



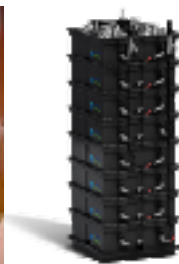
Energy storage solutions by Sunnytek



Many energy installations needs a energy storage in some way. In principal problem is same for a small rural house inside Africa and an industrial complex. Grid is not 100 % reliable or to high costs not acceptable. Here we share our solutions between all combinations needed.

Why an energy storage system by Sunnytek ?

- * You have a solar panel system making power when sun is up and you want to store energy for hours with no sun or it is to weak.
- * Area have a weak and unreliable grid and you need to have power all time. Here the energy storage stores power to be used when grid is down ur stabilise when unstable.
- * Grid is weak and you have large variations in power consumption. Here the energy storage can take the peak power situation without stressing grid over its limits.
- * You have a good power source and want to store and share power all over time to save costs and get better reliability and control.
- * There is several power sources you want to share and mix as you want to get best economy and costs and full control of power.



Sunnytek and our partners use several solutions and different technology as demands differs so much. Costs for power differs a lot and so do operation temperature. Life cost cycle differs so economy set different demands that can change solutions lot. Here we give a short information about what we can offer in general terms. To this we have product info about all solutions in separate papers. No single technology cower all installations and demands..

We offer all parts needed from the smal house with 3 led lamps up to a large cement factory that want to control 100% of their own power. Pls contact us and our local offices for a discussion about what fits your demands best.

Sincerely Allan Jansson technical manager of Sunnytek



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Battery storage by lead **Gel battery technology** is a very old technology still going strong. In smaller systems and when purchasing cost is essential this is often the alternative that is best. There are limits but often advantages makes this the solution preferred. Normally we use GEL batteries as they are best in deep cycling and handle a hard life better than an AGM battery. Life cycle cost is not that good if we look over 10 years operation of the installation.

- * Typical life time 6-8 years at max 25 C in temperature when charged and deep cycled max 30-40%
- * Special model can work for 10-12 years and + 30C when charged but then cost raise by about 2X .
- * Typical site of energy capacity from 0.1KWH for single houses to 100 KWH for larger sites.
- * Special large systems can do 1-5 MWH in capacity. Here we have 3600AH OPZV cells in numbers.
- * Green solution if recycled and reused when to old. Lead is today very costly and few throw old cells away.



Lithium storage are of 2 designs. One smaller that replace lead battery in dimensions and here it is far better when very hot and when demands of many cycles are higher. Life cycle cost is often better than lead if we look for 5-10 years ahead. The other design is for larger systems where demands in high outputs is very high and reliability demands critical. We have systems with full 10 years warranty of operation. All batteries can handle high temperatures up to 60C and more than 10 years operation with daily deep cycling to 80 % or more. The deep cycling in comparison to lead batteries makes it possible to use 40-50% smaller capacity in KWH. This balance cost differences almost fully compared to a lead battery. The larger designs is delivered on pallets / racks or in containers and have very large capacity and peak power.

- * Typical life time 10-12 years at up to 30-40C in temperature when deep cycled full high 80% of capacity.
- * Can operate to over 60 C in ambient temperature without significant degradation.
- * Typical site of capacity from 0.1KWH for small systems up to 100 KWH for larger sites.
- * Typical site capacity for larger systems in containers up to 10 MWH and more than so. 10 years warranty.
- * Green solution with no poisonous materials.



Example of a Multi MWH lithium energy storage system



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Flow-battery storage systems

use a liquid cell and energy is chemically stored in the liquids. This solution accepts 100% depth of cycles. Warranty is full 10 years. There are 2 models. One small fro 10KWH capacity and 3 KW max output and a container system of 600 KWH storage and 300 KW peak power output. Ambient temperature is 5C to 50C so it is aimed for tropical areas or indoor operation.



- * Typical life time 10-20 years at max 50 C in temperature when charged and deep cycled max 90-100%.
- * Smallest system store 10 KWH and can deep cycle 100% of capacity. Max output 3 KW.
- * Larger container system handle 600KWH storage and 100 KW in peak power output.
- * Many containers can operate in parallel for larger sites in MWH range.



Salt water batteries is an interesting system now available in 2 models. The smaller cell have about 2.2 KWH capacity at 24 or 48 volt output. The larger pallet cell have about 25 KWH capacity at 48 volts. The electrolyte is salt water and battery is very green in design and certified.

- * Typical life time 7-10 years at -5C to +50C in temperature when charged and deep cycled to 95-100%
- * Warranty 3000 Cycles.
- * Smallest system store 2.2 KWH and can deep cycle 100% of capacity. Max output 1 KW. Weight 110Kg
- * Larger container system have 26 KWH storage and 100 KW peak power output 12 KW. Weight 1500 kg.
- * Many units can operate in parallel or series for larger sites up to KV levels and MWH



Sunnytek Sweden
Sunnytek Burundi
Web sites

Glimmervägen 8 187 34 Täby, Sweden
Avenue Ndora 3 No 27 Bujumbura, Burundi
www.sunnytek.se www.sunnytek.nu

E-Mail sales@sunnytek.se
E-Mail barnabe@sunnytek.nu
All Registered companies



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Larger special systems for large capacity installations

Zinc hybrid battery is an advanced solution now going into production. It is a high temperature cell system and large capacity for the large demanding systems.

