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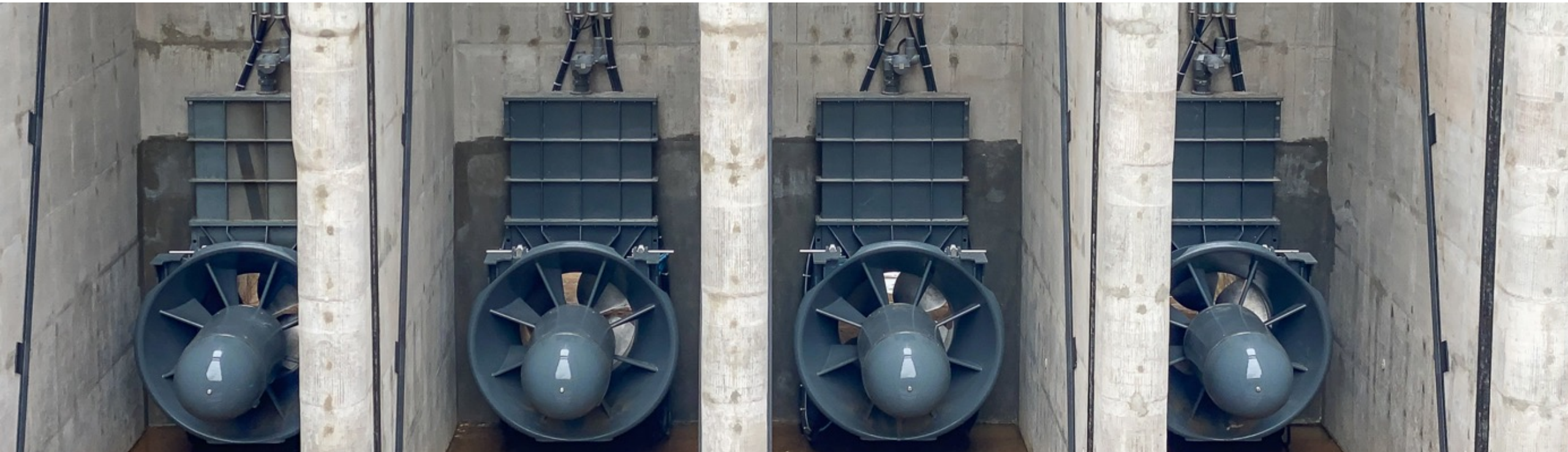
For low head hydropower stations
StreamDiver

Hydromatters 2022 | Padova, Italy I Michael Wippel | 20 September 2022



StreamDiver
Development Milestones

Start of development in cooperation with Verbund	First commercial contract in Europe	Contracts in Europe, North and South America (12 Units)			Contracts in Europe, South America and Asia (14 Units)		Contracts in North and South America (20 Units)	
		Development of optimized hydraulics Implementation of new materials Introduction of underwater plugs and LARS system			Development of new machine sizes and optimization of storage and sensors		Development of the StreamDiver product family and development of fish protection and sediment management concepts	
2011	2014	2015	2016	2017	2018	2019	2020	2021

StreamDiver
Development Principles

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KISS Principle

Keep it super simple

No oil-lubricated bearings

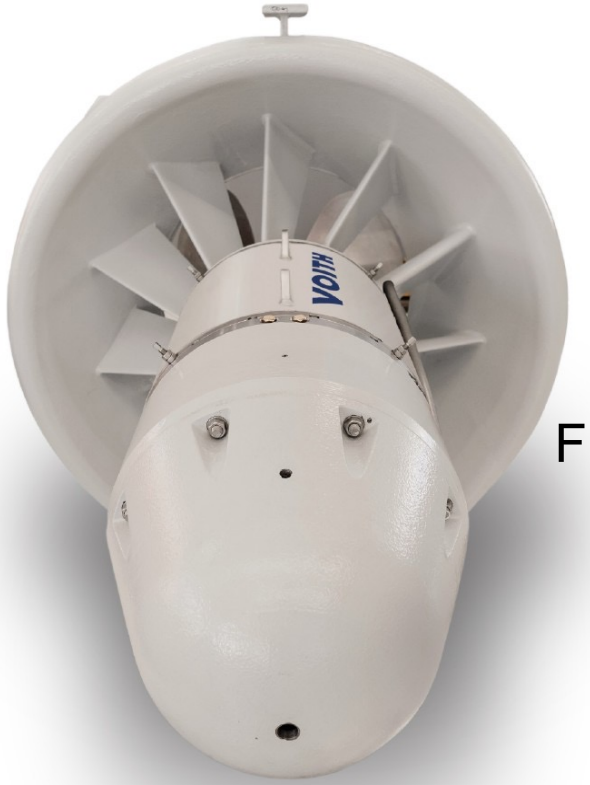
No shaft sealing

No cooling or drainage system

No oil hydraulics

No gear

No excitation system



Risk minimization

Avoidance of environmental risks

No risk of water pollution

Lowest possible visual impact

Fish protection and sediment management concepts in place

No impact from oil or grease

High quality = long service life

StreamDiver

Optimization of return through design principles

CAPEX

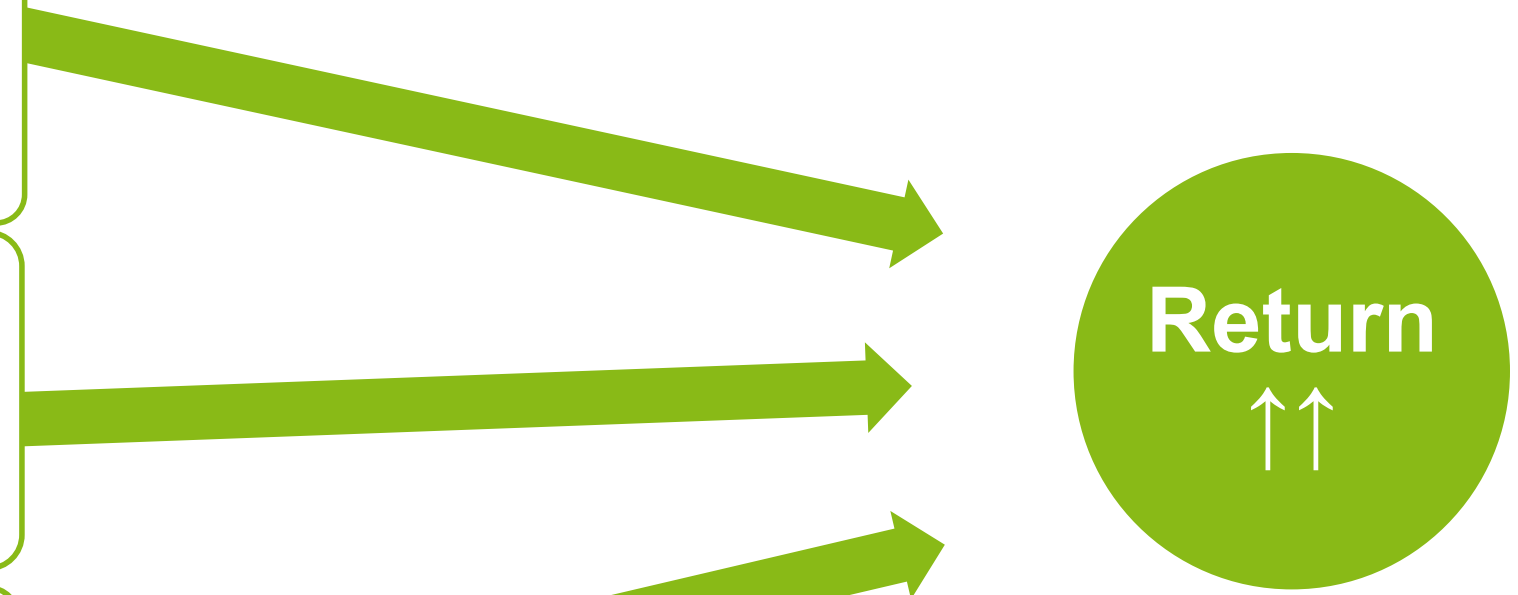
- Equipment costs ↓
- Civil costs ↓↓
- Installation costs ↓↓

