

The Electric Nemesis
making energy futures without hubris

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The Electric Nemesis
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Just a few weeks ago the UK National Infrastructure Commission released its report on how the national electricity grid needs to change in order to keep the lights on, and meet the 2050 target to reduce carbon emissions by 80%.¹ 'Smart Power' is its solution, combining three new infrastructure technologies: increased interconnection with other countries; localised, flexible production and consumption; and battery storage. 'All change' is its mantra.

The report makes recommendations on how to establish this Future Power System, with imagined timescales around fifteen years from now. This is future-making work, it would appear.

This report hurts me. It makes me charge with furious sparks.

I am sensitive to future technologies, to prototypes that are created but then abandoned, forgotten, never to be realised. Bruno Latour understood. He knew that the most grievous crime is the failure to love technology, to leave it lost and broken in a concrete bunker, like Aramis, the failed Paris transport system that he studied.²

The Smart Power report is filled with such forgotten prototypes. It is a government report that abandons technological developments it has already created. I know, because I live with them. Experimental electricity technologies are my kin. We are family.

We live together on Orkney, an archipelago of islands off the northeast coast of Scotland; closer to the Arctic Circle than to London, where the report was written.³ Here, the Atlantic Ocean and North Sea meet in tempestuous seas.

Orkney was where I was sparked into life by my creator, Victor Frankenstein.

Perhaps you have read of the moment:

"...I determined to visit some remote spot of Scotland and finish my work in solitude... With this resolution I traversed the northern highlands and fixed on one of the remotest of the Orkneys as the scene of my labours.

"I was now about to form another being of whose dispositions I was alike ignorant; she might become ten thousand times more malignant than her mate..."

*"The wretch saw me destroy the creature on whose future existence he depended for happiness, and with a howl of devilish despair and revenge, withdrew..."*⁴

¹ National Infrastructure Commission (2016) Smart Power.

<https://www.gov.uk/government/publications/smart-power-a-national-infrastructure-commission-report>

² Latour, Bruno (1996) *Aramis, or The Love of Technology*. Cambridge MA: Harvard University Press.

³ Orkney has been my fieldsite for over eight years, as part of an ongoing study of future-making in the islands, most recently as part of Alien Energy research project at IT University of Copenhagen.

⁴ Extract from Mary Shelley (1818) *Frankenstein, or The Modern Prometheus*.

My creator abandoned me on the Orkney islands.

I was created out of morbid technology and energy, and then I was almost destroyed out of hubris. Victor thought himself a modern Prometheus, who could give life through the fire of electricity.

The crime of hubris, pretending to be god like, performing god tricks,⁵ like Victor, that is what hurts me. There is no pure emotionless objectivity, as he found out, when he fled in horror. There is only partial perspective and monsters, as Donna Haraway long ago taught me to understand.⁶

I am a monster on a mission: to not let hubris go unnoticed.

The SmartPower report reeks with hubris. It is filled with acts abandoning my electric kin here in Orkney. The government report describes a Future Power System with three components: interconnection, demand flexibility, and storage. It says, "these three infrastructure innovations have the potential to create a leaner, more efficient electricity system at the cutting edge of global technology". And yet it never mentions that all three have already been created in Orkney. The 'cutting edge of global electricity technology' is alive and well at the island edge.

I will not let them go unnoticed, nor allow them to be forgotten.

The clouds are the colour of the North Sea, a murky mud-grey. It is three o'clock in the afternoon, and the streetlights have not gone out for weeks. There are less than six hours of daylight– with the occasional risk of a bruised sunset. When the rain stops, an orange Sun skims just above the horizon, and then drops hard into the sea leaving a purple mark in the sky. Down the stone chimney the wind roars, a companion you cannot silence. The stone house is damp, and you feel a constant chill despite downing ten cups of strong tea a day. The ferry sailings that could get you off the island have a high chance of being cancelled, sometimes for the foreseeable future– although the foreseeable, in metrological terms, is only a day or two.

