

ANANT HANARAYANAN

Green energy is now an industry all over the world. The growth would appear to reflect the resolve of all countries to limit the use of fossil fuels and the harm they do to the environment.

Michael Francis Moore, American documentary filmmaker, author and activist, in his 2019 film, *Planet of the humans*, presents a contrary view – green energy depends on inputs that are just as harmful as the fossil fuel-based energy. And the interests that promote green energy are the ones that gain from the market for inputs that green energy creates.

Moore is an award-winning producer and director, who has critically examined social and political questions, like presidential elections, the gun culture, health care, globalisation, large corporations and capitalism overall, in the US. In 2005, *Time* magazine named Moore one of the world's 100 most influential people. He says he was an early environmentalist – when he was 10 years old, bulldozers started knocking down the woods near his home. He retaliated by pouring sand into the bulldozers' gas tanks.

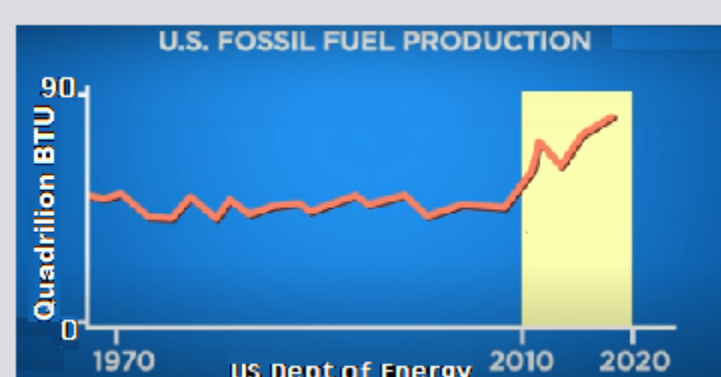
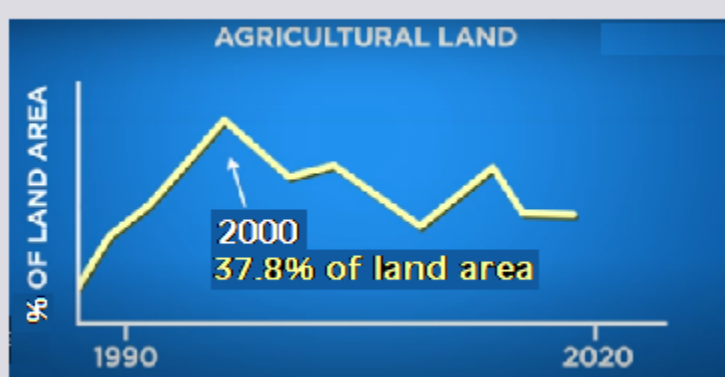
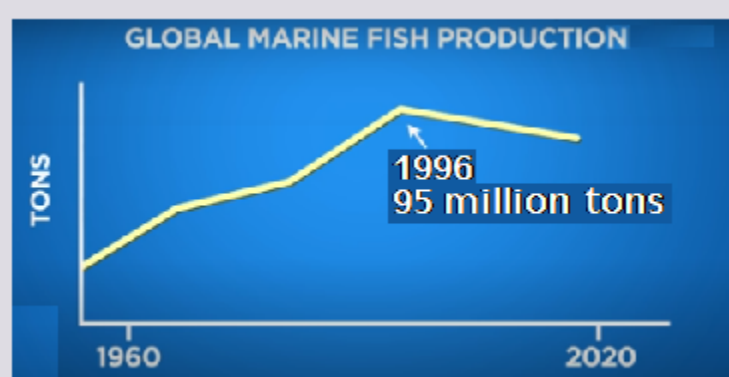
The documentary, *Planet of the humans*, is about the environmental cost of the production of solar panels and wind farms, half-truths that are put out to justify their use, and the rising energy footprint despite all the investment in green energy, because the solutions are inadequate, in any case. The whole movement, he says, is a series of "desperate measures not to save a planet, but to save our way of life." While there is talk of moves to block screening of the film, on 22 April, Earth Day, Moore put the entire film for free viewing on the Internet, for a month.

The film starts with a solar festival in Vermont, "powered by 100 per cent solar energy". But the weather changed after the festival got underway, and Moore and his team found the festival had a "biodiesel generator" back-up, and finally they had to plug into the state electric grid! That solar and wind power are intermittent, the film says, makes fossil or nuclear powered back-up inevitable. And if we power down these sources while the sun shines and the wind blows, this hits the efficiency of the plants, which puts us back where we started.

