



Renewing renewables: data analytics can unlock a new age of predictable operations and profits, for wind, solar and hydro

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Data can be our crystal ball. With advanced analytical tools, we can harness the flow of data from turbines, solar cells, dams, our organisations and even external sources, such as energy markets, to optimize performance and earnings. You can look into the future, now.

Businesses thrive on predictability. Stable demand, stable supply, stable operations and, if we're doing it right, stable growth and positive development that leaves us, and all our stakeholders, with stable smiles on our faces.

However, renewables are unpredictable. The supply of energy we convert is

inherently unstable – it fluctuates according to the whims and fancies of a power beyond our control, that of Mother Nature. Hydropower is perhaps the exception, as dams offer operators a steady means of power storage and production. All we have to do is, quite literally, turn on the tap. Nevertheless, unpredictable weather patterns, such as prolonged dry periods,

can impact upon even this most proven and reliable of renewable sources.

So, how do we bring predictability into this new energy arena? We can't tame Mother Nature, but we can learn from her, from ourselves, from our equipment, and from the energy market to continually adapt and optimize our assets and operations. In doing so, we can plan more effectively than ever before. We can unlock predictability within our industry.

And big data analytics is the key.

Star power

But, let's start with something we don't need a crystal ball to see: the sun is our



future energy source.

On a clear day, the solar energy hitting our planet at sea level perpendicular to the sun is about 1 kW/m². In real terms that means an area of 2350km² over the equator, roughly the size of Luxembourg, is sufficient to supply us with the same amount of energy that we produce globally today.

The amount of solar energy reaching the surface of the planet is so vast that in one year it is about twice as much as we will ever obtain from all of the Earth's non-renewable resources of coal, oil, natural gas, and mined uranium combined. The potential is staggering. It is up to us to harness, convert and realise it.

Solar, wind and hydro energy are as dependent on the sun as we are. With solar, no explanation is needed. Wind is caused by differences in atmospheric pressure as air moves from high-pressure areas to low-pressure areas in a constant search for equilibrium. The sun is the engine driving this perpetual movement, as it creates heat differentials between the equator and the poles. We harvest this solar energy as kinetic wind energy, with the abundance of the harvest determined by wind speed, swept area of the wind turbine, and air density (mass).

Hydro is a different version of the same story. Here the energy conversion cycle begins with the sun heating and evaporating water on the surface of the Earth. The water vapour/moisture evaporates, rising with warm air before eventually cooling down as it reaches higher altitudes. This causes water to form as clouds, and sooner or later rain falls and is carried through rivers and streams back to the ocean. In effect, this operates as an enormous energy pump, with our hydroelectric plants capturing just a fraction of this energy and converting it for the waiting consumers.

The sun is everything to us. But, as those of us living in the Northern hemisphere know only too well, we can't summon it on demand.

Our data, though, is always here to bask in.

No more guesswork

Wind turbines don't just produce power; they create a wealth of data. Each turbine has the potential to pump out 9000 data tags every second. This sensor data is usually utilised to control and steer the turbine, but with advanced analytics, it can unlock immense added value for

operators. Maintenance is an obvious area to start with.

The current industry norm dictates that turbines are taken out of operation twice a year for scheduled maintenance, usually before and after high seasons of activity/production. This seems wise, but is it necessary? If you could accurately monitor the condition of the turbine, you could gain real insight into its actual functional well-being – determining if it's ready for peak production without the time, costs and risks of physically checking it. Maybe it only needs one maintenance service for example, while another unit may need two.

The advanced analysis of sensor data allows turbine operators to plan their maintenance schedules according to genuine need and preference, rather than simple convention. They can alter operations or tweak the number of manual inspections and maintenance tasks, planning the replacement of key components, such as a gearbox, a motor or a bearing, at the most favourable point in time in relation to the weather situation, component pricing, and equipment availability.

Alerts can be created for components and systems that need attention and schedules adjusted accordingly. Overall lifecycles can be monitored and accurately predicted. In short, we can use data to take the guesswork out of the maintenance equation, creating – wait for it – predictability.

Mitigating risk

Maintenance tailored to actual need has obvious operational, safety and cost benefits. When these are multiplied out over entire farms, portfolios and businesses, real competitive advantage can be achieved in tight commercial markets. That's the data difference, but there's more.



Wind farms are never easily accessible. To take advantage of nature's extremes, while conforming to society's demands, they are remote beasts – with their armies of twirling blades stationed on hillsides, plains and out at sea. This means maintenance is demanding, must be planned, with the right parts at hand, and carries inevitable risk to workers, often conducting tasks at heights, in confined spaces and potentially surrounded by hostile seas. If we use operational data to reduce physical maintenance and inspection visits, then we also reduce risk, which is a key objective of every industry operator.

Hungry for challenges

However, it is important to note that data analytics doesn't stop at operational and technical data. The building blocks of big data analytical systems are mathematical algorithms, and they don't care what kind of data you feed them – they just want to get their teeth into a challenge. Systems have therefore been developed – and we'll get on to the details of Kongsberg Digital's shortly – to bring multiple layers of data together, from both inside and outside an organisation, to provide a full analytical picture of past, present and future performance.

As such, you can combine the data from a turbine, farm or business with that from your personnel department, weather forecasts, contracts, power purchase

agreements, and the wider energy market, to name just a few sources, to empower a depth of analytical insight that has never previously been possible.

This can help you navigate the increasingly complex energy market, combining your wind assets with other business operations while optimizing performance and operations to meet demand from all stakeholders.

This is the power of big data analytics – you feed sources in and receive actionable business intelligence in return. It is revolutionary in its potential.

Empowering developments

In 2015 Kongsberg Digital launched Empower. This is a system that is unique in the way it aggregates and analyses data. It offers the capacity to handle huge amounts of real-time data, alongside data from any desired internal and external sources, as well as historical data to provide powerful pictures of trends and developments over time. Built on the foundations of our proprietary digital platform Kognifai – which gathers data from any source, time and location in one place – it is the most powerful, flexible and user-friendly system on the market.

Empower allows for smarter maintenance, greater control, insightful planning and the ability – thanks to the way it connects to

markets, administrative functions and overall business operation – to enhance commercial decision making.

It is as applicable to the solar and hydro segments as it is to wind, utilising data to, for example, optimise the scheduled cleaning of solar panels to heighten efficiency, and enabling condition-based maintenance for equipment and systems within hydropower facilities.

What's more, due to the fact that it unifies all data on a single platform, it can be used to manage multi energy portfolios that encompass all renewables, harmonising and optimising performance and profits on all the energy sources under the sun.

And the result of all this information, gathered from multiple sources, in millions of tags, from anywhere in the world, is available to users on one intuitive interface, on their computer, laptop, tablet or phone. That is real power.

Renewables, driven by the sun, will unquestionably be our future source of energy. Big data analytics will help the people who provide that energy – you – run more effective, efficient, profitable and, crucially, predictable business operations. That should leave a big, stable smile on everyone's faces.

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