

# Monitoring, analysis and diagnosis

## OnCare.Health Hydro





**The OnCare.Health Hydro monitoring, analysis and diagnosis system combines our engineering and manufacturing expertise with your operational experience and knowledge to design a powerful predictive maintenance tool tailored to your individual hydropower plant.**





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**1 Picote, Portugal**

**2 Herdecke, Germany**

A power plant's one and only objective is to fully meet the electricity demands for a maximum of time at the lowest possible cost. Therefore, efficiency, reliability and availability are crucial, and it is of highest importance that the machines are kept operating under optimum conditions. A key factor to meet these demands is to be able to support early fault detection and preventive maintenance techniques.

This is the focus of OnCare.Health Hydro, which is designed to obtain early detection of incipient damages, reduction of inspection and repair work, and clear planning options for timely inspections.

Among series of monitoring and evaluation methods for probable root causes in machine behavior, vibration diagnosis and air gap analysis are examples of well-known and acknowledged machine monitoring methods in the hydropower industry.

Both have gained importance and have become part of condition-based maintenance for hydroelectric equipment, and match today's needs with respect to measuring technology, data processing and evaluation procedures.

# Condition monitoring system OnCare.Health Hydro

OnCare.Health Hydro is an online monitoring and analysis system developed by Voith, combining the know-how and experience of international hydropower operation and maintenance from Voith and our customers.

To meet various demands for different types, sizes and operation modes of hydropower machines, we offer:

- Highly scalable systems
- Custom-tailored solutions regarding protection, monitoring and analysis
- Predefined standard configurations for sensors to assure reliable and safe measurement

Our OnCare. Health Hydro is designed to be easily integrated with control systems, making it more beneficial, because the information already available in the control system does not have to be acquired twice, will be used for internal calculations and correlations and results can be sent to the control system back automatically.

To maximize the flexibility, the system is designed modular, enabling to update existing hardware components to achieve our Monitoring and Analysis capabilities.

For this purpose, standard site assessment procedures for OnCare.Health Hydro can be applied.

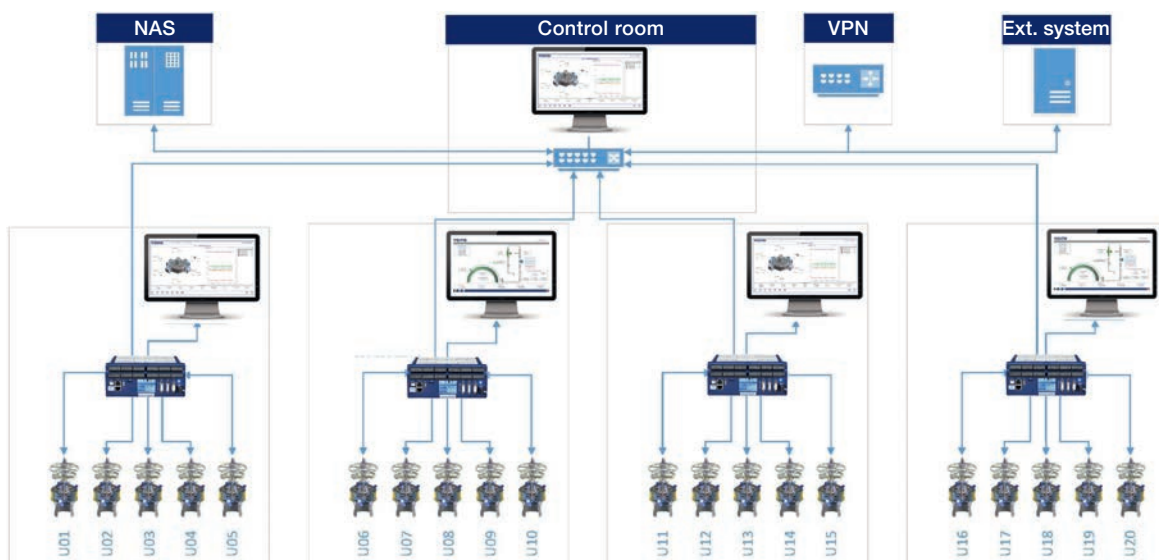
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## Overall benefits OnCare.Health Hydro

