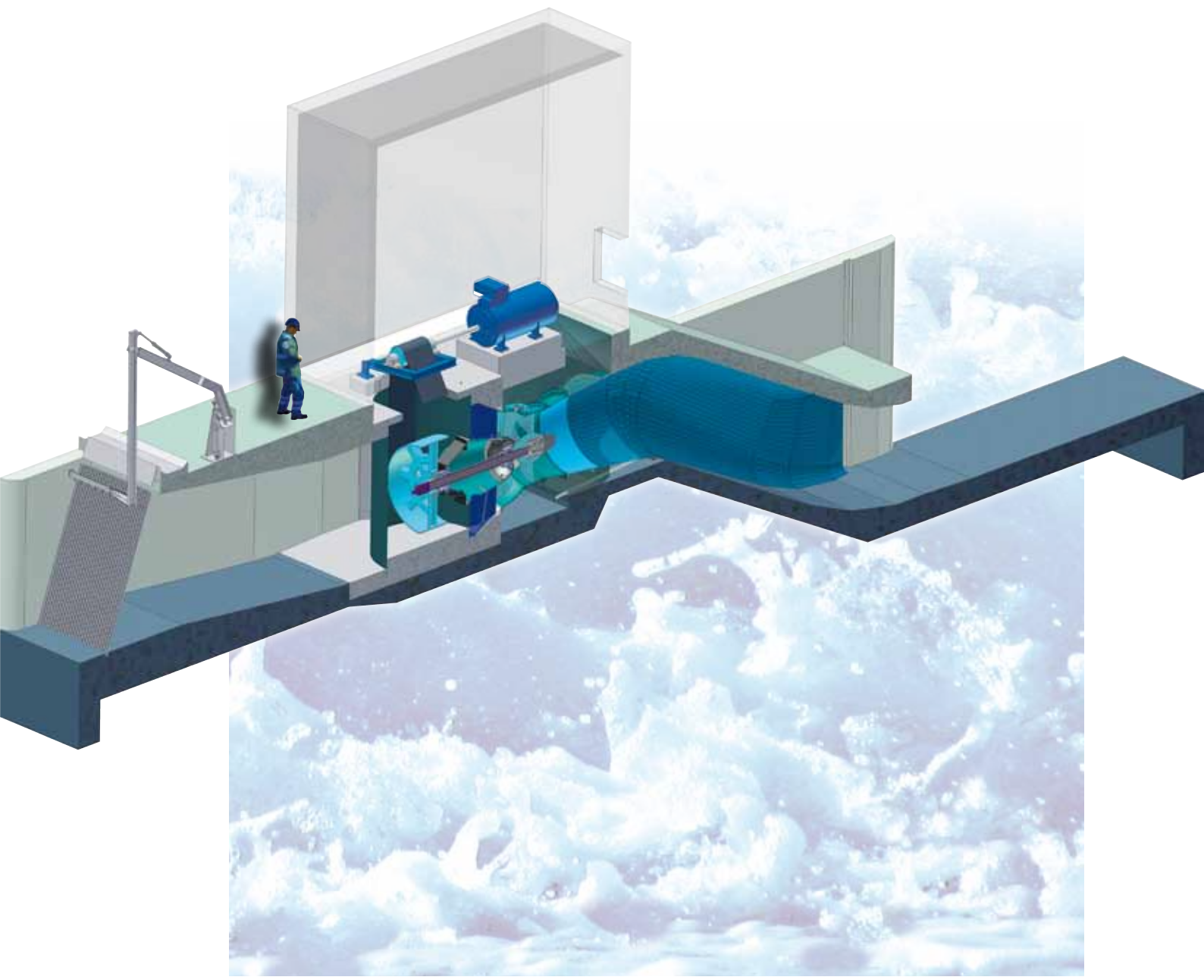
OSSBERGER

Kaplan Turbines



Development

Based on the principles of a Francis Turbine the Kaplan Turbine was developed by the Austrian engineer Victor Kaplan towards the beginning of the 20th century. Due to its adjustable runner blades this turbine system is most adaptive. Apart from the original version with vertical shaft and inlet spiral case the bulb turbine variant has spread widely over the world.

