ANDRITZ HYDRO

Company Presentation

Romania Hydro Power Energy Summit, February 12th, 2015

Edwin Walch

The ANDRITZ-GROUP

Overview

GLOBAL PRESENCE

250 production sites and service/sales companies worldwide

HEADQUARTERS

Graz, Austria

EMPLOYEES

24,468 (as of September 30, 2014)

KEY FINANCIAL FIGURES 2013

>> Order intake: 5,611 MEUR*

>> Sales: 5,711 MEUR

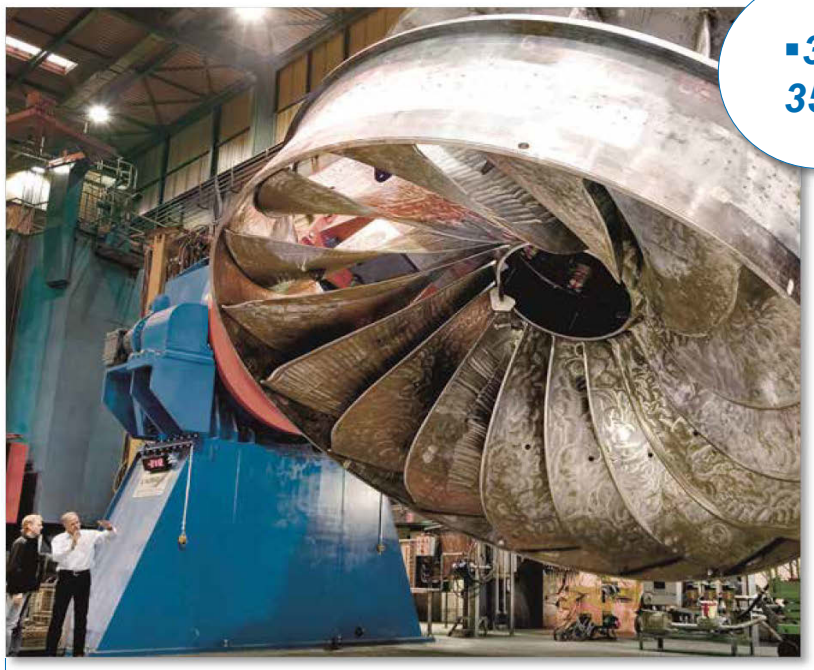
>> Net income: 53 MEUR

>> Equity ratio: approx. 17%

*** MEUR = million euro**

A world market leader in most business areas

HYDRO and PULP & PAPER as well as …



▪ 30-35%*

* Average share of ANDRITZ GROUP's total order intake

▪ 30-35%*

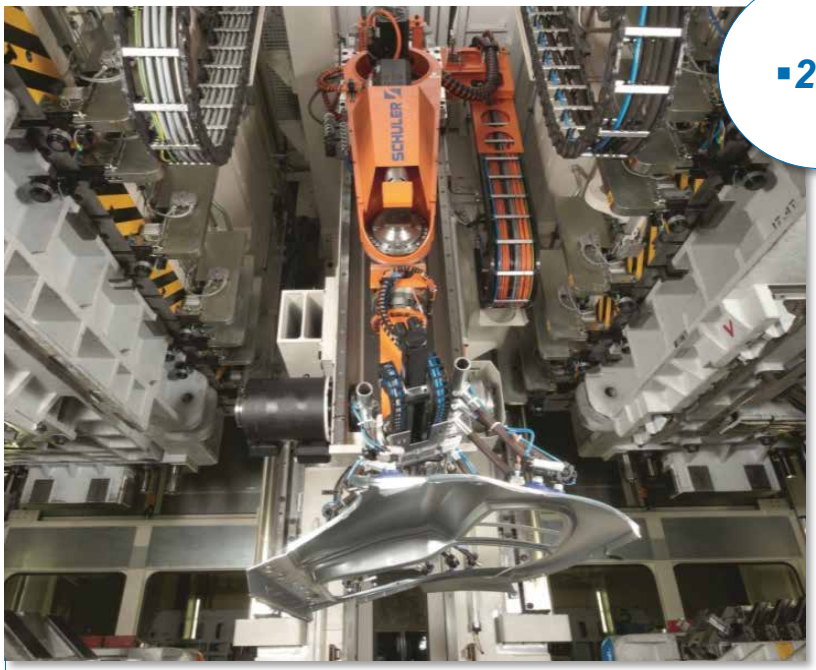
HYDRO

>> Electromechanical equipment for hydro-power plants (especially turbines and generators)
>> Pumps (e.g. for water transport and irrigation)
>> Turbogenerators for thermal power stations

PULP & PAPER

>> Equipment for production of all types of pulp, paper, tissue, and board
>> Energy boilers
>> Production equipment for biofuel (2nd generation), nonwovens, and plastic films

… METALS and SEPARATION



▪ 25%*

▪ 10%*

* Average share of ANDRITZ GROUP's total order intake

METALS

>> Presses for metal forming

>> Systems for production and processing of stainless steel, carbon steel, and non-ferrous metal strip