- + Optimized total cost of ownership
- + Reduced costs
- + Increased availability
- + Voith know-how implementation

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## Hardware configuration

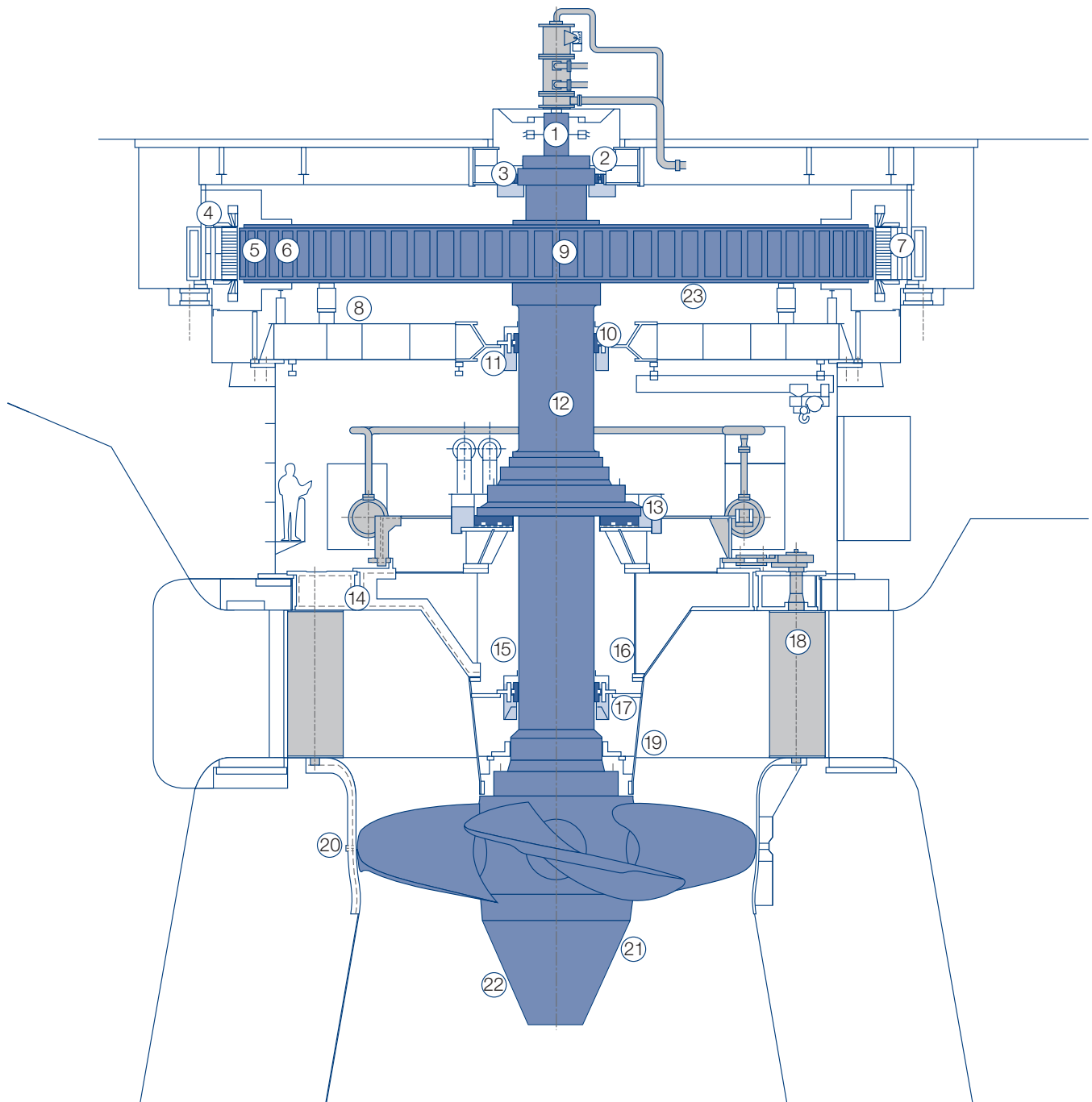


100 % time-synchronous 50 kHz sampling rate per channel and high 24 bit resolution.

