
Bob Stewart
Retire at 25
Carefreedom
Save the Planet

Acknowledgements

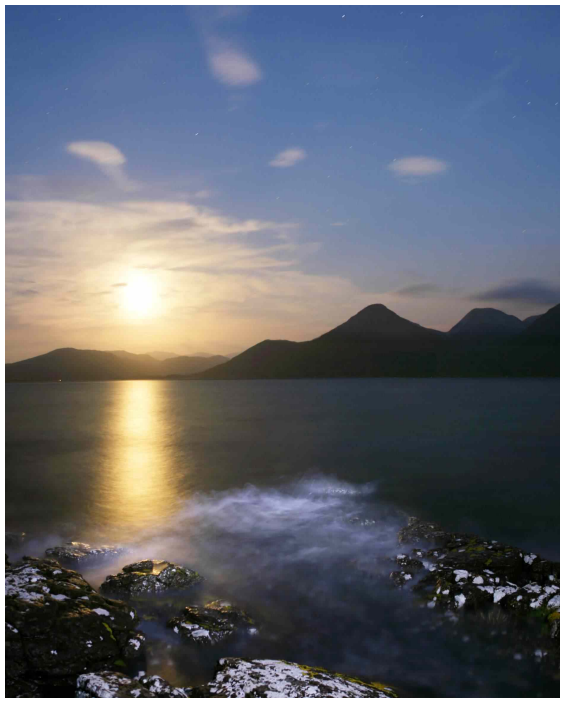
So many people have been part of this story
All the way back to my student days
That to list them here would cover many pages.

Thank you so much, for all your guidance, and humanity.

And as always

To my family
For their kindness and patience..

Introduction

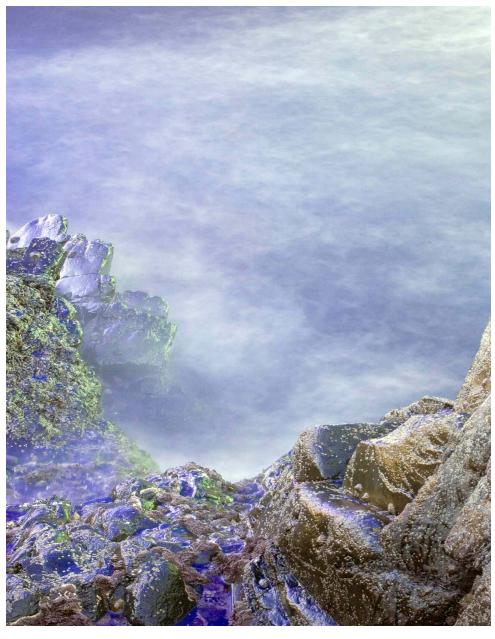


I have lived an amazing life, seen so many things that you may never do, lived outside of the world most believe in, for so many years now. Within this unusual book are my life experiences, locked in imagery, and friendship, which I will never forget. It all started when I studied the natural world, in the '70's, and has never stopped since.

I have always felt that humanity would finally appreciate that adoring the natural world, and its symbioses, would bring a collective desire to live the same way, and through this, develop an understanding of how it has managed to solve amazing problems with such elegance, efficiency of effort, and incredible duration.

We are at the end of globalisation, you have to be frank about this. There isn't enough energy left to burn: it is too precious to waste, and **we are becoming so much more efficient,** in the way we use energy. The planet is stupidly tumbling into thermal runaway and change at rates neither we, nor any other species on the planet has seen in a long time, and the timescales to prevent this, are a handful of years at most. This is the defining moment in all of your lives.

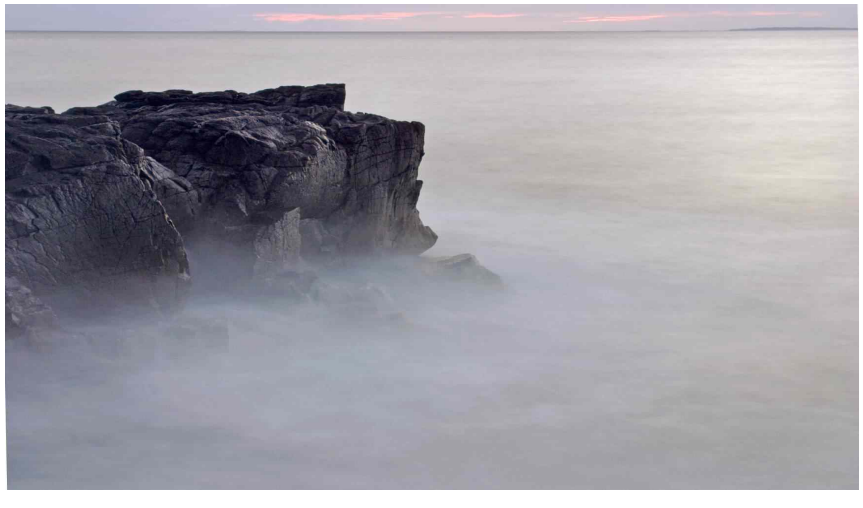
Woven into this book, is a story that started when I was 28, when I explored how we will adapt and thrive in this world ahead, it has taken many years to do.



We can make this planet a happy place for all, but we have to grow beyond our petty vanities, or they will burn us alive. The environmental and resource problems that are now brewing mean we must solve them very quickly, or they will dissolve into social chaos. I am sure that when faced with that ultimatum, those with youth and energy, will follow my idea paths, and make them their own over the wonderful years of their lives ahead. I hope so.

What is especially important to me is that we cherish our artistic creative senses, and make room for those who do, each of the living module designs I play with anticipates a world in which we genuinely retire at 25.

The book has several sections. The first part is a lifestyle statement, from someone who has had a fairly enjoyable life, which attempts to explain how drastic lowering of your energy use could change you, and the world around you, without affecting your quality of life. It is also about the story of the coming years of resource and energy depletion, and climate change.



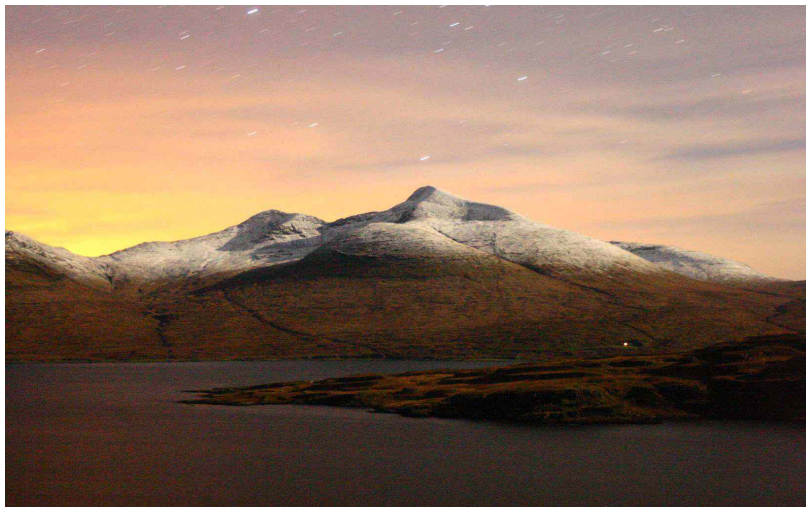
Finally there are several appendices which detail how I hope humanity will evolve and deal with the climate disasters. Nature has a mood on at the moment: no-change is not an option any longer.

These are presented so that anyone can explore my ideas, without having to rediscover the wheel. I honestly hope that these ideas act as a springboard to a more advanced set of versions, but that depends on how we waste the next 10 years, as well as the accumulated impacts of wasting the last 20.

The world ahead will be about this decline, and how honestly, and cleverly we manage it. Many people across the globe, are likely to be forced by simplistic political and economic narratives into gross poverty, simply because these narratives refuse to adapt. So I am flagging up that it doesn't have to be that way, and suggesting how to deal with this by direct action, which does not need to involve violence, or rule breaking. I remember the '60's and how we managed huge social change with panache.

The pictures and art, are my own, and reflect a fusion of art and science, without which you cannot grasp who I am, or why I wrote this in the first place. I am an artist, life scientist, and engineer, with a broad general competence, living in a world full of narrow specialists. That specialisation over the whole of our society also narrows perspective, so the imagery is there to stimulate your creative senses (right brain) and the words your rational ones (left brain). Hopefully by doing this I can engage with both your hemispheres.

At the start of adulthood each of us has a chance in life. Today it is mostly the chance to have its direction taken beyond our control, lost in a wilderness of debt and responsibilities we did not ask for, on terms that were so negative, and difficult, when they could have been easy. This is not your fault.



I am struck, living on the popular island of Mull, by the obvious conflict of compromise I see on the faces of people who visit here, when they realise that the natural world, despite the single-minded tooth and claw portrayals of the media, has a level of symbiotic adaptation that is on the one hand so simple, with so many implications for their lives, and on the other so obvious they struggle to deal with it.

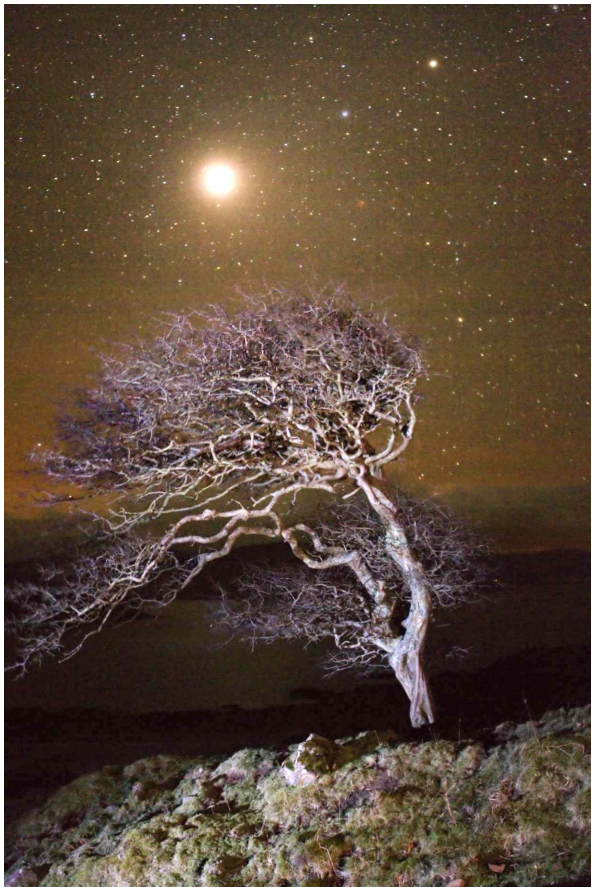
Just a couple of otters, doesn't even say it.

I learned about the natural world through freshwater ecology, at a time when nobody wanted ecologists trained to high standards, they wanted business as usual. I never forgot what I learned, and can deeply remember sitting at a table in the library of Waldhauser Ost, my head in my hands, in the University of Tuebingen, knowing that the '79 oil crisis had destroyed my 10 year career path, though I had solutions, mirrored on the natural world, that I could not yet develop in our boom and bust world.

The technology was not cheaply available then; it is now. Had it been, you would not be here now, in crisis, I am sure of this. We would have solved it. The lack of technology fundamentally changed things. After two appalling oil crises, in the late '70's, had solar PV, and neodymium boron iron magnets been available at low cost, all would have changed.

For those now who are young enough, with residual unblinkered intelligence from their years of harsh educational conformity, the message I am expressing in retirement is a complete solution to the simple question: “How the heck do I get out of this mess,

that everyone else needs me to become part of?”

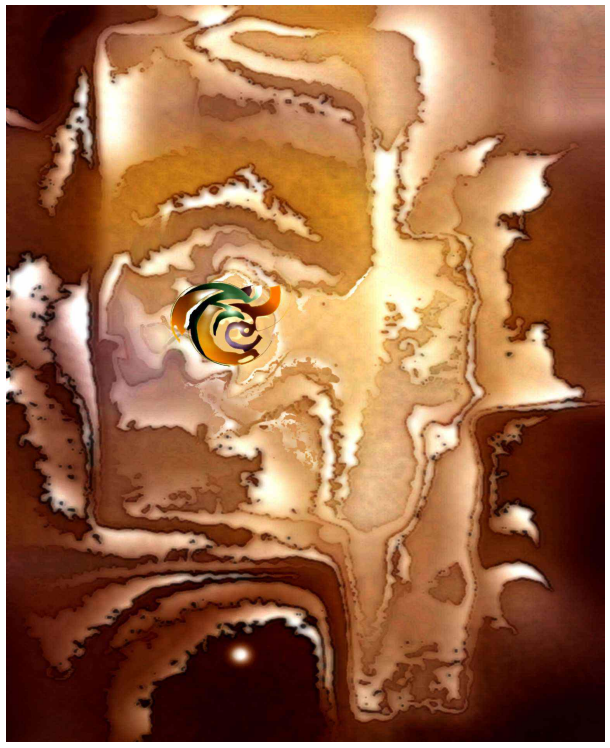


The answer is hyperfrugality: a way of living which can be organised as a mimic of the way otters and whales live, with all the benefits, and avoiding the planetary and personal disadvantages of high-energy-waste conventional living. I know, you can take this too far, but it is well worth trying, for the perspectives on living today that it brings, because you will be richer in so many ways. Please be clear: I do believe in modest deserved wealth.

To see this solution as a form of running away; as some do, is not correct. If you choose to downsize your energy wastage, early retirement is a direct consequence, and if you succeed in a way that gives protection from others’ leverage, you do not have to wash their feet, clean and organise their empires, or call them Sir.

The late Victorians grew up with the dualistic guiding role of energy: on the one hand in excess for a few, due to the availability of coal in recent abundance, and on the other, for the many, experiencing what life could be like when you did not have it. In the late 1800's an agrarian majority remained energy poor; only the minority were very rich, or had the time for leisure, art, or photography.

The end stage of the era in the 1890's was acutely focussed on energy efficiency. It was an almost perfect opportunity, then, to jump to a hyperfrugal renewables-based society, but just missed two parts: how to make good energy from the sun, and wind, and how to grow what you needed in an environment protected from the extremes we see. And of course, they were lacking intelligent political understanding and will, much as we see today.

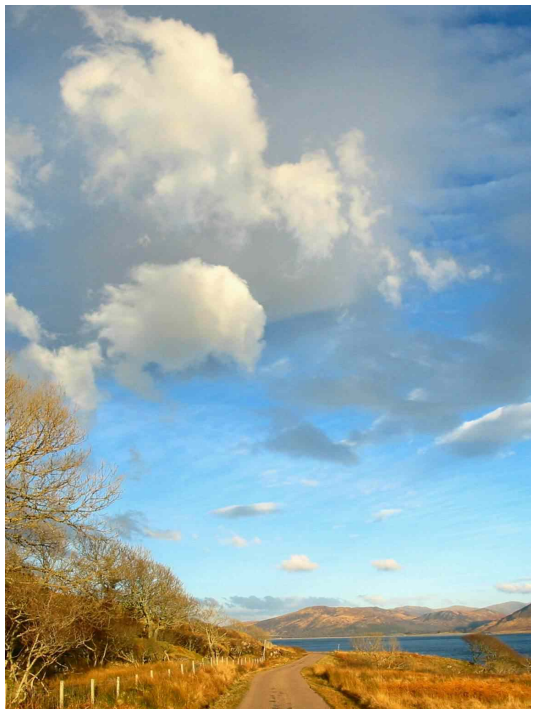


If you look back, they did very well indeed: old walled Victorian Gardens remain gems of unused investment across our landscape. Many have been brought back to original brilliance. Today, our collective social mental focus should be crystal clear, driven by the realisation that our coherent world is crumbling into ever more greedy, monetised, disorganised chaos. This is happening because those who are left in charge have no great ability, impetus, or perhaps desire to see rewarding collective solutions to the great challenges of our time.

You cannot function without energy, especially today, and the technology needed to do this is largely beyond your control. You can see this in your electricity supply, if you know the facts. There are unnecessary rules in place to try and stop you making your own. But there is a simple way out that few have really noticed: the collection of low voltage renewable energy. You bypass all the rules by using it, as lots of people are starting to do quietly in their private lives.

This way out is a looking-glass moment, a door so invisible, yet when you start, so obvious that you wonder why nobody else can see it, the key to energy supply is not to need as much as you are told you need; instead to cleverly use far less for the same standards of

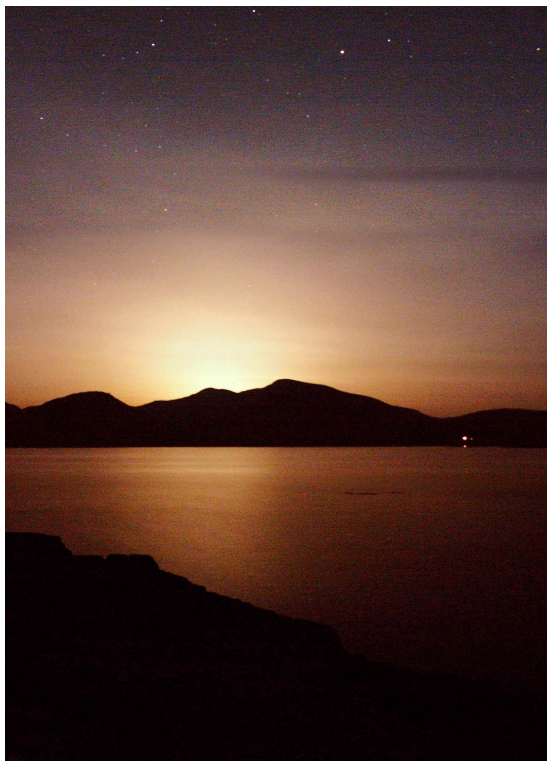
living. You can live really well for peanuts, you really can!



Now more than at any time I can recollect, you really should live this way. Your main tools for existence: phone, tablet, or laptop, use measly amounts of energy. You don't have to buy new, and can gain the energy to run what you need from only a small amount of rural solar or wind energy - so small it can now fit on your back, so to speak. Heating has moved in the same direction, using the sun. Interior lighting now costs pennies to run and lasts a very long time, leaving cooking as the last stumbling block, now resolving in front of my eyes.

In simple terms you can now get to a state of existence, that allows (care)freedom to exist, without enormous cost, in dwellings designed to encapsulate all that you need, with an energy footprint so small that people will laugh and mock the concept, until they see the reality in action.

To have a secure and enjoyable life off the wind and sun, the following issues are critical: Power, Food and Water, Warmth and Comfort, Health and Nutrition, Space and Time. Get any of these wrong and life goes pretty fast out of kilter. Each item links to the next, holistically, in ways that we do not talk about in public. I think this is because we believe that these issues are ours to personally resolve. However, if we do not talk about the relationships between them, how can we know how best to integrate them together?



Acute energy and food poverty, and food banks, are the best simple working examples of the direct consequences for many, now. Food banks are not a solution; they feed for a day, when provision is needed for a lifetime. They create dependencies when they should be trying to create the opposite. The next few pages cover my own take on this, mostly driven by a personal combination of disability and financial poverty. This has taken me a long time to bring so clearly together, so please do not misunderstand the message.

After going through the process of resolving these issues, I ended up able to live to a very comfortably on almost nothing, by most people's standards. When I say Space and Time, it refers to having both at no cost, ever; a pace of life that most people only associate with short holiday breaks, rather than something that exists for most of their lives.

That was the start on this journey. As I work this through, I am hoping that you will begin to see a way to live that springboards a huge social reduction in your CO2 emissions, as well as a very, very good life.

When I was young you could only dream of solutions like this: we did not have the technology which enables this now, and we have made this technology. Please remember this the next time you berate a greedy baby boomer. Some of us stayed very true to our values, and hopes.

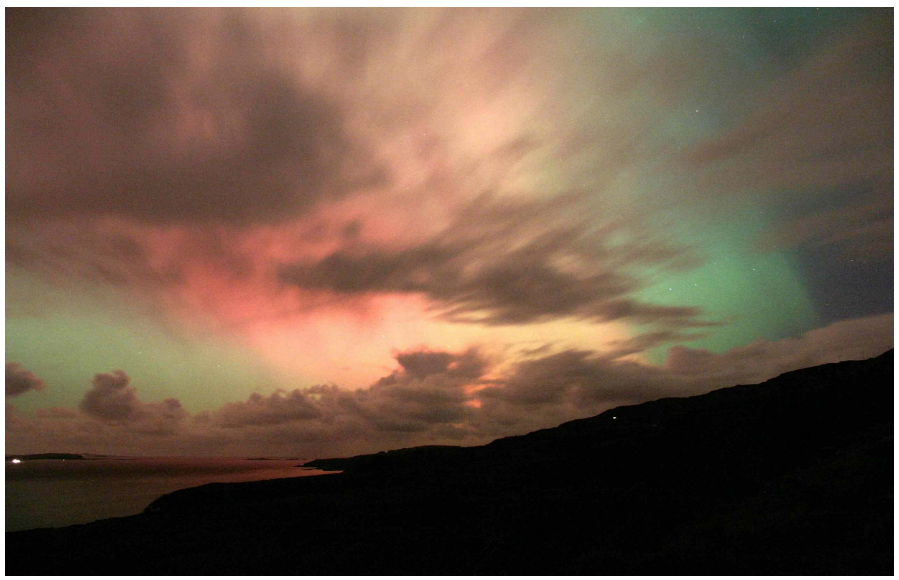
Electrical Power: Making your own, for free.

As an individual, you really do not need a huge amount of electrical power to have an enjoyable life. If you collect and process it yourself, 3-4 kWhrs each day should do you fine. Getting this from the sun and wind isn't that hard: about a kilowatt of solar and the same of

wind will do fine. Solar panels last a lifetime, if you keep them cool; wind generators only need periodic bearing replacement, if well designed. That much power can be easily bought for an outlay of around £2800 today, quite possibly purchased/made in instalments as I have, over several years. This will provide all that you need for the rest of your life, for free; you just collect it. The energy bills we normally pay, of about £1,200 per year, amount to £96,000 over a lifetime, so a lot of savings can be made, by making your own at lower voltage where you need it.

The sun, and wind deliver this energy **for free**, charge nothing for it: **free energy, freely delivered**. This is an amazing situation, nobody is talking about, and should be a legal right any individual should have. Nobody should be able to stop you making your own.

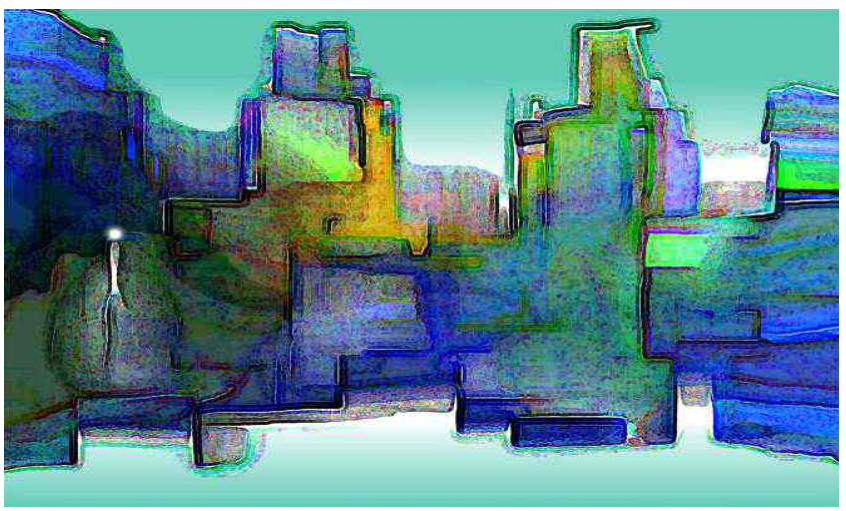
I have designed and fully tested out a low voltage electrical power system which you can build for yourself, with guidance, using modular printed circuits, some solar panels, wind generators and batteries, that are designed to be easy to build, are repairable, and reliable. Once built and running, you will never pay an energy bill again, for the rest of your life. Repairs tend to be minor. The batteries will last about 5 years due to the way you use them, maybe longer. The electronics, with repair, perhaps 100. Electronics are becoming progressively reliable, just as the products they are installed in have increasingly shorter lives. Average microchip mean time to failures are now in the region of > 1000,000 hours, more than 100 years.



This system I have designed is safe, and will not injure you. With it you can do almost any task needed to control and power your world, without needing to ask anyone's permission. Using these circuit boards, you can immediately find yourself living as a human version of an otter or whale does, within the means provided daily by the sun and wind. Once you have built this, you will rarely have need of money to power your life. I have to admit this is a bit strange at first, but you take it for granted very quickly!

This is an incredible existence. When friends complain that they do not have the money to heat or power their lives, you just smile and tell them it does not have to be this way: the current system has been cleverly contrived to prevent them knowing this; for profit. The wonder of the renewables world is that the sun and wind never need to profit: **they just give, selflessly**.

I will organise a course on building this system, so that once explained, you can go on to show others, and in this way all become independent of the high-energy-burn world of the past.

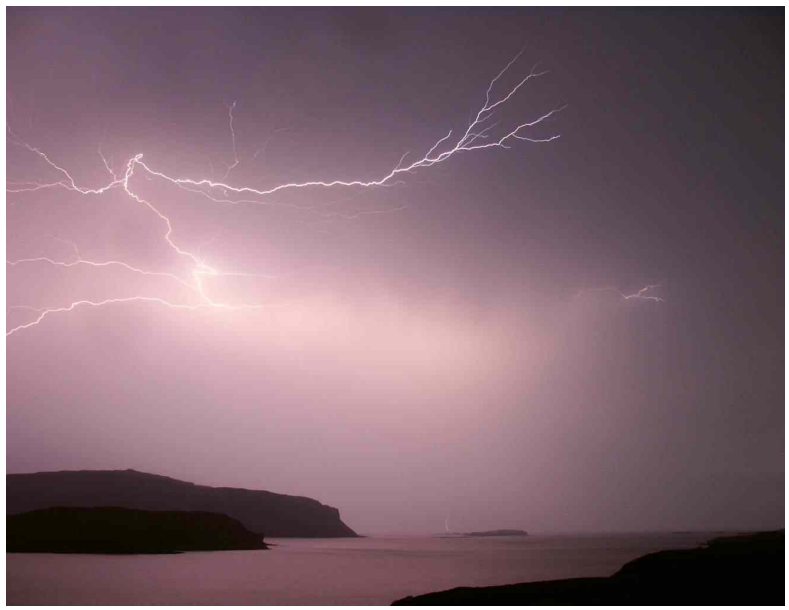


These electronic cards can also control a wider world of actions that then allow you to redesign your needs to fit to this power source. Using this system you can then reconfigure the world of washing machines or fridges to your needs. Making things last eliminates huge life costs; again, you are normally prevented from doing this yourself, by manufacturers who make unrepairable devices and politics who craft legislation to allow this.

To be fair things are changing now, I hope....

I will describe more later in detail. I am designing this system in final form at the moment I am writing, so the explanation will grow slowly into pictures, and examples.

It is very important to realise that everyone can do this: if you work together you can all know what it is like to be given all you need for free for the rest of your life, after you have worked to build the bits and connect them together. There is a caring sun, and a caring wind, in a unnecessarily cruel world. Do not underestimate the impact that living with their gifts can have on the way you live your life, and what a difference it makes to bringing up children, or caring for relatives.



Somebody put a colossal nuclear reactor above your head each day, with no management costs, no rental fees, no dismantlement or waste storage costs, no advisory fees, no insurance fees, no bills, policing costs or excuses.

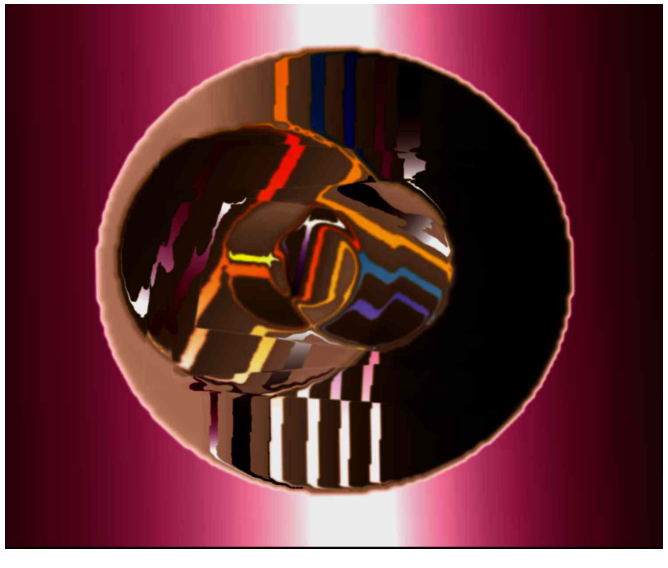
And forgot to tell you.

Food: Eat well, be well; your daily bread, keep your teeth.

You have to start somewhere. The role of food and nutrition in your decision-making is absolutely critical. I cannot continue this story unless I can explain why it matters, and is so important, in a way that you can understand. Your teeth are far more important to your health than you might realise, the gaps between them harbour the worst bacterial species on the planet, which is why human bites go badly septic. I floss, and scrape mine regularly with a calculus scraper, carefully and gently clearing out those gaps. If your gums bleed when brushing your teeth it is time to go for the gaps again. These bacteria contribute to chronic ill health, bone damage, and cancer. Dentists will advise you not to do this, but it has worked for me.

In the lives that most of us live, you daily put the money into the meter, turn on the stove, cook the meal, and end up less well off. In this real world I am describing, you don't have to pay, and most importantly, you have to change the way you think about energy, food, light, and nutrition. You cannot avoid doing so, the sun and wind teach you so kindly, and elegantly.

They create the important free time you need to think about how you live, and give you the time to develop such an understanding, and realise that what you eat really, really matters.



We have learned over the last 15 years that we are not always what we eat; the bugs (the microbiome) inside us, however, are. This knowledge has exposed a truth that what you eat to nourish them, acutely affects your own well-being, your emotional and physical quality of life, and the complex stories coming out of biosciences on the matter right now, are utterly amazing.

Standard nutrition texts are a long, long way behind; because of the rapidity of change in our understanding of what is really happening. As a result, a lot of what we take to be immediate problems with our minds, or

nutrition, are really problems with our microbiomes, and this is going to take some time for the awareness of this to settle down into a sensible set of guidelines for life. **Anxiety is a state of gut, far more than we ever realised, as is depression.**

With the understanding that both health and well-being come from a diet that is balanced in both your personal tastes, and the tastes of your microbiome, comes an awareness that what you eat and cook is critical. We are a peculiar species, and can end up with stupid dietary standards that wreck our lives. I do not have kids, or have the experience of training them to eat highly variable diets, but I do know how important it is to their future well-being that they do so.

My own diet begins with bread, in the past, in poorer times, it began with porridge. If you look at past human health, what is striking is how people fared so well, on either. I also eat mixed oatmeal, fruit, yoghurt and salads. These form a core nutrition for the microbiome, and personally I find them pleasant to eat. I do not juice and throw away the valuable fibre, I eat the whole lot.

The bread I make myself, is a mixed seed bread with a long ferment period; it is so tasty people fight over it. I am now fairly certain their microbiome is also saying 'yes', as the ingredients are also tailored for its nutrition. Hiding in the list of ingredients are tasteless complex polysaccharides that we gain nothing from, yet which feed the microbiome very well. Running on this bread, after a few weeks you feel very different; there is an assuredness to making this daily, (with energy from the sun!), and by doing so you save more than just money!

Here is the recipe, and the method: as you will see I introduce some good Victorian ideas, and it does make the bread a lot better!

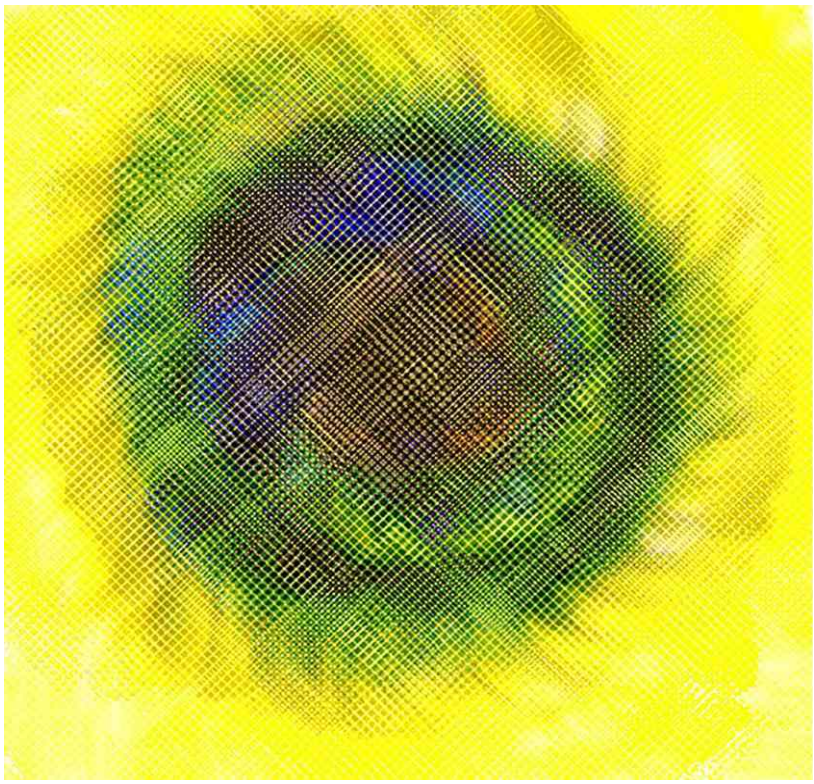
Lazy bread

Today, many of the problems with our diets originate in eating bread that has not been made from quality ingredients, organic flour, yeast, salt and water, fermented for a good while, and baked well.

This recipe is the easiest way I have found to make bread that consistently tastes incredible, yet needs almost no kneading. It makes use of the process of autolyse which happens when you mix flour, water, salt and a little yeast and leave it for half an hour to autodigest.

Mix 500g strong flour, 100g malted flour, with 390-410g water, 10g salt (if you are diabetic half that, it will be better for you too, and watch for allergies when giving it to friends, sesame seeds in particular), and 1g yeast Also add 40g linseeds/flaxseed, 40g sesame seeds. Some flours will require more or less water. Mix quickly by hand until all the ingredients are collected together. Do it several times, and repeat every 1-2 hours, for at least 6 hours.

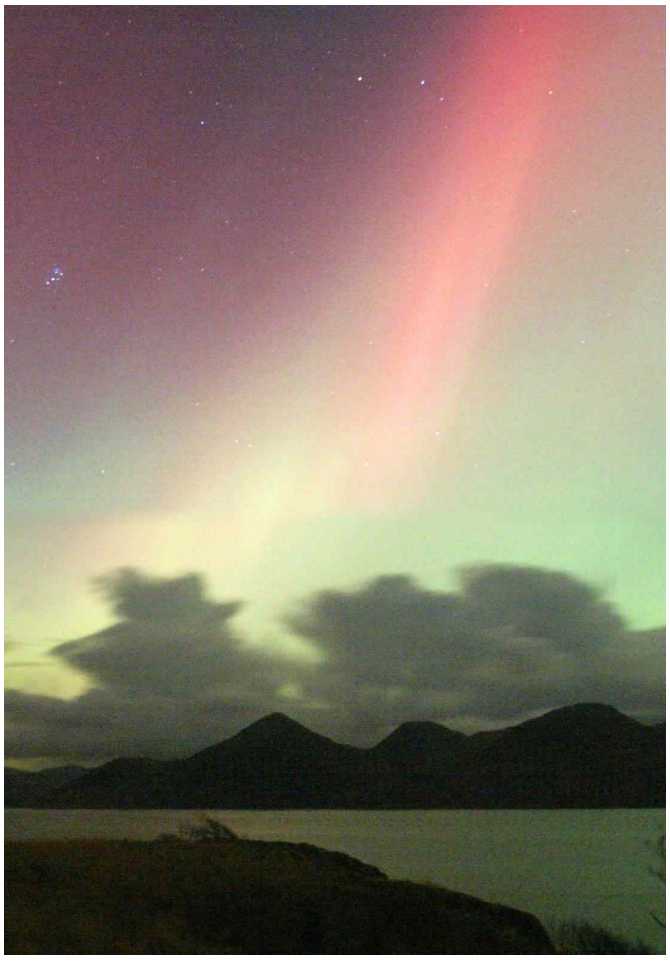
I take the mix and leave it in a warm insulated haybox with a couple of litre bottles of hottish water. Remove the bowl, and with wet hands repeatedly pull, stretch then fold the dough until it resists shape change; don't over-pull or it will tear. You do not place the dough on a surface to stretch and fold, just hold it in the air. As long as your hands are wet enough it will not stick. This takes about 10 seconds.



Place it back in the box and wait another hour and do the same again. Do this about three to four times. As you repeat the process the dough will slowly become elastic and bouncy, then shape it, let it rise again, slash with a lame, or sharp razor, and bake, preferably in a Remoska. To develop the crust thickness, let it rise slowly somewhere cool, covered with a damp cloth.

I use a Remoska oven because it is searingly hot; for the power it consumes, makes incredible crusts, as well as using 20% of the energy a standard oven uses. I also spray a mist of water inside a couple of times to develop the sugars in the crust.

This is bread anyone will compliment, takes so little effort, is consistently good at rising, and rarely goes wrong. You can play with the technique using sourdough preferments, as they fit perfectly into the method. If you keep the bulk of the flour as strong unbleached white/brown, it will behave reliably.



It turns out that the Remoska oven acts very like a pot breadmaker. In the past a heavy pot was used as the oven and placed above the fire. The Remoska makes such nice bread because it keeps a high steam level inside, during cooking. If you are short of cash, it is a good idea to buy one on Ebay. The Remoska was designed in the interwar years in the Czech republic, and remains a little-known gem. However, word is getting out, and you will find it now being marketed by such well-respected kitchen suppliers as Lakeland.

This bread forms the basis of my day. I make two loaves, and eat one each day. It takes very little to make a great start to the day, and when it gets stale in about 3 days, makes incredible toast. Longer-ferment breads are also nutritionally much better for you, because of the ‘predigestion’ that has taken place, and the longer baking time to dry the loaf out, and cook it. It is very chewy, and you would pay a lot for this in a shop. It is both sad and ironic that the best bread is also the cheapest, and easiest to make.

We form our own peer groups, and because this bread is so enjoyable, it could become a great way to gently influence your friends to try their own. Sharing your bread, you could also get the chance to explain the very low energy needs of the process, when compared to normal home or shop bought bread, and where you get this energy from. I have introduced two key tools in my life, one the modern version of a Victorian Haybox, and the other the Remoska oven. I will look at them in closer detail later.

Bobs Secret Curry Recipe

Over the years of my life, I have protected my health without really realising why, by making curries, and in doing so, have gained a love of the way you can completely change a curry by changing ingredients, and the order in which they are cooked. I also discovered the hard way, that what you see in cookery programmes do not do justice to the cause. So, as is usual for me, I am including it as a way to show your friends that you really have the needed cool in life, because cooking curries this way makes the flavour much better. On the microbiome side, the ingredients are all it really needs, tons of seeds, roots packed with antioxidants, and onions and garlic to add badly needed polysaccharides.

This is a generic sauce recipe, to which you add whatever you want. The beauty of it is that it cooks the spices and ingredients in the correct order to keep flavour, which many books appear to get wrong. It makes sense that the most delicate flavours like freshly ground coriander should go in last, and more robust like cumin and cardamom first, but there are ways that you can change the flavour by frying rather than gently sautéing like cassia and dark cardamom. Work on it!!

In 4 tablespoons of extra virgin olive oil, and some ghee (more than you feel comfortable with), because this carries the flavours better than reduced fats, you can skim this off at the end if you need to, gently fry 4 finely onions/person chopped across the axis to make semicircular segments, a half section of cassia bark, cassia is more flavoursome than cinnamon, one deseeded dark cardamom, 6 deseeded cardamoms, two cloves of finely chopped garlic, a good thumb sized bit of ginger finely chopped, same of fresh turmeric chopped, for at least 30 minutes. Don't fry hard, the intention is to caramelise. You can hard fry mustard seeds in the ghee first to lightly brown the ghee and pop the seeds at the start but you must throw the onions in fast or they will burn. Burned curry ingredients go bitter. The long frying period builds the flavour. Taste from time to time as you go along, you will be astonished how the flavours grow.

When the mix is well concentrated and caramelised, add one tablespoon of Kashmiri chilli powder, and stir well, then one teaspoon of organic soil association ground turmeric which has been checked for adulteration, and stir quickly. Add a tablespoon of water if there is any hint of burning, I usually add it quickly to stop this happening, but the turmeric needs a small amount of frying to develop flavour. Then add a tablespoon of fresh ground coriander, a large cup of water, two tablespoons of dried fenugreek leaves (methi) which are the magic smell you catch in the air around restaurants, three cloves of chopped garlic, and two tablespoons of low fat yogurt. Stir well, add meat if you are adding it now, and cook in an Instantpot at low pressure for as long as it takes to cook the meat, or 20 minutes. Depressurise, and add half a cup of red lentils and enough water, and repressurise, cooking for another 10 minutes, be careful the lentils do not stick and burn. Right at the end add chopped red peppers, onions, and some chopped tomatoes. This makes a thickish soup, which you then gently simmer to evaporate the water off. This bit concentrates the flavour and creates a drying thick sauce, and is very important.

