

Note: this transcript has been produced verbatim and includes all the quirks and idiosyncrasies of the speakers.

Dallas

Hello, and welcome to the eighth and sadly the final episode of our Geo4Earth Podcast Series brought to you by Innovate UK KTN. I'm Dallas Campbell.

Suzie

And I'm Suzie Imber. In this series, we've been continuing the COP26 discussions, looking at the role that KTN and its partners play in addressing climate change. Specifically, we've been exploring how we can use space data, and geospatial intelligence to build a better future.

Dallas

Yes. Now, the big question we are going to explore today is what is the role of digital twins and geospatial intelligence in the transition towards a resilient low carbon economy?

Suzie

Dallas, did you know what digital twins were?

Dallas

No, I had no idea what digital twins were, until we talked to our two fantastic guests today, Lucy Kennedy, and Sarah Hayes, who will explain all. So grab yourself a tea, a coffee or glass of wine, depending on what time of day it is and enjoy the conversation. Delighted to have Sarah Hayes with us and Lucy Kennedy, lovely to have you with us in hopefully a noise-free environment, wherever you are. Lucy and Sarah, will you just maybe give us a little bit of a little introduction about who you are and why you're with us?

Lucy

Hi, I'm Lucy Kennedy CEO and one of the co-founders of a company called Spottitt. Silly spelling with four t's.

Dallas

They haven't put four t's have they? Why did they do that? Whose decision was that?

Lucy

I was involved in that decision.

Dallas

Why did you go for four t's?

Lucy

.com .com domain name. When I'm not worrying about how many t's are in the name of the company, I help people get access to satellite imagery analytics, and in particular, clients in the energy sector. We help them monitor stuff using satellites. That's why I'm here.

Dallas

Great. Well, thank you very much for being here. And Sarah. Hello, Sarah.

Sarah

Hello. Hi there. I'm Sarah Hayes. I'm the Engagement Lead for the CReDo project. That's the Climate Resilience Demonstrator project, working with Connected Places Catapult.

Dallas

Connected Places Catapult. Well, listen, thank you both for coming. I'm really interested in this subject today, we are talking about energy resilience. I suppose it kind of means what it says on the tin, but I'm interested in, when we talk about energy resilience, can we just clear up that definition before we do anything else? What do we mean by energy resilience? What is it? Why do we need it? Why is it important?

Sarah

Are the lights going to stay on? Is the short answer for that one. In the face of climate change, so climate change means we're going to experience a warmer, wetter climates and more storms. So if you think back to the last winter, we've had a number of storms, Storm Arwen, Storm Barra and that meant lots of power cuts, loss of communications. In some cases, people didn't have running water, because the service is stopped because the assets, the infrastructure assets are impacted by the storms and it means that we lose our service. So that's what we need to be thinking about in the future is how resilient, how well protected are our infrastructure assets to a future climate change?

Dallas

I suppose, so in more extreme weather events, but presumably, are we talking also about the fact that we're transitioning from fossil fuels to things like solar and wind, which presumably, is also weather dependent? Is that right?

Lucy

Yeah. So we're moving generally from sources of energy that we can switch on and off to sources of energy that we can't choose so easily when to switch on and off. So how do we manage supply and demand when in fact, supply is driven by sun, wind, wave, nuclear, other things? And demand is driven by other things and is going to increase because we're all going to have electric cars and things like that.

Dallas

Yeah. It's really interesting, because I think the general populace myself included, we just sort of think energy is kind of magical, you just turn on a button and there it comes. We can't store it, that's the thing, when we need to make energy, we have to burn more coal or burn more oil, drop some water from the top of a mountain to the bottom of a mountain or whatever it is. It's a really odd thing that we can't store it and I think it's quite counterintuitive.

Sarah

We don't yet have the capability to store it as we need to, to be able to access it when we want to. But I agree. I think you know, we take it for granted. We can switch the lights on, we can we can turn the tap on. And I think with climate change, it is a question of changing people's expectations. In terms of the services that they get or acting to ensure that we will be more resilient.

Suzie

Presumably, there are a couple of aspects of this one is the availability of energy. So how much we're producing versus how much we're using and the other sounds like it's an infrastructure situation, where bad storms take down power lines, for example. So it sounds like there are a couple of different issues that need to be addressed in order to make sure we can always turn the lights on.

