Do-it-Yourself : Saving the Planet

4. Offsetting Emissions

4.0 Introduction

The idea of emission offsetting is that we will do something that either absorbs CO_2 out of the atmosphere or prevents CO_2 from being released into it so that the amount in the atmosphere is less than it would otherwise be. There are any number of proposals for doing this.

Here I will deal with solar panels, wind farms, planting trees, carbon capture and storage, fertilising the oceans and enhanced weathering. Of these, only solar panels is an option for us as individuals although we might be part of a group that builds wind farms or plants trees. The last two options are included to give an idea of where we will end up if the world doesn't pull its socks up.

4.1 Solar Panels

Solar panels use the energy in sunlight to generate electricity directly. Currently all the commercially available panels use extremely pure silicon crystals; the same material as is used in computer chips. The electricity generated is converted to alternating current by a box called an inverter and is fed into the electricity grid. It may be used by anyone anywhere in Britain but is most likely to be used locally. The effect of this is to reduce the demand on gas and coal fired stations and thus cause them to burn less fuel and release less CO_2.

Our house has an almost exact north south alignment so that one half of our roof faces east and the other half faces west. As neither face is better at catching sunlight, we decided to fit 16 panels on each face. Last year (22nd July to 22nd July) they produced 8,596 kwh of electricity. If, for the sake of simplicity, we assume that the effect of our generation is always to cause a gas fired station to throttle back then the amount of CO_2 saved is…

$$8{,}596.29 * 0.465 = 3997.28 \text{ kg}$$

This saving (4 tons near enough) is more than our emissions from our use of gas and electricity put together but not quite enough to also offset the car (the gas, electricity and car added together come to 4699.82 kg).

Currently the assumption that our generation will always cause a gas fired station to throttle back is a good one. However there is now so

much wind and solar generation in Britain that sometimes, when the wind is blowing and the sun is shining, their generation matches demand and thus all the gas fired plants are just idling. In this case further wind or solar generation does not lead to any further reduction in CO2 emissions. To counter this, both solar and wind installations are now being supplied with battery storage. The solar/battery installation will then charge its batteries when generation is high or demand is low and discharge them when generation is low or demand is high. Our installation, at the grand old age of three years, is too old to have battery storage so I have no direct experience of this. I know that one energy company (Octopus) will pay you a higher rate if you have a battery. There are also different battery technologies. The word on the street is that Lithium Iron Phosphate batteries are the safest, longest lasting and the most reliable.

If you are thinking of installing solar panels, you need to contact a reliable, certified installer and an energy company. I used Abel in Romsey for installation and Octopus is my energy company. The deal is that you pay the installer up front and the energy company pays you over time for your exports. We expect that we will get our money back eventually and thus, taking a long term view, we do our bit to save the planet at zero cost to ourselves. Our money might just as well sit on our roof where it does something useful as sit in a bank and do nothing… not even earn any interest worth talking about.

New Scientist magazine has a page in which they poke fun at the various curiosities that appear in newspapers. One of their regular topics is unusual units of measurement such as measuring weight in elephants or area in football pitches and so on. At the risk of attracting their attention, I'll measure the initial cost of solar panels in cruises (a one week's cruise for two in an outside cabin with no flying to be precise). The initial cost of solar panels on this basis is in the range of two to four cruises. Two would cover most installations; four would cover a large one such as ours.

On one level, solar panels are the nearest thing to magic that we are ever likely to see. There is no movement, they make no noise but, on a bright day, electricity just pours out of them and goes into the grid for someone to use. As the numbers show, our panels produce far more than we use ourselves. The main limitation of solar panels is that they don't produce much in the depths of winter.

In countries which have an area relatively near the equator with a dry climate and thus good, reliable sunlight (eg the north african countries, Arabia, the middle eastern countries, India, China, Chile, Australia, USA), solar panels may well become the primary source of electricity. This is particularly likely if new semiconductor materials reduce their cost. Such materials are very much cheaper than Silicon and experimental panels using them have been successfully made. Currently these experimental panels have only a short life and we cannot yet say whether they will become a fully practical, commercial proposition.

4.2 Wind Farms

Offshore wind farms are now a common sight. While they have tended to have been greeted with scepticism in the past, they now seem to be coming of age. The size and number of the turbines has increased while their installation has become highly mechanised (a large wind turbine in the sea is installed in just 16 hours) and thus the cost of the electricity they generate has fallen so that they are now the cheapest way of generating electricity.

Like solar panels, they only generate when conditions suit them but, like solar panels, when they do generate they cause gas fired stations to throttle back, burn less fuel and emit less CO_2. It appears that for the newest wind farms, the cost of the electricity generated by wind is less than the cost of the gas that would otherwise be burnt so money is saved as well as CO_2. There will be times of course when there is no wind and wind farms will generate nothing. At these times the gas fired stations will meet electricity demand.

As individuals, our only opportunity to contribute to wind farms is to invest in one. I have no experience of this.

4.3 Planting Trees

Planting trees is much talked about as a way of combatting climate change. The basis of this is that a tree uses energy from the sun to build its structure from water out of the ground and CO_2 out of the air. Thus, as large trees weigh tons, a growing forest can absorb a significant amount of CO_2.

There are two limitations we should be aware of. The first is that a tree is only a net absorber of CO_2 as it is growing bigger. As it matures, its rate of absorption will slow down and cease. When the tree dies, fungi will

cause it to decay and its CO_2 will be returned to the atmosphere. Thus the New Forest, which is the nearest thing we have to a natural forest, may look pretty but it's not much use as an absorber of CO_2. The plantations to the north of Verwood may not look as pretty but they are probably better at absorbing CO_2. Not least among the reasons they are better is that, when the trees reach maturity they are cut down and the wood used for some purpose such as building which preserves the wood and thus keeps their CO_2 out of the atmosphere. Thus to help with climate change, planting trees only works if either they are extra trees rather than replacements for existing trees or the trees are going to be cut down and the wood used for building and thus prevented from rotting for a long time.

