

Decarbonization is transforming our energy system, driving an accelerated shift from fossil-based to renewable power generation and electrification of transportation, industry and buildings sectors

ANDREW COLLIER

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Time to get real about digital

Andrew Collier graduated from the North Oxfordshire Technical College and then Oxford Brookes University, where he studied Electrical and Electronics Engineering together with microprocessor-based control systems. His work experience includes Test Field manager and Senior Design Engineer before moving into sales and marketing, where he has held international management positions for the last 19 years. He has been working in the transformer business for 14 years, and he is responsible for the digitalization of the Hitachi Energy transformer business. Andrew has co-written several whitepapers and co-developed both patents and trademarks relating to the digitalisation of Transformers. As a keen scuba diver with over 25 years of experience, Andrew has a real-life appreciation for the importance of protecting our planet.

Hitachi Energy is a global technology leader that is advancing a sustainable energy future for all. It serves customers in the utility, industry and infrastructure sectors with innovative solutions and services across the value chain, with more than 100 years of pioneering leadership. It operates this business in about 90 countries, 30 service centres and more than 50 manufacturing plants across the world, supporting customer requirements of high reliability, quality and efficiency.

A few weeks ago, we had an interesting conversation with Andrew Collier from Hitachi Energy, discussing about Hitachi Energy's vision of digitalisation in the electrical power industry and especially the digitalisation of transformers. Here's an excerpt from our discussion.

Hello Andrew, thank you for joining us. First of all, tell us a little about yourself and your background.

It is my pleasure to talk with Transformers Magazine. I have been in the transformer business since 2008, which was quite a change as my background is in industrial automation. I started my professional career helping to build and then run the test field for the UK subsidiary of a major international OEM. One learns a lot in a test field, and this proved a good grounding for the rest of my career, including 5 years as a senior electrical engineer, designing and commissioning automated material handling systems, before moving into the fields of application engineering and then account management, finally settling into product and portfolio management, which is what I have been doing since 2010. I have been working as Digital Lead for Hitachi Energy's transformer business unit since 2019.

I joined the transformer business of Hitachi Energy (it was ABB at that time) in 2008, but early 2010 was when I fundamentally transitioned into the world

of portfolio management, driving R&D projects and aligning investments with market needs, although I still recall my surprise when learning in 2008 that more transformers were not fitted with monitoring equipment as standard. Year 2008 was also an eye-opener for me as, coming from industrial automation and drives background, I had completely underestimated the technology and know-how that goes into those big (mostly grey) metal boxes the general public typically takes for granted. Before joining the transformer world, I even commented: "It's a transformer; how difficult can it be?" something that I corrected on my second day on the job. Though not my original intention, I have already spent 14 years in the transformers business and can now understand why once part of this amazing transformer family, people tend to stay. As a keen scuba diver, I also see how important it is that all of us do what we can to protect our planet and accelerate the move to decarbonisation through the Energy Transition.

We, as Hitachi Energy, are doing great things, but a globally sustainable future is founded on humanity's ability to move away from fossil fuels and over to renewable energy sources. Renewable energy sources bring lots of advantages but also lots of challenges, and those challenges stem from both the increased complexity of integrating renewables into the grid, but also the increased unpredictability.



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Digitalization allows you both the visibility and control to deal with the unpredictability and manage the increased complexity. Put simply, digital solutions mean you can host/bring more renewables onto the grid.

So how do digital technologies help in practical terms?

I am really excited to be part of Hitachi's Social Innovation business, as I believe investing in sustainable technologies is not only smarter but has also become a necessity and something we all need to accelerate actively. To quote United Nations secretary general Antonio Guterres from the recent COP27 summit: "We are on a highway to climate hell with our foot still on the accelerator." As he also highlighted: "We are in the fight of our lives, and we are losing." Digital technologies are fundamental to winning that fight.

Almost all of the electrical power community needs to do more with less. Either due to the retirements of experienced personnel or keeping older assets running which are now working in a grid dynamic that

was inconceivable at the time when they were installed.