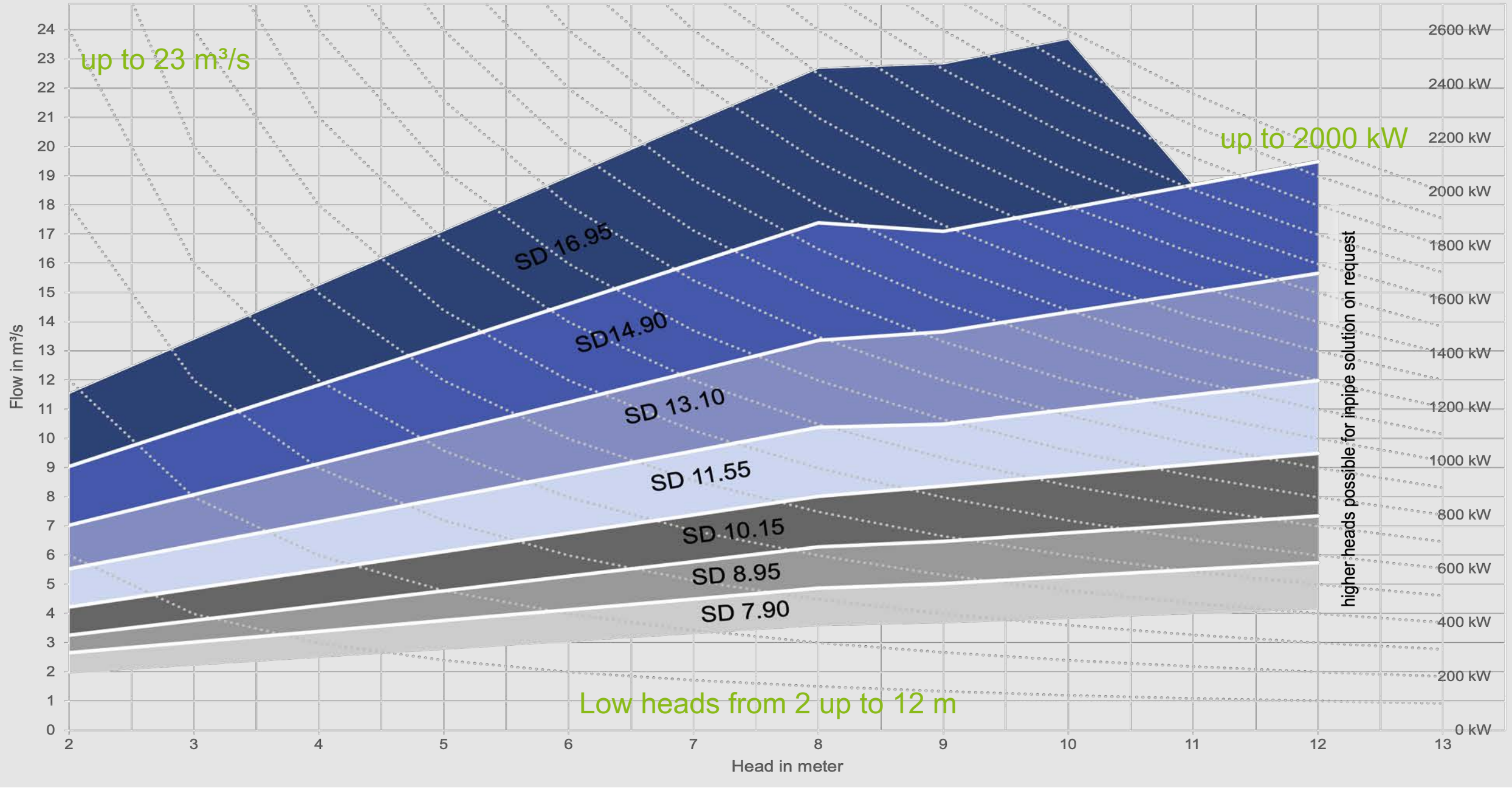
OPEX

- Maintenance intervals ↓
- Complexity ↓↓
- Downtime costs ↓↓
- Spare Parts ↓↓

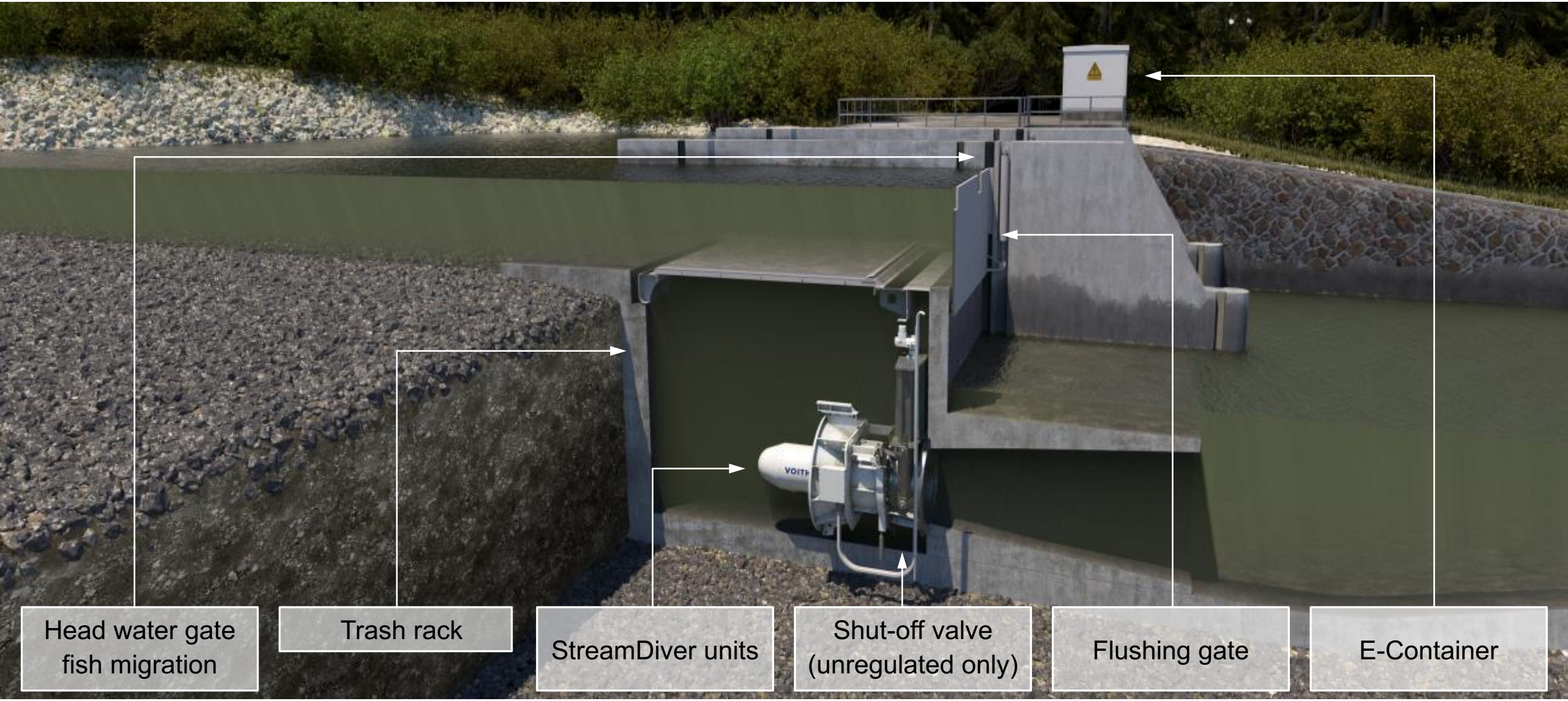
RISKS

- Downtime costs ↓↓
- Environmental risks ↓↓
- Interface risks ↓↓

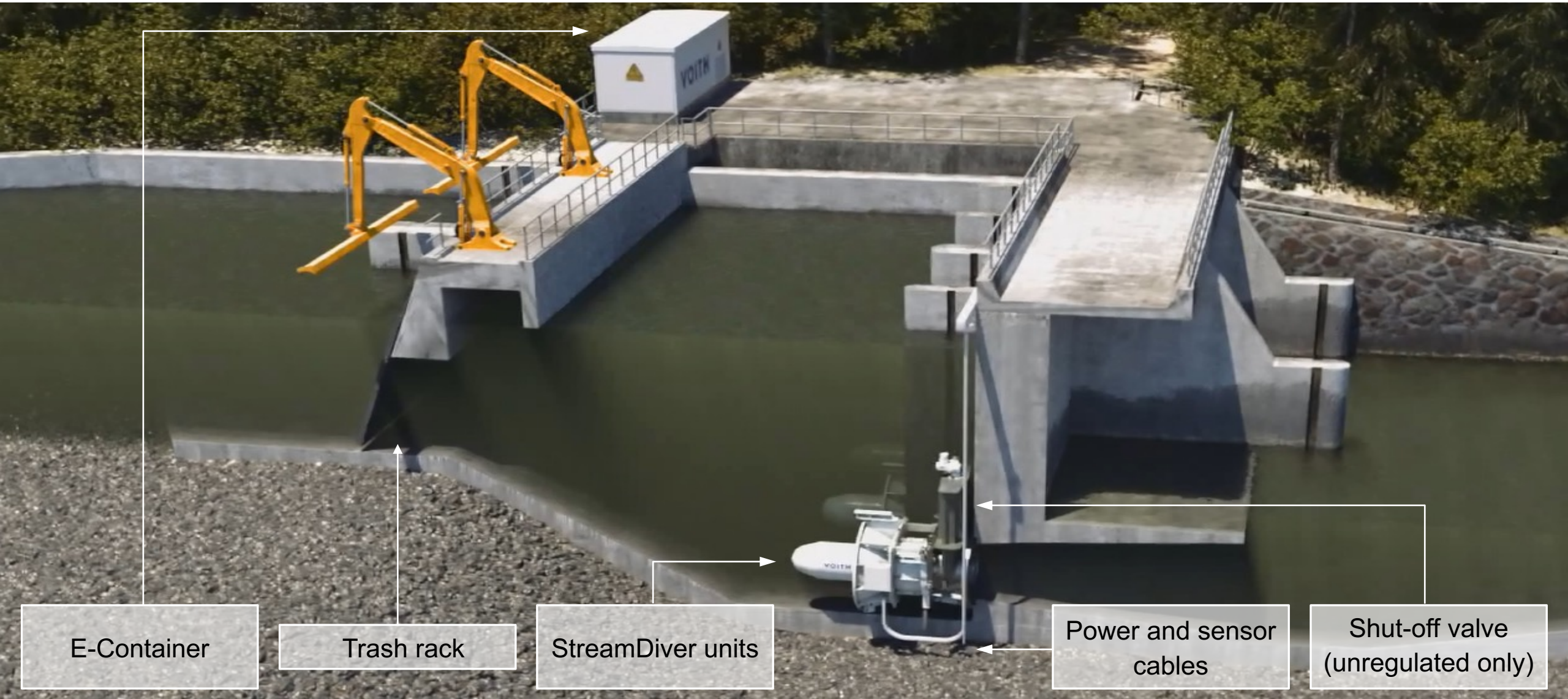



up to 23 m³/s
up to 2000 kW
SD 16.95
SD14.90
SD 13.10
SD 11.55
SD 10.15
SD 8.95
SD 7.90
Low heads from 2 up to 12 m
higher heads possible for inpipe solution on request
Flow in m³/s
Head in meter
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
2
3
4
5
6
7
8
9
10
11
12
13
0 kW
200 kW
400 kW
600 kW
800 kW
1000 kW
1200 kW
1400 kW
1600 kW
1800 kW
2000 kW
2200 kW
2400 kW
2600 kW

Overflowed shaft power station (“box-type”)
Regulated and unregulated / vertical and horizontal

