

COMPREHENSIVE ELECTRICITY COVER

Battery Storage Systems for Agricultural,
Commercial Operations and Industry



TESVOLT
THE ENERGY STORAGE EXPERTS

TAKE CONTROL OF YOUR ENERGY SUPPLY

Benefit from the energy transition and minimize your risk with battery storage systems

The current upheavals in the energy market mean that future energy costs cannot be reliably predicted. But every change also brings opportunities. Many people are already benefitting from the energy transition, earning a sizeable and secure income from photovoltaic installations, biogas

generation or wind power. And battery storage systems are the next great opportunity — you can safeguard against uncertainty while earning money and ensure you'll always have an emergency power supply in the event of an outage.



Use more of your own power

Operators of photovoltaic or wind power installations can now use even more of the power from these installations themselves by integrating battery storage, driving up self-consumption to 80% or more. Every kilowatt hour that you generate and consume yourself will save you cash and make you more independent of fluctuating energy prices.



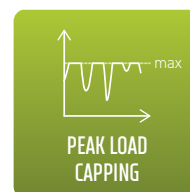
Who can benefit?

Businesses which already have their own photovoltaic system or simply a suitable rooftop, such as logistics companies, agricultural operations, workshops and factories.



Cap peaks in consumption and save money

Consumers with registered load profile measurement (RLM) predominantly pay for the power they have actually used. That means their energy prices are determined by the peak loads, i.e. the moments when the most electricity is used. Battery storage systems can release previously stored electricity when peak loads occur, reducing the amount of power that has to be drawn from the grid. This decreases the connected load and typically saves several thousands yearly.



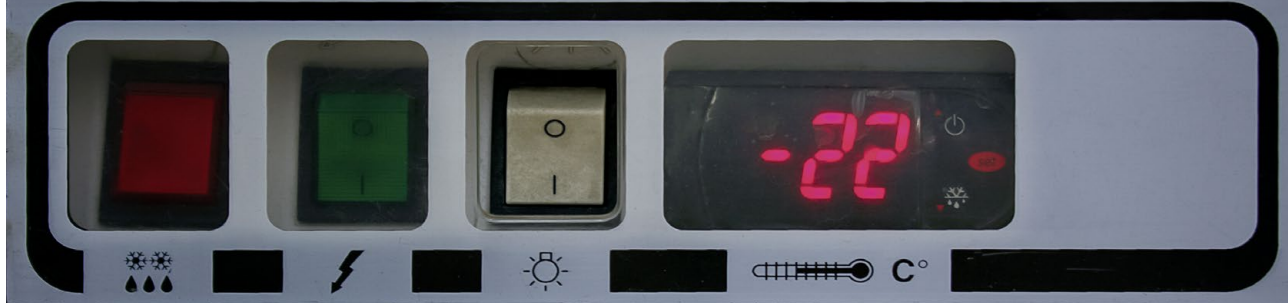
Who can benefit?

Operators of facilities with high electricity demand and registered load profile measurement, such as high-speed charging stations, agricultural operations, workshops and factories.



Click here for a free, no-strings-attached calculation of your savings potential:

<http://plc.tesvolt.com/login>



Low-cost back-up power

Battery storage systems can help ensure a reliable power supply. They can also be used to optimize or entirely replace diesel generators. In the event of a power outage, your battery storage system will take over as a back-up power supply to ensure uninterrupted operation.

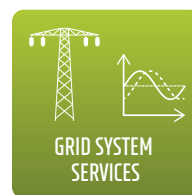


Who can benefit?

Businesses where a reliable power supply is essential, such as livestock farming and refrigerated storage.

Earn money with grid services

TESVOLT battery storage systems are also able to provide grid services. This means that your storage system balances out fluctuations in the distribution grid on behalf of the grid operator. In exchange, you will receive remuneration based on the type and scope of services you provide.



Who can benefit?

Operators of larger battery storage systems with a grid connection.

Reliable power supply off-grid

Need electricity but don't have an access to a grid?

