Use your own power grid.

Intelligent storage systems based on vanadium redox flow technology.

green energy

long service life, low maintenance, turnkey, ready for use

TransNet
Your Partners in Power

GILDEMEISTER
energy solutions

FOR EMISSION-FREE PROVISION OF POWER

CellCube. The storage system for intelligent power supply.

The CellCube energy storage system is regarded as a milestone in the history of regenerative energy management. Whether in combination with photovoltaic, wind power stations, biogas generators or in parallel grid operation – the vanadium redox flow energy storage system guarantees uninterrupted power supply. It is independent of weather fluctuations, temperatures, length of day or unstable grids.

With well thought through and mature products, from generation up to storage and provision with the CellCube energy storage system, GILDEMEISTER **energy solutions** offers holistic systems for the modern energy industry. Our solutions represent maximum energy yield, simultaneously being environmentally friendly. **The CellCube energy storage system, which was tested and proven in practice for over five years**, solves the problem of energy storage. It presents uninterrupted supply of power from solar and wind power stations, also during periods of darkness or without wind. Therefore CellCube is the missing link for supporting the development of renewable energy.

The CellCube energy storage system allows a **clean, emission-free and quick provision of power, can be charged very quickly and is ready for use immediately.** It distinguishes itself through high safety, storage stability and very fast reaction times and can be incorporated into **existing energy systems worldwide in numerous application fields. Best service, absolute safety and reliability!** Sophisticated technology, proven components, intelligent sensors and control functions ensure that **the CellCube is absolutely low-maintenance.** With the flow energy storage system controller a clever monitoring instrument provides comprehensive control and guarantees safe provision of power around the clock.

Modular and flexible for every situation

CellCube, the individual energy storage system adapts to every requirement. The system power output and capacity is scalable from the kilowatt range to the megawatt range without a problem.

The modular and flexible structure of the system allows varied application options - conceptualised according to requirements, depending on customer preferences.

CellCube history

1999 Research and development

2004 First field trials

2008 Market launch FB 10-100

2010 GILDEMEISTER participation

2011 Market launch FB 200-400

2012 Market launch modular systems in the MW-range

ENERGY PROVISION FROM 10 KW POWER OUTPUT AND UP TO 130 KWH CAPACITY

CellCube - for a stable supply of power

The low-maintenance redox flow energy storage system with its long service life, based on vanadium, guarantees uninterrupted power supply, fed by solar or wind power stations, for instance. In its weather-proof housing the CellCube can be used immediately worldwide. Clean power around the clock.

- **Power element** flow battery controller, stacks, fluid lines
- **Energy element** Negative and positive electrolyte tank, pump systems