All types of sensors can be connected (vibration, pressure, magnetic flux, etc.).

Internal power supply for IEPE sensors available.

Voith scope of turbine and generator supply



- |                                    |   |                              |
|------------------------------------|---|------------------------------|
| 1 Keyphasor                        | 10 Absolute bearing vibration                                 | 18 Wicket gate vibration     |
| 2 Absolute bearing vibration       | 11 Shaft relative vibration                                   | 19 Labyrinth gap (Francis)   |
| 3 Shaft relative vibration         | 12 Shaft current monitoring                                   | 20 Runner gap (Kaplan/ Bulb) |
| 4 Stator end winding vibration     | 13 Axial thrust vibration/<br>movement and oil film thickness | 21 Cavitation monitoring     |
| 5 Air gap                          | 14 Turbine headcover vibration                                | 22 Pressure                  |
| 6 Magnetic flux                    | 15 Turbine temperature monitoring                             | 23 Ozone monitoring          |
| 7 Stator core vibration            | 16 Shaft relative vibration                                   | 24 Sediment monitoring       |
| 8 Generator temperature monitoring | 17 Absolute bearing vibration                                 |                              |
| 9 Partial discharge                |   |                              |

# Monitoring interface

Reliable sensor selection, mounting, calibration and signal processing leads to good measurements; joined to the unit protection concept are considered to be of paramount importance for plant safety.

## Monitoring

The highly sensitive measuring systems that are adapted to the requirements of hydropower machines ensure effective condition-based monitoring and maintenance, and thus increase the life cycle of rotating machines as well as increasing plant availability and reliability.

To provide plant safety, the primary tasks of monitoring are to:

- Identify the plant's individual optimum condition
- Recognize imminent damage early on
- Optimize modes of operation
- Allow for scheduled maintenance

For complex excitation mechanisms with high dependency on specific operation conditions of the unit, special monitoring techniques are applied. The OnCare.Health Hydro monitoring system evaluates all measurements and characteristic values as a function of operation mode and operation point.

## Additional features

Our data acquisition devices include logical functions based on measurements and operational parameters that generate event signals to be transferred to the control system to support the protection of the unit.

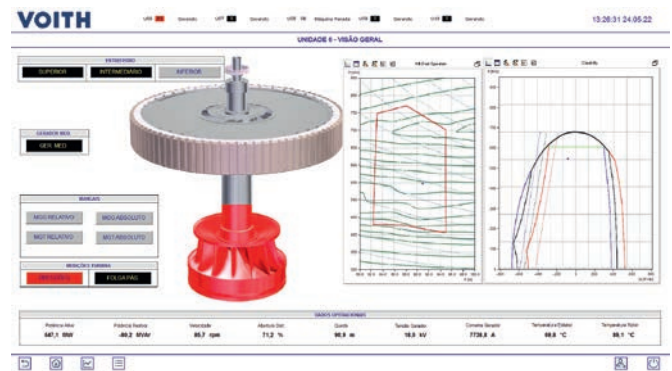
Even, smart characteristic values are calculated in order to improve the quality of the analysis and monitoring. For example, the dynamic run out separation allows to separate the vibration of the run out component.

If measurements already exists on the plant, OCHH can act as integrator for all of them enabling unique database and visualization.