>> Industrial furnace plants

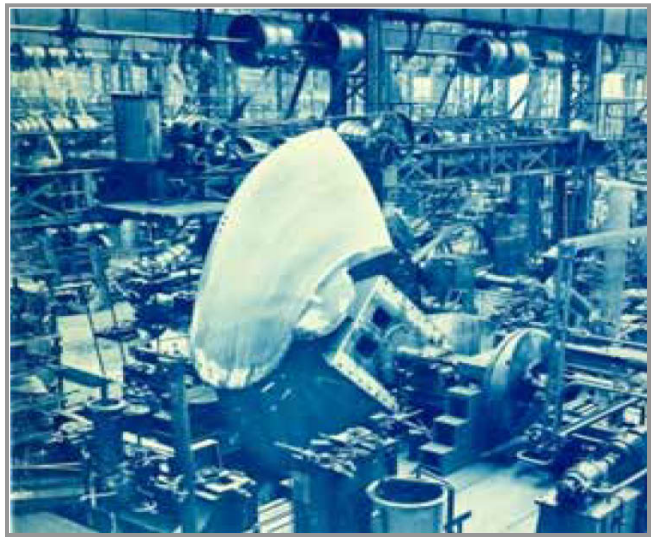
SEPARATION

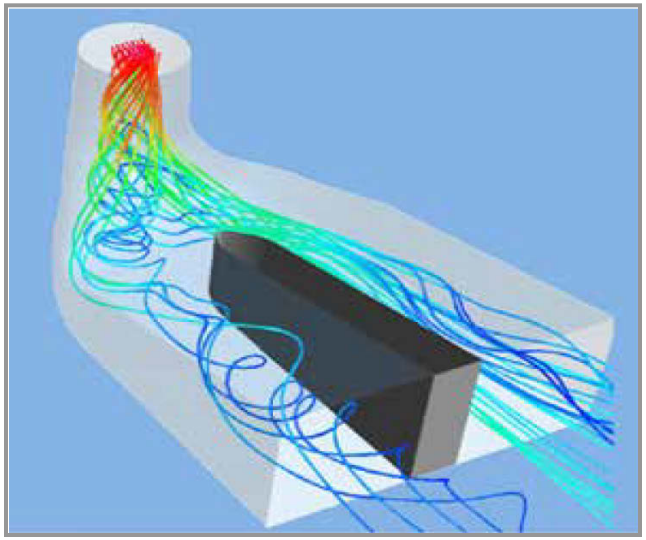
>> Equipment for solid/liquid separation for municipalities (waste water treatment) and various industries

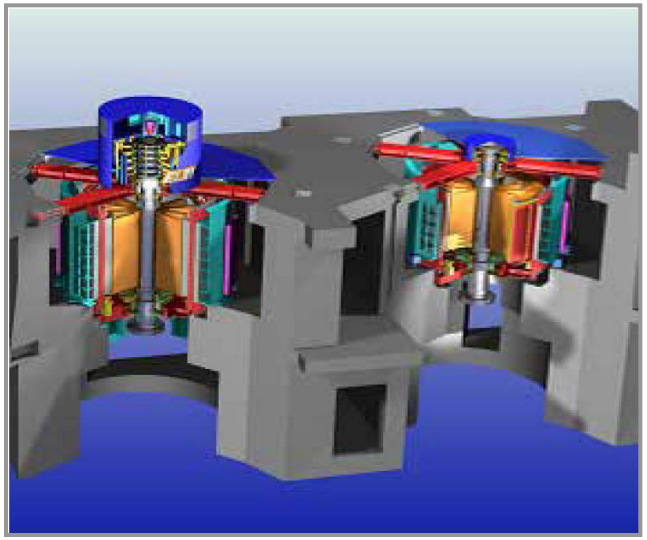
>> Systems and equipment for production of animal feed and biomass pellets

ANDRITZ HYDRO

Our Experience

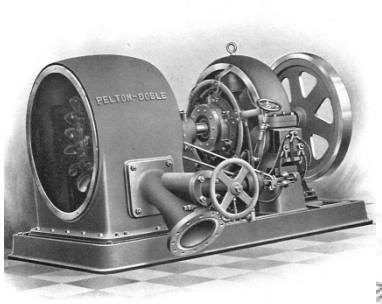




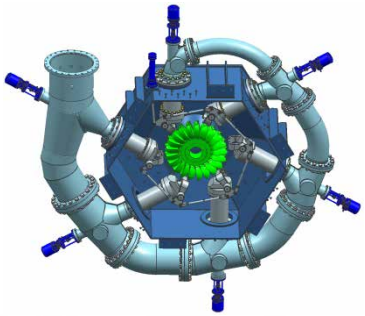


- More than 170 years of turbine experience
- Over 30,000 turbines (more than 420,000 MW) installed
- Over 120 years of experience in electrical equipment
- Complete range up to more than 800 MW
- Leading in service & rehabilitation
- World leader for Compact Hydro

Our History



More than 170 years of experience and knowledge in the field of hydropower generation



Charmilles

Pelton Water Wheel

VOEST

Baldwin-Lima-Hamilton

Hydro Vevey

VOEST MCE

VA TECH HYDRO

J.P. Morris

Bouvier

Precision Machines

Waplans

Ateliers de Constructions Mécaniques de Vevey (ACMV)

Andritz VA TECH HYDRO

SAT

Hemi Controls

Andritz

ELIN

GE HYDRO inepar

Bell

GE HYDRO

Pichlerwerke

Sulzer Hydro

Møller

Escher Wyss

C.E.G.B.

