MEGGiTT Vibro-Meter®

Optimising hydropower plant performance with digital technology

As the world searches for more sustainable energy sources, hydropower is currently leading the field, supplying 71% of all renewable electricity in 2016[i]

However, with a growing hunger for this type of power comes an increasing desire for performance, efficiency, and output. So, how can you ensure optimum productivity from your machinery and plant operations? Well, as the old saying goes 'you can't manage what you can't measure'.

Thankfully then, the endless developments in technology mean you can now review, analyse, and act upon a wealth of information about all of your assets in real-time. Industry-leading sensors and condition monitoring technology opens a window on the inner workings of hydropower plants, enabling you to identify malfunctions early on and optimise operational efficiency. Without these tools, minor faults can remain unseen and escalate to a major failure, requiring unscheduled, lengthy and expensive repairs. So, before the anxiety of regulatory fines, unsafe practices, and dissatisfied customers creeps into your already busy schedule, simply read on to see how technology and digitisation can revolutionise your hydropower facility.

Greater visibility, reduced downtime and optimised maintenance intervals

Not only do hydropower plant repairs take a great deal of time, but due to lost output and unscheduled maintenance, the costs can quickly spiral out of control too. So the best solution is to keep a close eye on all aspects of your operation – including the internal workings of your machinery. Now, this may sound like a time-consuming and potentially impossible task, but that's not the case.

With the latest condition monitoring technology, sensors combined with software and data analytics are able to track, measure, and report on the performance of all aspects of your machinery. Different and complementary measurement techniques are available for the monitoring of key parameters of hydropower plant machinery including vibrations, partial discharge, air gap, magnetic field, temperature, etc.

Repairing a large hydropower plant can take months because machinery must be accessed from the top[ii]

From the complex components within your hydro turbine, (such as shaft, radial and thrust bearings, generator frame and windings), to the internal parts of your pump storage units, every mechanism is continuously monitored and reviewed for any potential problems and/or damage.

Data analytics is particularly effective when combining data from multiple sources and recorded using complementary measurement techniques. By taking this proactive approach, you have the opportunity to identify maintenance or repair needs before they develop into more serious and potentially catastrophic issues.

Predictive vs preventative maintenance

With priceless machinery data to hand, you can diagnose problems and schedule servicing, maintenance and repairs for a time that suits your business needs (with minimal impact to your operational output). And by eliminating the need for emergency action, you also avoid the costs associated with callouts and out-of-hours specialists.

The simple inclusion of nonintrusive sensors, a monitoring system and easy-to-use software means puts you fully in control – not just of your plant's continued performance, but also of your ongoing efficiency and periods of downtime. Although traditional time-based maintenance programmes (preventive maintenance) can be useful in certain circumstances, they are not economical because machinery is regularly stopped unnecessarily.

On the contrary, condition-based maintenance programmes (predictive maintenance) allow you to optimise maintenance intervals. By monitoring the evolution of key parameters, it is possible to predict when machine components need to be refurbished, repaired or replaced and to schedule maintenance activities accordingly.

Unnecessary maintenance activities which would have led to costly downtime can be avoided. Plant downtime occurs only when really needed and planned, not only in accordance with guidelines written by machine manufacturers based on conservative and expensive preventive maintenance intervals.

Condition monitoring helps you to avoid unnecessary maintenance activities and reduce costly downtime

Improve equipment reliability and lifespan

Although hydro turbines and pumps can seem robust and fully capable of withstanding tough environments, it has been shown that servicing and maintenance can extend the life of such machinery by several years[iv] – thereby maximising the performance of your investment.

Importantly though, identifying the need for maintenance and ongoing servicing is not solely related to avoiding costs. The fact of the matter is, a well maintained and a fully functioning system ensures your plant is operating at an optimum level. Your equipment will be more reliable, perform better, and last longer. All of which is great news for you and your customers. So, even if your machinery is new or has been recently serviced, it is nevertheless a wise decision to implement condition monitoring in order to measure performance, identify future issues, and ensure the best output is maintained.

The oldest operating hydropower systems are over 100 years old, however more typically they operate for 25-50 years[iii]

Drive performance with data

As with most new forms of technology, the value is in the information that is made available. In the case of power plant sensing and monitoring systems, the data can be the key to a successful and profitable future for your organisation. And best of all, it can do this without you even noticing or being actively involved (if data analytics is used).

When sensors and a condition monitoring system are added to your hydropower plant machinery, you specify the parameters and measurements to monitor in order to ensure optimum efficiency and production.