Lucy

Oh, it's a it's a whole big, I don't wanna use the word mess, that's not the right word. But you know, our demand is going up, we have the challenges of climate change. We have hundreds of thousands of kilometres of ageing infrastructure in some cases. And we need it to be more flexible, right? Our houses might all in the near future be power generation plants in their own right. So instead of networks just supplying in one direction, energy needs to move in both directions. It's an interesting challenge.

Dallas

It really is. Is energy resilience, is it going to be harder as we move across to low carbon forms of energy?

Lucy

Is it going to be harder? That's a difficult one.

Dallas

We have energy resilience now, we don't really kind of worry about, well, we do people worry..

Sarah

But we still experience power cuts. So the question is, at the moment, do we have the level of resilience that we really want? And as the weather becomes more challenging with climate change in the future, and as we become more reliant upon renewable energy sources, that in itself is going to be more challenging. It will be more challenging for this system.

Suzie

It's actually quite an interesting point you make about storing energy in different ways. So obviously, there's the ways that we discussed earlier, but as we start developing our own generation on our houses, whether that's, you know, solar cells and our roofs or whatever, presumably, people are also installing batteries to store some of that energy for their own use for later on, and then feeding some of it back into the grid if they don't need it. So it sounds like the story is becoming more complex, associating with our energy needs, as we start introducing all these other factors as well.

Sarah

It is and I think the term 'mess' is not inaccurate. The question is, how do we make sense of all of this mess?

Suzie

So tell us a little bit about how we're using geospatial data to address some of these challenges. The core of our podcast is using geospatial data in innovative ways.

Lucy

So I mean, we can use geospatial data to find sites that are suitable for renewable energy. So sites with great you know, solar aspects, great wind resource and we can look at that both from the point of view where's got the best resource, most sun, most wind, highest waves, these kinds of things.

But also, which are sites that are perhaps easiest and most appropriate for development, where are they close to the user? Where is the slope, not too high? Access from the road? We're not cutting down any precious ancient woodland? All sorts of different factors that need to come into place and they're all geospatial data.

Suzie

I'll sort of build on that slightly. So talking about kind of how we're using the data that's for the design of new facilities. Do we also use it for the monitoring of existing facilities? Is it possible to use geospatial data or Earth observation data to help us?

Lucy

Absolutely, there's more and more of a movement to have the increasing network reliability and resilience that we need, network owners and operators need to have an increasingly better understanding of the risks and the changes around their network. Now that can be stuff like increased flooding, but it can also be, you know, Mr. Brown digging beside the gas or electricity pylon where they shouldn't do. And so there starts to be more and more tools whereby people are using Earth observation data, so drones, aeroplanes, satellites, and then using complex analytical tools, to be able to analyse that data and give people the flags that they need in terms of somebody doing something stupid, a tree too close to the line, whatever it may be. In fact, that's one of the things that Spottitt is heavily involved in.

Dallas

I'm always amazed at how close you can get, the fact that you can sort of look at individual trees and make decisions.

Suzie

Yeah, it's remarkable. I heard a story about people looking for water leaks from space a few weeks ago, you know how amazing that we can do that. It's phenomenal.

Dallas

One of the terms that I've heard about that I don't know anything about, is this idea of creating a digital twin, basically, sort of creating landscapes digitally that you can kind of experiment on but which kind of correspond to real life. Is that a thing? How does that work?

Sarah

Yeah, exactly. So it's a way of bringing in all the information together, to help you make a decision. So a digital twin is a digital representation or a digital model of something, you could create a digital twin of anything, a physical thing, a system or a process. It could even be a digital twin of yourself, like a robot you.

Dallas

No, we don't want that.

Sarah

But the idea is that there is some kind of data connection between the physical thing and the digital model. And that kind of connection can vary, so you could be using a static data set or a real time data set or something in between. So you could have a digital twin of an EV charging point, or a digital twin of a wind farm and of the turbines in the wind farm and a digital twin of the whole transport system which connects to the charging point and the wind farm. But the crucial point is to be able to connect digital twins and share data across organisations in a secure way, so that we can use this information to make better decisions. So for example, we can ensure that the EV charging points are in the right place, and can access electricity at peak times, when demand for charging is high and perhaps also look at ways to manage demand. So digital twins are all about bringing together lots of information to help us make better decisions and less mistakes.