KVAERNER

English Electric

Boving

Tampella

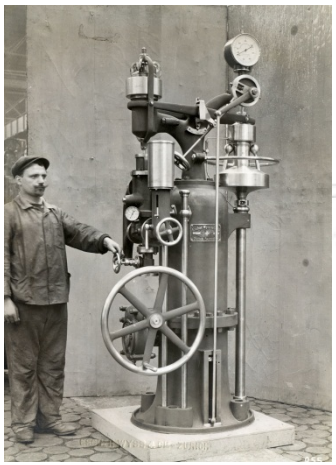
KMW

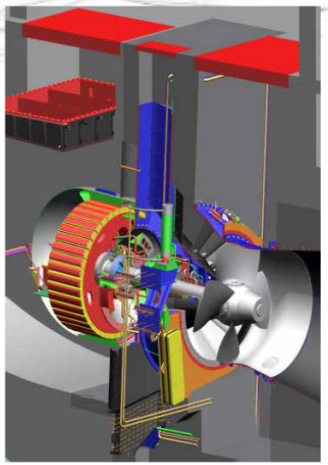
KAMEWA

NOHAB

Dominion Engineering

Finnshyttan





ANDRITZ HYDRO

Organization

ANDRITZ HYDRO					
Central Functions	Large Hydro	Compact Hydro	Service & Rehab	Pumps	Generator Turbo
					
					
					

Research & Development

Model Testing

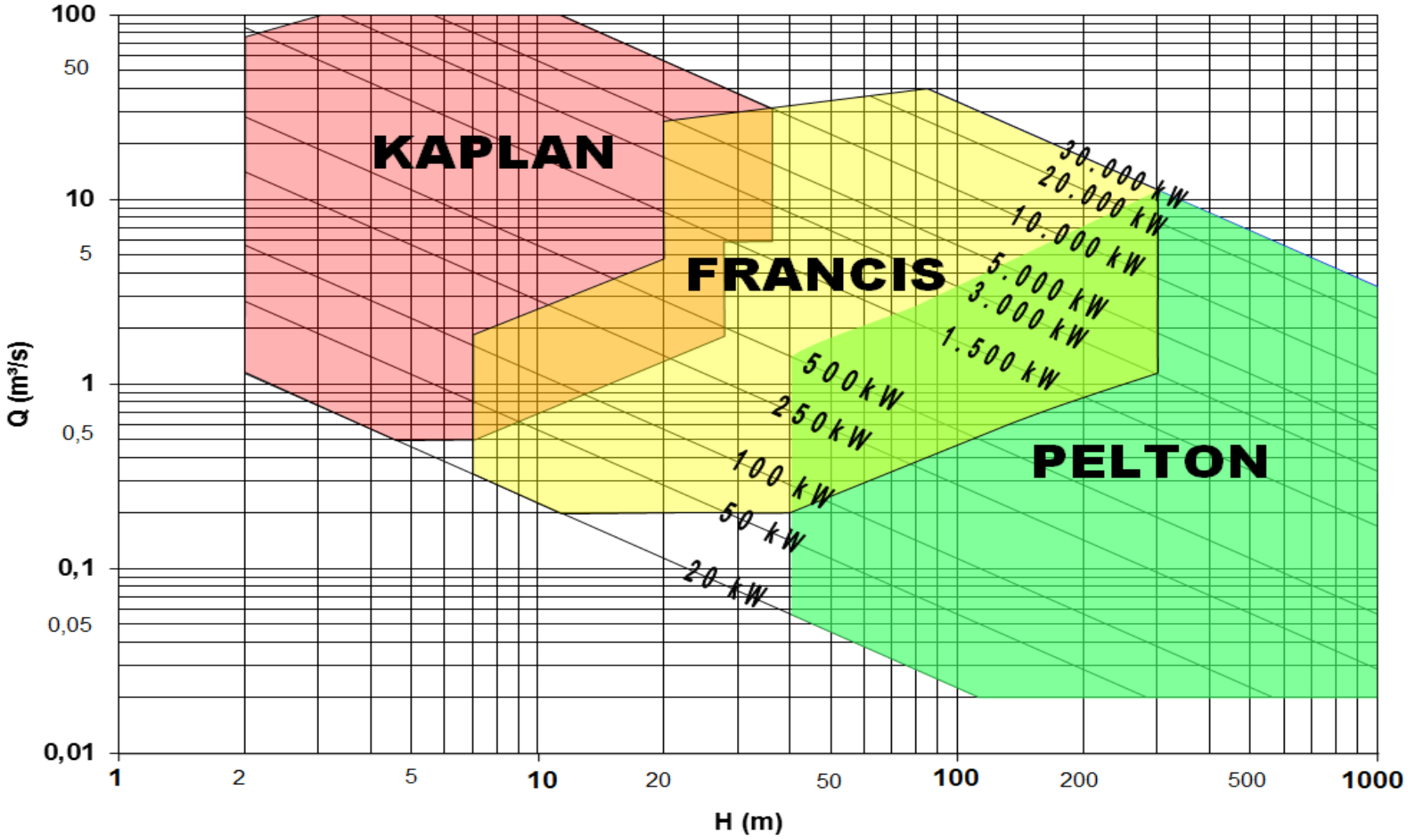
- **Main objectives of turbine model testing:**

