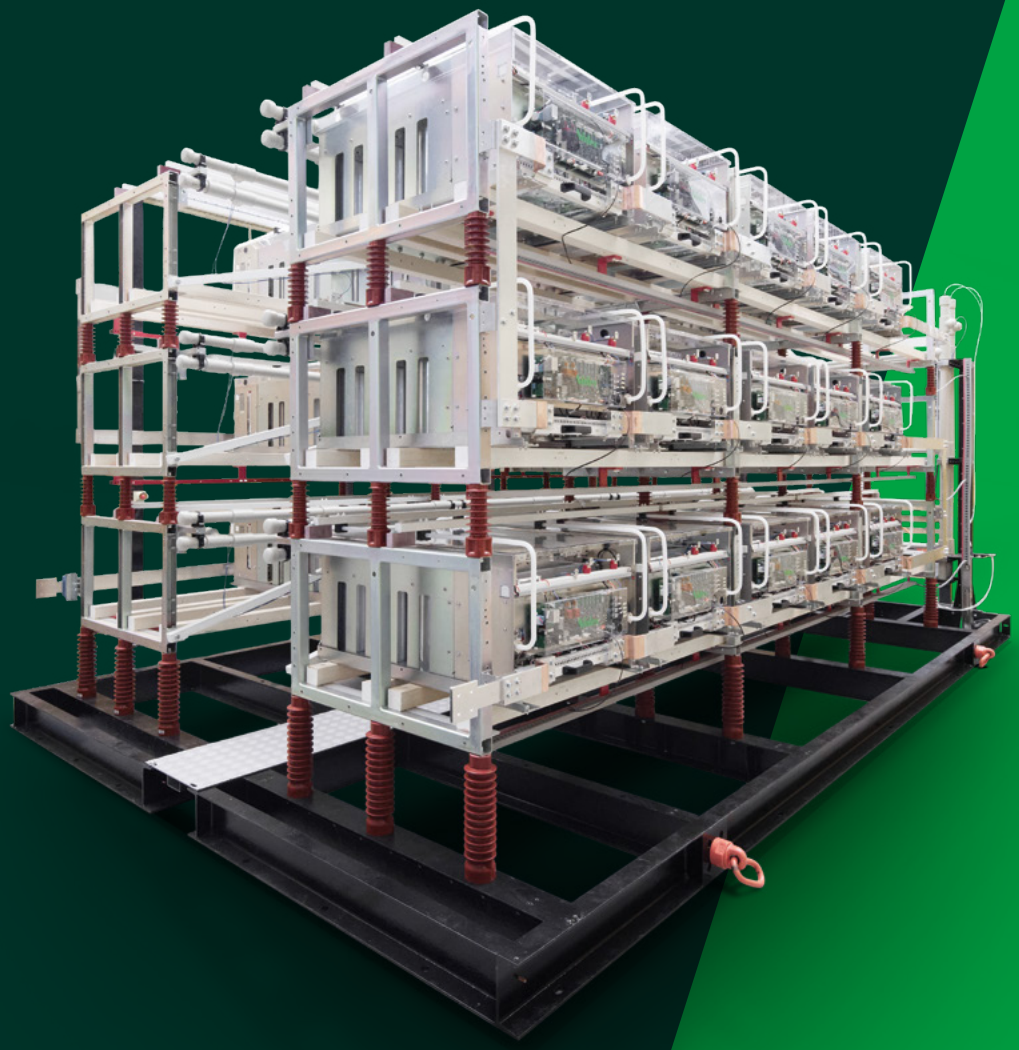
