HYDRO

ASSET MANAGEMENT AND AUTOMATION: ANDRITZ DIGITAL SOLUTIONS AND CASE STUDIES

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SALTO GRANDE HPP – AUGUST 27TH 2018

ANDRITZ

ENGINEERED SUCCESS

COMPREHENSIVE EXPERTISE OF ANDRITZ HYDRO

We are a global supplier of electro-mechanical systems and services (“from water-to-wire") for hydropower plants and a leader in the world market for hydraulic power generation.

More than 175 years of turbine experience (1839)

Over 31,600 turbines (more than 434,600 MW) installed

Complete range up to more than 800 MW

Over 120 years electrical equipment experience (1892)

Leading in service and rehabilitation

More than 120 Compact Hydro units per year

FROM THE HISTORIC PIONEERS OF TECHNOLOGY TO A MODERN MARKET LEADER

ANDRITZ HYDRO – FACTS AND FIGURES IN SHORT

LARGE HYDRO

hydro- and electro-mechanical equipment for large turnkey / expansion projects; as well as modification of existing plants

COMPACT HYDRO

world's leading provider for small and mini hydropower plants - providing the full spectrum of electro-mechanical equipment

SERVICE & REHAB

solution oriented state-of-the-art service and rehabilitation solutions to increase profitability and extend plant life span

PUMPS

pumps that meet the demand for ever-larger, higher performance units, whether for low flow rates or wear-resistant applications

TURBO GENERATOR

leading suppliers for high performance turbo generators for gas-fired combined and open-cycle power plants

KEY FINANCIAL FIGURES 2017:	2017
Order intake	1,317.2 MEUR
Order backlog	2,921.8 MEUR
Sales	1,583.1 MEUR
EBITA	123.0 MEUR
Employees (without apprentices)	7,237

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CHALLENGES OF TODAY'S ENERGY MARKETS VOLATILITY AND COST PRESSURE

Price volatility

RAPIDELY CHANGING PRICES AND REGULATORY CONDITIONS COMPLEXITY

New financing models

SECURE RELIABLE LONG TERM OPERATION

Increasing competition

ON STANDARD SERVICES

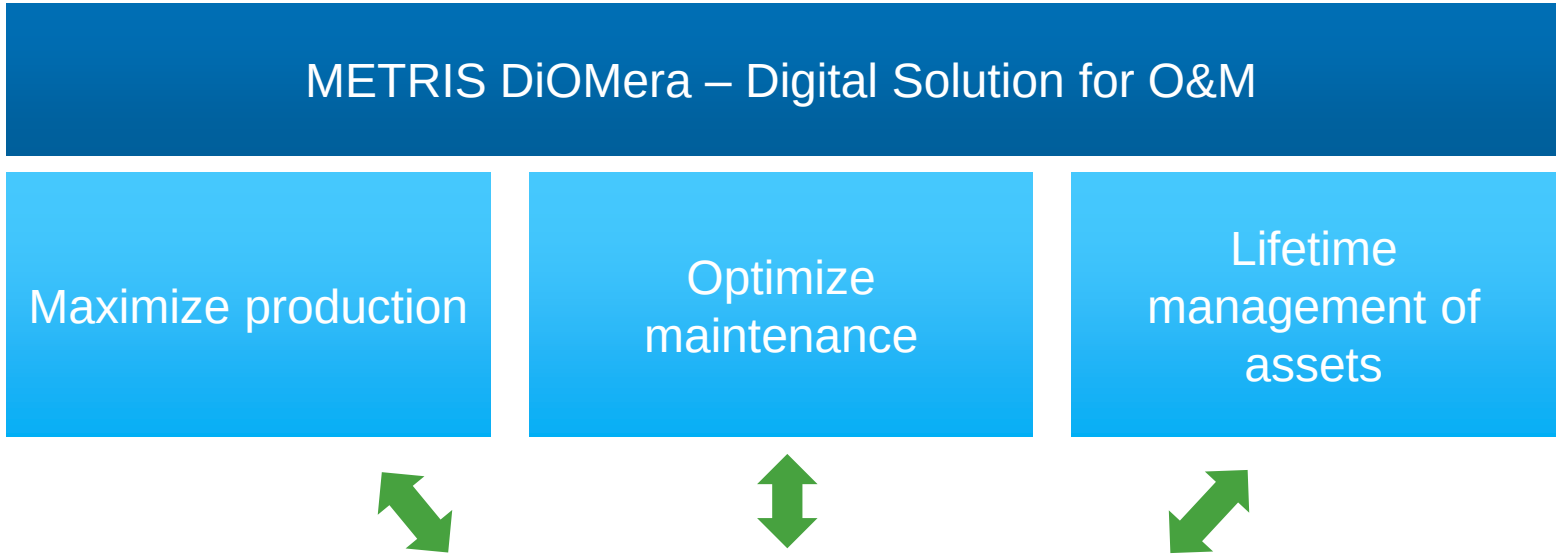
Asset management

FROM SELF OPERATED RESSOURCES TO PURE ASSET MANAGMENT

Grid volatility and climate change

INCREASED NUMBER OF VOLATILE ENERGY SOURCES AND HYDROLOGICAL CHANGES

METRIS DIOMERA'S MAIN FOCUSED AREAS FOR POWER PLANTS



Metris DiOMera™ is a digital platform developed to improve Unit(s) / Plant(s) / Fleets (s) performances by a combination of assessment & optimization

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OPERATION AND MAINTENANCE
OFFERED SERVICES

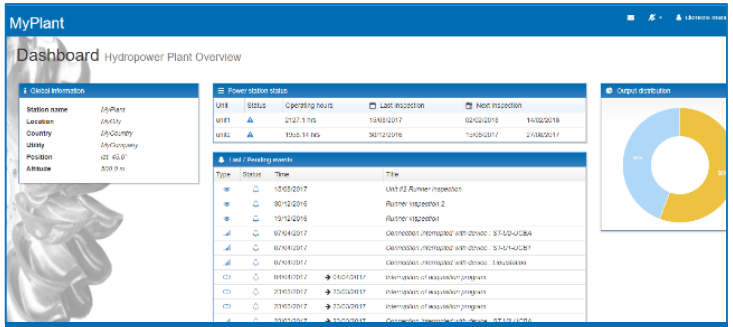
Special designed for hydro power plants

Maximize production	Optimize maintenance	Lifetime management of assets

System assessment / unit inspections	Reports / analysis Remote assistance	Preventive / predictive maintenance optimization	24 / 7 monitoring and operation	Spare part- and stock management	Provision of engineers
					