Range of utilization

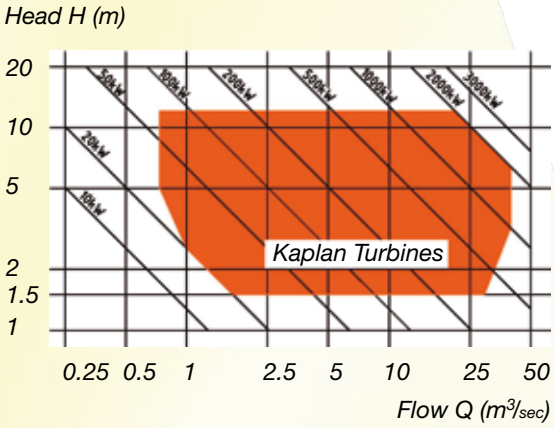
The Kaplan Turbine has an outstanding reputation for its high specific flow capacity.
As a double-regulated turbine it is therefore most suitable for low heads and large flows, but also for variations in flow and head.
Its main utilization concentrates on heads between 1.5 meters and 15 meters maximum.

Principle

The Kaplan Turbine is of the reaction type. The velocity of the water decreases steadily, entering the guide vanes, passing through the runner and final exit. The twist in water flow runs in parallel to the turbine shaft and to the fully admitted runner blades, where the pressure for energy conversion is reduced further. Special constructional measures are necessary to prevent cavitation.

The water flow is regulated by adjustable guide vanes. To achieve optimum efficiency at varying flows, the runner blades are automatically adjusted in relation to the wicket gate position.

Envelope



A strong team

Your power station will be made to the OSSBERGER CONCEPT.

More than 10,000 power stations have been tailor-made this way world-wide thereby implementing the highest technical standards at favorable costs. In Cooperation with you as the investor, a highly-efficient project management is provided.

The well-engineered hydraulic machine is manufactured by HSI. The well-proven trash rack cleaner and the comprehensibly constructed and reliable turbine controller are of the Ossberger production line. All other components are products of renowned manufacturers.

For more than 100 years we have been serving our customers successfully implementing matured and well-proven techniques, using up to date components to the latest technical standards at the same time.

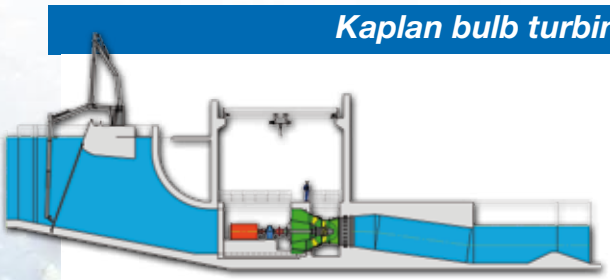
For these reasons Ossberger has been for decades the technological leader in the field of small scale hydro power for its customers' benefit. This holds true at the same time for the hydraulic turbine, the turbine regulation, the control system as well as for the automatic trash rack cleaning machine.

Power unit design and construction is always a balancing act: Individual units must be offered at favorable costs for different potential forms of energy.

This has been perfected by Ossberger, by using standardized components.

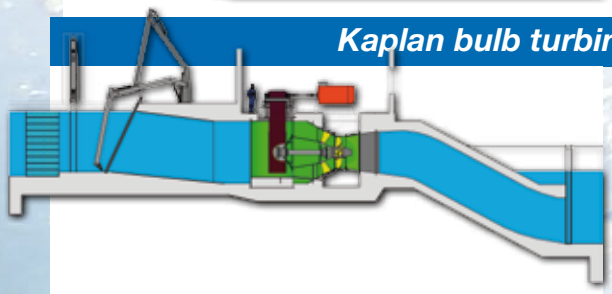
Kaplan Turbine Program:

Kaplan bulb turbine, construction type A with gearbox



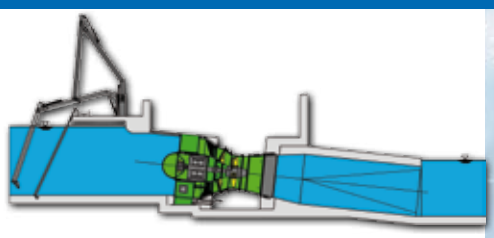
Heads:	*1.5 m – 20 m*
Flow rates:	*2 m^3/sec – 60 m^3/sec*
Runner diameters:	*0.63 m – 2.8 m*
Outputs:	*up to 3,500 kW*
Number of blades:	*3, 4 and 5*