Suzie

So the digital twin in the EV charging point might be a model of traffic flow throughout the UK, could that be like a digital twin that would be helpful for working out how frequently that charging point would be used? Is that an example?

Sarah

Yes. Is it in the right place? Is it the right speed of charging?

Dallas

I don't really understand, when you say, you can sort of plug the digital twin into the real thing. I don't understand that.

Sarah

So you want some kind of data connection between the physical things. So some data about the physical asset, so that could be the record of when it's used, how much power is drawn from the EV charging point into your computer model. So, there will be some kind of monitor, some connection between that charging point because you need to be charged for it. So you need to pay a price for using that electricity. So it's the connection between the physical thing...

Dallas

Oh, I see. So you just mean getting data from the real world and creating a model of something. Okay.

Lucy

Thinking about it from a power line point of view, you have your digital twin of where your towers are and how big the spans are, etc. But the data you plug into that is the current flow reading and the readings that you're getting is what's going through the span, and then your digital twin works on that. Easy.

Dallas

It is easy. I'm just imagining sort of dystopian landscapes of digital people. We have it already! Like social media is basically a digital us. It's terrifying. Suzie's like, what's he talking about?

Suzie

I am slightly lost and wondering where you're going. But keep going.

Lucy

A digital twin is a, it's a funky terminology. I mean, it's the next step on the simulation and modelling that we've been doing forever, right?

Sarah

But look, you know at the moment, we have lots of data, lots of information all around us, that we're not making use of, we are really struggling with the idea of how do we get to net zero? How do we increase resilience? We've got all this data around us, and we're just not using it. And the thing about digital twins really is helping us use it in a more organised way, so we stop making all these mistakes on the path to net zero.

Dallas

So basically, you don't have to dig up the road in real life, you can dig up the road in your digital twin and figure out what's going exactly.

Sarah

Exactly and you could perhaps then coordinate with the utility operators so they only dig it up once.

Dallas

That drove me crazy.

Suzie

But that's exactly it, isn't it? Having a network understanding where all the resources are, that presumably is a digital twin, and then..

Sarah

Understanding what conditions are in, so when do they need to be maintained? How long would they last? When do you need to upgrade them? What's the least carbon way to upgrade a piece of infrastructure?

Dallas

I think in my mind, I assume everyone knows what everyone else is doing.

Lucy

That's the scary thing, if you looked at the data on which you used to make some pretty big business decisions and choices, you might be a bit scared.

Dallas

This is what you mean by mess. We come back to mess.

Suzie

Well, so for example, I want to dig up my driveway. I wanted to know where all the infrastructure to my house was so I didn't accidentally dig it up. Some of it I was able to access, some of it was a complete mystery to all of us.

Sarah

And there's a live project within government NUAR, the National Underground Asset Register, run by the Geospatial Commission which is looking at that, exactly that point, the coordination of actors in this space and the sharing of information.

Dallas

Wait, exactly Suzie's driveway? The other word I'm struggling with is everyone starts to use the word actor suddenly, have you noticed that? Politicians use the words bad actors. As a former actor, this is a problem. I trained as an actor. So I'm always like, wait, what actors are involved in this?

Lucy

Someone is taking over the word actor.

Dallas

Actors are kind of digital twins in a way, we pretend to be other people. There you go.

Sarah

I think that's an interesting point, actually. Because a film in a way can explore another reality. It can run a simulation of what would happen in this situation. And in the project that I'm working on, we actually made a film to explore what happens when there's a really bad flood? How would that impact an old man at home, who's dependent on a breathing support machine? What if the power went out? What would happen to him? And we explored what a different future might look like if the infrastructure operators got together, collaborated, to ensure that the power didn't go out. So I think film is actually a really powerful medium for communicating some of these ideas.

Dallas

Yeah. I mean, that's kind of why we enjoy films, I guess, because as you say, we explore alternate realities in ways and I suppose what you're doing is building alternate realities. So we've established what digital twins mean. Can you give us kind of, you know, you've touched on a few examples but if you've got perhaps an example that you're working on, something you're really excited about, or something that you think is going to be a real game changer?