- Measurements of hydraulic data (efficiency, discharge, output, cavitation)
- Computer aided tendering
- Determination of hydraulic torques and forces (runner blades and wicket gates, axial/radial thrust)
- Investigation of performance (draft tube surges, aeration tests)
- Feed back to flow analysis (Laser - Doppler anemometry)

Compact Hydro

▪Compact Hydro

Application Range



ANDRITZ Hydro

▪Compact Hydro
Application range

- The range of products and services is developed from low to high head applications and covers a head ranging from 2 up to 1,000 meters with a unit output up to 10 MW for Axial and up to 30 MW for Francis and Pelton.
- The range of products includes in addition to the turbine itself, all or part of the electromechanical equipment within the powerhouse such as generator, inlet valve, governor, controls, switchgear, transformer.

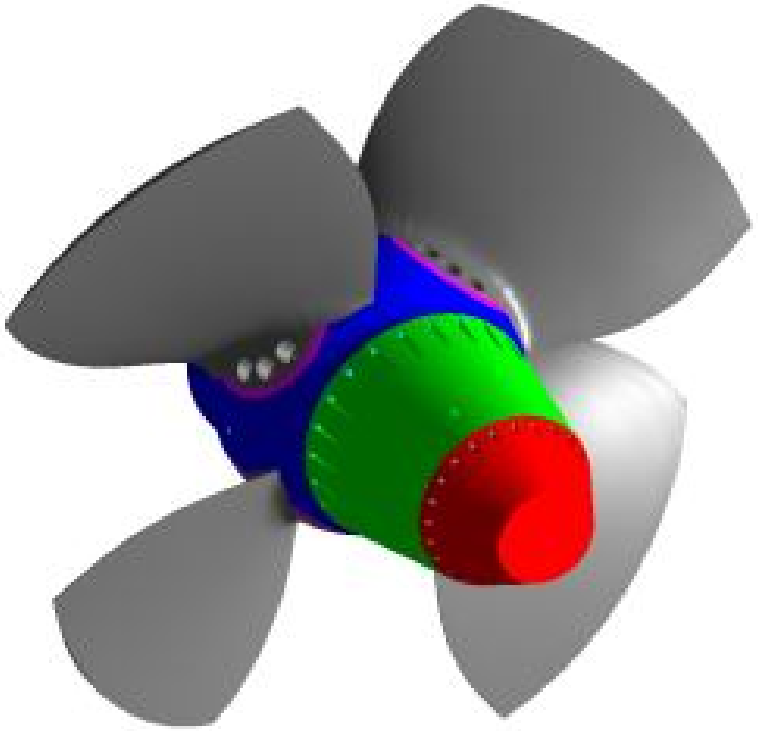
Head:	H ≤ 35 m
Output:	P ≤ 10 MW

Head:	H ≤ 300 m
Output:	P ≤ 30 MW

Head:	H ≤ 1,000 m
Output:	P ≤ 30 MW

▪COMPACT HYDRO

▪Axial Turbines

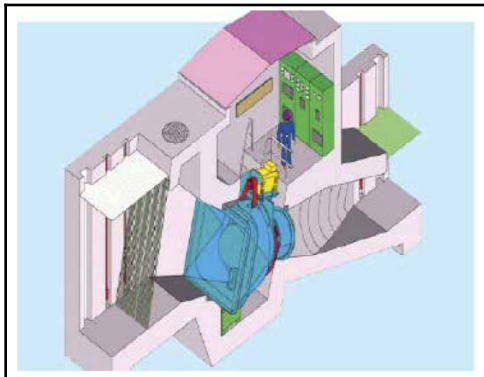


Head:	**H ≤ 35 m**
Output:	**P ≤ 10 MW**

- **Horizontal, vertical and inclined shaft**
- **3 - 6 blades**
- **Model tested runners in ANDRITZ laboratories**
- **Single or double regulation**
- **Direct coupled generators or with speed increasers enabling high speed generators**
- **Various configurations to fit the site conditions (Belt- or Bevel Gear Bulb, PIT-Type, Compact Bulb, EcoBulb™, vertical Kaplan, S-Type and CAT-Turbines)**
- **Simplified interface with concrete structure**
- **Compact power house arrangement**