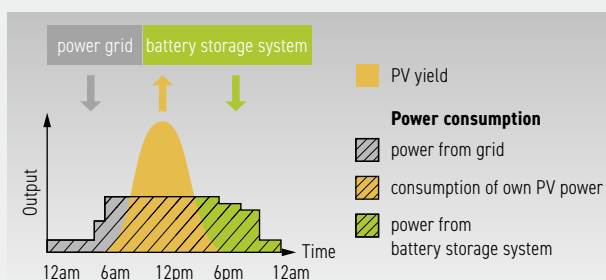
Battery storage systems can help create stand-alone grids in conjunction with a power generator such as a photovoltaic installation and/or a combined heat and power station. Battery storage can also help optimize the use of diesel generators.



Who can benefit?

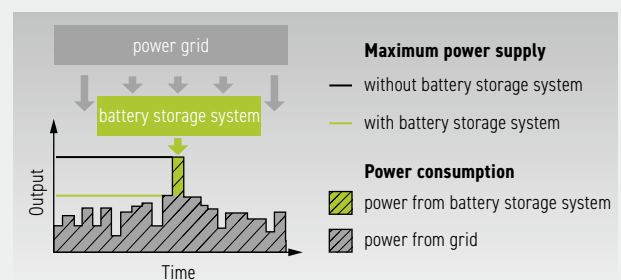
Properties that need electricity but do not have a grid connection.

Increased self-consumption — here's how it works

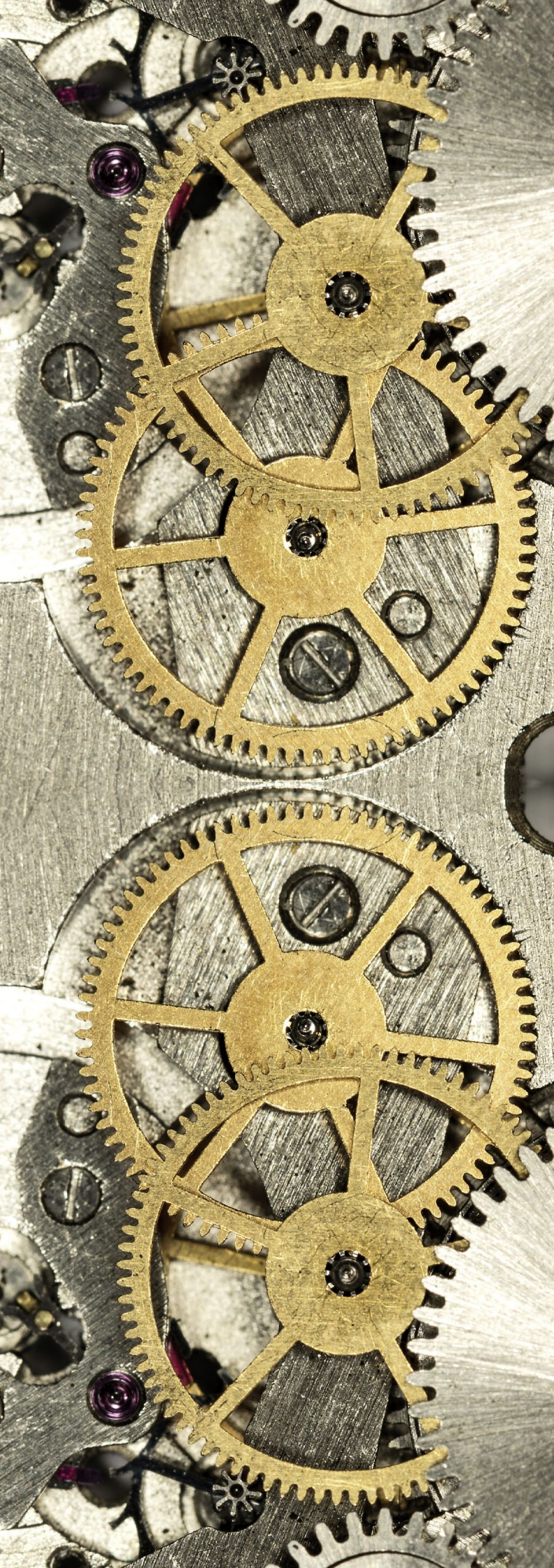


Whenever the yield of solar power exceeds current levels of consumption, the excess electricity is stored in the battery storage system. At times when the solar power yield is no longer sufficient to meet demand, the storage system will intervene and supply the power needed. Once it is depleted, electricity will be drawn from the grid again.