## Unit monitoring



## User friendly interface





# Intelligent measurement and analysis for additional benefits

In order to add on benefits for plant operators, our systems are designed to efficiently support predictive maintenance strategies.

## More than monitoring

Most monitoring systems only measure values and create alarms based on limit values. In order to extend the benefit for the plant operator, the system must be able to efficiently support preventive maintenance strategies.

To fulfill this demand, the following prerequisites must be met:

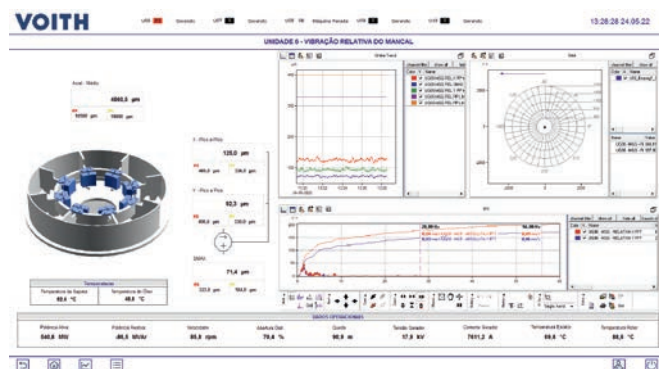
- Highly sensitive measurement technology with adapted analysis techniques
- Diagnostic tools for proper selection of specific parameters and comparison of the measured values with the expected behavior, depending on specific plant conditions and machine operation modes
- Tailor-made systems to meet specific conditions such as very low speed or various operating modes with highly volatile excitation requirements
- Precise machine monitoring through intelligent measuring and analysis systems covering analytic evaluation of pre-processed values from the measurement device, for example, frequency analysis providing frequency-selective observation results, and the calculation of further hydro-specific characteristic values.

Our modules are specifically designed to meet these advanced requirements.

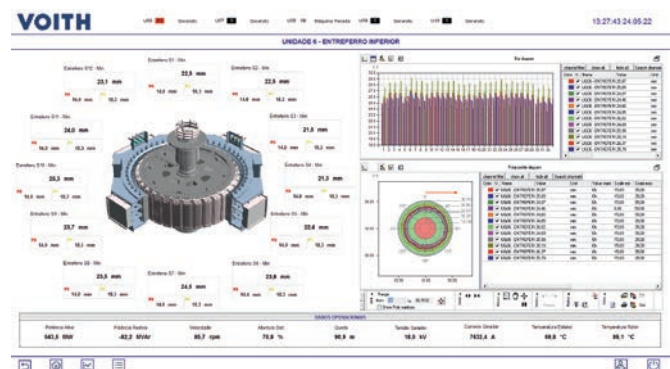
## Statistic module

To increase the information content of, for example, vibration signals, as well as to represent the great variety of vibration-related factors, our statistic module is flexible to provide measurement values from any desired process variable. Different measurement planes, signals and key parameters can thus be compared.