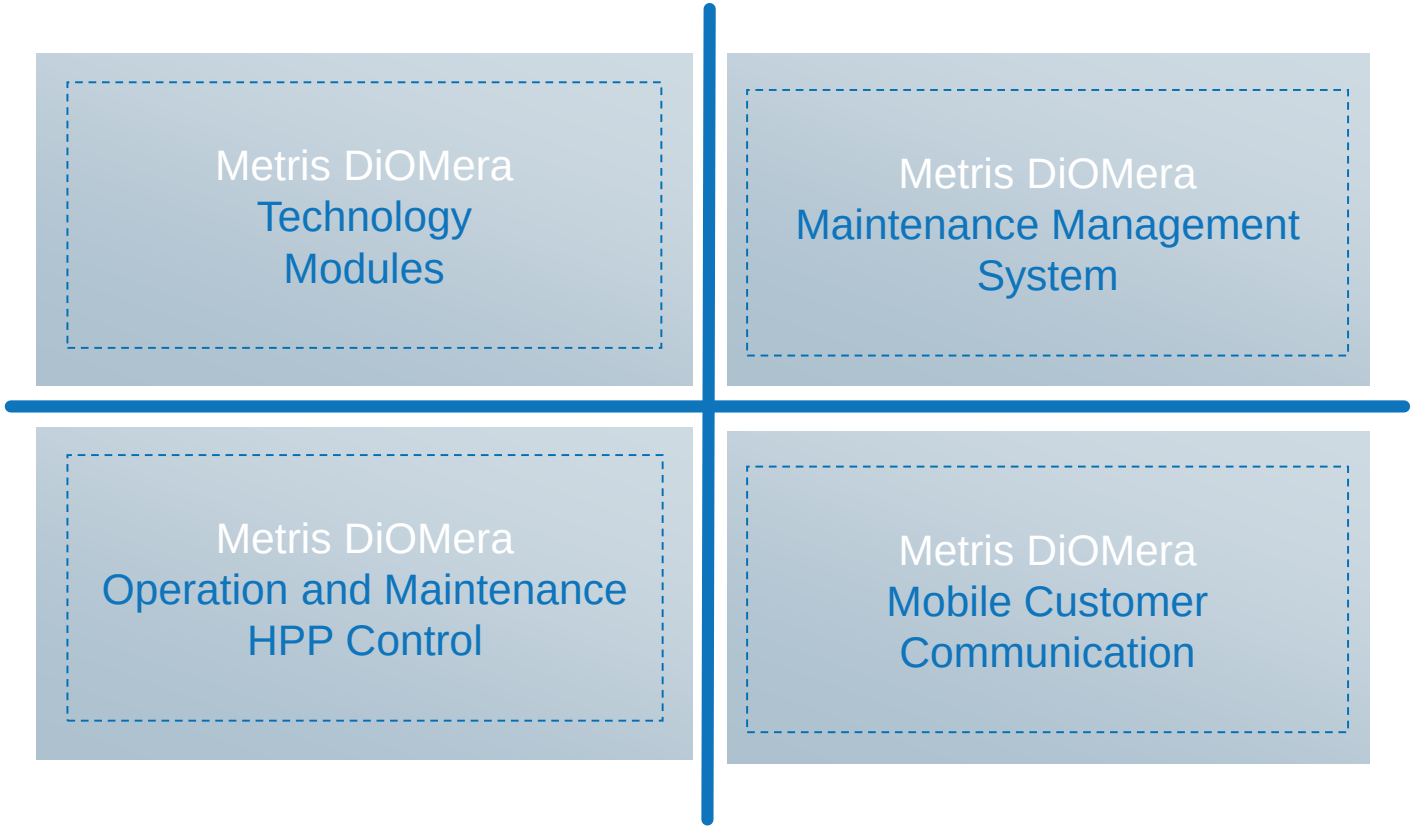
Engineers

supported by



System

METRIS DIOMERA SYSTEM
THE 4 MAIN FOCUS AREAS



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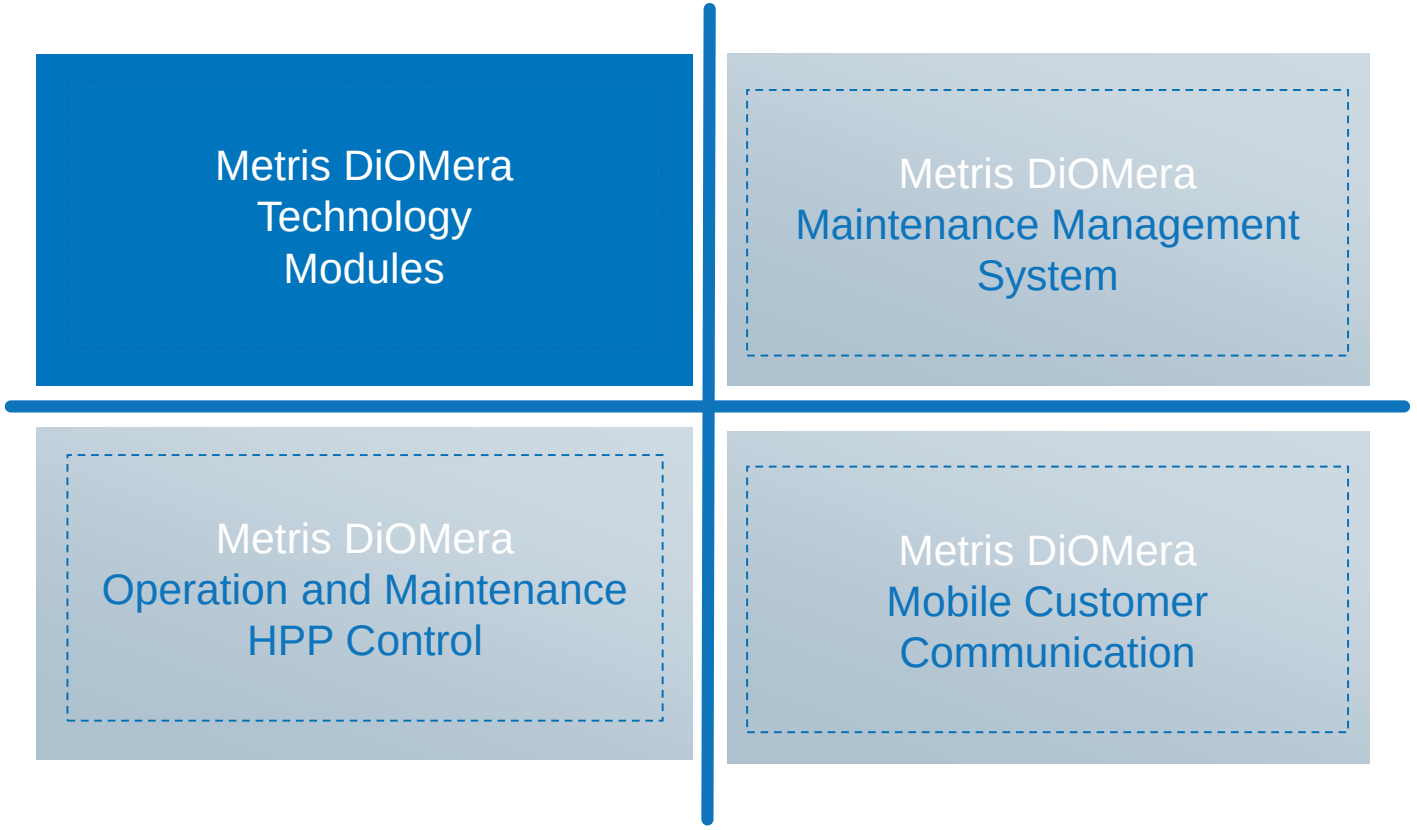
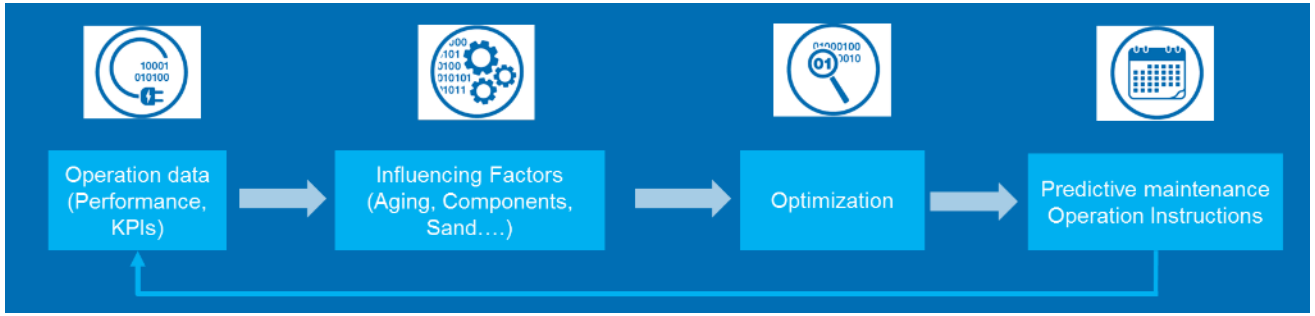


