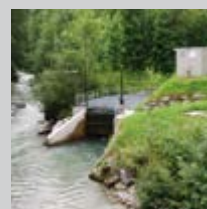




# ***DIVE-TURBINE***

*compact – efficient – reliable*

The compact turbine system for highest demands in terms of efficiency and ecology in hydropower



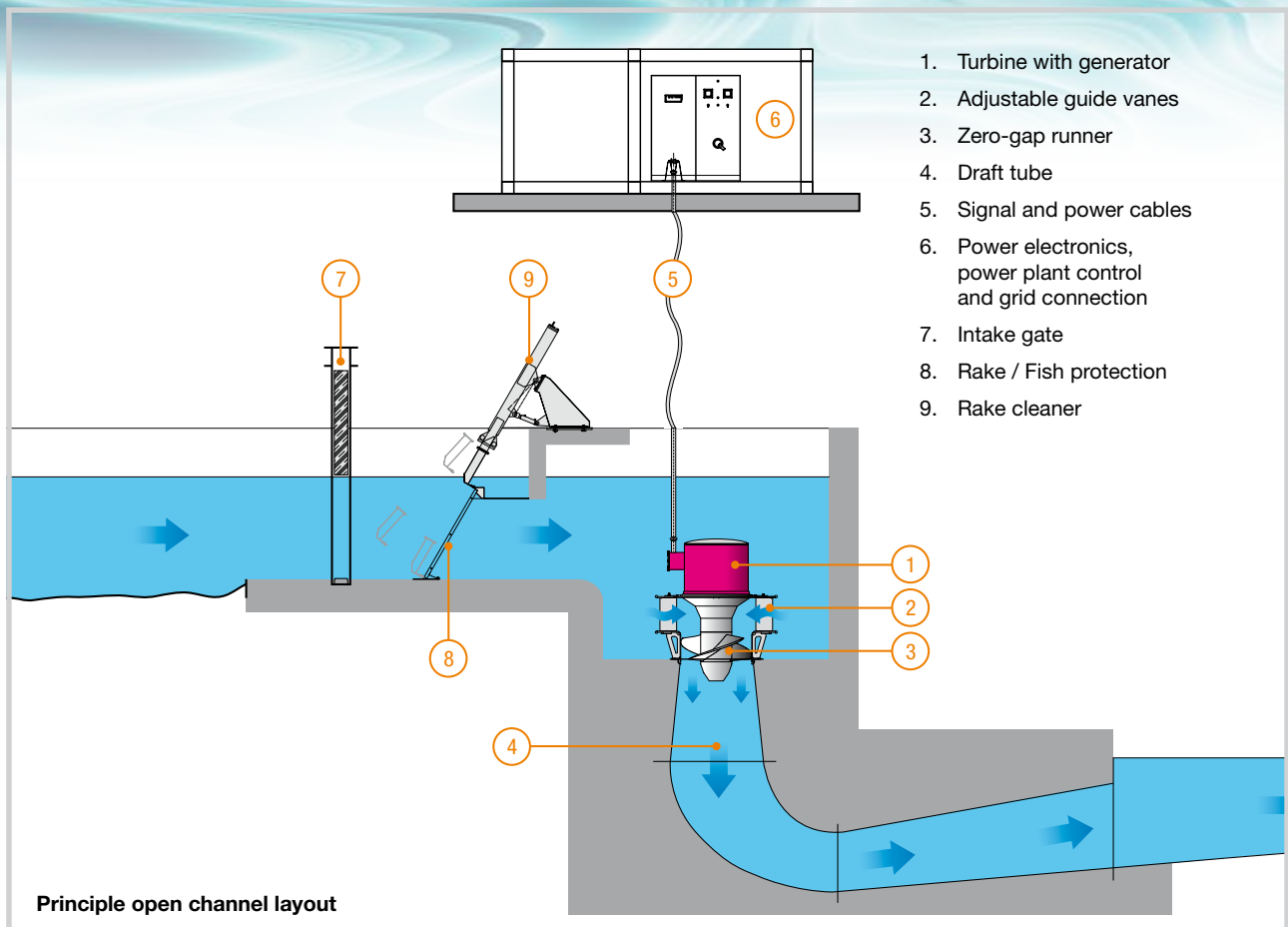


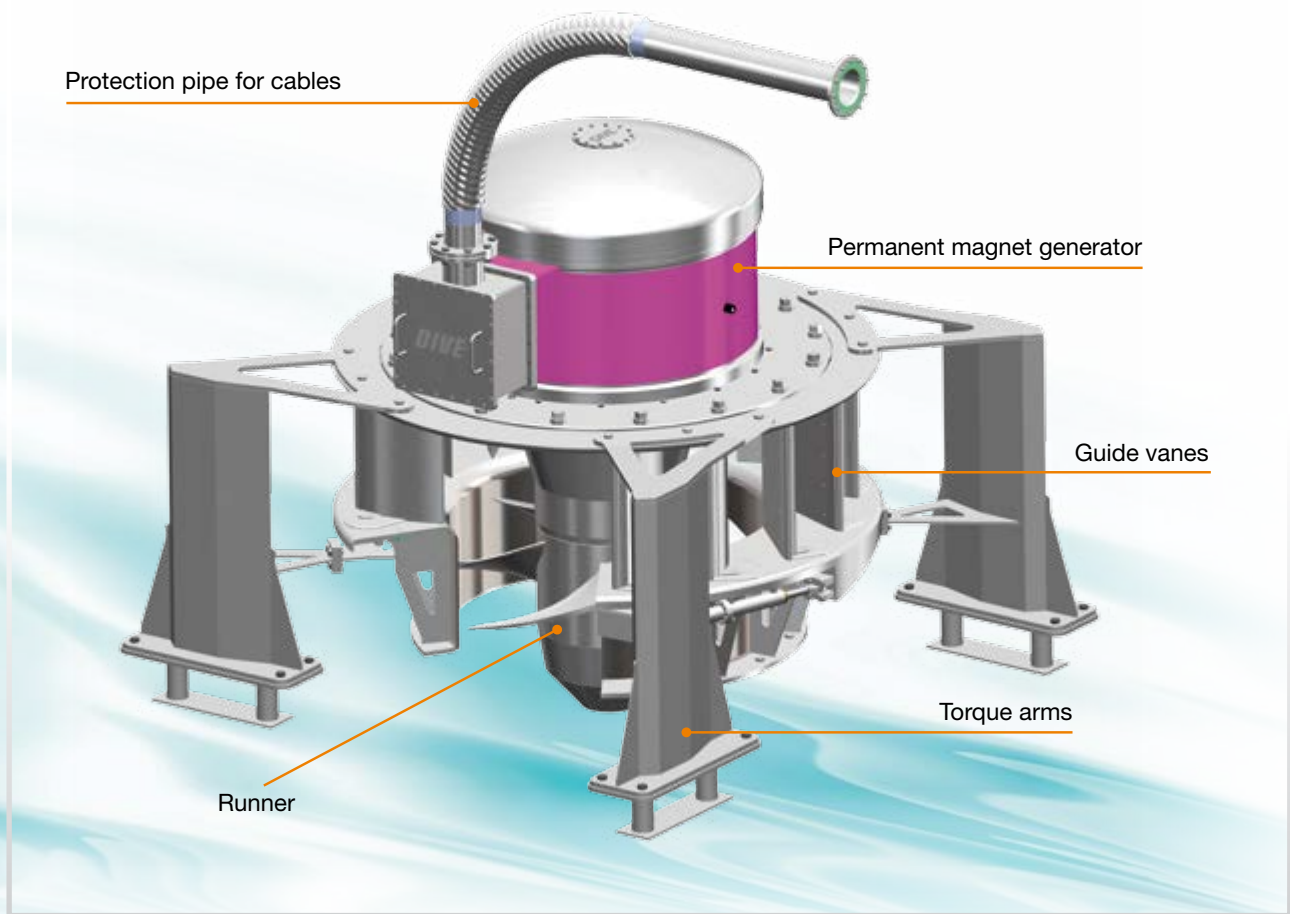
# DIVE-TURBINE

compact – efficient – reliable

Milestones	
2006	Commissioning DIVE-Turbine prototype
2007	First customer order from Austria
2011	DIVE-Turbine in Chile
2012	First DIVE-Turbine in a pressure chamber
2014	Three DIVE-Turbines in the megawatt category
2015	DIVE-Turbine in Croatia
2015	34 DIVE-Turbines in 7 countries

Turbine parameters	
Nominal power	30 kW - 2000 kW
Head	2,00 m - 25,00 m
Discharge	0,60 m³/s - 40,00 m³/s
Runner diameter	0,50 m - 3,00 m
Diameter incl. guide vanes	1,00 m - 5,50 m
Height incl. generator	0,80 m - 4,00 m
Weight incl. generator	1,20 t - 30,00 t

