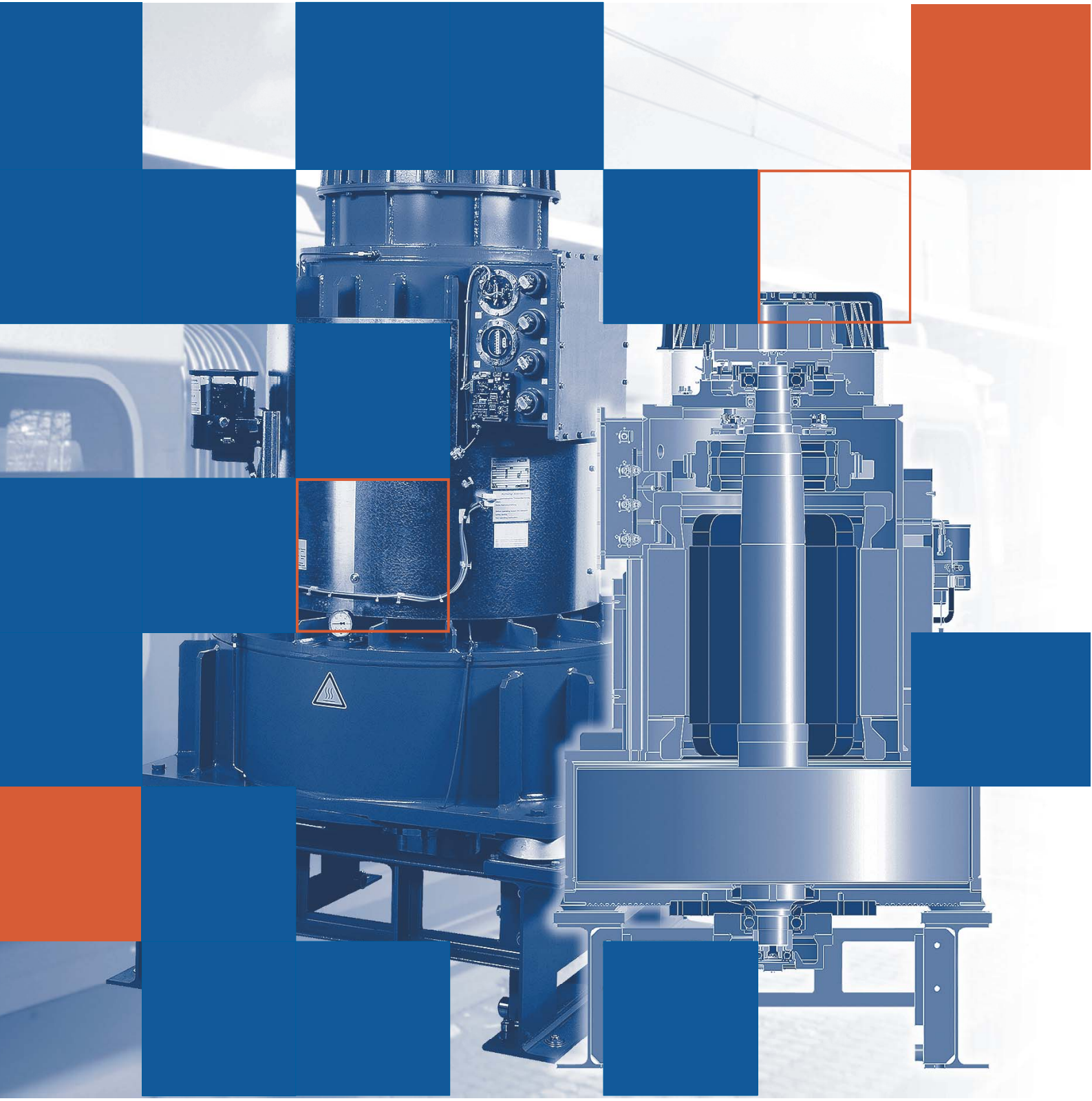


PILLER POWERBRIDGE

The attractive alternative to substations

PILLER
Power Systems

PILLER POWERBRIDGE

In DC railway networks an important criterion for trouble-free operation is that the contact wire voltage should be as constant as possible. Disturbances which affect voltage stability occur during changes to the network. Possible causes of these are:

- construction of new lines
- extensions to existing tracks
- use of new trains with higher power consumption
- use of new trains which feed back greater amounts of braking energy into the network
- shorter time intervals between trains

The above changes require the power supply to be modified and involve costly investments in the infrastructure.