COMPACT HYDRO

Turbine Types for Low Head Applications

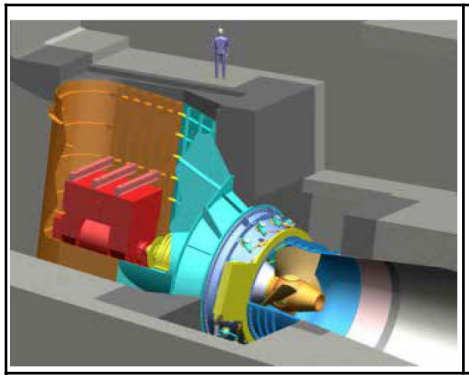


Head : up to **5 m**

Discharge : up to **25 m³/s**

Output: up to **0.6 MW**

BELT DRIVEN BULB TURBINE

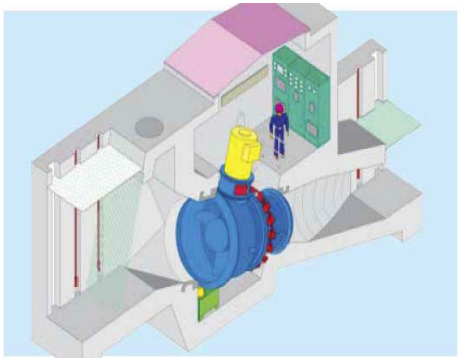


Head : up to **12 m**

Discharge: up to **100 m³/s**

Output: up to **10 MW**

COMPACT PIT

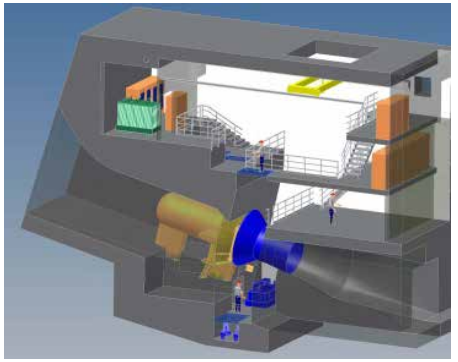


Head : up to **12 m**

Discharge: up to **45 m³/s**

Output: up to **2.6 MW**

BEVEL GEAR BULB TURBINE



Head: up to **18 m**

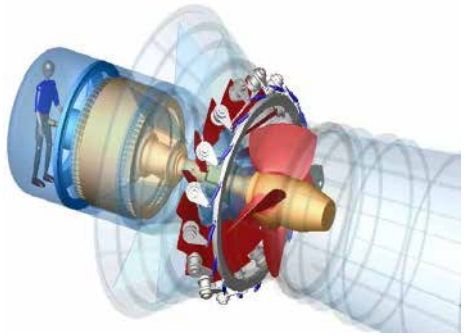
Discharge: up to **100 m³/s**

Output: up to **10 MW**

COMPACT BULB

COMPACT HYDRO

Turbine Types for Low Head Applications

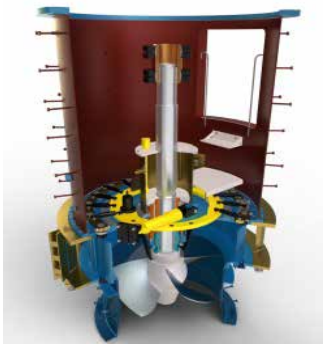


Head : up to **20 m**

Discharge : up to **100 m³/s**

Output: up to **5,0 MW**

ECO BULB TURBINE

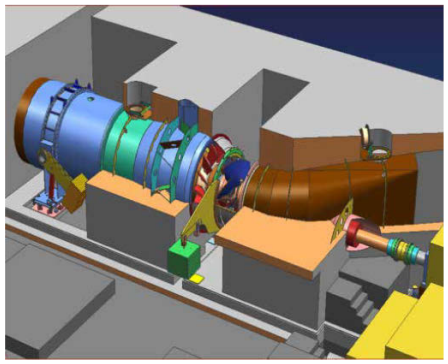


Head : up to **18 m**

Discharge: up to **80 m³/s**

Output: up to **10 MW**

VERTIKAL KAPLAN TURBINE

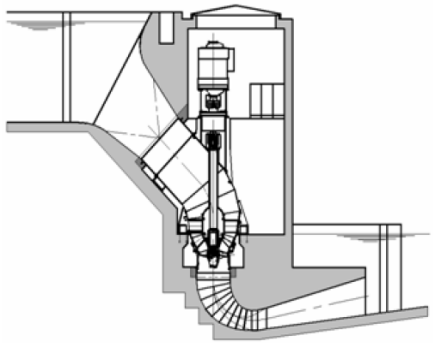


Head : up to **35 m**

Discharge: up to **80 m³/s**

Output: up to **10 MW**

S-TYPE TURBINE



Head: up to **35 m**

Discharge: up to **80 m³/s**

Output: up to **10 MW**

COMPACT AXIAL TURBINE

▪COMPACT HYDRO

Project – Steinbach / Austria

2 Compact Belt driven Bulb Turbines

Runner diameter: 1,950 mm

Head: 2.60 m

Output: 600 kW

▪COMPACT HYDRO

Project – Yeoju / South Korea