If you are making a vegetarian curry, add the vegetables chopped up now, and switch off the heat, with the lid on they will cook to tender in about 10 minutes, and be at their most flavoursome. You can grind your own garam masala by dry roasting a variety of spices (cloves, cumin seed, coriander seed, cassia bark, cassia leaf) and add this right before eating. Eat with fresh yogurt, fresh coriander, organic brown rice, and a good beer!! Season with salt at the end, and add a little sugar and vinegar to add acidity and flavour.

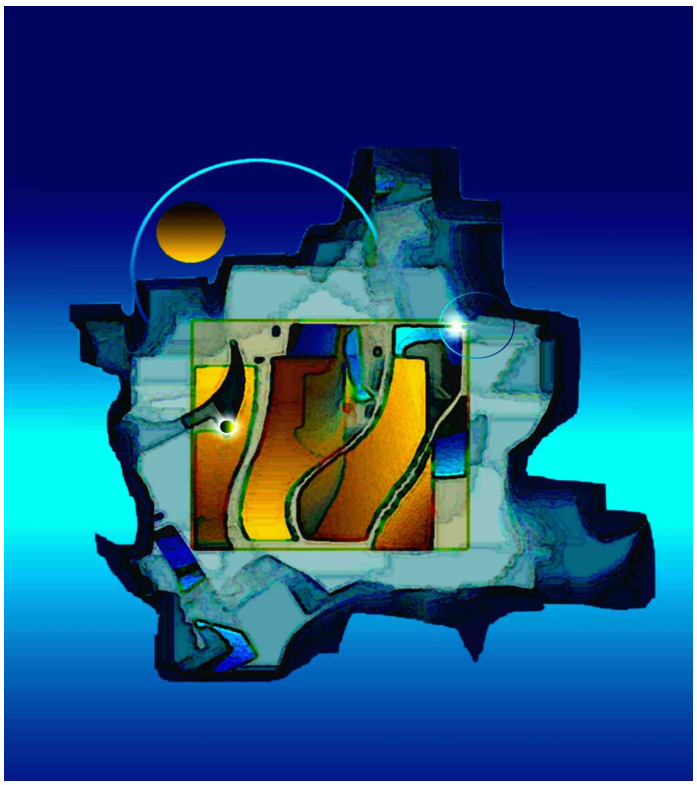
Take a lot of Teja chillies and grind them in a coffee grinder, add this to enough olive oil to suspend the powder, and fry very gently to extract the colour and flavour for a couple of minutes. Let it cool and settle, this takes days to form a clear deep red oil, and add a half teaspoon of this before serving and mix well. All these ingredients are available on Amazon. Teja chillies are magic!!

You can then learn to play with other spices like fenugreek, fennel, gojujang. Enjoy, you are now the envy of your peers.

The Victorian Haybox Cooker: 21st Century version, powered by the sun

In the world I live in, cooking is your biggest energy burden, so frugality matters a lot; and living frugally allows you to really save money.

In the late Victorian era haybox cookers were popular ways to keep food hot while transporting it to picnics. The idea was highly effective, and it allowed food to be kept both hot and to slow cook in ways that enhanced flavour. We completely forgot this wonderful culinary tool (although it has, in a way, been reincarnated as ‘sous vide’).

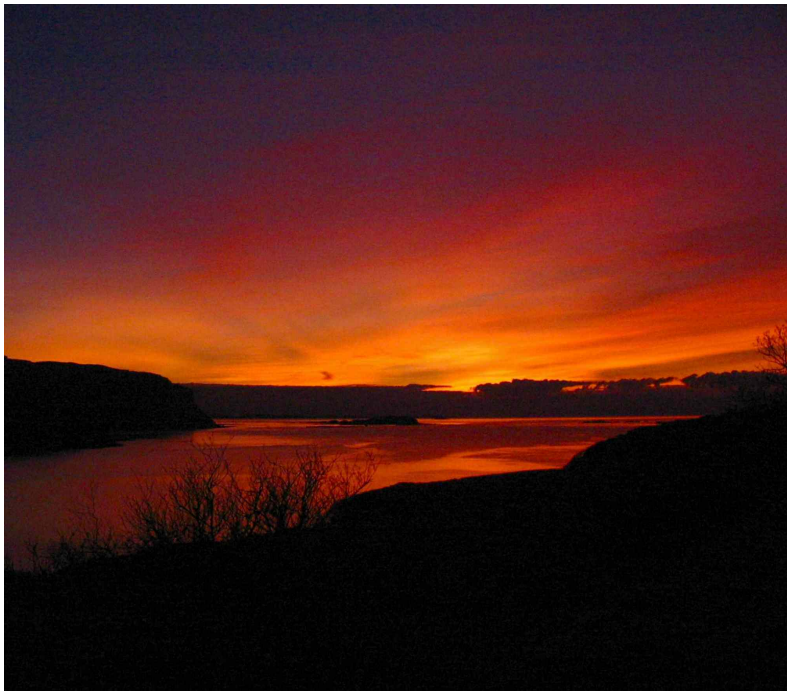


I obtained a one-use flu-jab shipping container, (see previous page) which is made from 2 inch thick expanded polystyrene. That these are disposed of to landfill rather than used for this repurposing, is amazing really: we have become so energy-rich and wasteful that we fail to live sensibly.

The polystyrene box is fragile, so I wrapped it in 5mm marine plywood inside and out, to strengthen and dissipate heat spots if they formed.

Then I coated the inside with adhesive-lined aluminium tape about 170um thick, the idea being that since the foil is reflective, it would block infra-red radiation and conduct heat away from any hotspots that might form.

The energy calculations based on measurements show that this box uses only 20W of power to hold a cooking temperature of 100C.



This is a simple way to enhance the ideas of the past and allow you to cook slowly, and incredibly cheaply, using the sun. All that is needed now is to add a conventional slow cooker inside, running off a 24V solar charged battery bank and you have a cooker nobody would think possible, which runs completely off the sun. Maybe you will never be so short of energy that you really need one! But if you are, no more heavy cooking bills.

When I think of the term ‘fuel poor’, I wonder if this really means being unable to realise that the sun can provide power for free for the rest of your life. It is terrible that we do not share this kind of knowledge more widely, through foodbanks, so that people can slowly begin to understand how their lives can be completely changed by making a new cooking system and running it off the sun!

This is critically important. In an age of energy and resource decline we should help, and not punish, those who find themselves in dire straits.

If the ideas I am working through now reach a wider audience the transition should be painless, and not involve the sheer stupidity of hatred and punishment.

Poverty is not chosen.

Finally, if the slow cooker is painted a dark colour and left in the sun, these numbers become even more unbelievable; they really do!

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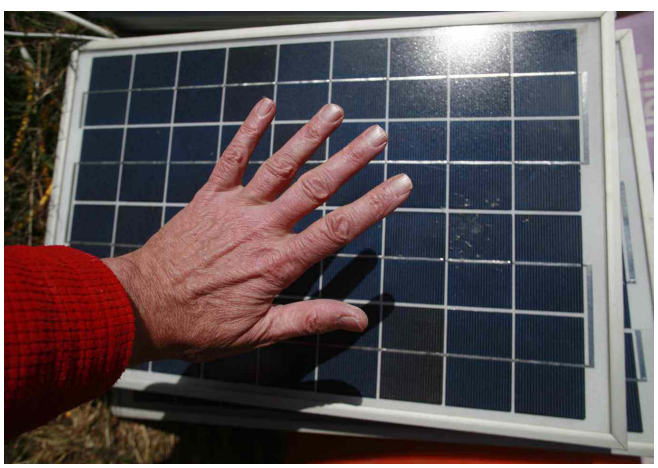
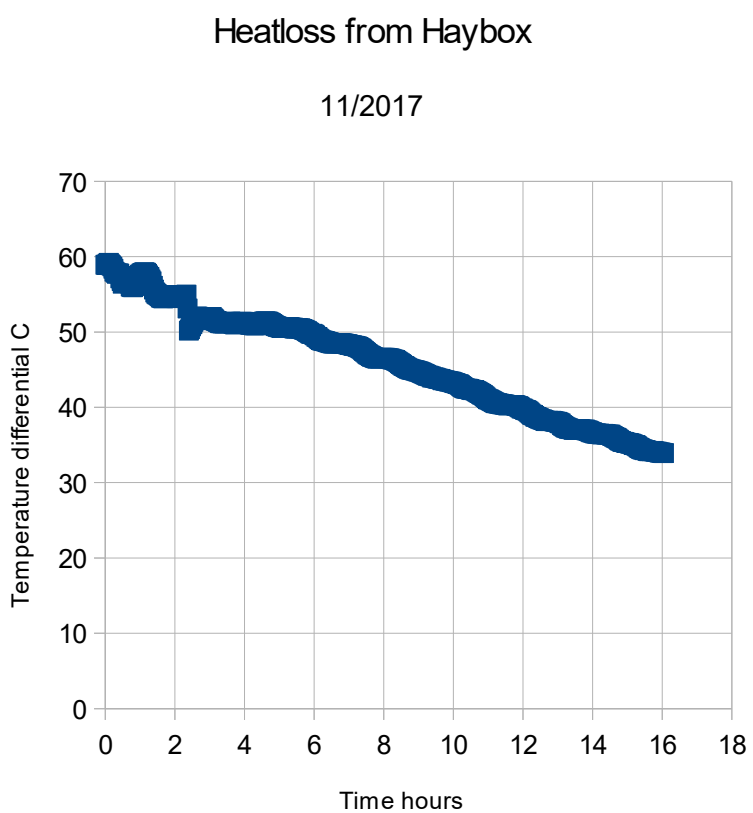
For those interested.

The box is 46cm square = (0.46 x 0.46 x 6) m^2 = 1.269 m^2.

Temperature change = 2C/hr for 5.272l of water, at 68C, outside temperature 8C
Eloss/C = 12.78Whr@ 60C delta T = 0.213 Whr/C, divide this by the surface area gives a U value of 0.167Whr/m^2K which is pretty impressive for a thickness of 70mm, 100 mm of Celotex has a U value of 0.2W/m^2K. The reason for the difference is clearly the use of a radiant reflector in the aluminium foil, and that its uniform surface temperature blocks convection.





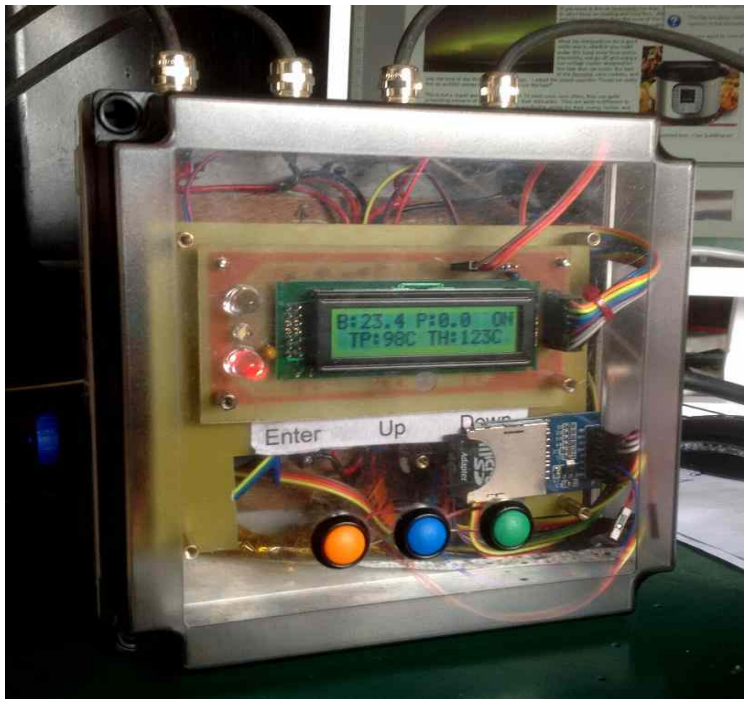
This box will only need 20Whr to hold 5 litres of water at 99C for an hour. This is 15% of the energy you would normally need, when simmering for an hour in a slow cooker. It is also the power made in a 20W solar panel (left) in full sun. This is pretty impressive. OK you still have to bring it to boiling point, which will cost you 105Whrs per litre, but if you reduce the water volumes needed, it brings that total number down. It should be able to run off two 80W panels in a sunny location. The working version manages this at 50W continuous.

The boat cooker

I have finally got the 200Whr cooker running on my renewables powered sailboat Orion, which should be in the sea this summer. It uses 50Whr to hold 95C, in a 12C ambient, 200-300Whr to make a substantial meal. This is pretty good, it means that a single 80W panel and a little battery power will give me hot soup any day of the summer period, and I should have enough battery storage to last for three days of use. I plan now to make a smaller one that will run at much higher temperatures so that I can make pancakes and bread as well.

50Whr costs literally nothing, an 80W solar panel costs less than £80, and will last your lifetime. The cruelty of forcing people to live in poverty really hits you when you think that anyone can make this cooker, with guidance.

The red temperature graph is the pad heater temperature and the blue the actual pan temperature; it contained a litre of water and takes exactly 90Whrs to bring to 95C. Soup made between 90-95C is exceptional due to no loss of volatile flavours.



A long-life commercial version would probably cost about £100 including the panel. Even running off mains electricity a meal cooked for three using it costs between 7-8 pence! (all your main meals for £7.40/month). True ultrafrugality. My version should make a meal for three at under £0.05. I know it sounds nonsense but it isn't, so why do we not talk about this? We fail to learn that this is the way the natural world thinks, doing as much as possible from minimal effort, not wasting anything, and living most of the time effectively for free.

We struggle to understand the idea that our needs can be given for free by the wind and sun, when we are so conditioned by dependency. All you need to do is then make the equipment last tens of decades, and the payback is quick. We are trained to believe that we must always pay for this. You can search through skips and find plenty of materials to make your own: you do not have to make it from new!!

For the sous-vide connoisseurs out there, this can do this as well and it can control at any temperature you select! I am looking forward to enjoying this cooker.

All I did was take a cheap pressure cooker and sit it inside an insulated stainless steel cooking pot which has a 24V x 200W 3D printer heating element heating element stuck to its base. There was very good contact between the two. The sealed nature of the pressure cooker should suit the rolling motion of the boat: there should be little mess. I discovered in trials that the taste is surprisingly good because all the flavour molecules are trapped within during cooking rather than released when boiling in normal cooking. We lose a lot of flavour by boiling.

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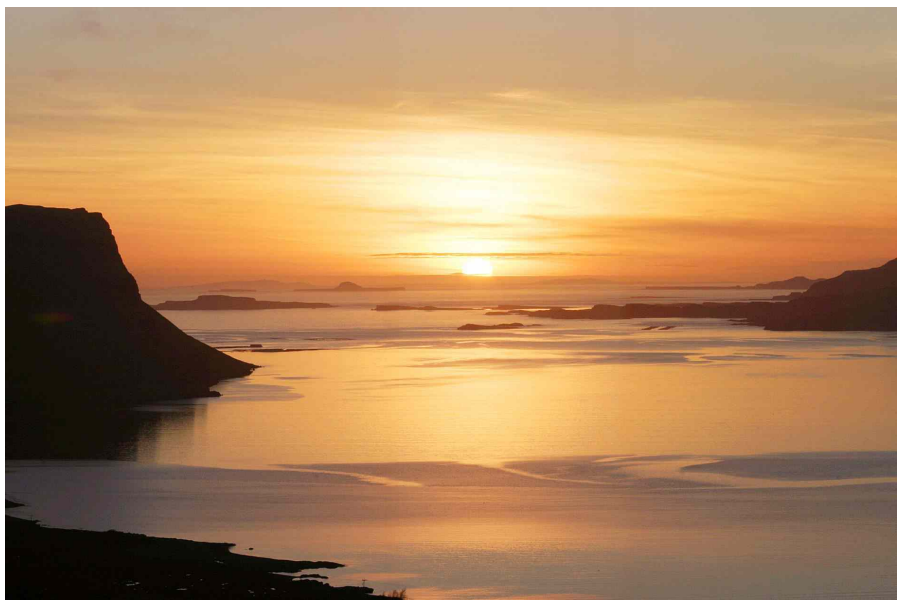
This focus on how we choose to cook involves a serious point. I start my day by boiling an egg and making toast: it has become a ritual. I boil the egg in a shiny stainless steel pan, because shiny pans lose less heat as you use them; this matters. Black pans waste and radiate lots of heat. I then use the boiling water to make a batch of Easiyo yogurt, in an insulated version of the incubator supplied by the Easiyo company. That breakfast probably needs 200Whr (costing £0.40). For lunch I have some soup and toast, for an evening meal, pasta works well, not much more energy.

Each day's meals are organised so that I cannot help but save energy when compared to normal cooking methods. Where you might normally use 3-4kWhrs/day, I use half that, for the same meals, a potential saving of >£20,000 over an 80 year life, using energy provided by the wind and sun for free. That's an over the top frugality you might find boring, but it does make the point.



The Remoska Oven

This is a gem of design brilliance, if cooking cheaply is your objective. It was designed in the Czech Republic in between the wars, mostly I would guess to reduce energy consumption. But it is also a cooking tool that has been thought through so well, that when someone complains about how much it costs to cook their family meals, I feel like grabbing one, and banging them over the head with it. A meal cooked in a Remoska costs usually about £0.15, with a roast perhaps the huge expense of £0.30.

What those brilliant Czech engineers made was a cooker that essentially mimics all the tricks of a conventional pan and stove method, but which uses about one fifth of the energy. It is an incredibly versatile single-pan cooker, and can make bread, cakes, lasagnes, goulashes, soups... the list goes on and on. If you were desperately short of money, using one would potentially quarter your cooking bills, depending on your chosen menus.

It is unusually safe in use and it's impossible for it to catch fire if you forget it, (which as you grow older matters a lot). If you do leave it too long, the sealed pan contains overcooked material and effectively charcoals (biochars) it. My own mostly makes roasts, pizzas, or bread, not biochar!

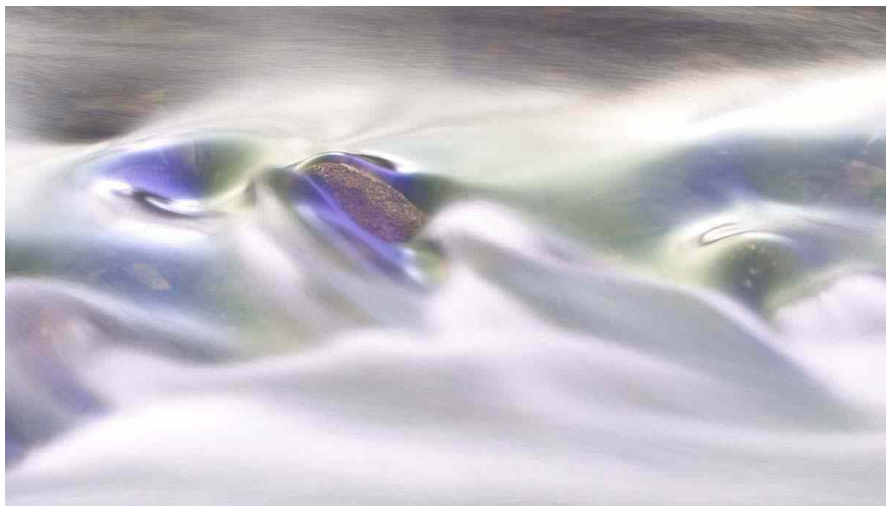
There are several models now, for differing family sizes, and the power consumption has come down a little. The original above used about 640Whr, compared to standard ovens which use about 1200-2000Whr, depending on running temperature. The latest Remoska uses 400Whr and could be made adjustable. There is a magic place on energy use at

around 200Whr, which brings cooking within reach of daily solar energy collection numbers at very low capital cost. A 480Whr array of solar PV (6 x 80W panels) now costs around £500, and this can provide daily on average 1250Whr of power most of the year, from the spring to autumn equinox. Effectively from February end to October end.

If you need to live on renewables for free, these numbers are critical, which is why I focus on cooking and food first. Although daily windpower and solar together provide more energy than this most of the time, it is the minimum numbers that are critical. Winter solar numbers are augmented by windpower, which is highest during this period.

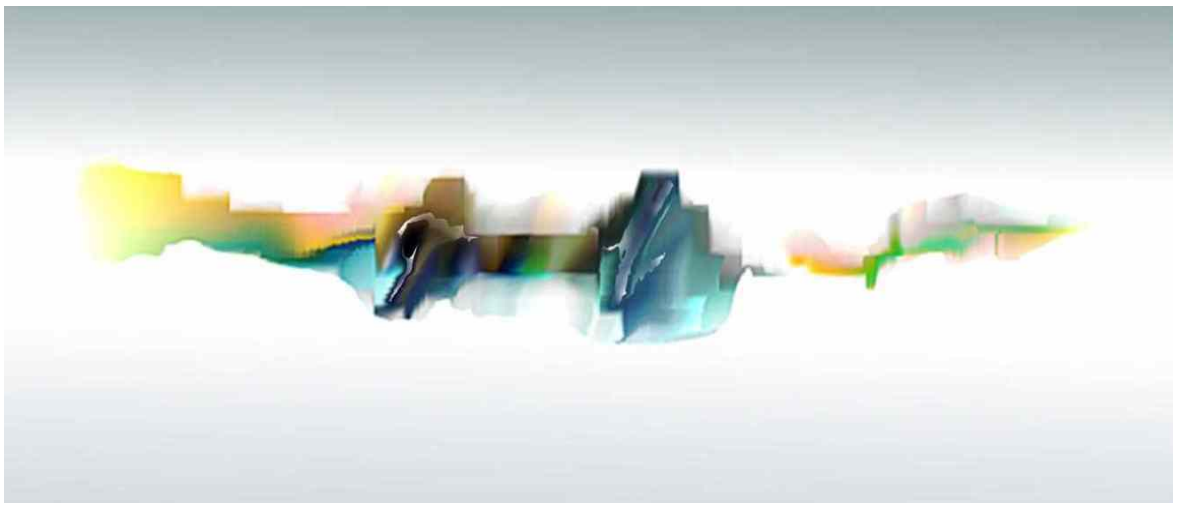
What has intrigued me for a good while now is whether you could make this jump away from mains electricity, and go off grid using a low voltage cooker designed for the task that can mimic the best of the Remoska, slow cookers, and also the best of the Victorian haybox design. I asked the simple question “Could we really live on as little energy as an otter does, from the Sun?”

This is not a stupid question. If you watch TV chefs cook, very often, they use quite astonishing amounts of energy to prepare their delicacies. They are quite indifferent to this as well. At a time when many people are finding paying for their energy harder, and harder, this wasteful issue matters. It also matters from a CO2 emissions perspective. Why teach people to waste their planet? I have recently found an utterly brilliant electronic pressure cooker called Instantpot, made in Canada, again expensive; about £65 on ebay second hand, but beautifully designed to cook fast at about 130Whr continuous. It requires 240VAC @ 1kW peak, to work, but proves you could make your own to run on 24V inside an insulated box.



Water: The stuff of life

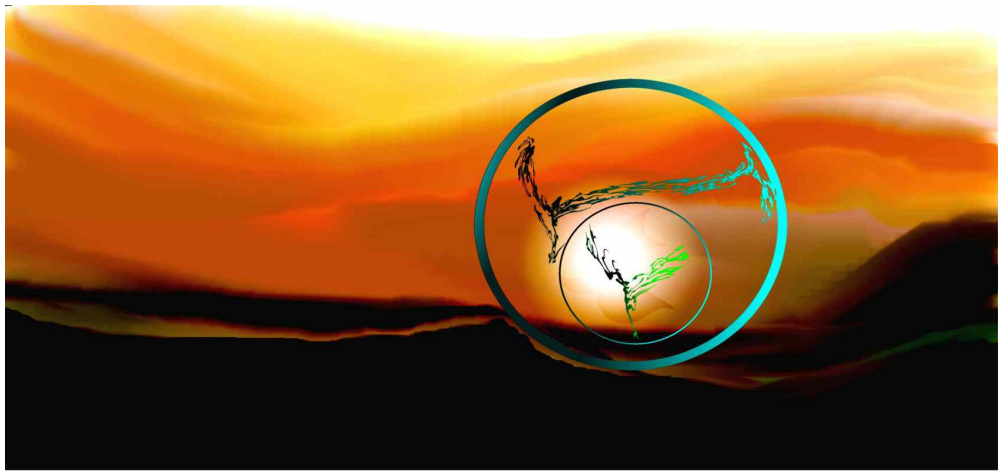
The reason why I am focussing on lifestyle issues like water use, is because we do not discuss or teach water or energy use well, and we should do. We take water completely for granted in the UK. Although it costs us, in Scotland we have gone from using 50l/day when I was young, to over 300l/day per person today (8.7kWhrs/day or £25-£50,000 over a lifetime for heated washing water). That is a lot of water. We use a lot more than we should, and much of this has to be heated.



Modern western standards of personal hygiene are very energy intensive. The energy needed to wash and clean is much higher than that needed to cook. Luckily the sun can provide a lot of that heating, if we are prepared to be clever about it, using energy storage, and if we reduce the washing bit, a little.

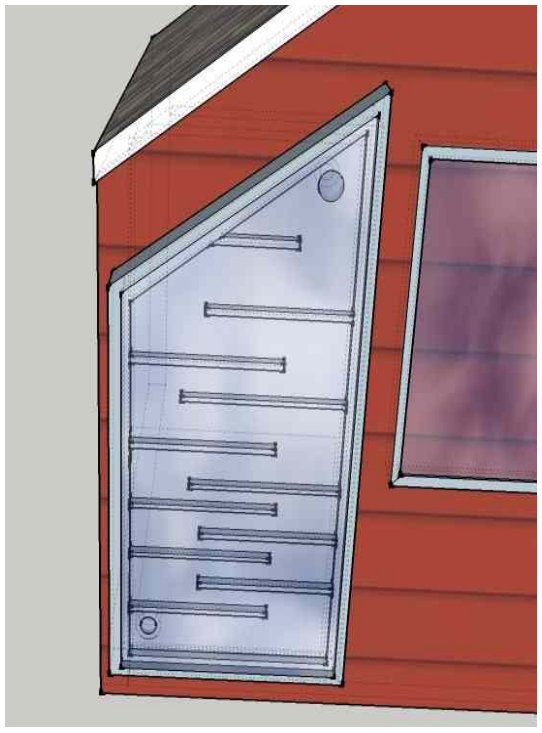
On the side of the microbiome, washing is not a priority. Over-cleanliness isn't good for you or your skin. There are a sensible set of boundaries here: we need to wash, but not twice a day, unless we sweat a lot or have other good reason to.

Because of this huge energy use per person, I examine the provision of water from two angles here: one is the energy you need to get it into a form you need to wash, drink, and cook with, and the other is how balanced it is in the salts needed to keep you and your microbiome running well. Rainwater is pure and free - freely delivered - something we often forget. Today we tend not to consider this, and instead spend money thoughtlessly. Hyperfrugal water use is important to reduce both your life costs and CO2 emissions.



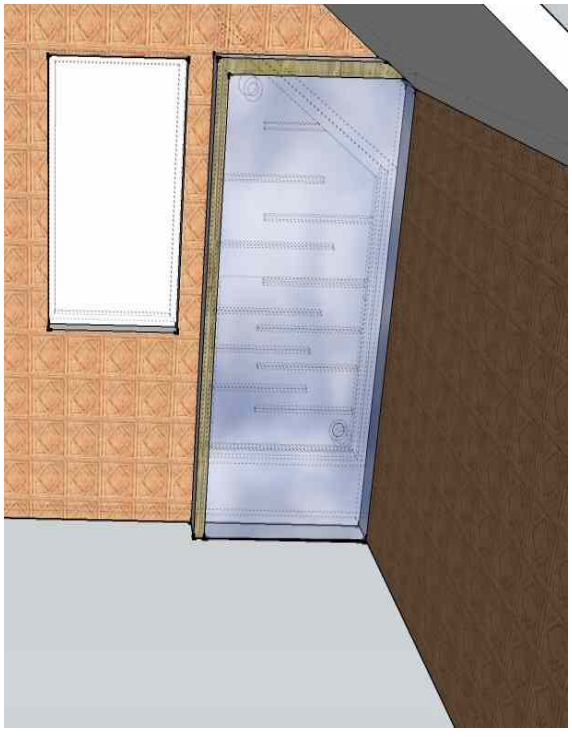
I grew up on the west coast of Scotland where water hardness is extremely low. The buffering effects of the Calcium and Magnesium salt content in the water you drink will affect the

stability of your microbiome and this is a fundamental issue.
Drinking water provision in the UK is basically excellent: mostly it is filtered and treated river or groundwater, which keeps the hardness of the locality, but increasingly reverse osmosis systems are being used, which produce water with much lower ion contents. I am considering now supplementing the west-of-Scotland water that I drink to elevate hardness, using calcite and corosex, which looks like ground up shells. I would never have done this before, but the developing understanding of human nutrition and Calcium and Magnesium deficiencies, and the microbiome's own needs for stabilised levels, has made me approach this in a more aware state of mind. West coast drinking water is distilled from the atmosphere, and the rocks on the west coast often leach only small amounts of Calcium and Magnesium salts, especially in South Argyll. Magnesium deficiency is critical in human health, as I have found.



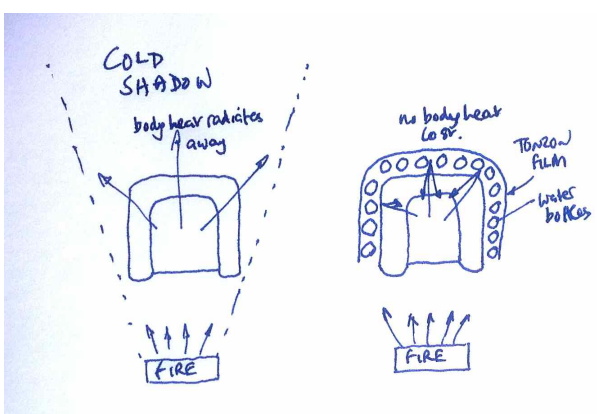
One’s view of life, as an older person, is often full of hindsight. I wonder, now, whether we have really made a mess of water hardness levels. Could issues such as health and mortality rates in towns and cities be related to the ion contents of the water we use and drink? Hard water furs up your hot pipes, so it is not in the water providers aim to keep hardness high. You on the other hand need harder water for the health of your microbiome, bones and teeth. I wonder how this will pan out…

The differences between the West of Scotland, Glasgow, and Edinburgh spring to mind. Glasgow uses almost distilled rainwater from Loch Katrine, and Edinburgh much harder water. Could Glasgow's historically low longevity rates be due in part to the lack of salts in the water supply? We have never considered this before, because the microbiome was considered irrelevant to our health.



I would also recommend you avoid caffeine, which is present in tea, coffee, and chocolate, especially if you are the anxious type! The other reason is that it takes a large amount of heat to boil water, 3 cups of coffee, about 100Whr. This adds up over a day. This one is guaranteed to make me popular, I have lived without it for health reasons since 1983. I can't say the experience has been wonderful, but caffeine is an addictive and unnecessary stimulant, and the headache you get when you stop reminds you why all the cost of caffeine-containing drinks is not worth it. I only drink water, and love it. Well, yes, and the occasional beer!

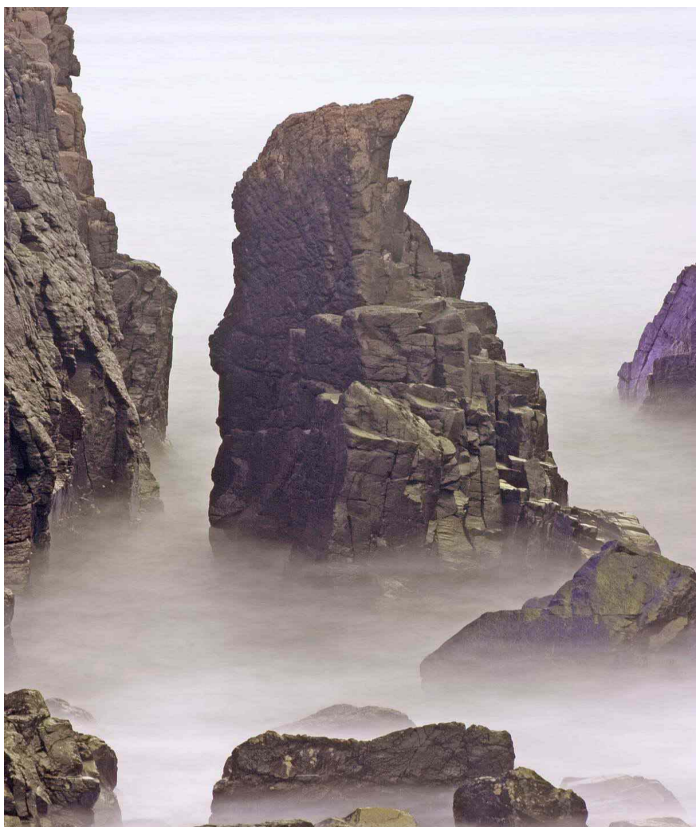
Warmth and Comfort



The UK is historically very weak on energy waste, and our homes have been badly insulated for most of the last century, a time when the rest of Europe was very aware of this, and building extremely well insulated homes.

As I write this I am sitting in a south facing room, which is heated using a low cost solar air heater I have designed. When the sun shines the air passes over the heater and is heated to about 45C on a sunny winters day. There is more data in Appendix 5 at the back of the book on how this works. The capital payback is about three years and each panel built should last about 10-20 years, with no maintenance.

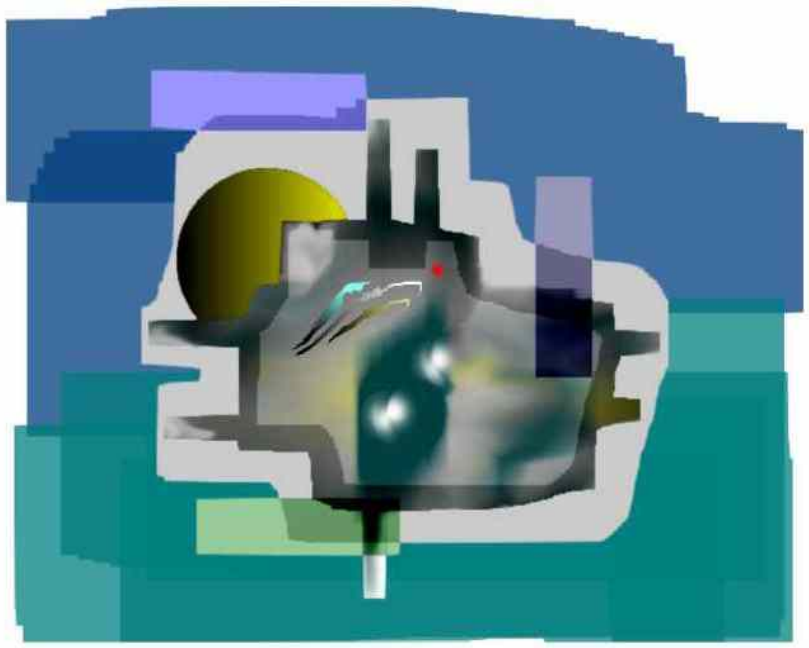
We don't make simple DIY approved solar air heaters like this in the UK, though we should. Because we do not, I consider energy poverty to be contrived, and in some parts of Scotland it should be considered a crime. Forget £200 each winter: cold deaths of ill or elderly people should be considered to be an inexcusable disgrace.



We burn fossil fuels while the sun shines, paint our homes white which rejects the sun's heat daily, then we complain about fuel poverty and the poor souls affected, as if there is nothing we can do about it.

There is a madness to these times of technical ignorance, and laziness. An old person sitting in an armchair beside a fire, on a freezing sunny day summarises our indifference beautifully.

When I played with the mirror film made by Tonzon (www.tonzon.nl), 20 years ago, it was immediately obvious that we should require radiant barriers to be present in furniture to stop the heat from people's bodies leaking away into the cold shadow behind. Old people are often sedentary because of infirmity. If we added thermal storage and a little inbuilt heating, probably less than 100W, into furniture, the occupant could stay warm, even through substantial power cuts. That is without considering the sunlight hitting their homes on cold days, and being reflected away. This is not a joke, and I challenge you to build one and experience it. Better warm than dead. My own take on the nonsense being spouted on energy poverty, started with the sunspace prototype I built in 1997, which taught me that there was a lot more energy coming daily from the sun than I had anticipated from the textbooks. Yes, the averages looked similar, but the more I looked at it, the less the textbooks made sense.

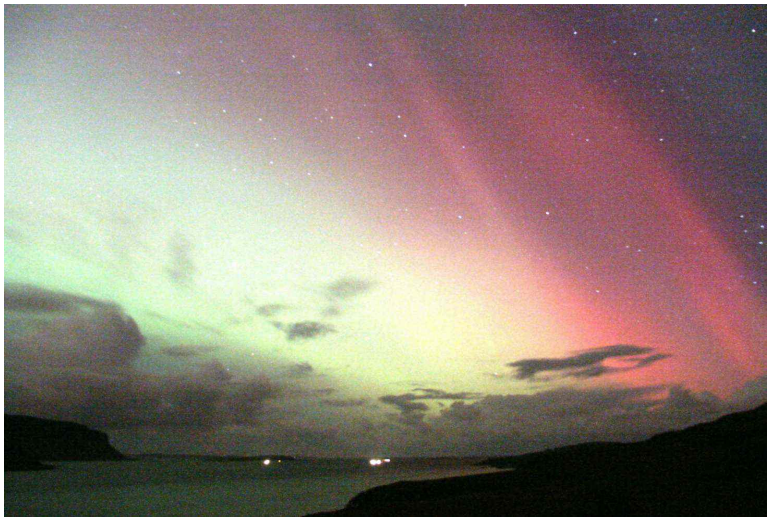


We live in white houses, which reflect 80% of the sun's heat and light away. We adore antiquated vernacular poorly insulated house designs from an era which heated with large amounts of coal and massive amounts of ventilation: it was an era that, for the masses, could not even make large glass windows.
If we were to collect what energy shines on our homes on a sunny day, the south facing rooms, if well insulated, would be warm and comfortable. These two mockups (left and right previous page) could change many south-facing old people's living rooms. It doesn't have to be every day warm, but what a difference it makes when it does!!

We make laws easily, and find it near impossible to unmake them. Solar air is a good example of a prohibited DIY technology we should retrofit to all south facing rooms of older houses.

I went on to explore these solar thermal air heating systems. They originate in a design patent dated 1882 by Edward S Morse, ‘Warming and Ventilating Apartments by the Sun's Rays’. Go find it: so simple and elegant. When people say to me, “Oh you are ahead of your times!”, I say, “No, that is making easy and lazy excuses: you are hundreds of years behind, and the fault is yours.” Doesn't make people happy; it shouldn't.

Solar thermal collectors can be built today using very advanced, yet low-cost materials with capital payback times in the order of 2-3 years, and lifetimes in excess of twenty. Space heating accounts for nearly a 18% of our energy costs and CO2 emissions. We should be legally enforcing all south facing homes to retrofit them.

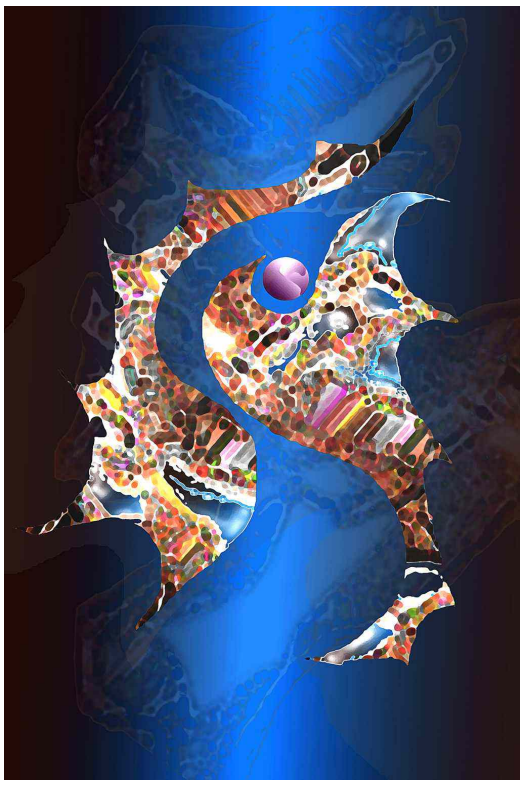


It is only when you re-examine past ideas, developed in the late Victorian era, that the wonderful paradoxes of renewables become clear. Efficiently gathering solar and wind energy can make homes cheaper to live in, substantially reducing life costs to the point that you can easily solve many planetary CO2 emissions problems, and have a shorter working life, because of this.