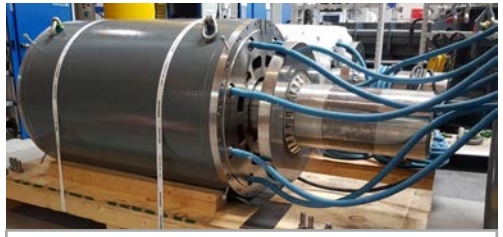


Standard: Diversion-type power station
Regulated and unregulated type



StreamDiver
Less components – higher reliability

Glass-reinforced plastic Bulb nose
- Light weight – easy to handle
- No corrosion possible

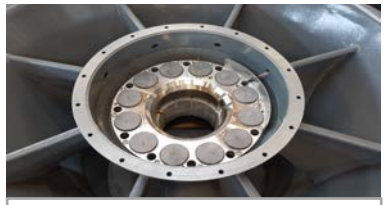


Permanent Magnet Generator
- Stainless shaft and shields
- Water flooded generator

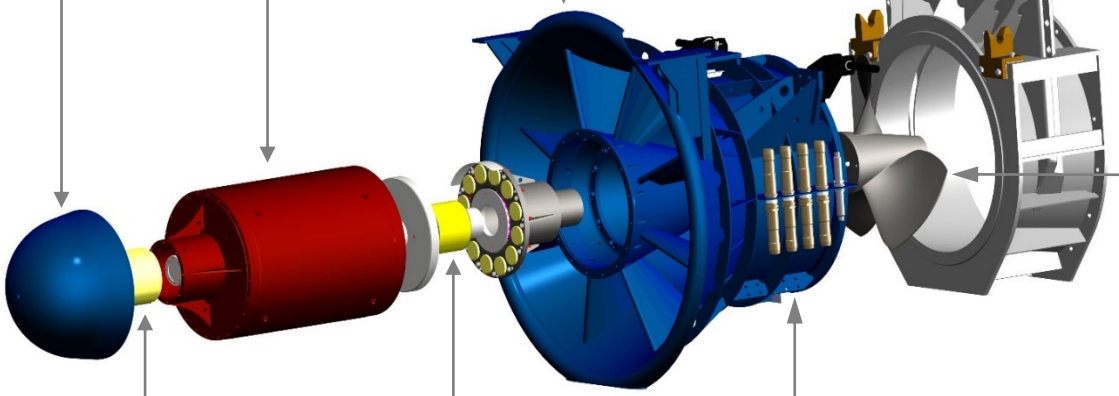
Turbine housing
- No moveable parts
- All In One

Shut-off valve

Runner, fixed blades
- High Quality stainless steel
- No moveable components



Water-lubricated bearing
- No oil or grease
- No maintenance during lifetime



Electrical plugs
- Special under-water plugs / Marine bronze
- Perfectly flexible

StreamDiver Innovations
StreamDiver In-Pipe solution

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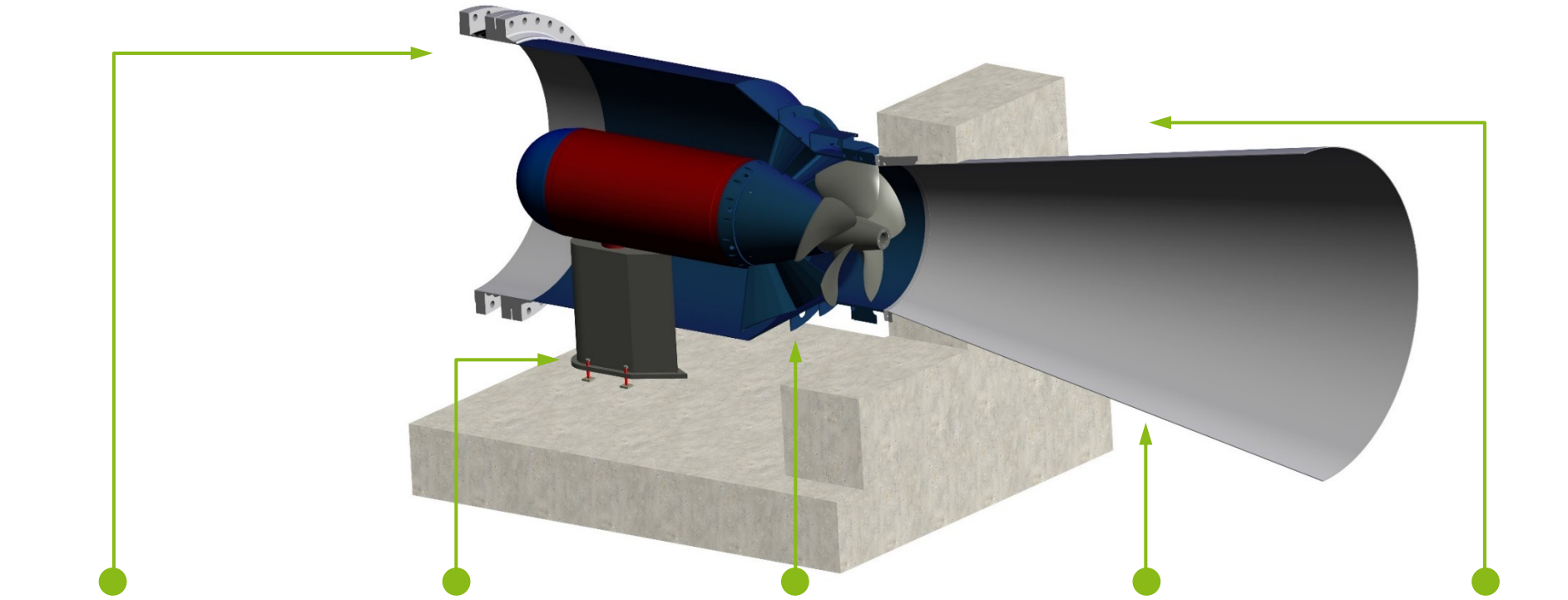
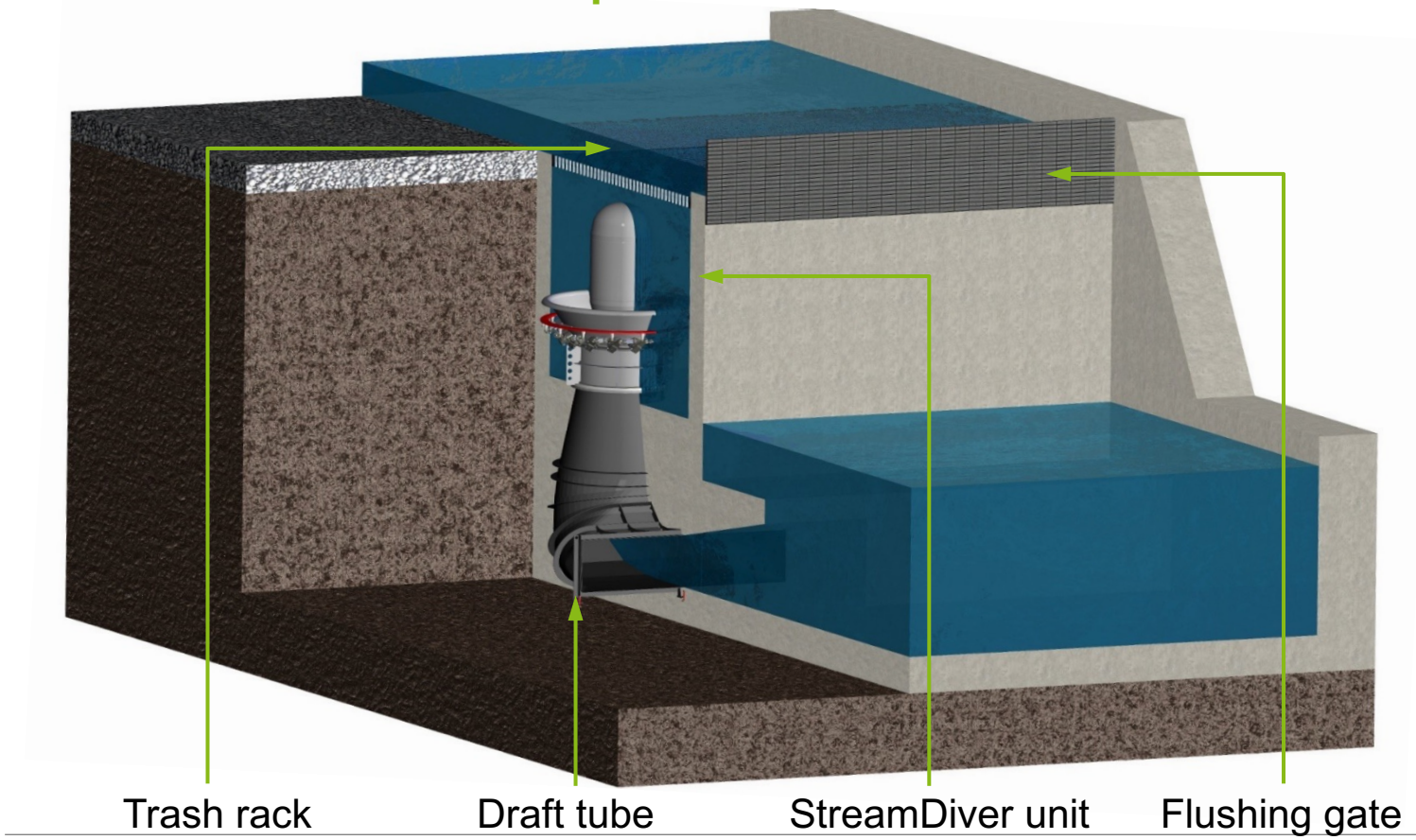
StreamDiver integrated into a pipe – can be combined with a Siphon arrangement