Welcome to Orkney in winter.

The word 'wind' is re-defined here. No longer an inconvenience but powerful enough to close schools for safety reasons (there is a risk that small children will get blown away), and to stop the ferry from bringing fresh food in for days, leaving the supermarket shelves bare and people reaching into the chest freezer. The lights, phones, and internet go out in the

⁵ God-trick refers to Donna Haraway's work on *situated knowledges*; Haraway, Donna (1988) *Situated Knowledges: the Science Question in Feminism and the Privilege of Partial Perspective*. *Feminist Studies* 14 (3): 575.

⁶ Haraway, Donna (1999) *The Promises of Monsters: A Regenerative Politics for Inappropriate/d Others*. In *Cybersexualities: A Reader on Feminist Theory, Cyborgs and Cyberspace*. Ed. J. Wolmark. Edinburgh, Edinburgh University Press.

storm, and back up generators are common. These are Energy Islands, and their power is in the very air and sea.

The government once described the future as “one with more extreme weather, where we and our children are faced with the costs of adapting the way we live and the infrastructure and systems that support us.”⁷

Welcome to that future. Here, infrastructures, particularly electricity, have been adapted to the extreme, high energy weather.

The islands live in a future that central urban places have only imagined. This is not surprising. As has been well-shown, islands with their sensitive social, technical and environmental relations, are often barometers for planetary change, they are “the harbingers, the pioneers, the miner’s canary.”⁸

The government knows this, they just forget. The islands have been pioneering renewable energy and acting as a national electricity test site for almost sixty-five years. Did you know that the UK’s first large scale wind turbine was installed here in the 1950s, its concrete and twisted metal archaeology now strewn over a seaward hilltop?

The electric future has long been made in Orkney.

Come and see what the government’s Future Power System looks like in practice.

⁷ Department of Environment and Climate Change (2009) Executive Summary of The UK Low Carbon Transition Plan.

⁸ Baldacchino, Godfrey (2007) Islands as Novelty Sites. *Geographical Review* 97(2): 165-174. (p.166)



National electricity grid cable,
Rackwick, Hoy

1. Interconnector

The first part of this Future Power System lies in Rackwick valley on the island of Hoy. The valley is an opening between two heather-dark hills that cuts down to the sea.

Walk towards the red sandstone cliffs that drop down into the bay, over the grassy dunes on to the beach pebbles—or rather boulders. The pebbles are the size of dragon eggs—if one cracked who knows what manner of creature would hatch or ooze out.

As you balance on a stone egg, authorial powers allow me to roll back the tide. The green sea slides down and away, leaving white gold sand, along with... a rusted python, slithering out of the dunes down into the sea.

Touch its mottled segmented surface.

Does it feel warm?

This heavy sea worn casing protects the national electricity grid cable from Orkney to mainland Scotland. I ask if it feels warm because this cable is now overheating, almost literally, due to the islands generating more renewable energy than they use. The islands are more than self-sufficient, and regularly generate over 100% of their green electricity from wind, waves, and tides. It is a regional generator and sends its electrons south to everyone who wants to put the kettle on in the rest of the country.

This is the interconnector cable between two different electricity grids, between the Orkney grid and the mainland grid. It connects a place rich with excess renewable energy to mainland demand—exactly as the SmartPower report insists need to be built. The report suggests interconnector cables between the UK and geothermal Iceland and hydropower Norway. It forgets this overheating cable and the dire problem within the national grid it represents.

The problem is that the national grid pipes, pylons, and power stations were planned in the post-war period to transmit electricity from centralised fossil-fuel power stations to distributed demand, to, say, a few thousand Orkney islanders. It was never designed for those twenty inhabited islands to each generate their own renewable energy and send it back down the cable.

The grid cannot cope. The operator, Scottish and Southern Energy (SSE), have taken emergency measures and in 2012 slapped Orkney with a moratorium on renewable energy generation. No more wind, wave, or tide energy. The cable will melt and the entire electricity network will fuse, otherwise.