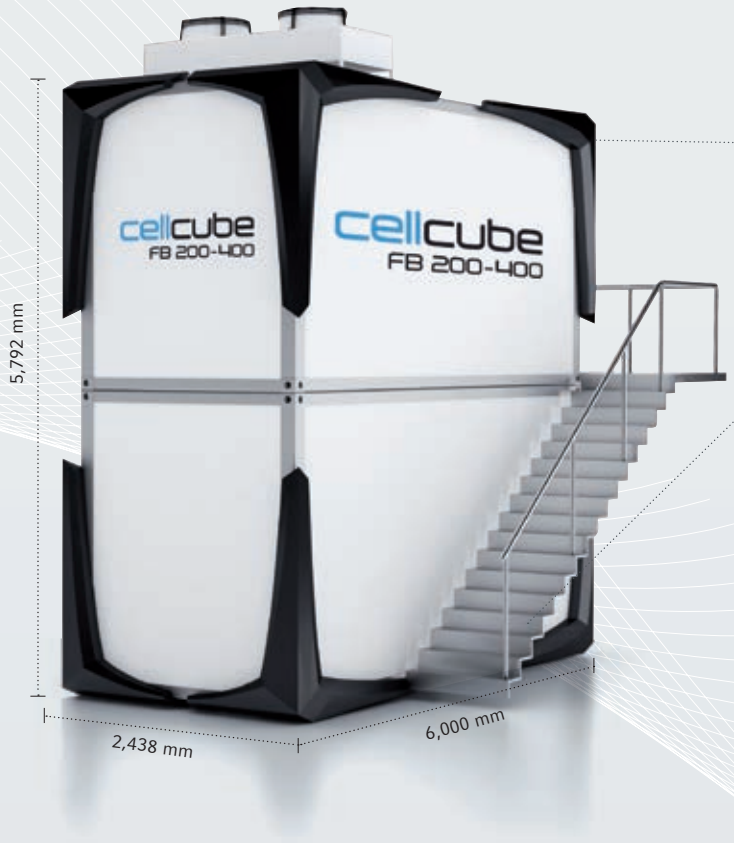
Highlights CellCube

- High safety, non-flammable, non-explosive
- Practically unlimited cycling
- Scalable up into the MW-range through simple parallel connection of multiple CellCubes
- CellCube is 100 % capable of deep discharge
- Turnkey energy storage in weatherproof and securely protected housing
- Up to 80 % efficiency
- Holistic system solution, including specially coordinated inverters, thereby allowing connection to different energy sources
- Remote or online maintenance is possible
- Central temperature management
- Optimal operational characteristics through intelligent battery management
- Standard freight containers allow simple and cost-effective transport
- Vanadium is environmentally friendly and recyclable
- Spontaneous reaction to load demand

THE POWER PACKAGE WITH 200 KW AND 400 KWH 400 KWH

CellCube - for individual applications.

The CellCube redox flow is the perfect solution for industrial applications. With capacities of 400, 800 and 1,600 kWh and discharge power output of 200 kW, CellCube offers huge energy reserves for power failures or to cover peak demand.



Power element
Stacks, flow battery controller, DC/DC converter, inverter

Energy element
Negative and positive electrolyte tank, pump systems

CellCube application fields

- **Grid support:** For the stabilisation of low voltage and medium voltage grids; as energy reserve; for smoothing out peaks (compensation of load and generation peaks)
- **Backup**: Use as inline UPS with frequency and amplitude decoupling; leading edge system safety
- **Wind and solar parks:** As buffer to smooth energy output and to compensate for fluctuations; higher contract security due to energy reserves in times of reduced power
- **Re-powering:** Investment protection - CellCube ensures constant supply, even after amortisation of the wind or solar park

TAILOR-MADE SYTEM POWER OUTPUT FROM KW TO MW

CellCube - The modular solution for every application.

Flexible, modular and individually applicable - that is CellCube, the redox flow energy storage system based on vanadium. The modules of the individual CellCube families can be combined simply and quickly, depending on the requirement. This is the basis for a flexible, tailor-made implementation and a wide range of power output from the kilowatt range to the megawatt range.

Available power and storage capacity

	Power output (kW)	Storage capacity (kWh)				
CellCube FB 10	10	40	70	100	130	
CellCube FB 20	20	40	70	100	130	
CellCube FB 30	30	40	70	100	130	
CellCube FB 200	200		400	800	1600	

CellCube - combination examples

FB 10-100
10 kW, 100 kWh

2x FB 10-100
20 kW, 200 kWh

1x FB 10-40
1x FB 20-70
1x FB 30-130
60 kW, 240 kWh

2x FB 10-40
2x FB 30-130
80 kW, 340 kWh

FB 200-400
200 kW, 400 kWh

FB 200-800
200 kW, 800 kWh

FB 400-1600
400 kW, 1600 kWh

FB 400-800
400 kW, 800 kWh

Technical data.