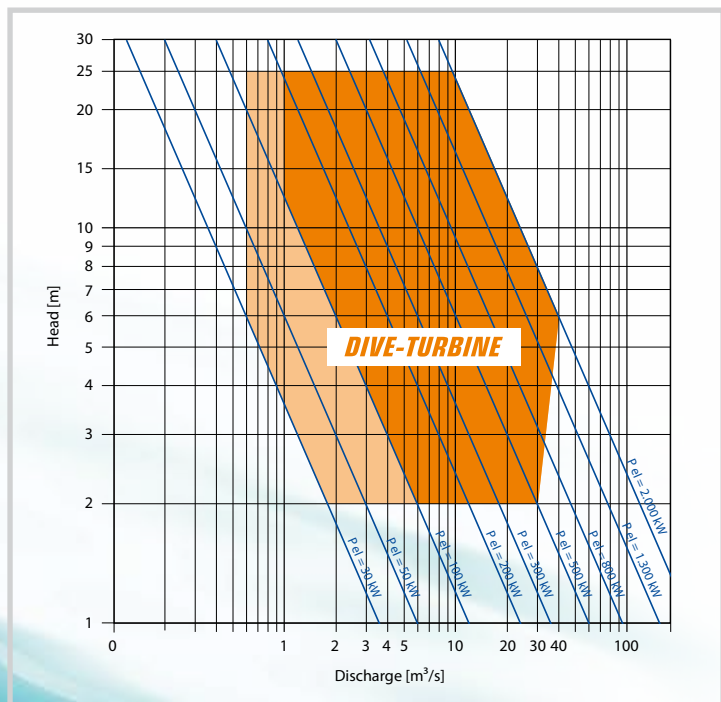




Characteristics	Technical benefits	Benefits for operator and owner
Compact turbine and generator unit completely submerged	<ul style="list-style-type: none"> <li>+ No turbine house required</li> <li>+ Minimum cost of civil works</li> <li>+ Save operation in flood-areas</li> </ul>	Reduced investment
Direct-drive, free of mechanical transmission	<ul style="list-style-type: none"> <li>+ Minimum noise and vibration</li> <li>+ Free from maintenance and free from wear and tear</li> <li>+ No gearbox or belt-drive losses</li> </ul>	Hydropower in residential areas
Single bearing unit for turbine and generator	<ul style="list-style-type: none"> <li>+ Permanent lubrication of bearing unit in oil bath</li> <li>+ Leakage of lubricants (oil) impossible</li> <li>+ No danger in cases of runaway speed and grid interruption</li> </ul>	Minimum operational cost and risk
Wear and tear free sealing system	<ul style="list-style-type: none"> <li>+ No necessity of a costly sealing system</li> <li>+ Free from maintenance and free from wear and tear</li> <li>+ Save operation in saline and dirty water</li> </ul>	Maximum technical availability and no risk at flood situations
Fixed runner blades	<ul style="list-style-type: none"> <li>+ No maintenance and wear-intense pitching of the runner</li> <li>+ Runner design optimized for max. efficiency</li> <li>+ Zero-gap and fish friendly runner</li> </ul>	Better chance of gaining approval due to a fish friendly power plant
Double regulation by variation of speed and pitching of the guide vanes	<ul style="list-style-type: none"> <li>+ High efficiency at part-load (reduced flow)</li> <li>+ Fish friendly hydropower plant operation</li> <li>+ Discharge from 10% to 100%</li> </ul>	High annual revenue
Components in contact with water made of stainless steel	<ul style="list-style-type: none"> <li>+ High resistance against wear and corrosion</li> </ul>	High durability of the main components (e.g. runner and guide vanes)

## Applications

- New hydropower plants
- Reactivation of existing hydropower plants
- Modernization and repowering of existing hydropower plants
- Integration into:
  - + existing weir structures (residual / ecological flow)
  - + existing buildings
  - + irrigation channels
  - + thermal units
  - + cooling circuits
- Fish friendly hydropower plants, e.g. shaft power plants
- Hydropower plants with open channel or pressure pipe