3 Compact Bevel Gear Bulb Turbines

Runner diameter: 2,600 mm

Head: 4.70 m

Output: 1,900 kW

▪

▪COMPACT HYDRO

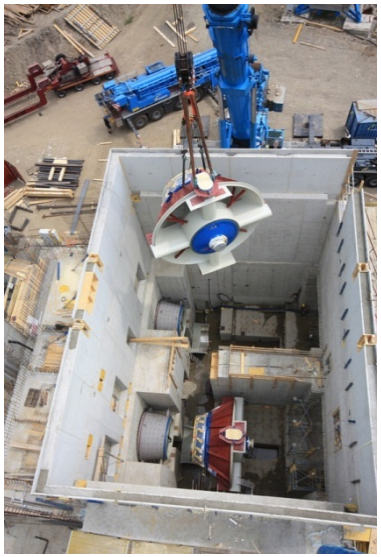
Project – Niklasdorf/ Austria

2 Compact Bulb Turbines

Runner diameter: 2,600 mm

Head: 4.65 m

Output: 2,200 kW



▪COMPACT HYDRO

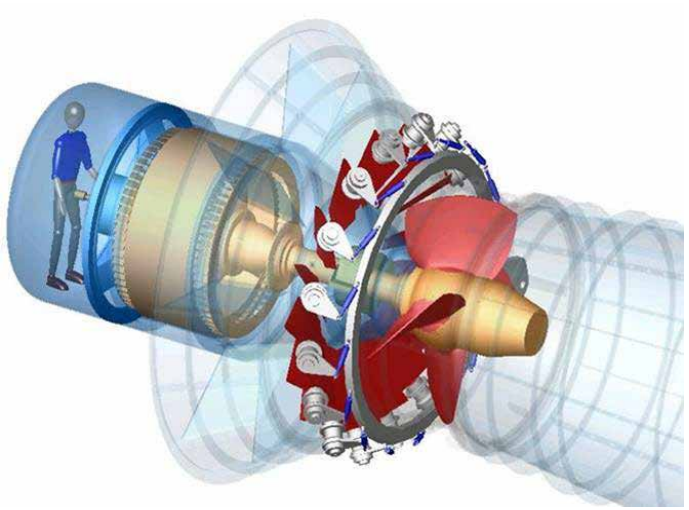
Project – Sonoco / Italy

2 Compact ECO-Bulb Turbines

Runner diameter: 2,600 mm

Head: 3.40 m

Output: 1,190 kW



▪COMPACT HYDRO

Project – Keselstrasse / Germany

2 Compact vertical Kaplan Turbines

Runner diameter: 2,350 mm

Head: 5.20 m

Output: 1,550 kW

▪COMPACT HYDRO

Project – Dafnosonara / Greece

2 Compact S-Type Turbines

Runner diameter: 2,600 mm

Head: 15.60 m

Output: 5,600 kW

COMPACT HYDRO

Project – Kashimbila / Nigeria

- **4 Compact vertical Axial Turbines**

Runner diameter: 2,850 mm

- **Head: 17.7 m**
- **Output: 10,400 kW**

▪COMPACT HYDRO

▪Francis Turbines

Head:	**H ≤ 300 m**
Output:	**P ≤ 30 MW**

- **Horizontal shaft**
- **Vertical shaft**
- **Model tested runners in ANDRITZ laboratories**
- **Compact power house arrangement**
- **Short installation time**

COMPACT HYDRO

Project – Stave / Canada

- **3 Compact horizontal Francis Turbines**

Runner diameter: 1,250 mm

- **Head: 95.1 m**
- **Output: 10,400 kW**

COMPACT HYDRO

Project – Arroibar / Spain

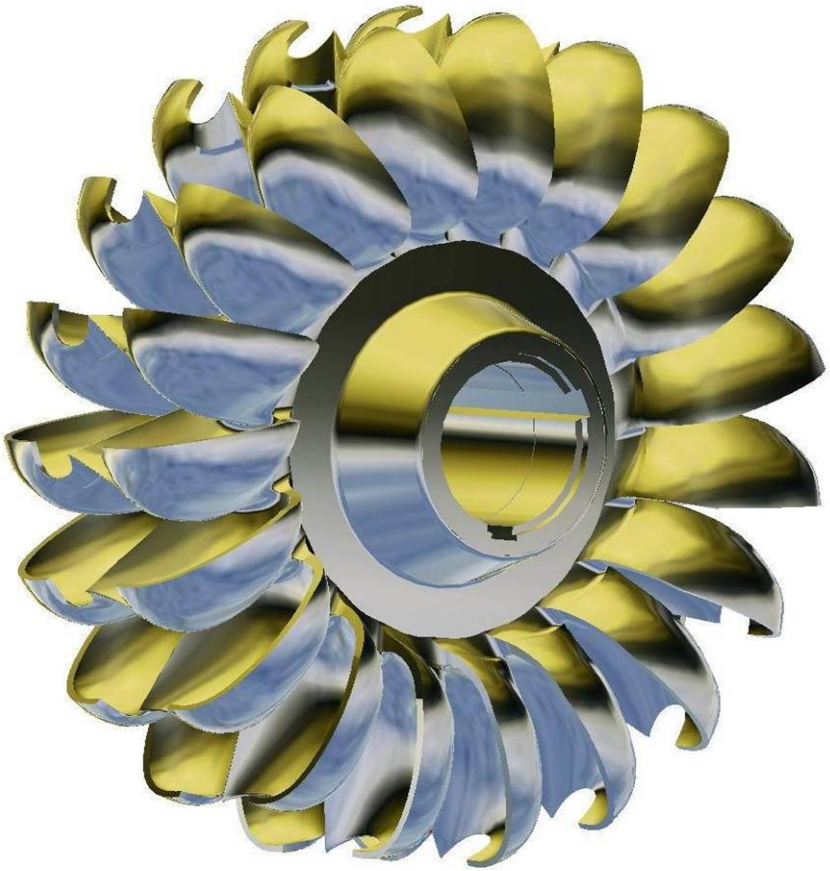
- **1 Compact vertical Francis Turbine**

