

Sue Nelson

Hello, I'm Sue Nelson and welcome to the Create the Future podcast brought to you by the Queen Elizabeth Prize for Engineering, celebrating engineering visionaries, and inspiring creative minds.

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Susan McDonald is an electrical and mechanical engineer by training, whose career has combined working on the National Grid and alternative energy with voluntary work, including in the Arctic, and closer to home with the NHS, the UK's National Health Service during the pandemic. Today, Susan works for the global strategic consulting firm Monitor Deloitte as Lead for Energy Transition Towards Net Zero. In 2015, she was named the EY and Energy UK Young Energy Professional of the Year. In 2021, she was selected as one of the top 100 tech women in the UK. And earlier this year, won a Women in Science and Engineering Community Champion Award. That last award I mentioned there was sponsored by the NHS. So let's start with what you've been doing then during the pandemic.

Susan McDonald

Engineering is currently the heart of recovering from our immediate global challenge COVID-19. As one of many who contributed to the government led highly complex and collaborative response to COVID 19, it was my engineering and industry experience and capabilities that helped contribute to making COVID-19 home testing a fair and inclusive service accessible to everyone. And it was that application of system engineering and a core design approach that enabled me to drive the improvements into the service.

Sue Nelson

So what improvements did you make then?

Susan McDonald

First of all, it was enabling people to access testing in their home. And looking across the system, thinking about how people could take that testing at home. Not everyone has access to an email address with internet. So it was enabling people who didn't have that to be able to order a test and get their test result, all the way to ensuring that people with different languages, or needing different support requirements could access instructions. And importantly, taking a test at home, to ensure you're taking it effectively was enabling live video support for a number of people both in terms of helping them undertake the test, but also to supporting those who were blind and partially sighted to take the test, from ordering it all the way to returning the tests and accessing their test results.

Sue Nelson

And you said systems engineering here and this is something where this very logical, rational approach can be applied to so many areas to create this order of ABCDEFG sort of thing in terms of providing solutions effectively, no matter what the issue or problem?

Susan McDonald

Absolutely and systems engineering is that interdisciplinary field of engineering and energy management, and really focuses on how you design, integrate and manage complex systems over their life cycles. And that approach to engineering and the work of engineers is central to solving problems. Engineers seek to find solutions, and systems engineering and systems thinking have got to be central to how we mitigate and provide adaptations to climate change. And this will need to embrace technology, policy, economics and behavioural change to be successful.

Sue Nelson

And are you still working on this because you've effectively taken a career break to work on this on the pandemic?

Susan McDonald

So I'm no longer contributing to the government led programme, but I've taken that experience into my work now as Energy Transition Lead and as an engineer as part of Deloitte's Net Zero Transformation team. And really my experiences, what they did amplify is the importance of creativity and diversity and lived experiences in the design process. And it confirmed to me, it has to be part of reshaping our future. And the insights, the principles and lessons learned from the COVID-19 project are really principles that we can take forward to how we combat and adapt to climate change by being mission focused, outcome driven, collaborative and really committed to a co-design model. So most recently, to kind of put that into context, I supported an organization that really help simulate and understand how customers behaviours could change over time, through the energy transition and how they can use technology and solutions to help customers accelerate, but also make it affordable.

Sue Nelson

That's great and it's a lovely use as well, isn't it? Like you say of the lessons learned from doing something voluntarily, that has an effect on what you get paid for effectively. You're from Scotland. This is a country known for its wild weather. Is this why you became interested in energy from alternative sources?

Susan McDonald

First of all, I hail from Glasgow in Scotland. So, I have to mention the fact that we had COP26. Not only in the UK, but in my hometown, which really brought to focus the importance of climate change. In terms of what inspired me into engineering. I was a Scottish space school alumni. And when I was 16, I got to go on a study visit to NASA in Houston, which was pretty exciting.

Sue Nelson

And this was space camp was it?