## Modernization

Hydropower plant Tegnsee  
Commissioning 2011



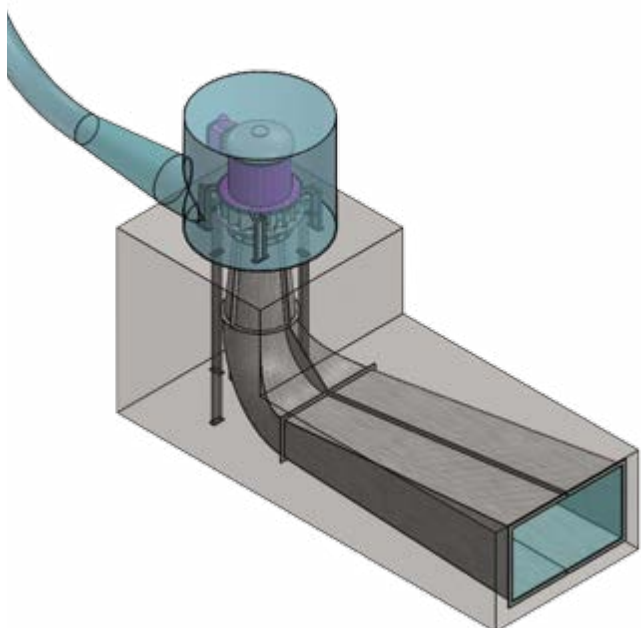
Before modernization



After modernization

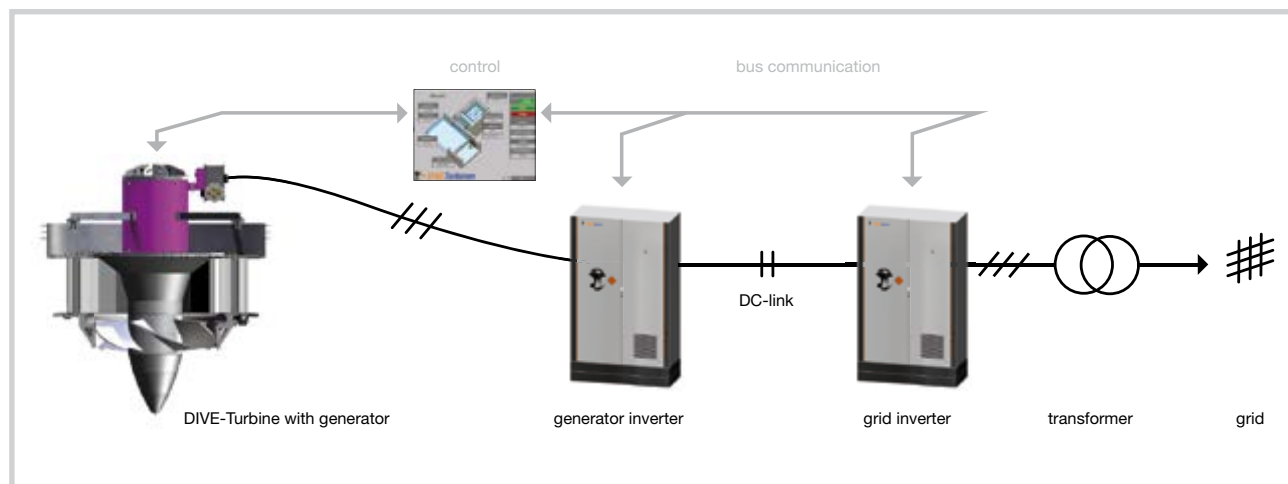
## Installation example pressure pipe

Hydropower plant Dabrova (Croatia)  
Commissioning 2016





Characteristics	Benefits
Speed variable operation with frequency converters (for power plants with only one turbine and / or variable discharge)	<ul style="list-style-type: none"> <li>+ Dynamic adaptation to the specifications of grid-operators from <math>\cos \varphi</math> 0,85 to <math>\cos \varphi</math> 1</li> <li>+ Feed-in according to the country specific grid code</li> <li>+ Optimized power plant operation</li> <li>+ High efficiency at the whole range of operation</li> </ul>
Fixed speed operation with direct grid connection (for power plants with multiple turbines and / or constant discharge)	<ul style="list-style-type: none"> <li>+ Maximum output at 80-100% discharge</li> <li>+ Very robust solution</li> <li>+ Cost optimization</li> </ul>
Customized coding of control system	<ul style="list-style-type: none"> <li>+ User-friendly operation</li> <li>+ Support of commissioning on site</li> </ul>
Fully automatic operation	<ul style="list-style-type: none"> <li>+ Support of the power plant operation via remote control and remote service</li> <li>+ Minimum operating expense</li> </ul>



## Flexible layout of control cabinets

Location of control cabinets independent of turbine's location, e.g. flood-proof



## No turbine house required

Small space requirement - only for auxiliary equipment e.g. control cabinet and hydraulic unit



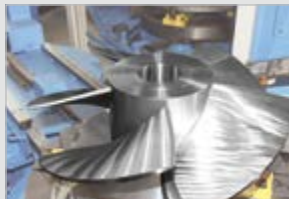
## Intuitive user interface

User interface in many languages incl. data storage

## Scope and service



Engineering and design



Manufacturing



Assembly and quality control



Shipment and transport



Installation



Commissioning

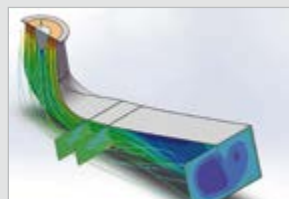
## Optional services



Consulting during permission process



Funding concepts



Flow simulation and hydraulic optimization



Power plant design



Fish friendly power plants



Extension of warranty and service up to 20 years



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