

THE SELF-SUFFICIENT ENERGY-SECURITY

ENERGY STORAGE for SUN + WIND

accu technology without risk
real secure autarky + feed in



**When it comes to energy storage,
ONLY THE SAFEST AND MOST RELIABLE SYSTEM WILL DO!**

Avdira- Solar-Grid and Offgrid-plants-planning - New possibilities with E-HYB

1. What is the E-HYB?

A novel delivering independent energy, both for own use and for feeding into the grid!

2. What does the system consist of?

1. Comand unit

Energy-Controll uses an industrial computer that allows remote monitoring and high security programming

- „New“ 7 inch diameter colour display is a user friendly touchscreen. It displays the flow of the electrical power as well as daily produced kWh.
- controller: operational protection, circuit breakers, grid and household connections, can be used with solar inverter using „Platinum-Diehl-AKO“ technology and 10 years warranty, external mounting is allowed, other digital inverters can be accommodated.

2. E-HYB battery module

- *Modular, variable kW sizes according to energy storage requirement.*
- *Made out of pluggable, separate 48 V segments with battery management systems.*
- *Avdira-Solar Battery system made in Germany by TRUSTEC in Ansbach.*
- *Li-Fe-Titanate batteries of the highest security level. Expected number of cycles are 12 000. This corresponds to 20 years of operation.*
- *Li-Fe-Graphite batteries. Expected number of cycles are 10 000. This corresponds to 15 years operation. (tested using a VDE test norm)*

! significantly higher safety standard than Li-ion batteries (alternative lead-acid gel with a larger volume available)

3. What does the E-HYB do?

- ✓ Secure energy in case of grid failure.
- ✓ Direct feeding of solar energy into the domestic network in case of a grid failure. Achieving an efficient 98% solar DC to grid or domestic AC conversion rate.
- ✓ Energy stored during the day is used at night, which leads to a high use of self produced energy.
- ✓ Synchronous battery use in case of reduced solar array output.
- ✓ Backup system: combined self use and grid operation.
- ✓ Off grid functionality in case no grid connection is possible.
- ✓ Once batteries are fully charged the system feeds into the grid.
- ✓ Automated generator start (e.g. Diesel generator) in times of reduced insolation.
- ✓ German Lithium batteries
- ✓ Single, autonomous, plugin battery units.
- ✓ GSM interface for remote diagnosis and maintenance.
- ✓ 3 phase 230V in case of grid failure.

Backup system functions:

Dominantly the energy produced is for own domestic use. The Lithium batteries allow for topping up in low energy times and at night. Surplus energy feeds into the public grid, missing energy is bought from the public grid.

3. Can the E-HYB-Modular-System be expanded?

- Additional modular E-HYB systems allow for twice the power.
- More batteries capacity can be added to achieve autonomy during low energy days.
- Optional TRUSTEC-Quiet-Wind-Turbine with 0,5 to 10kW output.
- Solar powered charging station for vehicles (see separate information).

Modular setup allows for expansion of the system up to a fully autonomous electrical power supply for domestic, commercial, and industry use.

- ✓ Automated generator start signal and load switching to the battery.
- ✓ Approximately 20 years projected use with “Titanate” batteries.
- ✓ The touchscreen graphically displays the flow of power, indicating both kWh and kW.

Off-grid system functions:

The solar energy produced feeds into the domestic grid with an efficiency of up to 98%.

Uniquely modular set up to allow for highest flexibility. (VDE certification applied for)

The E-HYB system is a new and important component for our planning procedure. In collaboration with our local partners designs and supplies secure off grid and backup energy systems for domestic, commercial, and industry use ranging from 2 kW up to MW capacities.

Avdira-Solar E-HYB Function Backup system & energy security



The new energy perspective - „Security Power“

The E-HYB contributes to the launch of a new period of energetic autonomy by making use of solar energy available by day and night. This is enabled by the new lithium/iron sulfate/yttrium store-cell with its perfect charging technology and system control (load cycles approx. 5.000-7.000 = lifetime from about 15 years).