Kaplan bulb turbine, construction type A with belt



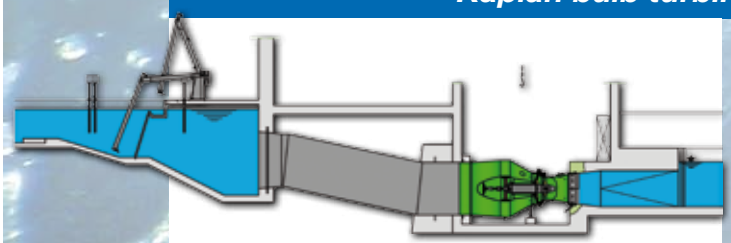
Heads:	*1.5 m – 20 m*
Flow rates:	*2 m^3/sec – 60 m^3/sec*
Runner diameters:	*0.63 m – 2.8 m*
Outputs:	*up to 3,500 kW*
Number of blades:	*3, 4 and 5*

Kaplan bulb turbine, construction type B



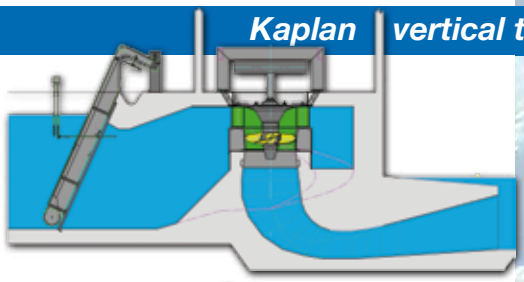
Heads:	*2 m – 20 m*
Flow rates:	*5 m^3/sec – 60 m^3/sec*
Runner diameters:	*1.41 m – 2.8 m*
Outputs:	*up to 3,500 kW*
Number of blades:	*3, 4 and 5*

Kaplan bulb turbine, construction type R



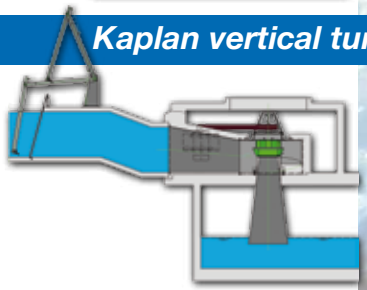
Heads:	*3 m – 12 m*
Flow rates:	*1.5 m^3/sec – 7 m^3/sec*
Runner diameters:	*0.63 m – 1.0 m*
Outputs:	*up to 700 kW*
Number of blades:	*3, 4 and 5*

Kaplan vertical turbine, construction type T (+K)



Heads:	*1 m – 25 m*
Flow rates:	*0.2 m^3/sec – 40 m^3/sec*
Runner diameters:	*0.25 m – 3.0 m*
Outputs:	*up to 3,000 kW*
Number of blades:	*4, 5 and 6*

