil & gas
- electricity
- information

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The future grid

- A network of distributed generation sites
- Renewable energies a major part
- Mostly invisible
- Cost effective DC transmission and distribution
- Controlled by "virtual utilities"
- Operated and controlled via Internet / Intranet

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How does ABB cope with that ?

- Components
- Systems
- Technology

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A comprehensive portfolio for wind power



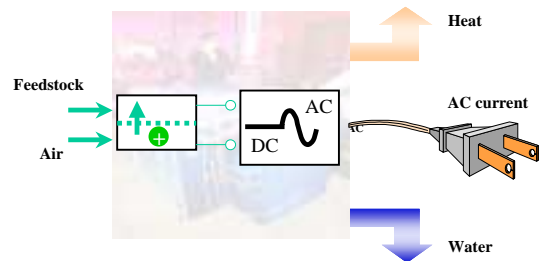
- A whole range of generators (already produce 25% of world's wind power generators)
- Converter technology
- System design
- Windformer

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Partnership for fuel cell systems

ABB and DuPont have formed an alliance



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TURBEC

A partnership for microturbines

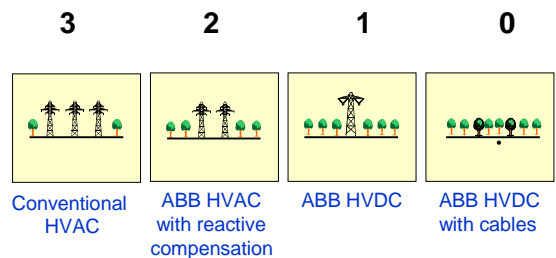


- ABB / Volvo JV
- Up to more than 60 units (~100 KW) delivered
- Building up business in combined heat and power

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Going Underground: Renaissance for Cables

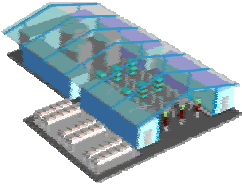


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HVDC Light: new transmission technology

- Modular build-up
- Compact
- Stabilizing networks



Conventional HVDC
 130 MW
 10,000 m²

↓


HVDC Light
 130 MW
 2,000 m²

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HVDC units shrink in size

Power: 50 MW


Traditional HVDC



HVDC Light




Future HVDC




	Traditional HVDC	HVDC Light	Future HVDC
Plant size:	10 000 m ²	1000 m ²	350 m ²
Power/area:	1	50	200
Frequency:	0.050 kHz	1 kHz	5-10 kHz

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Technology platforms for HVDC and SVC Light (annual growth 30%)



HVDC Cables




Dry Capacitors





Power Electronics


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Cables for environmental friendly solutions



Invisible power 
 HVDC Light & AC


Oil free transformers 

Highly efficient Windpower 

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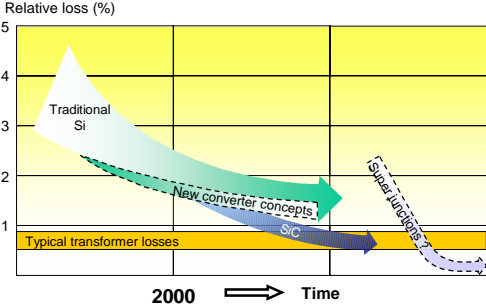
High energy density capacitors

- Very compact capacitors - 75% volume reduction
- Compact substations, SVC and HVDC plants possible, customers save space



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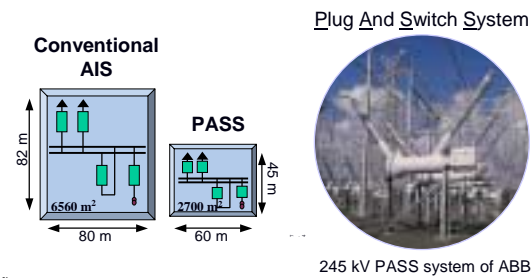
New power electronic technologies



The graph shows the evolution of power electronic technologies over time. The y-axis represents 'Relative loss (%)' from 0 to 5. The x-axis represents 'Time' starting from 2000. A horizontal yellow bar at approximately 1% loss is labeled 'Typical transformer losses'. A solid green arrow labeled 'New converter concepts' starts at ~4% loss in 2000 and trends downwards. A dashed blue arrow labeled 'SiC' follows a similar downward trend. A dashed purple arrow labeled 'Super junctions' starts around 2010 and trends downwards, crossing below the SiC line.

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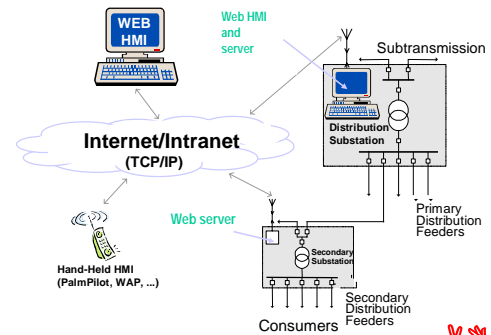
AC substations shrink in size



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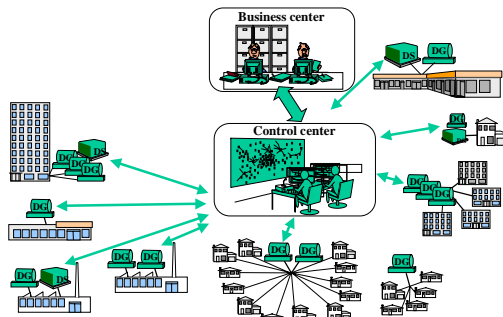
The INTERNET as platform for network control



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Virtual Utility

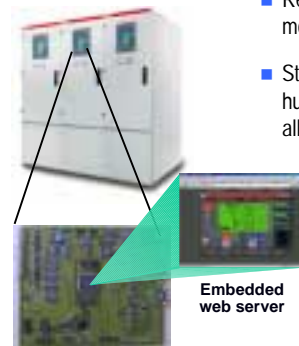


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Web based substation control

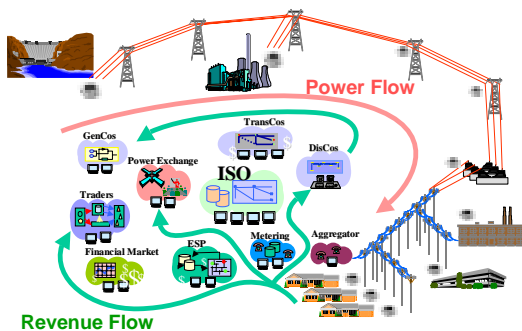
- Remote web-based monitoring and control
- Standard browsers as human machine interface, all functions accessible



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Operating the future grid



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Concluding remarks

- The future grid will be very different
- New technologies will change
 - sustainability and efficiency
 - visibility and economy
 - operation and control
- ABB through its R&D is shaping this future

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