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BSI Net Zero Week webinars

Insights from engineering for net zero: how digital transformation will be the key to success

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Inspiring trust for a more resilient world.

In a series of insight-packed webinars, BSI's Net Zero Week presented a multi-sector view of the collective challenges and what's being done to tackle them.

This final webinar in Net Zero Week looked at how we can move towards net zero by taking a new approach to engineering and design, underpinned by digital transformation.

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It was hosted by BSI's Digital Manufacturing Lead Ben Sheridan, in conversation with Alan Brown, Professor of Digital Economy at the University of Exeter Business School and Martin Aston, MD of Förvanda Ltd.

Engineering: complex and creative

Martin leads The Brunel Challenge initiative, which aims to establish a national programme of engineering capability development that will transform engineering through the use of digitalization.

Martin makes the point that:

"Engineering is one of the most misunderstood disciplines, because it's a very complex, creative and analytical process. It's where science becomes reality; we take science, and we use analysis and imagination to deliver viable products."

A change of approach

We need to change how we approach engineering, because achieving net zero requires complex interdependencies. For example, we now have electric cars but they're a very small part of the equation. The car might have zero emissions at the point of use, but the current process for designing and producing that car is far from energy-efficient.

"So we're going to need a systems approach to engineering, with a much more integrated engineering design process," said Martin."Digitalization has a key role to play here and interoperability will become absolutely paramount if we're going to do this."

Alan Brown then talked about the role of digital transformation in achieving this integrated approach. "Digital transformation is about far more than just digitizing our current ways of thinking and working. When we start to look at the world through digital eyes, it gives us a series of opportunities to think and work in a whole new way – whether that's using models that enable real-time analysis, or delivering offerings in new ways. So today we'll be taking a fairly holistic view, looking at what this allows us to do, how it allows us to think and what we need to understand in order to be successful."

The example of social media

Martin agreed that we don't want simply to digitize today's processes.

"The underlying engineering process we use today is virtually the same as the Romans used. It's a very sequential transactional process, where we pass information in turn between domains specialists.

"Compare a landline phone with social media. Social media is not the digitalization of a landline phone; you're doing parallel analyses, engaging everybody at the same time and using common standards, but you're also enabling people to do different analyses in parallel in real time. And digitalization gives us the opportunity to deliver that level of transformation in engineering. It's a complete culture change and it brings democratization; suddenly everybody is as powerful as everybody else. But now engineering needs to develop those systems, the people to work within them, and the data standards to enable us to do that."

Learnings from other sectors

So how do we apply this thinking to engineering? Alan agreed that culture is at the root of this issue, giving the example of software engineering.

"Years ago, when I was working in large-scale software development, we were very concerned with consistency, quality of delivery and specifying everything upfront. And there were a lot of efforts on engineering processes within the software world. And that got us to a point where we could begin to build large-scale dependable systems."

But when Alan and his team started to analyze these systems, they found they were the most expensive software systems in the world, frequently late and largely over budget. What's more, it was difficult for those systems to adapt when the environment was rapidly changing.

"That taught us we needed more than rigour, reliability and quality. We needed our systems to be more flexible. And finding out where and how that flexibility fed in was essential. So we began to build in architectural design approaches that allowed us to start replacing activities, or monitoring what was going on, or adapt to developments like advances in machine learning or changing circumstances, the advances that we've seen in machine learning, in pattern matching and so on."

They began to recognise that flexibility was critical.

"And finding ways of becoming flexible – building the models that could react, building systems in a way that adapted to the environment, creating solutions that were adaptable because of the way they were architected – has been really important over the last 20 years to build this idea of transforming to a digital way of thinking and working."

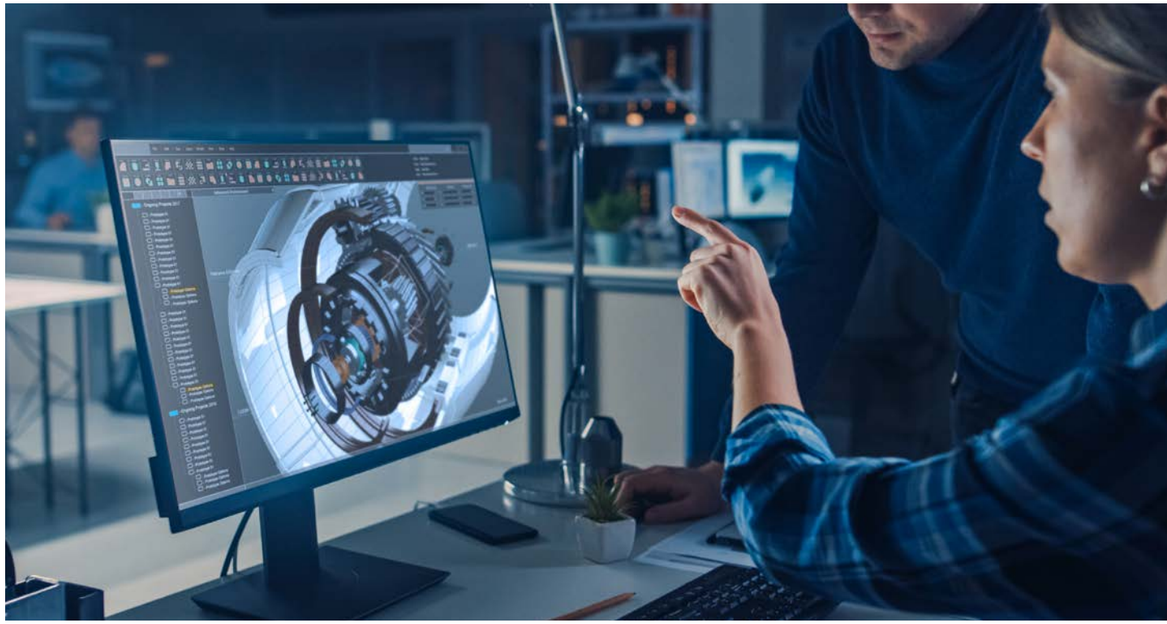
Complex challenges

Martin expanded on this point, saying that flexibility was critical but brings challenges of its own.