POWERBRIDGE instead of rectifier station

The POWERBRIDGE kinetic energy storage system is an attractive alternative to substations.

Its characteristic feature of decoupling the energy output from the energy consumption over time not only enables energy to be saved, but compensates load peaks too and thus makes a decisive contribution to voltage stability.

Compared to new substations, considerable investment and operating costs can be saved by the use of the storage system.

Overall, a more uniform electrical loading of all components in the DC supply network is achieved, which in turn has a positive effect on the operational reliability and service life of these components.

An energy saving of several 100000kWh annually is also possible.

Advantages of the POWERBRIDGE solution:

- **Customers saved more than 50% of investment costs compared to conventional substations**
- **Rapid amortisation**
  - low investment costs
  - reduced primary energy costs
  - no medium-voltage switchgear required
- **No external power supply required**
  - storage device is connected only to the contact wire (or third rail)
  - no installation costs for medium-voltage connection or for medium-voltage switchgear
  - greater flexibility in the choice of location
  - no low-voltage connection required
  - can be installed in a stand-alone, weatherproof container
- **Reduced energy costs**
  - braking energy is better utilised
  - amortisation of the product by energy saving alone
- **Simple integration into your control and instrumentation system**
  - remote control and monitoring
  - either via modem or telephone line
- **Over 500 UPS systems with storage device in use worldwide**

Proven technology in use

In the mid-nineties, Piller Power Systems GmbH developed the kinetic energy storage system, POWERBRIDGE, as a battery replacement for its high-performance uninterruptible power supplies (UPS). Thanks to the robust construction and limited number of system components a high reliability is achieved - thus meeting the requirements of a Premium Power UPS system.
The POWERBRIDGE is used in prestigious organisations in the EDP and industrial sectors, such as, for example:

- AMD
- Bayer AG
- Deutsche Bank
- Düsseldorf Airport
- Mercedes
- Deutsche Bundesbank
- BMW
- Sony
- Ford
- IBM
- Porsche
- üstra AG

Currently over 500 storage systems are in use worldwide under a wide variety of environmental conditions.