The Bicycle: Health giver in a nutshell

There is a story of the bicycle only cyclists know, which is that if you do not go nuts with exercise frenzy, and leisurely cycle wherever you need to go, you have a health that is ten years younger than your physical age. All my life I have seen this, both from a personal perspective, and in watching those of my own age grow old. What is most important is to realise that transportation produces 18% of our CO2 emissions. Travelling by bicycle is now being seen as an important way to reduce these emissions while also improving the general health of our increasingly obese society.
Cycling remains the essence of carefreedom: no insurance, because it is pretty hard to damage anything on a bike, except yourself; no travel costs because of its efficiency; no road tax for the same reason - bikes and pedestrians do not wear out roads - so for obvious reasons no tax is levied. The only 'penalty' people experience with cycling is the effort of exercise.

I am lucky to be able to remember times when the dull roar of traffic did not exist, cities were quiet, and cycling in them was a real pleasure. I hope we go back to such times.
Today most people in the UK, don't want that, and because of this never know what it feels like to be incredibly well. **They really don't, ever!** Aerobic exercise keeps everything inside you running well. All you have to do is look at Holland or Denmark: well, happy people make good clear decisions. Ill ones? Well, I am sure you can spot them in modern life, from their facial shapes and complexions, which reflect poor blood circulation, and bone health.



I believe that this fountain of anger, and outrage building in the UK, is primarily due to ill health and stress. Outrage these days is a clear symptom of poor personal glucose metabolism, which triggers wild emotional adrenal swings you can easily confuse with real feelings.

Healthy people do not do outrage: they laugh in its face, there is a calmness in good health.

My own take on this is based on my experience of the '70's, which was a decade of oil crises, shouting angry motorists trapped in queues, and traffic jams, people were unable to make the connection between their addictions to the car, and their general health, and emotional wellbeing.

These days it is much the same: I live in a world of large travelling bottoms: people who range across the landscape sitting down, never doing anything physically, apart from a short walk. If this is all you can do then get breathless, is the best message, do so energetically. You don't have to do it for long, 5 minutes is fine each day.

In the urban world, this trend for sitting while travelling has everyone in a vehicle zoo: roads are blocked with airless stinking traffic, nitrogen dioxide gases forming nitric acid dissolving their lungs, worse inside a car than out; no quiet any longer; a depressive selfish roar everywhere. When I was younger, cities were really quiet, and I have still memories of Prague, and Olomouc in the Czech Republic, empty and silent on a Saturday night, even as late as 1994. The only sound of the city being the crickets.

Get yourself a second hand bike and keep it safe, because at some time in the future oil supplies are going to be compromised badly, and then any form of transport will seem like a good idea. It is going to happen, Peak Oil is in process, (ignore the media on this) and it will change the world you know in truly wonderful ways; regaining peace within cities will be a lovely experience. Clean air again, comfortable conversations beside quiet streets.

The end of the Victorian era was one in which everyone who could afford one, got a bike, and between the first and second world wars cycling had a heyday. Everyone was fit and well. There is a wonderful film called The Red Balloon; about a balloon that befriended a little boy, based in 1960's Paris. The image I have of it, in my mind, is a visual stream of 7-10 year old schoolkids pouring over a six foot wall, chasing this balloon. That could not happen now. All we have now are fit thumbs.

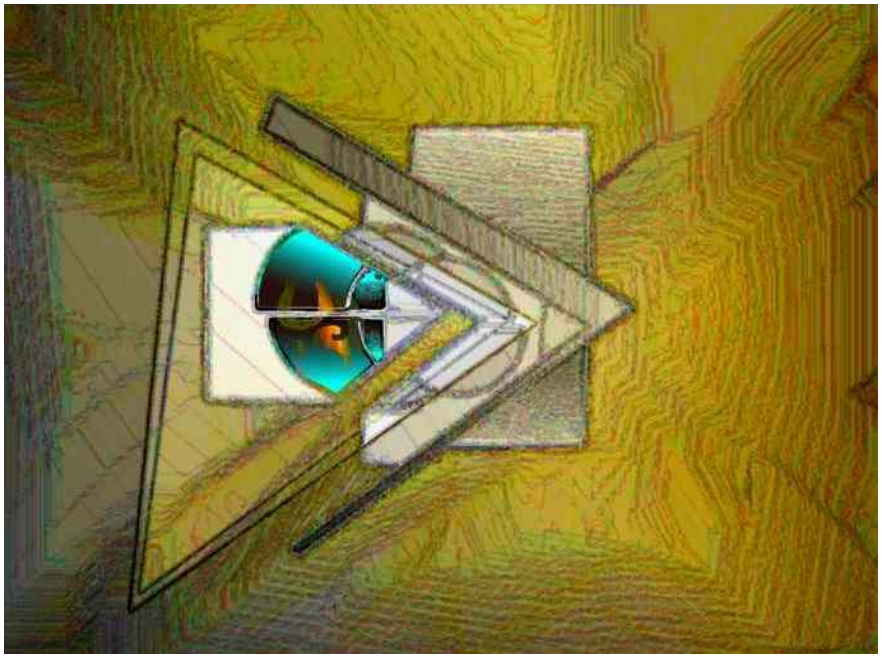
I sincerely believe that for a society to function well, it is critical that there exists within it at least one solid group of healthy people, to steer our collective happiness, goodwill, and imaginations. Imagine our PM smiling and happy, saying “Isn't it a wonderful day!? What good things could we do today?” No, it isn't possible.

Imagine the Beatles writing a song that started “You are the only reason I can never make a change?”?? Which then Vodafone thought appropriate for call waiting....

The tone of a generation’s songs reflects their wellbeing. Compared to the 1960's this world is ill; so ill, it doesn't realise it. Well people are happy people, as many professionals have explained to me. We are now living with ingrained endemic poor physical health and nutrition. Those are not my points, but of those who have to deal with the problems it causes. UK medicine is making this issue very clear at the moment.

Climate Change and extreme weather

We are in a professional stampede you cannot see, moving from denial for the last 30 years into resolution. We know now that rapid sea level rise is going to happen, and most likely abruptly, within a few years. The planet is overheating in spectacular fashion: droughts, fires, floods, storms, are wrecking globalisation. We are about to go truly hungry, because this unpredictability will wreck global agriculture.



Water crises worldwide will destructively consume our energies, and emotions.

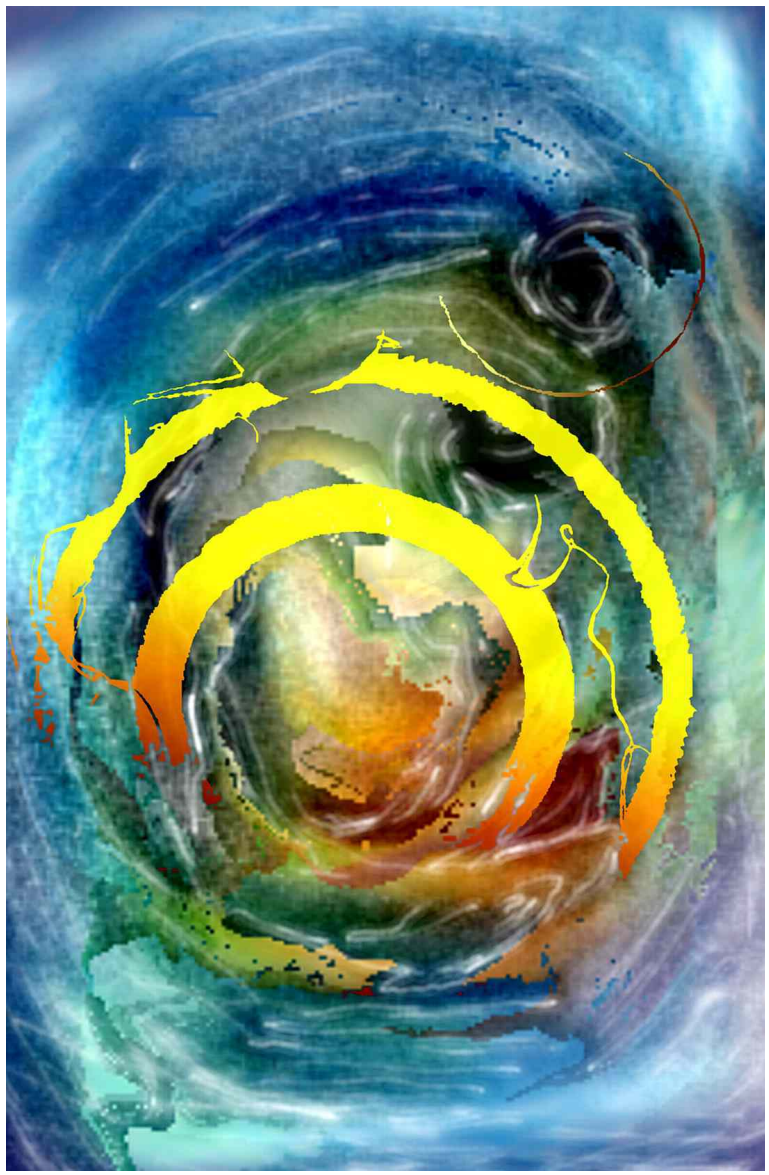
We need to decelerate CO2 emissions within a few years to have any chance of slowing and stopping this accelerating disaster. That means the ugly issues of consumption, heating, and transportation, all have to be reduced to nearly nil, and those involved protected. Everyone knows it cannot be done without offending someone, if business as usual is to be allowed. Worse, we also need to tax hard, to gain enough capital resource to make these huge infrastructure changes. Please ignore

those who say you can have your cake and eat it using renewables, there is not enough time left to build what is needed, to collect the huge quantities of energy we waste.

How are we going to reduce our CO2 emissions?

Insulation

The poor level of insulation in our homes is appalling, and many people do not want to change this, they think it is their right to waste energy if they can afford it. The UK CO2 emissions are some of the worst in Europe whatever the media says. Our transportation fleet emits 18% of our emissions, yet in real terms we throw away 80% of this energy as waste heat, and then we stupidly buy more fuel to heat our leaky homes and offices. If only we could collect the waste heat from our vehicles and use it in our offices and homes! Of course we could do this easily, but you do not see it happening. We should force people to make changes through heavy carbon taxation of poorly built and designed homes, and mandate vehicle heat recovery.



Agriculture

Agriculture produces a substantial part of our CO2 emissions, through milk and meat production. It is also destroying the land based carbon sinks we so critically depend on through soil damage and erosion. If we could only bite the bullet, we could slash CO2 emissions easily by encouraging no-till agriculture and no-dig horticulture. The two could massively recover the land based carbon sinks. In case you might forget improving their performance could very substantially offset our current CO2 emissions.

Consumption

We consume far too much junk, and it is designed to break down and fail within a few years. We refuse to take responsibility for the manufacturing emissions associated with this; it is another country's problem. Time to get real: Scotland has one of the highest historical worldwide CO2 emissions on the planet if you consider our oil, coal, and gas sales and use. On a per capita basis, we have caused a substantial part of the problem. We have to reuse, recycle, and stop the creation of junk goods. But we won't because it employs people who would be better retrained, and retaught how to live. We should tax hard to change minds, and have little sympathy for those who say it is their birthright.

The Oceans are dying

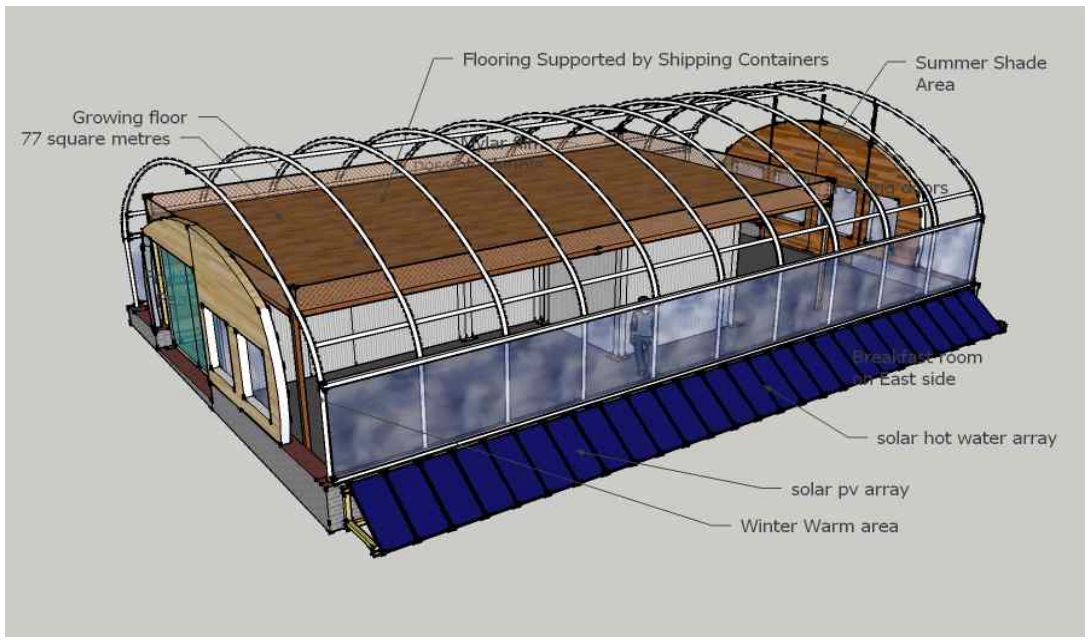
Our planet is mostly ocean, we have poisoned, polluted, and pillaged its productivity. In doing so we have become used to being able to forget the consequences. The oceans are our largest carbon sink: if we could choose to stop all the plastic waste, and overfishing, it could absorb huge amounts of atmospheric CO2. The case for worldwide oceanic protection is more than overwhelming, getting

politics and many of the extremely rich fishing interests to wind down for a decade, is not easy. If there could be a natural-world way of making fish unpalatable, then increasing poisonous algal blooms growing off excess fertiliser in runoff may well do the job, in a bizarre sort of way. Unfortunately the oceans make 70% of our oxygen, and the primary productivity that makes this is declining at 1% per year, meaning we will suffocate before we boil off the oceans. It is seriously ridiculous that we cannot see what is being done in the name of profound greed and stupidity.

A Home in the Future: Making nonsense of the term unaffordable.

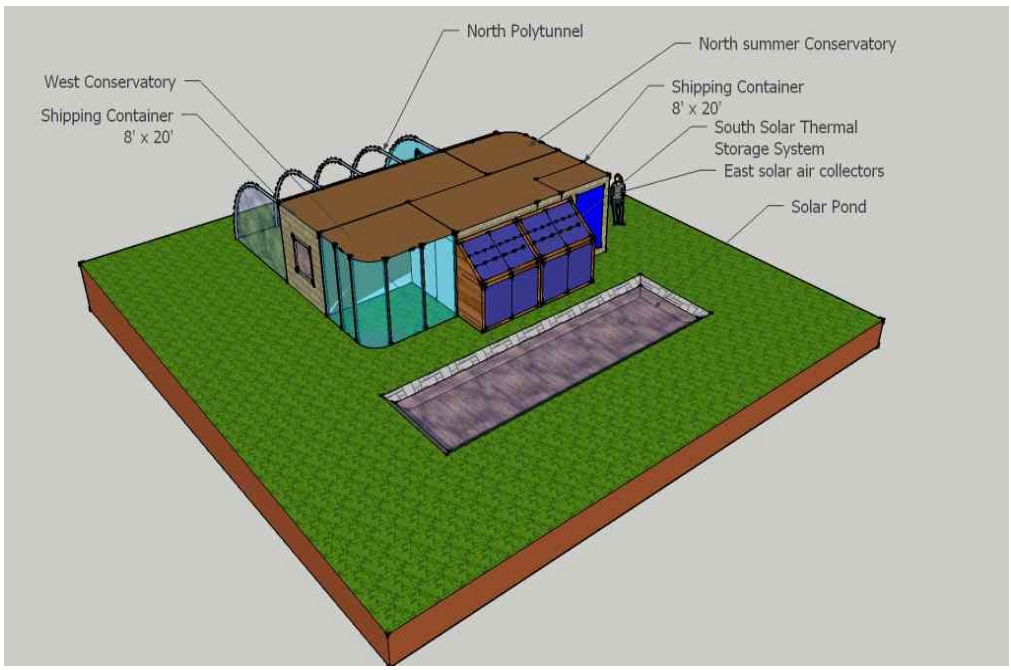
At 68 I am saddened by a political landscape which refuses to reverse the clearances. We call the result Planning, with a capital "P",when it cannot even begin to plan for what is coming, by then too late. Argyll and Bute planners are still allowing development 12 feet above sea level.

I (and many others) have been working to try and find solutions, and over the past 20 years, have come to the conclusion that we need firstly to develop novel high or exposed small communities across Scotland. Many older communities used to exist in these places, but are now just building shells. Up there, in bunded-membrane-skinned homes, out of sight and mind, there is a chance to show that hyperfrugality will work.
It is one of the best placed locations to do it, because nobody can currently do much with the land, and so it is cheap, and not in usage conflict. My design ideas should be able to merge unseen into the landscape, using willow.



Enforced energy use decline, for many people is going to be the kind of destabilisation, in an already very difficult world, they really didn't need to occur, and if politics cannot grasp how seriously they have to make the case, I can imagine them in trouble in the near future. The last time such imperatives and crises accumulated on a country was France, and the years that followed the revolution were chaotic, and an appalling waste of human resource. So, the decline must be well managed today. Downsizing is the big word, and fast!!

I am adding pictures of design mockups now in random fashion: I have so many attempts, all cheap and unnervingly powerful when compared to anything else that we call home; all attempt a complete integration of living, to give all the best we need in a home that protects and cares for us, at very low CO2 emissions. My favourite is a twin shipping container design with small north and west conservatories, later with a large greenhouse built on top. But I would still love to enclose a single container made internally into a home, inside a 30 x 120 foot wide polytunnel, with plants growing on a mezzanine floor supported by the container.



I seek to live in a home that is naturally warm in the daytime and cool at night. I seek a home that, more in winter, strongly cycles its internal temperatures, far more than a home would normally do, especially a superinsulated one, which can vary less than a degree centigrade from night to day. I seek a home which costs very little, and gives an incredible life. One that can still evolve as well. I do not need to be stuck with the best that can be made. I want to grow bananas and pomegranates!

Lots of land above 500 feet on the west coast of Scotland, has an enormous renewable energy footprint, so large that it could produce the electrical power needed to grow all you wish, right through any kind of winter - year round food productivity, coupled to seriously smart ways of doing this, this is what I propose to get out of the situation we are in: homes that pay for themselves through the energy and produce they make.

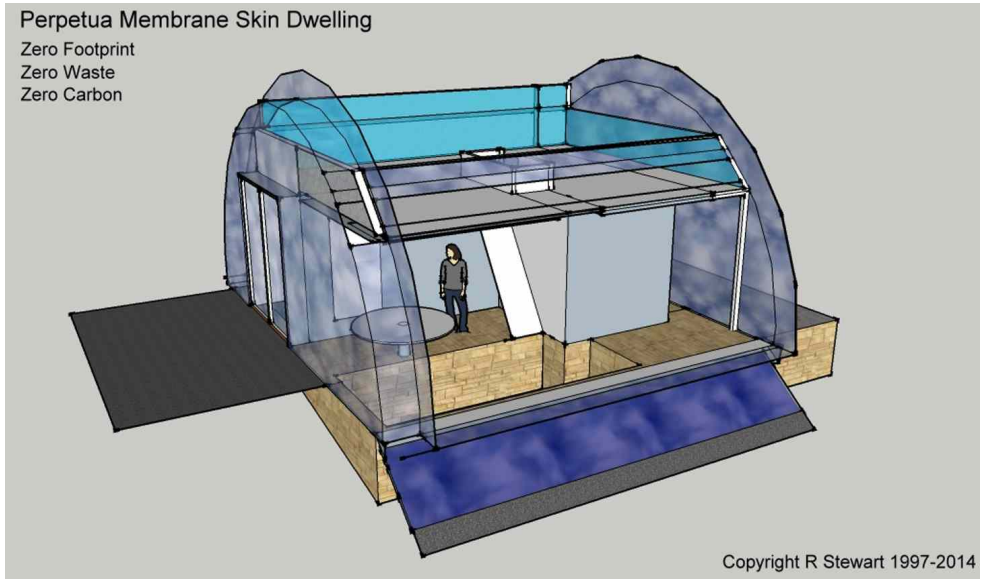
If local people could even begin to grasp this, then the bellow of anger would be heard all the way to Edinburgh! If we can live this way, for free, with almost no CO2 emissions, then why the heck aren't we doing so? They don't want you living for free, whatever they say, seems to be the only sensible reason. After a year of effort trying to get these ideas through to some sort of real world outcome, it is clear that the Scottish government has no idea how to resolve these issues, and simply will not rock the boat.

I want to live in a wonderful pest free indoor garden. Protected from the rain and wind, it doesn't have to be polythene enclosed gardens, but they turn out to be the most cost effective and the highest performing way of doing it. Possibly noisy: due to rain, but this can be damped. Normally polytunnels last 3-5 years. I made one last 23+, (still going!) because of the way the polythene creates a cool microclimate via condensation that builds up inside on a warm day, and turns the polythene into the thermal equivalent of glass.

Through all the ideas I have worked, from large indoor gardens as homes, to bothies in the most unconventional forms, I keep coming back to making use of the free gifts the natural world gives, to reward effort. To have, without cost.

The Energy Decline

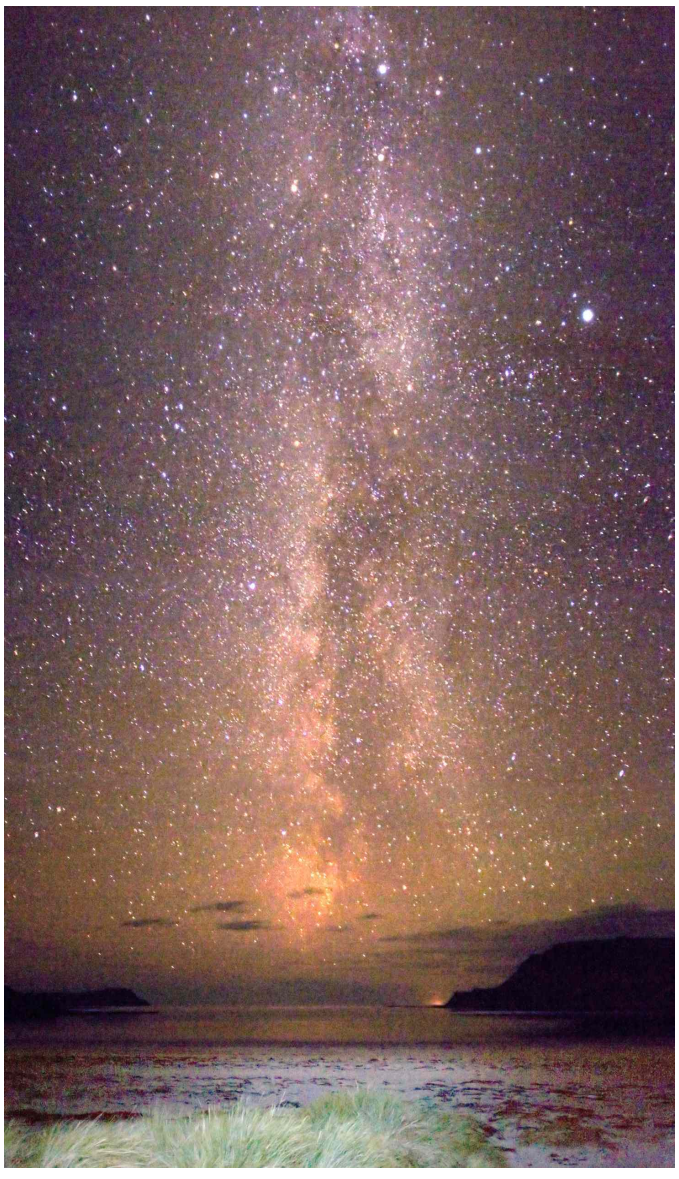
On a recent visit through Edinburgh, in festival mode, it was clear what a mess we have made of anticipating the energy wind-down. If you are going to have to downsize your society's expectations, the biggest mistake to make is to elevate house prices to the point that even in good times they take half of



people's disposable income/net energy gain.

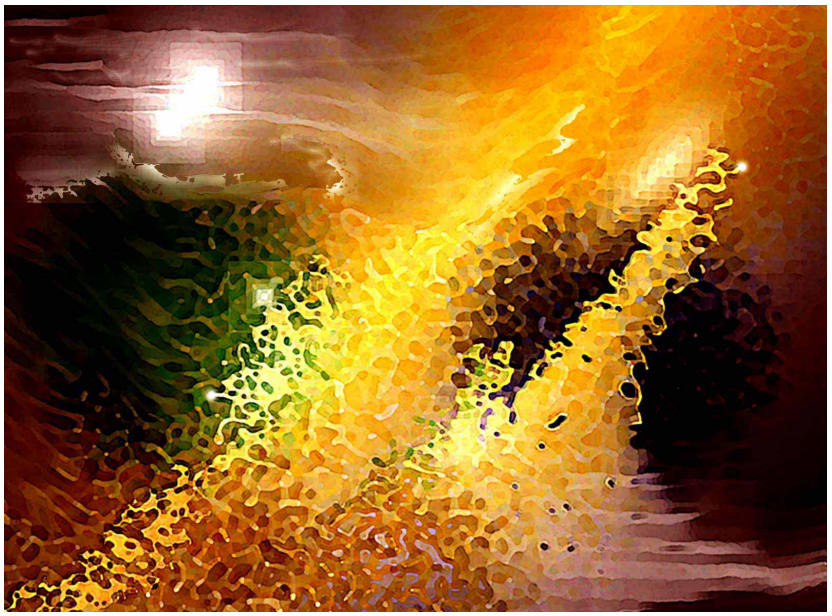
You can see everyone holding their breath too, because as soon as the energy wind-down starts, net energy and income will decline, people will not be able to afford what they used to, and a housing price collapse will start. This fails to express what it might feel like to be on the side of this loss at a personal level. The homeless demand for land will become a mob.

We must reduce our CO2 emissions really fast, to try and stop West Antarctica collapsing (see Appendix 4), at least Edinburgh and the east coast cities and towns in Scotland have the advantage of drier weather than the west, facilitating an increase in cycling. It is very evident that currently, the car still rules in the noisy, fume ridden stone canyons of Edinburgh, but it is a start.



For those on the west coast, where rain in summer now falls like a constant freezing cold shower, it is not going to be so easy to give up the car.

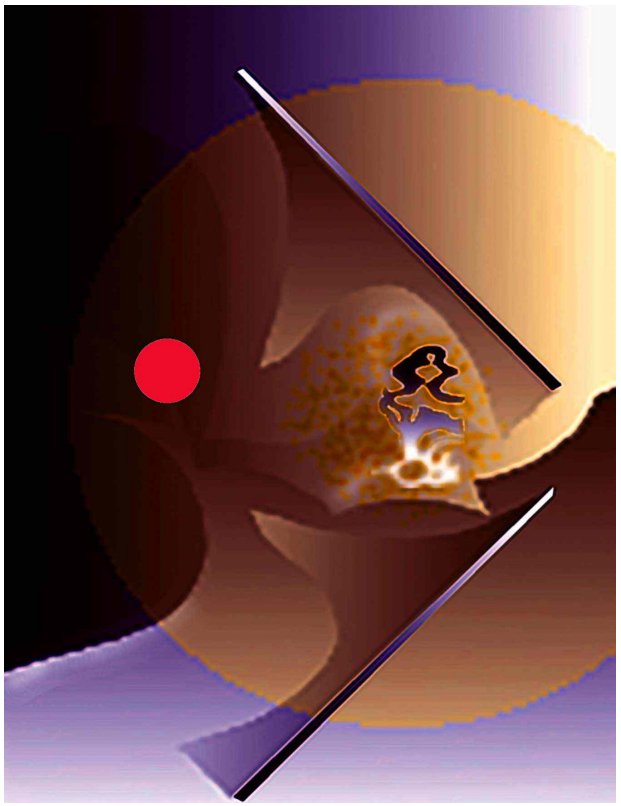
What has struck me powerfully on this last visit to Edinburgh, is how oblivious everyone is to the fragility of their world. In high energy waste societies like ours, just sitting or standing still costs more money in an hour, than low burn ones use in a day. This produces a ferocious mental focus on finding ways to gain the energy needed to sustain your day, then a week, in such a world. This overwhelms and destroys our ability to consider adaptation as a means of survival! Everyone is refusing to admit that radical change is needed, especially politics, economics and planning.



In Scotland we must rapidly redistribute people on the landscape, so that they can then harvest their own energy and food from renewables. We are going to have to do this, there is not enough land area in the urban world to produce the food needed. Rapid CO2 emissions reductions across the board will mean rapid localisation of energy and material supply, rapid reduction in goods purchase and transportation, and radical redesign of new incredibly low-cost dwellings to make full use of the sun and wind, which can also make food.

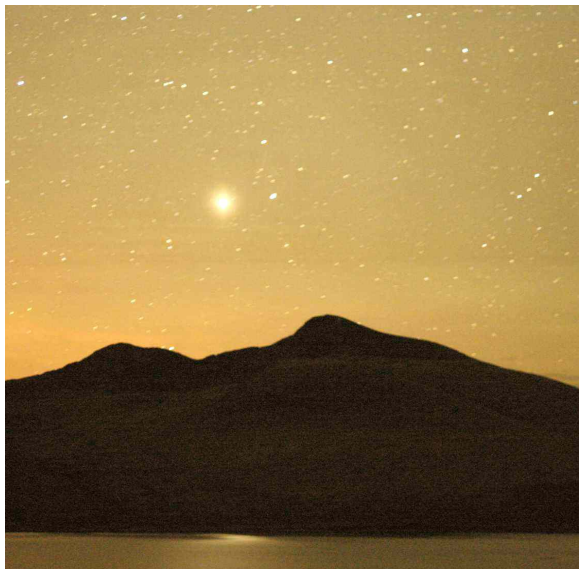
Right now, this isn't happening: those caught at the bottom are being punished for the lack of awareness or unwillingness to act by those at the top. It cannot last. How long will it take before someone at

the bottom decides that life is no longer worth the pain, and decides to take it out on the top?

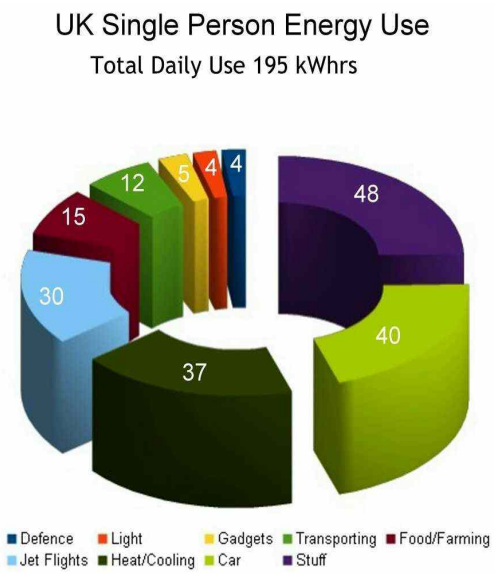


Let's return to the energy pie chart, below. The first thing we will have to downsize is stuff, which includes cars and houses. Most of this comprises the easily purchased, then quickly forgotten (plastic) consumer goods that keep our society working. 'Stuff' accounts for such a large component of our CO2 emissions that we have to hit it hard; that means losing service jobs, which tend to be low in skill anyway. For those affected, I am sorry, you will have to find room for retraining and learning more valuable skills in this coming world of transition, just as I did in 1979.

For the cars and houses we so adore, David MacKay the world expert on energy use, (www.withouthotair.com) favoured low energy vehicles, and houses, that were designed not to waste as much resource as most do. His instincts I feel were right. For example two houses were recently built down the road at a cost of £200,000 each. That is about 1.3 million kilowatt hours of energy use in total, for everyone involved, or 794 tonnes of CO2 emissions per house. That is a rough estimate based on conversion to kWhrs, and the huge effort to get them built deserves compliments all round.



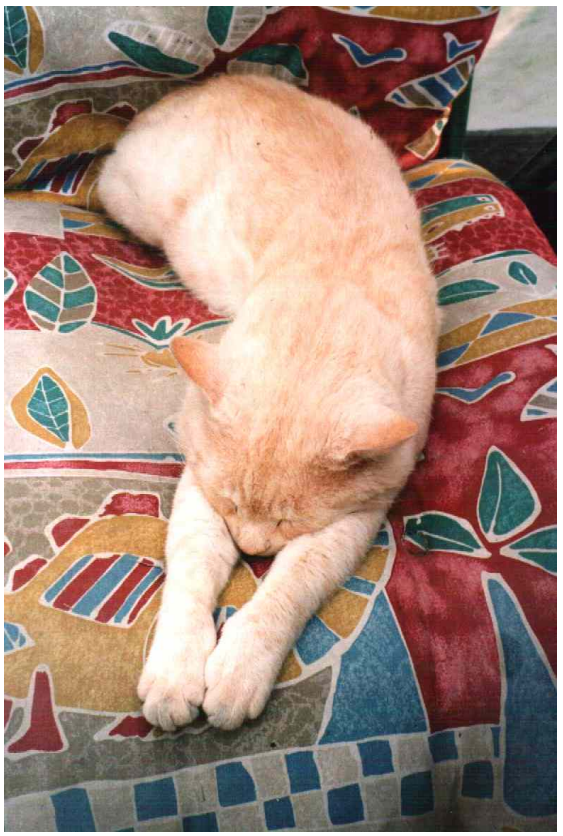
However, this is not an efficient way to make housing, which is why it costs so much. We really need to be building homes that cost 1/10th of this. When we cannot emit this amount of CO2 per capita, because of climate change, then we must build in a different way. This age of energy and resource decline ahead, creates a large headache nobody talks responsibly about; how do you run our just-in-time society, while consuming all the energy that it produces, and also build the infrastructure needed in this new-world-coming in which all we have left are renewables? If we are using all we have, standing still, then where does the energy and resource come from to make all these new shiny electric cars, wind turbines, and solar panels?



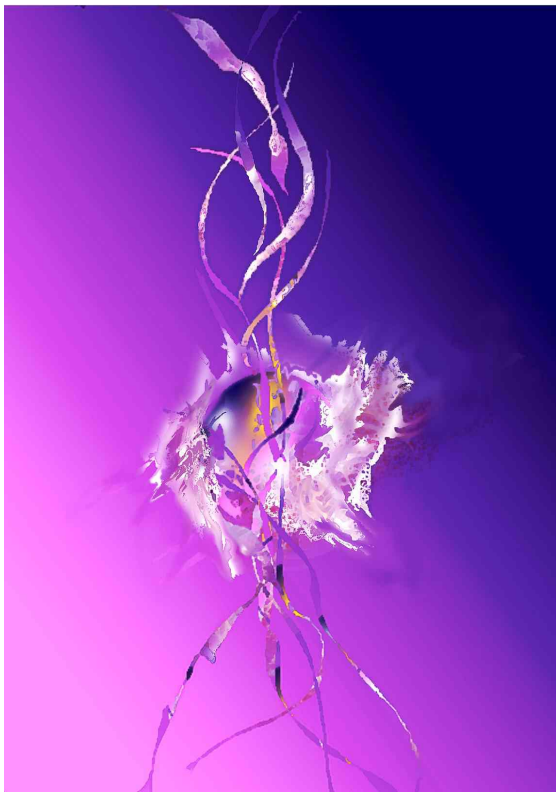
The answer seems to be by robbing the poor to pay for this: food banks are the direct consequence of not being able to pay good profits while also rewarding shareholders adequately. It is a lie that stands in clear daylight, that nobody is talking about. At some point in the future we will have to deal with this lie, as we continue to take from the bottom of the heap. Unfortunately the bottom will move upwards, quickly, falling EROEI (Energy returned on energy invested) defines that. I recommend you look the story of EROEI up, it makes many confusing aspects of economics understandable.

I argue that we need to restart how we are dealing with this, or face open revolution which itself is unlikely to resolve the issues of downsizing an economy and forcing everyone to deal with the changes. It is not true that the changes mean we will lose quality of life, unless we continue on the current path of consolidation. Human beings have the most astonishing ability to solve 'insurmountable' problems when they focus their minds. Being smart, small, and efficient is the new future that everyone can be part of, especially when it doesn't cost the Earth. So instead of building homes that reject the sun, resemble large expensive fridges, and cost the Earth, why not open them to the sun, and storage? It is called dynamic aperture housing and makes the Passif Haus look

over-expensive, unimaginative, and now very, very dated.
For a single person, the half size shipping container sitting inside a small 6-9m wide polytunnel, with a mezzanine growing area above is such an elegant solution. Remember, it no longer has to be polythene, but that remains the lowest in cost, and highest in performance.



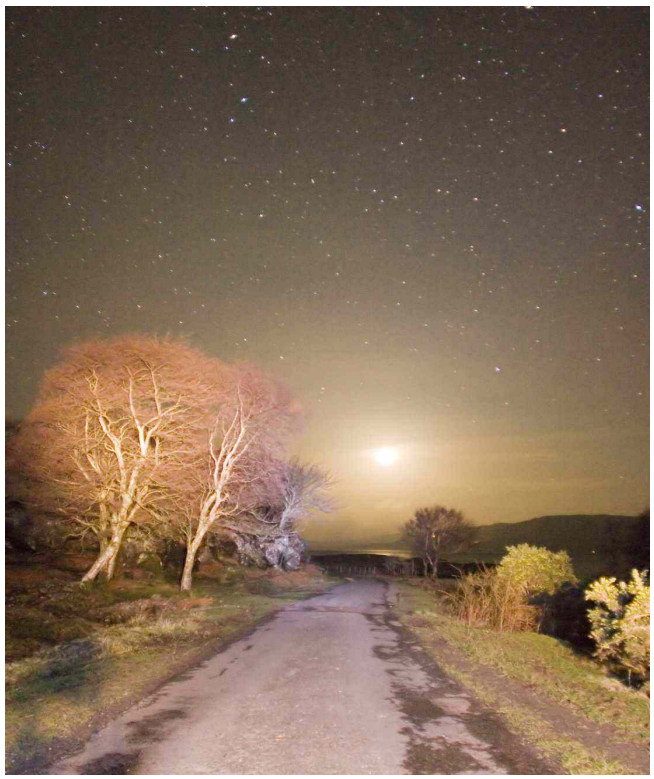
Firstly you get space at very low cost. Secondly, for 8 months of the year, that space is heated for free by the sun, so you can relax about paying for warmth. Thirdly, you can grow food plants in the same space you live in. Fourthly they can grow better using your nutrients and CO2 emissions. Inside the sunspace your home effectively moves 1000-1500 miles south.



What's not to like about it? Cats instinctively love it!

In 2020, a small group of wealthy people are organising a world so short of support for everyone, where deliberately-created fear and division are used to control and dominate how we think. Sometimes it takes a cat to laugh at it all constructively.

In this world we now live in, technology can solve most of the social needs for a simpler, fairer, and more reliable world than those with wealth and power wish you to experience. In the UK, in England mostly, this deliberate chaos we see is approaching self-destruction and probably minor civil war, but this isn't needed. Cats love the way engineered sunspaces make great places to live in without cost. You can engineer sunspaces in all sorts of ways. Even open ones like walled gardens.



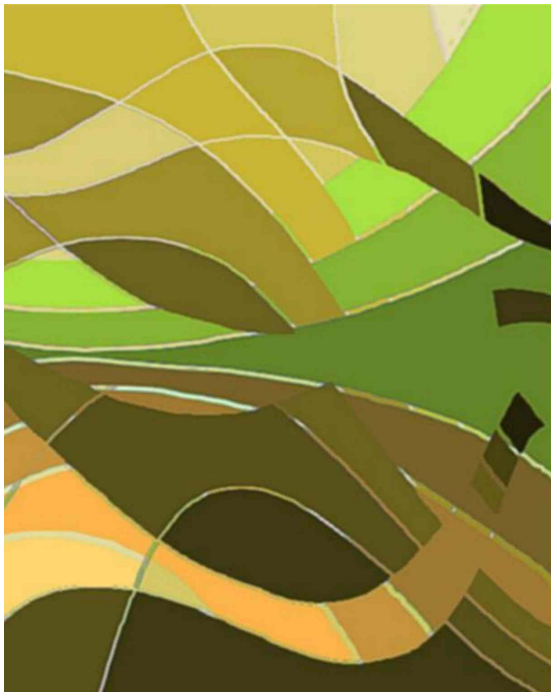
Planning, and land use, needs a revolution in understanding and outlook, or a new job for those who cannot organise this, I am sure DWP can help there. The '60's has come back again, with all its ingenuity, surprise, beauty and harmony!

The cat right above was called Monster; he loved being inside the polytunnel, and had such character; he spent his life enjoying carefreedom that nobody could take away. He didn't have to get up in a rush each morning, and drive to work which was always pressurised, and made him ill. All he had to do was wait till morning, and the same costs were met by the sun for free.

It is something that hits you again and again when you live off the sun and wind; how difficult it is for people to understand that a life of strife only exists because nobody explained what the real factual rules of the world they were living in were. In a renewable-powered world, nobody owns you, and what you need comes as part of the package for free; just go collect it!