METRIS DIOMERA SYSTEM TECHNOLOGY MODULES

Functionality

- Generating data out of physics
- Calculate key performance indicators (KPI) and cost of operation indicators
- Detecting influencing factors
- Optimization suggestions for
  Operation & Maintenance
- Predictive maintenance suggestions
- Graphical representation of all values



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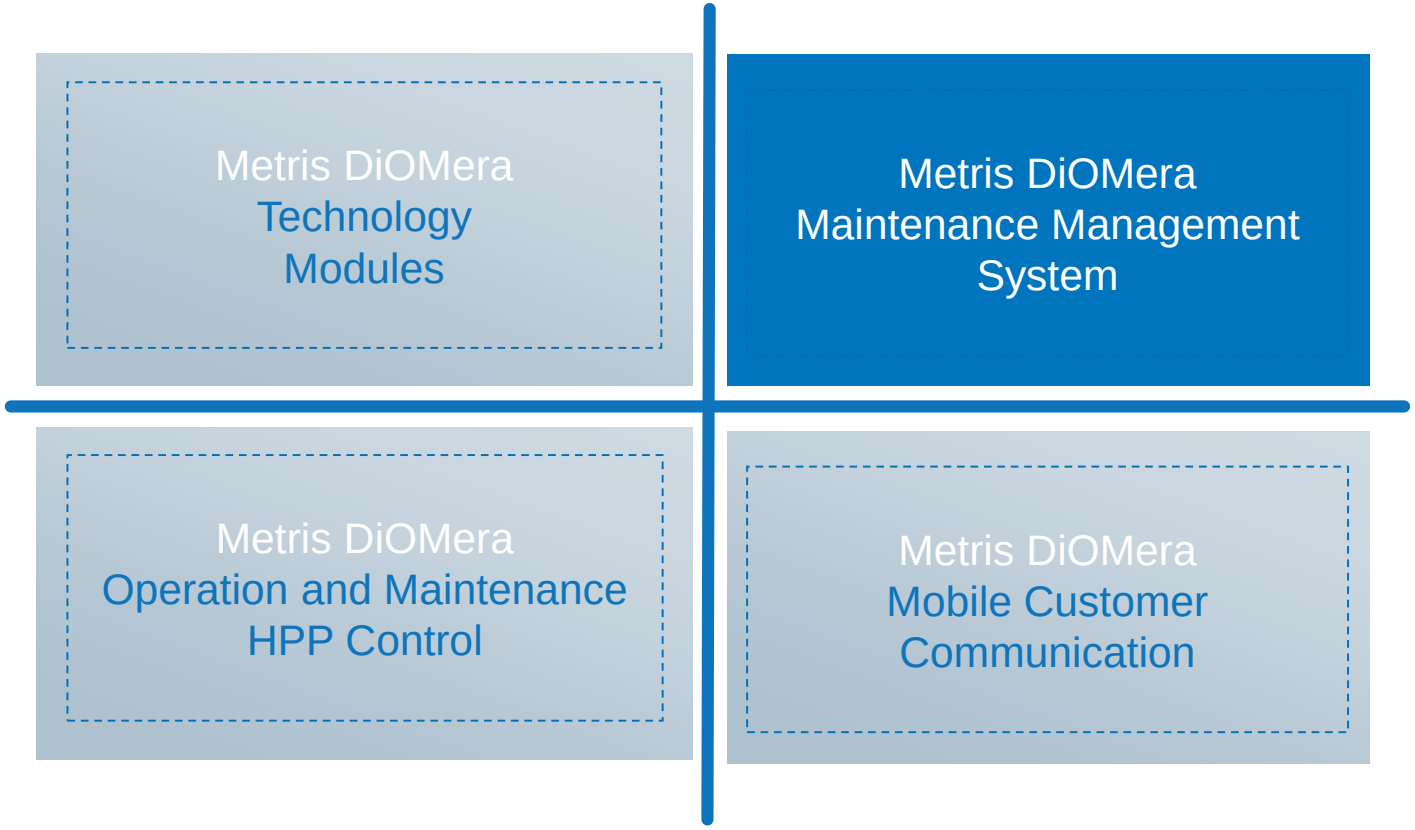


METRIS DIOMERA SYSTEM
MAINTENANCE MANAGEMENT SYSTEM (CMMS)

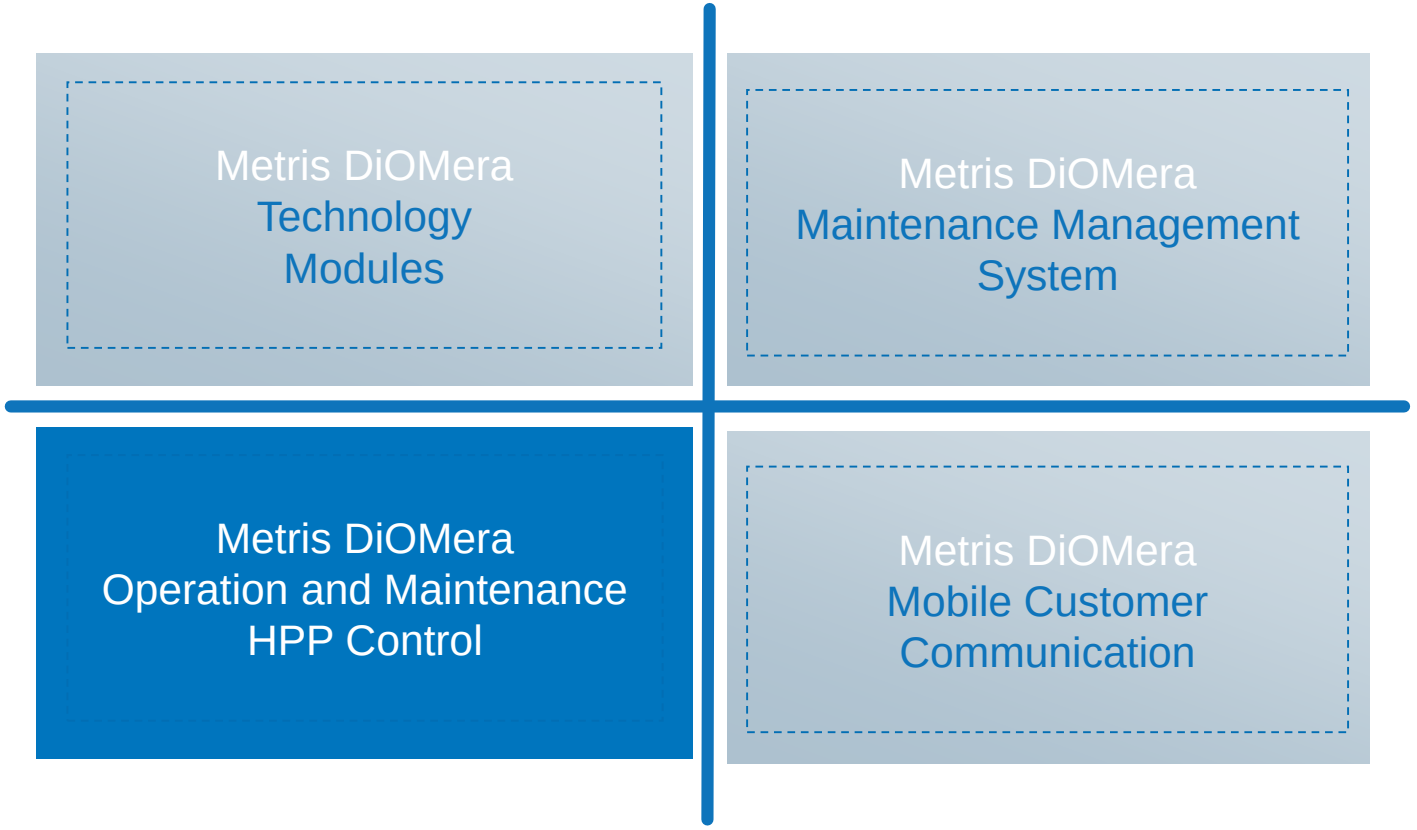
What is it?:

- Organizes to complete maintenance process

Maintenance management:

- Work plans
- Planning with scheduling
- Job administration
- Resource planning
- Mobile maintenance
- Spare part management

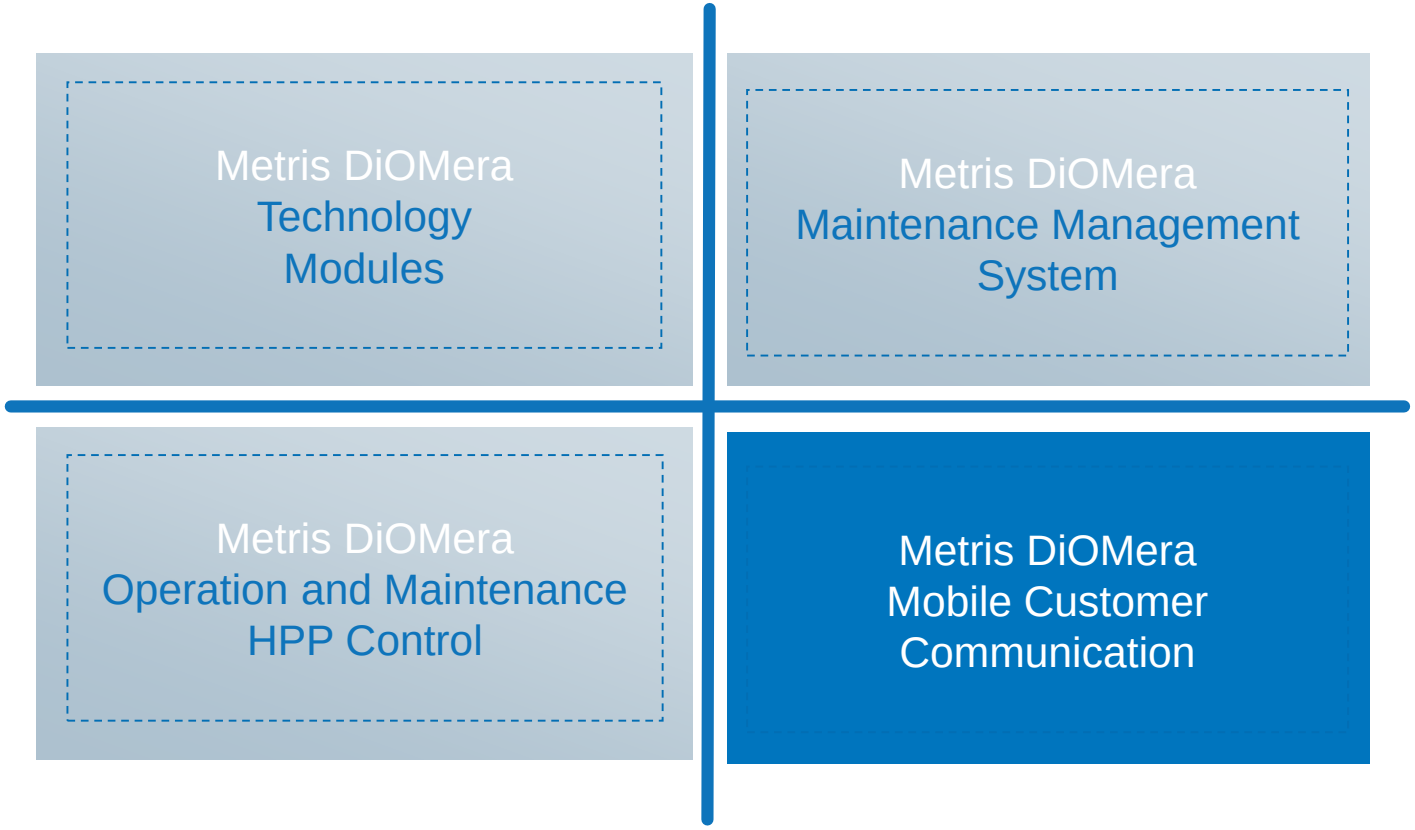
METRIS DIOMERA SYSTEM
THE 4 MAIN FOCUS AREAS



METRIS DIOMERA SYSTEM
OPERATION AND MAINTENANCE HPP CONTROL

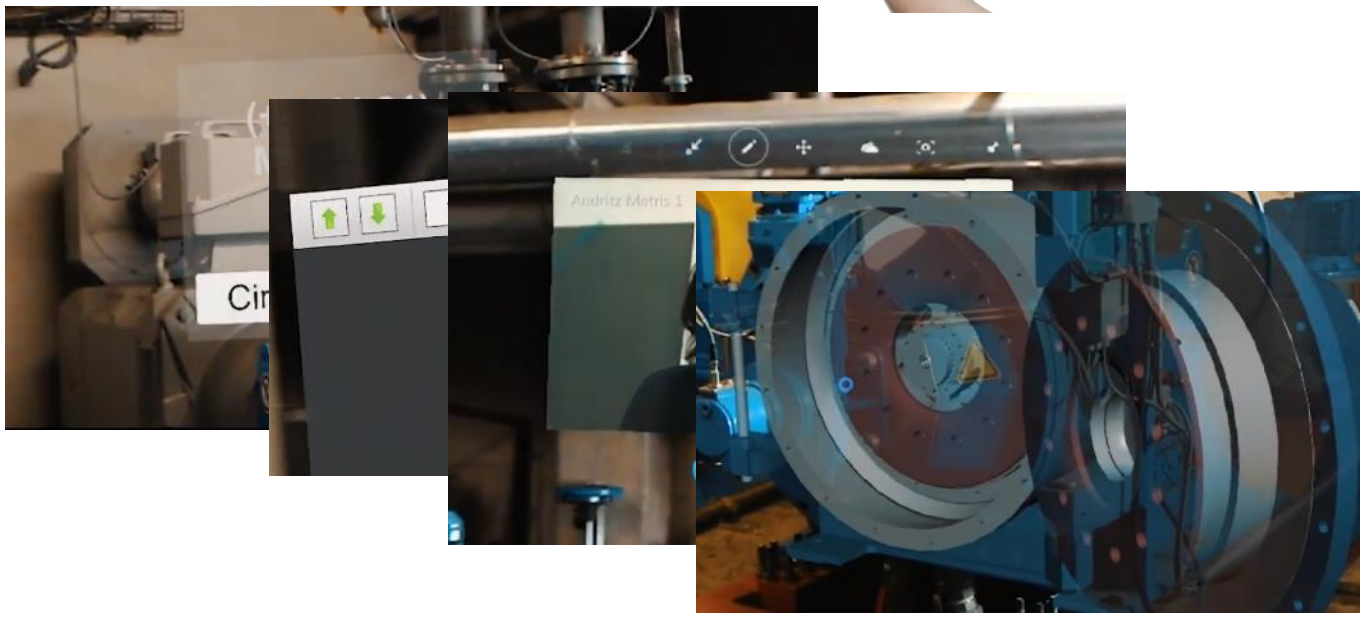
- Services provided by Regional Control Center
  - Collection of plant data
  - SCADA plant monitoring (up to 24/7 service)
  - Organization of maintenance works with Computer based Maintenance Management System (CMMS)
  - Technology modules
  - Detect optimization potential
  - Analysis and report functions