If more energy is consumed than generated by the solar plant – which might be the case at night time or on cloudy days – the required extra capacity is supplemented through batteries. Solar overcapacities occurring are fed

into the battery synchronously. The E-HYB is delivered pre-commissioned. This “plug-in“-solution allows fast and simple installation and commissioning procedure and even problem-free extensions, if desired.

This favorable profitability of the E-HYB plant is achieved due to low costs of energy storage (i.e. just the night-time storage volume in KW) of ca. 14 cent (depending on the plant size) and, apart from that, constantly rising electricity tariffs. Price increases on the electricity market

by ca. 7%, which took place during the past few years, are likely to continue, so that in 10 years' time 1 KW might cost 33 cent within 10 years and even 50 cent within the next 20 years

The system is, due to its modular design, each time going through the expanded use of solar modules, memory elements, TRUSTEC wind-Quite-turbine and other e-HYB units, easy expandable.



- highest consumption through intelligent measurement of power from the system
- Excess capacity can be sold to your energy provider with a backup system
- System is compatible with already installed solar systems

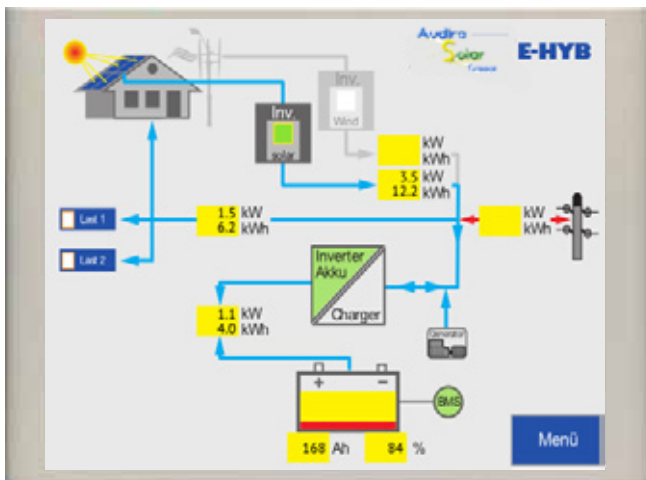
A new perspective! Feed in at day and save over-capacity for their own use at night.

The Trustec Wind-Sun-Tower is the perfect addition and fits perfectly with the E-HYB. The solar charging station can be found in our brochure.

Technical specifications are subject to change without notice. Mistakes of printing, translation and transmission are possible.



Avdira-Solar E-HYB Touchscreen - based on Siemens Industry Control



At a glance: Wind Energy / Solar Energy / DC inverter / lithium battery status / e-surveillance function HYB

The E-HYB informs about:

Where is what current?

- from solar
- from wind
- from generator
- into the house
- into the battery
- in supplement loads
- in/ out Network

Function monitoring red / green

- from solar generator
- from DC generator
- from charging stage
- from grid
- from emergency power generator
- from AC+DC over voltage protection
- of battery capacity and voltage
- battery monitoring system BMS

The E-HYB software has been professional programmed. Due to intelligent measuring and control of solar outputs, extraordinarily high domestic consumption rates, high-priority battery charging and even feed-in of surplus power into the public mains may be implemented.

The unique power circuit diagram on the touch screen provides direct access to all functions.

Thanks to the design structure, you will always keep the available battery capacity at a glance.

„Applied for the VDE-test.“

Segmental construction - progressively expanding

E-HYB segment

4 parts = all variants

high battery safety

variably adjustable

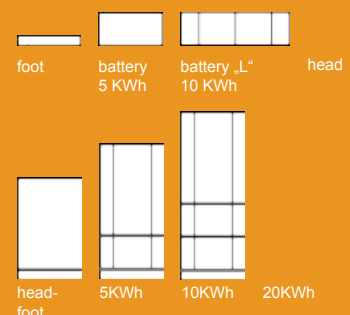
hole mounting

expandable and

transportable

230 V

Example options:



E-HYB segment

3 parts = all variants

high battery safety

variably adjustable

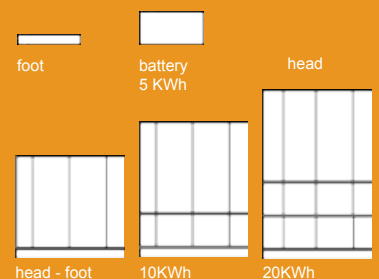
hole mounting

expandable and

transportable

400 V

Example options:





Technical data
1-phase and 3-phase design



Typ	TEH 5.000	TEH 10.000	TEH 20.000	TEH 10.000	TEH 20.000	TEH 30.000
output voltage V	230	230	230	400	400	400
phases	1-phase	1-phase	1-phase	3-phases	3-phases	3-phases
Lithium-iron phosphate / titanate battery or graphite -> more detailed information about storage capacity on our homepage www.trustec-energy.eu						
voltage V	48	48	48	48	48	48
storage Capacity AH/ Wh	5	10	20	10	20	33
monitoring/ Charge control				yes		
display A / V / Cap. / Outp. units				yes		
Estimated performance for solar plant optimization - Definition of size -						
module 235 W poly - units	15		20	15	32	40
maximum Solar-System Wp install.	3.525		4700	3.525	7.500	9.400
Average output per day						
various according to geographic region SE/ DE / GR / ZY / EGY - kW/h						
1 - firmly-mounted - kW/h	10/ 11/ 13/ 15/17		13/ 14/ 17/ 20/ 23	10/ 11/ 13/ 15/17	21/ 22/ 28/ 32/ 37	27/ 28/ 35/ 40/ 46
2 - two axe tracker install. kW/h	13/ 14/ 17/ 20/ 22		17/ 19/ 23/ 26/ 29	13/ 14/ 17/ 20/ 22	28/ 29/ 36/ 42/ 48	35/ 37/ 45/ 52/ 60
Average output per year						
various according to geographic region SE/ DE / GR / ZY / EGY - kW/h 7500 W in Tsd.						
1 - firmly-mounted - kW/h	3.638/ 3.847/ 4.767/ 5.491/ 6.283		4.850/ 5.130/ 6.350/ 7.320/ 8.370	3.638/ 3.847/ 4.767/ 5.491/ 6.283	7.762/ 8.207/ 10.169/ 11.715/ 13.403	9,7/ 10,3/ 12,8/ 14,6/ 16,8
2 - two axe tracker install. kW/h	4.730/ 5.001/ 6.197/ 7.139/ 8.167		6.300/ 6.700/ 8.260/ 9.250/ 10.890	4.730/ 5.001/ 6.197/ 7.139/ 8.167	10.091/ 10.669/ 13.220/ 15.230/ 17.424	12,6/ 13,3/ 16,5/ 19/ 21,8
Max. output power per day kW/h						
various according to geographic region SE/ DE / GR / ZY / EGY - kW/h						
1 - firmly-mounted - kW/h	25/ 21/ 26/ 30/ 34		33/ 28/ 35/ 40/ 45	25/ 21/ 26/ 30/ 34	53/ 45/ 56/ 64/ 73	66/ 56/ 70/ 80/ 92
