Chapter 1: A Personal Journey

My ancestors were sun worshipers

The ancients recognised the sun as the giver of life and they afforded their own star its rightful place in their worship. It is clear that our ancestors understood the connection between the sun's orientation to the earth and the seasons – that there were turning points when the days started to get longer at the winter solstice and shorter at the summer solstice. Religious tools were the calendars embodied in monuments to predict the seasonal changes that affected everyday life.

Well known are the Aztec and Egyptian sun cults. However my interest has been in how my own ancestors saw the sun. On my father's side my origins are Saxon-Celt. My grandfather John Hunt was born in in 1861 in Wootton Basset, on Salisbury Plain in Wiltshire, England. The town is near Stonehenge, probably the most famous monument in the world, and aligned with the sunrise at the summer solstice.

Stonehenge and the sun

The Hunts have been prominent in Wootton Bassett and district for centuries, as attested by the births, deaths and marriage records. And they still are going by the great number of Hunt's in the phone book. Moreover, a Hunt has gone down in history as an unlikely promulgator of the myths and legends of the origin of Stonehenge and at the same time as an assistant in helping successive investigators attempt to unravel its archaeological and astronomical complexities.

Gaffer Hunt, "a venerable old man", provided shelter for architect John Wood[1] in his work on the plan of Stonehenge, which he commenced in 1740. Hunt had built a hut against the stone 60. From there he plied travellers with liquors – his cellar was under the fallen stone 59 – and showed them the stones. Many came to take the dimensions of the stones and distances between them, so Gaffer Hunt always kept measuring rods in his cottage for this purpose.

Wood tells the devil story of how Stonehenge was formed and also how the heel stone came to have the imprint of a human heel.[2] Later E. H. Stone suggests that this story, as recounted by Wood, would have been told to him by Gaffer Hunt.[3] Astonishingly Hunt, who was an old man in 1740, was still carrying on his tourism business 30 years later when John Smith undertook his investigation.[4]

I first saw Stonehenge at the age of 18 when travelling from London to Cornwall on my motorcycle. The east–west highway passes quite close to the monument. I didn't know about Gaffer Hunt then; if I had, I would have spent time at stone 60 visioning the old gentleman entertaining visitors 200 years previously.

Carbon dating suggests that the monument may be much older than previously thought, begun not in the Neolithic but the Mesolithic period.[5] A semi-permanent settlement about a mile from the site has been dated 7500-4700BC.[6]

Stonehenge retains its mystery despite the hundreds of investigations carried out and theories promulgated about its origins and meaning. One thing remains certain, however: the design of Stonehenge gave great important to the sun and makes for a spectacular sunrise on midsummer's day.

Sunrise over the heel stone from the interior of Stonehenge on midsummer's day

Source: Image licensed from Mystic Realms.

The Vikings and the sun

I claim Viking ancestry on my mothers' side which gives me an excuse for talking about sun worship by the Vikings and the wonderful explanation they came up with for the traverse of the sun across the sky and its disappearance at night time.

My Viking ancestry claim is based on my affliction with the hereditary Dupuytren's disease. The disease, most often manifest in males, usually exhibits as a malformation of the tendon to the fourth finger; contraction of the tendons in the palm can cause the hand to close in on itself. Its highest incidence of the disease is recorded in Iceland and it is common in Scandinavia and countries of English stock.[7] My mother's family is from the county of Essex in England, Viking country and part of Danelaw that covered eastern England, being conceded to the Viking Guthrum by the Saxon king Alfred the Great in 886.

The Danish explanation for day and night is intriguing, as deduced from the Trundholm sun chariot, a late Nordic Bronze Age artifact discovered in Denmark. It is a bronze statue of a horse pulling a chariot supporting a large bronze disk.

The disk has a diameter of approximately 25 cm and is gilded on one side only, the right-hand side (when looking in the direction of the horse). It consists of two bronze disks that are joined by an outer bronze ring, with a thin sheet of gold applied to one face (see image). The gold side has an extra outer zone which may represent rays.

The Trundholm sun chariot, showing the side of the disc that depicts the sun.

Source: Image by permission of Malene Thyssen.[8]

The two sides of the disk have been interpreted as an indication of a belief that the sun is drawn across the heavens from East to West during the day, presenting its bright side to the Earth and returns from West to East during the night, when the dark side is presented. It is thought that the chariot was pulled around during religious rituals to demonstrate the motion of the sun in the heavens.[9]

In Norse mythology the sun and moon gods and goddesses are dramatic figures. The horse drawn chariots of Sol and Mani are hauled rapidly across the sky but the Sun-chariot is being pursued by the wolf Skoll and the moon by wolf Hati. The eventual devouring of the Sol and Mani by wolves will herald the twilight of the gods, *Ragnorak*.

