# Use your own power grid.

**Intelligent storage systems** based on vanadium redox flow technology.


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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

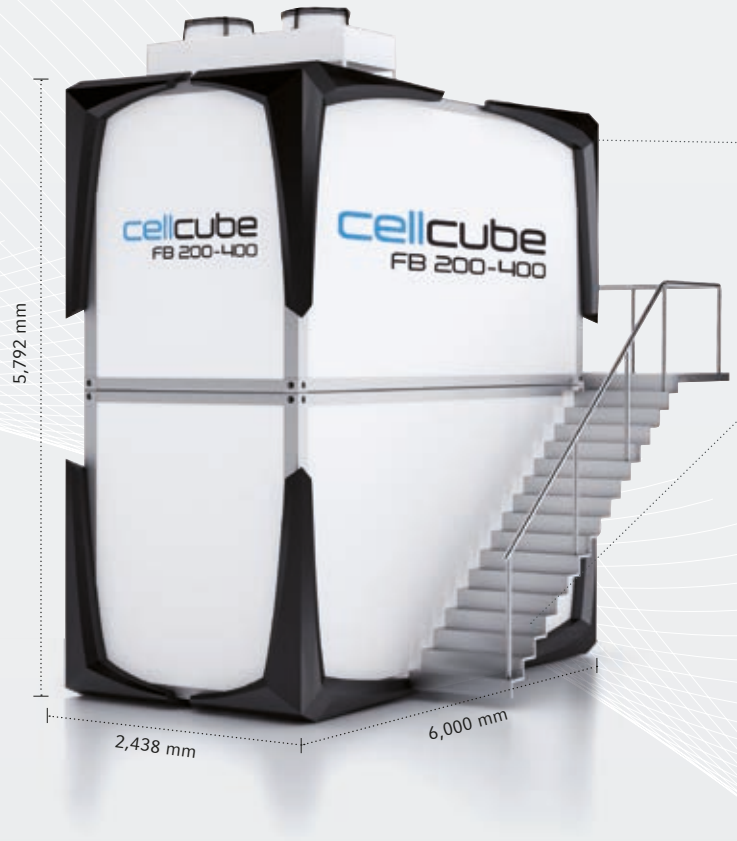
## Highlights CellCube

- 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

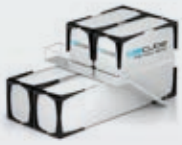
# CellCube - The modular solution for every application.

**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**<br>10 kW, 100 kWh |  **2x FB 10-100**<br>20 kW, 200 kWh |
|  **1x FB 10-40**<br>**1x FB 20-70**<br>**1x FB 30-130**<br>60 kW, 240 kWh |  **2x FB 10-40**<br>**2x FB 30-130**<br>80 kW, 340 kWh |
|  **FB 200-400**<br>200 kW, 400 kWh |  **FB 200-800**<br>200 kW, 800 kWh |
|  **FB 400-1600**<br>400 kW, 1600 kWh |  **FB 400-800**<br>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.

EMMISSION-FREE AND CLEAN ENERGY PROVISION - THE CELLCUBE TECHNOLOGY

# Energy storage system CellCube.

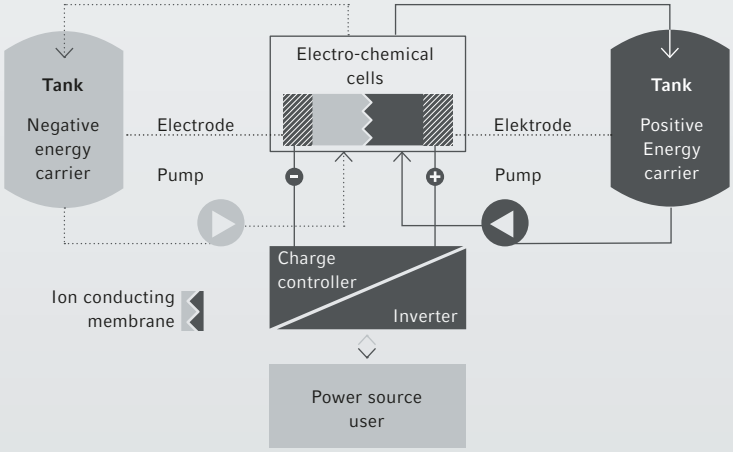
**Whether in combination with photovoltaic, wind power stations, diesel, gas and biogas generators or in parallel grid operation, CellCube is the optimal supplement to guarantee uninterrupted power supply.** The stationary, large energy storage system efficiently and safely provides emission-free power,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

