



# Sunnytek Solar Sweden

## Multi-Kaplan hydro power water turbines



Photo of falls in Bomet County Kenya with about 4 meters head



Power solution for electrical energy from low head water falls from 1.5 meter and up

Sunnytek is happy to offer a solution for hydro power turbine and generators for use too water falls from 1.5 meter and up. Normally the low level falls are hard to get power from and traditional designs are not cost efficient.

This is a new concept easy to install and operate with reasonable costs and by this realistic costs for electricity.

Multi-Kaplan systems are delivered preinstalled in a standard 20-40 feet container with electrical parts pre connected and installation is very fast. The dam just need a hole or a simple square channel to feed system and all is remade at factory so start up works is very small and simple.

Water guides are ready from factory inside the container so this issue get simple and correct from start up. Multi-Kaplan systems have normally more than one turbine in the container unit and can have up to 6 units side by side. This multi turbine design makes it simple to adjust output depending on water flow and maintenance can be done one by one while other turbines are used.

Normally we have 2 containers where one is under the other in 2 levels. Bottom container keep turbine and water guides and hydraulic controller. Upper container is always over water surface as it is higher than the dam. It have generator + controllers + switch board inside and have an access door for staff.

### Features of Multi Kaplan power stations

- \* Can use water falls from 1.5 meter and up so normally not useable water stream can have a generator
- \* Simple to install as all is delivered preinstalled in 2 containers from factory
- \* Upper part with sensitive devices is always over highest water surface and can not be flooded.
- \* Low part contain water turbine and water guides installed from factory.
- \* Water turbine can be lifted up into high up container for easier maintenance
- \* Switch board and all electrical components preinstalled from factory
- \* Contain all from 1-6 turbines side by side in a 20-40 feet standard container size.
- \* Realistic costs and easy installation saves costs and makes system attractive at earlier “ impossible “ sites
- \* Power range from 25KW to 250 KW Per container unit. Output depends on volumes in M3 / sec and height of fall.

This is a new concept to use water falls normally not profitable for hydro power am make electricity to a very reasonable cost. System is simple and reliable and not to complex so it can serve for many years and produce power to very low costs. Sunnytek can in some cases offer a financial package for end users.

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**Multi-Kaplan hydro power water turbines**

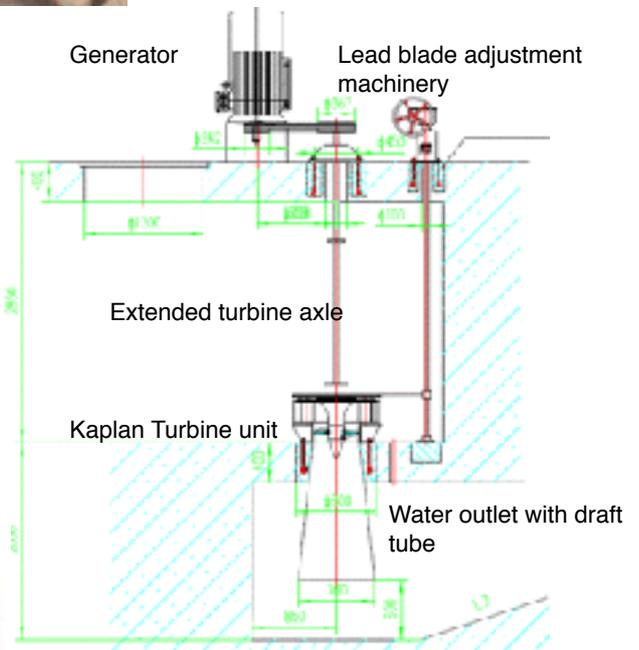
Kaplan turbines are the best solution when water head is low in range of 1.5-10 meters fall. Turbine it sels is just like a multi blade propeller that turn the generator to give power. MultiKaplan designs we offer have adjustable lead wings to correct flow to be as good as possible.



Here there is a synchronised array of blades around the kaplan propeller to get most power out of all.

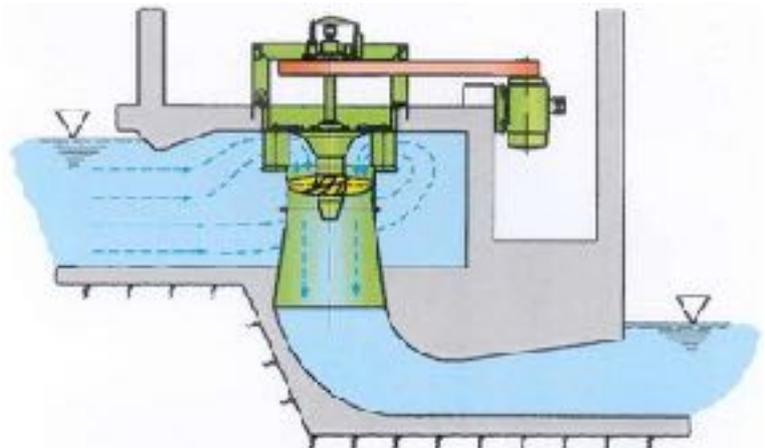
The flow is large and demands for power is high so there is a problem coming in max diameter of turbine versus the head in meters. To large diameter reduce power a lot and turbulence inside turbine is very bad.