After the apocalyptic event the world will resurface, new and fertile, the surviving and returning gods will meet, and the world will be repopulated by two human survivors. [10]

The wolves Skoll and Hati Pursue the sun goddess Sol and the moon god Mani across the sky.

Charles Dolman 1909.

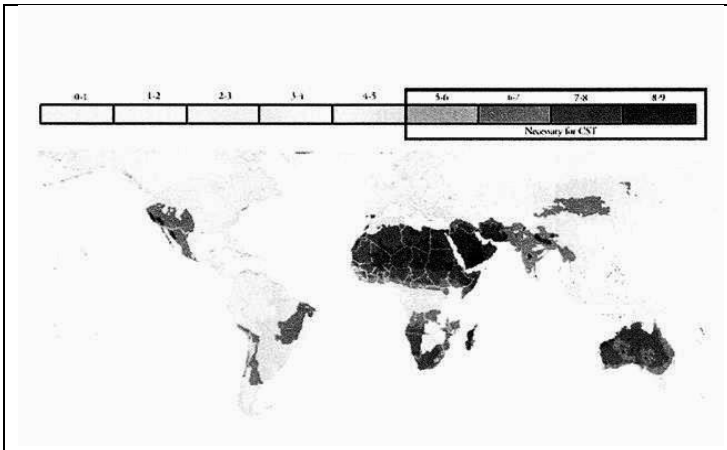
We have seen in two instances how our ancestors – the megalithic British and the Vikings – placed the sun front and central in their belief systems. Through the widespread adoption of solar power we will reinstate the sun to a pre-eminent place in our daily lives.

Sunshine state is home

I live in the state of Queensland – Australia's "Sunshine State", according to the promotional blurb on our state's car number plates. The tourism ads for Queensland say "beautiful one day perfect the next. While that's not always true, the sun is literally in my face most days so it's hard not to have solar power on my mind. As I travel through Queensland cities, towns and villages, I now see far more roof-top photovoltaic (PV) panels than there used to be, but there are still many houses and businesses with north-facing roofs that cry out for a panel.

Many parts of the world have sufficient sun for PV roof-top panels to operate efficiently.

But Australia is lucky, along with some other countries, in that it receives sufficient sun to run large scale solar plants or concentrating solar thermal (CST), capable of generating 24-hour power.

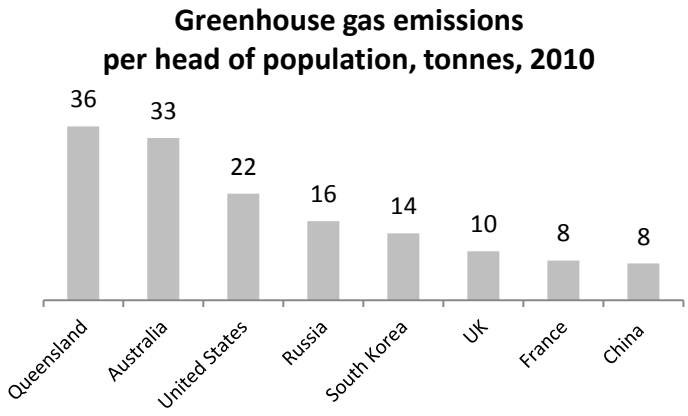


Darker shading indicates solar radiation strong enough for concentrated solar thermal.

Solar resources in Australia, the US, Mexico, the Middle East, and southern and northern Africa are sufficient. Parts of Latin America, India, central Asia, and China have potential.

Source: WRI. [11]

But the sunshine state has a murky side. Queenslanders generate more greenhouse gases than the average Australian who generates more than just about anybody else on the planet (see chart).



Per head of population greenhouse gas emissions are very high in Australia and particularly high in Queensland.

Sources of data: WRI CAIT 2[12]; Department of Climate Change Australia[13]; Australian Bureau of Statistics[14].

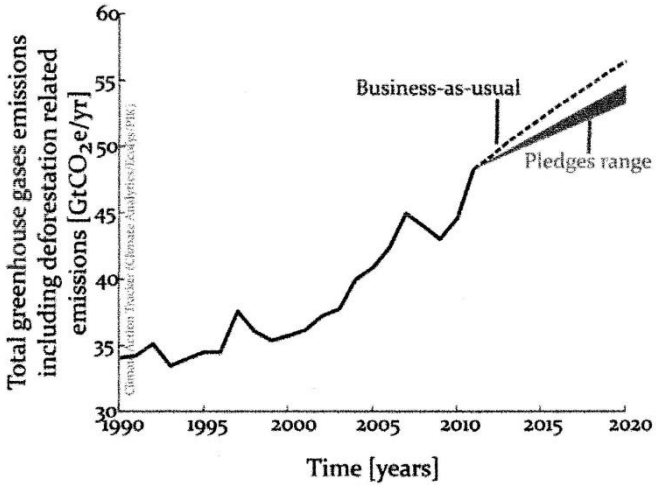
Why is this so? Its coal, stupid! Australia relies heavily on coal for the generation of electricity, and its embrace of renewable energy is only recent and tentative.