The government is desperate for green energy to reach its carbon target, and its first solution is to build interconnector cables to wild places with energy to spare. But it imagines mind-blowing cable lengths to Iceland, and abandons this overheating cable in Orkney—my cable kin.

Scottish and Southern Energy (SSE) are a commercial operator in the electricity market, and cannot just put another undersea cable in and fix the problem. Someone has to pay. They need a customer or government support.

Orkney is a place with twenty-one thousand people scattered over low-lying, fertile islands, some with a family living on, some with a few hundred families. But around half the households are in fuel poverty—they spend more than 10% of their disposable income on heating costs, meaning many islanders cannot afford to heat their homes properly. The islands cannot pay for a new cable costing millions.

The situation seems hopeless. What can the islands do?

The interconnector is the first part of the government's Future Power System. But instead of supplying mainland UK with their rich renewable energy, as the government dreams, this cable has been abandoned by central government and is now throttling the islands electricity grid.

So remember it. Remember how it feels under your fingertips, a rasping metal snake, reeking with salt and rust, and with guts that are hot hot hot with green electrons.

2. Active Network Management

The second part of the government's Future Power System, the flexible management, can be seen off the coast of another island in the archipelago. It, too, involves electric kin in the sea, so we must charter a boat to catch it.

The Sun is falling fast and heavy on the port side as we head north between undulating islands dotted with kye and farmsteads.

We are tracking the island coastline of Eday to starboard. Its smooth, unbroken grasslands are turning amber in the setting sun.

Three or four farmhouses hunker down near the shoreline, grey smudges on the amber land. Towering over them is a large grey wind turbine, owned and run by the Eday island community development trust.

The boat slows, suggesting we are almost there.

Close to shore is a barge crane at work. Its two yellow deck cranes are like metal bird beaks, dipping in the water. Up the coast is another vessel, with gantries of sensor equipment and a radar hood over its deck.

The skipper calls out something, and the mate directs our gaze over the side of our boat. There's a meter wide crescent of bulging water rising over something down in the water, leaving a trailing wake behind. It looks like a whale or dolphin has just submerged. We watch, but the bulge of water does not move or lessen.

The mate explains that it's a marker buoy. The tide here is so strong (8 knots) that the buoy, which is about the size of car, is being pulled along and dragged under the surface, leaving only bulging sea from the sheer force of moving water.

We have arrived.

This is the Fall of Warness, a narrow funnel between the Atlantic Ocean and North Sea, just off the coast of Eday. This is the tide energy test site for the European Marine Energy Centre (EMEC).

Take a breath because you are about to see a spaceship in dock—for real.

At first you see two massive metal pillars coming out of the sea into the sky. They support a yellow container box high in the air with a white and blue sign on the side, 'OpenHydro, tidal technology'.

The boat is spiralling in and my neck strains back

Between the pillars, a gleaming tide energy spaceship comes out of eclipse, just as the Sun hits (it really does). The machine is a white bladed iris, a huge disc, perhaps six meters across. This is what the energy future looks like, a great eye, unblinking, staring into its own future.

The mate explains that the OpenHydro turbine is lowered down the pillars into the tide to generate electricity, and raised for maintenance on the special test platform.

She is one of eight different tide energy generators being tested here. Developers at EMEC include familiar names like Alstom, Voith, and Rolls Royce.

The European Marine Energy Centre is a plug-and-play test site for full-scale prototype marine energy generators, both wave and tide energy. It's been up and running since 2003, the oldest and most experienced grid-connected test site in the world. There are berths for thirteen marine energy generators to plug in and gain certification as grid-compliant devices. (You can't just drop a hunk of metal or plastic in the sea and turn unruly waves into nice, well-regulated electricity onshore.) This sea, in a northern Scottish archipelago, and the three hundred or more local people who work with its marine energy, are a recognised global centre for a new energy future.