You will naturally change your outlook and aspirations. Yes, you will not need to take on huge debts to pay people to educate you. The absolute farce of university education occurs when somebody is paid to give the same talk year after year, when they only had to do it once in front of a camera, and then show it anytime needed on a monitor.

Education today should be virtually costless, after all the effort that has been made in this area. Instead, a huge tranche of very intelligent people get well used and poorly paid by rich beurocrats. It is hardly surprising that universities are rarely where real innovation comes from. Long live the spirit of the Open University!



My experience in life is that whatever you are told, education is mostly monkey hear, monkey say, and when you sit down and examine issues from scratch, from first principles, which few today are trained to do, each issue turns out never to be so simplistic or straightforward. However, doing that catches out the lies in dogma, and at the same time points out paths to solutions undreamed of.

The dogma concerning solar energy in the UK has been consistent: we are too far north; there is no value in the sun in the UK, even when efficiencies rise towards 30% and costs to $0.4/watt! There is also no heat economically worth collecting.

20 years ago when I started on this journey of opening my eyes, I could not be sure I was on the right path; now it is clear that an enormous shock is about to hit the fossil energy industry as we come to understand that we do NOT need their huge excesses. The young will realise this first.

This is a heck of a lot better than the alternative!! Gives you time to explore your creative needs. The renewable future will be a different, much more artistic and creative world than the one you inhabit, so please make a good job of it, after I am gone.

Re-Wilding(RW) vs Re-Forestgardening(RF)

This is a critical point that is working its way through Scotland's consciousness at the moment. Both are needing discussed. The former is about creating large tracts of land whose purest purpose is to re-establish native conifer woodland that established after the end of the last ice age, to the exclusion of humans. The latter, to re-establish the same landscape in a mixed format ecologically engineered to mix humanity, with natural forest gardens, like Amazonia. There are strong arguments made for re-Wilding, but very little on re-Forestgardening, which is a shame.

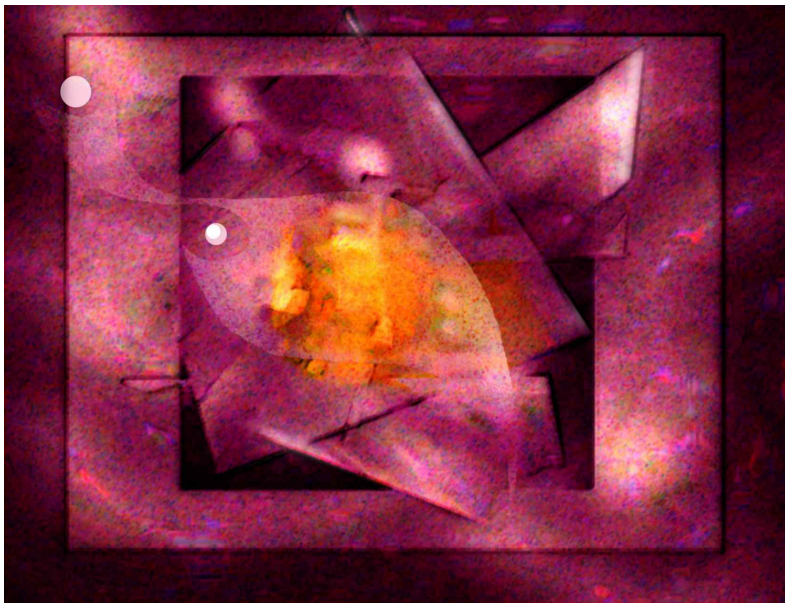
Both arguments rest on ecological wisdom. RW argues that this recreates the closest we can get to what Scotland looked like before human influence, and RF argues that we will need all the available land for human use in the future, so why not engineer it as Amazonia and many other resilient communities across the planet did, and do. Scotland's problem in the future is that by being surrounded by water, the worst aspects of the climate crisis will be seen less: the water ballasts temperature change. So LOTS of people are going to want to live here, all kinds, creeds and beliefs, in a way that is ecologically sensitive.

The RW argument has aesthetic merit, but not for long. The RW landscape has a poor carrying capacity, trophic status, or resilience. Conifers are shallow rooted and create around them an acid oligotrophic nutrient-poor soil which has a low associated biomass carrying capacity. It is pretty, and vulnerable. By mid century occasional severe flash

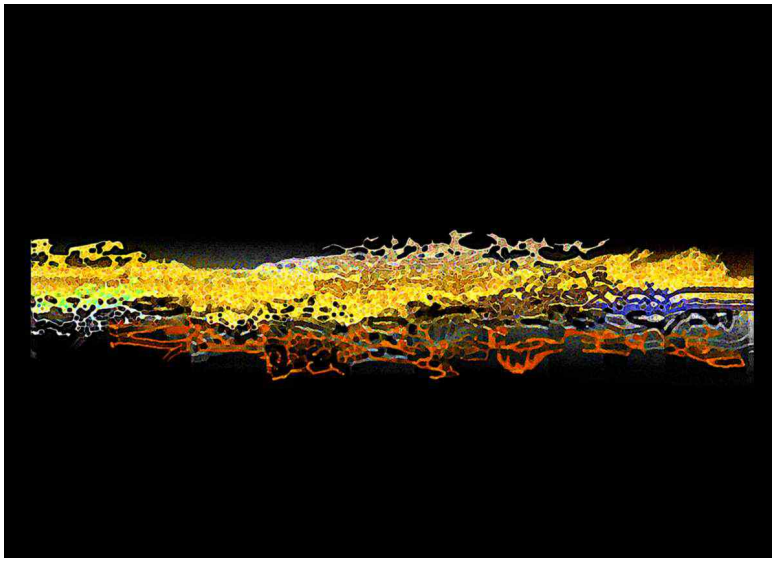
drought will become commonplace in the UK. Conifer woodlands will die off, you can see this starting to happen already. Invasive species will take over. Community forest woodlands are legally required to replant as conifer, when they would be much better to do so deciduous. Deciduous woodlands are the ones as a botanist you would instinctively choose in RF format.

They are deep rooted: look at the success of Sycamore and Beech across Scotland. Deciduous woodlands are eutrophic, the associated accumulative biomass is much higher than conifer, and the turnover rates of nutrients much higher. If you want to see the difference simply go walk among the two, listen to the wildlife, and do not use the word 'rare'. Rare is a legalese ecoword word for “I can control this land to the advantage of my values, how I want the world to be and how I contrive this”. The past was never rare: as a kid everyone disliked corncrakes for the racket they made at night: they were everywhere, now they are rare and everyone is happy.

We are in thrall with those who love conifer woodlands when we should be with those who love deciduous, and when we plant native deciduous we deliberately forget to plant trees whose fruits would also benefit humanity, were they to be allowed to live there again. There is an even more powerful argument for deciduous woodlands managed by humans: it is that they can be encouraged to respond to climate change in a quick, intelligent, and positive manner, the biggest problem with RW is that for some rather stupid reason we have to await nature returning the correct plants to the landscape, a process that can be easily ridiculed, since rhododendron will naturally outcompete conifer, and is already doing so across thousands of acres of moorland. RW is going to have to become RF anyway as invasive species take over, so why not also allow humans on the landscape to shepherd the process.



The RW argument badly messed up over winter when snow banks grew high enough to support the weight of deer, then allowing them to recolonise RW areas over deer fences. Nature has a determination and resilience we forget too easily. Talk to Mull voles.

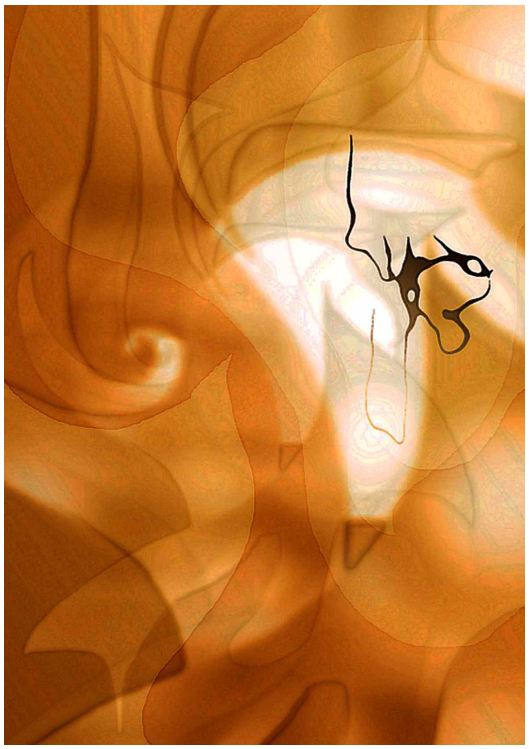


As my parents did, I ache to see communities long-closed, open up across the highlands, with humans treating the landscape as fervently as Twitchers and Rewilders do, but living integrated into this landscape sensibly shepherding their ecosystems as many people already want to do.

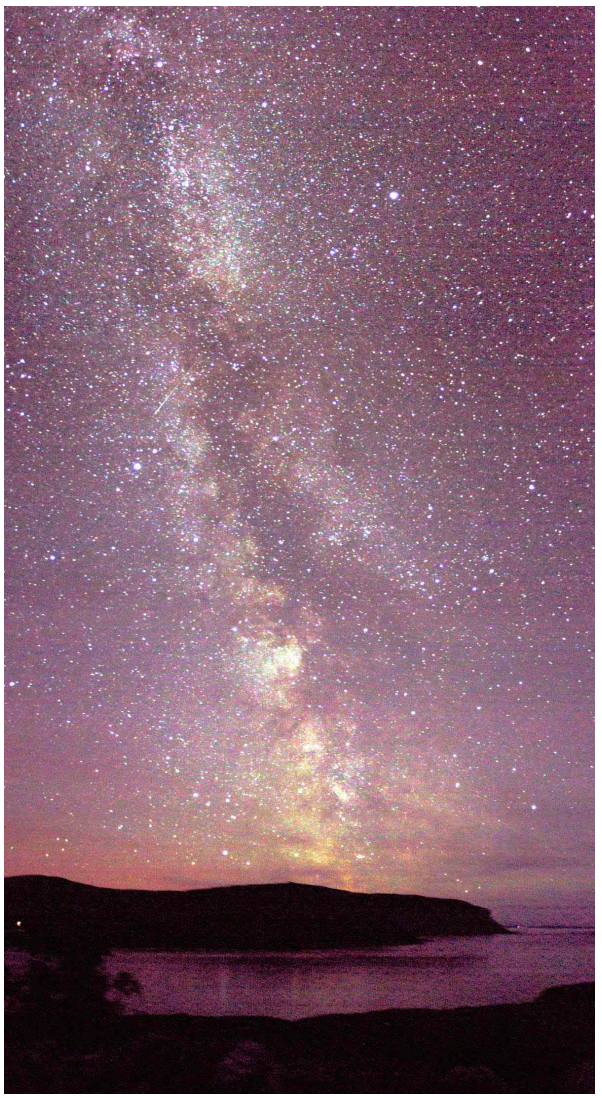
Legal control of the landscape is a priority among many rather stupidly created and financially supported agencies, from RSPB, to SNH and Historic Scotland. It is a way of legally stamping the clearance mindset on unruly locals who sensibly ask “Why not allow humans back where they came from, when they had in the past chosen the sites so carefully for renewables?” It is a cruel logic that states that ecological enhancement of the landscape is needed to help nature, to the deliberate exclusion of humans, because nature is not clever enough to know how. Giving a home to nature? are you kidding? Really?

Postscript:

I have to end with a description of the world as we need it, one where by living healthier and happier lives, we reduce the need for state and economic systems that currently are themselves deeply addicted to taxing and punishing unwell, overworked, humans.



The end will come as EROEI (export land model) declines far enough to hit the ability of states to employ, and reward those who run them. The rush to monetise everything, even the need to piss and crap, signals that our bureaucracy is in clear dependent decline. No amount of offshoring for profit can change the mathematics of energy use. Economics is a grand lie, though it worked for many, for a while.



At some point in the future we are going to have to abandon the rules that got us here, and we should be talking now about some, in particular, very seriously.

The re-dispersal of people on the land is a natural way to solve our problems, and many will have the courage to try and develop high land most could not currently care about. I find the challenges wonderfully exciting!. That land is needed now to set up this great adventure. It should be one with high tech roots, as well as a return to wiser yet simpler times. For those young enough to get their hopes up, take it from me, all this is possible. Communities can be built today that have few CO2 emissions and quite probably also pay for themselves through ingenuity. I still feel that somebody has to corner planning and politics and say, “No more NO”, and give no option but acceptance from those of high status.

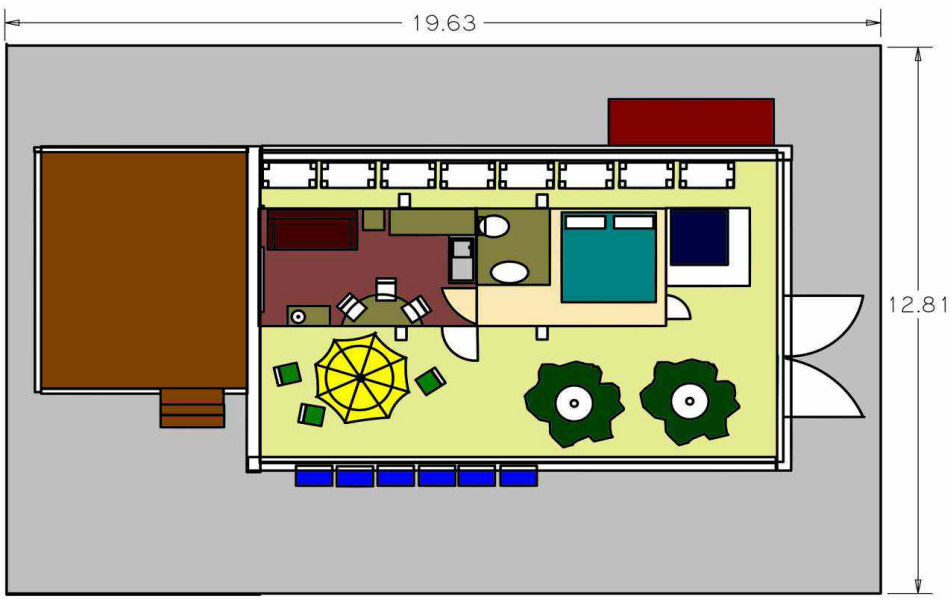
The land needed is there, up high in the clouds. Personally I feel that if you own more than a dozen hectares and can not make a living from them; because your need for more is just a vanity project, it should be yearly taxed exponentially based on size: the more you own, the higher the tax, eventually forcing you to either use or sell it. We have proven over the last 30 years, that a hectare is all that is needed to adequately feed a family. With a population of 5 million, and possessing roughly 5 million hectares of usable land, Scotland could still manage to feed itself, and re-carbonise the landscape (only 1.2 million hectares of usable land if the Gulf Stream collapses).

If you try and block what is evolutionarily common sense, then I think it will it will end in pain for many, though you may hate me for saying that.

Appendix 1

This is a little more detail on the sunspace bothy design.

You start by buying a half size shipping container, though full size would do as well. The internal conversion is into one or two rooms, with east end access to the outside world, east is better from an exposure point of view; the drawings show west, the prevailing winds are south westerly, and an internal access to the sunspace polytunnel later put over the top. If you build the polytunnel first, then you can borax coat locally sawn timber, and dry it out to close to kiln dry in one season; also making it fireproof, for use inside the container. There are many ways to build this, each with different merits. The main idea is to make sure that what you have is almost immediately watertight and habitable at below £10,000 self build.



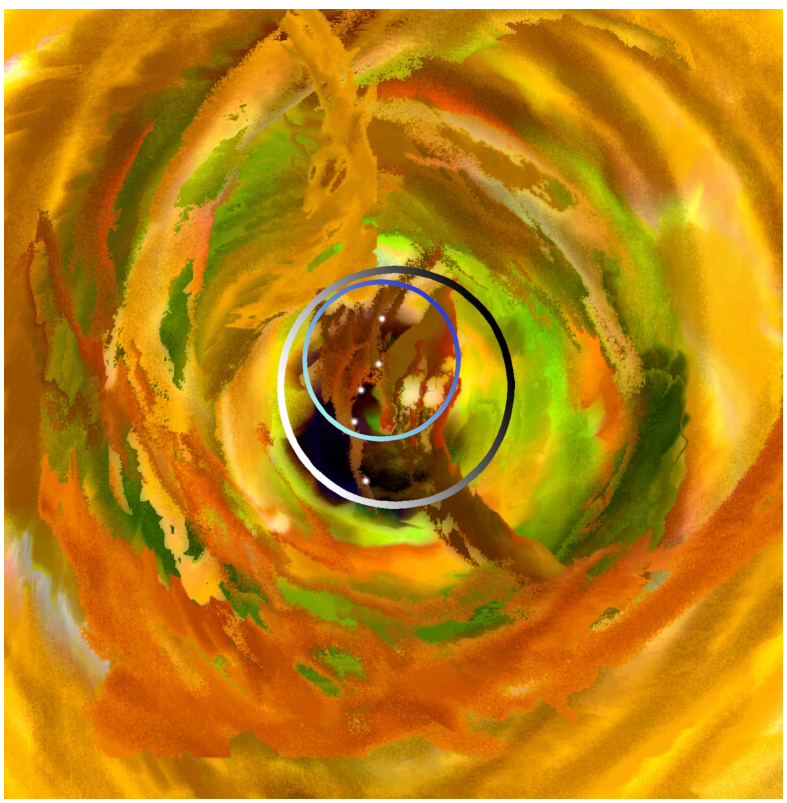
The version I will build for myself will probably start with a half size shipping container, though I would love to try a full size one.

Enclosing it is pretty straightforward: polytunnel technologies are simple and well tested now in horticulture. I have assessed how you manage to get one to work well using huge amounts of energy storage, again well tested, and shown that plants enjoy the growing environment. Yes, it can get hot, but can also reach astonishing temperatures in winter on a sunny day, and the visual brightness is extraordinary.

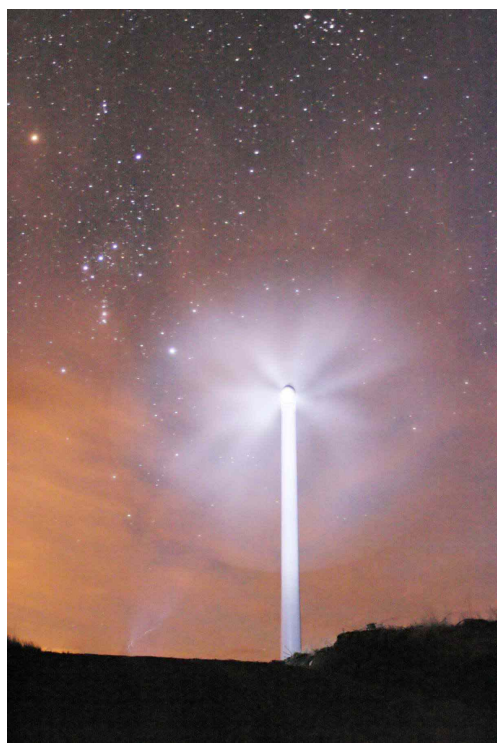
I have worked through so many versions, you can literally take your pick. A sunspace is a large open sunny place which is cool on cloudy days, warm whenever there is a flash of sunlight, and balmy to hot on sunny ones, for 8 months of the year. There are so many ways you can play with the design to create the ambience you prefer. You use the tools of reflection, absorption, and storage to manage incoming energy.

People who visit will stand with their mouths open, unable to speak, such is the surprise you get on a cold blowy day in spring, with just a hint of sun.

In April you can easily achieve internal temperatures of 25-30C, when outside snowflakes are falling on the skin, and the outside air temperature is at freezing with windchill, maintaining these temperatures by capturing sunlight between the showers. Snowflakes slide down the polythene without melting. All this has been fully documented, and witnessed, time and time again. The prototype has hit 25C at midday on Christmas day, once, when snow was lying on the ground outside.

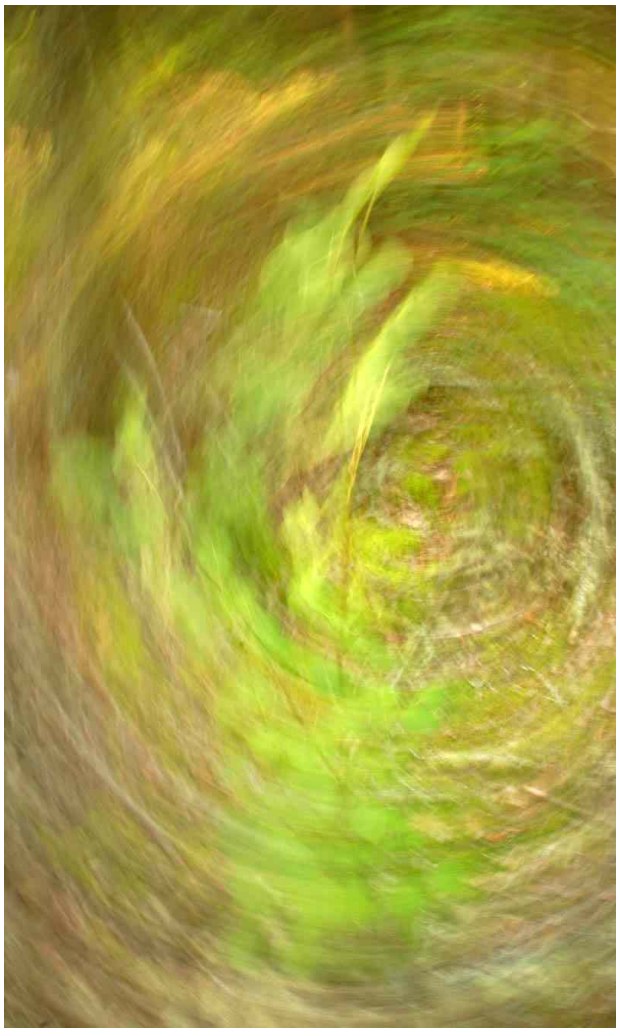


The sunspace is wholly unlike a standard soil-based polytunnel, which is sweaty and hot, as it is bone dry and has the ambience of the Gobi desert, or southern Mediterranean. It is it's winter ambience I love, and it achieves that by clever dynamic thermal mass which I will explain later.



I am very excited to be starting this final push now. I don't know where this shipping container will end up, but am preparing it to develop further solar air heating versions that would not have the sunspace, just the shipping container.

I ask only one thing, where it goes, I need support and a welcome. By that, I mean that if I am bringing such a well-researched design to fruition in your community, I expect you to pull your weight as well; for it will benefit everyone there.

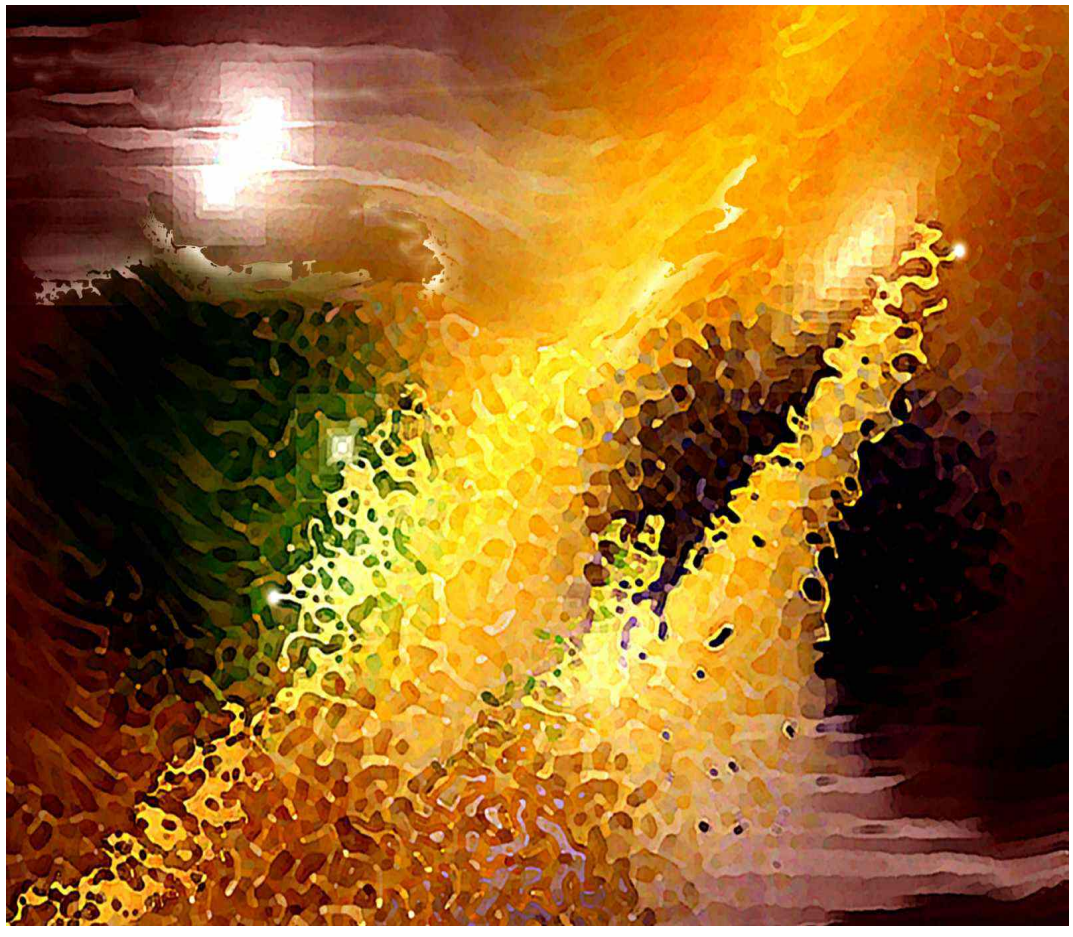


The current reactions I have experienced, were from lazy people who expected someone else to do all the work, and I find that, after 20 years of research, paid for by my business and personal funding, an insult.

The most attractive version currently being proposed has been turned down by planning, but would be both lovely to live in, and marvellously refreshing to experience. I am sure you could self-build it for £20,000, but am also certain that building control would do their utmost to kill it. Why? Because nobody wishes to allow such innovation to be built if it makes homes for poor people look better to live in than those for rich people.

We cherish business innovation ONLY if it does not threaten the status quo, and this design buries it dead. If you can live so economically that it gives retirement at 25, then I think few will choose to destroy themselves for a further 40+ years.

As a deafened person of 30 odd years, I also forget that this living space is alive with the sounds of the natural world around you, I need this because for me standard houses are deadpools of nothingness, without a sense of the world around, deafness in a standard house is close to hell, especially with loud tinnitus. I knew one person who having fallen deaf, then traversed an urban mid terrace flat all day, back and forwards, every day staring out at the world, trying to connect. For fun I will put up sound files on my website, from the prototype, showing spring and storms!! It makes me feel alive.



I am just waiting for the Class Action to be started representing all those who now know that their homes and roads are going to be flooded, while the Council sat on their thumbs and refused to change. What a painful Class Action that will be, to a Council then desperately struggling with a landscape being inundated by rapid sea level change, and a Scottish Government in chaos because we burned through all our oil, with little to show for it, and cannot afford the huge CO2 cost of infrastructure changes then needed.

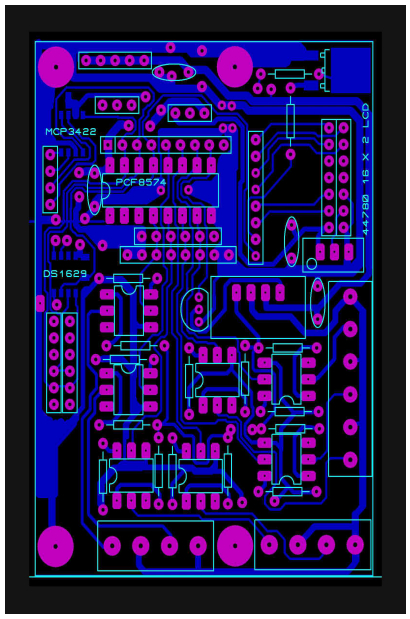
Antarctica, and the Arctic, has the knives out for us, and 250 million people are close to having to migrate to cooler climes. In 2019 it has been a satisfying moment to observe the weather reflect climate change. Now it is so obvious that nothing can be considered stable any longer, that each winter the worry will be for storms we have not experienced since 100,000 years ago, and flooding and freezing due to the gulf stream shutting down with winter temperatures heading for -30C wrecking our housing stock.
If you mock the sincerity and decency of those scientists who have given their lives in very difficult conditions, can you blame them if

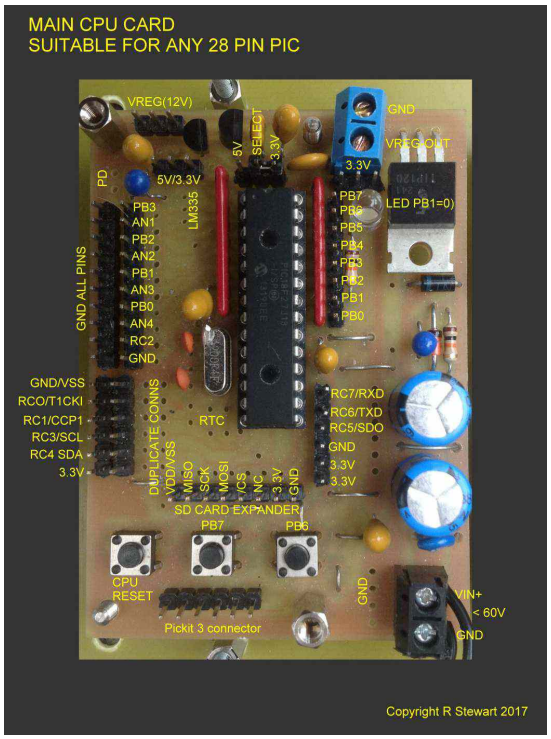
they now longer bother to warn you as loudly as is needed? They know what is coming, you do not.

As to the survivability of the sunspace, I prefer to protect it carefully and with respect, for it would also be able to keep me alive while clouds of radiation passed by, in this new world we live in, where homes need to be able to close down, and survive the unimaginable; which all but this design cannot.

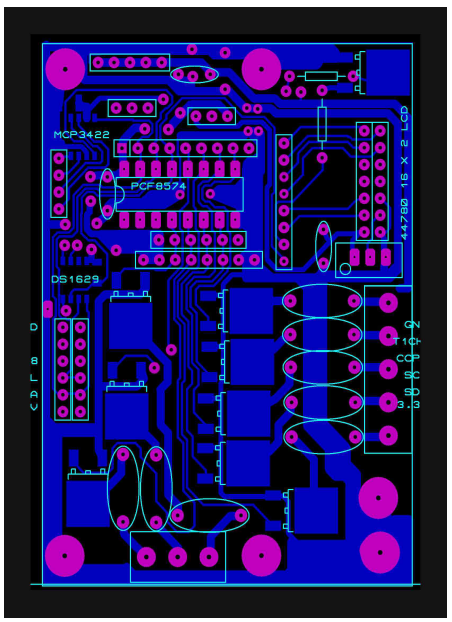
Appendix 2: My Electronics

I have designed 5 basic cards which are easy to build, and can control many different type of situations, so that these generic cards

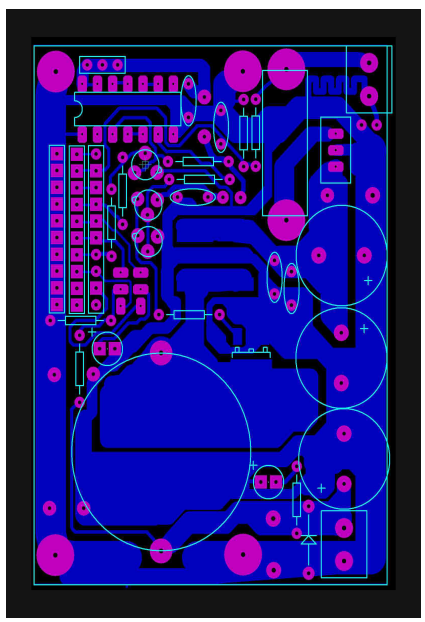




can be used by anyone. There will be a book shortly released on them. They are also evolving and improving.

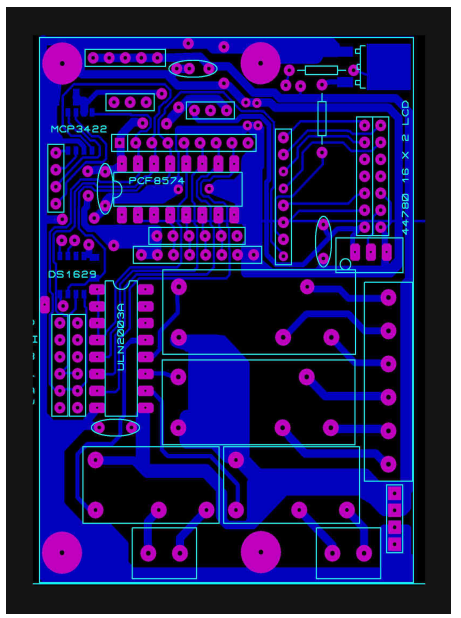


These 5 cards can control almost all you would ever need, they are stacked out with capability, and unlike the Arduino cards strongly



protected for reliability and ultra low power consumption. The CPU card can handle up to 100V DC, is current protected, and reverse polarity protected. The 80W maximum power point tracker card is able to maximum power point step up direct solar panel 17.5V to 24-30V DC to charge 24V batteries, the galvanic input/output cards allow you to measure switched events without interference and the Inverter driver card controls a second hand 700W APC UPS which cost £35 on ebay, so that you can make your own sinewave 240V AC. All are or have been tested for about 5 years now. They are programmed via a Pickit 3, and in the compiled language Proton Basic, with a powerful operating system software library that has been 15 years in the writing. They are a lovely mix and match that allow easy fault finding.

The beauty of modular design is that you can build and test out designs very quickly, the ability to prototype fast allows you to make the mistakes at the beginning, and not the end of the design cycle; when they are often expensive and time consuming to find and fix.



Over the years I have realised that Basic is a better language to use with microcontrollers, primarily because they never suited stack oriented languages like C or Python, due to lack of stack depth, until recently. I also hate coming back after two years to a tight C program, compared to doing the same thing in Basic. Finally, if you were going to teach this system, the easiest language is the most effective. Proton Basic can handle Assembly language and Interrupts, reliably and is a fast compiled language.

Appendix 3: The Killiemor Prototype

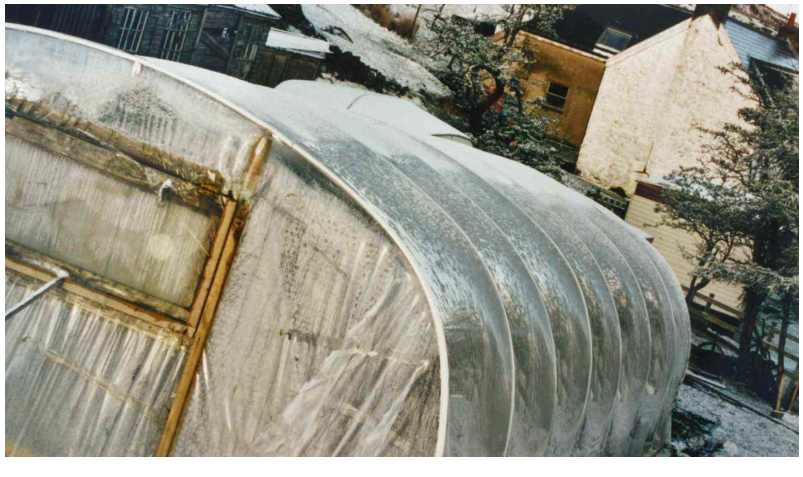
I debated not including this, and in the end was embarrassed, because it shows how people help and care for each other, and how community matters. It is impossible not to explain a little more, about the decency of those who helped.

On surveying the 1995 internet, I discovered a wealth of knowledge on what had happened after the US west coast hippy boom had lost its soul and hopes, and turned into self-interested capitalism. Surprisingly some had kept their roots, and had explored a (mainly) solar world ahead.

OK, only a few, self-funded.

Working by email, I realised that I needed to make a prototype here of the sunspace ideas I met online; thanks to Nick Pine and his acerbic personality, it got there!

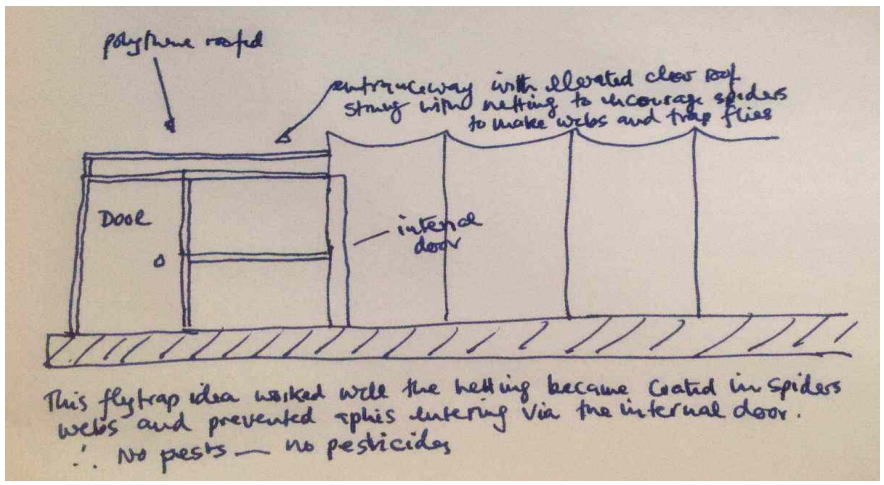
My Mum had sold her house and gave each of our family a dividend to do what we wished. I bought a 14' x 40' Northern Polytunnels hobby polytunnel, (3 year life polythene), and planted it on top of 40 tonnes of mostly type one aggregate from Pennygown quarry outside Salen. That was pure luck, but it turned out to make formidable concrete, and unbeknown to me had a thermal heat capacity higher than most rocks (basalt).



Since I was fairly ill in those days, many thanks to those who helped! When everyone else laughed at a polytunnel going up on the west side of Mull -“It won't last a winter!” - turns out it did, and is still there 23 years later.

We constructed the frame, and put the polythene skin on, after long days making a concrete foundation, which did not appear necessary, in May 1997, on a southerly wind threatening a good blow, and lousily cold as I remember. No idea then what would happen. The polythene skin was slack and safe by about midday. We took a rest, and by mid afternoon, the inside was sitting at 35C.

The shock of that day bears thinking about, when it was 5-8C outside. Nothing had prepared me for this, and no amount of rationalising the science made any sense. This was absolutely impossible in a polythene-skinned airspace. Completely impossible.
Everyone told me so. The published energy loss rates are too high, for this kind of temperature difference to happen. Yet I have it fully documented using high accuracy temperature sensors. This was as if I had used glass.



It really took me 8 months, to work through the issues, because I also tried out using Tonzon film to reduce north wall heat-loss on this West-East oriented sunspace. Look at the picture on the previous page, on the north side snow was still frozen to the polythene, to the south melting at about midday, inside about 20C. That was pretty stupid too, though it did impress the locals. 55C inside in summer does that to people.

It was possible to form a condensation skin; the cause of the effects, and then blow off all the internal humidity that created it, during a morning, leaving an internal airspace that was a pretty good version of the Sahara. All on Mull, in summer, cool-with-rainy moments. The local reaction was as expected: “This is insane!” I must admit to having enjoyed seeing people arrive, full of self-confidence, and then stand inside in total shock. They really do: mouths hang open.

Looking back, it was very funny, but at the time, it was a personal nightmare. I had to go back to first principles, which is all that a PhD is about, and show that small sub- millimetre sized hemispheres of water, little drops, were condensing on the inside of the polythene, (if kept squeaky clean), and then reflecting back any energy that came in and was absorbed. It was easy to use a windscreen wiper blade to remove it quickly across the whole south side of the polytunnel, to show it went cold instantly, and as it reformed became oddly warm again. (All surfaces reach the same temperate through internal reflection and radiation, then convection and conduction minimise, and then air movement stops). I had effectively built a sealed glass sunspace made of polythene.

After tensioning, it has never needed retensioning, which I was also told was impossible. All polytunnels need to be continuously retensioned. So the foundation was worth the effort. Then followed 12 years of using this sunspace and various growing arrangements of huge water stores (3 tonnes), and 8 growing seasons of mostly successes and some failures, to prove that I could grow anything really without pests. Mice dug in after about 12 years, they brought aphis with them, but twice now

I have seen aphis on tomatoes eliminated, by what vector I do not know, perhaps ants, perhaps spiders.