## Shaft vibration



## Air gas analysis



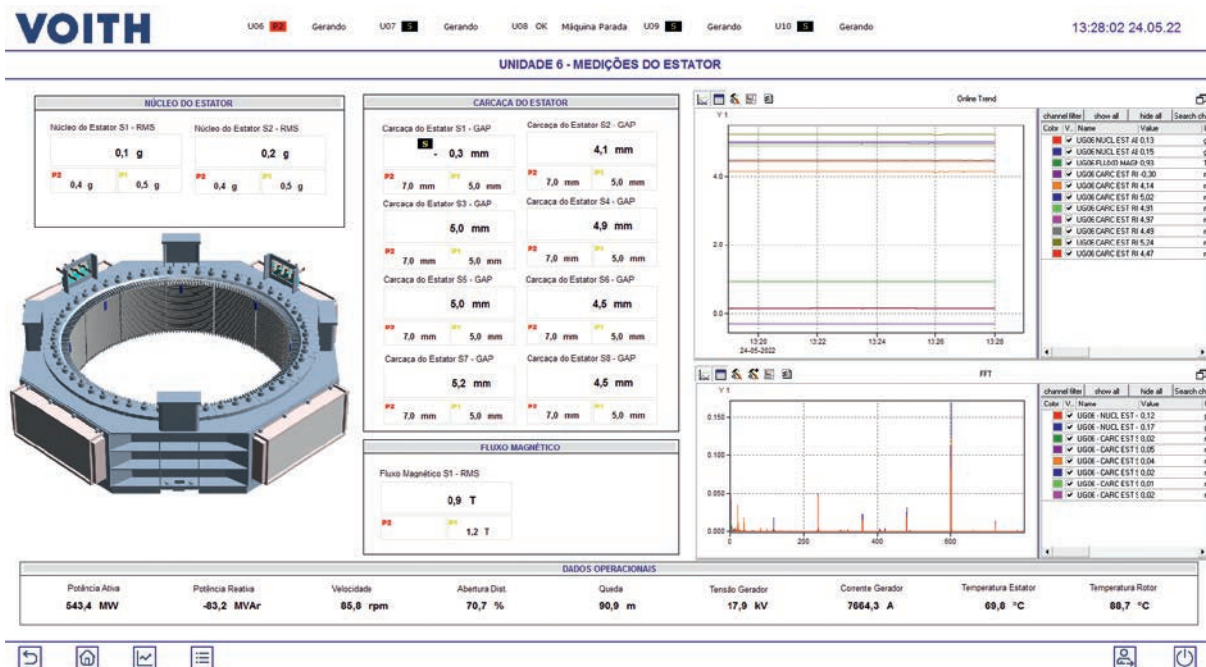


OnCare.Health Hydro

### OnCare.Health Hydro – the benefits of an online monitoring system

- + Machine behavior monitoring
- + Assess the condition of a hydropower unit to enable condition-based maintenance
- + Scalable monitoring function
- + Commissioning support for balancing
- + Integrated analysis functions
- + Standard configured electrical panel (micro, compact, standard, mega)
- + Flexible connection to foreign systems
- + Upgrade for automated diagnosis without system configuration change
- + Remote connection offers expert know-how on demand
- + Back-up support for field service with full access to on-site data
- + Prepared for troubleshooting by Voith experts
- + If required, web visualization, and therefore platform-independent measurement data on any user device (desktops, notebooks, tablets or smartphones)
- + Mobile with high-resolution data acquisition for vibrations and process values measuring
- + Cloud-ready monitoring system with possibility to use machine learning algorithms

### Online visualization and analysis





# Helping you to recognize, understand & optimize OnCare.Health Hydro offerings

## Voith also offers safe remote access from a central server to your OnCare.Health Hydro installation onsite

With this safe access possibility (only registered Voith specialists will have access to your Condition Monitoring System), we can provide additional services and guarantee even faster and better customer service.

This will help you to enhance the profitability of your plant through:

- Remote support and quick analysis in case of unforeseen unit standstills without Voith specialists going to site
- Cyclic assessments
- Commissioning, troubleshooting and analysis can be centrally supported by specialists
- Remaining work via remote access (parameter settings and configuration)

Voith is also offering a wide range of service contracts that will help you to optimize the plant conditions.

There are several options for these service contracts, such as:

- Evaluation of the machine condition
- Analysis of anomalies
- Troubleshooting recommendations and corrective actions
- Remote troubleshooting and system update
- Check of monitoring and data archiving system
- System optimization

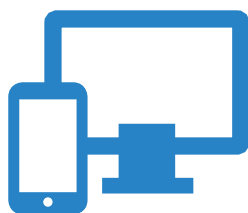
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## Helping you to recognize, understand & optimize – OnCare.Health Hydro offerings



### Acquisition and protection

OnCare.Health Hydro has a very powerful device for data acquisition and characteristic values calculation. Protection interface and short recording functions are available.



