

# Use your own power grid.

Intelligent storage systems based on vanadium redox flow technology.

green  
energy

long duration, low  
maintenance, modular,  
turn-key solution



FOR EMISSION-FREE POWER PROVISION

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# CellCube. The storage system for intelligent power supply.

The CellCube energy storage system is 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 conditions, temperatures, or grid instability.

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 provides clean and emission free power within milliseconds.** It distinguishes itself through absolute safety, a proven track record of reliability and the longest operation life. The system can be incorporated into existing power infrastructure in numerous application fields whilst incorporating new renewable energy sources. Sophisticated technology, proven components, intelligent sensors and control functions ensure that **the CellCube is the most reliable solution with the lowest maintenance.** The flow energy storage system controller is a clever instrument that provides remote monitoring and comprehensive control to guarantee safe provision of power 24/7 year round.





## 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

**2015** More than 130 projects

### 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.

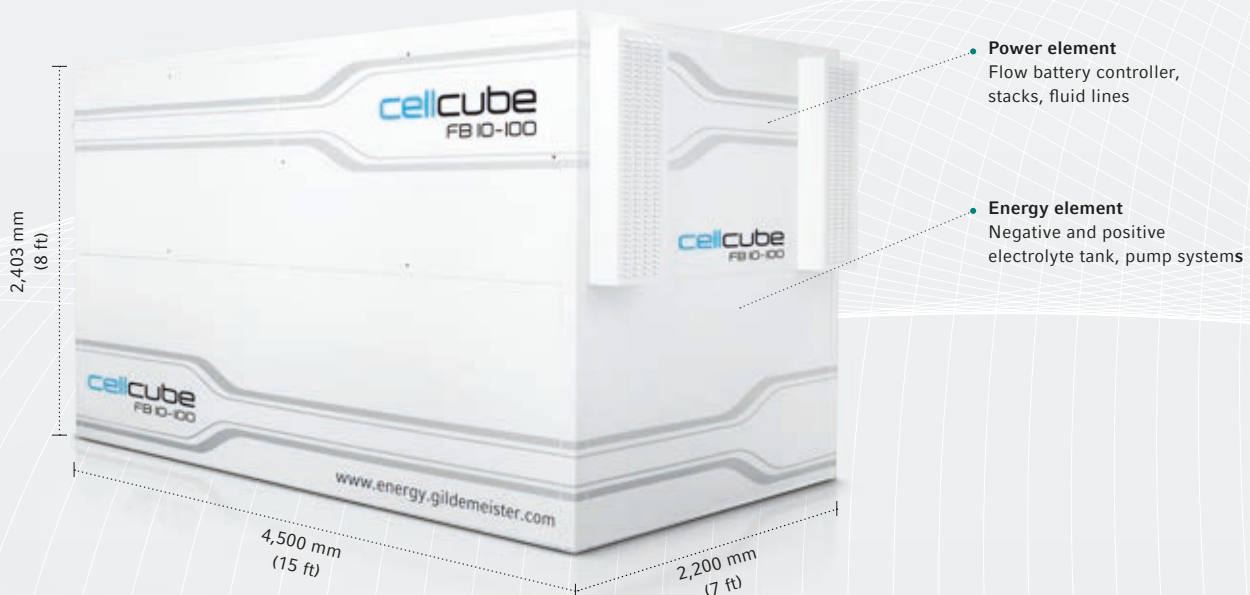
The modular and flexible structure of the system allows varied application options – conceptualised according to requirements, depending on customer preferences and requirements.



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

# CellCube – for a stable power supply.

The low-maintenance redox flow energy storage system 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 24/7 year round.