- * Modules with 1 MWH and up to 40 MWH
- * Container design with all inside container includes management system and controllers
- * Cost efficient in large capacity sites
- * 5000 cycles / 15 years life time at 100 % depth of operation
- * 10-45 C in ambient temperature.

Sodium sulphur battery is optimised for really large installations up to 100 MWH in capacity.

- * Modules of 30KW in clusters and modules of 1 MWH capacity
- * Can handle high output and high capacity out of same system
- * 4500 deep cycles / 15 years expected lifetime.
- * Battery is large and heavy
- * Ideal for larger micro and island grid installations.

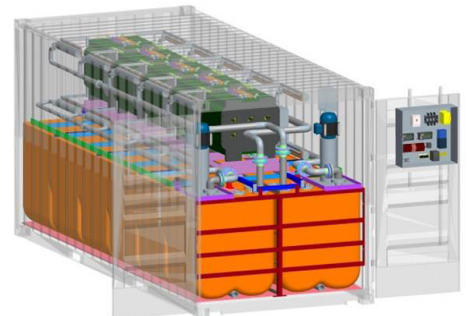
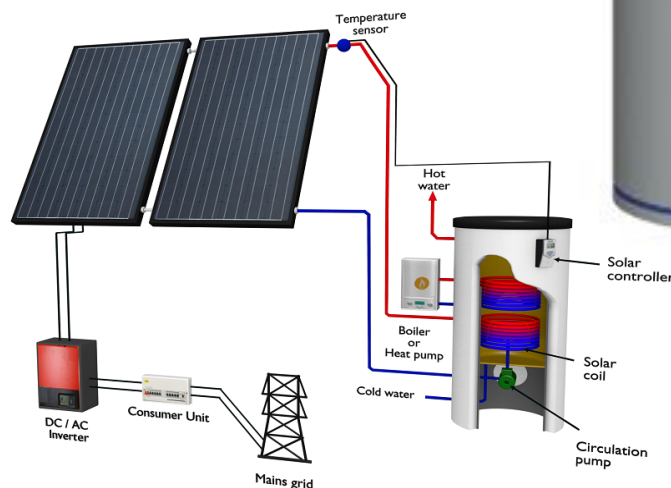
Single tank SOC Zinc- Iron flow battery is a new design of flow battery using non toxic liquid flow cell for energy storage in large scale. Alkaline chemistry and unique life cycle.

- * Modular design in containers with 160 KWH per module
- * 100% deep cycle and high power and high currents.
- * Non dangerous materials and no hazards for staff
- * Unique life time with 20 years life time and 10000 cycles life time
- * Warranty is 20 years which is very unique. 95% level at end.

Hot water battery and storage tanks is a special solution useable in many installations. We can use heat as it is from the water temperature energy. We can convert hot water energy to direct to electricity by a thermal ORC generator.

This can be a valuable add on in many sites with available waist heat. Hybrid panels gives booth electricity and hot water out of same panel unit.

Many industries have need for heat + electricity in the process and here we have all in same unit.





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How to create power to be stored by our battery and power solutions

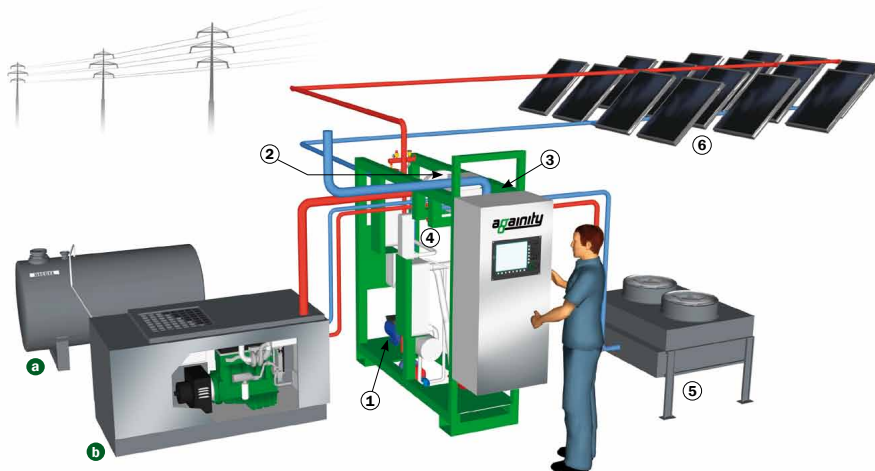
Solar and wind power are intermittent and not with any good stability. Here the battery will store and equalise output to get a good stability and power when wind and sun are lost. Today's solution with new developments will make this cost efficient and much cheaper than old combinations with diesel generators or long and costly high voltage power lines. Low maintenance is also a good reason and the attractive **Life Cycle Cost** is now impressing,



Hybrid combinations between solar + wind + hydro power can be very good when there are some water in the area. In areas with dry seasons this combine action is extra attractive as when sunny there is little rain and vice versa. This is reality in large parts of Africa and tropical areas of earth.

Stirling generators may be connected if there are sources of power and heat

to use. Here sold fuel burners of city dump is one source as well as biogas if available. We have complete systems with burners and generators in one package.



In areas with heat differences that have lower temperatures an ORC generator system is perfect. Here we can make electricity with a temperature down to 80C only. Here we use power from waist of diesel generators. industrial processes and thermal energy in many ways.

Example of an ORC system that se hot water by sun only. Water tank can be the water battery for nights. All over 80C can be used to charge battery.