The carbon footprint of producing steel, aluminum, concrete and fiberglass, which go into building a wind farm, apart from the acreage that it uses up, eats into the value of the power it generates. And then, it needs to be maintained and replaced. And in the case of solar energy, it has been put out that the raw material for the solar cell is just sand, and that we have in plenty. The trouble is that while the material is silicon, which is there in sand, for making solar cells, we need to use a much purer form of quartz. Quartz contains silica, or the oxide of silicon, and it is reduced to the metal by getting carbon to take away the oxygen, to release CO2. And the process needs a furnace at 1,800°C, which we get by burning carbon! And in any case, the film says, even a huge solar farm has



Could green energy be a shade of brown?



limited capacity. To provide for the 180,000 people of Lansing, in Michigan, the film says, we need a solar farm that is three miles wide and five miles long. "A dangerous concept that is gaining currency," one of the commentators in the film says, is that alternative technology, like wind or solar, are somehow different from fossil fuels.

Alternate sources of energy, like hydrogen, all take energy, which comes from fossil fuels, to produce. Ethanol from corn is produced through a massive, fossil fuel-based utility to produce corn – a case of using coal to replace the use of coal, the film says. We hear of coal-based power plants being replaced by green facilities, but what we are not told is that another natural gas-based plant with four times the capacity is also being built, the film says (the picture shows the rise in fossil fuel production in the US from 2010-20).

Richard Heinberg, author of *The End of Growth* (that we are at a turning

point in humanity's economic history), says he reviewed 25 alternative sources of energy that suggested we could "continue living the way we are, to perpetuity," but found it was not so. Richard York, of the University of Oregon, author of "Do alternative energy source displace fossil fuels?" in the journal, *Nature*, says that while the answer is that they do not, replacing fossil fuels does not even appear to be the objective of green energy. "The position taken is that, yes, we are in an ecological hotspot, but there are technological fixes that can get us out," says Nina Jablonsky of Penn State University. "But seeking technological fixes, one after another, is simply going to lead us to another level of catastrophe," she says.

The film shows the power hungry industries that green energy demands – mining and production of silicon, billions of tonnes of chemicals, silver, cobalt, graphite, coal, steel, nickel, copper, concrete lithium, tin, gallium,

arsenide, indium – all involve energy guzzling methods, in places where power is generated in the most wasteful ways and putting vulnerable populations to risk. "We just want to believe there is a green solution to the energy problem and we can go on living the way we are," the film says.

The film considers the technology of using desert land to set up solar farms. For one thing, it notes that deserts are not really deserts, they too harbour important life and ancient vegetation. All of this would be lost to solar farms. And then, the farms are not permanent, they need to be renewed or they would be abandoned. Moore sees the possibility of huge land being destroyed.

In the ocean, Moore sees that we have pushed exploitation of fish resources to the limit. We reached the limit of fishing in 1996, the film says as shown in the picture. And again, when it comes to agricultural land, we have reached the peak of what is avail-

The mindset

The solution is not where to draw more energy, to keep living the way we have been, but to find ways to consume less energy. One proponent of nuclear, in speaking of the cost of new facilities, had used the expression, "no power is as costly as no power." When we see the harm that the quest for power is doing to the Earth, we know it is the mindset that has to change.

able. The groundwater in most parts of the world is likely to run out in a decade and the rivers have been exploited to what they can sustain.

The frontiers have been breached. It is time to take notice, the film says.

The writer can be contacted at response@simplescience.in

PLUS POINTS

Eco-manipulation

Releasing herds of animals into the Arctic could help tackle the climate crisis, researchers say.

A computerised simulation of conditions at the polar region found that with enough wildlife, 80 per cent of the world's permafrost soils could be saved, preventing a vicious circle of environmental catastrophe. Half of all permafrost areas – ground that is permanently frozen – are on course to thaw by the year 2100 at current rates of climate change, scientists say. This is caused by rising emissions of greenhouse gases such as carbon dioxide, which are predicted to push up frozen land temperatures by seven degree Fahrenheit. But experts in Germany calculated that if herds of horses, bison and reindeer repopulated the tundra, ground temperatures would rise by only four degree Fahrenheit, protecting most of it from melting.

In exceptionally cold areas such as the Arctic, the air is even colder than the earth, and thick blankets of snow act as insulation on land, protecting it from the air and keeping it milder. But grazing animals can keep the ground cool by dispersing snow and compressing the land, according to the study, published in the nature journal *Scientific Reports*. When permafrost melts, it releases heat-trapping gases that have been buried for tens of thousands of years back into the atmosphere, so accelerating the climate crisis.

Last month scientists discovered the polar ice caps are melting six times faster than they were in the 1990s. The new study was carried out by Professor Christian Beer and a team at the University of Hamburg, who replicated the impact of animals in the northern hemisphere over a year using data from the area.