Kaplan vertical turbine, construction type S

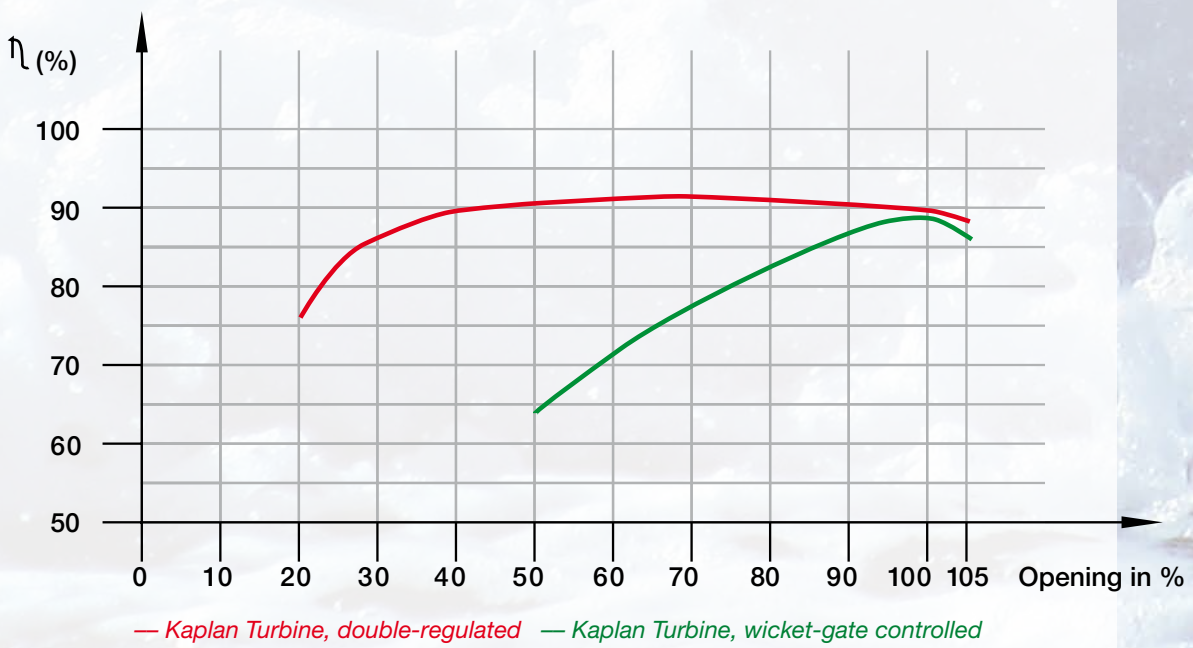


Heads:	*1.5 m – 25 m*
Flow rates:	*2 m^3/sec – 40 m^3/sec*
Runner diameters:	*0.56 m – 3.0 m*
Outputs:	*up to 3,000 kW*
Number of blades:	*4, 5 and 6*

Turbine type Comparison	A	R	B	K	T	S	BBD
Admission and discharge frontal	•	•	•	-	-	-	•
Admission and discharge displaced	-	-	-	•	•	•	-
3 Runner blades	•	•	•	-	-	-	•
4 Runner blades	•	•	•	•	•	•	•
5 Runner blades	•	•	•	•	•	•	•
6 Runner blades	-	-	-	•	•	•	-
Direct coupling	•	•	•	•	•	•	•
Belt drive (up to 1,000 kW)	•	•	-	•	•	•	-
Gearbox (outputs > 1,000 kW)	•	•	-	-	•	•	-
Min. head (meters)	1.5	3	2	1	1	1.5	2
Max. head (meters)	20	12	20	12	25	25	5
Min. runner diameter (meters)	0.63	0.63	1.41	0.25	0.56	0.56	1.00
Max. runner diameter (meters)	2.80	1.00	2.80	0.90	3.00	3.00	2.00
Min. flow (m^3/sec)	2	1.5	5	0.2	2	2	3.5
Max. flow (m^3/sec)	60	7	60	5.3	40	40	25
Min. output (kW)	50	40	100	10	100	100	60
Max. output (kW)	3, 500	700	3,500	500	3,000	3,000	1,800

• = Positive – = Negative

Efficiency curve



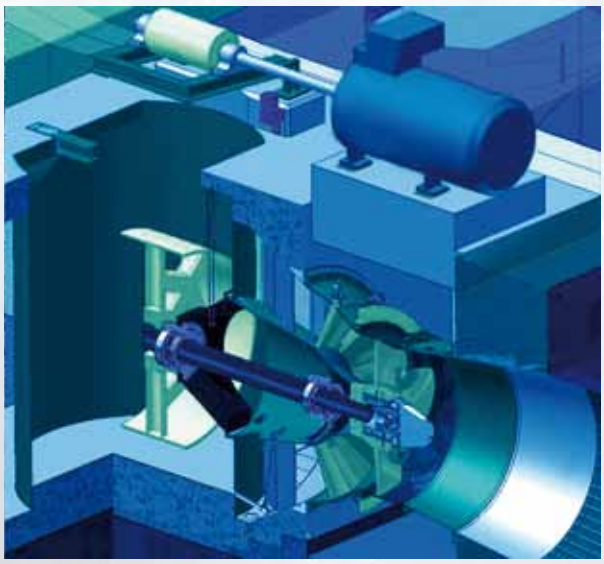
— Kaplan Turbine, double-regulated — Kaplan Turbine, wicket-gate controlled

Kaplan bulb turbine, construction type A:

Available with three, four or five runner blades.
An inclined or horizontal installation of the shaft is possible. Speed transmission with flat high-capacity belt for outputs of up to 1,000 kW, and with parallel shaft gears for larger outputs.
This machine is also available as construction type R for connection to a penstock and with belt drive connected sideways.

Kaplan bulb turbine, construction type B:

This further development of construction type A is outstanding for the use of a permanent-magnet-excited synchronous generator (PMG).
The generator rotor is mounted onto the turbine shaft. Therefore, one set of bearings is eliminated. As the stator is located inside the turbine bulb and surrounded by water, optimum cooling is provided.