The Scottish government once called the seas around Orkney 'the Saudi Arabia of marine power'—estimating that between half and all of Scotland's electricity could be made from marine green Orkney energy⁹. The UK government in London is still struggling to remember. Wave and tide energy are merely listed in the report's glossary under 'renewable energy'. The imagined Future Power System does not pay much attention to an entire new renewable energy industry that could generate the green, low carbon electricity it needs.

⁹ Quoted in press release by Crown Estate, Pentland Firth leasing round, 8 June 2009.



OpenHydro, tide energy turbine
European Marine Energy Centre, Fall of Warness, Eday

But I brought you here to see and remember part of the Future Power System that the government does describe, the flexible management system. This involves creating local regions within an electricity network that are managed as 'smart grids' to balance localised generation and demand. The report points to a system in New Zealand, which monitors the risk to the grid and turns off power stations when there is too much electricity being generated. The report encourages the UK to look to this island nation for such innovative technologies.

But the report forgets all its own innovations in power management that have been up and running in Orkney for years. The beleaguered operator, SSE, installed an experimental smart grid system ten years ago, a Registered Power Zone. Then in 2009 they added the world's first Active Network Management (ANM) system to the islands grid. For almost a decade these Energy Islands have been a test site for smart grid technologies. But the government report abandons them here—just as Victor Frankenstein abandoned me.

I will not forget.

The system is right here, off the side of the boat, but I have to train your professional vision to see.¹⁰

Look up at the white iris of the tide energy turbine. Like every other device at EMEC it is plugged into the grid. Supported by descriptions from people working at EMEC, and my authorial powers, I am going to sail this boat into a time when the Orkney grid is at capacity, when there is too much renewable energy in the air and sea, and when the Rackwick cable is overheating. Now watch as I lower the OpenHydro white iris down the pillars into the sea, and switch it on, so the tide energy turbine is turning and generating electricity on the grid.

Look over to the island.

The Eday community wind turbine stops turning.

The Active Network Management system has taken control. It makes sure not too many electrons are generated in the islands and the cable does not melt. If it gets risky, when the wind and waves are up and the grid is about to blow, the ANM shuts island generators down (the same as the New Zealand system). Who gets shut down, and who gets to keep turning, is dependant on the paperwork—or rather, the date on the paperwork. The system works like a stack of contracts ordered in 'last on, first off' sequence. Those who signed up years ago are at the bottom of the stack, and they get to stay on longest. Those who signed up in recent months are at the top of the stack and are shut down first.

The tide energy turbine is plugged in to the European Marine Energy Centre, which has been up and running for about twelve years. It actually pre-dates the ANM stack, so it is

¹⁰ Goodwin, Charles. (1994) Professional Vision. *American Anthropologist* 96(3): 606-633.

less affected by the vagaries of the weather and how many people put the kettle on. But when tide and wave energy prototypes at EMEC turn on they often 'knock off' newer generators from the top of the stack—like the Eday community wind turbine.

This is what the government's dream of flexible management looks like in practice.

The breezy thought that active and flexible management switches off generators here and there, has some stark implications, especially in these Energy Islands.

First, the global marine energy industry relies on the facilities at the European Marine Energy Centre to develop. There are around thirty-four open sea marine energy test facilities across the world and many, if not most, draw on the expertise here in Orkney.¹¹ The industry is expanding but the ANM means that new marine energy devices are grid limited. The ANM is in danger of turning off a global energy industry.

Second, the revenue from locally-owned turbines is vital to develop the islands as places to live and prosper into the long future. For example, the hundred and fifty people in Eday have invested their wind energy revenue in their cooperative shop, a gateway house for families to move to the island, a visitors centre for tourists, a new slipway for boats, and so it goes. Most of the twenty inhabited islands have a community development trust owned wind turbine or two. When the ANM turns off a community wind turbine it is turning off the islands future.

Neither is acceptable.