Global warming caused by greenhouse gases and its catastrophic consequences has been on my mind for a long time. Back in 1991, I wrote:

OK, let's get depressed

Climate change is a global problem requiring global solutions. For somebody like me, who takes the future seriously, the abrogation of responsibility to act by the heavy polluters has been depressing. Since Berlin in 1995 there have been at least 20 United Nations

Climate Change Conferences. And I am not surprised that these gabfests to tackle global warming have ended in failure (see chart). Failure, that is, if success is measured by managing the present so that the future is free of catastrophic climate change.



Global greenhouse gas emissions per year: historic (solid line), projected business as usual (dotted line) and with pledges (heavy line) put forward by governments.

Source: Potsdam Institute/World Bank.[15]

I myself have never held out false hopes for international action because I have long been aware of how – despite the very best of intentions – we end up with the tragedies of the commons.

In 1994 I wrote "…

> [T]he critical and increasingly scarce resources…being used up [such as the capacity of the biosphere to absorb CO_2] are public goods and do not have prices or markets. The finite nature of [such] global resources means that Adam Smith liberalism and self-interest will not globally achieve 'the common good'. Instead the prisoners' dilemma will apply. A promotion of self-interest by a country means that all countries will be worse off.[16]

The immediate benefit to an individual country to maintain current behavior in terms of economic growth may be perceived to be greater than the eventual but uncertain benefit of behavioral change. Such hesitancy by any single key country to curb greenhouse gas emissions causes cooperation to unravel. Other countries will soon baulk at taking action if their major competitors decide to take a free ride.

The much-heralded Kyoto Protocol had a built-in free ride for developing countries. It left all the cuts, to 1990 level by 2012, to greenhouse gas emissions to developed countries. Not surprisingly it failed to curb total global emissions because the developing nations pollute more than the developed. The Protocol was even more deeply flawed because

the U.S., the world's largest polluter, would not come on board while China refused to submit to specific emission cuts.

Notwithstanding the built-in free rider problem of the Kyoto Protocol, I have sympathy for the developing countries rejecting emission quotas because it will hobble their economic growth. It is the developed countries that have created the problem of an elevated level of carbon dioxide in the atmosphere. "You guys have been burning coal for 200 years", they told us at Kyoto and international meetings since.

The formal exclusion of developing countries from coordinated cuts meant that other innovative ways should have been found to reduce their emissions. The obvious one, put forward but only timidly followed through, is the wholesale transfer of clean energy technology to developing countries, for free. Such a strategy would have cost developed countries trillions of dollars but could have saved the world.

Once a solar skeptic

I have not always been so confident about the solar being able to take a central role in energy provision in Australia. A few years ago I was sceptical because sun and wind are intermittent and can't provide 24-hour power. The replacement of coal-fired plants with nuclear plants would solve the problem of providing a constant supply of clean energy, however. In any case the uptake of renewables solar and wind was starting from a very low base and would not guarantee a clean energy future. A mixture of renewable and nuclear energy would enable Australia to meet its greenhouse targets of an 80 per cent reduction in greenhouse emissions by 2050.

My plan had a big hurdle in that a majority of Australians are opposed to the adoption of nuclear power in their backyard. This is notwithstanding the fact that they seem comfortable with the hypocritical policy of export of uranium to countries such as India.

Since I pleaded in my article "Don't dismiss nuclear", advances in solar power technology has been rapid and the prospects of the provision of all electricity by renewable energy has become feasible, not only in Australia but elsewhere.

Power to the people

A Renewable Energy and IT expo was organized for our local village hall in May 2011 and, as a local economist and academic, I was asked by the organizers to make a presentation. I talked about the prospects for solar power and renewable energy generally and whether it paid the locals to install photovoltaic panels on a roof-top PV and solar hot water solar systems.

