Hitachi Energy Investor Days 2023

Energy transition perspective – Evolving energy landscape & technologies for tomorrow

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Hitachi Energy – Advancing a sustainable energy future for all
Electrification is growing like never before

Carbon emission reduction, energy security and energy efficiency are driving electrification growth

64 countries that account for 89% of global emissions have announced net-zero targets

Country with net-zero target announcement

The global power system of 2050 will require four times today's generation capacity and will need to transfer three times as much electrical energy

Direct electrification for mobility is outstanding in terms of efficiency.

Electrification growth driver efficiency – example transportation

- 100% for solar and wind energy
- 100% for direct electrification
- 60%-82% for electric vehicles
- 25%-35% for H2 fuel cells
- 23%-34% for fuel processors
- 18%-34% for hydrogen storage
- 14%-25% for electric vehicle charging
Electrification growth – need for a new energy system approach

Power System of Systems

- Consumers becoming prosumers
- Fast growing system
- Much more variability
- Need for flexibility

Power generation (centralized & decentralized)

- Industry and large commercial
- Transportation
- Residential

The electrification growth drivers are turning studies into real infrastructure – we are only at the beginning
The Power System of the Future will be significantly bigger, more interconnected and much more complex.
The Power System Evolution – Future Power Systems

- **Generation**
  - Central
  - Distributed

- **Grid**
  - Meshed HVDC
  - Meshed AC
  - Master Control System
  - Distribution

- **Industry and large commercial**
  - Integrated Renewables
  - Transportation

- **Future Power Systems**
  - HVDC
  - MVDC
  - LVDC

1. High-Voltage Direct Current
2. Medium-Voltage Direct Current
3. Low-Voltage Direct Current
4. Alternating Current

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Key drivers and enablers of the future Power System of Systems

Example: Germany – grid flexibility needed today and in the future

Hitachi Energy has leading technology, unmatched installed base and global experience to deliver at speed and scale for any electrification pathway.

Source: Hitachi Energy studies
Market leadership enabled by technology and global approach

Key aspects of global technology and market leadership

- Anticipating future needs: customer collaboration & co-creation
- Technology partnerships & collaboration: for complementary developments
- World leading developments in core technology areas
- Strategic protection of Intellectual Property

Fundamental technology areas for the Power System evolution

- Sustainable Products & Solutions
- Power Electronics
- Digitalization
Example HVDC: Towards a first regional HVDC grid in Europe

Scotland

- Improving Power Quality within the AC\(^1\) grid in Scotland
- Connecting Shetland Islands to mainland Scotland
- Ready to connect further offshore windfarms in the future

3 out of 4 GWs of offshore wind installations are enabled by Hitachi Energy technology

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1 AC = Alternating Current; HVDC = High-Voltage Direct Current
Digitalization – an enabler for the accelerating energy transition

Visibility from the asset to the control room, across the entire life cycle
Our pioneering sustainable offerings deliver total life-cycle optimization.

**Products**

- **The world's first eco-efficient 420kV circuit breaker**
- **Transformers** with enhanced energy efficiency and biodegradable fluids
- **HVDC connection** with sustainability-optimized design

**Services**

- **EconiQ™ retrofill services**
- **EconiQ™ consulting services**
- **Digital solutions & services**

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**Product Lifecycle**

- Raw material extraction
- End of life
- Material processing
- Product manufacturing
- Distribution
- Product use
- Cradle to cradle
- Cradle to grave
- Cradle to gate

**Cradle to Cradle**

**Cradle to Gate**

**Cradle to Grave**

**Energy Risk Software Rankings 2022 Winner**
Energy transition perspective: Evolving energy landscape & technologies for tomorrow

Leading technology, unmatched installed base, global experience, and partnerships to deliver at speed and scale

Key takeaways

01 The global power system of 2050 will require four times today’s generation capacity and will need to transfer three times as much electrical energy

02 This calls for a new energy system approach as the Power System of the Future will be significantly bigger, more interconnected and much more complex

03 Sustainable Products & Solutions, Digitalization and Power Electronics are fundamental technology areas enabling the Power System evolution