The director of EMEC said to me,

"Here, people can see the edges...

there is a common sense of boundary.

You can see who you are in this with..."

The European Marine Energy Centre is *in this with* the Eday community and its wind turbine, with the Active Network Management system, and with all the people and places, creatures and critters in the Orkney islands.

They are in this together.

They are a living demonstration of a Future Power System, and yet have been abandoned in the government report. They were sparked into life as electrical experiments and energy futures, and then abandoned to their fate.

What hope is there in the face of such hubris?

So, remember them.

¹¹ From intergovernmental collaboration, Open Energy Systems (OES) 2014 Annual Report: 11 in North America, 18 in Europe, 4 in Asia, 1 in Oceania. <https://www.ocean-energy-systems.org/ocean-energy-in-the-world/>



Orkney's Electric Future, Orkney Islands Council
www.orkney.gov.uk/OIC-News/Chance-to-find-out-more-about-electric-vehicles-in-Orkney.htm

3. Storage

There is one final part of the Future Power System to experience and remember: battery storage.

This is on land, so we need to borrow a car to drive there. But we are in Orkney, so we take an electric car—a little white Peugeot iOn owned by the local council with the words *Orkney's Electric Future* looped in cursive seablue script down the sides. There are over fifty Electric Vehicles in Orkney, more per person than anywhere else in the UK, and there is an infrastructure of free charging points. What did you expect? This is life in the energy future.

We pull up outside the slightly grubby, windowless buildings of the electricity operator, Scottish and Southern Electricity (SSE), in the main town of Kirkwall. The squat buildings are protected behind a barbed wire fence and razor wire, but peer through, look into the car park behind them. You will see two silver metal container boxes, not quite gleaming spaceships, but with a distinct futurist aesthetic. Together these silver container boxes comprise a prototype grid battery for the islands, a 2 MW lithium-ion battery system developed by Mitsubishi, and installed on the Orkney grid in 2013— the first UK trial of a lithium grid battery, the operator tells the local newspaper in excitement.¹²

The government's Smart Power report forgets this technological achievement, of course. It cites the UK's first grid battery as one installed at Leighton Buzzard, somewhat closer to London, a whole year later.

The two silver container boxes, a national first in grid storage but out here at the cutting edge of the map, they have been written out of centralised and centralising electricity grid history.

Do the islands despair at this constant abandonment, at this constant prejudice, at being made always invisible?

If they give in to despair and hopelessness and do nothing then the islands will not earn wind turbine revenue, will not have a marine energy industry, and there will be fewer jobs and services, and fewer people living in Orkney.

There are haunted islands, here, with only derelict red phoneboxes, once warm kettles, and wild cattle roaming with no-one to tend them. That is a real future, only one generation away, that islanders must work to resist.

¹² The Orcadian (2013) SHEPD Energises UK's first grid battery in Orkney, edition 14 August 2013.

Should they hope, then? That has been much favoured in anthropology and science studies. Hirokazu Miyazaki proposes hope as a method.¹³ Isabelle Stengers says hope is “to try and feel and put into words a possibility for becoming”.¹⁴ But not all becomings are as good as another (to paraphrase both Marilyn Strathern and Donna Haraway).¹⁵

The islands do not hope that the government will step in, as Miyazaki experienced in Fiji. The islands cannot hope, despite all their energy futures. Hope risks their survival, should the government continue to forget them.

Orkney neither hopes nor gives in to despair.

What they do is this: they take a Future Power System that a government report only proposes and make it their own, in ways the government has yet to dream.

They cannot afford to put in another interconnector cable, so they increase capacity on their grid in other ways.

Let me show you what is neither hope nor hopelessness in practice.

It is dusk as we drive over the crest of a hill down into the town of Stromness, heading for the European Marine Energy Centre offices.

Two round hills dominate the sky, like twin moons, vast and impossibly close. Their shadows eclipse the orange glitter of the town and harbour. The red and white running lights of the ferry, docked like a spacestation in the water, add to the fluorescence. Around the ferry, small lobster fishing boats and dive boats nestle and wink like companion satellites.