I pointed out to the audience that the cost of solar power was still more than coal-fired electricity but there were rebates on installation costs and at the time the feed-in tariff was a generous at 44 c per kWh. But I also predicted that householders would economize on their power bills, quickly realizing that it is more profitable to export at 44c to the grid rather than run appliances in the day. Unsurprisingly I came up with the answer that to install a 1.5kw system would return 13% on investment and the payback period – the time for the investment to be recouped – would be 5 years. I put my money where my mouth was and we immediately installed a 1.5 Kw system on the roof of our cottage, followed by another 1.5 Kw soon afterwards.

Over the last year I have exported twice as much power to the grid as I have used. We generate an average of 7.6 kWh per day and use 3.6.

The subsidies have long since gone and the feed-in tariff will reduced by the state government to zero. However, the cost of electricity from the grid has since risen sharply while, at the same time, the price of solar panels has plummeted; the economics can still stack up.

Household solar panels are of now an important part of the energy mix in Australia and many other countries. In a later chapter I will talk more about the potential for households to be to be even more potent suppliers of electricity.

There are very little environmental costs associated with solar power. In contrast, coal is very dirty. Greenhouse gases are only part of coal's problem. Other noxious materials are extremely damaging to land, river systems and human health. However these costs are not included in the official costs of generating coal-fired power. If they are, then coal becomes hugely expensive and solar is an even more obvious choice. There will some proper accounting for the cost of coal in chapter -.

Misinformation

One of my objectives in writing this book is to try and counter the misinformation about solar power and renewable energy generally that is being peddled by vested interests. These vested interests are not the fossil fuel industries but include governments that own utilities whose profits are being undermined by solar power.

The negative spin affects the attitudes of those involved in the important planning and approval process and it undermines future investment in and progress towards a renewable energy future.

A 2012 survey of UK of newspapers found that only 21 per cent of articles were positive or very positive towards the renewables industry and editorial policies were often

negatively biased. This is of concern given that the vast majority of the UK population is supportive of more wind and solar energy development. [17]

In the US, the negative campaign is being spearheaded by the lobby group the American Legislative Exchange Council (ALEC) funded by the Koch brothers and other large players in fossil fuel industries. Most states have renewable energy portfolio standards designed to increase the share of electricity generated from renewable sources. An example of the ALEC's work is the drafting of a model bill, so-called Electricity Freedom Act, that repeals state legislation requiring electric distribution utilities and electric services companies to provide a percentage of their electricity supplies from renewable energy sources.[18,19]

A Spanish study, from King Juan Carlos University, purported to show that 2.2 jobs were lost for every job created in renewable industries. The report became a talking point in the US as its release coincided with the House Energy and Commerce Committee discussions on the American Clean Energy and Security Act (ACES). It was also repeated in congressional testimony by US Representatives opposed to clean energy policy and climate mitigation measures.

The US National Renewable Energy Laboratory was forced to step in and analyze the Spanish report; it found that the Spanish study

…lacks transparency and supporting statistics, and fails to compare renewable technologies with comparable energy industry metrics. It also fails to account for important issues such as the role of government in emerging markets, the success of renewable exports in Spain, and the fact that induced economic impacts can be attributed to renewables deployment".[20]

In my home state of Queensland, state-owned electricity utilities are having their profits cut by the increase in supplies of solar power fed into the electricity grid.[21] The State government is trying to slow down the rapid increase in solar installations by suggesting that the rapid rise in 2013-14 electricity prices is somehow due to solar power when the main villain is heavy investment by the utilities in more poles and wires to carry grid electricity.[22]

Solar is good for the economy and jobs

The good news is that in the US job creation has also been rapid in the renewables industries, rising to 119,016 in 2012 from 105,145 in 2011. There are now more jobs in renewables than in both coal mining (85,520) and iron and steel production (93,200). [23, 24]

In the US, *A National Blueprint for a Clean Energy Economy* by the Union of Concerned Scientists confirmed that the fossil fuel industry has every cause to be worried. Renewable energy showed huge savings on energy bills from reductions in electricity and fuel use. These more than offset the costs of additional investments. Net annual savings for households, vehicle owners, businesses, and industries would be $255 billion by 2030 and under the Blueprint every region of the country stands to save billions. Even households and businesses in coal-dependent regions will share in the savings.[25]

In the EU, a study also indicated bright prospects for renewable energy. Policies that support renewable energy sources give a significant boost to the economy and the number of jobs. The target of 20% renewable energy 2020 will provide a net effect of about 410,000 additional jobs and 0.24% additional gross domestic product.[26]

In Australia progress has been extraordinarily rapid and now a million homes generate solar power from roof top systems and 800,000 have installed solar hot water. While solar subsidies and favorable feed-in tariffs are being reduced by state governments, there are new drivers of the solar revolution. These are the rising costs of electricity and the plummeting cost of PV.

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