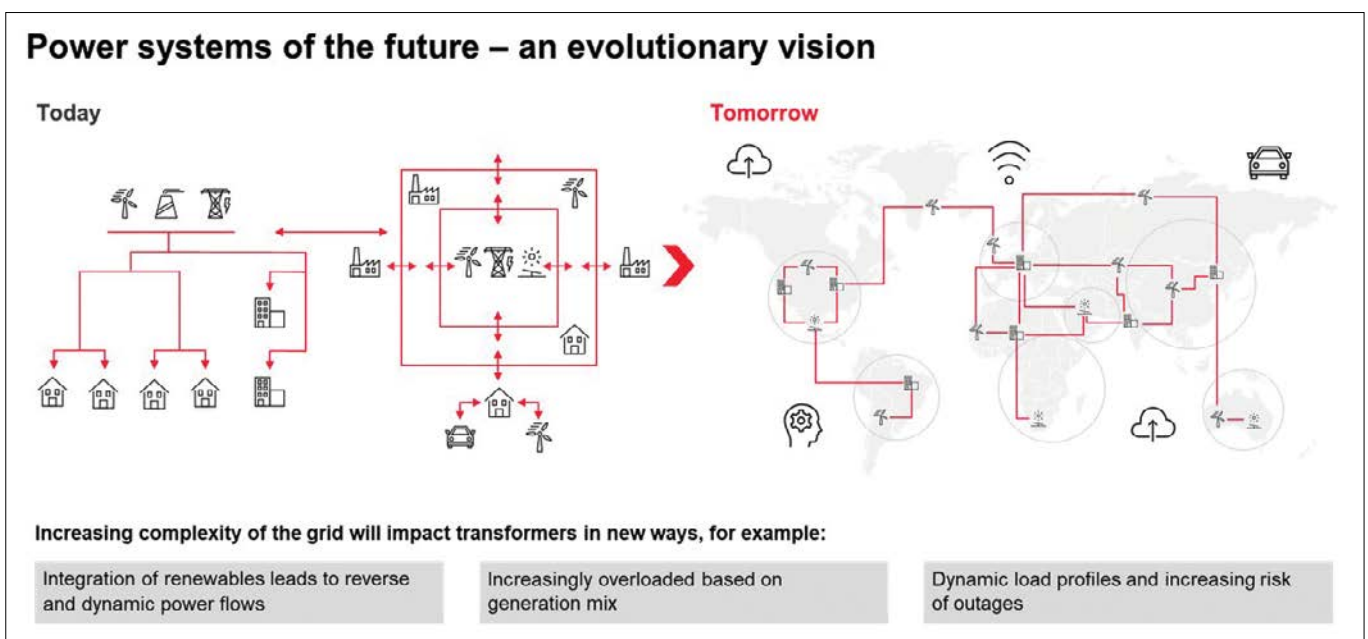
The move to green electrical energy needs to happen so quickly that digital technologies are fundamental to achieving the needed energy transitions. This applies to both existing and new transformers across power generation, transmission and distribution. In their most simplistic form, digital technologies enable energy companies to keep the lights on by providing near real-time insights into the condition of their assets, allowing maintenance teams to prioritise activities, plan for optimising outages and source spare parts or specialised resources. This is what we generically describe as the move from time-based to condition or reliability-based maintenance models. In many cases, these insights also allow existing transformers to continue in operation long after their planned life cycle or original decommissioning date.

More important to many is how digital technologies facilitate the transition from the erstwhile unidirectional power flows, which are traditionally mostly fossil fu-

elled "bulk power stations", to what is increasingly distributed generation, virtual power plants (VPPs) or even pro-summer models, where power flows in different directions at different times of the day or year. This has both technical and commercial implications resulting in power generation at what was previously considered the distribution level. Additionally, reverse power flows and regulating requirements, together with extensive intra-day trading and redispatches can now run into hundreds of millions of dollars per year. All the indicators show we need to accelerate decarbonisation, which will, in turn, require more and more information sharing across OT and IT systems.

So where does Hitachi Energy's TXpert™ Ecosystem fit into the digital landscape?