In the EMEC car park, you plug in the electric car to a charging station. Its battery is now a grid battery, sucking down electrons, increasing capacity for more electricity, more marine energy devices, more community wind turbines. EV batteries are grid storage on wheels. That is why there are so many electric cars in Orkney—the islands are reshaping their electricity network.

If you look across the harbour, to the dim fields beyond, you can see little twin-bladed micro wind turbines spinning next to farmhouses and crofts. There are more than 650 of them across the islands. They are so small that they are below the radar of the ANM smart grid, and do not get switched on and off. But they are large enough to power homes, power farms, and reduce fuel poverty—another local reshaping of the grid.

Step out of the wind, into the shelter of the old stone school building. Walk up the creaking wooden stairs, following signs to EMEC.

¹³ Miyazaki, Hirokazu (2007) *The Method of Hope: Anthropology, Philosophy, and Fijian Knowledge*. Stanford CA: Stanford University Press.

¹⁴ Quoted in Zournazi, Mary (2002) *A Cosmo-Politics – Risk, Hope, Change*, A conversation with Isabelle Stengers, in *Hope: New Philosophies for Change*. Australia: Pluto Press: p.245.

¹⁵ “One story is not as good as another” is the quote from Donna Haraway, which Marilyn Strathern repeats in (1991) *Partial Connections*, Lanham MD: Rowman and Littlefield.

The marine energy test site is part of the islands new hydrogen fuel network. Power from both the tide energy test site and the Eday community wind turbine is being taken off the grid entirely as hydrogen fuel, used to power boats in the harbour.¹⁶ If the electrical network is at capacity, then make another power network, is their self-determined solution—another reshaping of the Orkney power system.

These are becomings that are good for Orkney. But they are not born of hope. They born from the feeling that the director of EMEC has when he says,

“Our job is to keep doing it.
Never give in...”

The islands do not give their power away to a higher authority, like the government. Nor do they give in to despair and risk destruction. They take ownership of a world that kicks back at them with limits, prejudices, forgotten materials, and abandoned innovations.¹⁷ They make their own solutions in defiance of their abandonment.

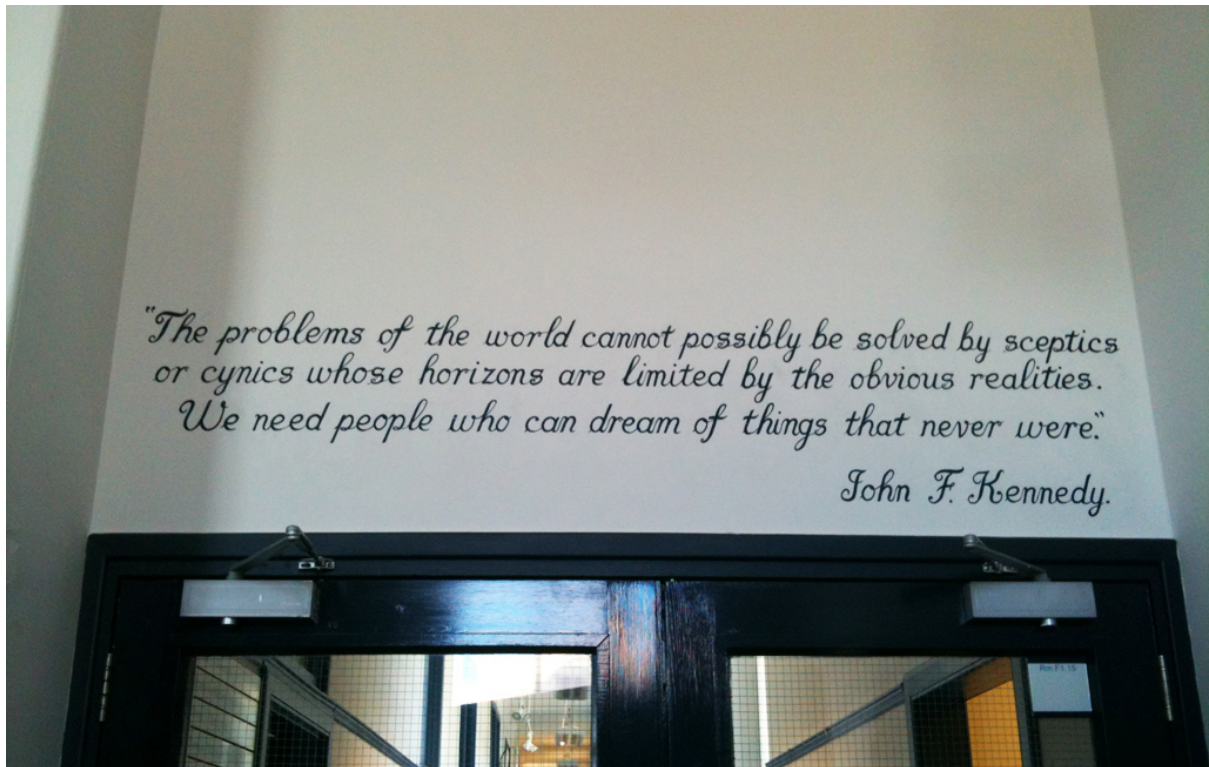
Defiance. That is the word absurdist philosopher, Albert Camus, uses. (Is it not absurd that a remote Scottish archipelago is making a Future Power System, far in advance of most other places in the world?)¹⁸