Peak load capping — here's how it works



If a peak load occurs while grid electricity is being used, the battery storage system will provide additional power to reduce grid supply to a defined level. Subsequently, the storage system will be continuously charged from the power grid or from the PV installation.



WHAT MAKES A HIGH-QUALITY STORAGE SYSTEM?

A good battery storage system is like a clock. It needs more than just high-quality, high-performance components — it also needs these components to be perfectly synchronized.

1-hour discharging (1C)

Fast charging is indispensable for high performance. If the C-rate is too low, the storage system must be very large in order to provide the required power output, which will make it unnecessarily expensive.

High efficiency rating & low standby losses

Every time energy is stored, some of it is "lost". Storage efficiency ratings reflect how much of the stored energy can actually be used. The rating should be well over 90%, while standby losses should be no more than 5 watts.

Flexible expansion and exchange

In most systems, batteries can only be exchanged or added within the first few months of operation. The best systems allow for battery upgrades or replacements at any time.

Stringent safety standards

Storage systems should have cell-level monitoring, because this is the only way to detect early on when maintenance is needed. And battery cells should come from a trustworthy source. Leading manufacturers offer premium-quality cells which won't ignite even when damaged.

Durability and long cycle life

Battery storage systems deteriorate with every charging cycle. That is why manufacturers specify the number of full charging cycles that a system can complete before its residual capacity falls below a designated level. They also give the maximum battery life in calendar years.

Intelligent battery management

Maximum performance, safety and durability are only possible if each individual battery cell is monitored to ensure that all cells are always optimally charged and discharged and that any faults are detected early on.

WHAT DOES THAT MEAN?

DoD

Depth of Discharge (DoD) refers to the maximum amount of stored power that can be drawn from the battery, and is important because many storage systems cannot be fully discharged, meaning that not all of the energy stored in the system is actually available. A good storage system has a Depth of Discharge of 100%.

Full cycle

When a storage system is fully charged and discharged once, this is called a full cycle. In practice, a full cycle can consist of multiple partial charging and discharging processes. The service life of a storage system can be given as the number of full cycles it is capable of.

C-Rate

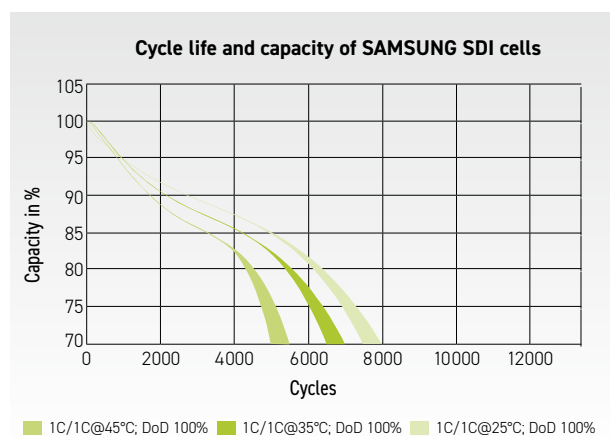
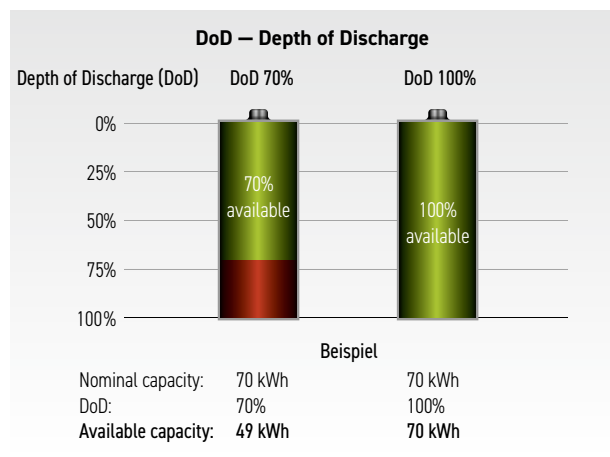
The C-rate specifies how quickly a storage system can be charged and discharged. 1C means that the storage system can be fully charged or discharged in the space of one hour. A storage system rated 0.5C takes two hours to charge or discharge, while a system rated 2C takes just half an hour.

