

## Electricity – where now?

To a degree, we all take electricity for granted. It's there at the flick of a switch. But if we think about it a little bit more, about where it comes from and how it's made, the biggest single change we can all make is to change where our energy comes from. But also, to use it in a better way, to waste less as well as use less.

The biggest single cause of climate change in our country today is burning fossil fuels to make electricity.

NEW SPEAKER: So what we see is that we really use the power of the sun, the wind, the water, and really create electricity out of that. And there is a lot available in this world.

NEW SPEAKER: To me, the turbine is absolutely beautiful. It's elegant and it's powerful and it's a real symbol of the 21st century. Whereas, the smoke stack, the smoking chimney, was the symbol of the 19th and perhaps 20th century, I think wind turbines and renewable energy are symbols of the 21st century and beyond.

NEW SPEAKER: It's power to the people, but also power *from* the people.

DALE VINCE: I used to be a new-age traveller, spent ten years living off the grid before I dropped back in to found Ecotricity, the world's first green electricity company.

The grid that we currently have is built around a centralised model, a kind of top-down model, where electricity is made in big power stations and is shipped up and down the country on the national grid and delivered to our homes.

It's one where consumers of electricity are very passive. I see renewable energy – harnessing the wind and the sun and the sea – as a great democratising force, because it puts power in the hands of people who haven't had it up until now. People can now make their own energy at home. Very soon they'll be able to store their own energy at home and give back to the grid as well as take from the grid. So there's a new relationship coming, one of interaction with the grid rather than passive dependence.

LARS FALCH: I'm the founder of Powerpeers. Powerpeers is an online marketplace where you can select your energy and also select to

whom you offer your self-generated energy. It's a more peer-to-peer kind of network where everyone can take part and get access to renewable sources, perhaps also close by – it could be from a neighbour, it could be from a school across the street. And if I'm generating energy myself I can offer that again to others.

This is really a sharing economy. It's a trend you see already in housing, like Airbnb, in transportation. This trend is now being transported also to electricity.

It's a democratisation of the energy that is consumed and supplied in a country. It's fulfilling a need of people acting and interacting together and jointly set a direction for the future.

ANNABEL PINKER: I study the ways in which electricity is becoming more and more decentralised, creating new kinds of energy control for communities.

I think it's important, particularly at a time like this, when we tend to think of our electricity as being somehow invisible. We tend to relate to energy as quite a distant thing that's generated in far-flung nuclear power stations

and coal-fired power stations. When you bring it into our everyday domain, we have to take responsibility for it in a different way.

So, for example, some communities are trying to develop new ways of distributing the benefits from electricity. So, instead of it going into corporate profits, it's about effectively distributing benefits in a new way.

You'll also find community projects where there's an attempt to actually gain direct ownership over energy generation.

NEW SPEAKER: Having our own turbine up there on the hill changes our relationship with electricity. It means that every time you see the blades turning round, you know that you're generating your own electricity and you're much closer to the source of power itself.

DONALD BOYD: I'm a member of the group that erected the Great Wind Turbine Project here in Huntly, 20 miles from the Moray Firth coast in the North East of Scotland.

WOMAN: Go turbine, go!

DONALD: The turbines started turning on a

cold and frosty November morning in late 2016. It was a fantastic moment for those of us present to see those blades turning.

ANNABEL: The position of a turbine on a hill in the eye line of the community makes its presence felt as a kind of monument to a future in which things can be different; a monument to self-sufficiency in which the relationship with technology and nature can be much more in the hands of the community than before.

DONALD: It's a community-owned turbine which, for us, is really important. It means that we're empowering ourselves to generate our own future. I think the cut of the blades and sweep of the blades as they turn at different paces, but always within a sense of almost controlled acceleration and you know that they're generating power – there's a real beauty to it. There's a real beauty to it. It's hard to explain. It is hard to explain! Mm.

GERAINT WYN JONES: Operations Manager at Dinorwig Power Station at the foot of Snowdon in Wales.