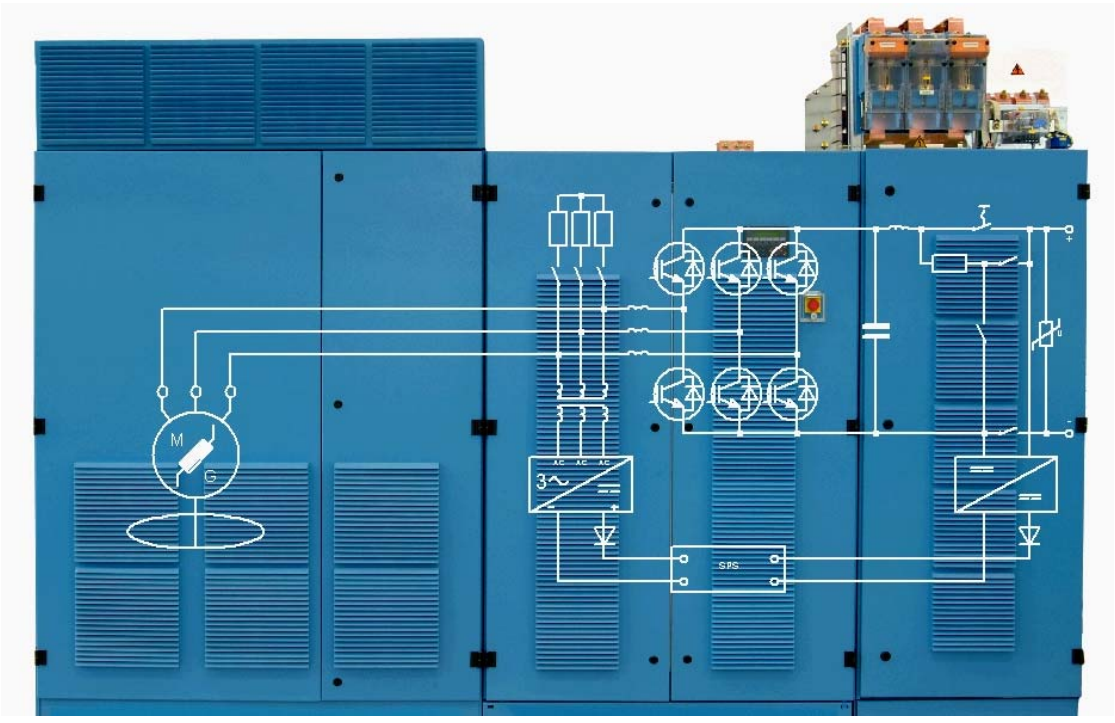
The POWERBRIDGE storage system consists of the proven kinetic energy storage unit and the interface between the unit and the contact wire.

This interface is identical in construction and operation to the well-known power electronics in modern vehicles:

- **IGBT converter for charging and discharging the storage unit,**
- **braking resistor for controlled discharge of the storage unit if the contact wire is not available,**
- **mains filter to isolate incoming mains interference from the power electronics,**
- **high-speed DC circuit-breaker.**

The system is controlled via a PLC that supports extremely fast control algorithms. In addition to control of operating functions it also provides full system monitoring. Apart from fully automatic operation, integration into a telecontrol system is also possible. With an optional add-on, remote control and monitoring can be implemented via a modem and telephone line or GSM.
The system is supplied ready to connect and can therefore be installed and put into service within a few hours.

Block diagram



POWERBRIGE energy storage device

Technical Data:

Voltage range:	400 V – 1000 V (2500 V) conforming to EN 50163
Usable energy content:	18 MJ (5 kWh)
Power:	1000 kW
Current:	1500 A

The power output can be increased by simply connecting storage systems in parallel.

Ready to connect in the container

The PILLER POWERBRIDGE is also available in a ready-to-connect standard container. For you this means:

- Immediate availability when connected to the network
- Fast commissioning
- Simple installation, no expenditure on planning or new machine room construction
- Simple change of location as required
- Transportation via truck
- Increased power – even at a later date – by simply connecting containers in parallel.

Other advantages:

- **Simple simulations of the energy flow in the DC network enable the improvement due to the POWERBRIDGE to be reliably assessed and the optimum location to be determined**
- **Enhances the standing of the transport company**
  - environmentally friendly
  - innovative, high awareness factor
- **CO_2 reduction**
  - saving of 500 000kWh per year reduces CO_2 emissions by around 300t per year
- **Service by trained personnel**

Piller Power Systems provides analysis/simulation to installation to service/maintenance – all from one source.

Within the Langley Holdings, Piller Power Systems GmbH is the international centre of competence for system solutions for ensuring high quality power.

Worldwide, Piller Power Systems stands for first-class system solutions for industrial applications, computer centres, telecommunications and aviation.

Piller Power Systems Service offers you around-the-clock security and reliability – 24 hours a day / 365 days a year.