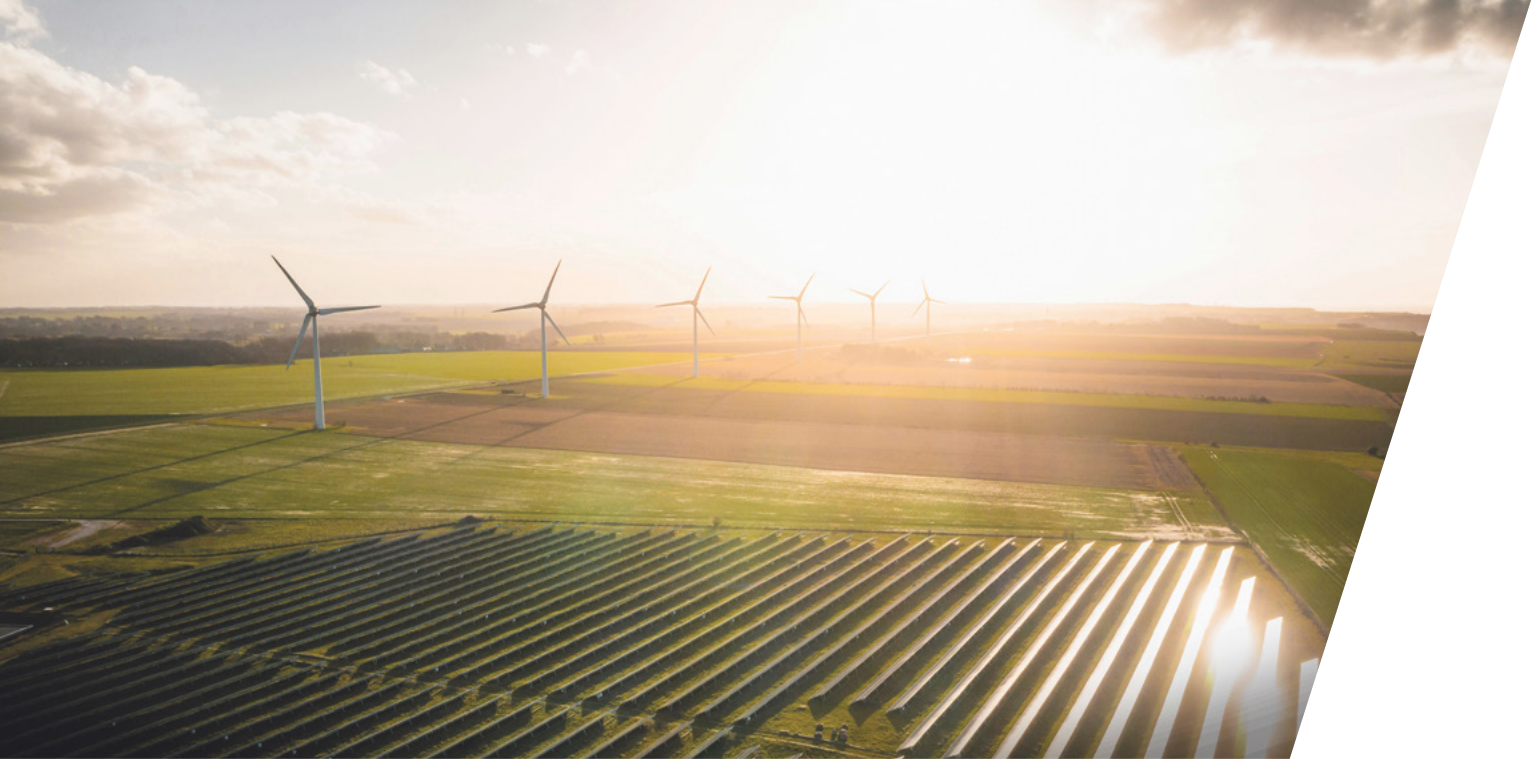
Nidec Conversion