"This type of natural manipulation in ecosystems that are especially relevant for the climate system has barely been researched to date, but holds tremendous potential," Beer said. He told CBS News in the US that more research was needed but the results were promising. "Today we have an average of five reindeers per square kilometre across the Arctic. With 15 reindeer per square kilometre we could already save 70 per cent permafrost according to our calculations."

But he said he was unsure how realistic it was to expect the Arctic could be repopulated with enough animals. "It may be utopian to image resettling wild



animal herds in all the permafrost regions of the northern hemisphere, but the results indicate that using fewer animals would still produce a cooling effect," he said.

The study was inspired by an experiment in the town of Chersky, Siberia, where more than 20 years ago scientist Sergey Zimov resettled grazing animals to Pleistocene Park, an area of Arctic tundra, CBS reported. He found that 100 animals across one sq km halved the average snow cover, dramatically reducing its insulating effect on the earth and intensifying permafrost.

"If theoretically we were able to maintain a high animal density like in Zimov's Pleistocene Park, would that be good enough to save permafrost under the strongest warming scenario? Yes, it could work for 80 per cent of the region," said Beer. He now wants to work with biologists to look at how animals would spread out across the landscape.

But Rick Thoman, a climate expert at the International Arctic Research Centre in Alaska, was sceptical. He told CBS, "Unless the plan is to cover millions of square kilometres with horses, bison and reindeer, how could this possibly have any significant impact? I would not call it 'utopian' to destroy permafrost lands as we know them by having animals in the distribution and numbers required."

The Independent

Building smarter cities

A data scientist explains how complex data models can be used to execute urban planning initiatives in the future



SUVODEEP MAZUMDAR

Data science and visualisations can help to understand large-scale dynamic events as they evolve. The two-year Engineering and Physical Sciences Research Council-funded project, UrbanMapper started in April 2019, and explores how we can use digital solutions to understand how well urban planning initiatives have worked.

Our aim is to develop a network between academics, researchers and industry, to build frameworks and methodologies to develop strategies for evaluating outcomes of urban planning initiatives in smart cities of the future. By using digital solutions to gather evidence on an ongoing basis, the project is working to ensure that urban plans have their desired

outcomes, as well as trying to update the somewhat antiquated processes around urban planning.

In the past, planning applications were just paper submissions. There would be a lengthy process of making changes, then going back for permissions and then making more changes and so on. Now, things can be done digitally and the process is starting to become quicker and more flexible, as well as providing more scope for ongoing evaluation once initiatives have actually been deployed in a given environment.

Whilst the UrbanMapper project is heavily focused on networking and theory, I am also introducing a practical element. My experience in user-centred design and co-designing solutions will be used to develop quick prototypes to deploy in various loca-

tions and contexts, to test what works and what doesn't. These could be technologies to measure rainfall, levels of pollution or other environmental conditions, for example. Because we can build these prototypes quickly using Arduino and Raspberry Pi kits, we can make several of them and see which ones work best.

However, there are some important steps to come before that stage of the research. Right now, I'm mapping out the domain of knowledge we need in order to make these methodologies work and developing ontologies for urban planning, mostly for the purposes of evaluating initiatives. Once we have this knowledge laid out, it can then be applied to case studies where development has already been done successfully, looking at real data sources. For example, take Kings'

Cross railway station in London: that was a massive regeneration project, and I want to see how much of the data that's publicly available can align with such ontologies.

Most often, evaluation of planning initiatives is done in a very quantitative way, and I want to look at it in a more qualitative way as well, and see how the two can feed into each other. One of the things I am interested in is how we measure these qualitative assessments. What do we need to measure? What is important? Different people find different things important or interesting depending on their own interaction with an environment, and it's all valuable. This is why firstly, we need to map out what data already exists and how we can go about collecting complementary data.

With an increasing availability of open datasets, information such as weather, population or pollution can be used to enrich data models. Furthermore, data sets which might be more pertinent to assess personal experiences, like social media and online unstructured information could be analysed to understand what people are saying about their space, qualitatively; livability, walkability, and so on. For example, when people are discussing Kings' Cross, are they expressing displeasure because there are a lot of people walking, or are they generally happy to see a lot of new businesses?

It's only after we understand this kind of information that we can really do any valuable work with physical prototypes. In terms of technologies in development right now, it's mostly ontologies, domain models and data analysis techniques; semantic technologies. But, from the perspective of a data scientist, this is an exciting area of research.

A lot of the work on the project will be based on information gathered through interviews and workshops with industry partners and stakeholders, to understand the kinds of solutions that might be required. These technologies could include sensors, which monitor the volume of pedestrians or traffic, used to estimate trav-