METRIS DIOMERA SYSTEM
THE 4 MAIN FOCUS AREAS



METRIS DIOMERA SYSTEM
MOBILE CUSTOMER COMMUNICATION

- Mobile App
  - Display the most important values on mobile devices
  - Get an quick overview about current plant condition status
- Augmented reality features with Hololens
  - Display documentation
  - Display operational values
  - Remote assistance
  - Overlay of 3D objects for optimized maintenance



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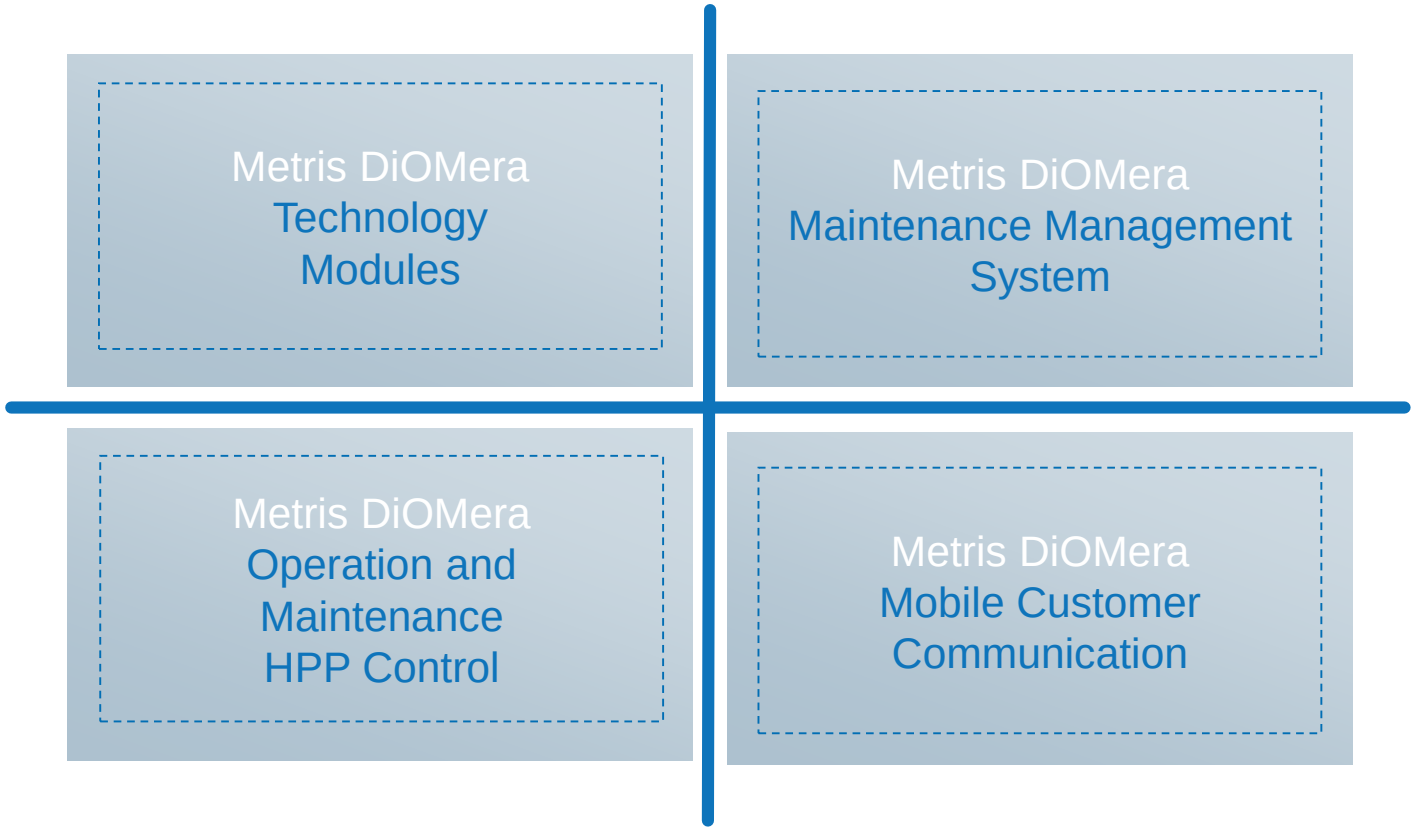
METRIS DIOMERA
THE 4 MAIN FOCUS AREAS

Connectivity



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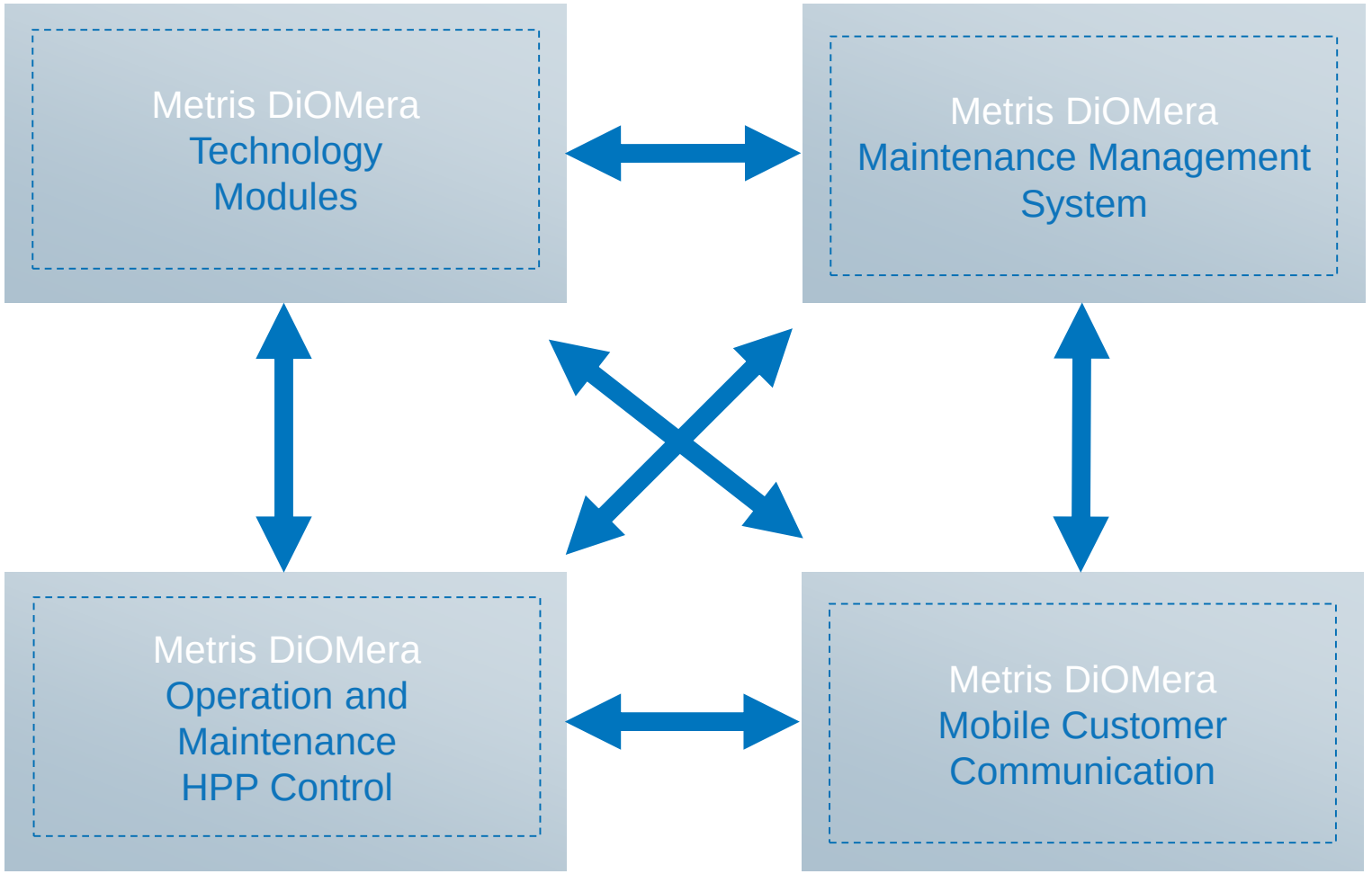