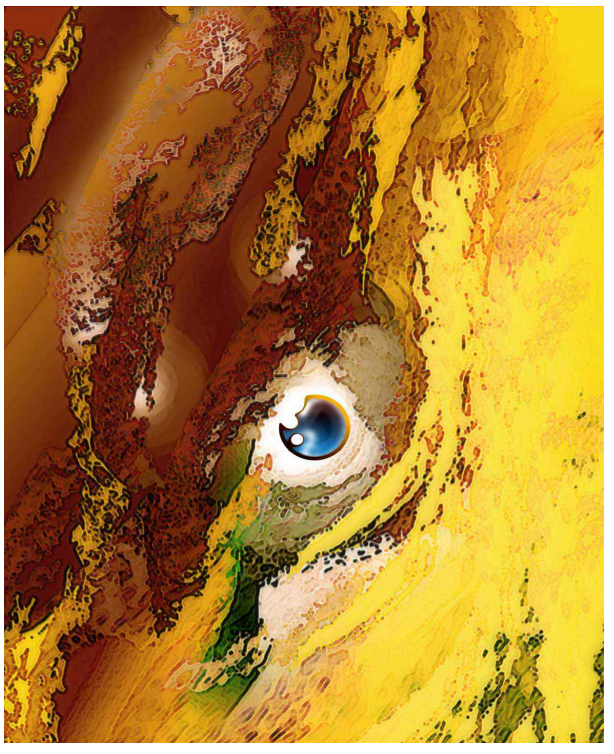
Looking back on the amount of work involved, is hard to believe. Aphis was also banished by the entrance-way design, a cute spider trap.

It is still standing fine, clear, and well, would make 30 years easily, now I know why it has lasted so well.

Sadly the Peruvian seed Lulos (*Solanum quitoense*) flowered but didn't set: they would have done had I had longer sunny northern evenings, as I discovered in Washington DC, where they do.

I would also like to try multiwall designs with high insulation values.

Some of the design rules:



Create no shadows which make for cool spots pests can survive in. In summer all surfaces should be high thermal mass, in winter low. The surfaces of all high thermal mass objects must be accessible, and cleanable, as they will form condensation, and be used by slugs and snails.

The condensation skin evolves, and requires daily clearing and reformation, evening to morning, I choose to do so using surface vibration, and spray.

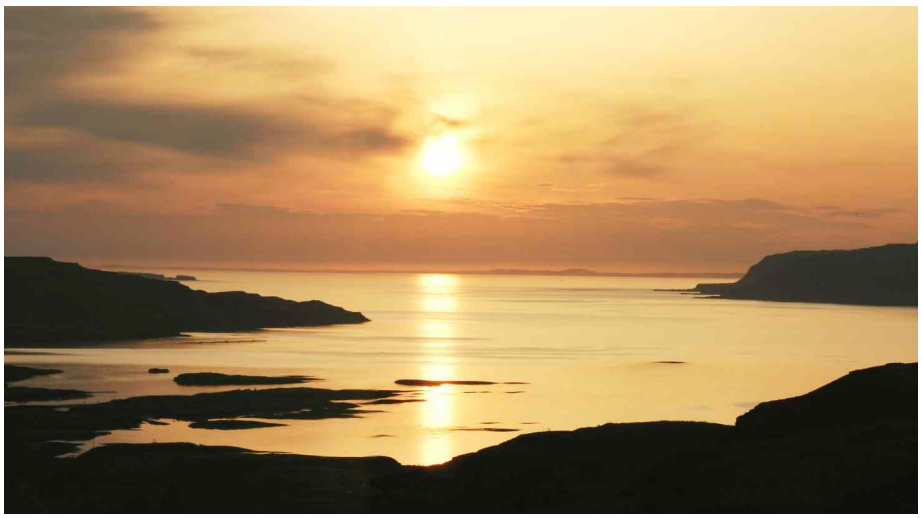
In winter the north wall must be protected using insulation and radiant barrier film, to minimise heat-loss, I anticipate using removable panels that clip and overlap to the hoops. All flooring should be low thermal mass behind which is radiant barrier to prevent heat-loss downwards, again removable in summer.

To maximise energy gain reversable panels can be used on the shipping container, which can either be reflective (white surface) or absorptive of visible light (dark surface). If the whole sunspace is white in colour, the energy in sunlight will be reflected outwards. If so protect your eyes, or you will get sunstroke, I am not joking here.

Organise layouts of water barrels which place plants above in trestles, while also allowing the barrels which need to be dark-coloured to absorb sunlight. All springtime solar shadows should only land on walkways. This forces the root zone temperature above, at night, to be stabilised well before end of March by warm air rising from them. Think 3D when arranging plants, three layers are easily possible because the sun provides far too much brightness. Photosynthesis saturates at 3000-10,000uW/cm^2, summer sun is 100,000uW/cm^2.

Water use is high, 1l/m^2/day, you can reduce this by preventing the root zones overheating using reflection, critical in summer, as the greatest weakness of growing plants in this environment is excess rootzone thermal cycling (pH shift). Tonzon is critical.

Keep mice out by rolling the base tension batten to the outside of the polytunnel, this creates a large roll of polythene outside that confuses them. Calk the boundary between concrete and polythene on the inside. Raise the walls to make it harder for them to gain access.



Slope the concrete outwards to throw condensation water out of the polytunnel by capillary action, or inwards to keep it. Clear the polythene with a windscreen wiper blade for the first three weeks to bring to cleanliness needed, and do NOT let flies in, as they will die trying to get out, release nutrients and green the polythene. Use ventilation systems that retain the heat in the bed, and reduce the need to ventilate.

Use muslin filters on windows, and fans to keep insects out: big flies will sleep underneath the polythene in winter and birds will peck at them, penetrating the polythene. Cats love sitting on the top of the polytunnel: make it easy to get up there, or they will use their claws! Bees will get lost and die inside unless you shelter them and give them a home. Don't smoke inside; grow herbs like basil for fragrance. You can get three fruit crops out of moveable tubbed cherry and plum.

The heat protection teflon foam tape on the hoops must be wire wrapped down or it will slide sideways on the hoops, exposing the polythene to the hoop metal surfaces and wear; this is the only way to stop it sliding, and if not done will shorten the polythene life.

If you want to increase heat-loss rates, use floor to ceiling groups of water barrels: this will set up strong vertical air flows, and bring about immediate heat-loss. Ensure condensing environments are cleanable.

NFT hydroponics doesn't work: the rootzone gets too hot. Compost that is fermented at high temperature is best, as it kills fungal spores. Precook all purchased compost for a year unopened, in an exposed part of the sunspace. This will kill off all pests. Do not bring in plants unless you are sure they are pest free: most are NOT!! I would say ALL. Beetles are impossible to remove.

Best to have an internal thin concrete surface (non load bearing), or one that can be sterilised. In March clear everything out, dessicate/desert the place for 7 days. This kills emergents.

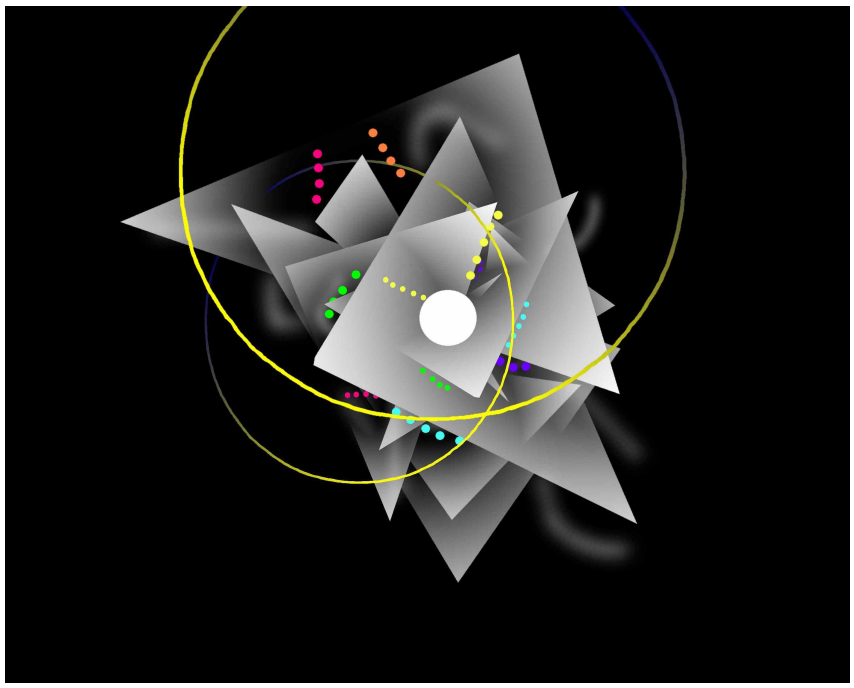
And Finally

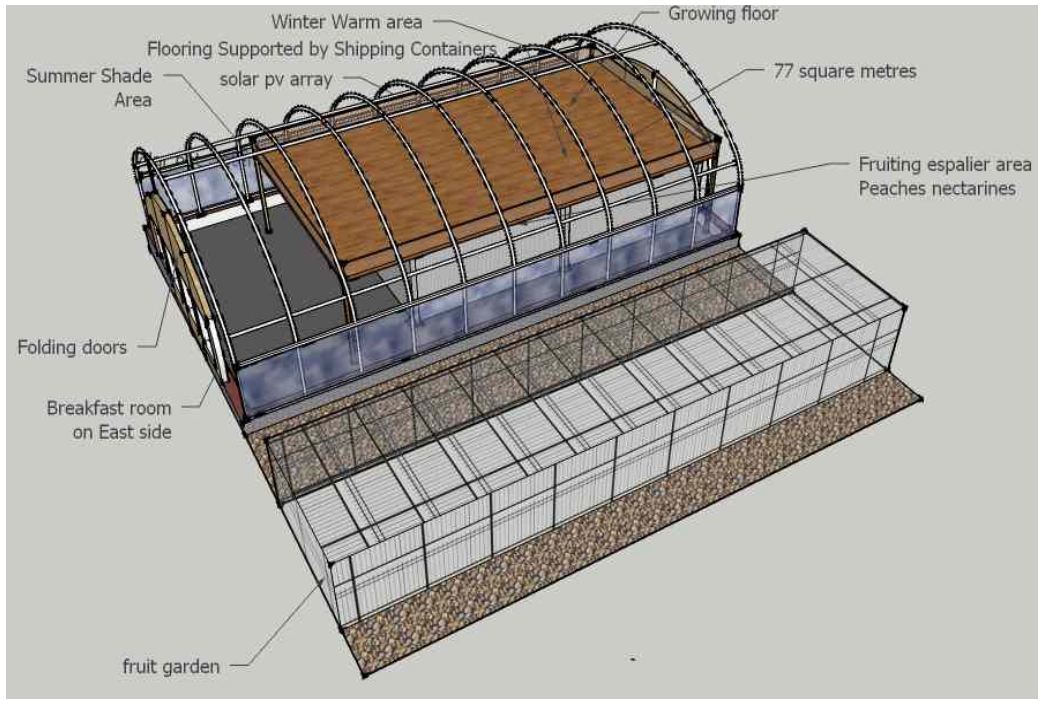
For the professional, this book will appear technically naïve, for several reasons. Appearances can be deceptive; this has been a hard lesson for me. What I am proposing is possible; and it’s very difficult to make it look this easy. At the moment intellectual discussions on Climate Crisis are stalled in intellectual relativism, which is serious. Scotland as a country, should be much further along the road to renewable independence

than she actually is, despite historical post-war investment in hydro-electricity (thanks to Polish people), and despite the fact that our renewables footprint, relative to most other European countries is so much higher. This advantage has been dissipated in our collective CO2 emissions due to North Sea Oil, and our very severe addiction to this.

It has brought a level of denial that is obstructive to the debate as to how we change our society from oil to renewables, without the infrastructure transformation costs, and the means to make the change being maturely discussed, in relation to the worldwide problems humanity has in this area.

David MacKay's data still stands: to manage this, we must reduce our working levels of energy use and CO2 emissions intensity per capita, in ways that will offensively impact employment, in the areas of consumption, heating, and transportation. Because of this, and because the issues are not being seen in scientific ergonomic terms, rather in pseudoscience economic ones, politics has got away with idleness and stupidity, when it shouldn't have. Since starting in 1980, I have repeatedly confounded those who say a problem cannot be solved, frequently utterly infuriatingly so. I know I can do this. Whether politics likes it or not, not wasting energy means not having to work to cover its costs, and this is highly palatable for the young person who simply does NOT wish to spend the rest of their lives working for someone else. It also is realistically possible; if you show ingenuity and refuse to accept a dogma that prevails in many professional outlooks these days, because we forget the lessons of the past, and refuse to challenge the status quo.





Appendix 4

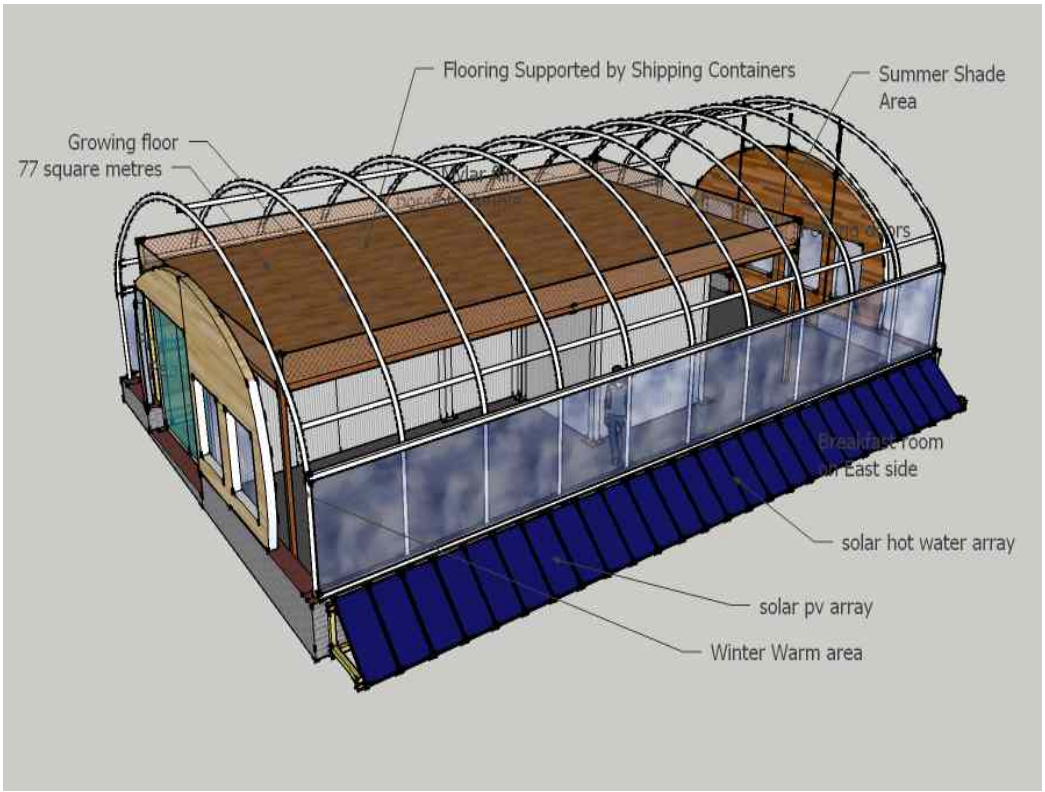
This is the original planning proposal, I would love to live in one, well placed on the landscape.

The Barmolloch Living Module: Outline planning design description

Design Statement

The Barmolloch Farm Living Module is a design of home that is probably the first serious attempt over the Northern Hemisphere of our planet, to build a modular home that fulfils all the objectives within the Argyll and Bute Development Plan, and the Scottish Government's plans for sustainable

development. It in fact defines many new living concepts, such as self funding housing, ultra long life designs, material science minimisation, true affordability, and building performance. As a consequence it cannot be seen to relate to the vernacular, in either design aesthetic, or achievement. It is a difficult concept to understand so broad is its scope, and potential.



It is NOT a **"Development that both meets the needs of the present without compromising the ability of the future generations to meet their own needs"**; as defined by the Scottish Government.

It is a **"Development that both meets the needs of the present while also <u>enhancing</u> the ability of the future generations to meet their own needs"**

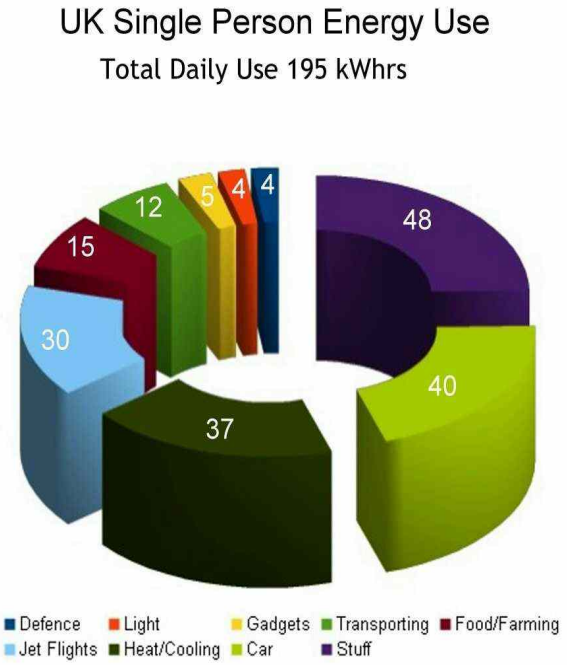
The first statement simply supports the status quo and lacks vision; the second expresses the need to give future generations the best chance possible

To establish exactly how it achieves this it is necessary to look at the pie chart below, which defines exactly what we must do to retain our rural landscape without drowning it due to CO2 emissions. Each heading needs to be drastically reduced as our energy use translates directly into CO2 emissions. It is the reduction of these CO2 emissions that will create a sustainable economy based on localisation of skills, energy resource, services, food supply, and homes that will assure certainty of continuity of the world we know and love.

To ensure that Global Warming does not exceed 1.5C over the course of this century, each of these headings must be examined, and their energy use altered to achieve this. It is currently estimated that reductions of CO2 emissions by 6-8% annum will be needed.

To most sensible people with sufficient understanding, it seems a near impossible task, because it immediately affects our ability to live and function, and for this reason is often being paid lip service to in words and writing; because it is such a hard technical problem to solve.

This is particularly true of the subject of affordable housing, which is currently truly unaffordable in either the present, or the future. This design is a solution to all the major headings, it for the first time incorporates food production within the boundary of the home, this food production uses plants growing directly from the waste streams of the occupants, and localises this on a farm.



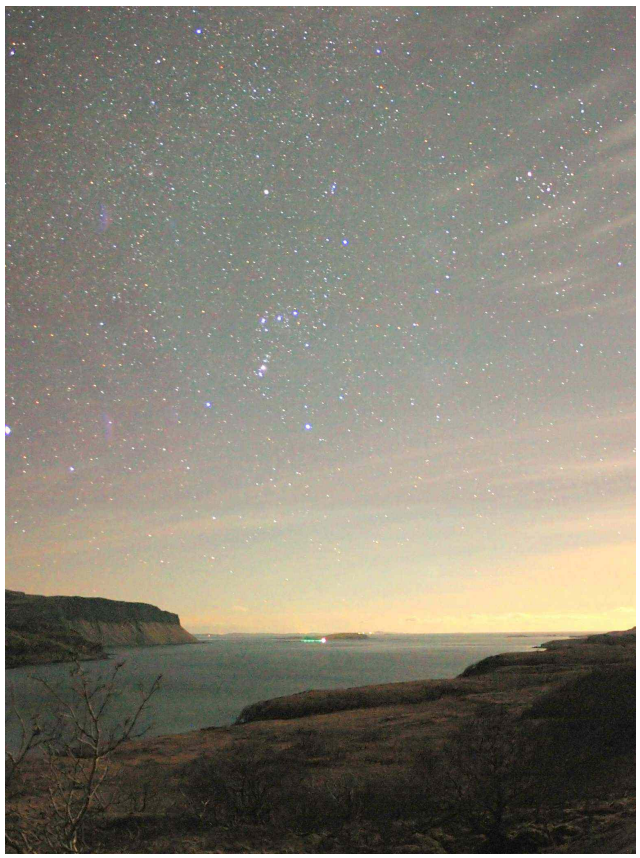
Next its ultra high solar performance; compared to anything conventional, and longevity, will allow it to pay for itself through the energy it creates and the food it produces. As the occupant will not need to travel, it substantially reduces their associated CO2 footprint, and because of its wonderful internal climate will eliminate the need to travel to hot parts of the world for recreation. Finally even seen within conventional building perspectives, it costs so little as to be startling, because nobody has ever tried to resolve all the problems of sustainability under one roof before.

As the designers we ask your patience and forgiveness at producing such an innovative challenge, and countering lies we perpetuate to maintain our unsustainable lifestyles.

Have patience please, you will love it, and be proud to make Scotland its first home.

Design Details

This text describes the basic format and function of the proposed Living Module membrane skinned home for the purposes of planning permission. Some elements are not described in detail on the grounds of commercial confidentiality, these in essence define the building function and performance, and will be subsequently patented once prototyping is complete. This phase will probably take about two to three years to test out.



Within some parts of the design, the material sciences will be chosen that do not possess a building Agrement, however, these will not be in conflict with any existing health and safety legislation, as this will be considered of critical importance to the success of the design, and to peoples' perception of safety and risk.

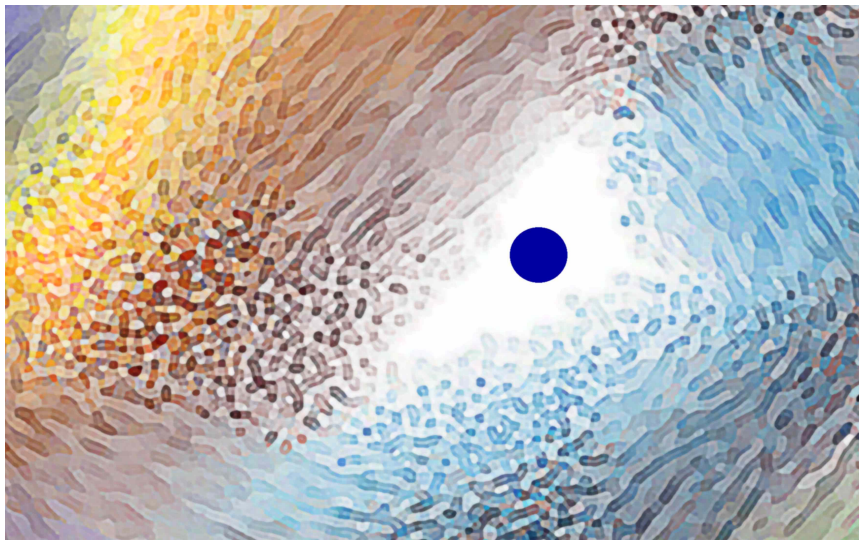
This is a very strange type building to live inside.

As a design in solar engineering, it breaks into two parts for both aesthetic, and building control purposes. The internals of the two shipping containers are laid out individually to conform to standard building control practices, with 240V AC power, fresh water supply and storage, separative greywater, and septic waste handling. The polytunnel living area, is in essence an indoor garden, will have features that more resemble garden centres and their building control requirements, than the inside of a conventional house.

For reasons of safety and efficiency, the power sources being driven in the indoor garden will be powered by 24VDC taken from the solar photovoltaic panels and battery bank

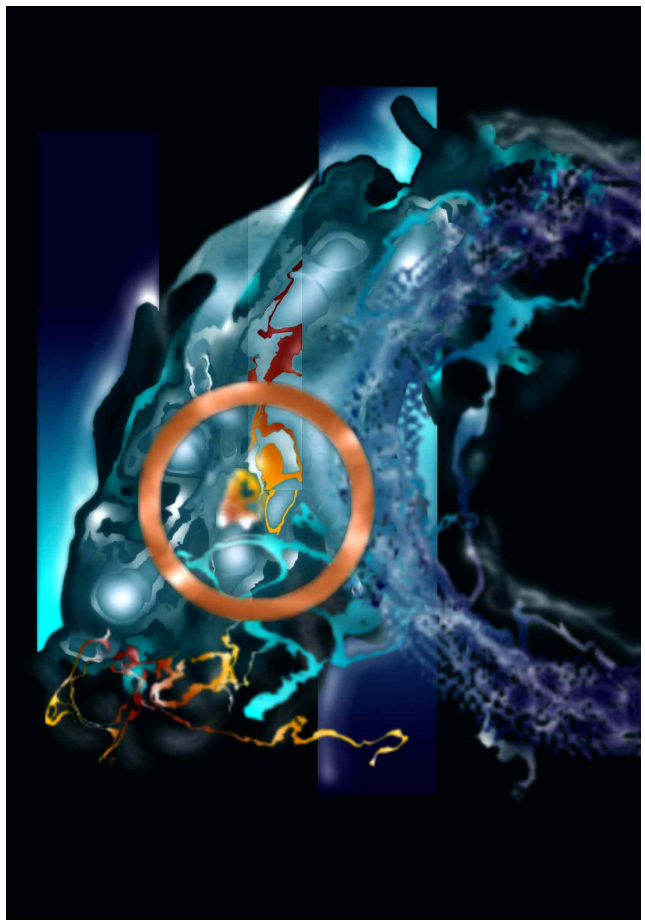
aligned externally to the south facing side of the structure. By removing the power plant outside of the envelope of the building fire hazard is substantially reduced, and is considered best practice for renewable energy installations.

Seen as a standardised shipping container home sitting inside a garden centre, is a good way to start to try and understand how this indoor garden might feel, but it must be emphasised that the structure can receive in total 1 MWhr (9600kWhrs/day) on a sunny June day, and how you deal with this is very important for user comfort and sensibility. The most common comment made professionally is how does it manage such excess of energy?



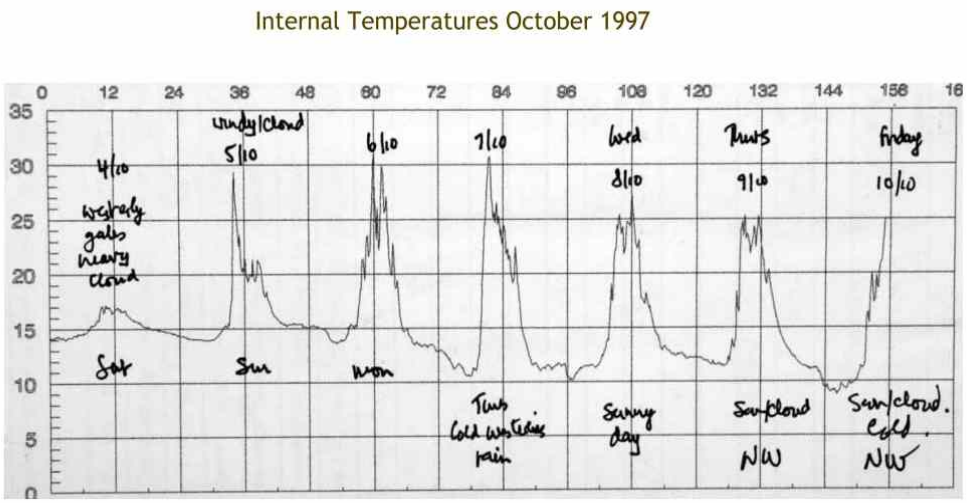
The techniques it uses are proprietary and developed over the past 20 years. The combined building structure uses air ventilation coupled to reflection, radiation, and absorption, with thermal storage arranged in highly innovative and dynamic ways. It will feel as warm as Portugal, for most of the year. The prototype managed 25C midwinter on a sunny day. In the US designs like this are called sunspaces, they are warm when sunny and slowly return to a few degrees above ambient when not. This variant feels warm most of the time, even when not in direct sun.

The purposeful growing of plants with humans afford great strengths to the design, you get to feed them off your own waste streams and they effect conversion of this into food and oxygen. This structure feeds you and keeps you warm and comfortable for free. While the system is not designed to run fully closed cycle, it will handle short term hermetic sealing, and could with little additional complexity manage closed cycle for weeks on end, meaning it is truly capable of dealing with events no conventional house can tolerably withstand.



This is simply a facet of a sealed hermetic design, and not its intention, yet it emphasises how innovative design can have many indirect consequences that do not add cost, yet improve performance. This cannot be said of conventional housing.

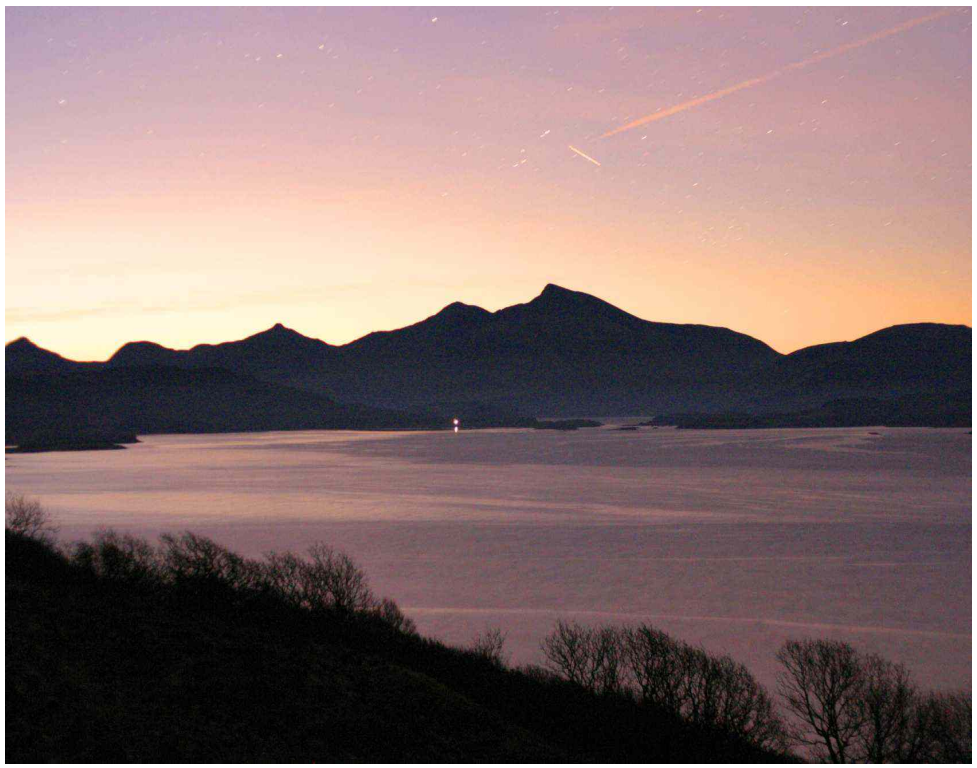
It is intended that the scope of the design serve many uses, not just as an economic home for farm workers, that might well pay for itself, but for use across the whole northern hemisphere, in many different design variants, based on this original. Refugee use will be very interesting.



The building requires about 10 skill subsets to understand, and manage adequately. At Barmolloch we are creating the facilities and intend to train prospective builders in how to manage these issues. We intend to create a centre of innovation based on this design and through this retain very high grade local employment, much needed in Argyll and Bute. People will visit from across the world once its strengths, and cost

advantages are understood.

This design has been about 25 years in development, and many of its facets are now so well understood that it cannot be adequately copied. This inherent advantage; it is hoped, will put the area on the map of worldwide renewable design innovation.



It must be emphasised again that there are currently NO straightforward design solutions to humanity's requirement to reduce CO2 emissions at a rate of 6-8% per annum worldwide, which people would consider palatable. This rate of reduction is needed to control climate change to less than 1.5C.

I must apologise for my bluntness, while making it clear that we should be starting massive home insulation programmes coupled to high carbon taxation to force people to change. We should virtually ceasing vehicle use, and reducing heating our homes or workplaces immediately; especially in winter to enact this rate of CO2 reduction, as these are the main sources of our CO2 emissions, and we are not doing so.

Fire safety in the design is paramount, and the whole airspace of the sunspace will have a sprinkler system in place supported by about 10,000l of cold water storage, possibly underfloor.

There is one accessible entrance to the shipping container from the outside via patio doors, placed for critical airflow patterns. This form of access is deliberate to avoid ingress of pests, or other contaminating materials. The shipping containers are floor mounted. The smaller one contains the core water services, and may contain a large heatstore between 4-6 tonnes, to conserve summer heat. To the south of the structure can be found a conventional solar thermal and solar PV array.

This is a concerted attempt at creating a design standard for such membrane skinned dwellings. Over the planet in the northern hemisphere there have previously been very few economic design attempts to create liveable solar heated sunspaces like this.

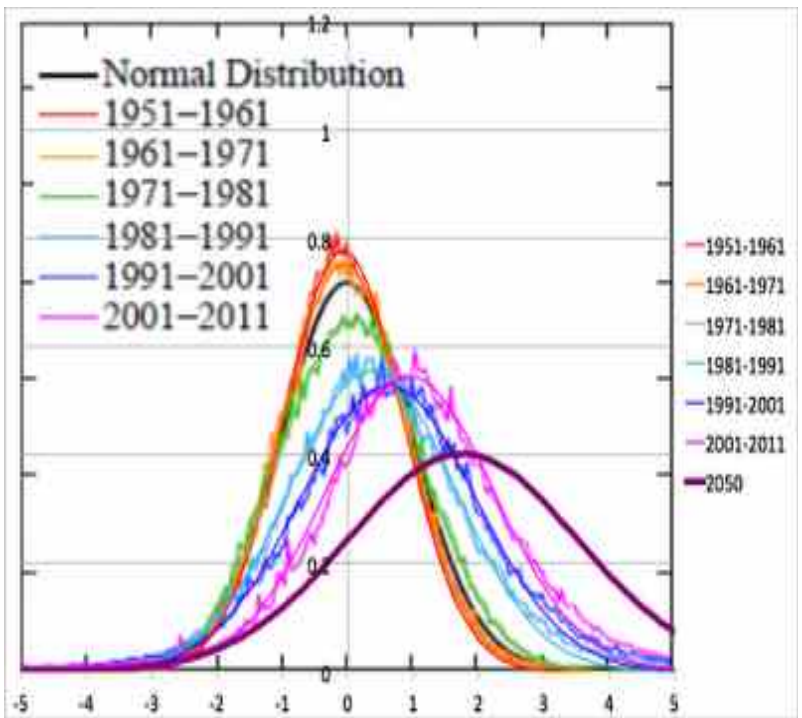
In Scotland, the Achiltibuie Hydroponicum is the notable and successful variant, created by Robert Irvine, in the early 80s, sadly and shortsightedly now demolished.

It was a design concept of independent brilliance, way ahead of its time. He showed that most plants whose fruits you normally would find in a supermarket could be grown in Scotland, despite external conditions being north temperate, and extremely inhospitable. He was the first in the country since the Victorian Era to make effective use of solar energy, in very imaginative ways.

His hydroponicum was the source of my own inspiration to take this further.

We are rapidly forgetting the lessons he learned, and in a world which has deep need for solutions to our CO2 emissions, these need rediscovery. He showed that despite a freezing inhospitable landscape, that you can achieve 20C internal

environments most of the year, all it takes is good solar engineering. He also showed that it is possible to localise food supply, thus drastically reducing road haulage and associated CO2 emissions. Solar thermal living coupled to localised food supply is capable of reducing to nil the two major sources of western CO2 emissions; heating and vehicle use, as shown in the pie chart (previous page). If you get it right you also reduce the need for hot holidays and so the CO2 emissions relating to air travel.



This design is primarily an extension of 20 years of prototyping work, personally made by myself on Mull. It was proven conclusively over 8 growing seasons that the 14' x 40' sunspace developed and tested could handle both extremes of heat and cold you would not think possible.
The graph left shows how our weather will become much warmer more frequently as the next 20-50 years pass. The data extrapolates a world we cannot recognise today, full of extreme weather events. Nobody is currently proposing any immediate, sensible, low cost, high performance solutions to these CO2 emissions, worst case scenaria will become the norm, in a world hugely unprepared for the consequences of ignoring them. In the near future, the excesses of temperature which we will more frequently see will exceed anything humanity has ever experienced this far north, and for that reason it must be emphasised that the design is a standardised attempt at resolving this; tolerating extremes of both heat and cold in ways that would be highly unconventional in relation to normal building control regulations.

Extreme cold also is a threat due to the cold pool of Greenland meltwater growing to the west, this is predicted to turn off the Gulf Stream (AMOC) by century end, which will depress winter temperatures across the whole of the western European shoreline in the future.

The thermal engineering of the indoor garden involves using dynamic thermal heatstores; these are capable of damping down temperature extremes, coupled to elegant use of heat loss processes. This has never been attempted before in a structure with such wide dynamic range of energy inputs and outputs.

The upper floor will be used to grow foodplants. It will partially shade the lower, giving areas of localised comfort even in very hot weather.

In very cold weather a large heatstore located inside the small ¼ size shipping container will also store large amounts of summer heat to support the shipping container home internal temperature. This has never before been attempted, and should dramatically reduce CO2 emissions in winter.

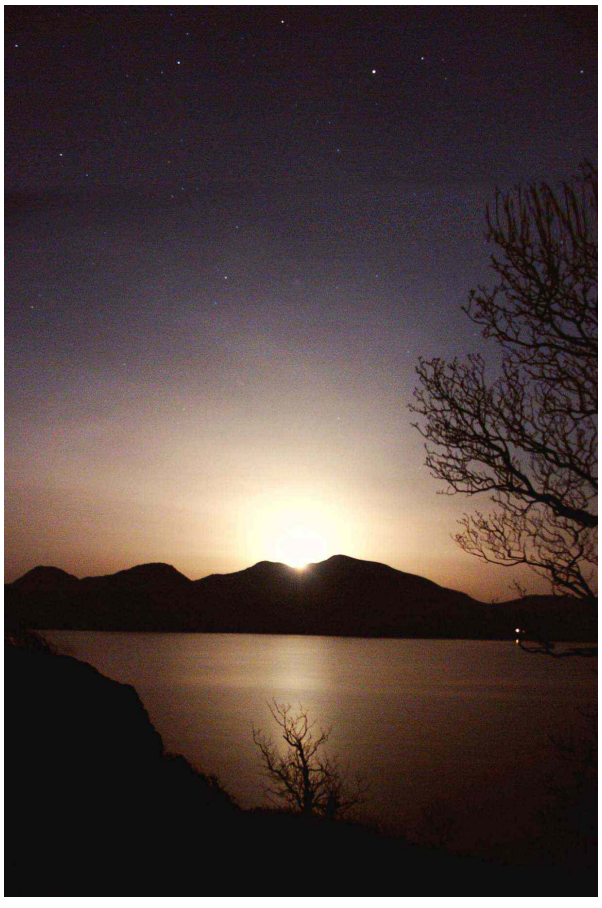
Because the internal temperature of the sunspace is higher than ambient all year round, the energy needed to heat the shipping container home will be reduced dramatically. It will also be insulated to higher than standard building control regulations because of the possibility of overheating inside in summer.

Plants grow strangely inside this sunspace due to the elevation of CO2 levels by the occupants, cats love it!!

Barmolloch Farm is a subdivided original, and as such has restricted available land, economic diversification is the wholistic business strategy being developed. As the farm has need of employee accomodation, and as local housing is unavailable at the cost needed, we have chosen to seek this opportunity to solve several important problems at once. Economic and comfortable farm worker accomodation is a continuing social rural need in west Scotland; one that has not been adequately solved by conventional design, which remains very expensive. Looking at the Argyll and Bute design statements in the sustainable materials and technology case studies, what catches the eye, is how minor incremental design change is being praised, when we really need complete design reappraisal for fit for purpose dwellings in the future. The extraordinary resistance of the building industry to Moore's Law type change can be summarised easily.

These following five issues never get grouped into a functional solution; at the same time, and should.

1) Human waste nutrient stream recycling, human urine is valuable as a farm nutrient, each person releases about 20kg of nutrient a year, which in normal housing is completely wasted. Its high Nitrogen, Phosphorus and Potassium content is important for vegetative and reproductive plant growth.
2) Human food production is not being integrated into the design of human living spaces when it should be; because the future needs it. Being able to grow your own food is a human right.
3) Advanced materials science should be used to create massive building cost reductions, across the board, instead we laud the conventional and the middleman; because of this all building costs are ludicrously high. I have seen this over the past 25 years.
4) Performance is not being used to describe innovative housing, the current best design emulates an insulated, mortgaged, ventilated cave, which cannot deal with the extremes of climate coming.
5) Current building design best practice does not have the ability to self fund. Even though it is known on many sites that the renewables input is sufficient to self fund, we still build the vernacular that cannot do so. This is a disgraceful situation when we are screaming for low cost housing.



I cannot think of any justification not to build what we propose, as it answers all these problems with direct striking solutions.

The design is made to last far longer than the rot period of conventional housing.

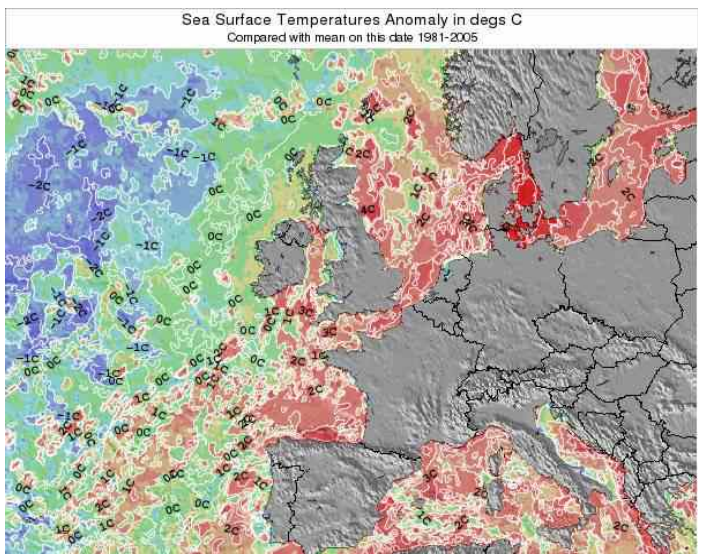
Over this long period it can easily export both energy and food for sale. Carefully chosen produce can be added in value, for higher profits from localised sales. The sunspace can grow three to four fruit crops in one season, producing all the way from June to October. If intensively cropped using vertical organic hydroponics, substantial very high quality production is possible; especially as the human nutrient stream is easy to convert into this format.