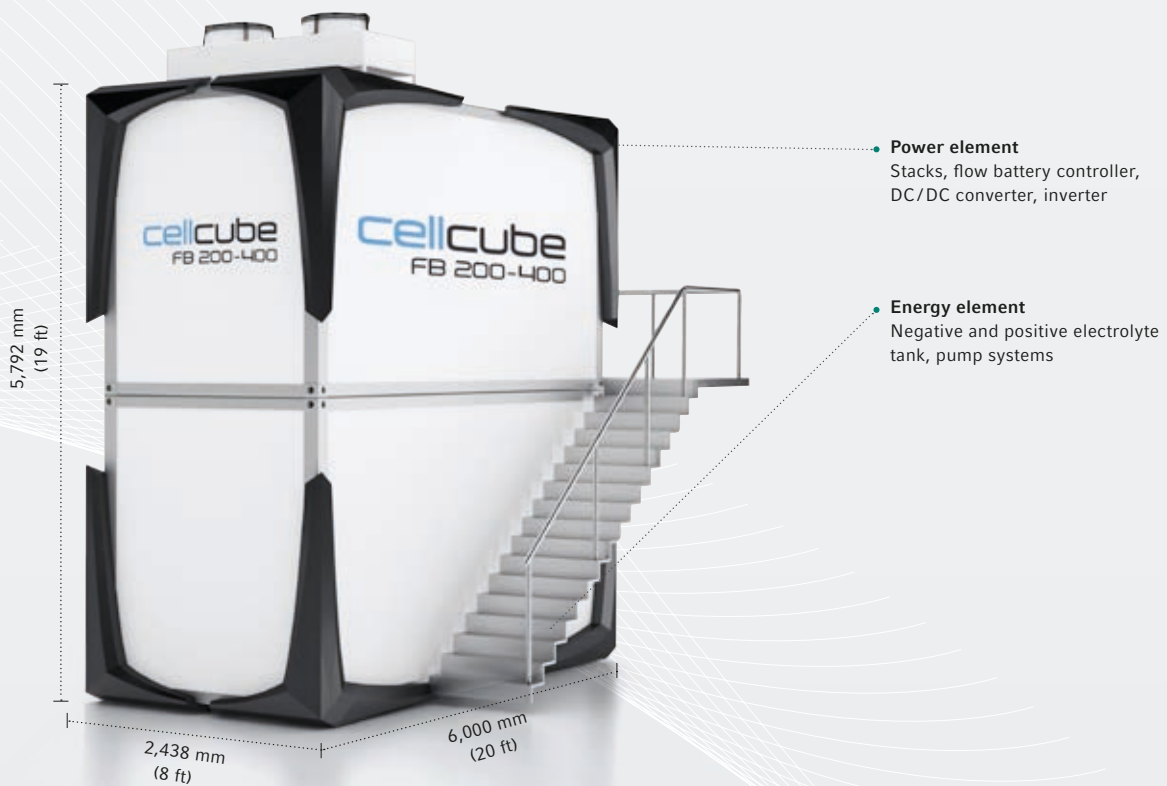
## Highlights CellCube

- High safety, non-flammable, non-explosive
- Practically unlimited cycling with no degradation over time
- Scalable to the MW-range through simple parallel connection of multiple CellCubes
- 100 % depth of discharge capable
- Turnkey energy storage self-contained in weatherproof and securely protected housing
- Up to 80 % efficiency
- Holistic system solution, including specially coordinated inverters, allowing connection to different energy sources
- Remote or online maintenance
- Central temperature management, climate controlled
- 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.





## 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







# 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

 <b>FB 10-100</b> 10 kW, 100 kWh	 <b>2x FB 10-100</b> 20 kW, 200 kWh
 <b>FB 200-400</b> 200 kW, 400 kWh	 <b>FB 200-800</b> 200 kW, 800 kWh
 <b>FB 400-1600</b> 400 kW, 1600 kWh	 <b>FB 400-800</b> 400 kW, 800 kWh

## A solution for every requirement \*

Power (kW)	1 h	2 h	3 h	4 h	5 h	6 h	8 h	10 h
10	FB 10-40	FB 10-40	FB 10-40	FB 10-70	FB 10-70	FB 10-100	FB 10-100	FB 10-130
20	FB 20-40	FB 20-70	FB 20-70	FB 20-100	FB 20-130	FB 200-400	FB 200-400	FB 200-400
30	FB 30-40	FB 20-70	FB 30-100	FB 30-130	FB 200-400	FB 200-400	FB 200-400	FB 200-800
100	FB 200-400	FB 200-400	FB 10-40	FB 200-800	FB 200-800	FB 200-800	FB 200-1600	FB 200-1600
150	FB 200-400	FB 200-400	FB 200-800	FB 200-800	FB 200-1600	FB 200-1600	FB 200-1600	
200	FB 200-400	FB 200-800	FB 200-800	FB 200-1600	FB 200-1600	FB 200-1600		

\* The optimal combination of power and energy capacity are specified in each case (other combinations or oversizing are also possible)