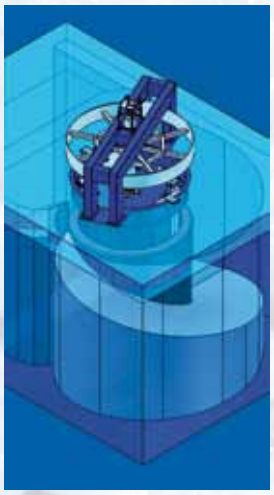


Kaplan Turbines, construction types K, T, S:

These construction types incorporate a vertical shaft and are particularly suitable if existing civil structures must be considered. Intake and discharge do not necessarily need to be in line – looking at plan view.
Turbines are available with three, four, five or six runner blades.
Whereas inlet scroll cases of construction types K and T are made of concrete, construction type S is supplied with a scroll case in steel.
Reduced risk of a clogged runner due to the spiral twist.

Kaplan Turbine, construction type BBD:

Also called "Movable Power Station": A compact solution, suitable for existing weirs. The whole plant essentially consists of a semi-sphere screen with trash rack cleaner, a movable weir flap and a Kaplan bulb turbine with permanent-magnet-excited synchronous generator, similar to construction type B. In case of high water condition, the whole plant can be hydraulically swiveled, up or down, to accommodate the rising water level and divert the flow discharge as needed.



The automatic trash rack cleaner is indispensable, increasing energy production.

What you can expect:

Supply Provision
If transportable by normal means, the unit arrives on site completely assembled. Installation can therefore be completed within a few days.

Turbine Shaft
Hollow shaft with internally sealed adjusting rod for the runner blade setting.

Shaft Bearings
Low-maintenance type, grease-lubricated with programmed automatic lubrication system.

Shaft Seals
The multi-chamber type lip seal is connected to the automatic lubrication system. The seal does not require re-adjustment and is therefore maintenance-free. The shaft protection sleeve is exchangeable and the seal faces are hard-chrome plated or coated with corrosion-proof hard ceramic materials to resist wear.

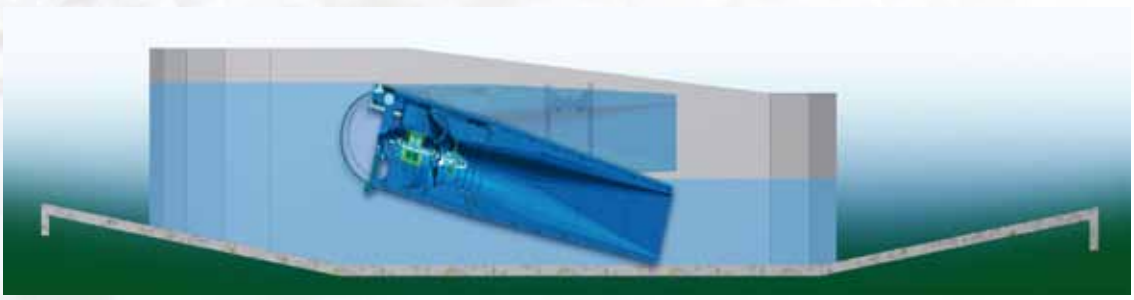
Runner
The runner blades are made of aluminum-nickel bronze, which is highly resistant to wear and cavitation (EN-CC333G) or of chrome-nickel steel. The blades are uniformly set by the adjusting rod and the lever mechanism, located inside the hub. The vane plates are double-sealed to protect against water leakage.
The number of runner blades and the material composition of hub and vane head depend on individual requirements and utilization of the hydro plant.