Once you choose to ecologically interlink plants and humans inside a livingspace, the solutions are endlessly interesting and challenging to conventional housing. Please go and

look online at what people have done over the northern hemisphere!. Year round food production powered by renewables is the one that fascinates me as a challenge.

The ability of the design to protect in the same adversity that will hammer the vernacular in the coming years is critical. Plants don't like cold roots, as people are now finding out. This westerly cold pool has ruined outdoor gardening the last few years. Many vegetables are unable to deal with cold soil at times of the year you'd normally expect warmth.

Not only does the cold pool increase heating costs in summer, it limits food production. However, inside this structure this does not feature at all, the plants have warm roots and grow well, even in winter, if there is brightness in the sky. For most of the year they think it's Portugal. I have previously highlighted that we need to reappraise our lives very quickly now. Not as an idle Sunday think session in our armchairs, but with an urgency that should involve fear.



This design will give the occupant a sense of security our world is begging for. In so many ways it enhances the outlook into the future, for those born today, starting life as adults, and living midlife crises. For the elderly it is a place of wonder, with comfort without cost, allowing them to do what they would love to, but cannot because of the pathetic restrictions in conventional housing dogma.

For so many elderly people, trapped in disability, the idea that they could play in such an environment, growing plants and enjoying the produce, is charming.

Children will love the place, most of the year, it's warm enough in bad weather to play inside, and has the space to hide!!

Could it be bigger?.....**Yes, it's only hoops, and polythene!**
Could it have fish?.....**Yes but they sometimes smell!**
Could it have a shipping container swimming pool?.....**Yes, no problem!**

Please let us build it, before it is too late.

….....

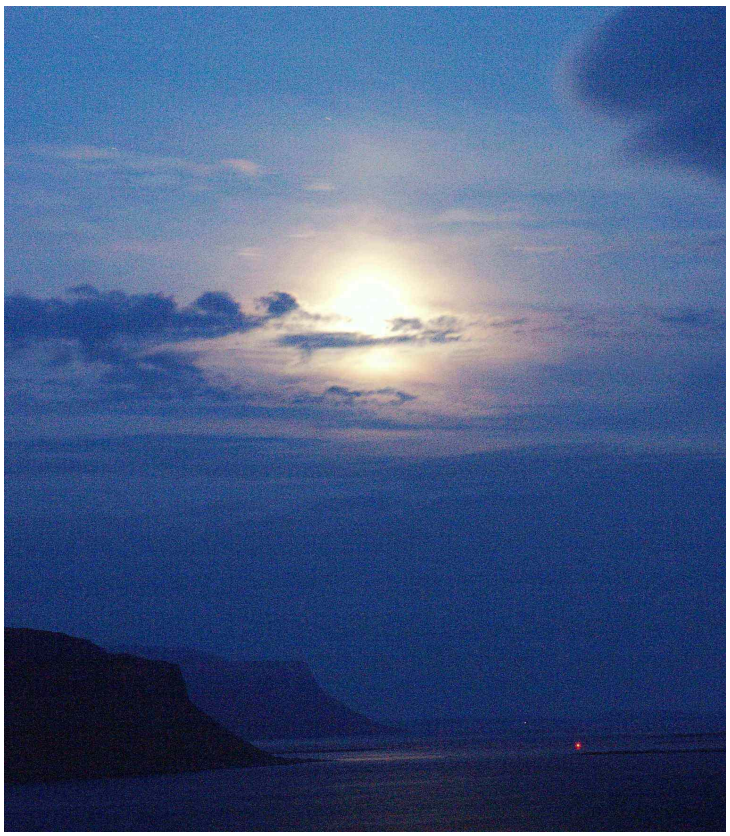
With thanks to Dr Stewart Wright and Helen Wright of Barmolloch Farm for their encouragement and enthusiasm.

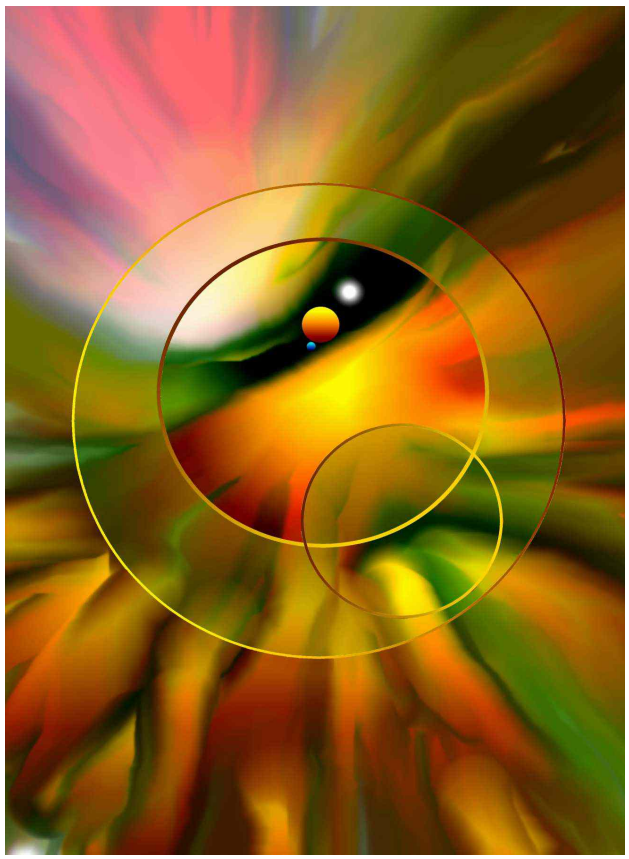
….....

This proposal describes on the nail of the type of problems we live with in Scotland. Rising Atlantic sea surface temperatures, very noticeable this autumn are causing freak hurricanes and excessive rainfall; winter and summer are fusing into one continuous cold shower. In the face of this onslaught people are leaving, who can, and this is adversely affecting tourism and the survival of small communities on the west coast, which are being blocked from expansion or innovation by planning officers who believe in moving goalposts, and denial. This cannot last.

The proposal was rejected because at every level, it is beyond the ability of a planning authority to understand it. That is a very sad testimonial to their competence in a world changing as fast as it now is. I understand that we must all bide by the rules, but this is not the time for mental rigidity, infatuated with a world of excess energy, now in passing.

The following pages describe in much more detail how this home will work. I need to emphasise that this is not now an experimental design: that part happened 23 years ago. Now it is the fun bit, where the design boundaries are thrown open to interpretation based on this original work, and where what appeared to be the work of a fool wanting to live inside a polytunnel, now develops into a broad pastiche of building composition that still mirrors that original hope to live inside a ultra low cost sunspace, but also makes it a wonderful place to live.





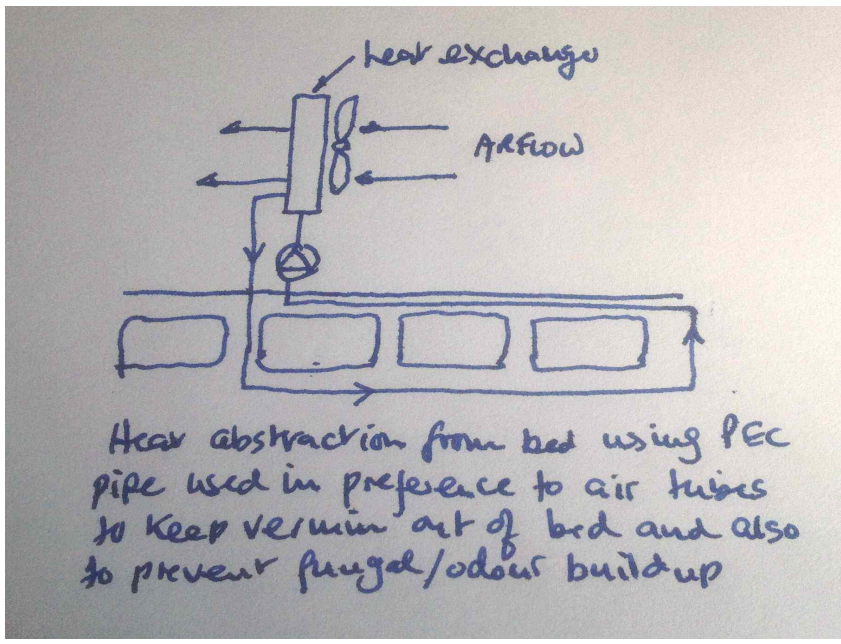
The design aim and intention:

To protect the occupants from what is coming in terms of environmental catastrophe: heat, cold, flood, drought, storm, famine, pestilence, and war, in ways no conventional vernacular dwelling can.

Heat

The Scottish government still wants to emit CO2 as usual, until somebody invents a non-existent way to pull it back, late in the century. This will not happen, and is hoping for the impossible. Severe hot weather is coming our way, in ways we have never ever experienced, and which no normal home can accommodate. The Portugal firestorms associated with hurricane Ophelia, were a severe warning; plant trees and they will burn, especially shallow rooted conifer!

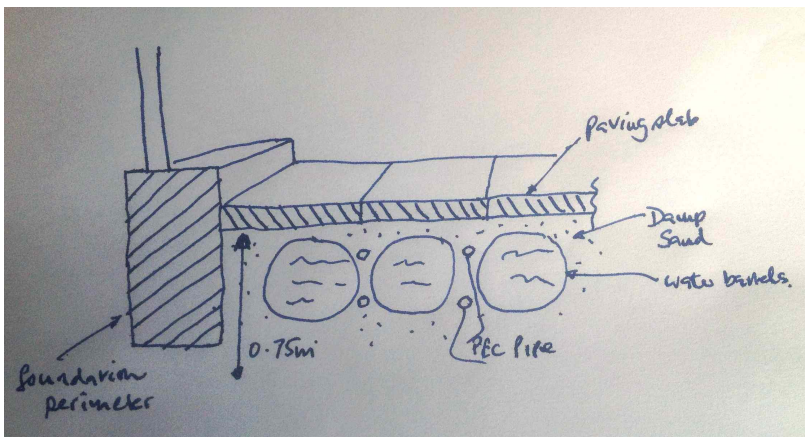
To handle heat in excess being brought on these Lucifer heatstorms via southerly winds from the Sahara, the sunspace needs to be able to create short term (at least week long) comfort zones when all around the structure, temperatures in excess of 30C are present. These are exactly the temperatures now occurring in northern Europe, in summer, and predicted to rise above 40C by mid century. A Passif Haus in such circumstances will sit at unreal internal temperatures because of the additional heat from the occupants, and only heatpumps will keep them cool.



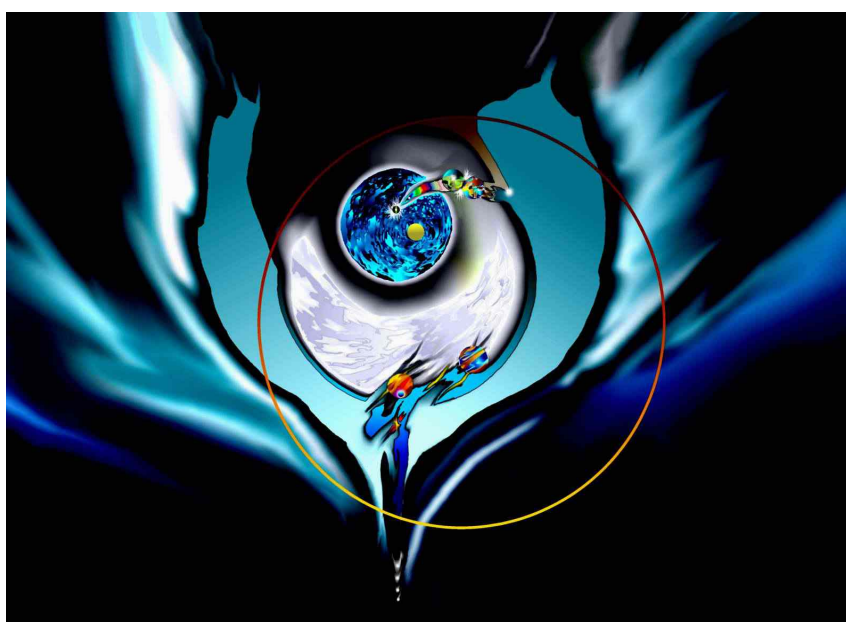
The Barmolloch Design deliberately creates a coolzone arranged within the internal space which creates a pool of cool air, in a way that stops it mixing with locally warm air. It is based on an observation with the prototype which was that cool air will not mix with warm above in these circumstances. Shading/reflection can allow this to be maintained, as long as you also have huge thermal heatstores built into the design. The coolzone will feel surprising, because since the prototype build, amazing materials have developed that both absorb sunlight and yet do not re-radiate the energy absorbed. Inside this sunspace it is possible to have cool shaded, and hot areas side by side.

This sunspace is all about thermal radiation and its control, not convection and conduction; which is not how conventional buildings are viewed. To

manage this you need a colossal underfloor heatstore, created by using second hand 45 gallon plastic bins full of water, cheaply available. Water has a huge heat storage capacity and is freely delivered onsite. These store 220l of water, and when buried in damp sand for improved thermal conductivity, across the whole floor area of the sunspace, give the ability to absorb about 1800kWhrs of energy. This is enough to cool a zone within the sunspace which is configured to shade or reflect all incoming light.

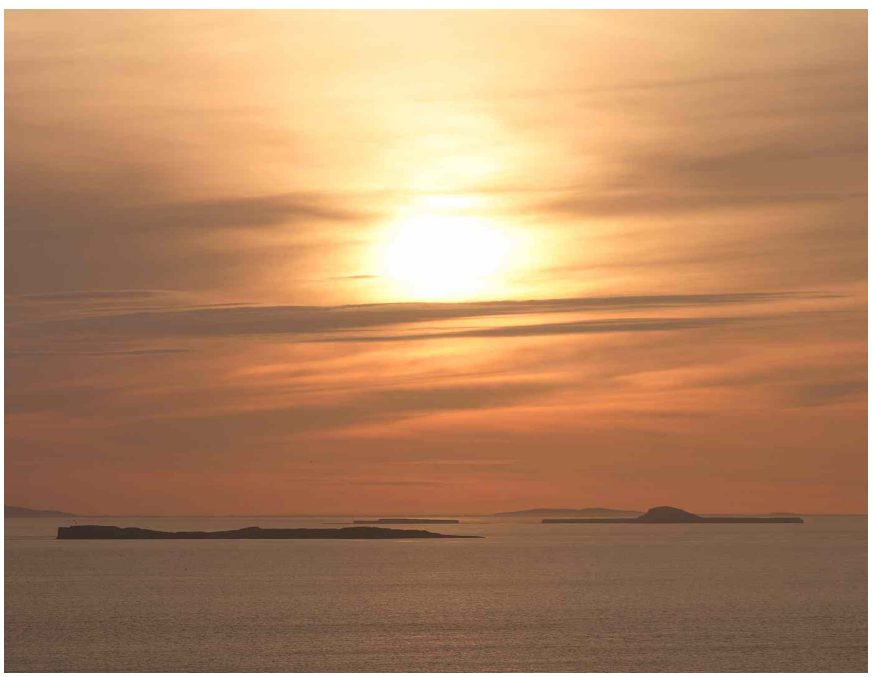


The mezzanine growing area for plants, above, will manage most of the shading, and reflection. The temperature difference between above and below will be very noticeable: it turns out that plants can tolerate much higher temperatures than I had expected, so long as they are pest free and fungus free, and do not run out of water. For example strawberries and other fruiting crops grown commercially can tolerate very uncomfortable levels of heat compared to humans, as those picking them know.



Alanod Mirotherm will probably play a role in being able to absorb, but not re-radiate solar energy between levels, as sometimes you want maximal heat absorption, when it is colder than normal outside. Tonzon is so lightweight it can be incorporated into light reflector panels, and can reflect energy with very high efficiencies.

The condensation skin can also be manipulated to increase or decrease energy loss rates dynamically, allowing the structure to use skyward night energy loss as a deliberate cooling strategy in very hot weather. One facet of really hot weather is that it rarely coincides with high stratus or cirrus clouds which can trap and reradiate heat downwards. Mostly it is clear sky to the stratosphere which sits at -60C, and can cool fast at night. Another strange and wonderful effect I witnessed several times is that you can cool the internal sunspace so fast at night this way, that condensation forms on the outside, not the inside. When you build a condensation layer on the outside, the physics reverses and it can become difficult to stop it losing energy and make it harder to gain this; reflection works both ways.

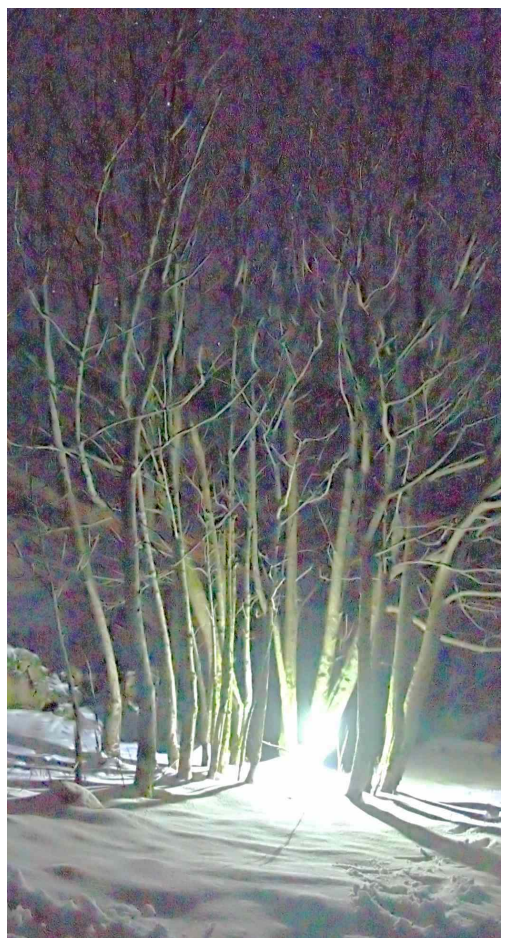


In the design the condensation layer acts as an air cleaner, particularly for fungal spores and small particles. The consequence of this is that fungal problems on the plants are very low due to both the layer, and due to the environment being non-condensing. Condensation does form on any surface with high thermal mass like the heatstore barrels, but not on the plants, and this eliminates one of the main fungal transfer vectors. Elimination of insects gets rid of the other primary vector; aphis and its viral loads. Ventilation will always be used worst case.

Heat is present, but can be elegantly managed. Cold is another issue: sunspaces do become cold especially if they lack thermal mass. In the winter of 1982 Nature did a trial run of this: I can remember standing in the middle of Loch Fyne, on ice, in March, as the loch used to do two centuries back.

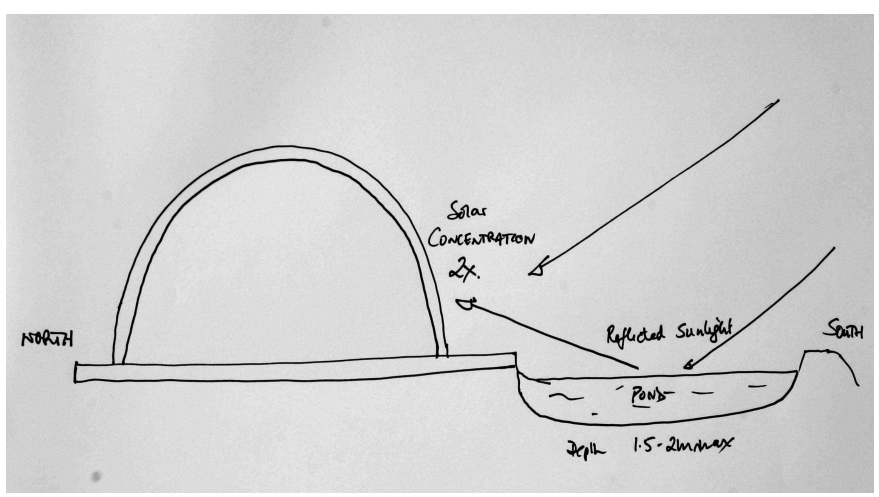
Cold

Extreme levels of cold, and massive reductions in productive farmland due to drought, are now to be expected in north-western Europe, because of the switch-off of the Gulf Stream that will occur within 20-60 years. This switch-off is going to be a nightmare for older conventional vernacular housing which has never been designed for sustained outside temperatures of -20-30C, and is a horrific problem for UK buildings because of cold-warm shock events, in which a cold landscape from several weeks of brutal cold, suddenly sees warm southwesterly winds carrying a lot of water vapour. The internal condensation that takes place will rot these buildings from the inside out. Nobody is talking about this because there is nothing you can do about it in older buildings, built before 1997.



The sunspace will protect against this without effort, and also gives one wonderful aspect of a complex design like this in that it performs best in such weather. Providing the sky is clear, sunlight alone maximally captured and stored on low thermal mass darkly coloured surfaces will keep the internal temperatures above freezing. I saw the prototype manage about -15C without any internal freezing; what surprised me then was that the condensation skin freezes, and doesn't fall off, so the thermal gain it makes can be continued down to low outside temperatures. What does happen is that the polythene skin contracts and increases in tension, and creates a sideways movement that can drag the PTFE foam tape on the hoops in the same direction, causing the polythene to touch the metal hoops, that is why I wire tie the foam in place on construction.

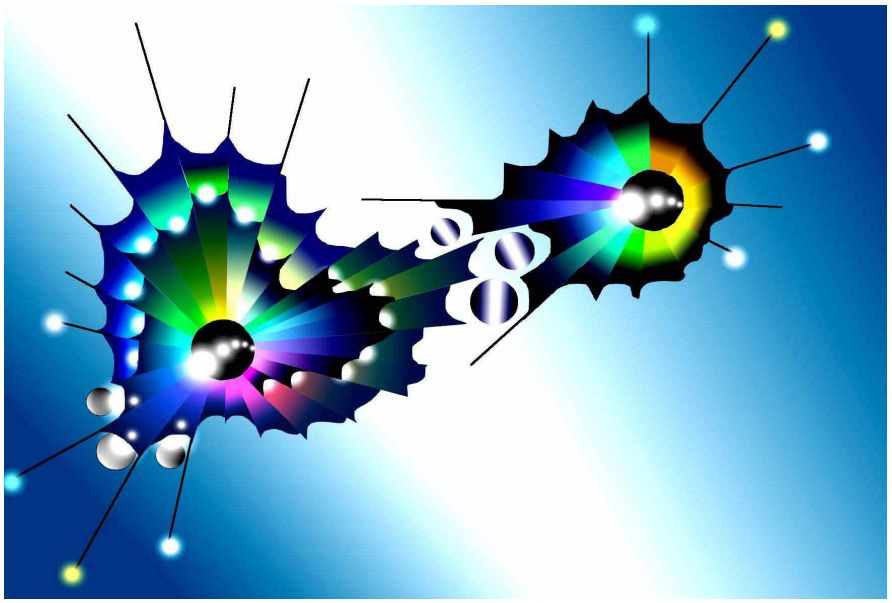
The lack of convection and conduction is spectacular, as snowstorms can deposit snow, which simply slides off the sides, without melting, while internally the airspace sits above 25C, in early spring. My take on the snow-loading concerns of polythene, is to use groundwater heated 12C water sprays to melt snow repeatedly as it falls, so that it sloughs off. I tried this out on the prototype and it worked fine. There was a secondary way of dealing with extreme cold which was to deliberately create a self-supporting igloo covering of ice, which then managed to hold a higher snow-loading. In addition, kevlar sail tapes now exist which can assist in dealing with high snow loads, by strengthening the polythene. Also, I like mylar, so polythene may be passé.



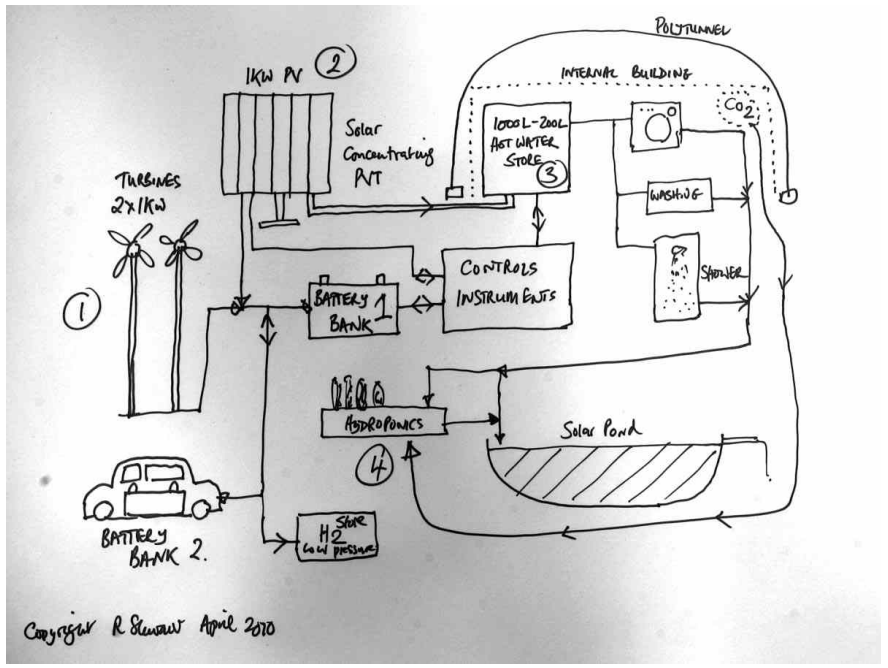
The wonderful thing about an engineered sunspace is that while the sun shines, you can maximise the design to be low thermal mass and the lack of convection and conduction through the still air created by uniform radiation means that the air inside, which itself has low thermal mass, rapidly rises to comfortable temperatures in sunlight.

The great strength of the sunspace is its ability in these extreme weather events to keep plants from experiencing either frost damage, or

rootzone cold. Both wreck plant growth outside as we saw in the last cold pool event, where Greenland meltwater spread to the west of the UK and chilled prevailing winds for two summers. In those conditions due to cold soil, nothing grew outside, in traditional gardens, while inside a sunspace it would be business as usual.

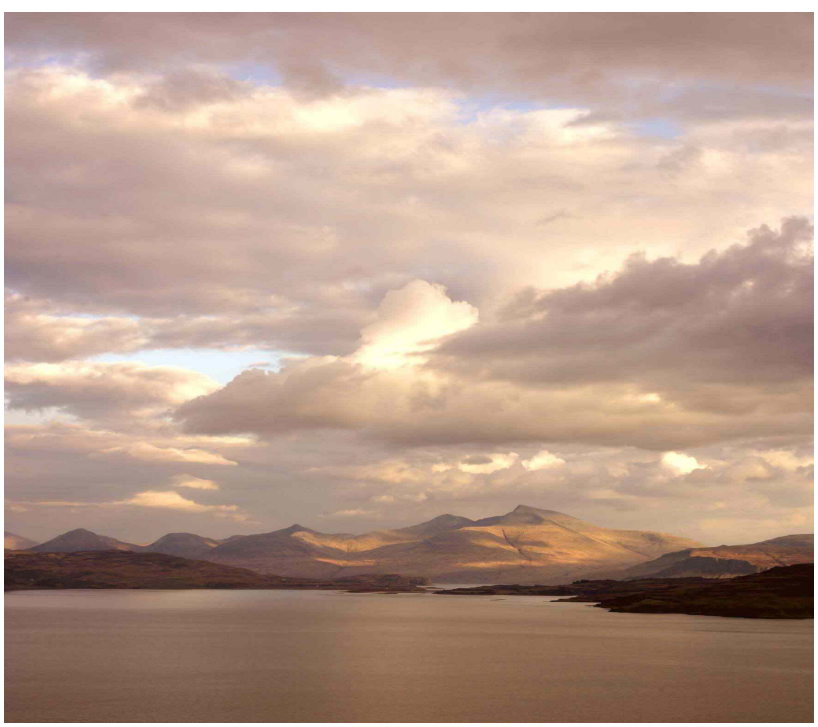


A reflective solar pond to the south is a great way to further enhance solar gain, as is snow on the ground. Measured at Killiemor, the mid-December sunshine with snow on the ground, is 125% as bright as direct midday June sunshine. (read that again). Bounce reflection off the sea to the south, when the wind blows, also adds 15% more energy on sunny days. This is one of the reasons why many now empty older villages face southwards on the islands: even outside in those days you could gain benefit, and they knew it.

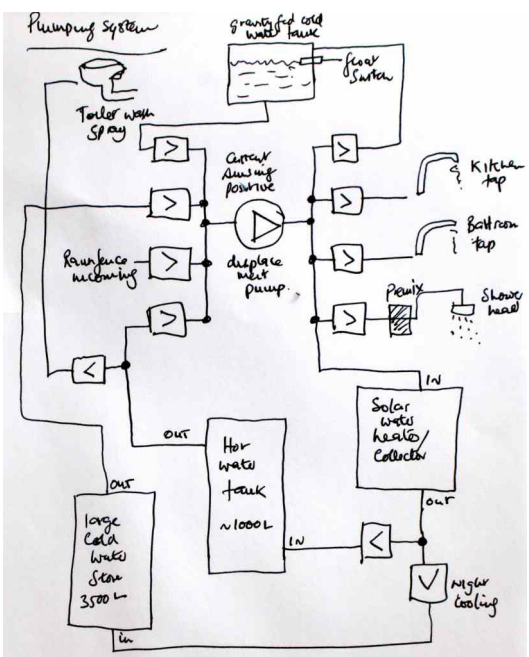


Cold down to -30C doesn't worry me. Most internal functions will still make for an enjoyable sunspace; below that, will have to wait and see. I see cocooning or iglooing as the best option, where you form an ice sheet over the whole sunspace structure, by spraying water on it, and then let it build up thick enough to support a snow cover.

I often wonder when I express the complexities of the design, how people who live in conventional homes will deal with the surprising degree to which it will cope with the altered realities we shortly face. I would hope it will be with a positive outlook and not immediate fear that the world they have built will be wrecked by it. These coping mechanisms can also be retrofitted to existing homes; well some of them can!



As I explain this design through, it becomes more and more complex, while at the same time mostly looking after itself. Good design works this way: most of the problems become self-solving. So, I am moving on now from cold and heat; we can deal with it.



Flood

Here we do not ever have a problem: drainage solves it. Flash flooding just means diversion, though not in a village, town, or city.

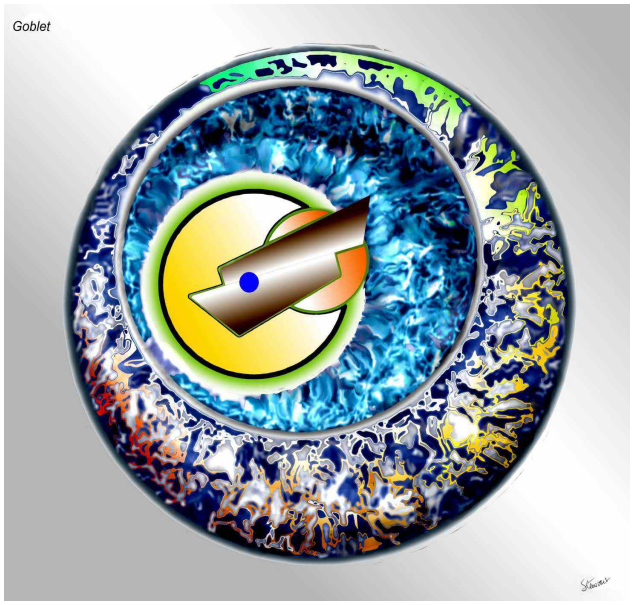
Drought

If flood was not a problem to this structure, neither is drought. The

building covets winter rainfall, using storage in the solar pond if needed, and collection of locally-delivered distilled water (rain). There is enough there to meet all needs. I checked to see if the condensation skin could be used to condense drinking water, the prototype created and held 7 litres each day on its skin and collection was easy.

Severe drought will mess Mull and the west coast up badly as stuck high pressure systems merge over the March to June period. Tourism is not going to like it: lots of places outside of the mains infrastructure will run out of water. Minimising water loss becomes the priority, because the foodplants need it; the solar pond will contain that, and evaporation rates would be too low to matter if wetland reedbanks surround it in summer.

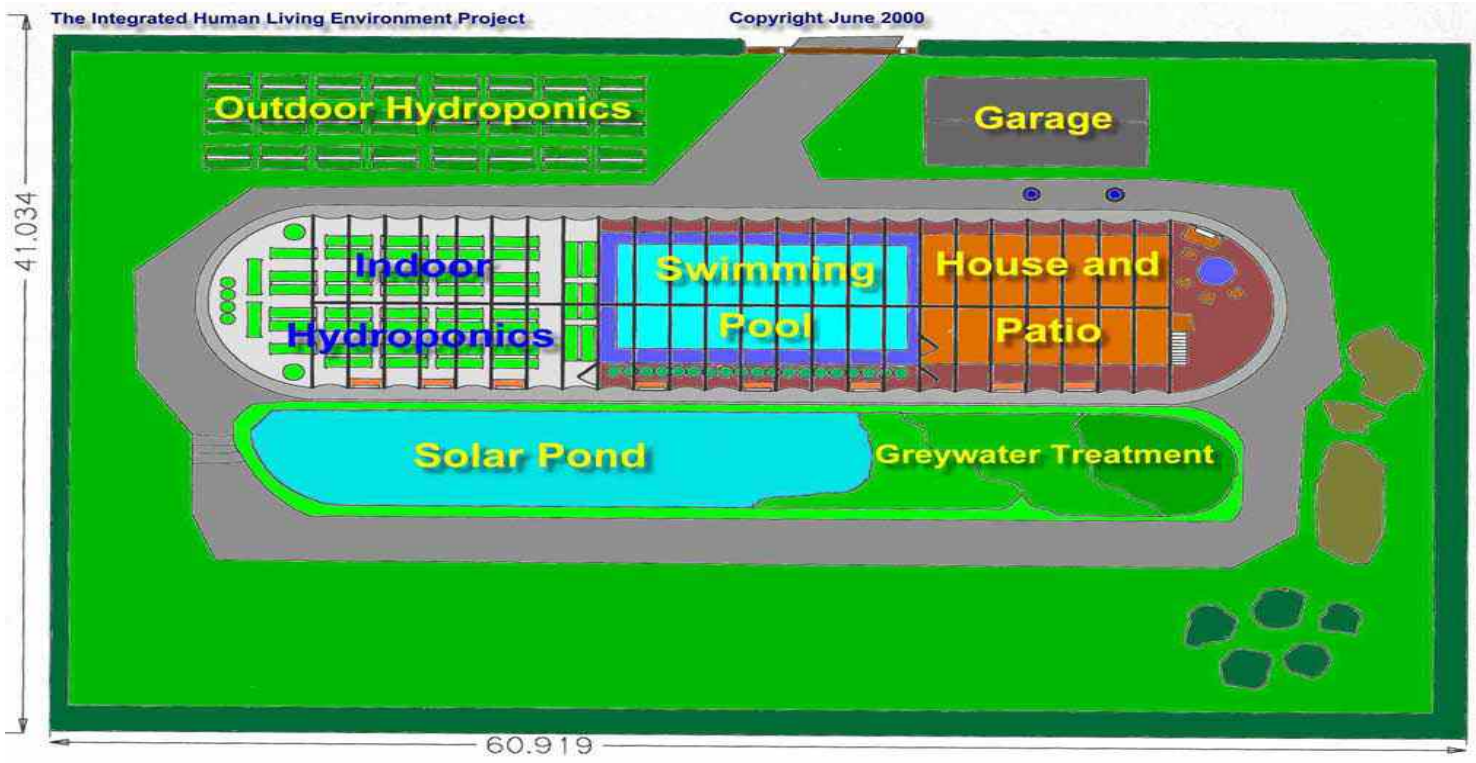
Drought is irrelevant: it will be sunny and warm.



Storm

OK this is where the design takes flak from people, unfairly, since I have seen it cope with storms here over the first 5 years, when the trees surrounding the prototype were young and small.

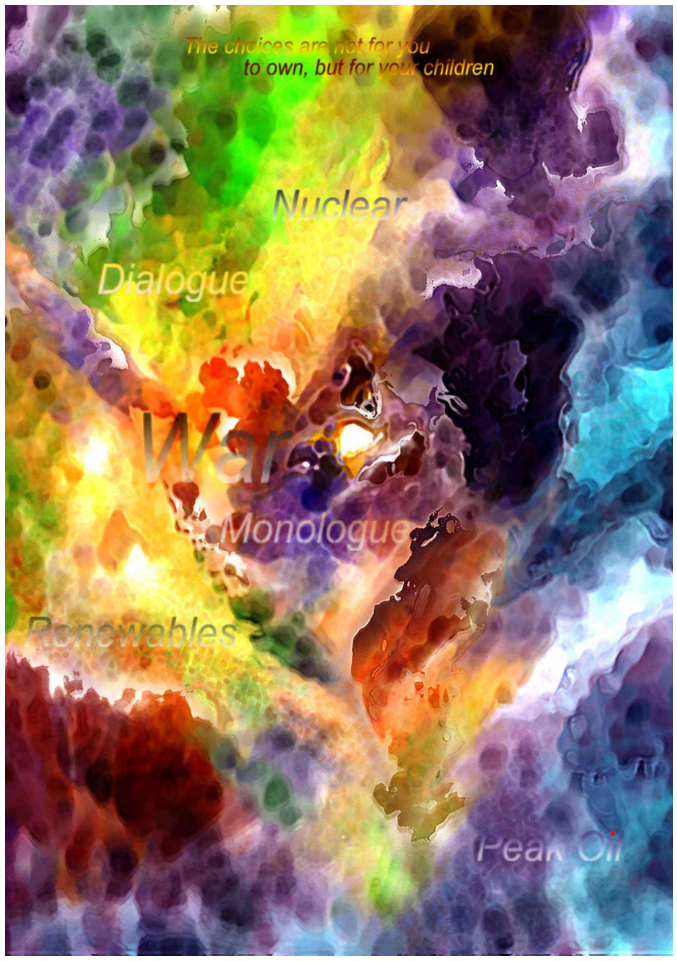
I also went to Orkney to see how they fared there, in 2017. Most of the initial observations held true; a polytunnel sunspace can survive a lot more than people would expect, if built correctly. I require an East-West long axis in the design, and in Orkney these configurations seem to stand up well, which surprised me as I had been warned that polytunnels don't survive there; however, they do. North-South axis ones do not. Over my travels there, those were the ones that were poorly-tensioned and frequently just hoops on the landscape. It appears to be due to a combination of tensioning and severity of wind directions. I know, from direct measurement, that the worst winds are Northerlies, and the best are Easterlies.



Northerlies are turbulent, Easterlies laminar. Westerlies can be a mix.

In my own design I discovered that the membrane skin behaves like a rubber ball and flexes often stunningly, but doesn't fail, or lift until “S” shapes form along its length. This can be prevented easily by linking the hoop backbone of the sunspace to the shipping container. The other way you can improve wind handling without slackening is to negatively decompress the structure, which is easy to do using the wind, and a trick I saw

on ships at sea. Then the windier it gets the more the polythene is sucked down onto the hoops.



Polythene appears to be able to handle any amount of large scale flex without fatigue, as long as you maintain sufficient tension to block short scale flex, as my prototype has shown. I am still not worried that storms can damage this design, because there are ways to anticipate failure, and strengthen it.

One major area left for controlling this is to bund the sunspace well, and that also fits into the idea of living willow windfences surrounding it, which have the dual effect of reducing wind shear while also making the structure invisible in summer to tourists, apart from its green fringe of willow.