Perfomance and energy	CellCube FB 10/20/30 kW	CellCube FB 200 kW	
Nominal charge output	10/20/30 kW	200 kW	
Nominal discharge output	10/20/30 kW	200 kW	
Capacity of the energy storage system	40/70/100/130 kWh	400/800/1600 kWh	
Battery and system voltage			
Output voltage option	- 48 VDC; 120 VAC; 230 VAC (1-phase); 400 VAC (3-phase)	400 VAC	
Duration of connection / Reaction time	grid-independent: < 20 ms, remote control: < 8 ms		
Control system			
Control via external interfaces	serial, TCP / I P, bus systems		
Monitoring			
Condition detection via remote interrogation by e-mail	State of charge (SOC), available energy, charge / discharge power output, and more		
Efficiency			
Charge / discharge cycle DC	up to 80 %	up to 70 %	
Multi-stage management reduces power losses	3 independent, switchable circuits with energy-efficient pump control system	4 independent, switchable circuits with energy-efficient pump control system	
Discharge time at nominal power output		**DC battery power**	**AC inverter power**
Discharge time (autonomy)	Depends on power output and capacity		
1 hour**		220 kW	200 kVa
2 hours**		140 kW	130 kVa
3,5 hours**		110 kW	100 kVa
5 hours**		80 kW	70 kVa
Self-discharge			
Self-discharge in standby**	< 150 W	< 200 W	
Self-discharge in tank	negligible (< 1 % per year)	negligible (< 1 % per year)	
Size and weight			
Dimensions L × W × H	4,500 × 2,200 × 2,403 mm	6,000 × 2,438 × 5,792 mm*	
Weight (empty condition)	3,600 - 4,500 kg	20,000 kg	
Gross weight (filled condition)	12,800 - 14,000 kg	60,000 kg	
Climatic operating conditions			
Climatic conditions	-40°C bis +50°C (monthly average)		
	The inside temperature is controlled between 20°C and 30°C by an intelligent temperature management system. Suitable insulation (for heating and cooling) allows deployment in all climatic zones.		

* Base unit. ** Subject to change.

Energy storage system CellCube.

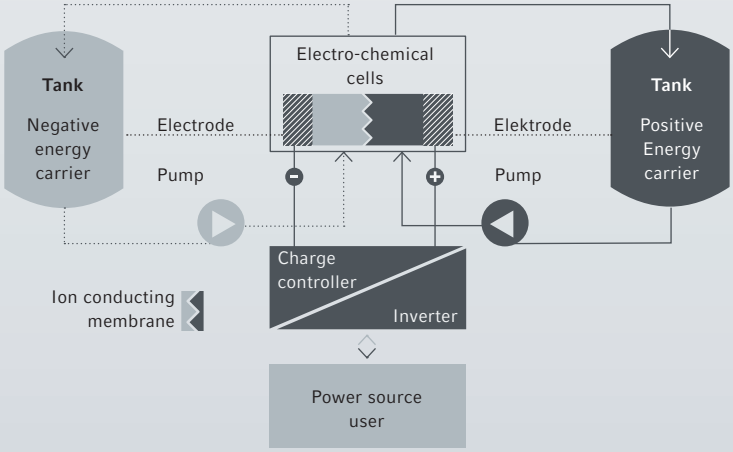
Whether in combination with photovoltaic, wind power stations, diesel, gas and biogas generators or in parallel grid operation, CellCube is the optimal supplement to guarantee uninterrupted power supply. The stationary, large energy storage system efficiently and safely provides emission-free power, independent of climatic, weather or periodic factors.

100 %
capable of deep discharge, unlimited cycling

Redox flow energy storage system mode of operation

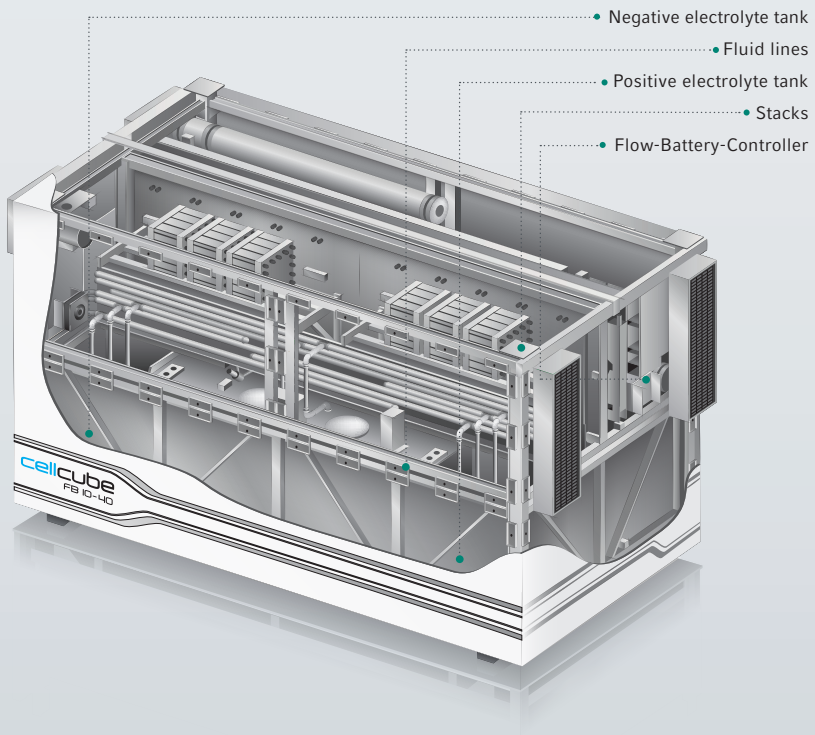
The liquid energy sources are stored in two tanks and pumped through the electro-chemical cells. Depending on the applied voltage, the energy sources are charged or discharged electro-chemically.
The charge controller and inverter represent the interface to the electrical energy source and the user respectively.