SILCOVAR S (SVRS)

E-STATCOM Grid Forming Solution with Enhanced Supercapacitor





Future network grid evolution

The increasing penetration of renewable energy sources (wind and solar) has reshaped the electricity landscape worldwide. While these technologies drive decarbonization, they also pose challenges to grid stability, such as voltage surges and frequency fluctuations, due to the reduction of inertia previously provided by large thermal power plants.

New grid faults or power oscillation events can happen because of the higher penetration of renewable sources in the network and because of reduced inertia due to the shutdown of the traditional thermal generation plants.

The major effects into the network grid can be resumed in the following events:

- Fast voltage grid variations
- Fast frequency grid variations
- Decrease of network grid inertia
- Declining physical inertia
- Renewable intermittency
- Voltage dips and flicker

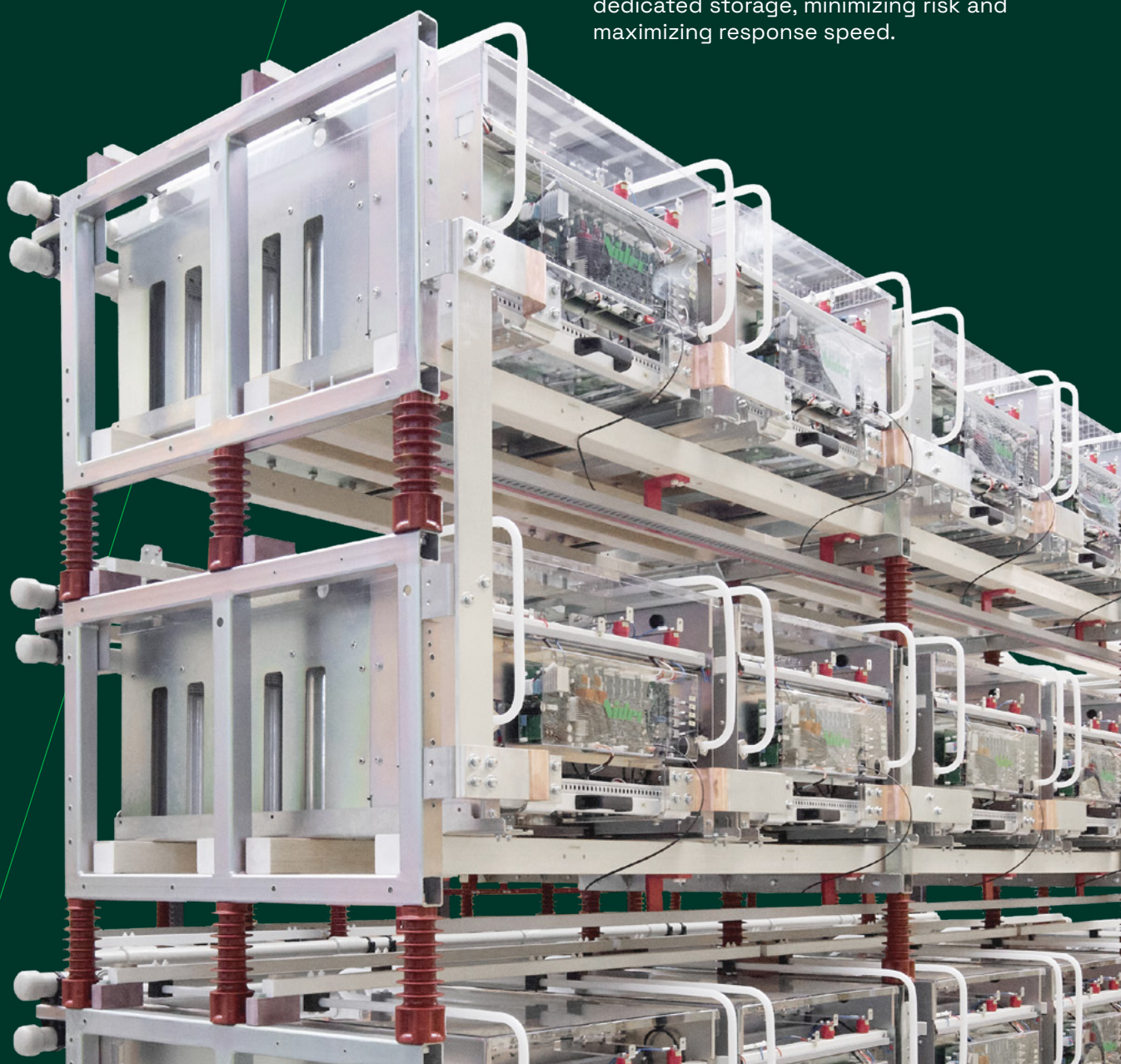
“The increasing penetration of distributed and intermittent energy sources is leading to dangerous frequency fluctuations and power oscillations.”

The Solution:

Silcovar S goes beyond traditional reactive power compensation. By integrating Short-Time Energy Storage (Supercapacitors), it provides the "Synthetic Inertia" required to prevent grid collapse and ensure a seamless energy transition.

Core Innovation:

A Cascaded H-Bridge (IGBT) topology where each level is equipped with dedicated storage, minimizing risk and maximizing response speed.