2 - two axe tracker install. kW/h	32/ 27/ 34/ 39/ 45		43/ 36/ 45/ 52/ 60	32/ 27/ 34/ 39/ 45	69/ 58/ 72/ 83/ 95	86/ 73/ 91/ 104/ 119
Domestic grid - AC inverter***	4.000 H		4.800TLTD	7.000 R3*		9.000 R3*
max. AC Watt**	3.850		4600	6.700		8.200
max. efficiency	97,70%		98%	98,40%		
warranty period	10 years/ opt. 20					
DC Sine Inverter	XTM 2600-48	XTM 4000- 48	XTH 6000-48	3 x XTM 2600-48	3 x XTM 4000-48	3 x XTM 4000-48
sine inverter phase	divided into three phases		divided into three	3 phases	3 phases	3 phases
rated battery voltage V	48					
continuous outp. 25 ° C VA	2.000 VA	3.500 VA	5.000 VA	6.000 VA	6.000 VA	10.500 VA
power for 30 min at 25 ° C VA	2.600 VA	4.000 VA	6.000 VA	7.800 VA	7.800 VA	12.000 VA
energy 5 sec on 25°	6,5 kVA	10,5 kVA	15 kVA	19,5 kVA	19,5 kVA	31,5 kVA
output voltage (pure sine waves) at 120 Vac	230 Vac (+/- 2 %)		230 Vac (+/- 2 %)	400 Vac (+/- 2 %)	400 Vac (+/- 2 %)	
output frequency	50Hz adjustable 45-65 HZ quartz-controlled plus/ minus 0,05%					
harmonic distortion	< 2%					
max. load	maximum load leading to short circuit					
charging current adjustable	30 A	50 A	100 A	3 x 30 A	3 x 50 A	3 x 50 A
consumption OFF/ Stand-by/ ON	1,4/ 1,6/ 12 W	1,2/ 1,4/ 14 W	1,8/ 2,4/ 30 W	4,2/ 4,8/ 36 W	4,2/ 4,8/ 36 W	3,6/ 4,2/ 42W
load recognition „Stand -by“	2 bis 25 W					
max. efficiency	0,96					
CE Confinity	Guideline EMC 2004/108/EC : EN 6100-6-1, EN 55014, EN 55022, EN 61000-3-2, 62040-2					
operating temperature range	Low Voltage Guideline 2006/95/EC : EN 50091-2 EN 60950-1					
relative humidity during operation	-20 up to 55° C					
ventilation	95% without condensation					
warranty	forced from 55°C					
battery alarm + auto switch-off	2 years					
overtemperature	yes					
short circuit + Overvoltage protect.	yes					
measurements (w x h x d) in mm:	700 x 1500 x 400	700 x 1900 x 400	1200x1900x500	1200x1900x500	1200x1900x500	1200 x 2050 x 500
approx. weight:	180 kg	250 kg	500 kg	500 kg	500 kg	1000 kg