I must say, I am very proud of what we have achieved since launching the world's first digitally native distribution and power transformers in 2017 and 18, respectively and the very positive feedback we are getting from end customers and other transformer OEMs. The TXpert™ Ecosystem is transformer manufacturer agnostic. It is open, modular, scalable, and designed from the ground up to both accommodate individual customer preferences and adapt to their changing needs. At the heart of this is our TXpert Ready program, where we prove the integration of the 3rd party devices that customers are familiar with and may well have spares for. This provides the peace of mind for customers that their pre-



ferred smart sensors can reliably ‘talk’ to the transformer’s brain, which is in the form of our TXpert™ Hub. Additionally, the TXpert™ Hub provides a single pane of glass to view and compare multiple parameters and trends together with the security that having a single **cyber-secure** connection point brings.

The TXpert™ Ecosystem also allows users to start simple and build their own experience with as little as comparing one or two key parameters under various loads and / or differing ambient conditions. More sensors can be easily added, as can our station-level asset performance management tool (APM Edge), which can support up to 50 transformers of the same or differing types of transformers. Already at the individual transformer level, there are popular additions, such as various levels of online DGA monitoring, which can easily be visualised at the transformer via Duval triangles or Rogers ratio graphics. However, the step up to a station level or, better still, enterprise-level APM tool allows users to visualize multiple assets and their health in the context of their importance to the wider business, the path to do this is seamless with TXpert™ and the patented algorithms used by Hitachi Energy’s APM solutions. These benefit not just from the designs of our extensive legacy installed base but also from more than 10,000 transformer inspections. Should

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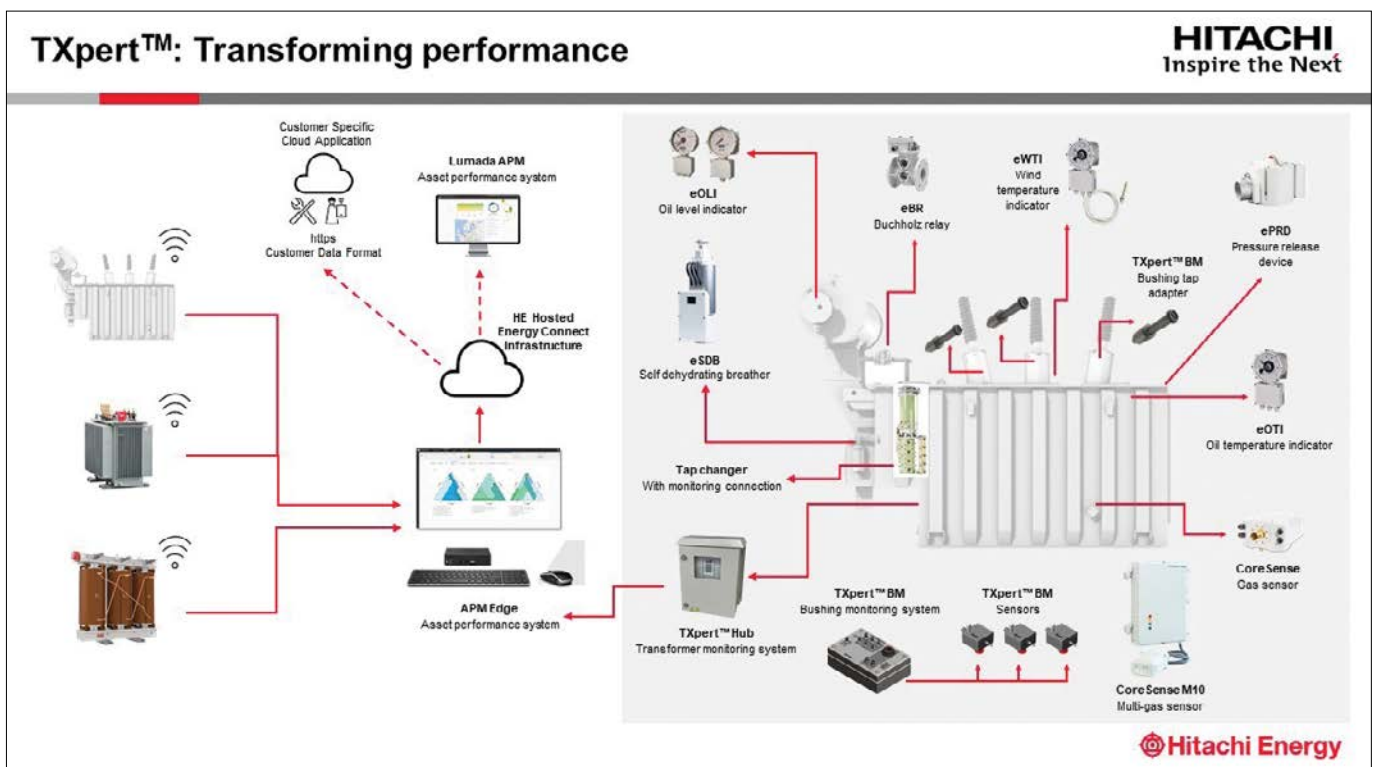
customers wish, they can choose to share data with Hitachi Energy’s domain experts either locally or remotely. We can literally offer sensor-to-boardroom connectivity and insights.