Susan McDonald

It was.

Sue Nelson

I've always wanted to do one of those, oh I'm very envious.

Susan McDonald

It was just an extraordinary experience. I think the one kind of light bulb moment, so to speak, was being able to speak to astronaut Michael Foley, while he was on board the International Space Station. Meeting Michael back on Earth in Scotland, which it sounds bizarre when you say that, but listening to how he shared his views of what he was able to see down on Earth, you realise actually how precious and vulnerable the planet is and the importance of protecting it. Whilst in Scotland and where my family home is an Ayrshire in Scotland, I did some summer experience with a wind turbine manufacturer, and it was just, my interest was sparked in renewables there and I went on to, before Deloitte, I worked with National Grid, an international electricity and gas company. I went on to lead 12 of the UK's offshore wind projects. So, I've got to say, renewables is kind of in my DNA. And certainly, it was incredible to see COP26 in Scotland. And I think for us in the UK, and globally, there's a real momentum now of how we drive and accelerate to net zero. And I'm just the I think it's such an exciting place for future engineers, and technologists, and I really hope it encourages others to pursue those fields.

Sue Nelson

What did you feel when you saw your first wind farm up close?

Susan McDonald

I think first of all, as an engineer you love to understand how things work, and the feat of how something has been designed. And coming back to that kind of systems design thinking and having seen it first-hand when working at National Grid, you realise the number of engineering and technician and design skills that have gone into design it. And I think if I was to paint my ideal future home, I would be sustainably living off my own onshore wind farm and hydro plant, if I could that that would be quite something.

Sue Nelson

What are the challenges though, of energy production from wind farms?

Susan McDonald

By its nature, engineering programmes and designs are complex, but what's exciting, is we have the technology there to accelerate to net zero. And I think what's important is it's not just about designing the engineering machine and looking at the power electronics and making sure it can operate in the grid. There's so much more interconnectedness in terms of the supply chain of materials, the planning, and more importantly, the involvement of the community where you're placing that technology and ensuring that you're doing that with respect.

Sue Nelson

How do you do that?

Susan McDonald

Whilst I was at National Grid when we were really understanding all the options to connect an offshore wind farm. In my role as a Power Systems Engineer I had to ensure, with the technology and policy and customer teams that were identifying a preferred connection that balanced the technical requirements, the impact on the environment and biodiversity, whilst meeting the needs of the future energy customers, and ensuring it was robustly evidence based and represented value for energy customers. And I think most critically, as we look into the next 15-20 years, we need to ensure that when we are designing the solutions to net zero that we're creating a just transition. What I mean by that is we're not leaving anyone behind. When we look at the UK, and we're not the only country, and the reliance on hydrocarbons in our systems, there's a real need to ensure as we switch from hydrocarbon to a more green economy, that we ensure that we also support the communities in both employment, as well as opportunity and don't burden specific parts. And that's why I feel really strongly that for us to be successful, we need to ensure that diversity and learning from lived experiences are part of that systems thinking and systems approach.

Sue Nelson

And when you were leading the coordination of these 12 offshore wind farm projects, that's quite a huge job, not least in terms of money, you know, that's over a billion pounds in terms of the project. That's quite a managerial job as well, effectively. Do you find that aspect as challenging as the engineering, or do you find one easier than the other, or do they both work well together?

Susan McDonald

First of all, I'm quite a people-oriented person, I'd say, you know, some projects have got a technical challenge to it. But from the start, stakeholders and teams are so important. I've heard the terms recently, and I quite like

them. I've heard the terms "human engineer", and "business engineer", but effectively, engineers really focus on how do we help build a better future? And at the heart of that it's about how do we build a better future for people and planet. And so for me, I really enjoy listening from different stakeholders, because it helps you innovate. And it comes back to that systems engineering approach, if you were to design something in a closed room, it's bound to not be effective, or bound to not have that your life value and enduring value to society. In those particular 12 offshore projects, the thrill of that was working with multiple capabilities and skills in different organizations to identify the proposition and then working with the regulator to demonstrate the preferred option. And I think for me, that's what makes engineering so exciting. It brings those both worlds together.