StreamDiver Innovations
StreamDiver RVT – Vertical, regulated StreamDiver

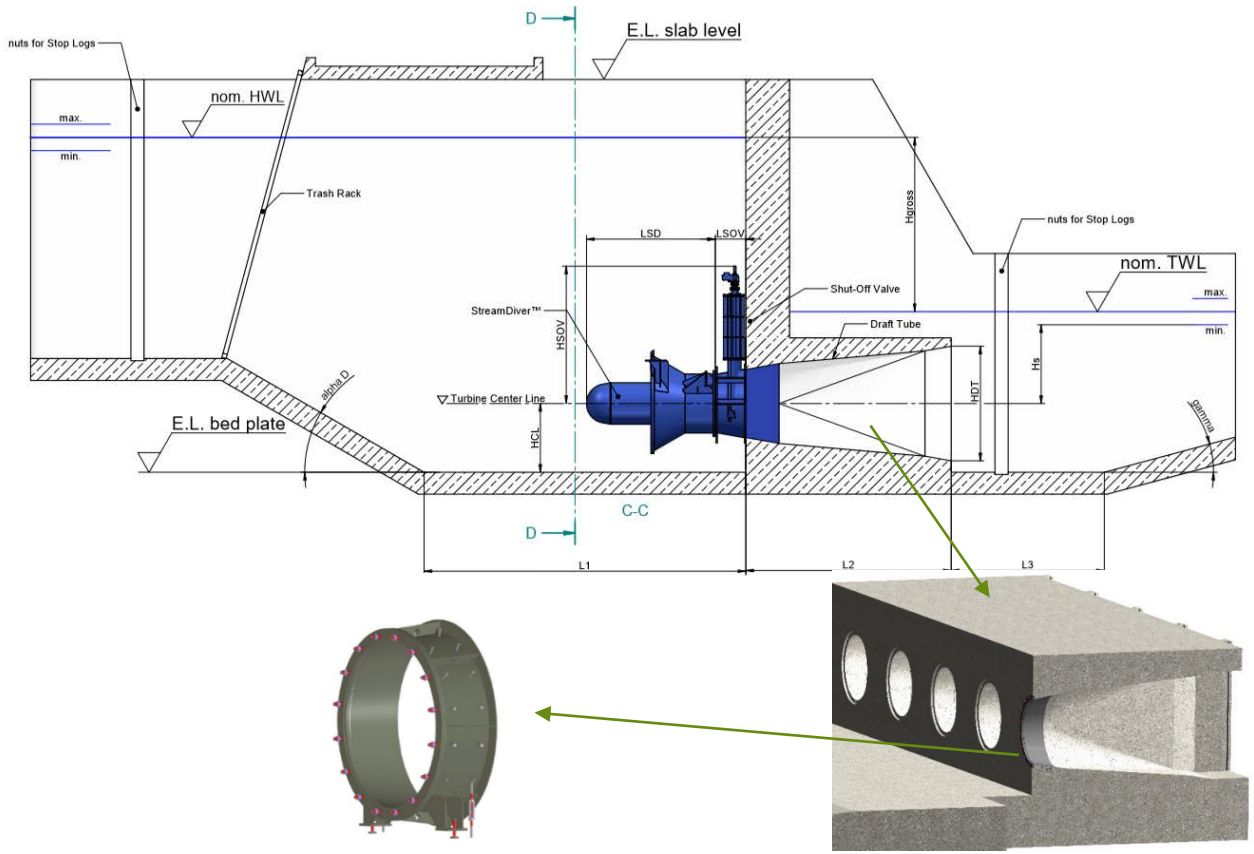
StreamDiver cross section power station



- For vertical installation in shaft power stations (especially as a replacement for existing Francis shaft turbines)
- A positive machine setting allows easy access for inspection and maintenance

Civil
Reducing the construction efforts to the minimum

Construction



- Simple civil construction
- Standard layouts available – quick at planning
- Optimized draft tube to reach the minimal length for maximum efficiency
- Less deep foundation compared to other turbine concepts
- Only one interface to civil – fast process in construction phase