Sarah

Yes. So CReDO, the Climate Resilience Demonstrator project. So it's a digital twin of the infrastructure system. It brings together data about assets across energy, water, and telecoms, in a particular area in East Anglia. It also brings in data about future floods scenarios that would be caused by climate change, so that we can then see what happens in these future storms. So where would the flooding happen? How would the assets be affected? And then if some assets are wet, they're flooded, and they fail, how they impact other assets in the system? So you could be looking at a dry area of the city that hasn't got flooded, or it's not going to be dry, there's a storm happening, but it might not be as badly flooded as saying where the power substation is.

But if that power substation has gone out, then it means that people who were living in that other area would lose service, along with people who were living nearer to the substation. So what we're really doing is showing how you can bring together data across different organisations to inform our understanding of the interdependencies across the infrastructure networks, across energy, water and telecoms, because it isn't just an energy issue, we need to be thinking about other networks.

Lucy

It seems at the moment, perhaps everyone seems to be in their little silos, all these institutions. And of course, everything presumably is interdependent so this is a way of bringing them together.

They're all managing their own assets, that's how they're incentivized. In the field that I work in, in terms of sort of Earth observation, which is the use of satellite imagery and data analytics based on that, we are a great source of input data for digital twins. So in one project, I'm working with we're working with the National Grid, we are going to be using satellite imagery and analytics to monitor their networks on a potentially more frequent basis than they do it now. Then they can input that into their digital twin. So for example, if you look at vegetation encroachment or trees, you may have trees that are by the regulation not too close to the line. But if it's a tree with poor health, and the wind starts to blow in a particular direction, that tree then becomes a high risk for taking out your network. And these start to be things that you can then model.

But it's very true what what Sarah says, it's impossible for network operators at the moment to make a decision that isn't, I was going to say in their best interest but that's the wrong way to do it. So it's very difficult for them to say, I won't protect this part of the network, because I need to keep the water pumps going or there's a hospital here. I mean, in the grand scale of things, they do have critical infrastructure that they do protect, but beyond that, it's really difficult for them to make a different choice beyond, how do I keep as many of my customers on as I can?

Sarah

But what we found interesting in this CReDO project is the water company has said publicly, we recognise with this kind of tool we could see the rationale for investing, say in the resilience of the energy network, rather than our own water network because we are dependent on the energy network. And really the next step, I think, is to bring the regulator's round to that way of thinking, to thinking about system resilience, rather than network resilience.

Dallas

As we were recording this actually, it suddenly occurred to me that we just had an EU announcement that the EU are going to ban Russian oil and gas from the end of this year. I'm just wondering, does digital twins and geospatial data, can it when, unexpected events like this happen, big events like this happen because of geopolitics, can we use geospatial data to help us replan or reshift as things like that happen? Because obviously, resilience is the word that everyone's using at the moment.

Lucy

I think they focus the minds. Right? There are other reasons, it's a very visible and obvious reason, right? Climate change is very real but also a little bit intangible for

the everyday person. But it's very, very real, you know energy prices and that opens enough discussion, are we really paying the right, true price for our energy independent of the kind of Russian oil discussion? So I think it focuses the mind and certainly, you know, digital twins can help people accelerate decisions on renewable energy production, decisions to have more nuclear power sites, where do you put them, etc, etc. But maybe, Sarah, you've got something to add on that?

Sarah

Yeah, I think it's about having access to the right information at the right time. So if you are in an emergency situation, you don't necessarily have time to go around setting up all the data sharing agreements, finding out who's got the data, where it is, what quality, can you rely upon it? But if you've kind of encouraged this culture, where organisations work together, they share data in a secure way, when you are faced with an emergency situation, you'll know where to go for that information and its reliability. Then you can use that information to make the decisions that you then need to.

Suzie

Do you ever struggle with getting access to data? Bear in mind there's lots of different companies involved here, presumably. Do they all just share openly everything?

Dallas

That's a really good question.

Lucy

Sarah, I'm sure you have lots of wonderful stories about security and how you got people to share data on your projects.

Sarah

Yeah, it is always an issue. So, some data, people are happy to share, they are keen to make it open and public. But when you're talking about, say, energy, network assets, information, that's confidential data and we're talking about infrastructure assets, that's confidential. So in our project, we've had to set up a data licence to allow the operators to share it with the team and with each other, to build the digital twin. But there are very restrictive uses of that data within the project. So what we've also done is we've created synthetic data, from the real data. You can use the synthetic data to do modelling, to show what the impact is, to tell the public story, to talk publicly about the project without exposing confidential assets. It's not just about confidentiality it's about security.