Vanadium redox flow principle - this is how the flow battery functions



Advantages of the vanadium redox flow battery

- Almost unlimited service life of the energy sources; system is designed for up to 20 years
- Unlimited cycles (charging / discharging) at the energy storage unit
- 100 % deep discharge
- High safety - non-flammable and non-explosive
- Low maintenance
- Power output and energy can be scaled independently of each other (modular flexibility)
- Scalable up into the MW-range through simple parallel connection of multiple CellCubes
- Self-discharge is negligible
- Only one battery element - therefore no cross-contamination
- Homogeneous energy medium
- Vanadium is a widespread raw material



Vanadium

CellCube represents best sustainability: The vanadium flow energy storage system exclusively uses fluid energy sources with dissolved vanadium salts. They are not subject to ageing and can be used without limitation - this is optimal resource management. Conventional batteries are subject to wear and tear through loss of reactive material. Vanadium flow energy storage system do not contain any problem substances like lead, cadmium or mercury and are neither flammable nor explosive.

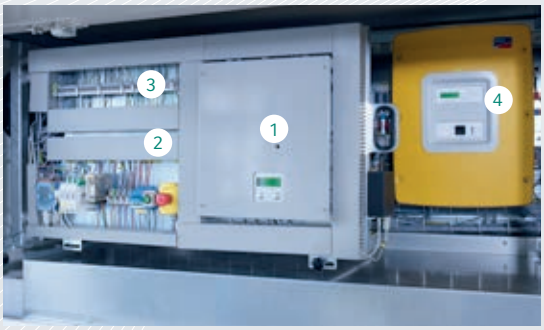
Optimal power for your system

Stacks & electrolyte tank: A stack is a number of serially connected cells, with electrolyte from both tanks flowing through them. The battery is then charged and discharged via these cell blocks. The more stacks a battery has, the higher is the power output. Separated storage of electrolytes in two tanks offers significant advantages for energy storage: The larger the tanks are, the more energy is available.

- The electro-chemical process, which charges or discharges the battery, takes place **in the reaction cells.**
- **The electrolyte** is pumped from the electrolyte tanks to the stacks by chemical-proof pumps and taken back to the same tanks via return lines.

Highlights: Stacks

- Modular flexibility: more stacks, higher power output
- Simple maintenance
- Tested for 100 % leak tightness
- Simple and exchangeable membrane



1 Flow-Battery-Controller (FBC)
2 DC bus bar
3 Transition converter (stacks) to DC bus bar
4 Inverter with AC connection

Service function monitoring: All important operational parameters can be interrogated online at any time, for instance state of charge (SOC), electrolyte temperature or charging power. An optional monitoring touch display can be attached to the battery at an extra charge.