Once installed and configured, the system works autonomously, as the software and algorithms track, record and analyse all of the data you have specified to help keep the machinery running normally.

95% **40%**

Modern hydro turbines can convert as much as 95% of the available energy into electricity, the best fossil fuel plants are only about 40% efficient[v]

Ensure regulatory compliance and safety

Risk management is the identification, assessment, and prioritisation of risks followed by coordinated and economical application of resources to minimise, monitor, and control the probability and/or impact of unfortunate events[vi]

When working with power plant machinery, safety is paramount. And this is certainly the case in the hydropower industry as the large and heavy machinery, moving parts, and the presence of electricity and water result in hazardous environments that can de dangerous for your workforce. However, with sensing and monitoring equipment installed in hazardous areas, you can make sure that your most valuable assets – your employees – are safe at all times.

The ultimate safety feature is an emergency shutdown procedure. This means that in the event of any data highlighting a serious issue or problem which could endanger lives, the monitoring system will automatically trigger a shutdown of the machinery. Despite temporary loss of productivity and output, such a shutdown has the potential to saves lives and avoid catastrophic damage.

As experience shows, failure to adequately protect staff from health and safety risks can result in very large fines – so a temporary shutdown is a negligible cost when compared to a potential loss of life. Installing a machinery monitoring and protection system also helps to alleviate some of the concerns of insurance companies, thereby reducing the costs of their policies.

In addition to protecting your workforce, a machinery monitoring and protection system also has the potential to avoid catastrophic failure in the machinery itself. As mentioned previously, operating and maintaining hydropower equipment can be very expensive, so avoiding unnecessary repair costs is simply good business sense. With an emergency shutdown procedure, the machinery is shut down before any major damage can take place – saving you time, money, and long-term loss of output.

Importantly, for safety-related applications, only sensing and monitoring systems that have been developed in accordance with the IEC 61508 “functional safety” and ISO 13849 “safety of machinery” standards should be implemented.

Despite temporary loss of productivity and output, an emergency shutdown has the potential to saves lives and avoid catastrophic damage

Deliver continuous improvement

With benefits such as enhanced safety, increased efficiency, productivity and output, it's not surprising to learn that many energy organisations are planning to digitise more and more of their operations. As well as helping to improve their current business operations, the implementation of innovative technology supports continued growth and future advances.

The data available from power plant sensing and monitoring systems can be put to other uses within the hydropower business. For example, instead of stockpiling spare parts and equipment for maintenance and repair jobs, simply analyse the data to determine the core issue and order only the parts that are actually required.

By reducing the capital tied up in spare part inventories, budgets are kept fluid while still ensuring that the machinery maintenance and servicing requirements are covered.

Another benefit of the progress in digital technologies is the availability of regular software updates. Just like computers and mobile phones, our industry-leading machinery monitoring software is regularly updated to include start-of-the-art data processing algorithms and analytical tools. By ensuring users have access to the latest condition and performance monitoring solutions, plant managers can have up-to-date operation reports and rest assured that their hydropower machinery will continue to operate safely and reliably.

By 2020, electric utilities will spend $90 billion implementing digital technologies[vii]

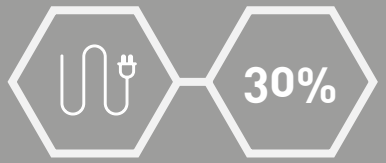
Trusted technology

Here at Meggitt, we are world-leading providers of high-performance sensing and monitoring systems for extreme environments. With 65 years of experience, many turbine manufacturers frequently recommend Meggitt Vibro-Meter® as their most-trusted supplier, with our systems monitoring all types of hydro turbines (Kaplan, Pelton, Francis and variants) for OEMs and end-users.