Applications

Two basic objectives are achieved by the use of the PILLER POWERBRIDGE:

- Voltage stabilisation at weak points
- Saving of primary energy

This results in a variety of possible applications:

Cost-effective alternative to substations

- **Voltage stabilisation**
  - at weak points in the network
  - at end track sections
  - with the use of new, higher-performance trains
  - for periods of high traffic density
  - for new and extended routes
  - during extensive maintenance operations
  - for track sections with short-term high loading (e.g. after large events in stadiums or halls)

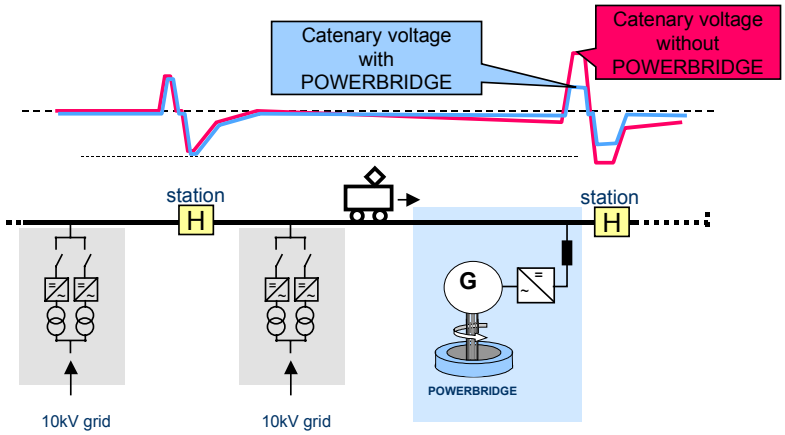
Mobile substation

- **Mobile power supply without medium-voltage or low-voltage connection**
  - connection at any point along the track
  - installation in container already standard for UPS systems with storage unit
- **Where there is a space problem**
  - compact volume ⇒ can be installed in existing substation
  - no need to purchase new real estate or buildings

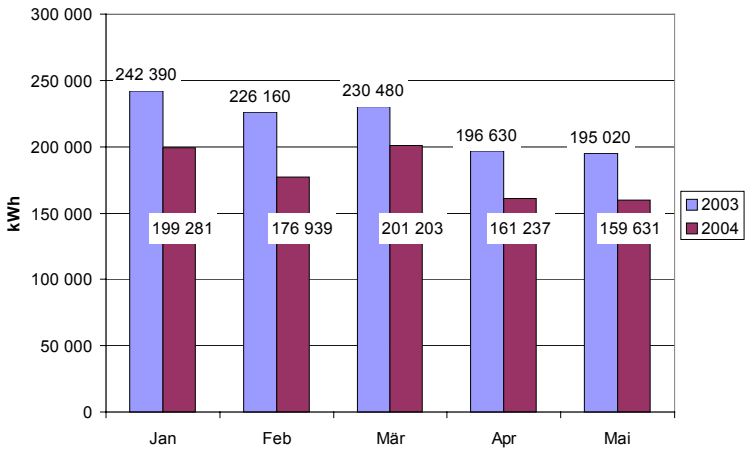
Reduced energy costs

- **Storage and output of otherwise unused braking energy**
  - 500 000kWh/a energy saving = 40 000€/a lower energy costs (at 8ct/kWh)
  - distinct reduction of 15-minute power peaks

POWERBRIDGE:
Reduction of voltage sags and overshoots



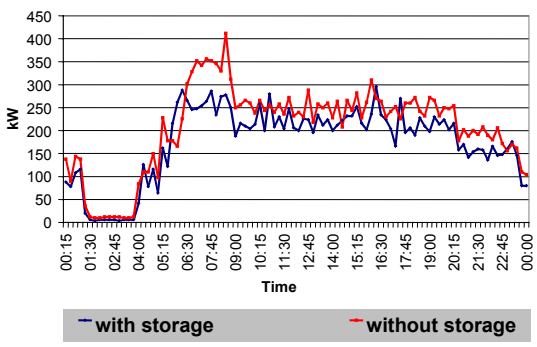
Comparison of 2003 – 2004 energy consumption at the Hanover-Vahrenheide site



Projected savings: 462 000 kWh by means of one POWERBRIDGE

Energy saving at the Hanover-Vahrenheide site

15-minute power peaks



Distinct reduction of 15-minute power peaks

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