Runner diameter: 1,180 mm

- **Head: 87.3 m**
- **Output: 7,850 kW**

▪COMPACT HYDRO

▪Pelton Turbines



Head:	**H ≤ 1,000 m**
Output:	**P ≤ 30 MW**

- **Horizontal shaft: 1 - 3 jets**
- **Vertical shaft: 2 - 6 jets**
- **Model tested runners in ANDRITZ laboratories**
- **High efficiencies at part load**
- **Low overpressure in the penstock**
- **Compact power house arrangement**
- **Short installation time**

COMPACT HYDRO

Project – Cobasel / Romania

- **1 Compact vertical 4 nozzles Pelton Turbine**

Runner diameter: 760 mm

- **Head: 87.5 m**
- **Output: 580 kW**

COMPACT HYDRO

Project – Wöllbach/ Austria

- **1 Compact 3 nozzles horizontal Pelton Turbine**

Runner diameter: 590 mm

- **Head: 219,5 m**
- **Output: 280 kW**

COMPACT HYDRO
Project – Las Truchas / Mexico

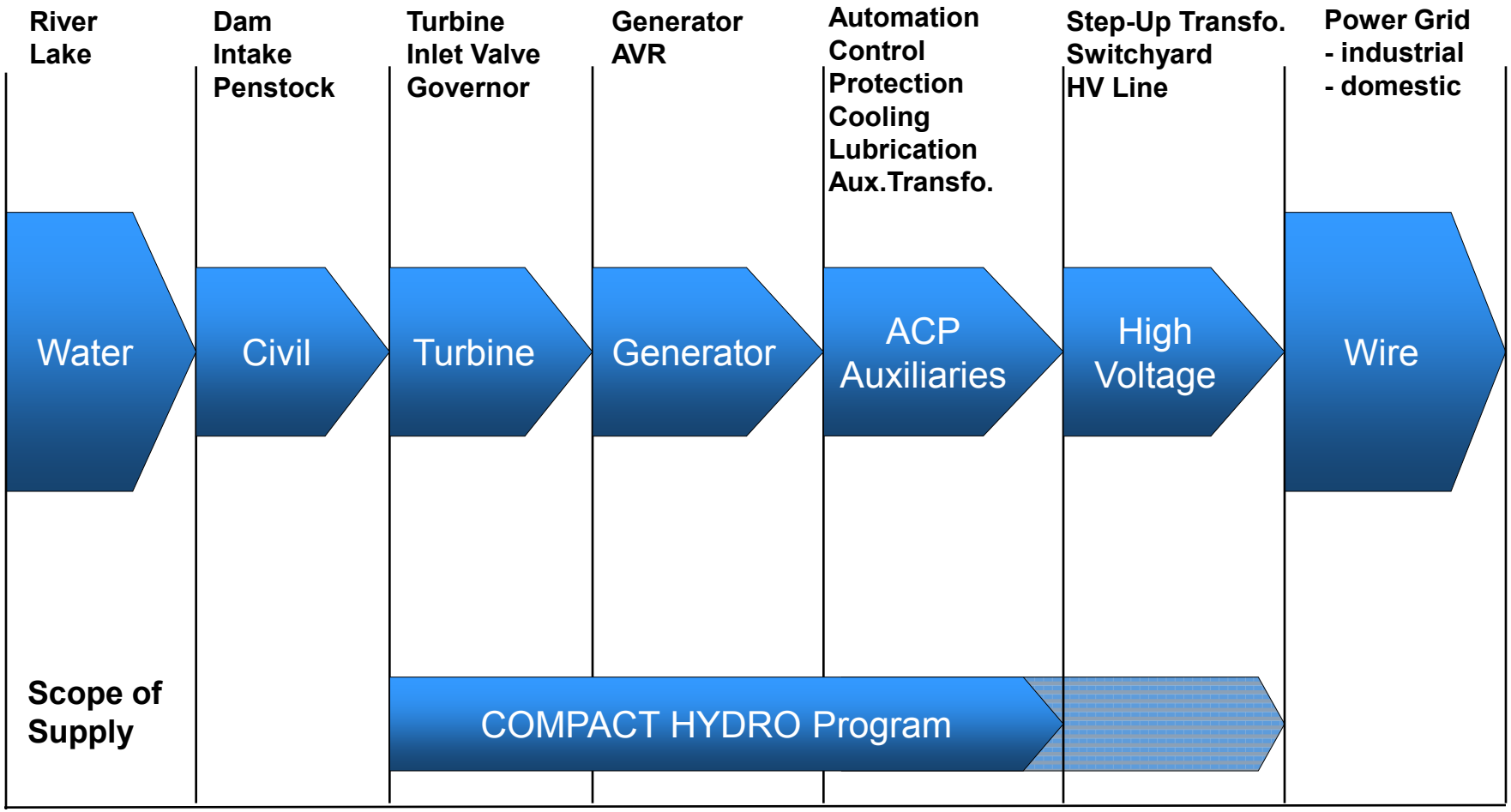
2 Compact 2 nozzles horizontal Pelton Turbine