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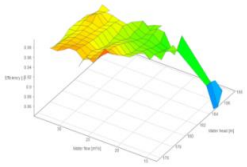
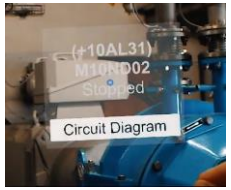


Technology Modules

Maintenance Management System

Operation and Maintenance HPP Control



Mobile Customer Communication

Connectivity

- Seamless interaction of all services to an integrated approach
- Distribution to different places possible (HPP, Control room, data center, etc.)
- Accessibility of data from where ever needed
- High level of security for data transmission/storage/access

Customized solution

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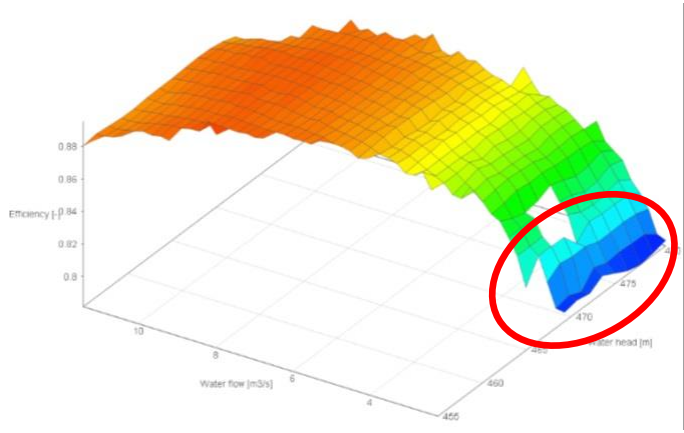
METRIS DIOMERA PROJECT EXAMPLES

HPP Montrose – Canada, 2x 75 MW Pelton

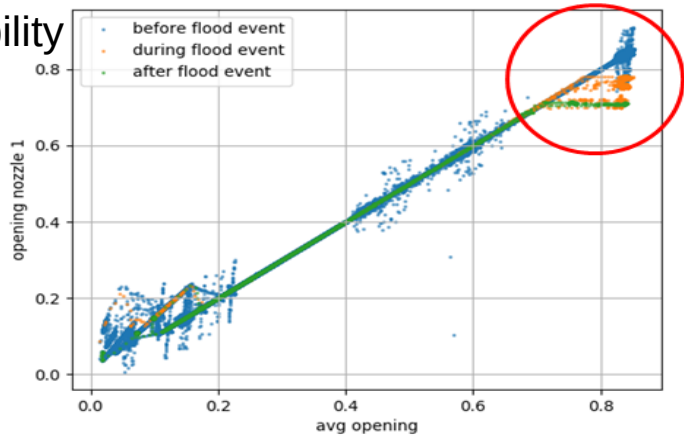


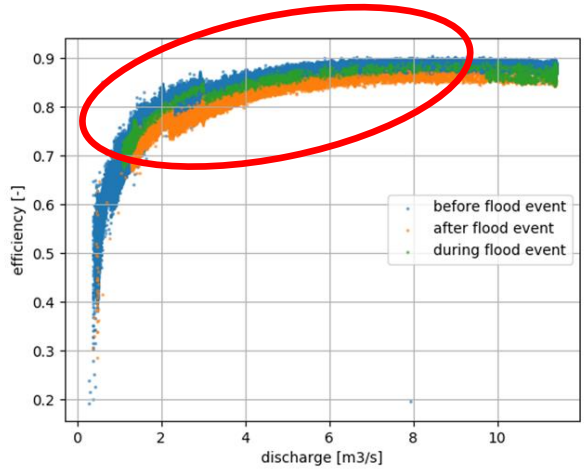
The need:

- Basic monitoring for enhancing operation
- Joint reviews to show detected operational potential
- After 6 month in operation → major flood event occurred with eventual occurring damages

The solution provided by ANDRITZ Hydro

- On-site monitoring system placed
- 1) Detecting operational enhancement and feasibility study for enhancing the operation
- 2) After flood event: vibrations are detected → units operated at full load but lower index efficiency
- Automatic detection that nozzles are opening incorrect → corrective measures applied





METRIS DIOMERA PROJECT EXAMPLES

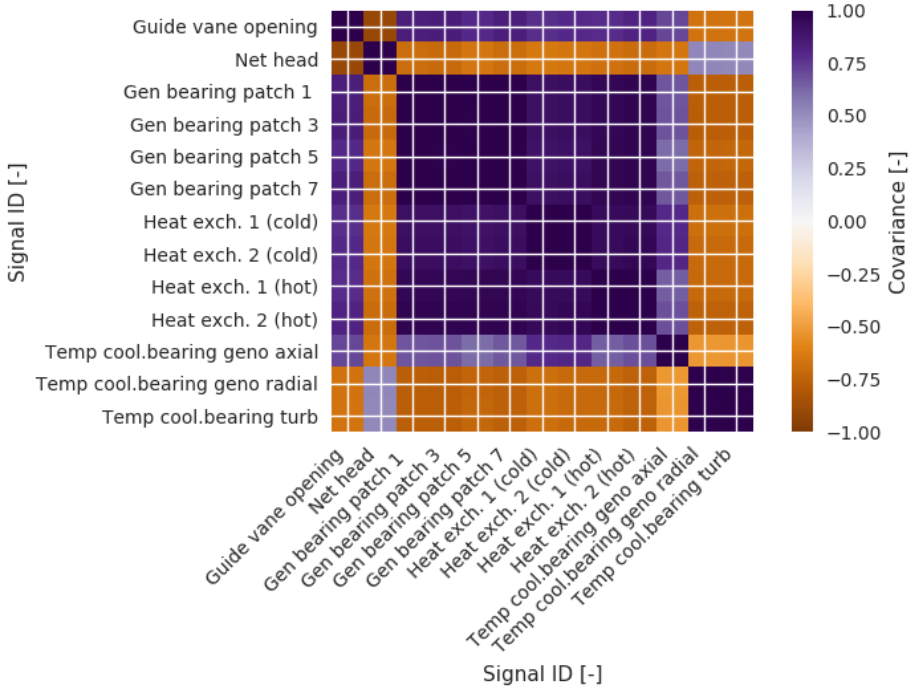
HPP Galleto – Italy (slide 1)