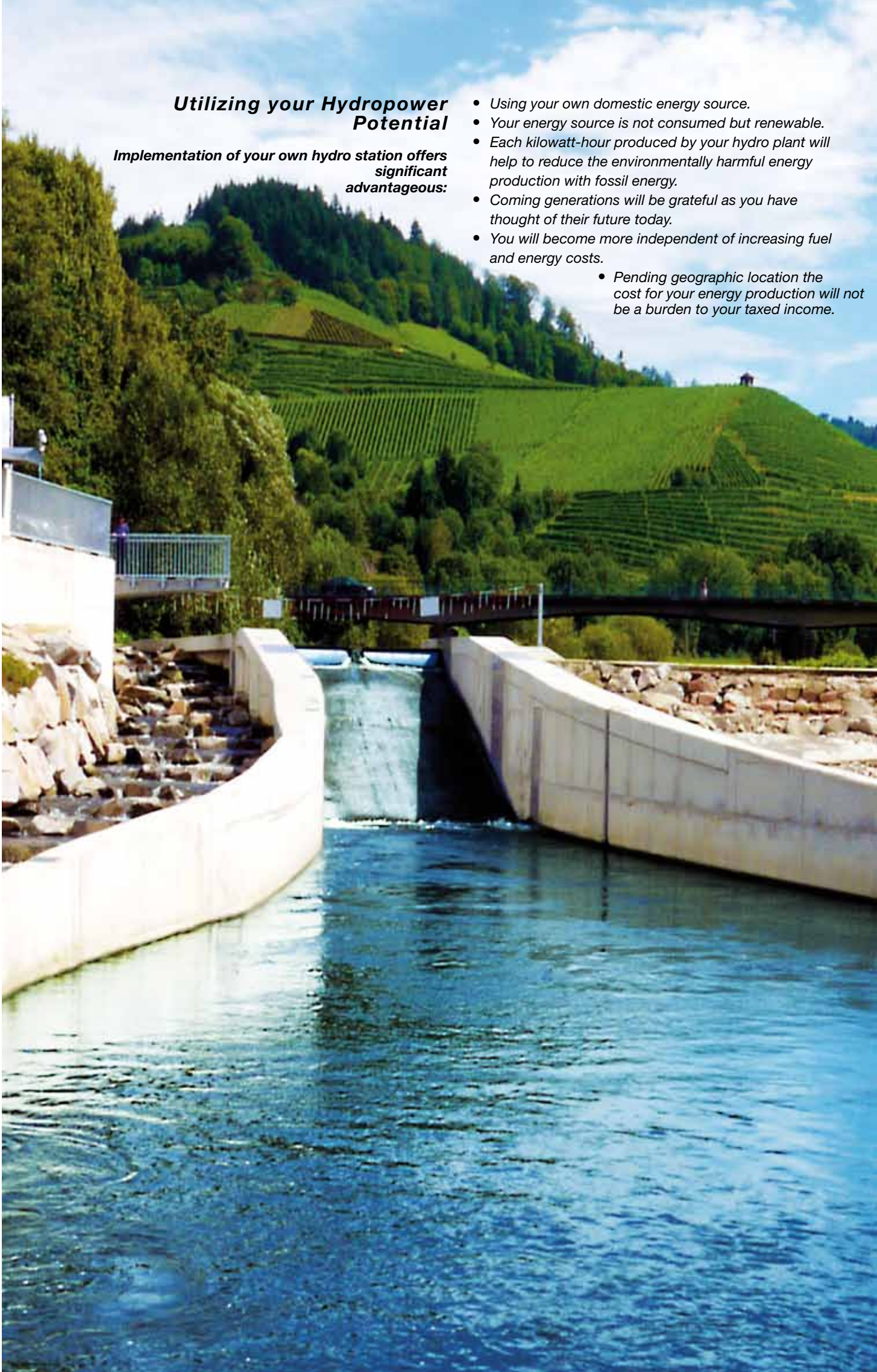
Runner Blade Adjustment
The runner blade setting is accomplished by means of a double acting hydraulic cylinder which is rotating with the turbine shaft. The hydraulic oil supply line for the cylinder is equipped with a special rotary adapter device.

Runner Housing
Is hemi-spherical, as fabricated steel construction.

Wicket Gates
The wicket gate design depends on the turbine construction type. A detailed description will appear in your cost proposal.
All turbine types offered include maintenance-free bushings for the wicket gate axels.

Design Concept
Detailed individual investigations have shown, that multiple standardized units are superior to solutions with excessively large runner diameters. This superiority is a result of the lesser expenses for machinery and civil works and the higher flexibility in regards to flow variations.





Utilizing your Hydropower Potential

Implementation of your own hydro station offers significant advantageous:

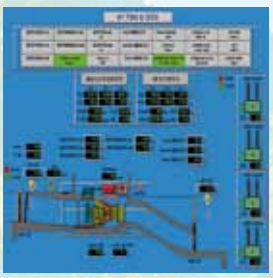
- *Using your own domestic energy source.*
- *Your energy source is not consumed but renewable.*
- *Each kilowatt-hour produced by your hydro plant will help to reduce the environmentally harmful energy production with fossil energy.*
- *Coming generations will be grateful as you have thought of their future today.*
- *You will become more independent of increasing fuel and energy costs.*
- *Pending geographic location the cost for your energy production will not be a burden to your taxed income.*

Hydropower stations must conform to
site specific conditions requiring diverse operating tasks.

OSSBERGER builds tailor-made hydro stations – world-wide!





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