There has been a flurry in the news about the potential for geothermal energy on the Isle of Man, so we turned to an expert from the Manx Geological Survey.

What is your background? Hello, my name is Dave Quirk. I have a PhD and have been working on the geology of the Isle of Man since 1990. Dr Dave Burnett and myself set up the Manx Geological Survey (MGS) in 2000 as a scientific charity. As well as making geological maps and interpreting geophysical data over the Island, MGS has looked for evidence of warm water in springs and in the mines, unfortunately without success. Since 2017, I have been working on the green transition in Denmark. Prior to that, much of my career was in oil and gas exploration… that was until I sat down to work out the impact of carbon emissions! Nonetheless, this guilty past has given me expert knowledge of the feasibility, economics and risks of drilling boreholes.

Is there any chance of powering the Isle of Man with geothermal energy? No, not really. The Island has many advantages when it comes to renewable energy but unfortunately geothermal is not one of them. We have published a short piece at www.manxgeology.com on why the geology rules it out. However, it is interesting to note that 350 million years ago there would have been lots of geothermal energy in the Isle of Man - it was volcanically active, rather like the East African Rift Valley today. This is no longer true - the Island is geologically inert and, as a consequence, it is cold.

Can you explain why it isn't viable? What is needed for geothermal energy is rocks of high temperature at relatively shallow depths. In addition, you need something to carry the heat to surface – usually water. On the Island, the temperatures increase relatively slowly below the surface. One would have to drill to depths of more than 5 km through hard rocks. A borehole would take around a year to drill and would cost several tens of millions of pounds. At least two boreholes would be needed but then there would not be enough natural water flow – the Manx slate and granite rocks found at these depths are impermeable – meaning you would have to form artificial fractures ("fraccing").

So where does geothermal power work? There are two systems in commercial operation in different parts of the world. In volcanic areas like Iceland and southern Italy, the ground is so hot that water can be circulated through shallow boreholes to form steam which drives turbines for electricity. In other areas like Denmark and Germany, there are porous and permeable rocks ("aquifers") around 3 km depth which contain hot water. This hot water can flow by itself into the boreholes and is brought to surface where it is distributed to nearby communities via insulated pipes ("district heating"). A small-scale scheme has been in operation in Southampton since 1986 where there is an excellent aquifer. No such aquifers exist on the Isle of Man. There is the chance one could find a Manx thermal spring similar to that at Buxton in the Peak District but this would only provide enough warm water to heat a few houses or a swimming pool and, as mentioned, the Manx Geological Survey has not found one yet!

Aren't there new geothermal technologies we can use? Geothermal energy has always been an attractive source of power because the internal heat of the Earth is constant and almost limitless. New ideas continue to be tested, even in the UK. One idea is to use warm water from flooded coal mines. This is currently being investigated in Glasgow. Unfortunately, there appears only to be cold water in the old lead mines on the Isle of Man. Another concept is to drill into unusually hot granite rocks such as those in Cornwall, circulate water through natural or artificial fractures and then bring the heat to surface. This has been tried before and proved disappointing but, nonetheless, the EU has funded a new attempt – the United Downs project (Figure 1). This site has a large geological fault with natural fractures along which water can flow. The Cornish granites themselves are hot because they are mildly radioactive, unlike the Foxdale granite: the natural flow of heat from the Cornish granites is roughly twice that of the Island. Of course as scientists, we would like to see more measurements to be absolutely sure that a "hotspot" hasn't been missed here. However, we are also missing the type of geological fault that the United Downs project relies on for the hot water. In short, the geology on the Isle of Man is highly unfavourable for geothermal energy.

With these sort of projects, what are the risks? Mostly commercial, caused by the fact one never knows what a borehole will find. Even in the best areas there may be an inadequate flow of water, the main risk in the United Downs project. For this reason, the oil and gas industry – who knows how to drill boreholes – has largely avoided geothermal because the chance of economic return is very low. In addition, there is a small risk of causing earthquakes, particularly if fraccing is involved.

So are there other ways we can be self-sufficient in renewable energy? Yes. The Isle of Man has genuine assets in the form of wind, sun, hills and sea. These offers us many options to move away from fossil fuels. However, it is the private sector who can decide what it is worth investing in. Tax-payers do not need to fund the energy transition and Government subsidies are not required for projects, at least not for those which make commercial sense. However, it does need to be relatively easy for new companies to invest here. With the right legislation, renewable energies offer stable, predictable prices, in clear contrast to oil and gas.