The second limitation is that a peat moor is as good at absorbing CO_2 as a forest. This is essentially because the same amount of sunlight is falling on a given area of ground but, because the ground is wet and acidic, the grass or heather won't rot at the end of each year. A peat moor will continue to absorb CO_2 for thousands of years whereas a forest will only continue to absorb it for a few hundred. The peat on Kinder Scout appears to be a couple of meters thick. It's that thickness because that's how long it has taken to build up in the time since the last ice age.

The first conclusion to be drawn from these points is that peat moors should be repaired, protected, not have their heather burnt for the benefit of grouse and should not be planted on. The second is that forests planted for climate change reasons should ideally be managed and a use found for the resulting timber. Using more wood and less brick and concrete in house construction would have the double benefit of storing the timber safely and reducing emissions from brick and concrete manufacture. You will notice that some of this is contrary to what you will read in wildlife magazines. That is because we are pursuing different objectives.

As planting large trees near houses is a bad idea, our opportunity as individuals to contribute to tree planting would appear to be to support a tree planting group. I have, in the past, planted trees for the National Trust. There's also the Ecosia search engine which uses its profits to plant trees.

4.4 Carbon Capture and Storage

The idea of carbon capture and storage is to extract CO2 from flue gasses and to store it in depleted natural gas reservoirs. This is an idea that has been much talked about for years but there has been much more talk than action.

There are technological difficulties in extracting the CO2 from flue gasses without the solvent used to do this escaping into the atmosphere. There have also been cost problems…it costs money to extract the CO2 and store it but there is no benefit other than the reduced CO2 emissions. There is now however serious work going on in Britain with big companies involved. These projects aim to capture CO2 from steel, chemical and cement works (the big industrial emitters) and use redundant gas pipework to take it to the now empty natural gas reservoirs under the North Sea.

In this case, I think all we can do as individuals is to watch with interest.

4.5 Fertilising the Oceans

4.5.1 Runaway Climate Change

If the world is faced by runaway climate change, fertilising the oceans has been proposed as a way of getting the situation back under control. Runaway climate change is when higher temperatures themselves change the condition of the Earth such that the temperature will then rise further still. This further rise then causes a further rise and so on.

There at least three such mechanisms…

1. The higher temperatures cause there to be less snow cover and thus a light, reflective surface is replaced by a dark one which will absorb more of the sun's heat.

2. The higher temperatures decrease the ability of forests and oceans to absorb CO2. This happens because their plant life is being taken out the range of conditions for which it is suitable… Norway Spruce won't grow in tropical conditions.

3. The higher temperatures cause greenhouse gasses that are currently trapped to be released into the atmosphere. This happens because methane trapped in permafrost is released when it melts.

There is evidence that all three of these processes are starting to happen today. It is thought that at least the third process has also happened in the distant past and was responsible for the very rapid rise of temperatures at the ends of the ice ages. As these processes have only been scientifically recorded in the last few years and are still not fully understood, the prediction that we have until 2050 to reduce our emissions to zero does not take them into account and thus it is dubious that the prediction is valid, that is, we might not have that long.

4.5.2 Plankton Bloom

In spring each year there is an explosive growth of plankton in the oceans. After a few weeks the plankton then dies and sinks. The growth is triggered by rising sea temperatures in the spring. The die off is caused by the plankton exhausting the supply of minerals, particularly iron, in the sea water. With the plankton gone, the sea's minerals are then replenished by rivers ready for the next spring and the cycle repeats. Any one who has dived off the coast of Britain will tell you that the 'viz' (i.e. underwater visibility) goes through a bad patch in the spring. You can see the stuff as fuzzy threads with your own eyes.

4.5.3 Iron Supplements

The idea of fertilising the oceans is to supply suitable minerals so that there will be unprecedented plankton blooms. Then, when the plankton die, they will sink to the ocean floor taking all the CO2 they absorbed with them.

There has been some experimentation with this and it is thought that this might actually work to a useful extent. The advantage of this method is that you only have to provide the trace elements the plankton need. Thus a 100,000 ton tanker fertilising the oceans could lead to tens or hundreds of million tons of CO2 being removed from the atmosphere.

This is not something for us to do as individuals. One reason it is not is that the wording of international treaties makes it illegal. The reason I mention it is so that we do not give up hope. This sort of thing might just save our bacon. Such an action might, of course, have unintended and disagreeable side effects. Thus this should be regarded as a means of last resort and only to be used as a last resort.

4.6 Enhanced Weathering

Some rocks, particularly silicate rocks such as basalt and olivine, react slowly with atmospheric CO2. This process is known as weathering. The

reaction starts with a silicate rock and carbon dioxide and finishes with a carbonate rock and silicon dioxide and, as silicon dioxide is a solid (sand), the carbon dioxide just disappears from the atmosphere. This process has been going on slowly for millions of years.

There is a proposal to invent an industry 10 times the size of any industry that has ever existed which will quarry and crush silicate rocks and then spread them over large areas of land to accelerate the natural weathering process and thus bring the earth's CO2 levels down to a safe level. It is thought that this would actually work if performed on a large enough scale provided all the necessary machinery and transport did not lead to further CO2 emissions.

If this sounds both very expensive and a risky thing to do, that's because that's exactly what it is. Thus this should also be regarded as a means of last resort.

4.7 Conclusion

Are we sitting uncomfortably? Then it's time to begin… sorting our emissions out… looking at our gas bills perhaps?

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