Planned service intervals
Maintenance plan

Remote check

StreamDiver is fully automated, therefore only a weekly remote check is required

On-site inspection

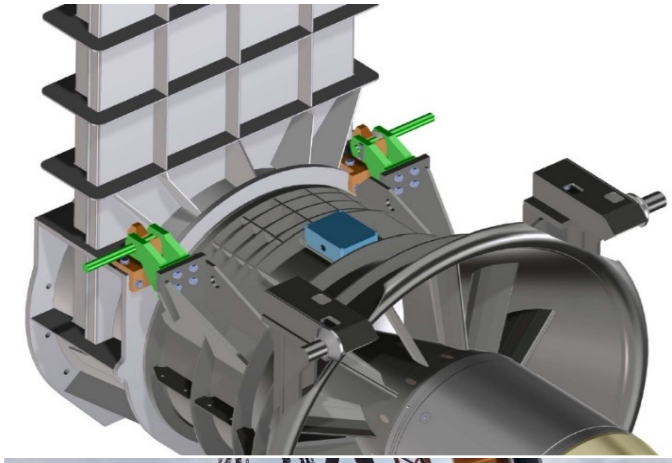
Recommended every 5 years
Duration: ~ 1 day

Main service interval (bearing exchange)

Recommended every 10 years or later
Duration: ~ 3 days

- Important sensors for monitoring are redundant
- Main service interval to replace slide bearing modules depends on the machine loading (head) and operating hours
- Actuators for the shut-off valve (or rack cleaning) can be removed in complete segments for maintenance with intervals similar to StreamDiver

Make handling easy and fast
Reducing outage time



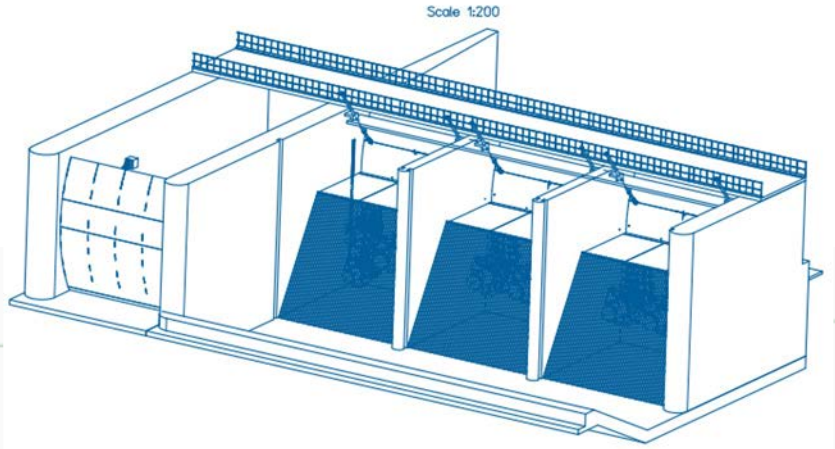
Reducing outage time is one key factor of profitable operation of hydropower turbines:

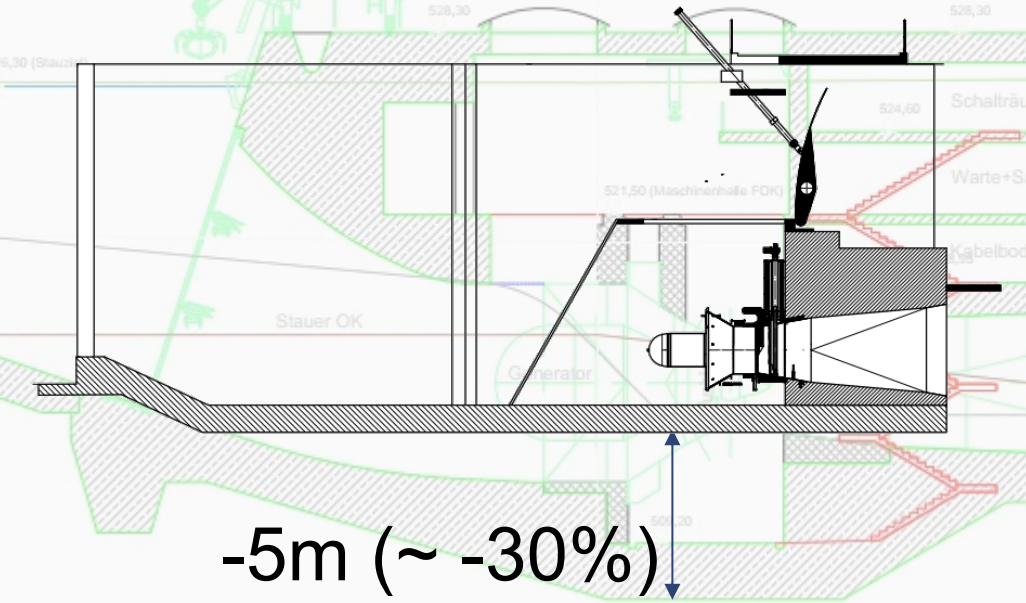
- Simple “hanging” of StreamDiver turbine allows faster dismantling
- Underwater plugs for easy electrical connection / disconnection within minutes