LCOS

The levelized cost of storage (LCOS) describes the cost per kilowatt hour of energy stored and released by a battery storage system. It is determined by the service life or the number of cycles, the maximum depth of discharge and the system efficiency.

Li-NMC

Lithium nickel manganese cobalt oxide (Li-NMC or NMC) describes a cell chemistry which is characterized by high energy density, high efficiency and a long service life.



SoH

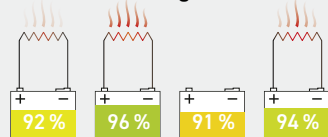
The State of Health (SoH) describes what percentage of the initial battery capacity is still available in the current charge cycles. The speed at which a battery ages depends on factors including the battery's quality and the balancing process used.

How does balancing work?

The speed at which cells age varies. Differences between cells have a negative effect on the battery's charging and discharging behaviour. Cell balancing is used to try and reduce these differences to a minimum.

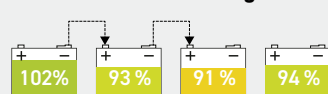
Passive balancing means that all cells are brought down to the level of the weakest cell, with the charge from the stronger cells being dissipated as heat. In **unidirectional balancing**, charge is redistributed from stronger cells to any subsequent weaker cells. The **Active Battery Optimizer** balances the charge between all battery cells within the battery module and even between different battery modules.

Passive balancing



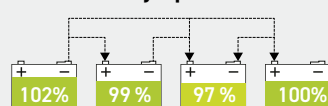
Efficiency: 0 %
Balancing current: 0.05 A
High losses

Unidirectional balancing



Efficiency: 70 - 90 %
Balancing current: 3.0 A
Moderate losses

Active Battery Optimizer



Efficiency: > 90 %
Balancing Strom: 5.0 A
Low losses

An outstanding battery storage system is more than the sum of its parts

and every cell. This helps us create safe, high-performance, durable battery systems with an efficiency rating of up to 98%. All of these features combined make TESVOLT storage systems some of the most advanced products available today. You don't need to take our word for it — we've won a multitude of awards that show experts share our view, such as the Hugo Junkers Award, The smarter E AWARD and the German Entrepreneur Award.

+ Maximum safety

The prismatic battery cells used by TESVOLT won't ignite even if punctured by a metal spike. And in the rare event of a fault occurring, you can rely on the ABO battery management system to detect it early on.

+ Maximum service life

The intelligent ABO battery management technology ensures that each battery cell is always optimally charged and discharged. In combination with the premium battery cells used for TESVOLT storage systems, this makes for a service life of 30 years or 8,000 cycles.

+ Uncompromisingly high performance

The ABO battery management technology and premium-quality battery cells enable fast charging and discharging. With a discharge rate of 1C, our storage systems are suitable for professional use in agriculture, commercial operations and industry.



Every TESVOLT storage system can be seamlessly monitored using the BatMon software, which visualizes not just the overall system's health but also that of all battery modules and even of each individual cell. This means you can check up on your system at any time and make sure that it is working reliably. And in the unlikely case that any anomalies or defects do occur, they can be identified and rectified quickly. Thanks to the TESVOLT ABO, you can exchange battery modules without losing efficiency even after years of operation.