# Technical data.

Performance 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
Reaction time	grid-independent: < 20 ms, remote converter: < 3 ms	
Control system		
Control via external interfaces	serial, TCP/IP, bus systems	
Monitoring		
Condition detection via remote monitoring by e-mail	Charge level, available energy, charge/discharge power output, and more	
Efficiency		
Charge/discharge cycle DC (cell)	up to 85 %	up to 85 %
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
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	4,660 × 2,200 × 2,420 mm (15 x 7 x 8 ft)	6,060 × 2,440 × 5,800 mm* (20 x 8 x 19 ft)
Weight (empty condition)	3.8 - 4.5 t	20 t
Gross weight (filled condition)	7 - 14 t	60 t
Climatic operating conditions		
Climatic control	-40°C to +50°C (monthly average temperature)	
	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 any climate.	

\* 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 guarantees uninterrupted power supply. The stationary, large energy storage system efficiently and safely provides emission-free power, independent of climatic, weather or periodic factors.

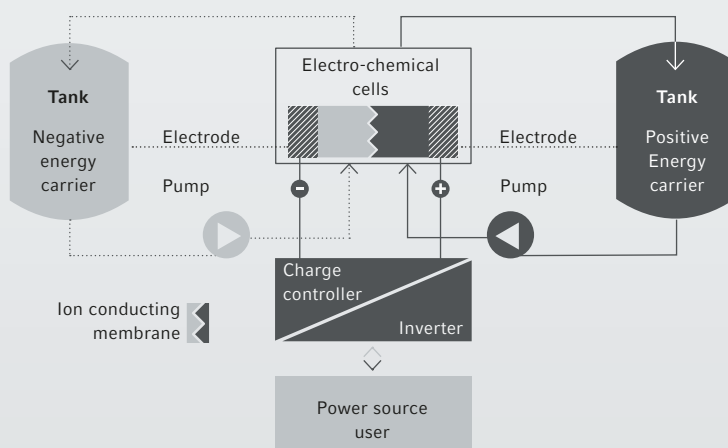
100%

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 technology



## Advantages of the vanadium redox flow battery

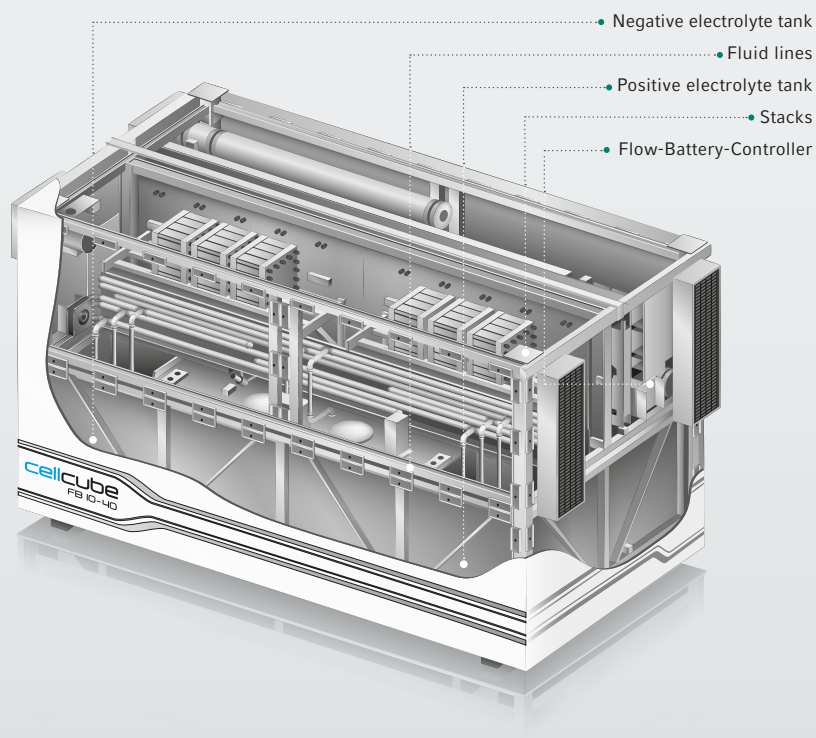
- Almost unlimited service life of the energy sources; system is designed for up to 20 years
- Unlimited cycles (charging/discharging) at the energy storage unit
- 100 % deep discharge
- High safety - non-flammable and non-explosive
- Low maintenance
- Power output and energy can be scaled independently 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

Vanadium redox flow is the most sustainable and durable energy storage technology available today. The vanadium storage system exclusively uses fluid energy sources with dissolved vanadium salts. They are not subject to cycle degradation and can be used without limitation. Conventional batteries are subject to wear and tear through loss of reactive materials. Vanadium flow energy storage systems do not contain any deleterious materials such as lead, cadmium or mercury and are neither flammable nor explosive.