Connectivity clearly adds value, but what about cyber security?

Digitalization is propelling most industries, especially utilities, into a new world of technology adoption, at a rate many are struggling to keep up with, opening them up to new threats. This is also the case for many suppliers who have organisations that are experienced in power technologies rather than information technol-

ogies. Without an organisation that is fundamentally focused on this area of the business, it is easy for both customers and suppliers to underestimate the complexity or may struggle to keep up with this side of the business. At Hitachi Energy, we benefit from the wider Hitachi market leadership in IT/OT integration, but above and beyond this, we have a ground-up approach where our Transformer Digital R&D organisation is itself already certified to both IEC 62443-4-1 and ISO/IEC 27001. Something we are very proud of and the foundation for us being able to move from compliance and 3rd party accreditation to certification. Our organisation and products are leading

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the industry with cyber security certification to standards such as IEC 62443 and 62351.

How do you see the digitalisation of transformers evolving in the future?

Secure communications are the key to achieving the full value of digitalisation and the way to really improve efficiency and reduce human error. I can't talk about the future of digital technologies without touching on machine learning and digital twins. As I mentioned earlier, over my career, you could say I have transitioned from milliamps to MVA, but some things remain true. To achieve a goal, you need not only the best software engineers but

also the deep domain knowledge to frame the objectives, understand the pitfalls and manage the outliers. At Hitachi Energy, we embrace these technologies, and tools like machine learning are assisting our engineers in completing complex tasks in shorter time frames. This is set to continue and will reduce the time needed to bring products to market and replace simple repetitive tasks through tools like natural language processing. Less new is the principle of digital twins, which many engineers may have been using for years without realising. In simple terms, a digital twin is a digital representation of a physical object, so many monitoring systems are already simplistic twins. The real value is not however in a single twin but

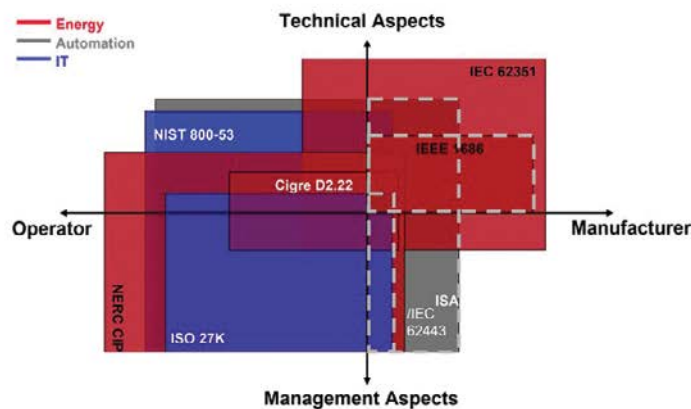
in a system of twins and their attributes. If we use a power analogy, then we have a number of component twins, which form parts of an asset twin, then multiple asset twins forming a station or switchyard twin, which in turn is a subset of the much larger network twin. Just as important is how we feed these twins to ensure what we get out of them is useful, with the best twins starting with Building information modelling (BIM) based engineering information and a digital thread that is supported all the way through operations and ultimately recycling.