**100 %**
capable of deep discharge, unlimited cycling

## Redox flow energy storage system mode of operation

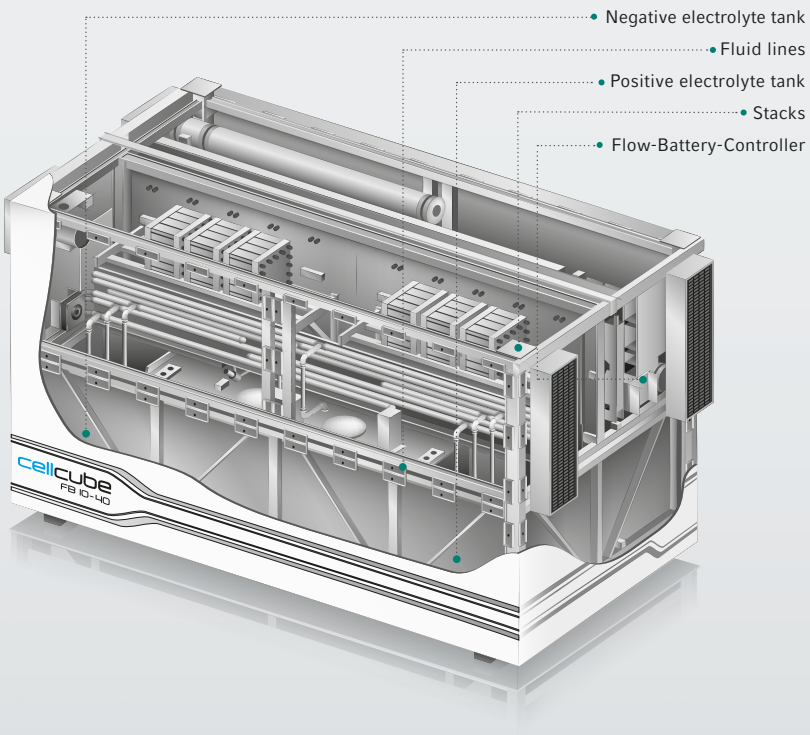
The liquid energy sources are stored in two tanks and pumped through the electro-chemical cells. Depending on the applied voltage, the energy sources are charged or discharged electro-chemically.
The charge controller and inverter represent the interface to the electrical energy source and the user respectively.

## 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.

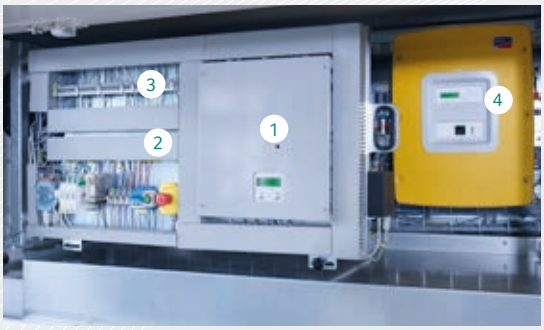
# Optimal power for your system

**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.

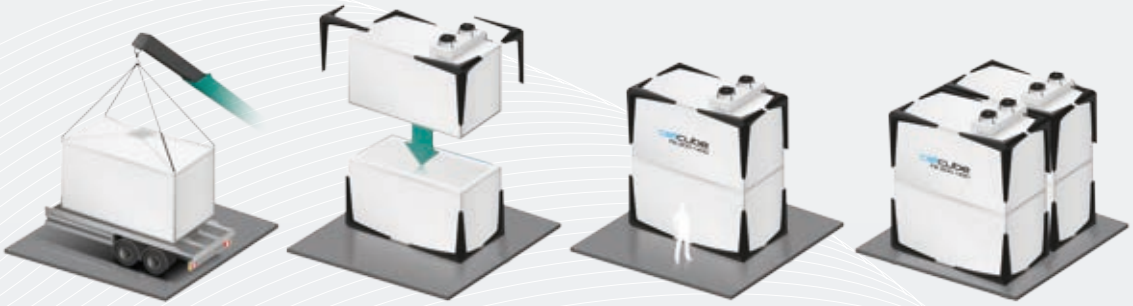
## Integrated energy management system

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**

## Contact us

GILDEMEISTER **energy solutions:**
T +49 (0) 931 250 64-120, F +49 (0) 931 250 64-102, energysolutions@gildemeister.com, **www.gildemeister.com**
**a+f GmbH:** Carl-Zeiss-Str. 4, 97076 Wuerzburg, Germany
**cellstrom GmbH:** Industriezentrum NOE Sued, Strasse 3, Objekt M36, 2355 Wiener Neudorf, Austria

## All information here!

If your mobile phone has QR software installed, you can go directly to www.gildemeister.com

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