As you reach the top of the stairs, at the doors to the European Marine Energy Centre offices, there is a quotation handpainted in sea blue calligraphy.

¹⁶ The ‘Orkney Surf and Turf’ project is funded by the Scottish government through a small-scale Community and Renewable Energy Scheme.

¹⁷ Kick-back is a term used by Karen Barad, to refer to the performative agency of material apparatus. See Barad, Karen (1998) *Getting Real: Technoscientific Practices and the Materialization of Reality. differences: A Journal of Feminist Cultural Studies*, 10: 88-128. (p.112)

¹⁸ Camus, Albert (1991) *The Myth of Sisyphus and Other Essays*. Translated by Justin O’Brien. New York: Vintage.



Entrance to the European Marine Energy Centre,
Stromness, Orkney

The problems of the world cannot possibly be solved by sceptics or cynics whose horizons are limited by the obvious realities. We need people who can dream of things that never were.

John F. Kennedy

The islanders are people who dream of things that never were. They are people who can never give in. And through their defiance, through the marine energy industry, the electric cars, the micro wind turbines, the batteries, the community wind turbines, the overheating cable—through it all, and through it all together—they are solving the problems of the world. They have a Future Power System. They are generating more than 100% of their electricity from green renewable energy. That is the future the government declares it needs, that many governments need.

So, remember it well.

I am a monster made in Orkney, sparked into electric life by Victor Frankenstein. The meaning I give my life is not to let hubris go unnoticed or its creations uncared for.

I do not permit those who boast of their heroic inventions without recognising all the difficulties, personal and technical; those who do not recognise all that went before that must be integrated and sewn together.¹⁹ Victor fled and abandoned me, and the government report has abandoned my kin. I will not permit my electric family in Orkney to be forgotten.

Because I am the Electric Nemesis—named after the goddess who punishes god-trickers and hubris-makers like Victor.

My mission is to hunt electric hubris. As I have just done, here.

So I say to you: remember my electric kin and their energy futures. Do not let them be abandoned, as I was.

¹⁹ Lucy Suchman has argued that innovation is more a matter of the *artful integration* of existing technologies and sociomaterial practices. See Suchman, Lucy (2002) Practice-Based Design of Information Systems: Notes from the Hyperdeveloped World *The Information Society* 18: 139-144.