Runner diameter: 1,260 mm

- **Head: 768.0 m**
- **Output: 7,200 kW**

Compact Hydro

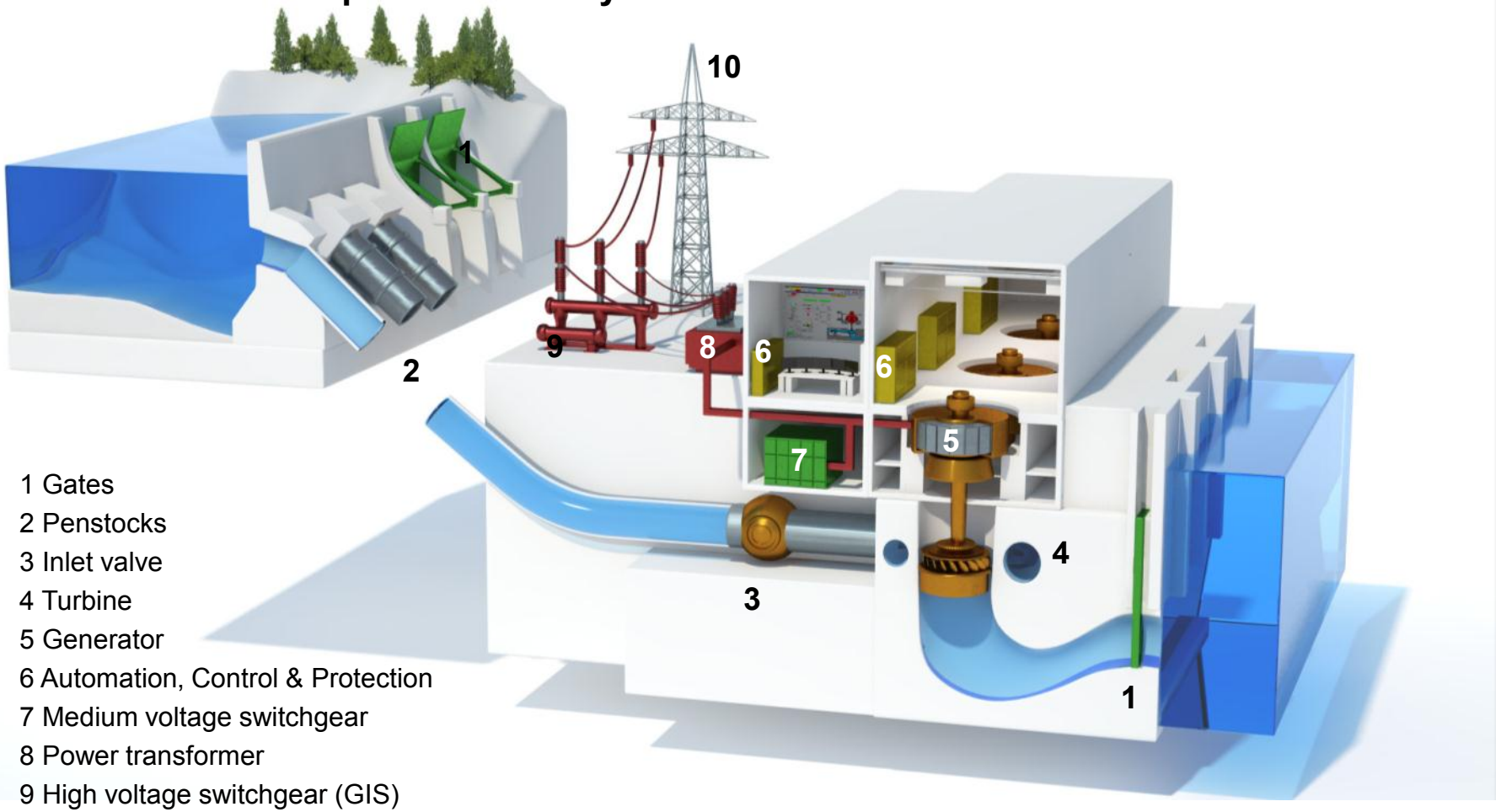
“Water to Wire” (W2W) Concept



ANDRITZ Hydro

From Water to Wire

Extensive know-how of products and systems - “From Water to Wire” within ANDRITZ HYDRO



1 Gates
2 Penstocks
3 Inlet valve
4 Turbine
5 Generator
6 Automation, Control & Protection
7 Medium voltage switchgear
8 Power transformer
9 High voltage switchgear (GIS)
10 Transmission line

Quality

All operational Divisions and Subsidiaries are certified according to the Standards ISO 9001, ISO 14001 and OHSAS 18001.

Quality one can rely on!

COMPACT HYDRO

Summary

Compact Hydro stands for:

- Complete line of turbine and electrical equipment up to 30 MW unit output
- Modular equipment design
- Low environmental impact
- Short period of project implementation
- Low investment cost and risk due to proven design concept

Compact Hydro

More than 10,000 units of Compact Hydro power plants supplied

Every week another three Compact Hydro units start operation


ANDRITZ HYDRO
Your partner for renewable and clean energy