Active Power Unit – APU

The Active Power Unit contributes to battery management and allows communication with other system units while monitoring the safety of the battery system.



- + minimal standby losses
- + maximum safety
- + optimized for SMA systems

Battery module with Active Battery Optimizer (ABO)

In addition to the cells, every battery module comprises an Active Battery Optimizer, which monitors and controls the charging and discharging of each individual cell.



- + quick active balancing
- + total transparency
- + exchangeable at any time

Battery cell

TESVOLT only uses prismatic lithium NMC cells from SAMSUNG SDI. These cells are durable, high-performance and extremely safe.



- + durable
- + extremely safe
- + high-performance



NO MATTER THE CIRCUMSTANCES, WE HAVE THE ANSWER.

Our battery storage systems are suitable for every application

TS 48 — When flexibility is needed

The TS 48 is a flexible lithium battery storage system for indoor applications. It is available in three cabinet sizes with a maximum of 48 kWh. The size can be selected in 4.8 kWh increments, with one Active Power Unit (APU) able to control a maximum of 16 battery modules.

TESVOLT TS 48 storage systems can be used both on-grid and off-grid. They can be used with a single-phase or three-phase power supply.

Technical specifications

System size:	10 – 3,000 kWh
Inverter:	SMA Sunny Island 4.4 M/6.0 H/8.0 H (3.3/4.4/6 kW)
Applications:	Back-up power, increasing self-consumption, off-grid



TS HV 70 — The all-rounder

The TS HV 70 is a high-voltage lithium battery storage system for indoor applications. It is available with a capacity of 67–304 kWh per battery inverter. Up to 20 inverters can be interconnected. Its high-voltage technology makes the TS HV 70 one of the most cost-effective systems on the market.

TS HV 70 storage systems can be grid-connected or can help optimize the use of diesel generators.

Technical specifications

System size:	67–6,080 kWh
Inverter:	SMA Sunny Tripower Storage 60 (60/75 kVA)
Applications:	Increasing self-consumption, peak load capping, generator optimization, grid system services



TS HV 70 Outdoor — The weather-proof all-rounder

The TS HV 70 Outdoor is a high-voltage lithium battery storage system for outdoor applications. The unit has full temperature control, making it suitable for most climatic zones around the world. It is available with a capacity of 67–307 kWh per battery inverter. Up to 20 inverters can be interconnected. Its high-voltage technology makes the TS HV 70 Outdoor one of the most cost-effective outdoor systems on the market.

TS HV 70 Outdoor storage systems can be grid-connected or can help optimize the use of diesel generators.

Technical specifications

System size:	67–6,080 kWh
Inverter:	SMA Sunny Tripower Storage 60 (60/75 kVA)
Applications:	Increasing self-consumption, peak load capping, generator optimization, grid system services



TPS — For large-scale applications

The TESVOLT TPS is a high-voltage lithium battery storage system for outdoor applications. The optional full temperature control makes it suitable for most climatic zones around the world. It comes with a capacity of 0.5–100 MWh and in three container sizes (20, 40 or 45 foot) and can be configured to meet your needs. The TPS is particularly cost-efficient when used in the megawatt range.

TPS storage systems can be grid-connected, can help optimize the use of diesel generators, or can be integrated into off-grid applications starting from 0.5 MW.

Technical specifications

System size:	0.5–100 MWh
Inverter:	SMA Sunny Central Storage (500–3,000 kVA)
Applications:	Peak load capping, generator optimization, grid system services, optimizing self-consumption, off-grid operation possible from 0.5 MW



Benefit from the versatility of SMA systems

TESVOLT storage systems have been optimized for use with SMA products. Benefit from the high-quality components and sophisticated energy management offered by the German market leader for inverter technology. TESVOLT's specialist partner for your region will put together a system that's perfectly suited to your individual needs.



The company logo SMA is a registered trademark of SMA Solar Technology AG

THEORY IS GOOD, PRACTICE IS BETTER.