And what about the people needed to achieve this vision?

All of the above-mentioned changes are happening, while at the same time, the electrical power industry is losing many of its most experienced engineers. However, at Hitachi Energy, we are incredibly lucky and very proud of the great team we have, which combines world-leading knowledge and experience across transformers, industrial control systems and services. We have dedicated R&D teams as well as highly trained local experts in each of our 5 regional hubs. More recently, we have started to install hub digital centres, supporting the regional markets with logistics, local stocks and the option for customers to locally source everything from devices to systems tailored to meet their individual requirements, all with world-class service and support.

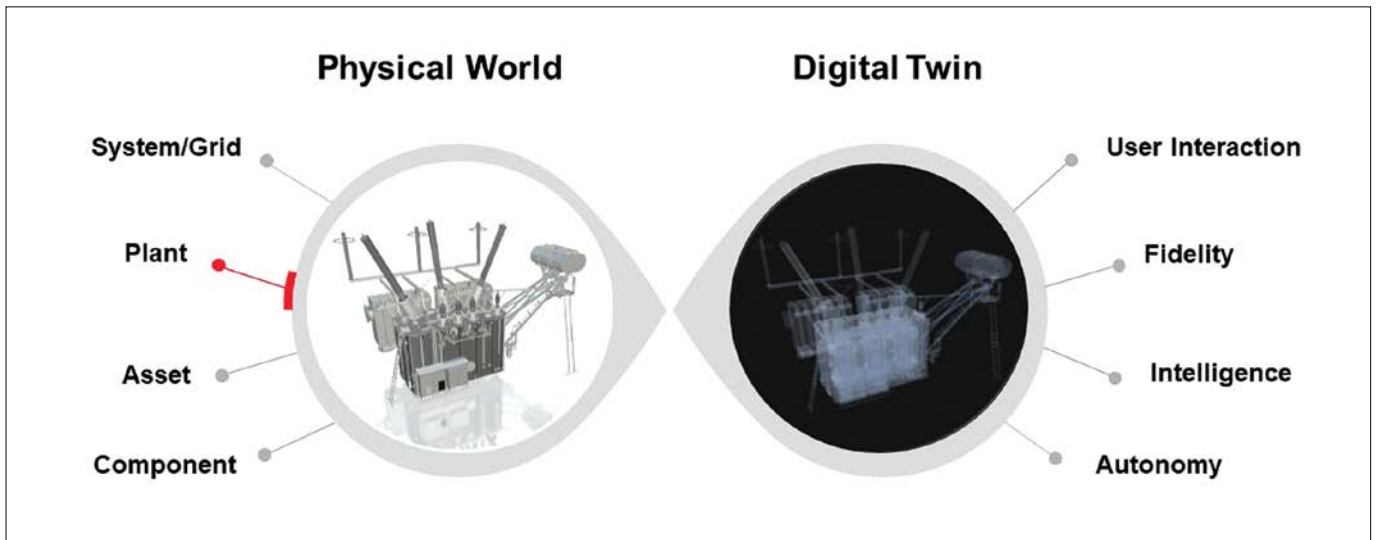
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Cybersecurity – TXpert Hub certifications



Graphical representation of scope and completeness of standards from IEC62351-10

Cybersecurity can only be achieved through coordinated efforts



Helping you unlock real business value with digitalization

Decarbonization is transforming our energy system, driving an accelerated shift from fossil-based to renewable power generation and electrification of transportation, industry and buildings sectors. This is creating the need to optimize energy both locally and system-wide leading to a complex “system of systems” that must be integrated and managed. Digitalization is the only way to manage this complexity, simplifying the context-

tualization of massive amounts of data. But this must be balanced with managing and optimizing today’s operations. Hitachi Energy can help you navigate this increasingly complex energy land-

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scape. We have the right combination of connected products, software-based solutions, and digitally enabled services to solve real-world challenges and add real value.