"We're talking about net zero. So you've suddenly got to be able to connect a company that's developing a hydrogen powered propulsion system with an organization that's actually distributing hydrogen to airports and bus stations. If this system isn't designed as a whole, it doesn't work."

But engineering is highly regulated, which creates issues when it comes to digitalization. Martin cited the aerospace industry. "The certification data for an aircraft has to be kept available for the life of the aircraft programme plus seven years. But the B52, for example, will be 100 years old by the time it goes out of service. At the moment we largely use paper and its long-term storage is environmentally quite good. But what happens with digital data? If we've got to store exabytes of data for decades, the actual environmental impact of all those data centres becomes an issue.

"So that's why the whole engineering challenge is huge. It's an exciting time and there are massive opportunities, but we really need to take a step back and look at what we need to do. And we've got to get cracking now."



Managing the paradox

Alan then spoke about how moving faster will be essential to reduce scrap and rework, helping the industry reach net zero.

"It can take five years to go from defining the environmental problem to specifying, modelling, building and testing the solution – by which time it no longer meets the need, because the world has moved on. We've been having to adapt as we go along, while still conforming to certifications, external validation and so on. And managing that paradox – the need for certainty and flexibility – has been a major constraint for decades. So making some progress in that space will have a huge impact on us being able to reduce scrap and rework."

Ben asked Alan and Martin how they would go about tackling the problem of the two worlds they described – one where the asset's design and performance is frozen in time after regulatory approval, and the other where we continue updating design and performance to reflect new knowledge and changing circumstances.

Alan said that regulatory agencies such as the National Audit Office are making significant changes to their approach.

"They used to criticize any adaptations to the original design and schedule, then also criticize the results for failing to meet the client's needs years after they were defined," he said. "But now they see it as their job to help us use public money as effectively as possible to provide the solutions that adapt to their constituency to benefit UK PLC. They want to move to a supportive interpretation of the rules and regulations, so that we can conform in the right way and deliver the best value that we can. People are starting to look at what words like 'risk', 'trust' and 'value' really mean in this fast-paced world, where we're trying not only to deliver for today's requirements, but to anticipate future needs too."

Martin drew a parallel with online banking and shopping; ten years ago people were nervous about its safety, but now it's the norm.

"We need to demonstrate similar safety in the products we develop. One of the Brunel Challenge case studies is in autonomous cars. With today's regulatory regime, you'd have to drive that car 11 billion miles, and it would take 500 years to demonstrate compliance. Clearly, the general public wants autonomous vehicles, but they don't want to wait 500 years. So we have to work together across the entire stakeholder map, to demonstrate that these products are safe, but also deliver what society wants."

Ben wondered what this holistic approach to engineering design meant for sustainability.

"About 15 years ago BSI published a standard on just this topic," he said " BS 8900 is all about understanding your system in the context of other systems and trying to get things done holistically. Are you starting to see a movement of digital towards the sustainability agenda, with people really understanding that the two things are interlinked?"

Alan said this is definitely happening. "Over the last year I think we've seen a recalibration of values. Sustainability is one of those big areas that was important beforehand, but is now receiving even greater attention".

"I try to think of sustainability from three perspectives. The first is from an environmental point of view, looking beyond the physical resources to things like the use of energy in data centres and so on. The second is sustainability from a human point of view, because people working in these areas are burning out and we need to support them. And thirdly, we need sustainability from the business point of view, to continue employment and support societal needs. The big challenge for 2021 and going forward is tying those three things together. "

Finally, the panel addressed some of the many questions submitted during the webinar – from the top three risks of digitalization, to what government can do to help the industry achieve net zero.

You can watch the webinar on demand. Find out more on the BSI Net Zero page

Why choose BSI?

Climate change has emerged as one of the biggest challenges of our time. Several factors have prompted countries around the world to commit switching to low-carbon economies. It's estimated that warming above 2°C will expose nearly 3bn people to severe climate risk. If warming can be cut to 1.5°C this figure could be halved.

Despite progress in recent years there is still much work to be done. The Paris Agreement aims to achieve net zero balance in the second half of this century and seeks accelerated action from governments across the globe to meet this goal.

Major milestones have already been defined. For example, by 2025, a full net-zero policy package must be in place, and by 2035 almost all new investments (such as cars and heating systems) should be zero-carbon. Further details will be added in the coming months to maintain the UK's credentials ahead of COP26.

As energy costs continue to rise and climate change concerns grow in the public consciousness, low-carbon technology will play a significant role in the world's future plans. It is no longer a question of if the UK will fully embrace the low-carbon economy. Rather, how efficiently we can manage the transition.

The recent global events provide a unique opportunity for many to 'Build Back Better', embedding sustainability with real commitment and in a manner, which evidence each individual effort and strengthen the global effort. Now is the time for action.

So, how will your organization play its part in the energy revolution towards net zero? BSI is here to help with a full range of tailored solutions to support your Net Zero journey.

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