StreamDiver Planning Example

10 x StreamDiver // 2 x Pit - Depth

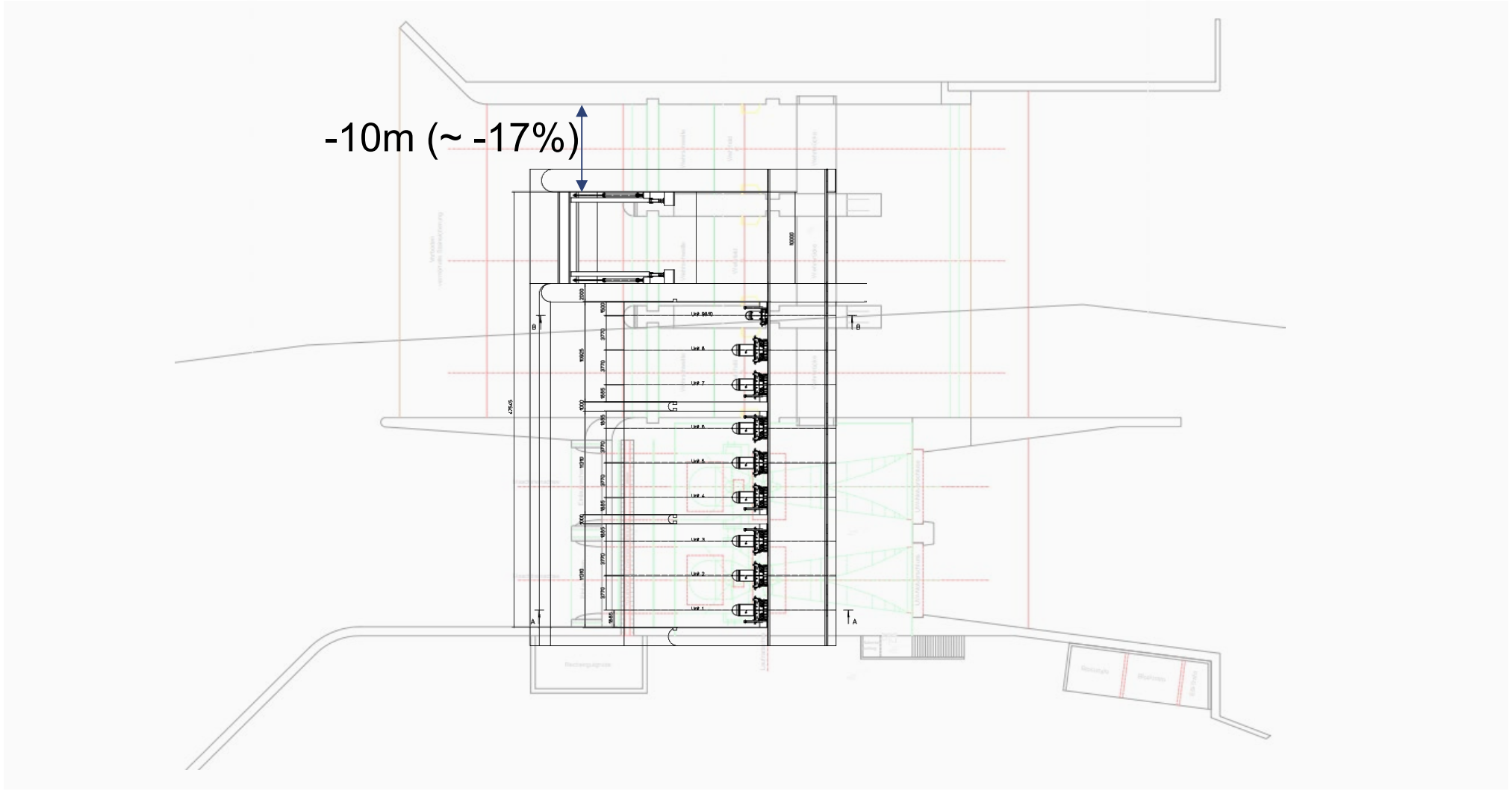
2 x Pit 30,06 //
8 x Stream Diver 16,9 unregulated &
2 x Stream Diver 13.1 regulated