### User interface and data analysis

Voith offers a supervision system with a clear and friendly interface pertaining to the actual healthy state, as well as detailed and complex data analysis.



### Report

Voith provides decisive information to derive smarter recommendations and decisions. Plant operators benefit from actionable information.

# Build your service package yourself

## OnCare.Health Hydro Service Packages

Voith offers you to build your own OnCare.Health Hydro Service package by choosing the desired service components from our service scope

### 1 – Remote system care

- System check
- System settings optimization
- System backup

### 2 – Remote monitoring assessment

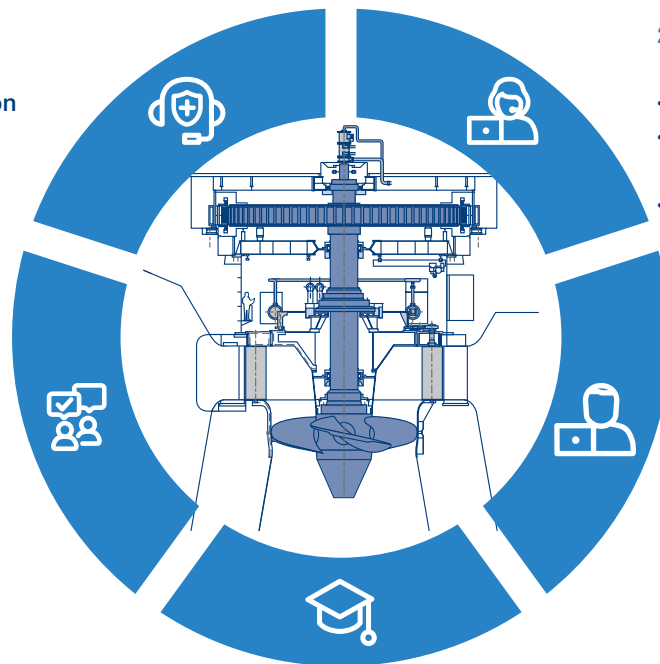
- Remote data assessment
- Monitoring reporting with recommendations
- Regular expert support calls

### 5 – On-site consulting

- On-site evaluation of OnCare.Health Hydro (HW/SW)
- Discussion of challenges and configurations
- On-site training

### 3 – Remote support service

- Software services and upgrades
- Remote support and troubleshooting with recommendations



### 4 – Hydro monitoring school

- First level monitoring training
- Expert monitoring training



**Basic**

✓ 3 times a year

#### 1. Remote system care



**Comfort**

✓ 4 times a year

1. Remote system care
2. Remote monitoring assessment
3. Remote support service
4. Hydro monitoring school
5. On-site consulting



**Premium**

✓ 12 times a year (monthly)

1. Remote system care
2. Remote monitoring assessment
3. Remote support service
4. Hydro monitoring school
5. On-site consulting

- 1 Baguari, Brazil
- 2 Omkareshwar, India

## References in recent years

- 2013 Frades, Portugal  
2 x 383 MW (Francis units)
- 2013 Yacyreta, Argentina  
20 x 145 MW (Kaplan units)
- 2014 Karcham Wangtoo, India  
2 x 300 (Francis units)
- 2014 Beyhan, Turkey  
3 x 200 MW (Francis units)
- 2015 Cambambe II, Angola  
4 x 179 MW (Francis units)
- 2015 Teles Pires, Brazil  
5 x 370 MW (Francis units)
- 2016 Belo Monte, Brazil  
18 x 671 MW (Francis units)
- 2016 Polpitiya, Sri Lanka  
2 x 40 MW (Francis units)
- 2018 Vamma, Norway  
2 x 90 MW (Kaplan units)
- 2019 Las Lajas, Chile  
2 x 135 MW (Pelton units)
- 2021 Ffestiniog, United Kingdom  
4 x 80 MW (Francis units)
- 2022 Tarbela 4, Pakistan  
4 x 352 MW (Francis units)





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