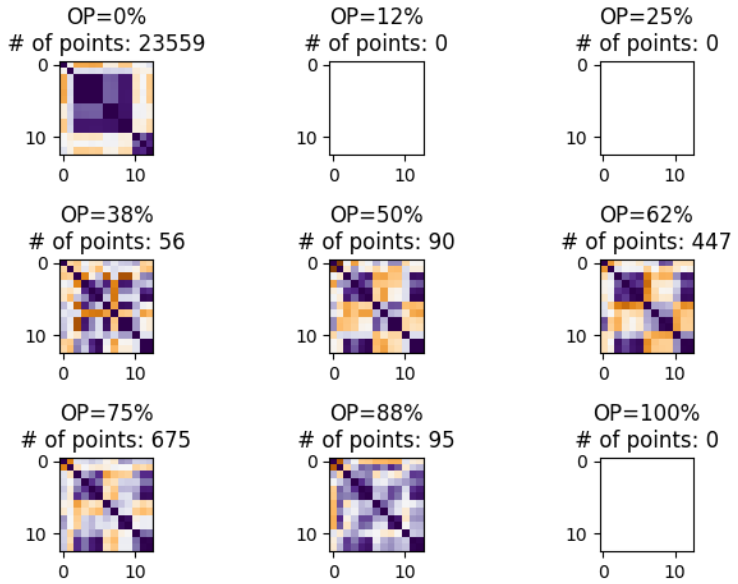
The need:

- Basic monitoring for enhancing maintenance
- Preventive maintenance based on KDI's (Key Diagnose Indicator)

The solution provided by ANDRITZ Hydro

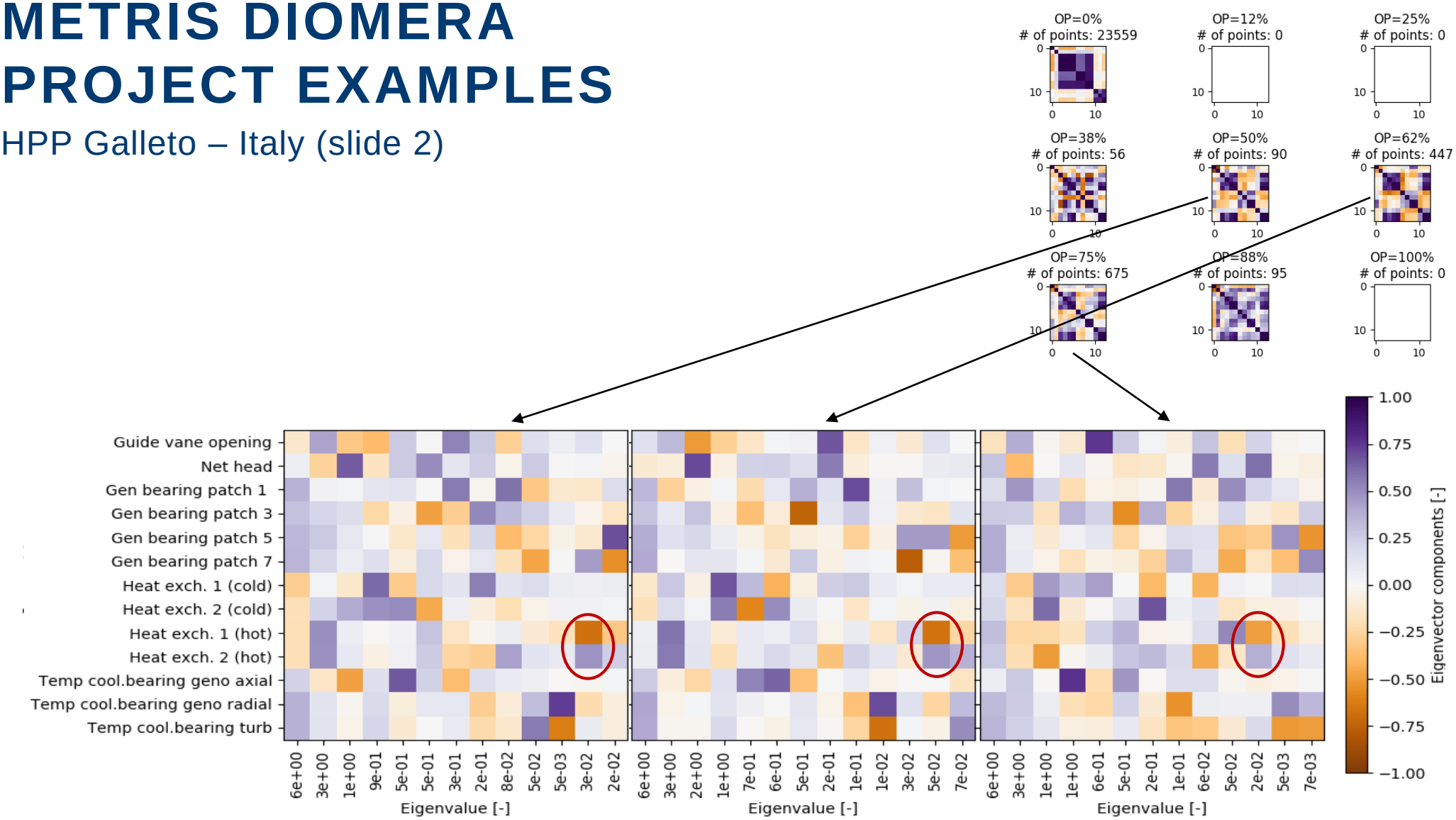
- Classify by operation point;
- Correlation changes due to operation point, identifying in which load they have correlation
- Automatic KDI determination, and definition of the threshold





METRIS DIOMERA PROJECT EXAMPLES

HPP Galleto – Italy (slide 2)