Sue Nelson

You've been at Monitor Deloitte since 2016, but when you joined it wasn't originally in the energy area was it?

Susan McDonald

My experience in the last five years with Deloitte, I focused initially on engineering complex programmes. So, my focus was around helping intensive organizations in the water sector, in the rail sector, and energy services, to shape, design, and deliver changes to asset maintenance and operations.

Sue Nelson

So that's infrastructure effectively. Is that right?

Susan McDonald

Yeah, that's right. And it was, I really enjoyed those experiences. And now my focus is around our net zero transformation team, which is focusing on shaping and setting a strategy to enable transformation. That's where we're helping to really set the business models and the deliberate choices organizations can make to really accelerate their contributions to net zero economy. And it's really exciting because what I'm able to do with that engineering programme experience is make sure that the strategy we're assessing is practical and is something that can be enabled through the organization, not only for communities, but employees as well.

Sue Nelson

Now, voluntary work, as we've touched on a little bit already is an important part of your career. I was quite envious of this one you did in 2013, because it sounds so adventurous, but obviously it's serious as well. You went on a 10-day research expedition called Climate Change at the Arctic's Edge. What drew you to that particular project?

Susan McDonald

My Arctic expedition with the non-profit organization Earth Watch was one of those bucket lists. I've always been excited to go to the Arctic and it could be very much watching those David Attenborough documentaries as a family and just being inspired about understanding the impacts we all have around the global world. And going to the Arctic was, it was very cold, it was minus 55 degrees Celsius with windchill.

Sue Nelson

What?

Susan McDonald

So, I was really fortunate, there was a time when I was at National Grid, one of my colleagues was an ex-Marine and so I was very fortunate to do today's cold weather training with Marines. So, I was very prepared for the expedition. And what was incredible, you know, I was part of an expedition with people. And the first day, I

didn't know that after the expedition were great and continued to be great friends. But that experience of measuring the depth of the ice, and the snowpack, really understanding the ice crystals, what that meant, in terms of the sensitivities of that area. Worrying for me, and for us as a planet, we were identifying that there had been a shift in the sites that we were monitoring. And so, our work did contribute to the research, contributed to the Arctic polar research work. And so, it was both an exciting time to be there, but also one that really brought home the importance of how we all can play a role in averting climate catastrophe and that the importance of communities are already being impacted. There's obviously something that attracts me to cold areas.

Sue Nelson

That's living in Scotland.

Susan McDonald

It could be. I'm really excited because I've just recently been selected to be a member of the community called Homeward Bound, a 12-month Leadership Initiative for women in STEM, science, technology, engineering and mathematics. But excitingly, it culminates in a voyage to Antarctica together. You know, what I really hope to achieve through my participation is, first and foremost being able to collaborate with these accomplished women from diverse backgrounds in science and engineering and being part of this global movement to shape the future of planet. I really hope that my participation can help amplify the critical role engineers have in shaping the future. And help others pursue a career in engineering technology and the energy industry, particularly in the context of decarbonisation, and achieving net zero.

Sue Nelson

And do you think engineering voices are being heard?

Susan McDonald

For me, engineers are at the heart of helping recover the current global challenge COVID-19. Climate change is the challenge of our generation and engineers have a crucial role in shaping and securing the future of our planet. And I think what has taught us the most over the last couple of years, is the critical role that engineers, scientists and technologies have in helping to address some of these global challenges. What's important for me really, it's about how we encourage more women to pursue engineering, technology, and energy careers to help create an inclusive profession. Diversity and learning from lived experiences leads to more robust solutions. It's critical, not only because we've got to avert climate catastrophe, but to ensure the energy transition does not burden specific or vulnerable communities.