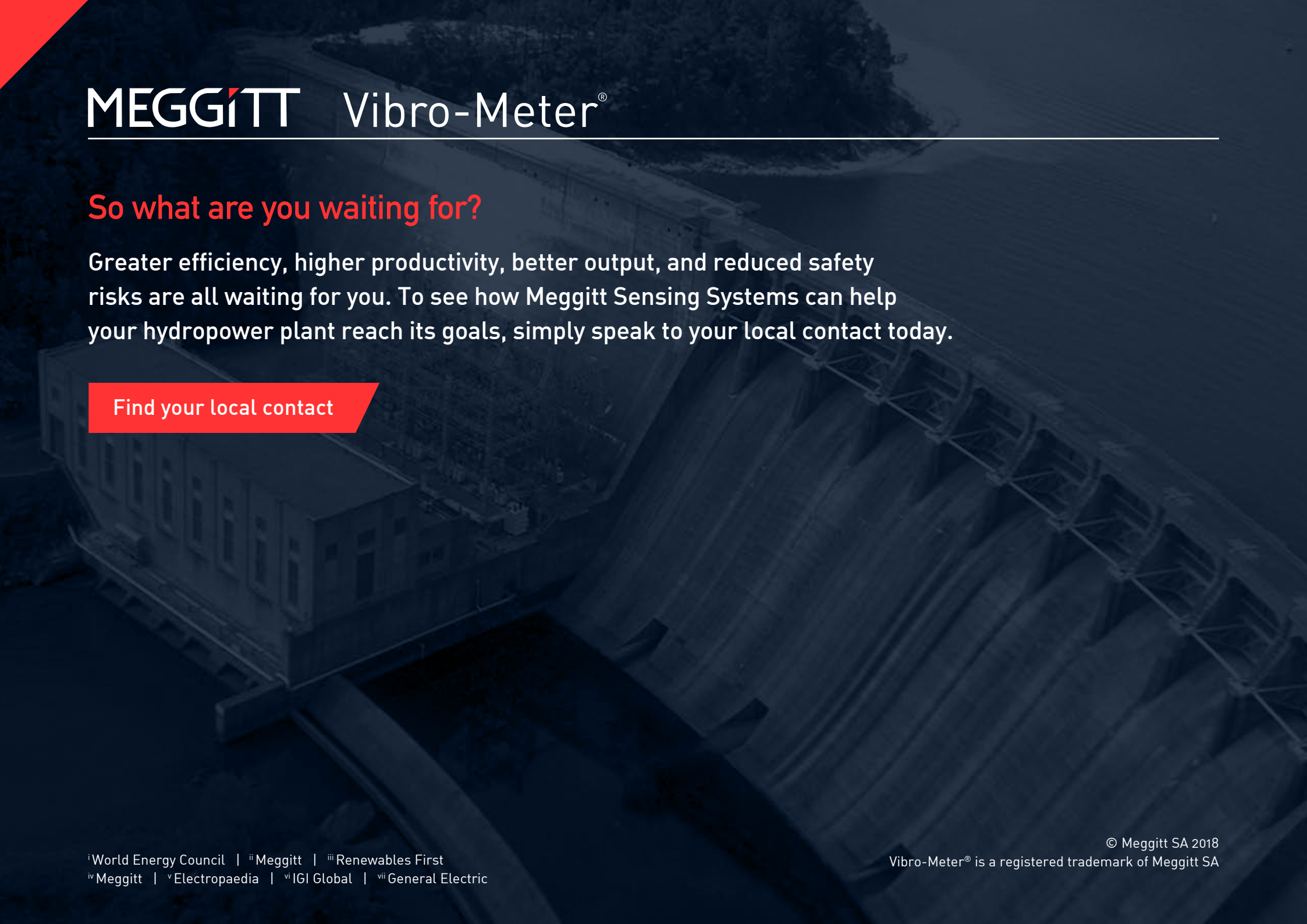
Not only does our technology provide the features and benefits mentioned in this guide, but due to the design of our VibroSmart® distributed monitoring system, we can also reduce installation costs by up to 30%. This means that when you do decide to digitise the monitoring of your power plant operations, we can help you reach your goals faster and more efficiently.

Our industry-leading solutions consist of measurement chains using our high-performance sensors, monitoring and protection systems such as the VM600 and VibroSmart®, all managed and operated using VibroSight® – fast and user -friendly software with exceptional data handling and visualisation capabilities. For example, VibroSight® supports the flexible configuration of channels, processing, outputs, alarms and plant structure, and enables you to monitor the condition of all critical assets from a simple dashboard. With continuous data acquisition offering seamless monitoring of all events, our technology is suitable for the most demanding applications. While to ensure that you are not overwhelmed with data, data logging can also be configured to suit your needs.

Importantly, we continue to develop our products and solutions in order to meet the changing requirements of the energy market.



VibroSmart® distributed monitoring systems can reduce installation costs by up to 30%



MEGGITT Vibro-Meter®

So what are you waiting for?

Greater efficiency, higher productivity, better output, and reduced safety risks are all waiting for you. To see how Meggitt Sensing Systems can help your hydropower plant reach its goals, simply speak to your local contact today.

Find your local contact

[i] World Energy Council | [ii] Meggitt | [iii] Renewables First
[iv] Meggitt | [v] Electropaedia | [vi] IGI Global | [vii] General Electric