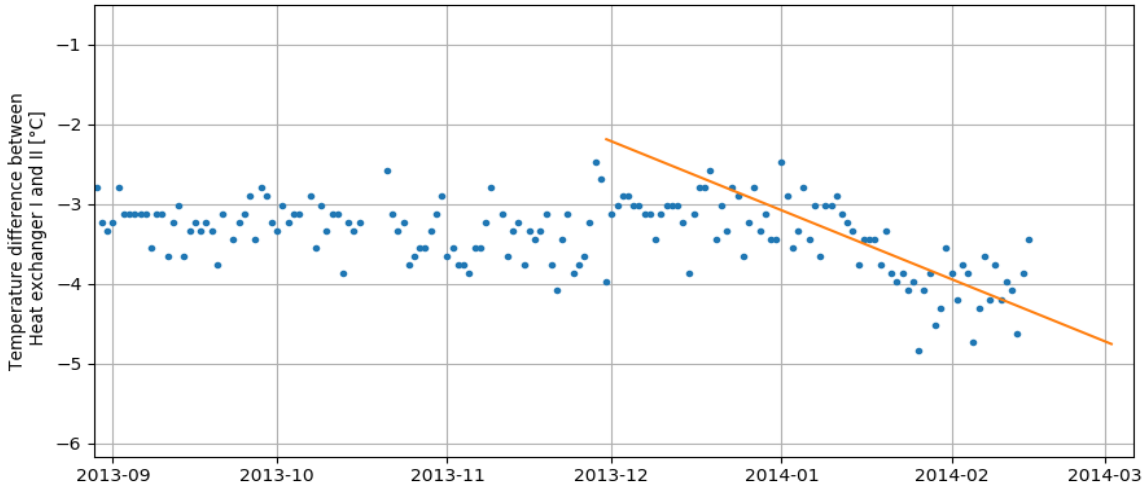


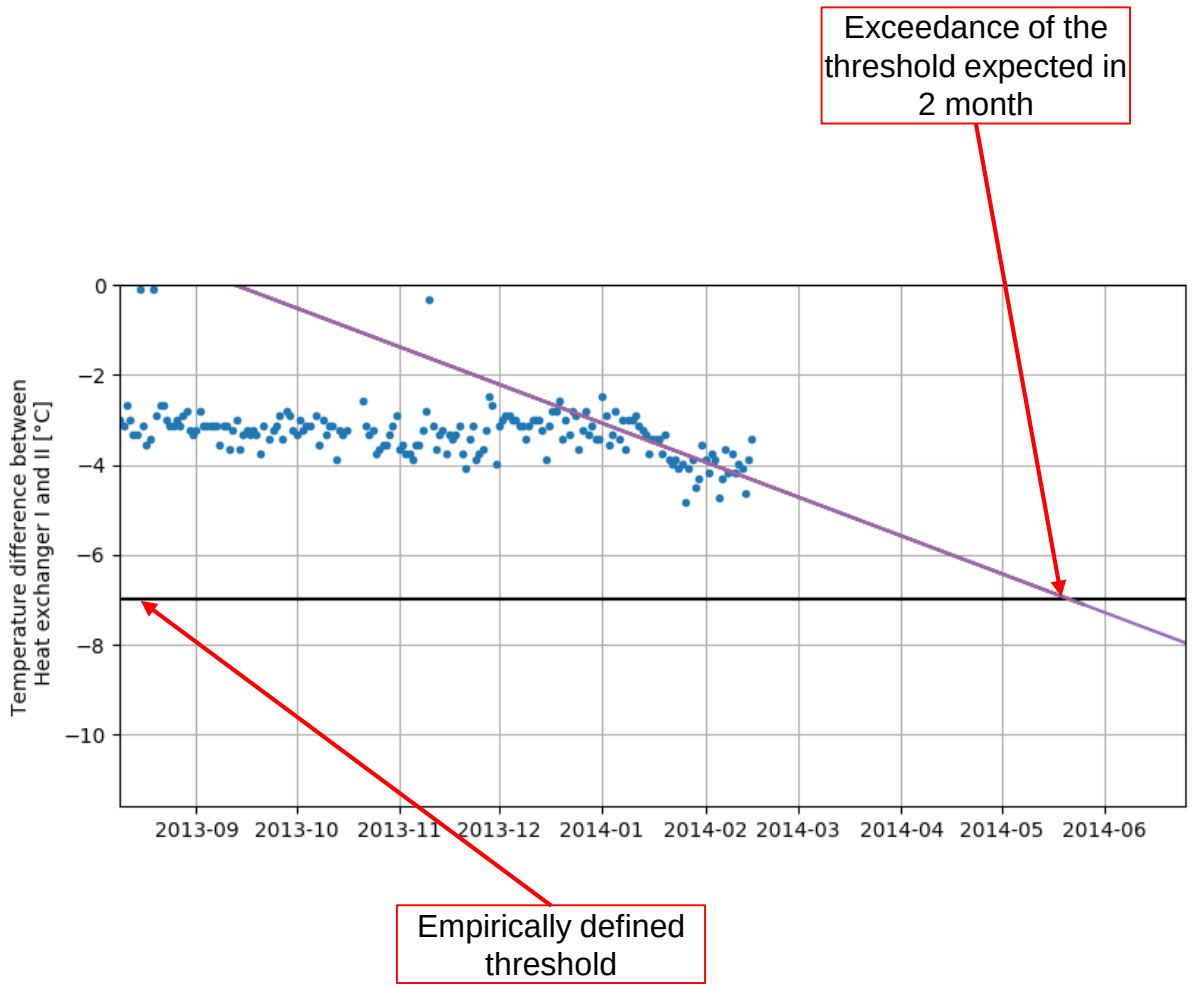
METRIS DIOMERA PROJECT EXAMPLES

HPP Galleto – Italy (slide 3)

KDI:
Difference between heat exchanger 1 and 2
T_1: Temperature cold heat exchanger 1
T_2: Temperature cold heat exchanger 2

$$KDI = T_1 - T_2$$





METRIS DIOMERA PROJECT EXAMPLES

HPP Teesta Urja - India, 6x 200 MW

The need

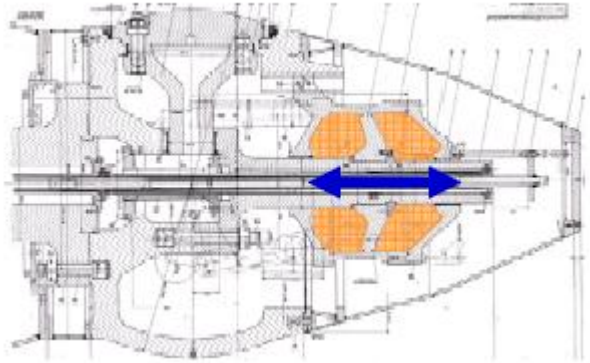
- Operation: “Optimization of the available water resources to get the maximum efficiency and ultimately maximum revenue”
- Maintenance: “Target to achieve maximum availability of machine by optimizing resources and adopting best maintenance practices”

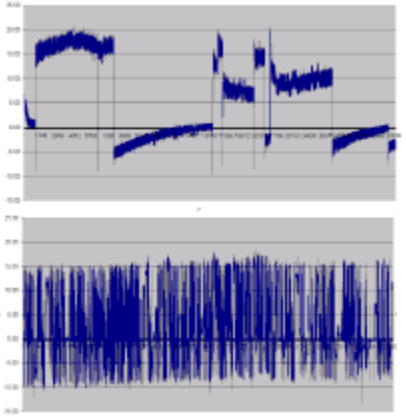
The solution provided by ANDRITZ Hydro

- Routine maintenance works (daily, weekly, monthly, bi-annual, annual)
- Maintain record of un-schedule activities performed
- Preventive maintenance on recommendation of condition monitoring system, trouble shooting activities
- Operation of units in agreement with dispatch center under consideration of maximum efficiency
- Daily generation reporting

METRIS DIOMERA PROJECT EXAMPLES

HPP Melk – Primary Control for Kaplan Units





Runner servomotor differential pressure for discharge control

Runner servomotor differential pressure for frequency control

The need

- With the insertion of intermittent energy sources, grid control becomes more challenging;
- Kaplan units are being required to operate to regulate in Primary Control;
- Runner components maintenance is a big issue.

The solution provided by ANDRITZ Hydro

- Detail analysis of the impacts on the lifetime of runner components;
- FEM of the components based on original design, operation and future needs;
- Impacts on the efficiency of the units due to new operation;
- Final fatigue resistant design