Dinorwig Power Station is a 2,000-megawatt pumped-storage power station built inside

Elidir Fawr Mountain. The main cavern is vast. It could house St Paul's Cathedral quite easily and is the length of some three football pitches. We're a fast-responding power station, designed specifically to assist the grid system operator in the event of a national blackout. We have a direct green phone link to the National Grid control centre. It's a backup for communicating in an emergency what their needs are.

ROBIN PREECE: my research is about stopping blackouts.

There's definitely a moral shift towards using renewable powers like solar power and wind generation, rather than traditional fossil fuels. The problem is that that has knock-on effects for the system. Because we can't store energy, everything has to be balanced in real time. So, every time you turn on a kettle or switch on a light, somewhere a generator has to ever so slightly increase the amount of power it outputs, burn a little bit more coal, in order to be able to produce that energy and match the demand in real time.

As we move towards having renewable sources of generation, you can't ask for that same response. We can't ask the sun to shine

brighter. We can't make it windier when we need it. So we have to come up with new ways of balancing this power requirement in the grid. If that balance isn't met, the system will black out.

GERAINT: When demand exceeds generation levels, and if it significantly exceeds generation levels, then it can cause problems that could ultimately lead to a blackout. That blackout could be a complete one or a partial one. Dinorwig would then step in quickly to maintain that balance and keep the lights on.

NEW SPEAKER: Blackouts reveal what's become taken for granted as the *need* for electricity. The pervasiveness of power has just gone into every nook and cranny of daily life. So we just don't know, and would never know, really, how far that dependence has gone, until the blackout, which is illuminating.

ELIZABETH SHOVE: I'm a professor. My research is on energy in everyday life.

I work at Lancaster University and in Lancaster in December 2015 there was a massive blackout. I was driving into the city and suddenly I noticed something was wrong.

There weren't any traffic lights at all and all the streets were dark. The phones didn't work. It was quite scary. Electronic door-locking systems defaulted to open, letting anyone in. Fire alarms that had only limited battery backup failed after a while. Lots of building energy management systems didn't work. Cash machines didn't function, nor did credit card payment systems or traffic lights or petrol pumps.

It's clear that this is a very unresilient, a very fragile system.

REPORTER: People underestimated the effect this is having on the area. It's bringing everyone together.

ELIZABETH: These forms of dependency that have grown in the cracks and spaces between technologies and practices really do need revealing.

NEW SPEAKER: A blackout reveals to us how dependent we are on the electrical system. So the history of blackouts is also the history of the consumption of electricity and the history of our dependence and how it grows.

DAVID NYE: I'm a historian and I've written on the history of blackouts.

The very beginning of the use of this term was in the '30s, when people were intentionally blacking out cities or airports or military bases as a military tactic – the intentional control of light and the reduction in the use of electricity.

Something similar has been happening in recent years. It appears to have started in Australia, this idea of a “greenout” or of an intentional reduction in the use of electricity to make the city not totally dark, still safe, but much darker than normal, as a way of saying, “We would like to use less electricity. We would like to be environmentally more sustainable.” It also, briefly, allows people to see things that they don't normally see – the stars in particular.

We might want to say to ourselves that it's worthwhile to recapture a little bit of that contemplative way of life and the contact with the people around us that you get during blackout. In other words, maybe the choice isn't really blackouts or greenouts, but also more human connection.

ROBIN: Originally, the plans for electricity networks were almost off-grid plans. If Edison had his way, we would all be off grid with our own generation, consuming all the generation we created ourselves. It's only now that the technology is around to be able actually to make that dream a reality – for people to have their own generation, to store their own generation locally in batteries, and to then use that when they need it, and to not be reliant on the electricity network.

NEW SPEAKER: Many people write about renewable energy without them having any experience with it. I don't think that's very smart because it's only when you use these things that you really start understanding them.

KRIS DE DECKER: I'm the writer of *Low-Tech Magazine* and I power my home office in Barcelona with solar energy.