Lithium. Iron battery
about 30% more volume
therefore much higher security as conventional Li-Ionen accus

remote maintenance
system monitoring
remote alarm

battery system
fuse failure
DC-AC lightning protection

* Inverter has got reserve capacities - the module capacity could be extended to inverter load rating
 - in case of insular operation this would cause no load increase - then inverter is then limited
 ** At sunshine both inverters work in synchrony complementing one another - priority assigned to the AC-Inverter
 *** Installation flexible - close to solar plant or left / right of the E-HYB (not included in the E-HYB delivery)

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E-HYB mobil -Energy from sun/ wind -found everywhere-

Compared to hitherto-known lead battery technologies the stated AH values of the **QcãããUj |æ** lithium store cells can be fully used, i.e. by 100% and not by 50% only.

Thus, only half of the Ah needs to be invested with the same capacity being obtained. Space and weight can be decisively reduced with volume and weight remaining still the same, capacity at the same time growing to four times as much than before.

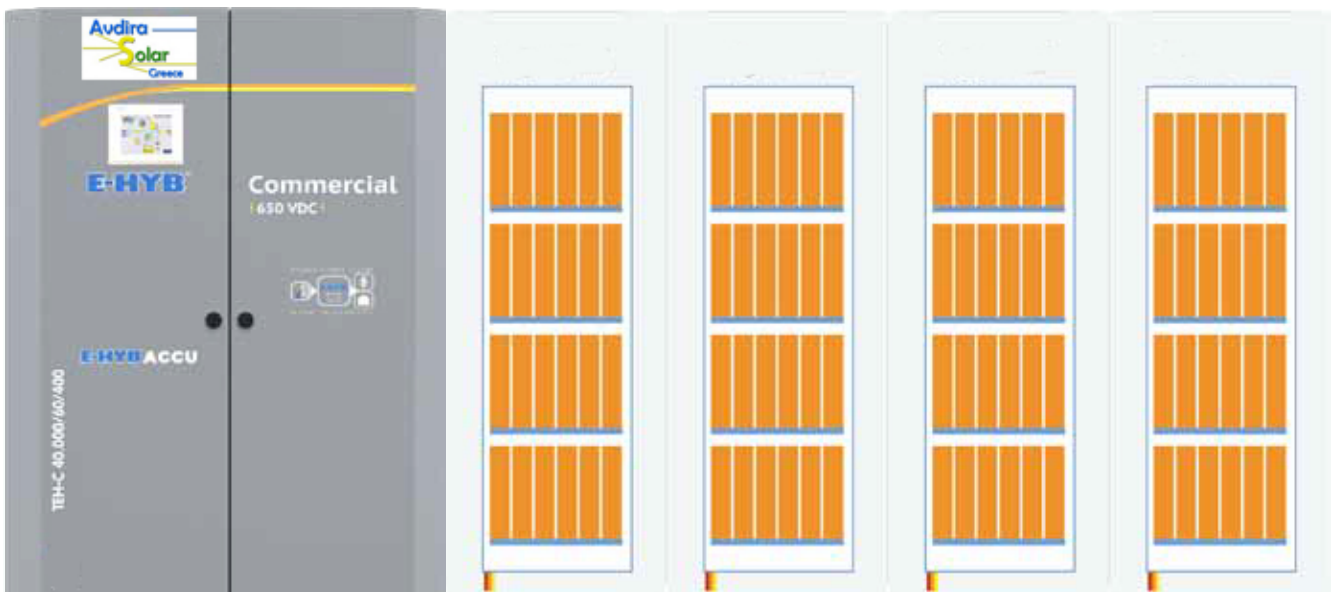
5j Xjfu!Gc`Uf Li Store Cell MW system

This storage technology allows large-scale solar plants of 100 kW to 1 MW of energy storage and the delayed feeding according to EEG direct marketing. Since the cost of storage systems optimized per cent W, depending on plant size at about 12 cent lie, this technology will be profitable and pioneering.

It fulfills high energetic efficiency requirements of commerce, industry and utilities. Continuous power supply, generated from the sun or wind, will so be that way guaranteed for the future.

RAM voltage, depending on the technical execution of about 700 V.

For this technology **QcãããUj |æ** offers a maintenance and service contract.



Advantages of Lithium-Iron-Yttrium Accus:

- higher energy dense and lower weight
- higher number of loading cycles

(approximately 15 years)

- Fast partial and full discharge - without Memmory effect
- Batteries not sulphonation
- almost no gases during charging and

discharging

- Explosive gases are not -
- High storage capacity of up to 94% storage costs per kW / h at about 12-14 cent

E-HYB LI-FE-TITANATE POWER STORAGE

Up to MW capacity



NEW

**Delayed solar energy to grid
feed in at fixed date according to delivery contract**

**Peak-power feed in
for the best tariffs via power trading according to EEG
load shifting**

**Peak shifting for
industry customers**

THE CONTAINER FOR COMMERCIAL USE

Get on the way to use your electrical power commercially with E-HYB

The Commercial-Energy-Storage-Container fits 800 kWh worth of energy in a container as short as only 6m. As storage, compact Li-Fe-Graphite or Li-Fe-Titanate batteries are used.

The Energy-Container can be used as an independent energy supply for residential areas, businesses, and industrial areas.

Individual planning by C&S!

Parallel units can be used to increase capacity into the MWh range!

Commercial-Energy-Storage-Containers are insulated and are supplied with conditioned air.



The solar energy is fed into the batteries directly from the solar installation using an intermediate circuit with ca. 650 V.

Energy which is needed by the consumer at the time of production is taken from the 650 V DC circuit and fed into the end users net with 400 VAC.

The installation operates at an efficiency level of 97%.

5 j X f U G c ` U f Commercial Solar Inverter 650V

- in 60/ 120/ 240 kW, and if run in parallel up to MW
- compact, water cooled
- industry standard
- easily accessed by doors

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