STORE MORE ENERGY, USE MORE ENERGY

# 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 stacks. The more stacks in a battery, the higher the power output. Separated storage of electrolytes in two tanks offers significant advantages for energy storage: The larger the electrolyte tanks the greater the energy storage capacity.



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

## Highlights: Stacks

- Modular flexibility: more stacks, higher power output
- Simple maintenance
- Tested for 100 % leakproof performance
- Simple and exchangeable membranes



- 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.

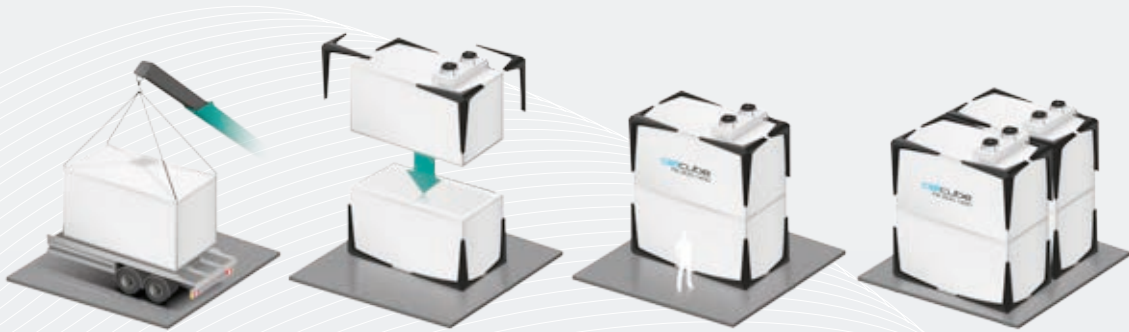
## Integrated energy management system

Absolute safety and reliability is provided by sophisticated design and technology: double-wall tanks, intelligent sensors and control functions, comprehensive monitoring procedures and simplified maintenance. The flow battery management system ensures comprehensive control around the clock, so that all battery information can be monitored online anytime. In addition, GILDEMEISTER **energy solutions** offers tailor-made services and maintenance contracts for a reliable supply of power for the system life.

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



# 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 worldwide with sales and services. If required, 3,200 service employees are available to you worldwide.



## 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.



# Energy-efficient complete solutions.



Energy efficiency in industry



DECKEL MAHO Seebach, Germany



Energy solutions Park, Bielefeld, Germany



E-mobility solution DMG MORI Global Headquarter Winterthur, Switzerland

## Save energy

GILDEMEISTER **energy solutions** represents necessary and comprehensive awareness of energy, focusing on intelligent generation, storage and use of energy.

The basis of a comprehensive energy solution is the reduction of energy costs and consumption through an energy analysis and the implementation of the GILDEMEISTER **energy monitor**.

## Generate energy

**SunCarrier:** The SunCarrier is a unique tracking system, which continuously aligns its module face to the current position of the sun and thus yields 40 % more energy.

**WindCarrier:** The small wind turbine based on the Darrieus principle has a nominal power rating of 10 kW and guarantees efficient power generation.

## Store energy

**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 energy

Intelligent products and technologies for modern industry:

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

Our energy experts will be happy to work out a detailed plan on how to sustainably lower your energy costs.

Give us a call on: +49 (0) 931 250 64-120

GILDEMEISTER energy solutions GmbH  
Carl-Zeiss-Str. 4, 97076 Wuerzburg, Germany T +49 (0) 931 250 64 -120, F +49 (0) 931 250 64 -102  
GILDEMEISTER energy efficiency GmbH  
Riedwiesenstraße 19, 71229 Leonberg, Germany  
GILDEMEISTER energy storage GmbH  
Industriezentrum NOE Sued, Straße 3, Objekt M36, 2355 Wiener Neudorf, Austria



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