Sue Nelson

So how do you do this, you know, for engineering to increase representation of marginalized communities in climate discussions, is all purely about communication?

Susan McDonald

I think in terms of both encouraging people into engineering and technology and energy industry, as well as involving people to participate. I think, first of all, when it comes to encouraging more diversity and an inclusive engineering profession, it's about role models. I can remember, I had fantastic mentors in my career of all backgrounds. But I remember the importance when I was able to see a role model and who was a female in engineering and really, you feel that that was achievable, and really helped break down barriers around what the art of the possible was, that's really important framing the art of the possible and that we each have the ability to make an impact. And when it comes to involving communities in all parts of society, it's a co-design model. And that experience, whilst I was at National Grid, it was, stakeholders were involved in that design

process, but most recently working with the Royal Institute of Blind People, for instance, and other charity partners to inform and shape our improvements to how we support the government to create a fair, inclusive national testing service. It really shows that we need to involve diverse lived experiences and stakeholders at the front end. And it really helps lead to those robust solutions.

Sue Nelson

Now, you mentioned you know, the importance of role models, and you're quite lucky in a way in that effectively, you also had role models closer to home, because you're from a family of engineers aren't you?

Susan McDonald

I am. So, my father is an electronic and electrical engineer, my mother is a podiatrist. Science was very much in the house. I've also got an identical twin sister, Lynne, who's an engineer with UK Power Networks, and my younger brother, Ross, who is an electromechanical engineer with Scottish Power. And so we do joke, with or focuses in engineering, and particularly the energy industry, McDonald Energy may be something of the future. But I think what's great is, as a family and with my network of friends, what's really exciting is you've got that support and shared perspective. It's a great conversation around the kitchen table at home around the latest things we've seen in the news, or just sharing stories, because I think that's the thing I really enjoy. Although we work in the energy industry, we all have different experiences and perspectives. So I learn a lot from my parents and my sister and brother as well.

Sue Nelson

That's great. And you're also an Ambassador for the Queen Elizabeth Prize. So, you know it well, you know the work that it does, the winners and types of engineering that it's championed so far. What ground-breaking innovation would you like, one day perhaps, to win the Queen Elizabeth Prize for Engineering?

Susan McDonald

Wow, that is a very tough question. I think, first of all, what is incredible, and I remember at the beginning when the Queen Elizabeth Prize for Engineering was inaugurated and being able to celebrate incredible engineers in the same feat as a Nobel Prize. You know, for me, the Queen Elizabeth Prize for Engineering is an exceptional award and the past and present award winners just really show the creativity that engineering can bring. In the next 10-15 years, I think what would be really exciting is, I'm going to be a little bit cheeky and have two themes. One, that's obviously helping solve the energy challenge. So really helping us scale to low carbon technology, be that in fusion or storage. And the second is about how we enable services, both in how we live our lives to really embrace choice and optionality, that it doesn't matter what support requirements you may need. That is just something that's designed in. And I think that's something that's really important as we look forward as engineers.

Sue Nelson

And I believe you have a motto "default green default accessible"?

Susan McDonald

Yes. And it's a simple one, but I think it's simple to try and be effective. I think. As an engineer, we're in a very privileged position to be part of designing and engineering new products, services and engineering programmes. I think it's really important that as all engineers do, we take that responsibility of the choices we make have to enable that green, low carbon future. And we have to create and design a product and services accessible and usable for everyone. And that's the way that we will be successful in shaping a fair, inclusive, greener and sustainable future and it combines so many things, but my motto to keep it simple is, yes, default accessible, default green.

Sue Nelson

Susan McDonald, thank you very much for joining me on the Create the Future podcast.

Susan McDonald

Thank you very much.

Sue Nelson

You can find out more about the Queen Elizabeth Prize for Engineering by following @qeprize on Twitter and Instagram, or visit qeprize.org. Thanks for listening and join me again next time.