By this reason we have several smaller units side by side up to 6 pcs in a 40 feet unit.. This will also increase redundancy but still the com plate unit is more like one system to handle. If river flow have large variations over the year we can



turn of one or more turbines so dynamics in Multi Kaplan design is far better than a single

large turbine. Images shows some details normally built on site. Multi-Kaplan models have this done in steel at factory and it is located in bottom container ready to use. This saves large costs at site as all is far simpler. Time is saved and costs much lover. Installation in les some week is possible. What is needed is a dam with water head + cement structure to put container on by a crane. Turbine needs a channel for water flow with locking door to turn on and off turbines.





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#### Delivery of power station.

Power station comes in 2 pcs of standard container sizes all installed inside.

Bottom container is wet and contains the water turbines with the shafts going up to the other container on top through a hole. Upper container have generators + electrical equipment and control system and switchboard. All is installed from factory and tested before delivery.

At site the containers are lifted by a crane to the cement foundation already prepared and protection covers are removed for open areas of container. Bottom part have external doors to control water flow intake and outputs. Works at site are very limited and with a few days it can operate. The reduce expenses at site and start up is much faster.



Photo shows a standard container only.  
Hoist handle 12.5 tons

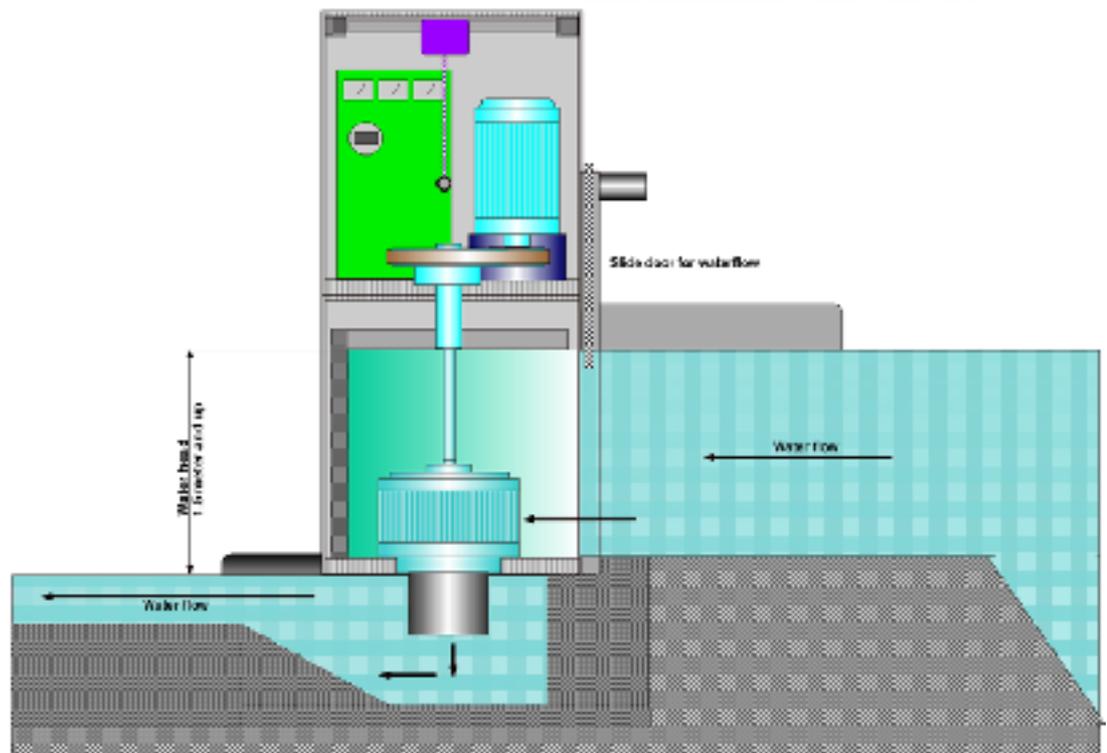
#### The solution of Multi kaplan power stations.

System is delivered in 2 containers. At dam before delivery there is a need for some cement works and support beams for keeping containers in place.

Bottom container is a wet area under water surface and contain the array of kaplan turbines. Power per turbine is up to 50KW / 2 meters water head and we can have up to 6 turbines in the container in a line.

Shafts of the turbines goes up through the roof into the upper container. Outside container side on dam side we have doors that can control water flow and turn off each h section individually.

Upper container have a dry department always over water surface and here we have all generators, controllers and switch board and maybe a transformer. At delivery it is a simple work to connect and start all systems to operate. All is ready at delivery and tested at factory. Containers are sealed at delivery and are handled as an ordinary 20-40 feet container.