I live and I write off grid. It forces me to lower my energy use and you get very creative when you have a limited amount of energy available. It makes life more interesting, in a way. Not every day is the same and you cannot always get what you want.

NEW SPEAKER: We accept that we might not be able to power our homes to the extent that we might like on a cloudy day or a day with no wind. And I think there's something really profound about that. Something not animalistic, but I think it does tell us that we are vulnerable, right? We are not fully in control.

JONATHAN TAGGART: I'm a documentary director based in Canada. I've recently completed a film called *Life Off Grid* about the experiences of people living off the grid all across Canada.

You know, I think off-grid homes are sort of an experimental lab for our collective future. And I think the way life is being lived out in those homes today can really tell us something that we might need to know in a future where we have fewer resources to work with.

KRIS: You know, I'm sitting at my desk, in front of the window. I actually see the energy source, the sun. I see it shine on my panels. It's a very magical thing.

When the sun is at the highest point in the sky, you feel the power, you see the energy in the batteries going up. I feel much more connected

to the sun. I really appreciate the sun, as all human beings should.

ANNABEL: Fossil-fuelled infrastructure is about digging into the dirt. By contrast, the wind turbines are neat and they are autonomous – or they appear to be. And this is where there's perhaps a potential for conflict as well. The turbines look towards a kind of automated future. Whereas, in relation to nuclear, in relation to oil, in relation to coal, we think of the armies of men, specifically, who were mobilised in order to intervene and make this material, bring it out from the earth and mediate it and bring it to the public.

With these turbines – and I think this is partly a threat to us – it almost testifies to a kind of robotic future where we don't really need very much else to bring that energy to us. There's very little labour attached to it, by comparison with our fossil-generated energy.

DALE: What's happening now is a great crossover between renewable energy, electric cars, battery storage, smart grids, that kind of stuff. It's really empowering for people, because we can put solar panels on our rooftops, for example, and not just make the electricity we

use at home, but we can make a replacement for the oil that used to power our cars. We can charge our cars from it. The cars themselves are batteries on wheels, so when we bring them home at night and plug them in, they can give to the grid as well as take back.

Smart devices are changing when we ask for power. It's putting so many options in the hands of all of us. It's a really fantastic place and I think will challenge the model of the top-down power company absolutely, and break it, there's no doubt about that.

KRIS: We are trying to switch to renewable energy but we are not the first who have tried that. Actually, it has been tried before, to great success, in the pre-industrial period. All mechanical energy was delivered by water power and wind power. They adapted to the weather. They adapted their entire production process. My point is not that we should go back to the technology of the past, to past technology. You don't have to go back to the wooden windmill to adapt your production system to available wind power. You can do that with modern installations. My point is that if you combine new technology, new materials with this old way of dealing with the variation

in the weather, it's a source of inspiration that could be useful for the future, in order to build a really sustainable society.

ELIZABETH: If the future really involves a lot more renewable power, then the power supply *will* be more intermittent. It doesn't necessarily mean full blackouts, but it probably will – and actually hopefully will – involve a much more calibrated ebb and flow of demand. So not everything is available to be on absolutely all the time. Closer connection with the seasons is really very likely to happen. There's lots of ways in which the future of electricity is more intermittent. The practices that depend on electricity will have to be rethought in terms of their timing. So, peak load won't be the same as we know it today.

DAVID: The choices we face now with electricity are fundamental. Will we continue on the high-energy binge of the 20th century? Are we going to treat the electrical grid's technological power and momentum as something that's inevitable? Or will we consume, maybe, a little less?

JONATHAN: If we choose to reinvent the systems that have been handed to us, living off grid can show us how resilient and inventive

we really are within ourselves. Moving off grid, in a way, conditions us to want less, and we will take what we have at hand and use it in a respectful and ingenious way to live good lives.

DALE: So is this a movement? I see it as a kind of force of nature, really. I see it as something that's not been planned by anybody, not necessarily led by anybody, but it's a combination of the ability given to us by technology and emerging ideas of what to do with that technology. And this is happening now.