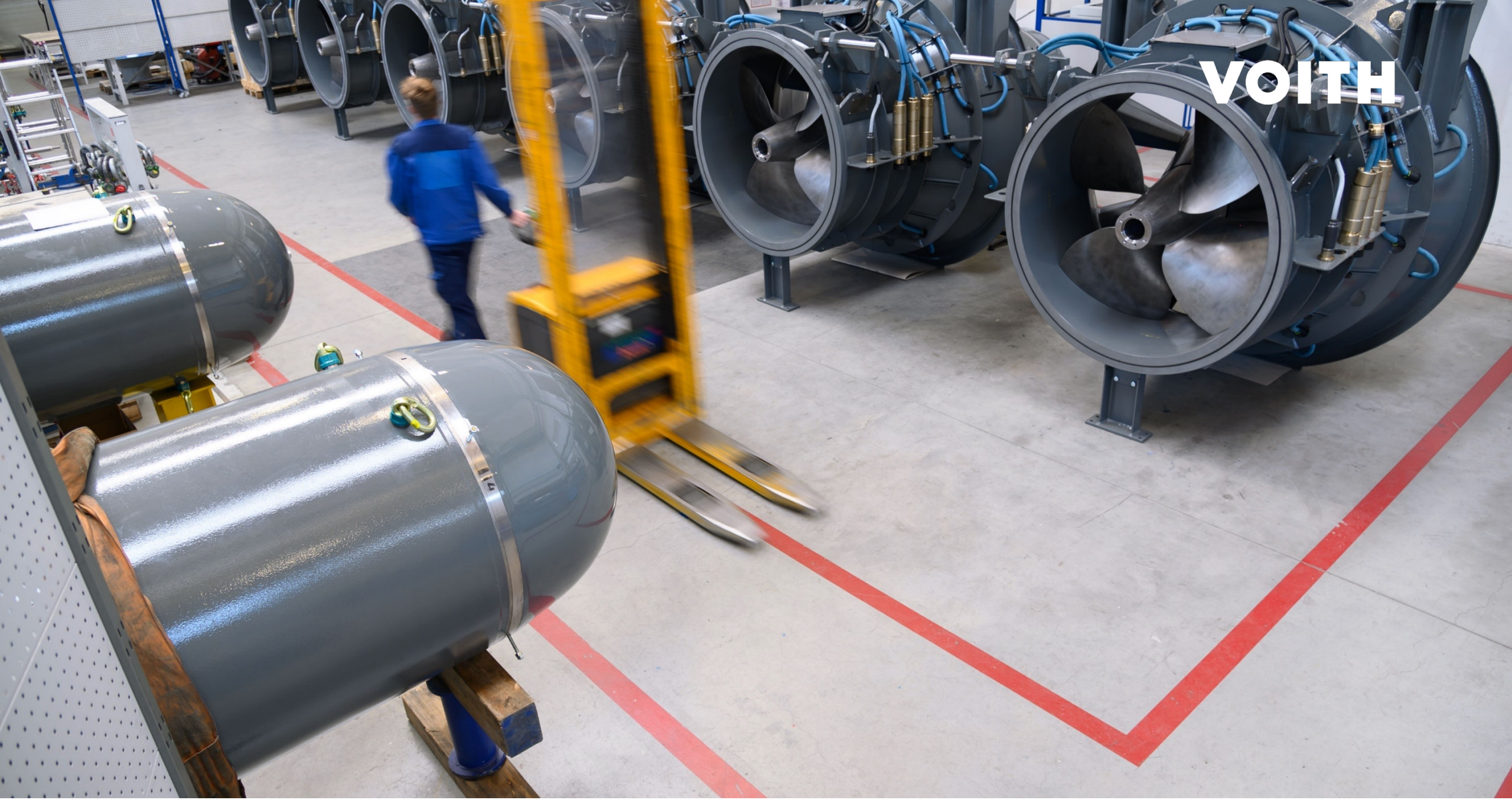


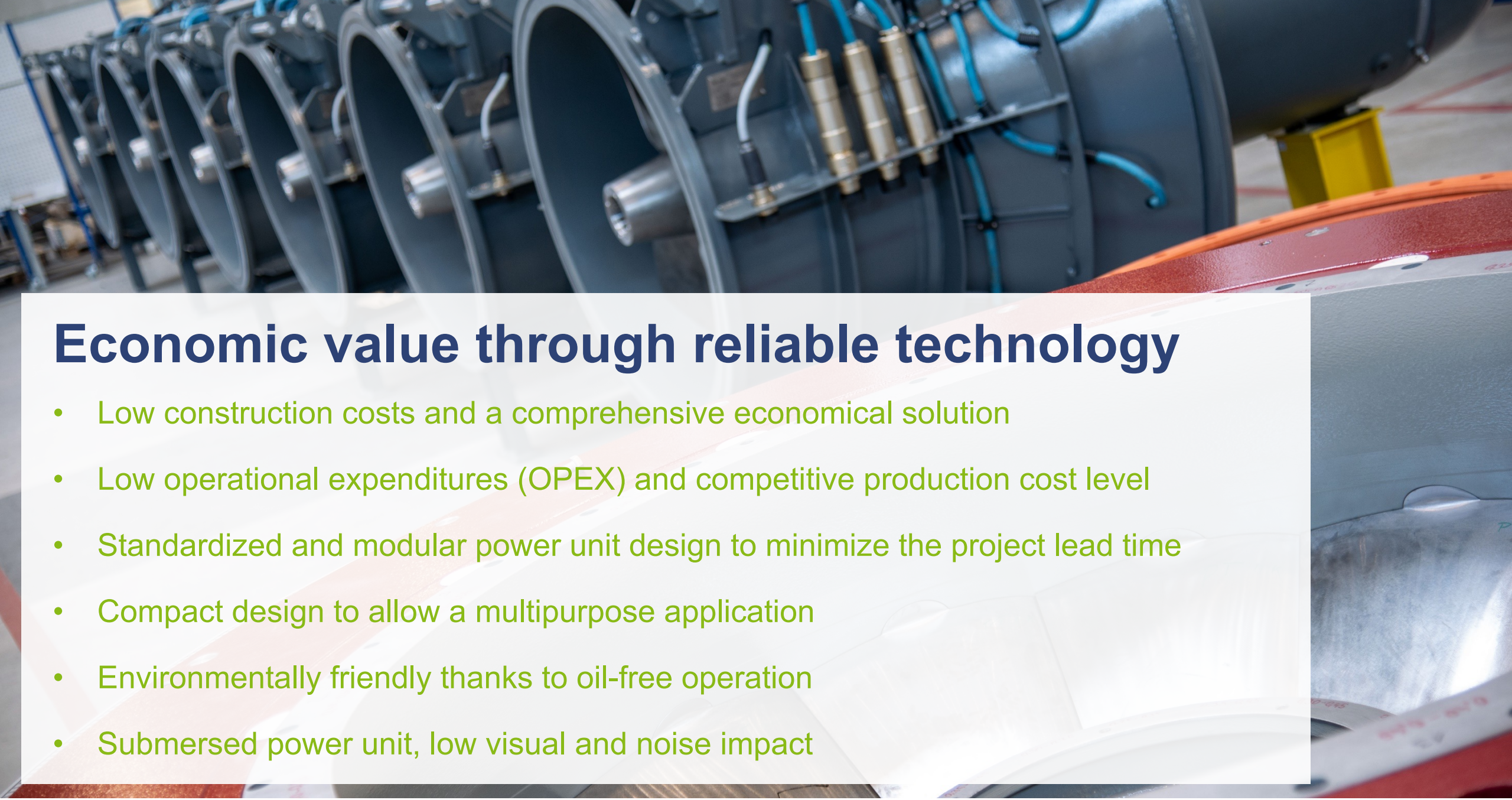


-5m (~ -30%)

StreamDiver Planning Example
10 x StreamDiver // 2 x Pit - Width







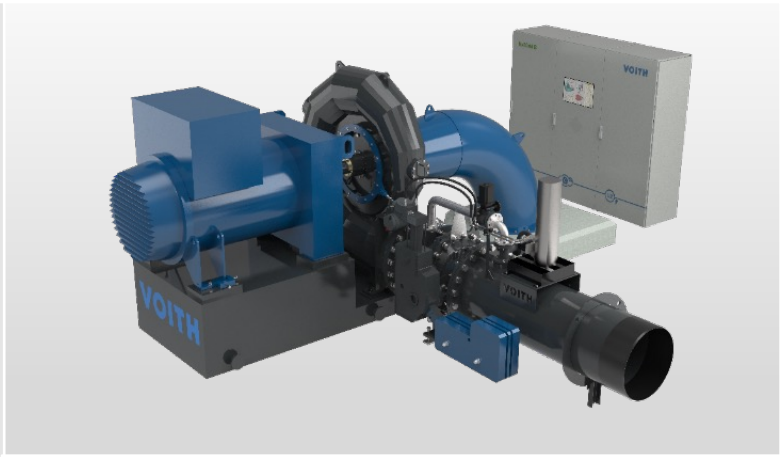
Economic value through reliable technology

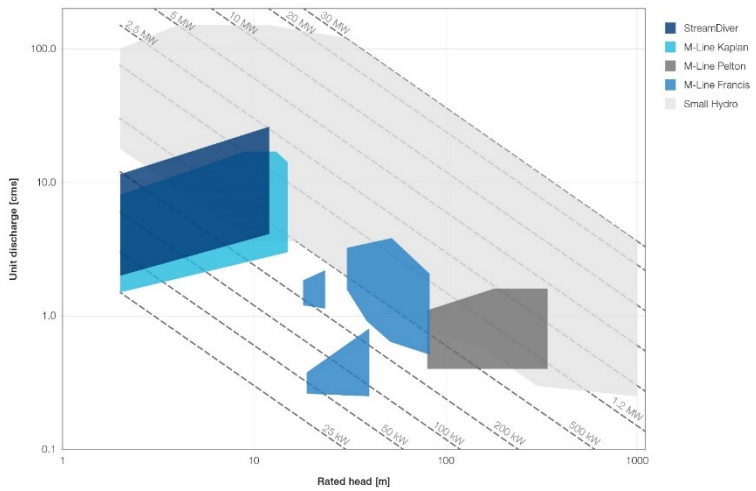
- Low construction costs and a comprehensive economical solution
- Low operational expenditures (OPEX) and competitive production cost level
- Standardized and modular power unit design to minimize the project lead time
- Compact design to allow a multipurpose application
- Environmentally friendly thanks to oil-free operation
- Submersed power unit, low visual and noise impact

M-Line Turbines

M-Line | Hydromatters | 2022

M-Line Turbines
Development





We focused on developing a solution with:

- **shortened delivery** time
- possibility to provide **space information** for powerhouse plannings from the beginning
- **fast installation** with the proven Voith Hydro quality

For more information, visit us on our booth!

Thank you!

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