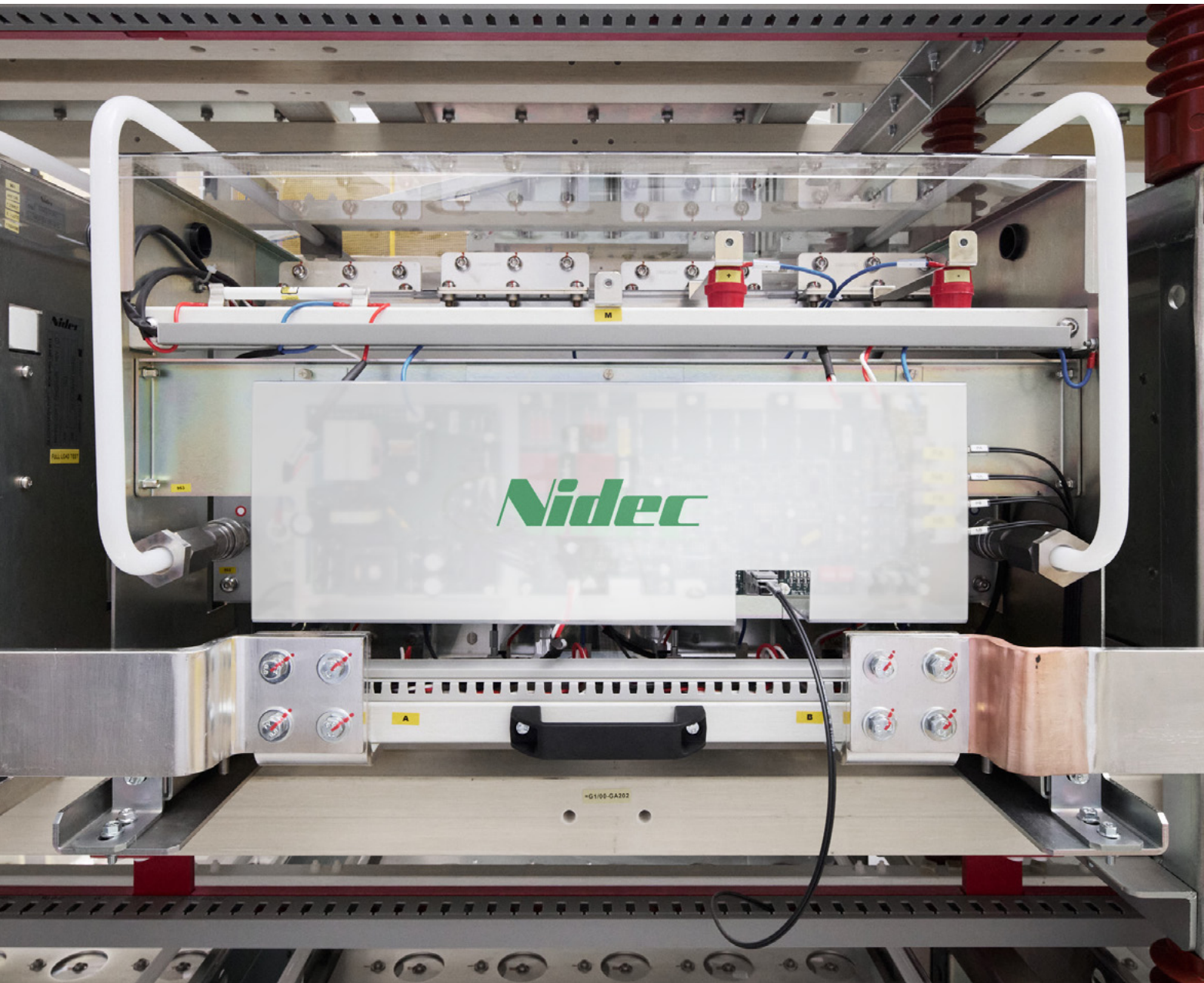
Problem statement

The Challenge: Stability in Low-Inertia Networks

The decommissioning of fossil fuel plants reduces natural inertia, creating:

- Risk of grid collapse
- Power oscillations between areas
- Reduced meshing and stability
- Need for fast synthetic inertia

Static converters with short-time energy storage offer a viable solution.



SILCOVAR S Technology

Second-Generation Statcom with Integrated Supercapacitors Topology

Delta-connected Cascaded H-Bridge (CHB), each level including:

- **H-Bridge**
  - Multilevel DC/DC converter
  - Supercapacitor assembly
  - Protection & monitoring
- **Supercapacitor Assembly**
  - 20-year lifetime
  - Optical communication interface
- **DC/DC Converter**
  - High switching frequency
  - Low ripple → Longer SC life
  - High peak current capability

Applications & Benefits

What SILCOVAR S delivers

- **Grid-Forming Capabilities**
  - Synthetic inertia
  - Frequency support
  - Fault current contribution
  - Negative-sequence compensation
- **Power Quality Performance**
  - ±300 MVAr reactive capability
  - ±150 MW x 1.25 s
  - Fast active power injection
  - Harmonic mitigation
  - Power oscillation damping
- **Operational Advantages**
  - High efficiency
  - Full modularity
  - Redundancy at level granularity
  - Simplified maintenance
  - Integrated SC + Power electronics in same hall

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