So is it just a question of selecting the technologies which would work best on the Island? By way of analogy, one would not choose to generate power from wind in the Sahara, nor would one choose solar power to heat homes in northern Norway. The geology of the Isle of Man is really unsuited to geothermal power production but is well suited to other forms of renewable energy. After 40 years of investment, it is nowadays cheaper to generate power from wind and solar energies than by burning fossil fuels. Just for reference, 60 offshore wind turbines or an equivalent combination of onshore solar and wind would provide all the power we currently use on the Island in electricity, heating and transport. That being said, we would also need a way of storing surplus power for when it is needed – involving technologies such as those using batteries, water, gravity, heat or a combination of these.

Finally, what would you like to see happen over the next few years? Self-sufficiency in renewable energy is not only possible but is a real economic opportunity for the Island. Personally, I would like to see the energy transition lead to affordable heating for residents on the Isle of Man.

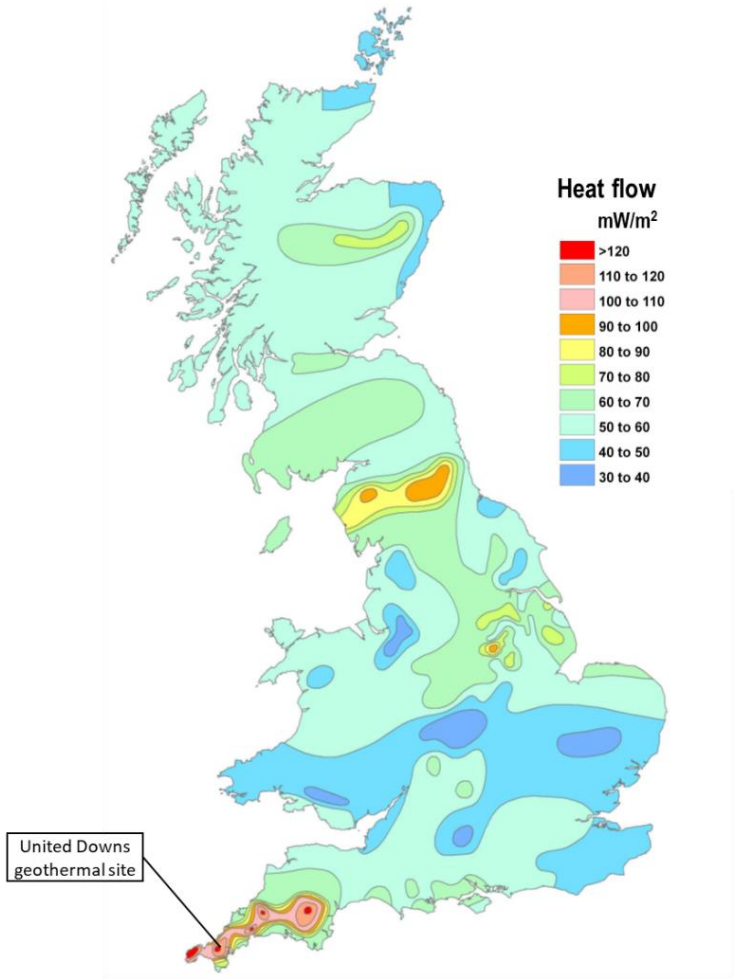

Figure 1. Near surface heat flow map of the UK from Busby et al. (2011). The rocks below Cornwall are unusually hot (red colours) whereas those in the Isle of Man are relatively cold.

Suggestions for further reading. Another article on geothermal energy in the Isle of Man is available at https://www.manxgeology.com/wp-content/uploads/2022/04/Potential-for-geothermal-energy-on-IoM.pdf. For people interested in geothermal energy in general, a useful presentation produced by the Technical University of Denmark (DTU) can be found here: https://backend.orbit.dtu.dk/ws/portalfiles/portal/235911337/2019_IOB_GEOTHERMAL_ENERGY_FolkeUni.pdf. To start with it is fairly theoretical but practical information on geothermal power can be found from slide 10 onwards.