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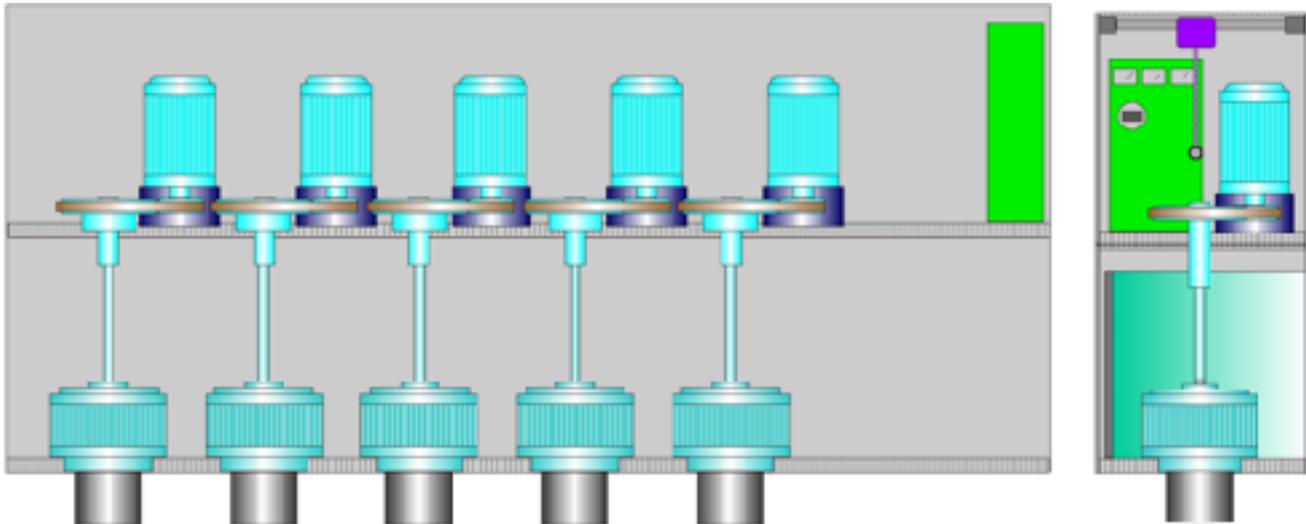
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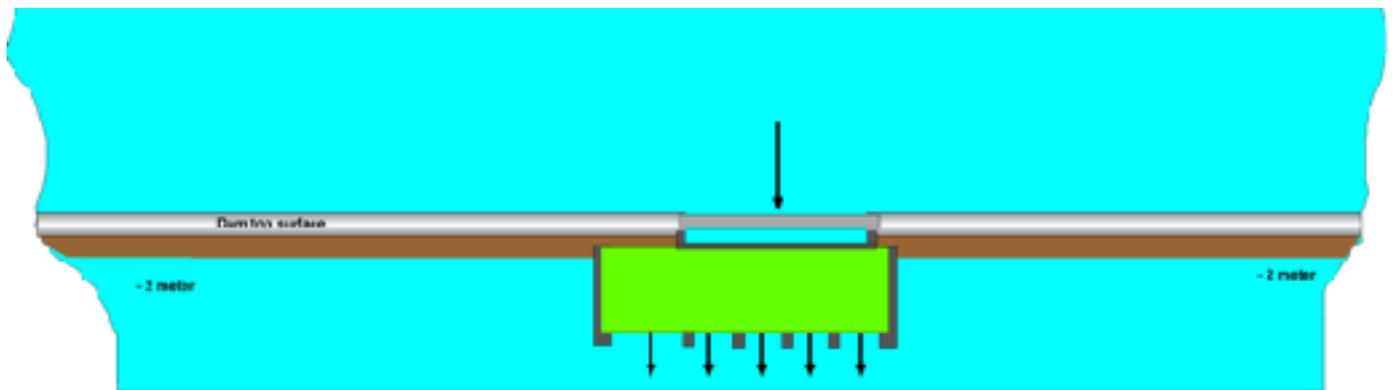
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View in x-ray of layout inside container. Uber container have plenty of space for easy maintenance and service. Lower container can be dried in each section and there is easy access to turbine unit with no diver. y a smart design we can lift up the turbine unit very simple and change and check while all other turbines are working.



Top view of all where container unit is in centre of dam. Dam is simple a cement wall and when water get to high water just flow over the top. The dam have a gap where water comes to turbines and the locking door. Normally turbines balance water so it is 5-10 cm under dam top and all water goes through the turbines. If there are lower flow now and then e can adjust turbines but also stop 1 or more to match water flow and se turbines works at max efficiency.

Turbines can have auto attic controls or be remote controlled by grid operator. Service and attention alarms can be send my messages over mobile telephones to own staff.

The multitude of smaller turbines makes it possible to ha idle low water head and lots of water as the turbin e diameter must be small in relation to water head.

This design is cut efficient and can produce power very cheap for many years. Combined with easy dam works site in total get cheaper and power less costly. Sunnytek and partners can often handle a finan coal package for our solutions like this.