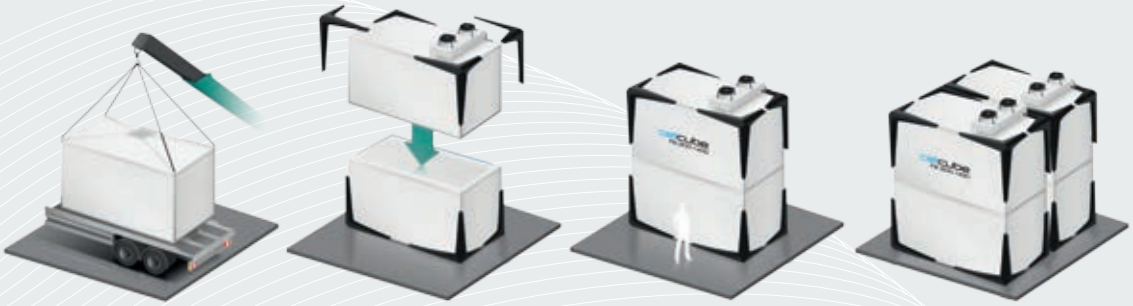
Integrated energy management system

Absolute safety and reliability! Sophisticated technology, a double-wall tank, intelligent sensors and control functions, comprehensive monitoring procedure and simplified maintenance guarantee safe storage of energy. As a clever monitoring instrument, the flow battery controller ensures comprehensive control around the clock, so that all battery information can be interrogated online at any time. In addition, GILDEMEISTER **energy solutions** offers tailor-made services and maintenance contracts for a reliable supply of power.

QUICKLY ON SITE - QUICKLY READY FOR OPERATION

CellCube. The short cut to a storage system

Quick provision of energy has been a decisive criterion for the CellCube energy storage system right from the start. Transport to the installation site is as simple as the installation itself. The storage system for intelligent power supply has taken simplicity as its role model.



TRANSPORT

Quick supply to the installation site through the use of standard container sizes.

INSTALLATION

Multiple CellCube units can easily be combined and are ready for operation immediately.

COMBINATION

The energy storage capacity is extended into the MW-range with every additional CellCube unit.

APPLICATION

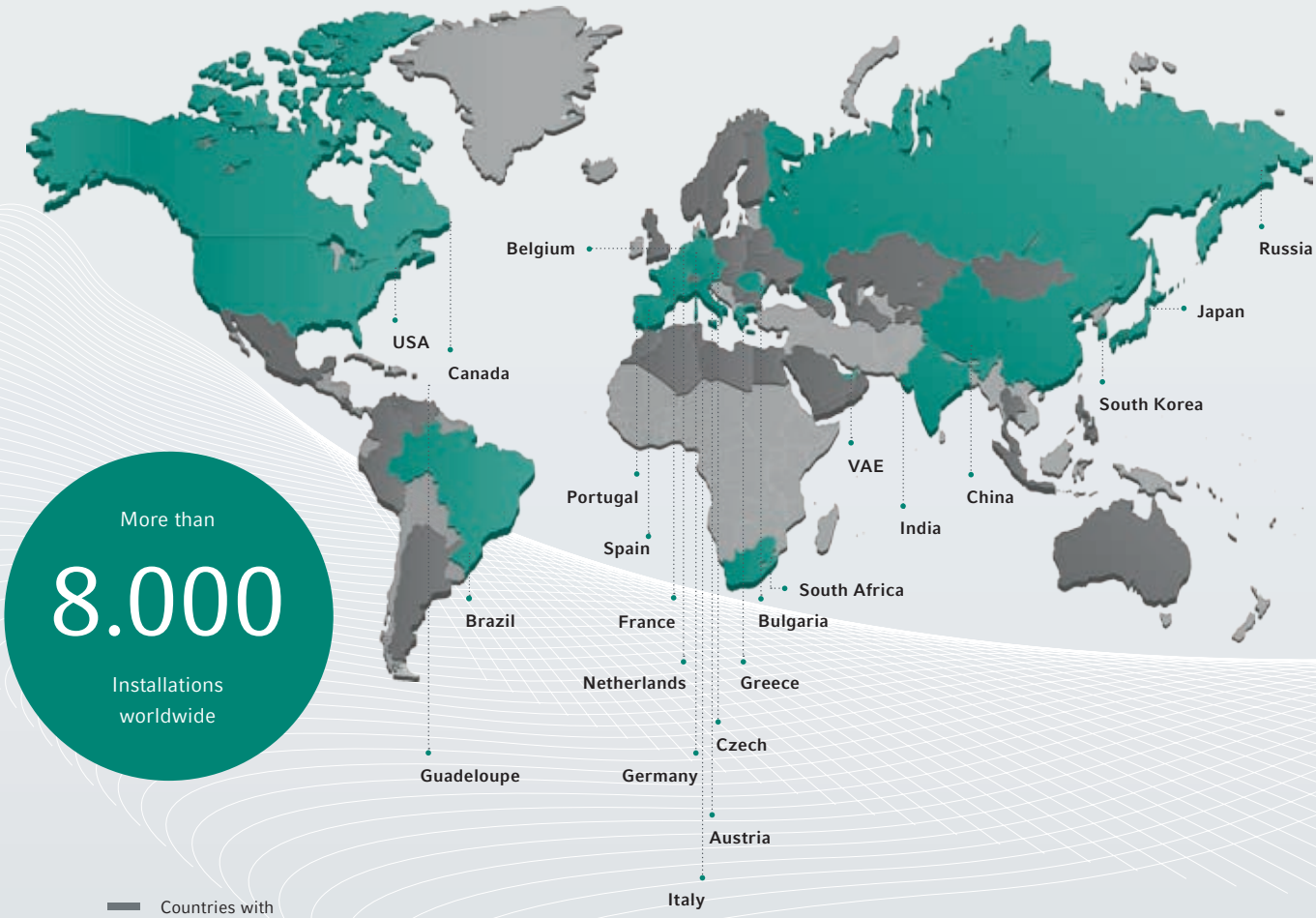
The CellCube energy storage system is ready for operation in all climatic and weather conditions.