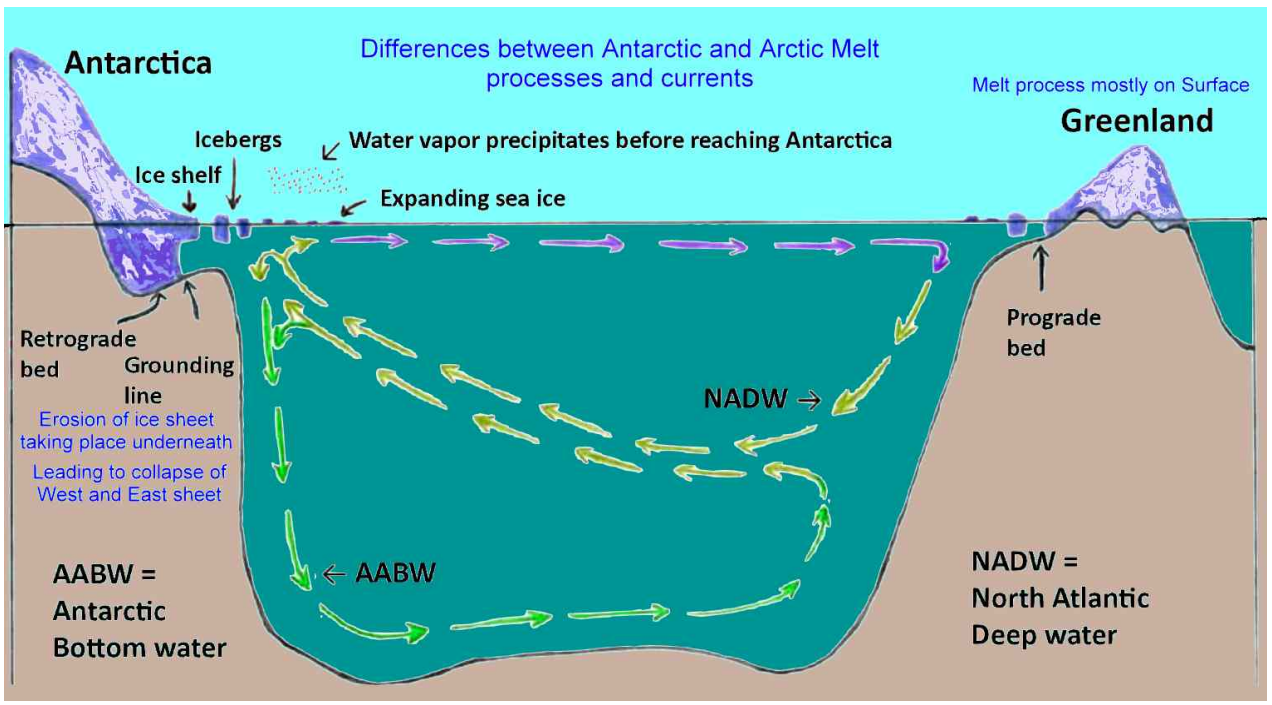
I think severe weather on exposed landscapes can be sensibly managed. I am not saying you will initially feel comfortable inside in such conditions: a large sheet of plywood held vertically can shudder spectacularly in your hands when the air inside does the same. But in these conditions, I want to be hunkered down inside the shipping container. I will say though that kids will love it for its unfamiliar wildness compared to anything they have met before.

They can still play 'outside' in the sunspace, when the weather is horrendous. Yes, it can be noisy; I love it! Noise can be muted by resonance control technology, and height; with a 12 foot ceiling height everything is (inverse square law) muted.

Famine

This year I tried a novel sideways shoot planting method for potato in old fish boxes full of compost and got 12kg per square metre, outside! The biggest problem with going hungry in a conventional home is nobody, neither planner, nor politician had the mental ability to plan for the coming need. Why should homes grow food?! Doh!!!

With worldwide crop yields this year in a mess because of the direct and indirect effects of climate/weather changes, that norm is being stumped hard. You need your home to be able to grow food. Food banks at that yield??



When you can recycle the atmosphere and water supply as you can within this design, and when plants grow happily from your waste streams, it is pretty hard to go hungry. Sure, they can try and steal your crop, but charging the membrane skin to 10kV would sort that out. You can do that by the way, the membrane is supported on an insulating PTFE foam. I learned that one day, by the crackle, as I moved close inside to the membrane on a dry day.

The reason the poor are in such difficulty today is because they have nowhere to grow their food, and not actively being shown how.

Pestilence and War

This is an awful subject. Unlike some Western European Countries, ours does not care for its domestic population's safety, in such circumstances. Let them die, it solves the population issues! For comparison look at Sweden.

It made me think though of how the lie of the future will be paid back in kind towards those who might survive, and how some might thank this design. Mull is a blast wall of sorts to a multi-megaton central belt nuclear event; the prevailing winds are westerly away from the epicentre. Most of us here would survive the detonation, only to eventually be hit by radiation.

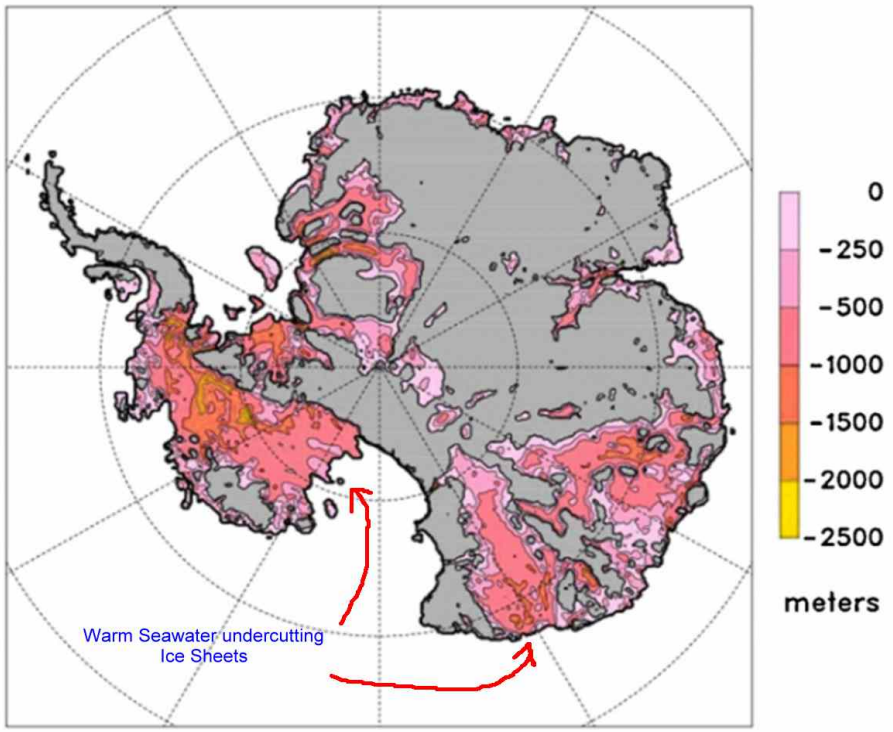
It is a sealed design, you could at worst keep it out, and if needed positively pressurise through an air handling unit, possibly even pressurised by natural air pressures.

On the subject matter of war, it might be apposite to note that wet polythene doesn't burn easily, this brings me to the final issue.

Fire

Polytunnels are not known for catching fire, probably because we don't cook inside them. This design will not permit naked flame fire sources inside the sunspace for sensible reasons. When the ratio of plants to humans reaches 30% of the space, the condensation film is near permanent, so the polythene cannot catch fire if soaking wet.

It would make sense if the costs were right to add sprinklers controlled by flame sensors. That would not be hard to do. Low Voltage electrical systems do not catch fire easily, and can be designed to prevent this, unlike 240V, which can arc easily. I struggle to conceive of a way the occupants would be injured by fire. The wood used will be borax treated making it flame retardent, and the internal space will be organised to allow safe escape. You cannot burn the shipping container.



Appendix 4

This is the state of knowledge on the future for Scotland, written in 2016 to inform locals, it is still very relevant.

This letter summarises the current state of knowledge about climate change, and will probably come as much of a shock, to you, as it did to myself. Until now, as a scientist and engineer, I have been able to cling to a set of predictions from the international panel on climate change, knowing them probably to be a bit out; as knowledge increases, and predictions come closer to reality. But I didn't expect them to be so badly out; mostly due to lack of understanding of how ice melts, and where it goes when it does.

The two scientific papers that shook last summer and this spring were by the respected scientist Jim Hansen, and a top league support group of other scientists, who have been looking at a period in the past called the late Eemian, just over 100,000 years ago,

when CO2 levels in the atmosphere were similar to today. They were trying to get a handle on how the planet behaved in the past, compared to similar circumstances as today.
I now summarise briefly, as an advocate; that is someone trying to put a huge knowledge pool into simple terms, please be under no illusion, you can't deny the power of the climate science now, and if you still deny, it's because you do not, or can not understand it, so your opinion on the matter is irrelevant.

Over the past 15 years, the main shock has been the scale and speed of the Arctic Melt, and whilst that is very bad news for the world; we could not understand why, and were struggling to catch up, it would not have caused sea level to rise much, before we had got it under control. Everyone; myself included, thought Antarctica was invulnerable.

What nobody expected was that Antarctica would join the story with such an impact. Melt is now taking place underneath the West and East Antarctic ice sheets, due to warming seawater.

Unfortunately the erosion that is taking place is accelerating due to the huge ice sheet that covers the continent having large areas that go way below sea level, and are now known to have collapsed very rapidly, in the past.

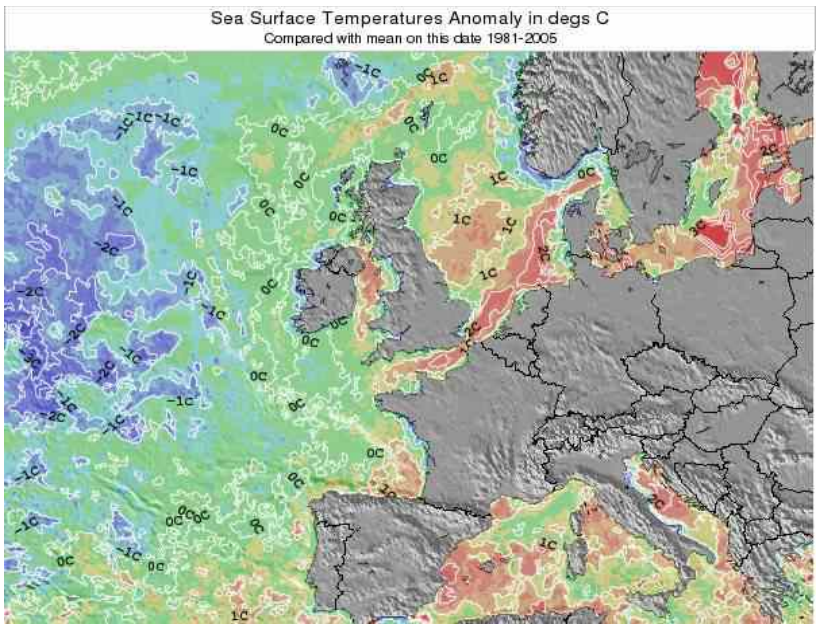
How rapidly everyone is trying to find out, but so far multimeter sea level rise in less than 50 years is expected, and it could be substantially faster because huge ice sheets do not support themselves well when eroded this way. The West sheet would give 3 metre sea level rise and the East; afterwards, many tens of metres. We should know accurately in about 15 years time, as the curves on the graphs smooth out. The chart on the previous page shows how much of Antarctica is below sea level.

This is not being factored into decision making, by either the Scottish government or by A&B Council; they do not assume this in any planning document I have read, and it is one of the most vulnerable Council areas to small sea level rises, due to the number of roads, and towns, that are on the shoreline, very near sea level.

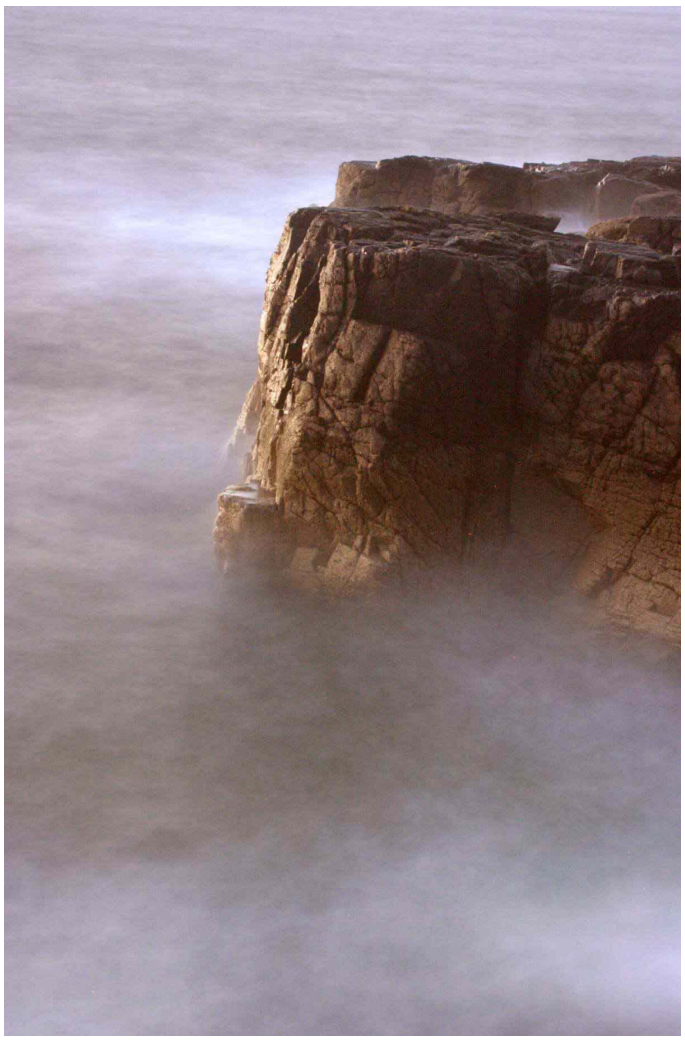
However, this isn't the the issue that most worries now. The Arctic melting freshwater from Greenland, all 200 cubic kilometres each year and rising, is spreading out on the sea surface to the south and east of Greenland, (and in Antarctica) forming a cool pool of water that is changing our weather dramatically.

The chart below was taken in 2016, during this period, to the west sea temperatures are up to 3C below normal. I am assuming you have noted that our lovely warm winter storms, where tropical air rushes over to us, and brings balmy weather in the middle of winter have gone, for at least two years now. Our night time, and daytime air temperatures are created by the sea temperature over which the air passes, very noticeable on the west coast, less so further inland.

Here, last summer it was persistently cold at night, due to this pool of water. This winter was the same, yet it was the hottest worldwide on record, with a reversal (La Nina) now forecast for this coming autumn and winter, which could bring severe, much colder weather.

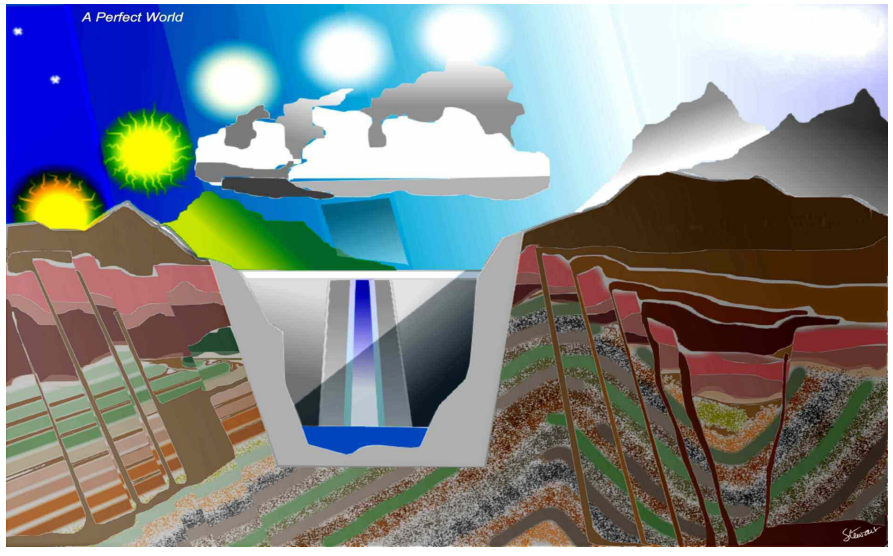


This cold pool of layering fresh meltwater is about to shut down the gulf stream (AMOC) over several decades, it is being predicted to be pretty well off by 2060-2080, and my personal take on the scientific arguements is still not that clear as to how this will affect our weather, apart from saying we will see serious cold during la Nina winters. The further north in the country you go the worse it will get. The last time this happened we got a mini ice age.



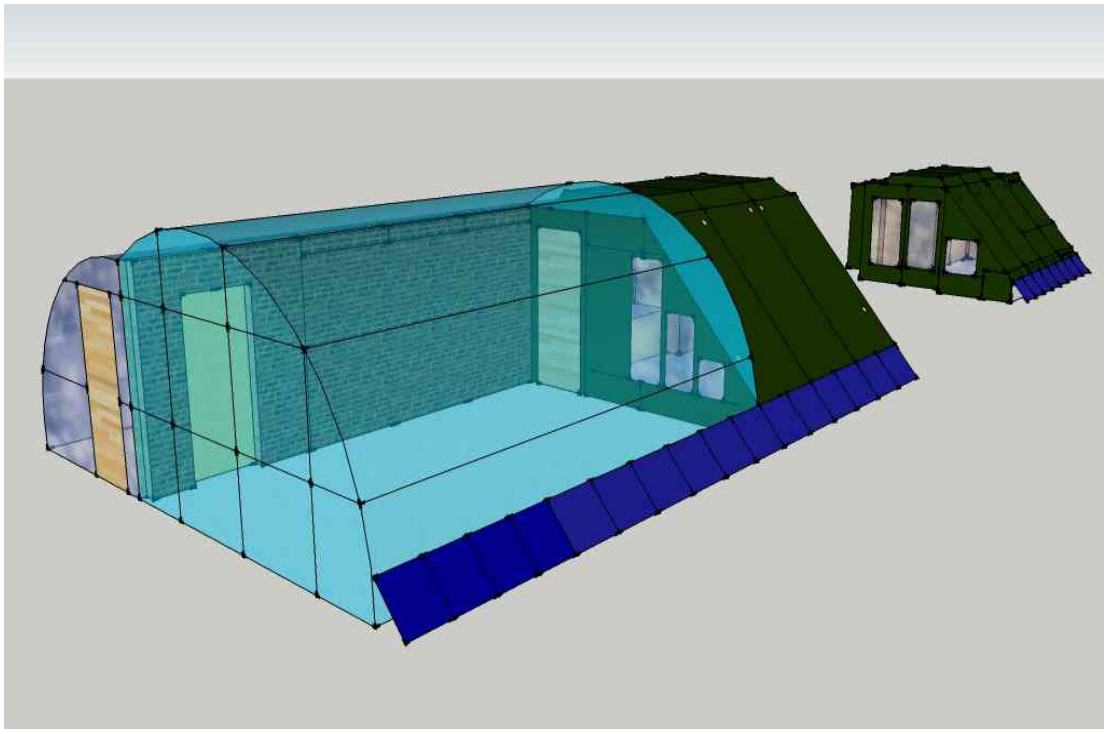
But this will occur only along the northwestern European seaboard. The rest of the northern hemisphere will roast, in ways that are far beyond our current lay understanding.

If that was not bad enough, this cold pool will also trigger much more severe storms, and rainfall, due to the huge temperature difference between it, and the hot humid tropical waters of the Caribbean. Much is made of these storms during the late Eemian period having lifted 1700 tonne boulders to rest on the top of 20 metre cliffs, on Eleuthera in the Caribbean (above).



I suppose this winter has hinted at that, in the rainfall, or deluge that has hit Scotland, but what worries is the variability it could introduce to agriculture, in a country that cannot feed itself completely. Farming needs relatively stable weather, and has had that for the last 8000 years. We are losing this stability, and you are all going to have to live with this reactively. No more sitting on your thumbs, you need

to start growing your own.

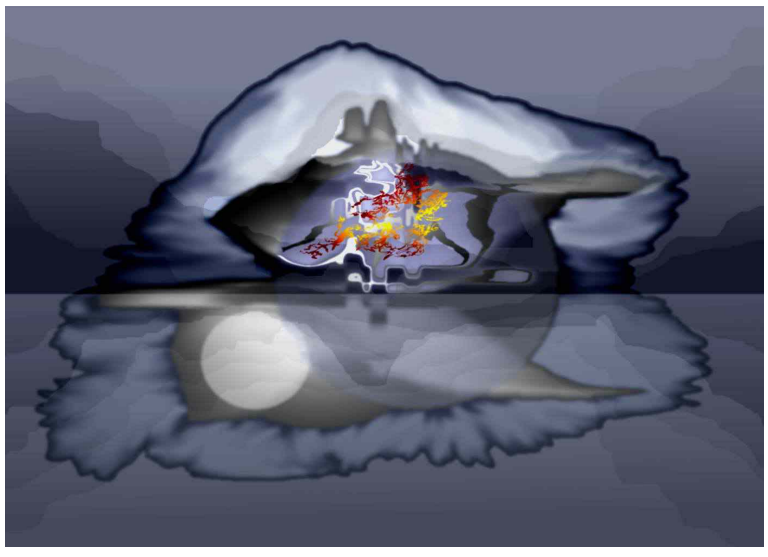


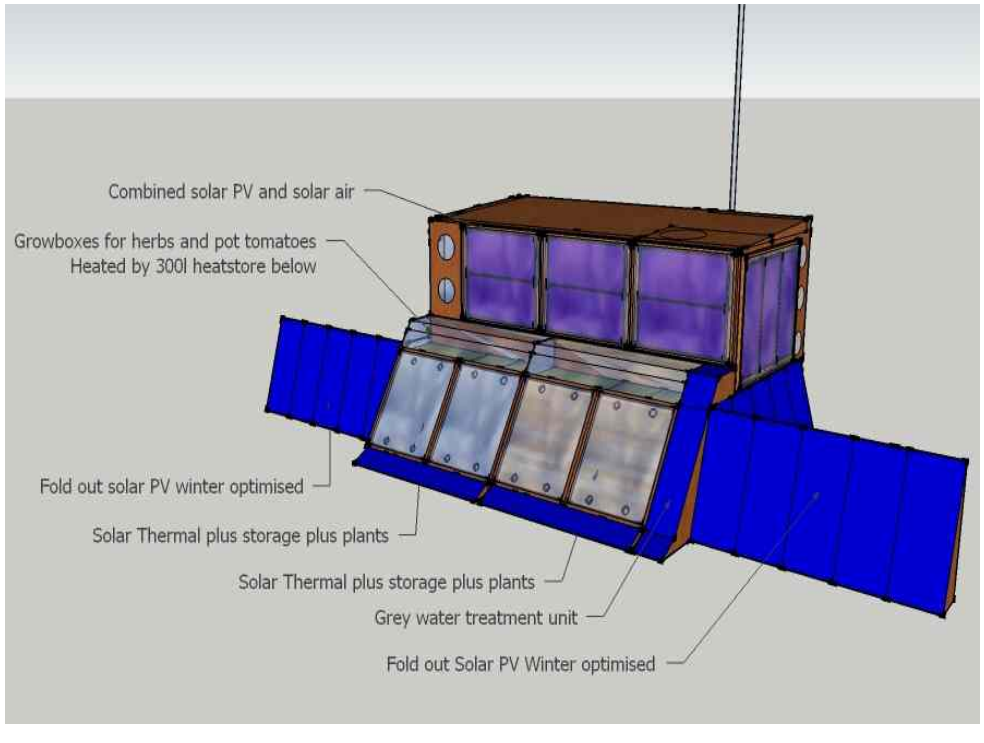
And you are going to have to protect your polytunnels from these storms. We are going to have to design different homes, and the ones we have are going to struggle with severe wind and condensation damage due to rot. None of our housing stock is ready for this future.

News on cloud water content published this year means that it is going to get worse faster than originally thought. In addition summer Canadian and Siberian wildfires (hardly mentioned in UK news) are contributing both soot and nutrients to the arctic ice sheet, which decreases albedo, due to blackening, and encourages algal surface bloom discolouration doing the same.

Most of the news is now of an accelerating melt worldwide, carbon sink failures, drastic environmental damage.
To solve these in enough time means the need for multilateral solutions, which develop simultaneous solutions to multiple problems. Innovative, ultra low cost, yet high performance solutions, which leapfrog social change. We are not ready for this either, because big money has roots so deep in those systems which will fail, as a result of them.

It looks increasingly likely that ocean gyres, and the great southern ocean are going to be used as a huge scale CO2 dump, and to break stratification, to try and sustain business as usual, while we await catastrophic ice sheet failure. I once was wholly against this, as it simply allowed the polluter to postpone bankruptcy, now I feel we have little choice to go at it innovatively. For the moment oceanic

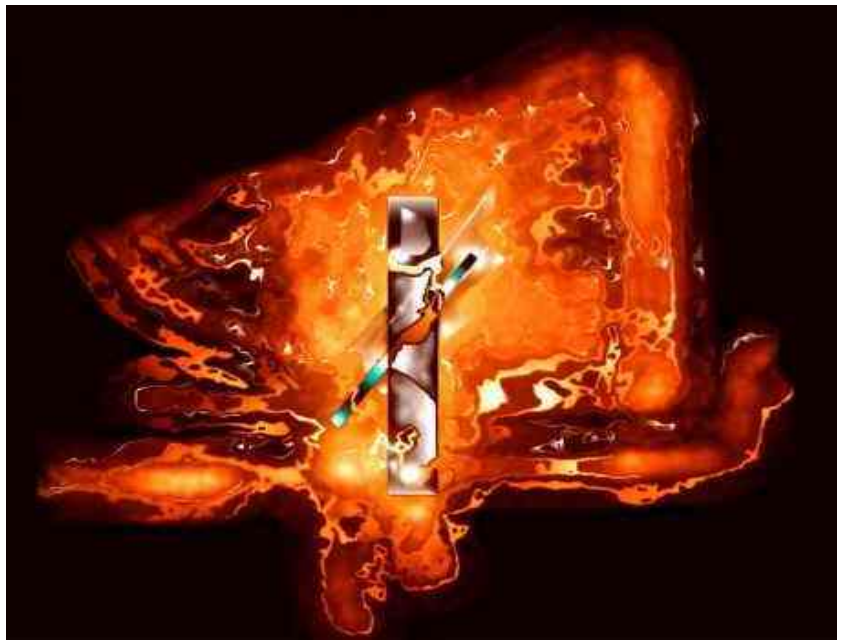




experiments have been technically passive. Active designs could be structured for process optimisation, if you can get the carbon dioxide down there without robbing the water column of oxygen.

The role of ice loss on Icelandic volcanism should never be underestimated. Through glacial ice loss, the isostatic pressure that holds down magma chambers is being reduced, and at some time, a major eruption will occur that is as bad as the Laki one in 1783-4, which eventually triggered the French Revolution, due to widespread European famine. Iceland's glaciers are losing lots of ice at the moment, and some parts of Iceland are

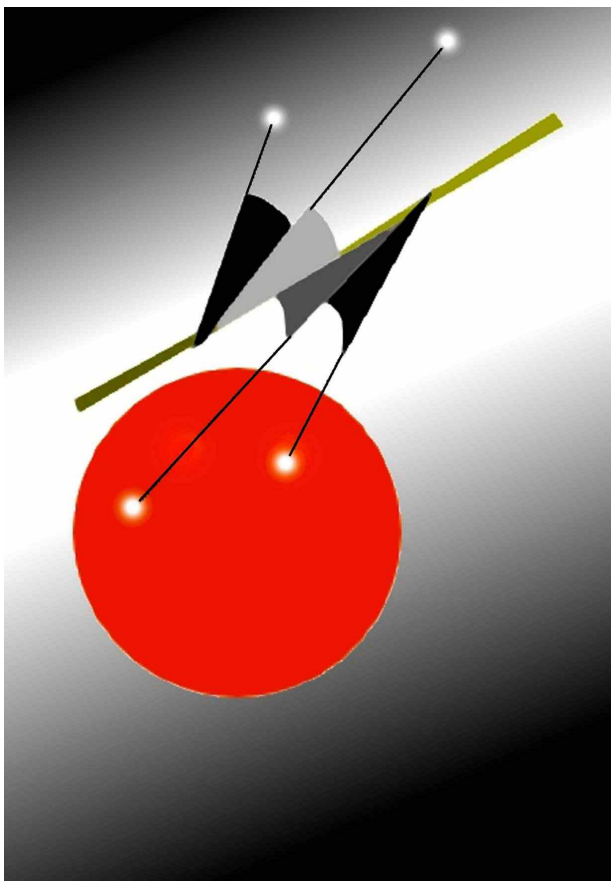
rising at 1 foot a year in response.



So in summary, fast sea level change, drowned roads and towns, severe storms, and ruined crops, and; in bad years, severe cold weather. That we are being warned is only the beginning, because the severity of CO2 rise in the atmosphere is also destabilising methane deposits across the northern permafrost, and shallow continental margins in the Arctic. These are releasing accelerating amounts of methane; a gas that is 20-80 times more potent at warming than CO2, to add to our woes. And this is just the start, as a lot of these effects are locked in already by the current emissions we have made.

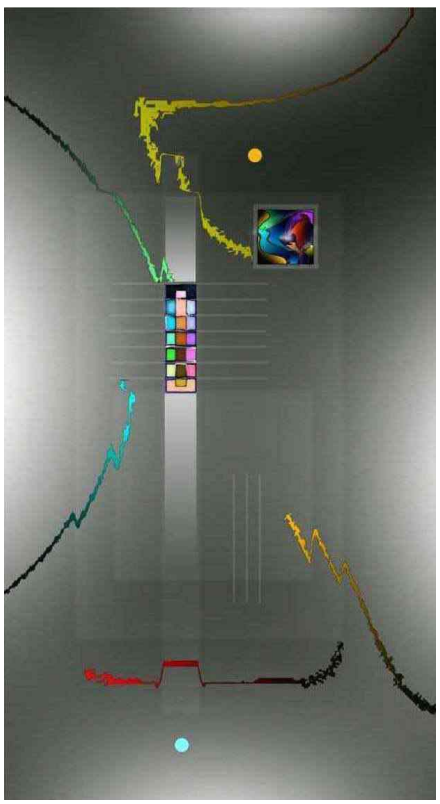
We can stop this now, by making huge changes to our CO2 emissions, but the events could become unstoppable very quickly. I really dislike the word unstoppable.

Even worse, those unelected representatives of the agencies; who define our lives, will be able to continue to refuse to attend presentations, arranged to try and handle the consequences. In the process they stop innovators like myself; who can see solutions that they seriously dislike, from making headway. Yes, I am also asking for your help here, I cannot do this alone. I can solve many problems in enough time, but not on my own.



It's not your life any longer, we will mostly be dead by the time the fan hits the smelly stuff. Some will still be alive. Personally, I would not wish to be them, then, in the eyes of their children, and grandchildren, because they will not forget that indifference.

There are solutions, we could stop this now, by quickly reducing CO2 emissions.



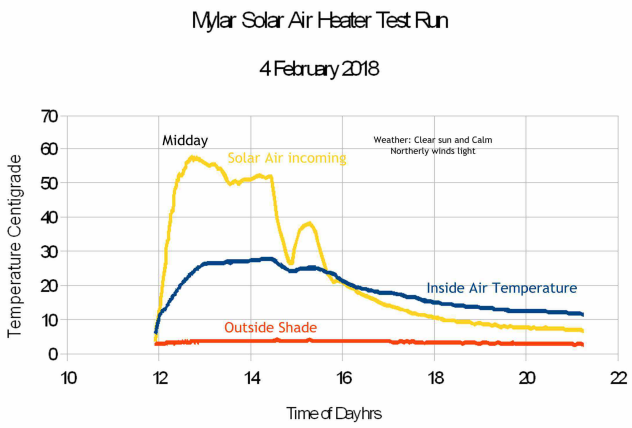
Appendix 5: DIY Solar Air

This is a description of low cost high performance Solar Air panels we could put on all south facing exterior walls of our homes, taken from one of my design briefs.

<u>Designing the solar air panel</u>

It is extremely easy to add a two square metre solar air collector to a south facing wall, four wooden strips, alu taped, a few double sided self adhesive sponge pads to damp wind flexing, two cpu fans (£20) ducts made using 3D printing, a sheet of 170 micron mylar film (£20), and you have it, approximate costs £60, especially if you use second hand!

That added to a panel will pull a lot more energy than you would realise on average, 830 kWhrs a year, for a 1 year payback. Still they are not as normally designed into buildings, and if you look online, you will find inelegant versions that as usual cost a fortune, and don't do the job any better. If you don't believe me go and build one!



If the film and strips last 5 years before mylar replacement the EROEI is 6:1 if 10 years 12:1. Modern waterproof tapes hot glued do have this lifetime, as does UV stabilised mylar, and better still doesn't look messy. I am certain these would change the lives of many elderly people in winter. Using dark coloured perforated paper to absorb the light and turn it into hot air you get an incoming air temperature about 50C above ambient air temperatures, and with Mirotherm about 75C above on a sunny winters day. You see them nowhere on buildings for some crazy reason. You can burn your hands at any other time so much heat is generated with the Mirotherm. Using Mirotherm would be substantially more expensive! (£60 more)

Solar air has been around for 128 years, yet nobody thought a suitable simple application through, at a time when we have such superb materials now available. Over a 100 year period the solar air front panels on the CDB 3 design would make £14,800 of heat (@9p/kWhr). In heat alone, the building solar air pays for the building in the energy it returns for free. This is the EROEI we need to keep our world running (100:1).

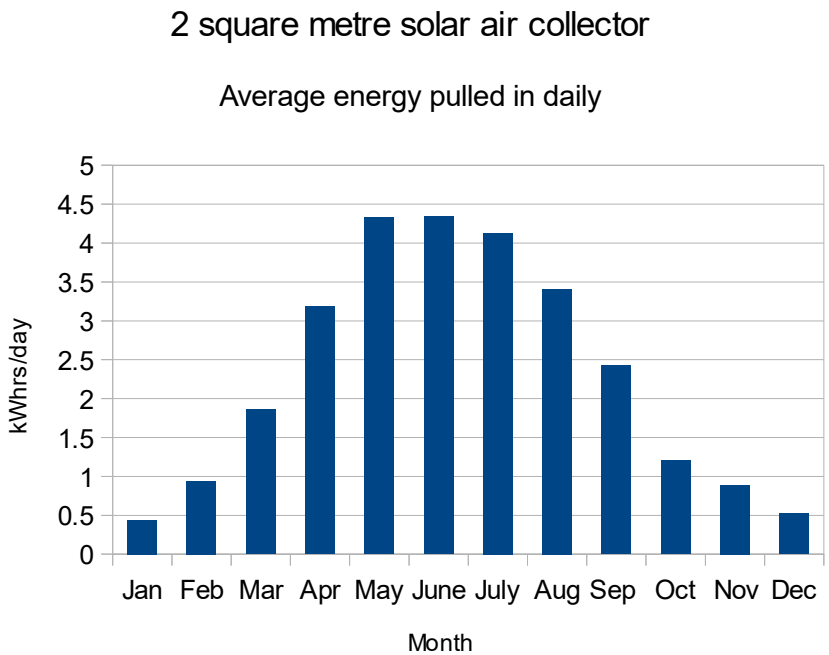
There is a secret in solar air I am keeping quiet on because of the degree to which it could change building design, and unfortunately because design professionals are all trained in the same ways, they have missed the chance to retrofit these to older buildings. In some cases they will have messed it up completely.

When you return to empirical measurement and first principles, rather than use computer models and their limitations, almost immediately you see the mistakes being made. It is a true shame that we have so easily forgotten the real world, in favour of clever looking modelling and mathematics. Solar engineering is not intuitive.

Preliminary Costing	
Sunspace (polytunnel 24' x '60')	£5,000.00
Shipping container (40' x 8' x 8')	£3,000.00
Electronics, solar, wind (incremental)	£3,200.00
Wood (seasoned local)	£1,000.00
Doors/Windows (reused?)	£2,000.00
Plumbing (reused?)	£1,000.00
Wiring	£1,000.00
Civils(cement)	£1,000.00
Labour	
Cutting/Welding	£2,000.00
Single person UBI for build duration	£6,000.00
(One year build time)	
Documentation	£1,500.00
(keeping the build documented)	
Total Materials/Overheads	£17,200.00
Total Support Cost	£9,500.00
Total Cost self build one year	£26,700.00

Appendix 6: Project Scope and Scale

If you think I am asking people to return to the end of the Victorian Era, you will be badly disappointed. This is a huge project, or none at all. I could just build my own to retire in, and that would be it, or we



could really try. One unit, who could fix it after I am gone? What a waste of commitment, and knowledge!

Electronics engineers are taught excruciating degrees of design minimisation, no other profession thinks this way. We do it because if we do not minimise cost, and increase performance, someone else will.

This is where Moore's Law came from.

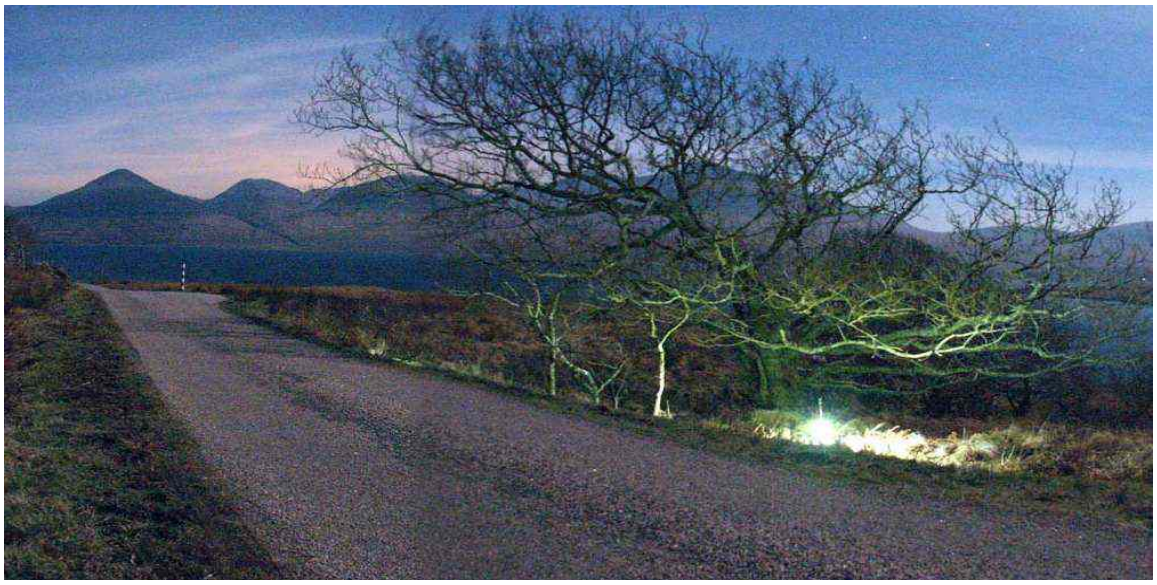
The UK Law does not prevent me designing wonderful ideas, but it does with housing for reasons I do not agree with or understand.

Planning has a chokehold on housing innovation, it has no right to this for any professional reason.
I love the concept of a packaged design shipped to destination. Everything onboard, shippable worldwide. The shipping container is there for several reasons. It is strong, waterproof, can handle the loadings of the mezzanine floor, and is secure so that it cannot be broken into. It also can be prefabricated/modified in a centralised workshop, and used to transport all that is needed inside for the final installation. This allows centralised economies of scale, transportation, collective focus, and training in one place, which is likely to be owned by the founding communities. They are the pioneers, so in fairness, the knowledge should stay based there. Considerable investment has been made at Barmolloch Farm, Kintyre, and there are fabrication training facilities owned by UHI in nearby Lochgilphead, and in Oban.

The sheer numbers of homes needed does bother me a little, if 20 suitable communities over Scotland asked for 5 units each as part of their participation, 100 units would give excellent economies of scale and delivery. At £18,000 each DIY self build, that would give 100 homes for about the price of 10 single modern homes. But if you maximise cost/performance, and couple it to localised waste supply chains, and community forests, then it could come down to less than £10,000 each. That is my target.

I feel instinctively that this networked group of homes across the country will shine only if you can cope with the attrition of involved personnel that always happens, some leave some stay; one reason why you need so many. But I have to be clear, once you see one of these working, I would doubt that attrition would be the problem.

Business common sense says this is too cheap, and I would prefer to assume a higher material cost, but the original concept was supposed to be incrementally built over a few years. All the costs were not to be paid up front, rather slowly as the build progressed. So let's say the first 100 are designed at a cost of £28,000 each self build.



£2.8 Million, in housing terms peanuts.

Where does the land come from?

Forest Enterprise, Community forestry, and donated unproductive farmland would make sense. It has to be exposed to the elements, and for this reason will be naturally unproductive. The homes would all be permanently owned by their communities with guaranteed tenure, possibly involving Universal Basic Income, say set at half the current levels being proposed, to encourage people to settle in and commit to the life.

That gets rid of the headache of cheap housing threatening private household values. They are never going to be sold, and never on the market. If unoccupied they can be leased out, but not in ways that threaten the rental market. Summer lets for tourists as renewables powered bothies could make them self funding, and then provide secondary over-winter accommodation for locals who can only find summer employment, as many do here.

The project management and training could be handled by UHI, but at the moment, I lack confidence in their ability to handle such a demanding project, and would need to be persuaded. Sure they could train in a distributed manner, but they do not possess the mindset to manage this. I say this based on observations on current course structures needed to train the skill sets, which remain stuck in the past. Frankly no Scottish University has ever coordinated anything as broad in scope and ambition as this, since WW2, and it shows.

The rest are in the details, and I am not much interested now in discussing them further, you resolve them as they develop within these budgets, and allow for this in the final costings. I still belong to a generation that just goes out and does things, rather than beg permission.