Lucy

So just running different models, running different models so you can spit in different bits of data and just see how things turn out. Is that what you mean by synthetic data?

Sarah

Same model structure, but different data sets.

Suzie

So representative data rather than actual data that you feed in?

Sarah

Yeah, exactly.

Lucy

Okay, got it. Got it. Okay, here's a question for you. You've explained digital twins beautifully. Thank you very much. And you've explained how it all works and some of the parameters. I'm interested in, in sort of projecting forward five or ten years, where you're sitting now and what you do and where you're working for what, would you like to see or what would you count as a great success? If I could give you each a magic wand to wave.

Oooo right.

Dallas

So things like wars aside and unknown unknowns aside.

Lucy

So I think, I in five years time want to say that Spottitt and the Earth observation sector as a whole played a big part in the reduction of methane losses from our gas networks. Methanes huge.

Dallas

We don't know about this, well some people know about this.

Lucy

20 to 80 times worse than CO2 in the atmosphere.

Dallas

Presumably not as much as CO2?

Lucy

No, but if it stays longer in the atmosphere, and it has a stronger effect than CO2, so one tonne of methane is, depending how you're calculating, 20 to 80 times, the equal to admitting 20 to 80 tonnes of CO2. So there are new rules coming in, in the UK and in the EU, which we'll see a lot more monitoring and we will see new technologies being used both to monitor for leaks, and also to increase the reliability of the network from a start, such that they don't leak so much. So that will be my thing.

Dallas

Cow burps, isn't cow burps like a big methane producer?

Lucy

Cow farts as well.

Suzie

Outgassing, cow outgassing.

Dallas

Suzie's the world authority on outgassing and I don't mean that in a burpy, farty way.

Suzie

No, no. In a space related technical way.

Dallas

Sarah, you have the magic wand.

Sarah

So, five years is not a long time.

Dallas

You could have ten years.

Sarah

Yes. Thank you. I think I might need ten years. So I think it's about seeing a future where infrastructure asset owners work together, they share data in a secure way through connected digital twins. So they have a common framework for sharing data, because I think there is a risk in five or ten years time that everyone has their own digital twin of their own network but it doesn't add up to the whole system. So it's everyone sort of planning their own path to net zero in their own separate way, which ultimately isn't going to get us to net zero, it's not even gonna get us halfway there. So I think it's about seeing the system more joined up through data sharing and connected digital twins and a recognition I think, that you can use this information around us, we can make better use of it to forge that path to net zero. And also I would add, it's a culture change. So it's about us not having the same conversation in five years time "oh we must be making better use of the data around us". You know we need to sort of really cultural change towards more openness to sharing data. So I think it's about making some progress in this space.

Dallas

I might ask Suzie the same question, actually. Because obviously, Suzie, as a Space Scientist, and someone who's an expert on geospatial data.

Suzie

I guess I am just about to start a grant looking at space weather and the impact of space weather, on geomagnetic disturbances, which can have impacts on the infrastructure that we rely on, whether that's the energy grid or power lines. So I guess I do, when Dallas said that, I thought, gosh, I have nothing to add to this conversation. But I guess I do. And we're doing this research to try to understand the fundamental physics that then drives some of the events that we need to understand better. So you know, maybe we'll be working together in five years time.

Yeah, a digital twin.

Sarah

It's really about understanding those future risks. I think we have a sense, but we don't really have a proper understanding of what the risks are. And what do we do to mitigate against those risks?

Lucy

And I think we all have an individual role to play, because we're sort of forgetting a little bit about the greenest energy of all, is the energy that you don't use.

Dallas

That's the best answer! I'm gonna steal that.

Lucy

[Unintelligible] that one because that's really very much the truth as well. So you know, the digital twins is going to come down to the choices about how you set your thermostats, when you choose to cook your cupcakes when you charge your car. You know, maybe how many times you flush your toilet a day. Who knows?

Dallas

Let's not go into that. If I had a magic wand, I want to make sure Suzie's driveway is seamlessly dug up.

Suzie

Please do that. Yes, I have some anxiety around that. So yes. So that's it for today. Thank you so much for listening. And if you enjoyed our conversation, make sure you listen to the other episodes in the series.

Dallas

Yeah, that is the end of the series. Just to say a big thank you to the Space and Geospatial Leads at KTN, that is Andy Bennett and Luca Budello. Thank you so much for putting it all together.