Five examples of how our customers benefit from a storage system

100% self-sufficient



"Our TESVOLT storage system and solar installation have made our logistics company 100% energy self-sufficient. The investment will have paid off in just eight years, and after that our electricity will be free," says Martin Gerold, one of Lutter's shipping company managing directors.

Shipping Company Lutter

Storage system:	TS 48
Capacity/output:	48 kWh/18 kW
System:	On-grid, photovoltaic installation 80 kW _p
Industry:	Logistics (54 employees)
Location:	Germany, Bönen



Image source: Andreas Keuchel

Green stand-alone grid



"The entire facility would not be possible without the TESVOLT storage system's high performance. To ensure that the water pumps can start up quickly, fast charging and discharging were essential to us," says George Zombori, CEO of the installation company Unlimited Energy.

Avocado farm in Australia

Storage system:	TS 48
Capacity/output:	48 kWh/18 kW
System:	Off-grid with 53 kWp, photovoltaic installation and 160 kWh sodium-ion batteries
Industry:	Agriculture
Location:	Western Australia, south of Perth



Unlimited Energy and TESVOLT received
The smarter E AWARD for this project in 2018

Earn money with grid services



"As one of the first solar farms to be built with battery storage and free from government subsidy, we are blazing a trail among local authorities and demonstrating that councils have a role to play as local leaders on energy," says Louise Goldsmith, Leader of the County Council (right).

Municipal solar-plus-storage farm

Storage system: 2x TPS 2000
Capacity/output: 4 MWh / 4 MW
System: On-grid with 7.4 MW_p photovoltaic installation
Customer: West Sussex County Council
Location: UK, Westhampnett



Back-up power



"We are extremely happy with our TESVOLT storage system. We can rely on it to supply our chicken farm with emergency power in the case of a power outage, and it has been running smoothly since 2015. We are even going to expand the storage capacity," says Stefan Beutel, who runs a chicken farm in Eberhardzell, southern Germany.

Eberhardzell chicken farm

Storage system: Li 40
Capacity/output: 40 kWh/18 kW
System: On-grid, photovoltaic installation
Industry: Agriculture
Location: Germany, Eberhardzell



Capping peak loads



"When the milking system is running in the morning and evening, there is a surge in electricity consumption — at times when the solar installation isn't generating anything. Our battery storage system supplies the power needed during those times, which saves us a lot of money compared to expensive peak load electricity," says Jens Fromm, owner of the Seydaland agricultural business.

Seydaland agricultural operation

Storage system: TS HV 70
Capacity/output: 67 kWh/60 kW
System: On-grid, photovoltaic installation 650 kW_p,
biogas plant 800 kW
Industry: Agriculture
Location: Germany, Jessen



About TESVOLT

TESVOLT was founded by Daniel Hannemann and Simon Schandert in the summer of 2014 based on their vision of supplying affordable, clean electricity to every corner of the world. Their goal was to develop and manufacture battery systems that would store electricity from renewable energy sources as efficiently as possible. Since commerce and industry have the highest energy requirements in many countries, the company has always concentrated on high-capacity storage systems.

Today, TESVOLT's commercial storage systems are in serial production and are delivered all over the world.



Team TESVOLT

Multiple award-winner



2019

Lucas Cranach Award
presented by the city of
Wittenberg (first corporate
award winner ever)



ARE Awards Winner 2019

2019

Alliance for Rural
Electrification
Award



**DEUTSCHER
GRÜNDER
PREIS**

Eine Initiative von

stern | Sparkasse

EDF | PORSCHE

2018

German Entrepreneur
Award in the category
Rising Star



2018

The smarter
E AWARD*,
Avocado farm
project



2017

ManPack Global
Manufacturing Award,
Best Flexible Battery
Storage Systems
Manufacturer



2016

Hugo Junkers Award,
Most Innovative
Product Development

* Joint award with our collaboration partner Unlimited Energy

Would you like to benefit from a storage system in the future?

Just call, send us an email or use the contact form on our website — we'll put you in touch with a TESVOLT specialist partner near you!

Get in touch!
www.tesvolt.com



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