Sustainability and Technical Solutions in Mobility

Green mobility.

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As a major source of CO₂ emissions and energy consumption the mobility sector must take action for change

Globalization

How can we connect the world regions in a sustainable way?
- 85% of the world’s exports will come from the EU and China
- China will have increased its exports by a factor of seven, India by a factor of eight

Energy consumption

How can we facilitate mobility but consume less energy?
- Total world consumption of marketed energy will have increased by 50 percent from today
- The transportation share of total liquids energy consumption will have increased to 63% in 2030

Greenhouse gas emissions

How can we reduce CO₂ emissions of our transport systems?
- The level of CO₂ emissions will have increased by 25%
- Transportation will cause 1/3 of CO₂ emissions
- Emissions of transport-related greenhouse gases (GHG) will grow, especially in developing countries
- In 2030, CO₂ emissions from the non-OECD countries will exceed those from the OECD countries by 72%
Siemens Picture of the Future – Technologies of Tomorrow

**De- & Centralized Generation**
Renewable, Storage Technologies

**Complete Mobility**
Optimization of the Networks

**Security of Energy Supply, Electrification**

**Eco-friendly Products, Energy Efficiency, New Materials**

**The Intelligent Grid, Grid Automation**

**I&C Business Models**
IT Platforms

**SIEMENS** has the vision of intelligent and automated grid operation - minimizing CO₂ emissions

Customers will benefit from early innovations to maintain & develop their business

**SIEMENS** aims to lead the industry by sustainable and reliable solutions
With its solutions portfolio, Siemens can directly impact around 26 gigatons of the annual energy-related CO₂ equivalents (CO₂e) of greenhouse gas (GHG) emissions. Around 5.3 gigatons of this can be ascribed to transportation-related emissions. At around 2%, railways account for the smallest component of all transportation modes.

![Diagram showing total GHG emissions and transportation-related GHG emissions](source: IEA World Energy Outlook, Vattenfall, Siemens)
To cope with transport demand and environmental challenges, all transport modes need to operate in concert.

Intermodality seamlessly integrates all modes and leverages their individual strengths in order to:

- Accommodate growing demand
- Maximize the effective capacity of the overall transport system for both personal and goods transport
- Reduce transport’s ecological footprint
- Facilitate sustainable economic growth
- Reduce time loss, emissions, noise, congestion and accidents
Urban Areas and Underground Grid

- Wind turbines as part of tower building architecture
- Solar-cell films on building surfaces contribute to power generation
- Underground power corridors and substations coupled with storage facilities
- Large centralized power plants supply the majority of power demand
- Wireless sensors and smart metering coupled to load management and market-driven energy supply software
- Car-parking for plug-in vehicles, buy or sell electricity shaving peak loads
- CO$_2$ emissions are constantly on display for licensing/brokerage
- Nano-materials enhance insulation and conductivity of equipment

Megacities: The entire bandwidth of innovative energy transmission and distribution architecture will be concentrated here
Powerful central power supply systems will remain the backbone of the global energy landscape.

- Bulk Power Generation and Long Distance Transmission
  - Large centralized power plants supply the majority of power demand
  - Supply of deep-sea oil & gas exploration and production
  - CO₂ sequestration and storage facilities
  - Wind farm connected by Gas Insulated Lines or cables (DC or AC)
  - Nano-materials enhance insulation and conductivity of equipment
  - Large storage plants buffer fluctuating generation
Moving more people more efficiently on a smaller ecological footprint

Intermodal end-to-end travel
- Personal mobility assistance
- "Life on the move" Personalized public transport
- Hands-free travel: Seamless baggage transport

Integrated eco-based traffic management
- Smart capacity and space management
- 2-way navigation & information
- Active guidance of priority vehicles

Integrated intermodal hubs
- Passenger flow management
- Multi-story vehicle access
- Seamless end-to-end security

Demand-responsive rail
- Alternative drives
- Flexible train configuration
- Netload optimization