CellCube combination

THE GLOBAL NETWORK OF GILDEMEISTER ENERGY SOLUTIONS

Worldwide at home - wherever our customers are

GILDEMEISTER **energy solutions** relies on an international network of subsidiaries and sales partners, who are at your service at 99 locations worldwide with sales and services. At the sites in Italy and Spain a professional, permanently employed service team supports you. If required, 3,200 service employees of the enterprise are available to you worldwide.



More than

8.000

Installations worldwide

suncarrier windcarrier cellcube

Industrial solutions

Individual solutions for companies that generate their power requirements and use it themselves.

Power solutions

As a buffer to smooth the power output and to compensate for fluctuations.

E-mobility solutions

Problem-free storage or renewable energy for the operation of e-vehicles and solar filling stations around the clock.

Tele solutions

Reliable storage of energy and power supply for telecommunication networks in regions without a stable power grid.

Off-grid solutions

A low-maintenance energy storage system for buildings without connection to a power grid.

GILDEMEISTER
energy solutions

The best way to fight rising power costs: Efficient use of energy.

GILDEMEISTER **energy solutions** represents necessary and comprehensive awareness of energy, focusing on intelligent generation, storage and use of energy. It all starts with an energy efficiency analysis.

ENERGY EFFICIENCY PROCESS

1 Analysis of the actual condition
2 Evaluation of collected data
3 Catalogue of measures

Our energy experts and their team will gladly compile a concrete plan of measures together with you for a sustainable lowering of your energy costs: +49 931 250 64-120

The energy-efficient complete solutions.

Energy solutions Park, Bielefeld, Germany

Energy solutions Park, Bielefeld, Germany

DECKEL MAHO Seebach, Germany

generate

SunCarrier: The SunCarrier is a unique tracking system, which continuously aligns its module face to the current position of the sun.

WindCarrier: The small wind turbine according to the Darrieus principle with a nominal power rating of 10 kW guarantees efficient generation of power.

store

CellCube: The vanadium-based energy storage system with a long service life offers interruption-free supply of power. It is available with power ratings from 10 to 200 kW and a scalable capacity up into the MWh range. In this way base load coverage, power peak limiting and safeguarding of sensitive areas can be guaranteed at all times.

utilise

Intelligent products and technologies for modern industry:

- **E-mobility solutions**
- **Tele solutions**
- **Backup solutions**
- **Off-grid solutions**
- **Industrial solutions**
- **Power solutions**

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