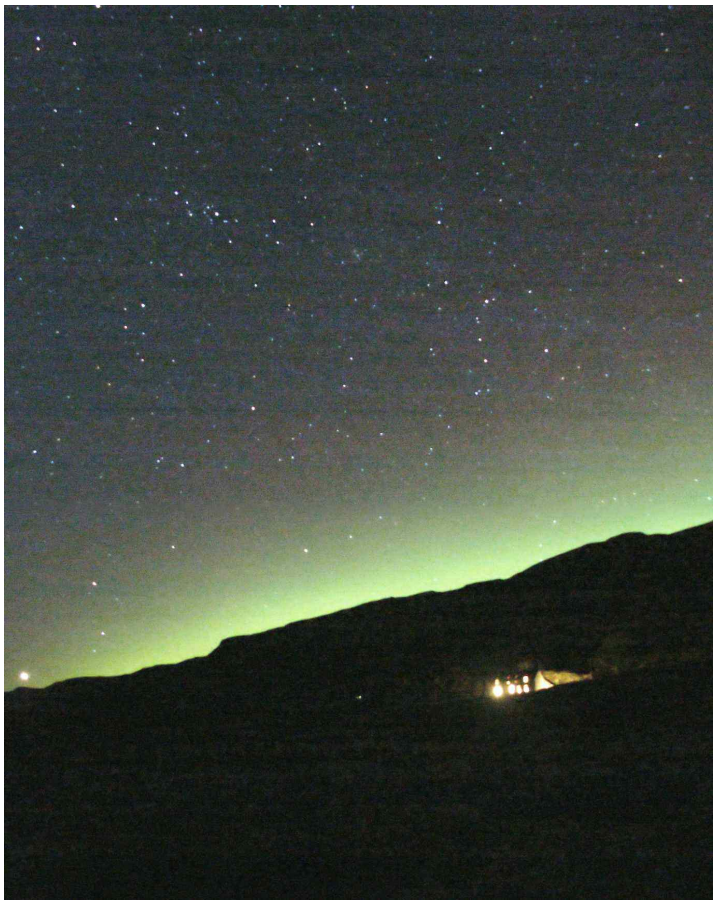
I have to be clear, to anyone who might wish to be part of this, that you will be expected to live this way too, and will not gain as much financially as do people working in the wider world, but you will have a security to be envied.

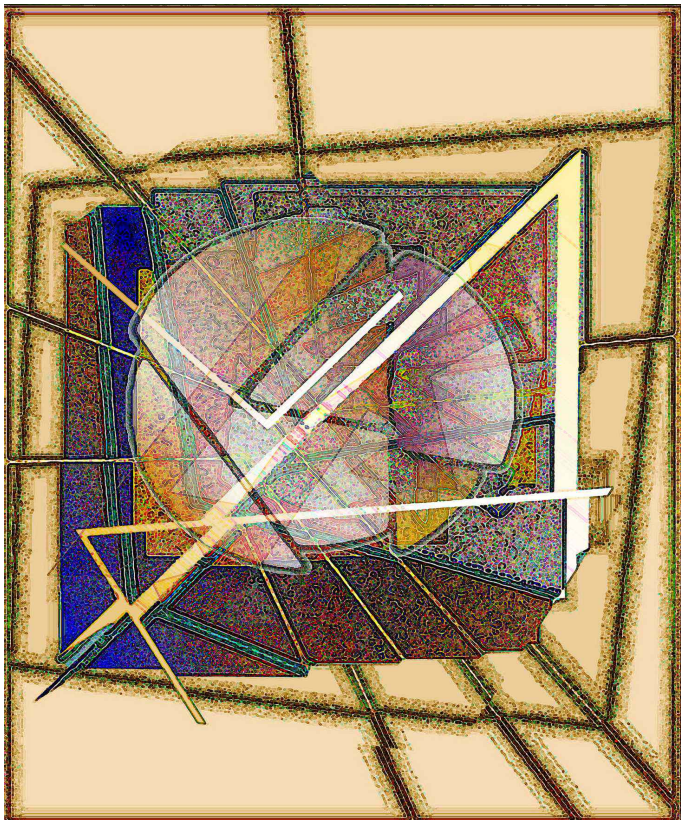
The legal aspects of this project will play out in the court of public opinion, for many years to come. I consider it a legal human right to build professional structures that explore the renewable future, as long as you do so safely. To do so even if these offend the vernacular, and those who wish society to stay stuck with an increasingly serious mess.

As to how the designs cope with love, marriage, children, divorce, and all the other joys of life, that is worth debating hard!!

Appendix 7:

The things I appear to have forgotten are worth thinking about. I do not intend to go into most of these in detail because they are covered elsewhere. Clothing, footwear, refrigeration and hot water come to mind. Thanks to psychedelics, the 1960's were a legendary era for creativity, yet we had little in the way of variety in clothing, and in some countries this is seen to be fashionable even today. Have just a few changes of clothing, but make them very high quality and timeless in style, is a norm in France and Italy. Own a sewing machine is another easy way out, and make your own.

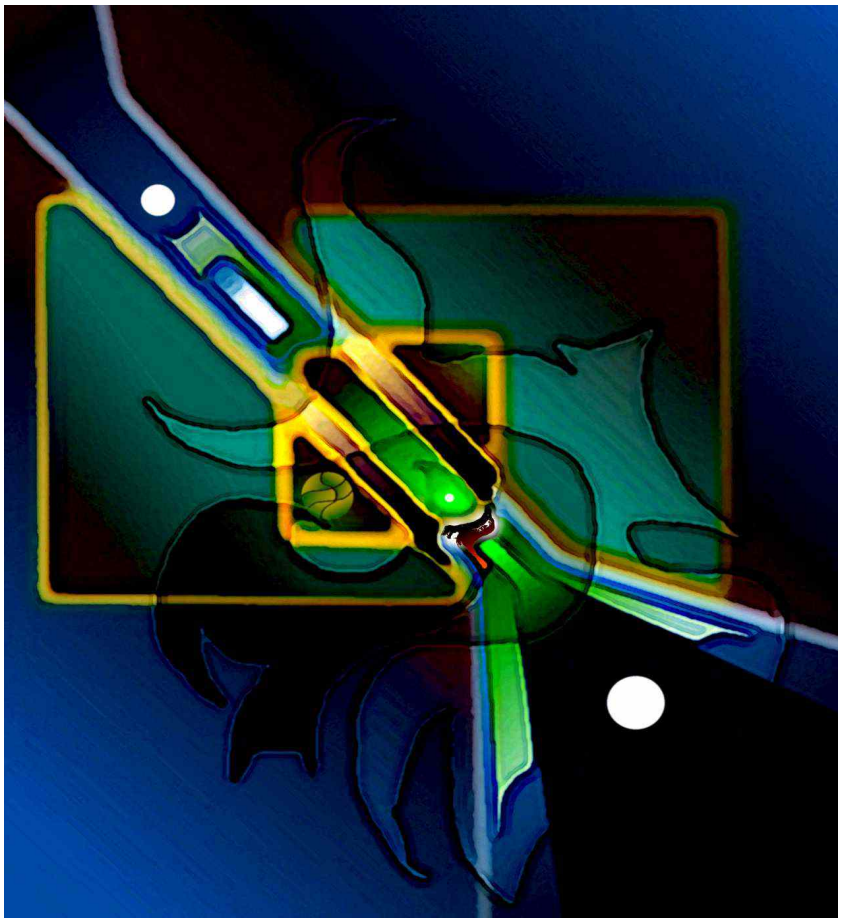




Hot water, mostly as washing water in winter will have to be met by reduction in use, and possibly by wood burning as a last resort, when thermal storage runs out. Heatpumps driven by fuel cells powered by hydrogen stored from summer excess solar energy remains a dream, except large scale; were it ever to be small scale then the world would change. In the '70's crises we used to wash cutlery in small volumes of water and a sponge and rinse in cold. Each shower you take uses 1.2kWhrs. Again washing by a different method seems the best alternative: for most of the year you will have excess. Refrigeration is another matter. The most glaring issue I seem to have forgotten is the one that needs more discussion: I am acutely aware today of the role of fermentation and culture as an alternative to refrigeration.

There are two types of refrigeration, one holding foods between 1C and 5C, and one holding them below -10C. The former can be accomplished using a north facing evaporative cold store, as we used to do in the past, and the latter by using fermentation to preserve foods that would be frozen today.

Evaporative cooling is not a perfect solution, however, really efficient freezers use about 45Whr: even if home made, which adds up to 1kWhr/day. In a hyperfrugal life, that is too much to keep running all the time, although in winter, in continental climates you can use nature itself as the freezer.



The reason why fermentation is so useful as an alternative is that it acts as an enormous support to your microbiome, in ways we are really only now beginning to understand. Some countries like Korea use fermentation as the primary preservation method, and the range of foods they work with are fabulous.

I first met the background story of fermentation from reading Sandor Katz's amazing book “Wild Fermentation”, and now his masterpiece “The Art of Fermentation”; if you want to see the future, read both.

Why fermented food is so great is flavour: it is not just good for your microbiome, and in the future you can expect to see many more amazing foods developed using fermentation. In the past all the foods we consider cultured and of very high quality arose from using fermentation in the process.

From civet poo coffee to kimchi, anchovies, cheese, beer and wine, fermented foodstuffs have a flavour density rarely found in fresh food. Refrigeration is useful on occasions like seasonal vegetable excess, but traditional methods of preservation using low salt fermentation beats it hands down if energy conservation is important.

The placement of the sunspace home in areas of high wind exposure should allow some refrigeration, simply due to the normal run of winter storms which last several days: electricity production at these times tends to be in excess.

We have also forgotten ice storage systems which were in Victorian times used very effectively to store ice till summer, so I am sure that the desire to have fresh vegetable produce stored frozen still remains an imaginative option in a hyperfrugal world.

All we have to do is design it, if someone will let me do so!

The response so far from politics and the Scottish civil service has frankly been so lacking in both understanding and enthusiasm it has left me speechless, angry and a little hurt. Mostly frightened, because they cannot see what is coming. They still think linearly, when the planet is using exponentials.

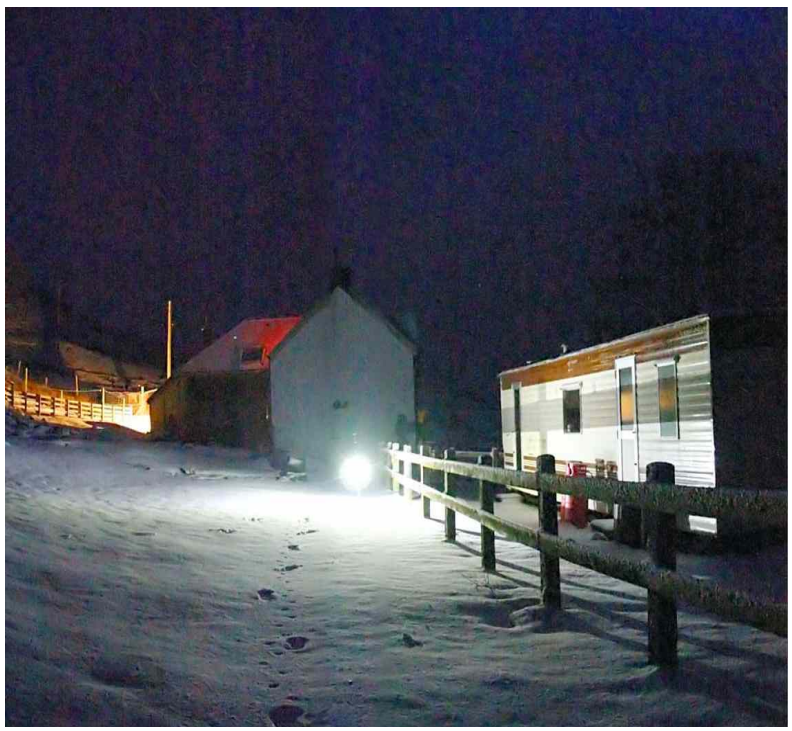
It is impossible to understand a mindset that says we only support projects that are easy to achieve, never really need the money, and only those which do not rock the boat, while wildly enthusing about future opportunities That is why we need to start talking about punitive legal action against obstruction, for the sake of the planet and our children's future.

Appendix 8: My Current projects

The Bolger Micro: Orion

I have lots of ideas, but have to ground them in reality. My primary love in life is a Bolger Micro I have been building, which should be in the water this summer. It has taken me years and on the face of it, not been worth the effort, but I am so looking forward to seeing her finished. Phil Bolger was an American marine architect, of wonderful imagination and skill. I fell in love with the scope of his designs 8 years back now, and have slowly built her as health allowed.

The Micro is one of his most popular designs, about 1000 have been built worldwide, most have given their owners great fun. I plan to use mine to travel across the west coast of Scotland and stay in places you cannot reach by road easily. There are many remote places in Scotland accessible by sea, the problem has been staying there so you can get great imagery in comfort.

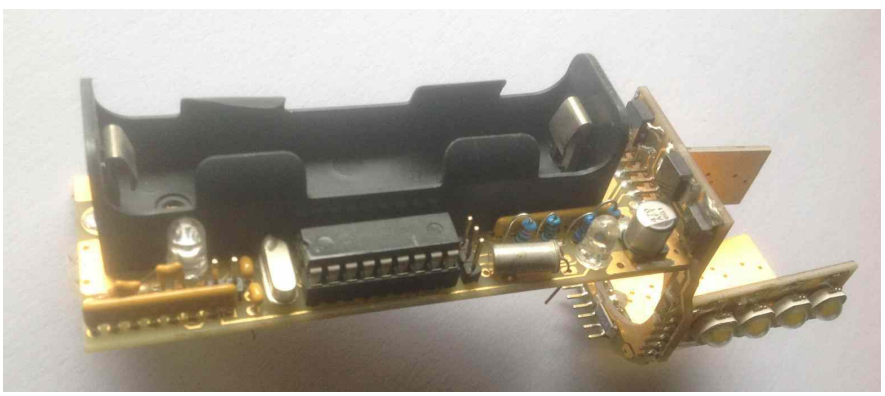


She will be coated in solar PV and I am testing the bits out now. Identical in format to the sunspace home all mod cons, a cooker, and outboard, all powered by the sun, and possibly wind as well.

My Spinlight

For many years I have wandered the landscape supported by a walking stick that illuminates all around at night, I have tried to take it to commercial success but never got there, maybe someday someone will go east and get it made in volumes.

Illuminating the landscape at night is a tricky affair especially if you are a night photographer. Big and bright produces cone vision and you see a central view with no peripheral vision, it is made worse by modern high efficiency LED lighting by being searchlight quality.



The spinlight uses your peripheral vision more effectively, and given the advances in battery technology should be really effective today.

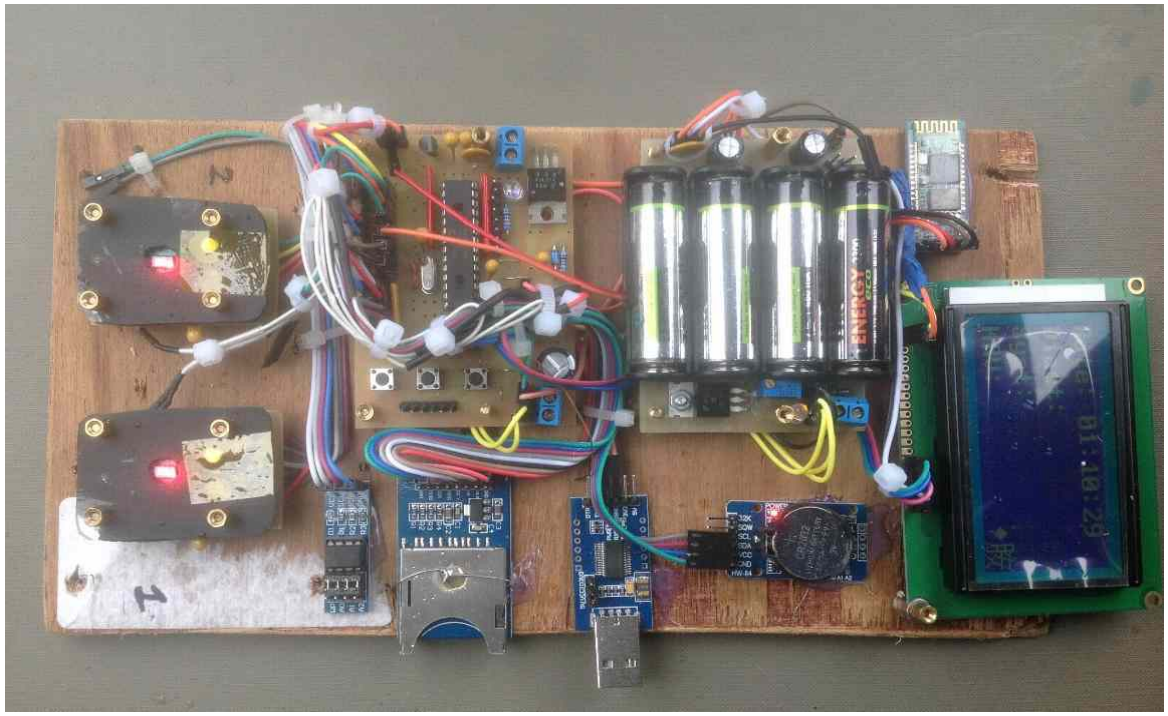
Sometimes when you are looking down or up with a head torch the worst happens: you bang your head on a branch, when looking down, or trip up on a rock when looking up! The spinlight spins a beam of light around you so you can see the world in 360 degrees and at a height that gives you critical depth of field and clear visibility, even in a whiteout you can see the ground. But the greatest strength of the spinlight is its ability to support you via the walking pole. The number of times I have slightly tripped and been able to see where I was going while using it to support! It is a lovely bit of technology too, including the 3D prints.

Human Thermoregulation Monitor

This is one of the last great frontiers of medical science. We all need stable diurnal rhythms in the core temperature of our bodies, but the difficulty measuring this reliably and finding techniques that allow us to interpret what we measure has prohibited the development of an understanding that could well be critical to our well-being.

I have been looking at this for years, but only recently has the task been made easier by some pretty incredible electronics. The prototype to the right works better than expected. How our physiology reacts dynamically to the stresses and strains in life is a critical area of understanding.

There is an irony in this wee bit of kit, because it has explained my own health issues so precisely I am a bit embarrassed: I had not realised why, but without the kit you can only suppose without Proof.

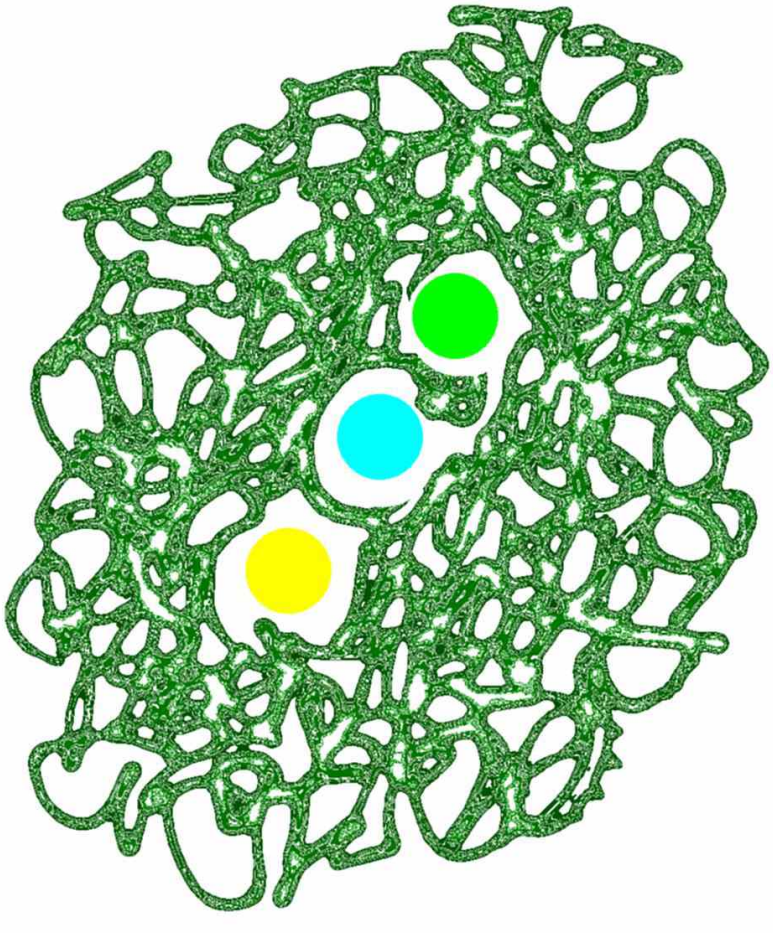


This is designed to be coupled to neural analysis so that we can use it as a detective tool to find patterns of significance that represent issues with our well-being. Sometimes you have to go for it, not knowing if you will succeed, hoping that it does not end up a waste of time and effort. After 6 months it is looking very exciting.

Human well-being is incredibly subjective, and seeing cause and effect is very hard: there are often many ways we can interpret a health problem.

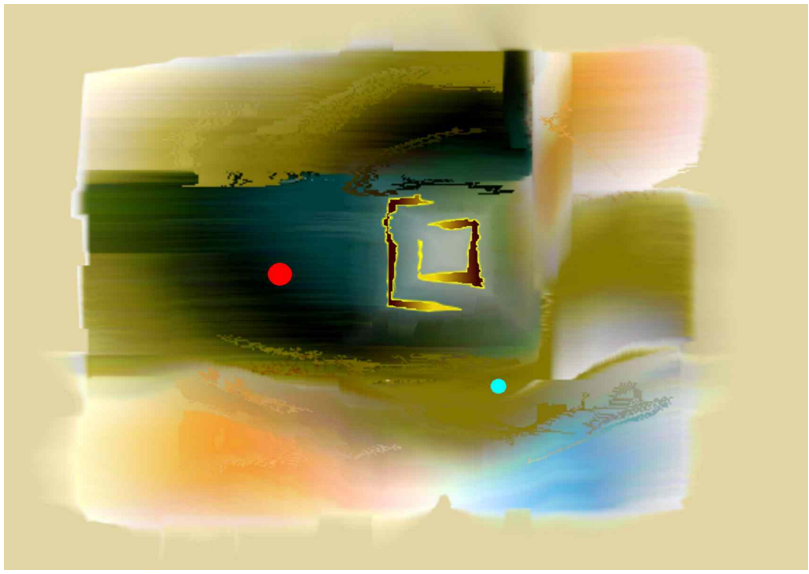
How do you know for sure which might be the best way to deal with it? This subjectivity is there primarily because we have little in the way of generalistic tools at our disposal. Sure, we have cat scanners and hugely expensive and powerful tools, but we have very little that work in our day to day lives. My hope is that this will make a real difference when trying to help numerous conditions we can do little for at the moment. A tricorder.....No!

Watch this space.....



Note it is using my proprietary cards linked together using jumpers. It is an amazingly quick way to prototype an idea!

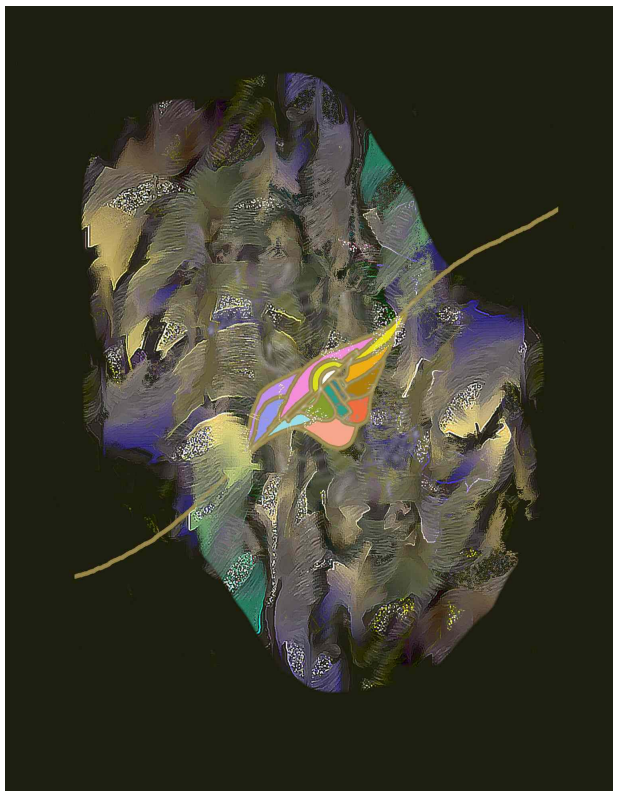
Times of change



I am writing this on the ramp of the pandemic in the UK about 6 weeks away from Peak. I assume many still think this is all nonsense and false news.

These are times of enormous change. The two Oil Shocks of the '70's were similar in feeling, in change and uncertainty from normal life. Most people struggled at first, and then got on with things, accepting the changes needed to survive and prosper. With disease, this is a lot worse, highly prejudicial, may last at least as long, creating deep follow on recessions, but this shock has been predicted for a very long time, and is caused by humanity's increasing destruction of the natural environment and damage to the mechanisms that allow it to deal with environmental catastrophe. Australia was a warning shot: so is a pandemic. So listen hard to Mother Nature: Gaia does not forgive ignorance. If you were looking for powerful negative feedback processes that could reign in economics, reduce CO2 emissions, and point us vulgarly in the right direction, one just arrived, a big one in a small package, freely delivered.

Peak Oil has just passed, we need the remaining oil kept in the ground, and used wisely and slowly to rebuild our world. Everyone wants to be protected from the damage their existence has created. Falling EROEI will kill the US oil shale market, and there is no means of getting oil out of the ground as cheaply as we need, without bankrupting the low EROEI producers. The hugely wealthy middle eastern countries with large reserves will never be able to sell them in a world that has had the time this pandemic will give us to reflect on our collective stupidity. I would hope so. I am sure many said that after the two oil shocks of the '70's; instead we went on a bonanza of greed, and may well do the same in rebound to our old lives. The next disaster coming will be the West Antarctic ice sheet collapse.



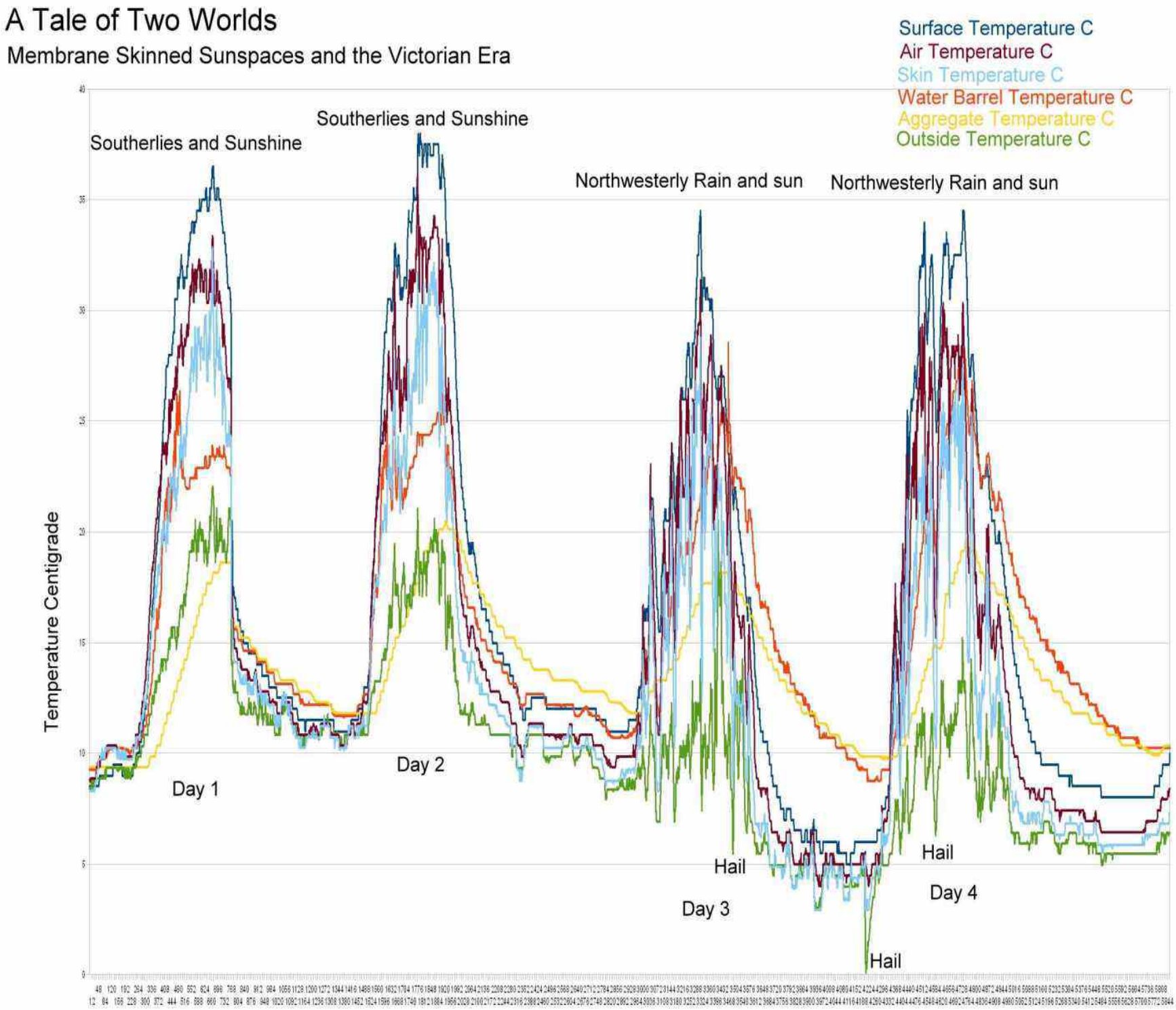
I believe that hyperfrugality is going to have to be a major part of the way we live now, especially for the poor. You cannot run society on exponential debt; we have to pull together on this, and not look after ourselves alone. But, the realisation of this will take time, we are so dependent on each other now, that self-interest has to give way to common decency.

On the plus side, pandemic forces us to dramatically reduce our CO2 emissions and NO2 as well: locked down cities with clear air and little traffic is well worth experiencing, I would like to hope that after all the dust has settled that we will yearn to go back to this peace, and work towards it productively. Silent Cities will change minds, you can never forget them. Afterwards let's start with Silent City Day, once a week. Everything stops: that will do it.

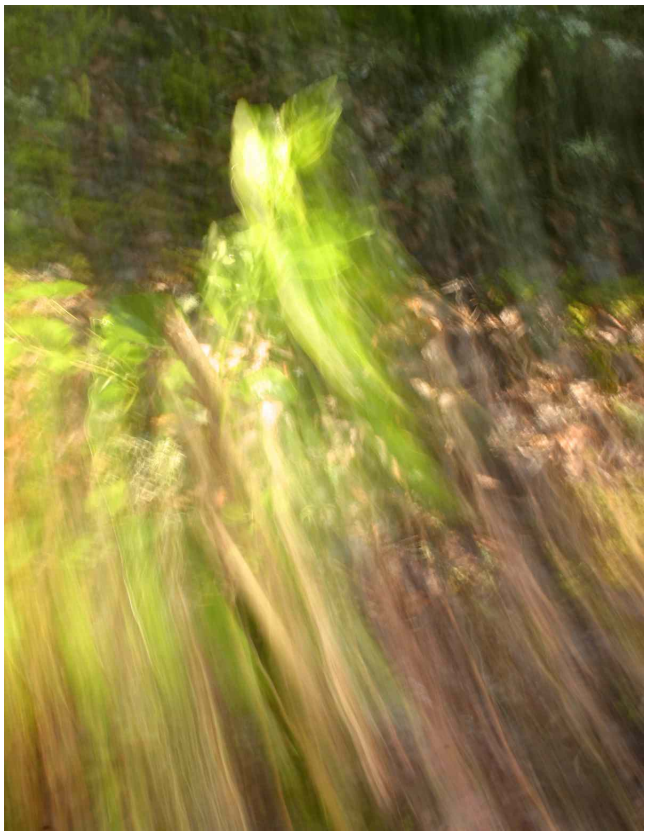
One small organism, barely alive has shown us how we can reduce our CO2 emissions and still survive and prosper. Personally I see it as final warning, only those who heed this can continue to live on this planet. I really think that this is the start of an onslaught from Nature that is intended to overwhelm, and destroy those societies who cannot, or will not learn. Grief is strange, during denial we refuse to acknowledge our feelings, and this period is going to involve loss at many levels: loss of friends and family, loss of wealth and comfort, loss of security, loss of faith in many things. Denial only lasts as long as the initial events themselves. Then it turns to anger. We are going to be hungry by the time this is all over, so help your friends and neighbours, as hungry people are often also cold and very angry. When anger dissipates, we are left with bargaining, and our major bargain is you live within your means, and not just go back to your old ways. That will for some be very hard indeed. To those in government: change or be fired. Only support those industries that allow us to live within our means. Take the wealth needed from those who could never possibly spend it all, and demand their support.

A Home in the Sun

The graph below shows what April temperatures are like inside a sunspace, without north side insulation, as the weather changes from southerly to northerly. To experience this is amazing!! Will I get to live in one, before I die, I do not know; I hope so!



Project Ambitions

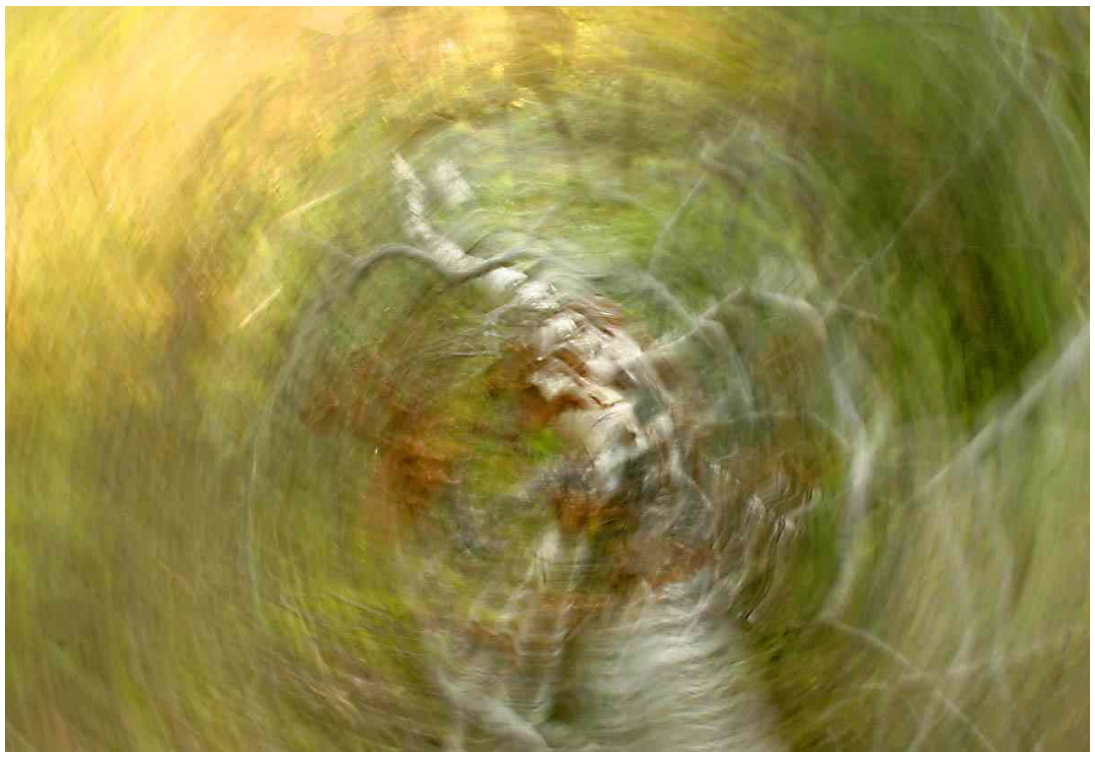


I have been at this for most of my life, and would now really like to see two buildings finished, as demonstration units for people to visit, and stay and experience first hand for a while. My own one, the cheapest and most compact version, will be paid for by me, to live in for the rest of my life; the second would be paid for by charitable fundraising, as would be the land. On completion I would donate my unit to the charity as a permanent artist in residence.

I will place my own capital into the funding process. If at the end of this process insufficient funds have been raised to build these units, properly costed, the capital will be returned to the donors and project abandoned. The charitable funding will be raised using social media, over a 12 month period or shorter.

It is hoped the charity will be called The Carefreedom Trust, and its charitable duty will be to maintain the demonstrators in good condition and disseminate the ideas it develops worldwide for charitable purposes only. There may be a commercial arm of the organisation which develops these design ideas onwards for refugee use.

Once built, the project running costs will be covered from the rental of the second unit during the summer months, for four months from April to July, and the rest of the year it will be used for development work, and as an artist in residence: an artist with green fingers, and technical curiosity.



The project initially will only require a project chair, four core trustees and project manager; once completed it will then need several trustees relating to each of the technical areas required to keep the whole of the units working. I would hope that university interest in becoming part of the project would grow as the publicity phase develops, as many of the design elements like growing plants inside homes, and linking these to renewables powered integrated systems, will be part of our future built landscape.

To be frank, the rest is up to you, the reader. This does not have to end with two demonstrator units. The scale I originally felt fit for purpose would be about 100 units in 50 communities, across Scotland.

Each pair of units would have their solar engineering fine tuned to their local landscape in ways that would be impossible in a non-charitable situation due to the many costs involved. This fine tuning is critical, because subtle site to site variations could make a big difference in how they operate.

With 100 built, the normal yearly flow of people through the project would have a scale sufficient to overcome some of the finer issues of living off the sun. These comprise some of the social and emotional challenges caused by isolation, including, even boredom! I would hope that each community would be networked so well, that problems would be resolved collectively, and nobody would feel isolated or lonely. For me this is the essence and meaning of the word community.

I do not provide literature references, as I assume that either you have read them already and understand them, or have no idea at all, which means you have a lot of reading to do, my dear friend Google will probably help, just use the names I have mentioned.

About the author:

The author is 68, and has the following qualifications
Honours Botany 2(1) 1974 Dundee University.

PhD “The Effects of Light Quality on Phytoplankton Carbon Metabolism” 1978 Dundee University.

Scotec V Electrical and Electronic Engineering 1983

Senior Equipment Engineer Mechatronics, National Semiconductor UK 1983-1989

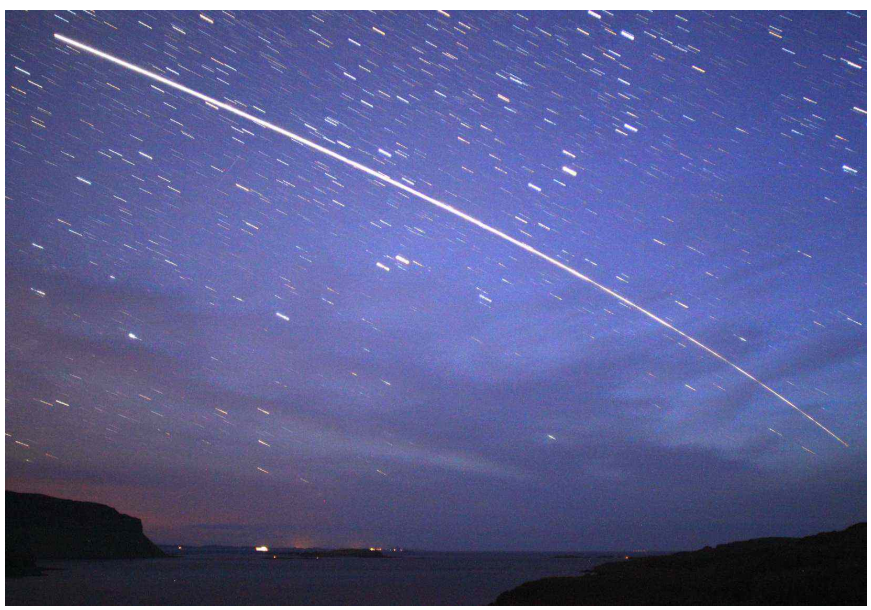
Freelance Instrumentation Engineer and Designer Aquaculture 1989-1992, Managing Director Bobcat Ltd, Designer of the Bobcat Datalogger.

Wastewater Systems Designer, Landfill Leachate Treatment, 1992-1994 Technical Director Generator Systems Ltd.

Freelance Biological Process Engineering Consultant 1994-2000

Photographer, Artist and Renewable Engineer, Mull, 2000 - 2016

Now retired, on permanent Sabbatical.



Your Notes:

I know you wouldn't retire at 25, but if you were so secure, protected, and comfortable in life, what would you do with your remaining years?

When you see for the first time
you never forget it.
In those short fleeting moments of surprise
a torrent of understanding
floods through,
then the gates of consciousness close
with a loud and painful clang!
Inside, a storm ensues
lashing the old ways.
Old stays, on which we hold
our view of the world intact
fracture and tear
then
slowly
a new smile forms upon
tomorrow

Waste far less
Live off the Sun and Wind
Retire early
Save the Planet
Could anything be
More Easy
To Understand?