Mobility on demand
- Automatic piggyback
- Passenger cocoon

Smart road grid
- Autonomous driving
- Road energy grid
- E-car

Mobile resources management
- Eco-buildings

Passenger flow management
- Scalable, automated BHS

Passenger flow management
- Seamless end-to-end security

Seamless end-to-end security
- Eco-buildings

Mobile resources management
- Eco-buildings

Passenger flow management
- Seamless end-to-end security

Seamless end-to-end security
- Eco-buildings

Eco-buildings
- Scalable, automated BHS

Demand-responsive rail
- Always-available rolling stock
- Netload optimization

Integrated intermodal hubs
- Multi-story vehicle access
- Seamless end-to-end security

Integrated eco-based traffic management
- Active guidance of priority vehicles

Personal mobility assistance
- "Life on the move" Personalized public transport
- Hands-free travel: Seamless baggage transport

Universal payment & pricing
- Scalable, automated BHS

Integrated intermodal hubs
- Multi-story vehicle access
- Seamless end-to-end security

Demand-responsive rail
- Always-available rolling stock
- Netload optimization
Fast and sustainable just-in-time transport forms the backbone of global economies

- Efficient intermodal transport
- Integrated port logistics
- Adaptive freight vehicles
- Automated, intermodal freight hubs
- Fast and integrated logistics
- Smart load units
- Seamless, borderless transport
- Standardized cargo
- Automated freight handling
- Combined passenger and freight trains
- Scalable, modular vehicles
- "Energy-collecting" rail freight cars
- Integration of freight disposition and production systems
- Universal logistics platform
- Complete and efficient freight corridors
- Smart supply chain

"The internet of goods: Smart, autonomous goods

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Corporate Technology
Our innovative key technologies drive advances in all areas of the future mobility system and beyond

- Ambient intelligence
- Ubiquitous computing
- Self-organizing systems
- IT integration & cooperation
- Peer-to-peer communication
- Smart and networked sensors
- Autonomous systems, robotics
- 3D-vision and augmented reality
- Adaptive, intuitive multi-modal user interfaces
- Seamless indoor and outdoor localization
- Dynamic modeling & simulation
- Remote- and self-diagnosis
- Decentralized intelligence
- Automatic image analysis
- Data systems integration
- Secure communication
  - Track & trace
  - Data mining
Innovative key technologies drive advances in all areas of the future mobility system.

- **Safe**
  - Always-safe infrastructure
  - Remote & self-healing systems

- **Efficient**
  - Predictive maintenance
  - Smart, energy-efficient buildings

- **Intermodal**
  - Crowd management
  - Integration, dynamic MSO

- **Secure**
  - Contactless authentication and payment
  - Universal payment & pricing

- **Comfortable**
  - Personal Mobility assistance
  - Personalized cabins

- **Sustainable**
  - Smart & efficient energy systems
  - Distributed smart energy grid

- **Green Mobility**
  - New insulation materials
  - New insulation materials

- **Vision**
  - 3D vision & augmented reality
  - Ambient intelligence

- **Application**
  - Knowledge-based, automatic image analysis
  - Neural networks / self-learning

- **Technology**
  - Nanotechnology for rail applications
  - Magnetic materials for sensors & actuator systems

- **Adaptive HMI**
  - Crowd modeling and simulation
  - Crowd modeling

- **Zero-failure**
  - Self-healing systems
  - Self-lubricating coating

- **P2P communication**
  - Remote & self-diagnosis
  - Self-healing systems

- **Efficient drives**
  - High power density drives
  - New insulation materials

- **Efficient**
  - Smart, energy-efficient buildings
  - New fiber composites & polymers

- **Biometric scanning**
  - Secure wireless communication
  - Secure wireless communication

- **IT platforms**
  - *Integrated architectures and platforms*
  - *CT focus topics*
Sustainability for Ports - Examples

Onshore Power System
Connections to reduce emissions

Saving fuel using ECO - RTG hybrid drive system

MSO and IT Platforms for entire logistics chain
Sustainability is part of our corporate philosophy

- Active member in important national and international organizations
- Listing in the Dow Jones Sustainability Index for the eighth time in succession
- Global certification of Siemens’ EH&S standards for projects, development and production sites according to:
  - ISO 14001
  - OHSAS 18001

“I won’t sell the future for quick profits”

Werner von Siemens, 1816–1892
Thank you for your attention!