

The Suppression of the Solution?

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Behind the smoke screen of carbon trading schemes and underground pollution sequestration, the way forward for Victoria's electrical energy supply is in fact crystal clear. Beneath layers of rock outside of Geelong, and also under others near Lake's Entrance in Gippsland, super-heated aquifers are seething away at about 150°C, right beneath the existing grid towers. The scale and pressure of these aquifers are sufficient to supply enough geothermally generated electricity to power not only Victoria but New South Wales as well for centuries into the future. All that is required is to sink the mine-shafts, build the heat-exchange generators, and hook them up to the power-lines already in place, in order to create a zero-emissions supply pumping nothing but water vapor into our drought-ravaged atmosphere.

Exciting developments in the field of geothermal electricity generation are already underway in South Australia, where a company called Geodynamics Limited now power the outback town of Innamincka with a geothermal plant using the fractured-hot-rock variant of the geothermal idea. This method pumps cold water down into the Earth where it is heated as it percolates through fractures in the hot granite sub-strata, then returning to the surface where its heat is converted into electrical energy. Other companies such as Petratherm Limited and Pacific Hydro are developing such plants elsewhere in Australia and around the world. As there are several sites in Victoria suitable for both pressurized super-heated aquifer and also fractured hot rock technologies, the question arises as to why Victoria is not actively seizing this golden opportunity to become a world leader by demonstrating the simultaneous solution to so many of the world's problems, by setting up a working model of a geothermally-powered state of the future?

A little research turns up what a skeptic might suspect to be yet another example of a familiar pattern of corporate behavior retarding the development of this exciting potential, effectively ensuring that Victoria remains a coal-fired state of the past. The green light for the development of this resource was given by the Victorian parliament back in 2004. The exploration rights for the Geelong region, the most promising site for development due to its proximity to the concentration of heavy industry in Geelong and in Melbourne's western suburbs, were granted to a company called Greenerth Energy Limited. What have Greenerth Energy been doing for the past five years? Why isn't this most important resource in our state front page news? A visit to www.greenerthenergy.com.au sheds some light on these questions, and raises several others. For the board of directors of Greenerth consists of some major stakeholders in the fossil-fuels industry.

Greenerth are headed by Simon Molesworth Q.C., an environmental and resources lawyer. He reviewed and rewrote the Victorian Mineral Resources legislation in 2005 and has served as Victoria's mining warden, and also chaired a number of boards of publicly listed corporations in the resource sector. The remaining board members are: Robert Annella, executive chairman of Lakes Oil NL, an ASX listed oil and gas exploration company, who is also chairman of both Minotaur Exploration Limited and Xtract Energy PLC Limited, as well as non-executive director of both Gippsland Offshore Petroleum Limited and Rum Jungle Uranium Limited; John Kopcheff, a geologist and geophysicist with a long career in the petroleum industry in both operations and management, and he is also the managing director of Victoria Petroleum NL as well as director of both Kestrel Energy Inc and Great Panther Resources Limited; Robert King, who led the Geological Survey of Victoria exploring Victoria's geothermal potential back in 1985, producing the report forming the basis of the current

geothermal legislation. He is also the director of the Minerals and Petroleum Regulation Branch administering licensing and environmental law covering offshore and onshore petroleum operations, and was a member of the federal government team formed to establish the National Offshore Petroleum Safety Authority, remaining a member of that board; Mark Miller, a geologist with extensive senior management experience in downstream oil marketing, banking, finance, consumer products manufacture and environmental technology; and their secretary, Vicki Kahanoff, is a CPA who has spent her career in the resources sector, with eight years in forestry in Orbost and in Melbourne, managing the accounting for the privatization of Victoria's plantations as financial accountant for the Victorian Plantations Corporation, assisting in its successful sale to Hancock Victorian Plantations. She is also the corporate accountant and chief financial officer of Lakes Oil NL.

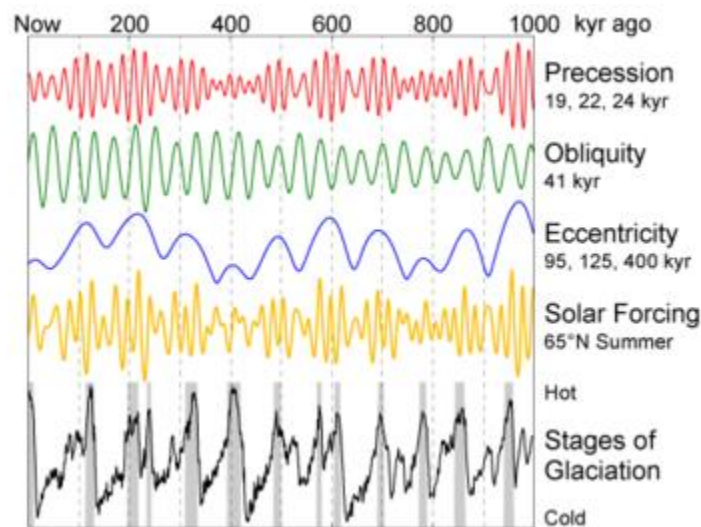
Admittedly, establishing a geothermal power station is specialized work requiring major drilling of several kilometers into the Earth's crust. The industries best equipped to do this are the oil and mining industries, whose equipment and expertise would have to be brought to bear on the task. But equally clearly, the board of Greenerth appears to consist of individuals with vested interests in the fossil-fuel and uranium industries. While this does not constitute a blatant a conflict of interest, as would be an outright acquisition of the geothermal rights by the coal industry itself, the situation would seem nevertheless to be what might be described as a conflict of spirit. Like the acquisition of the patent to the electric car by General Motors in the 1990s in order to ensure its suppression,¹ the key to geothermal power generation in Victoria would appear to have been sold off to the fossil fuel industry, whose vested interest remains the maintenance of their current markets, effectively closing the door on the development of geothermal power stations.

Why have all geothermal plants built so far in Australia been located well away from urban centers? Is it in order to lower their profile and to minimize the competition they pose to the coal industry's monopoly on power generation? And why is Peter Garrett ignoring geothermal and instead approving new uranium mines? Like water desalination plants, an important feature of nuclear power plants is that they keep power concentrated in the hands of a small number of corporate and government entities, and ensure an ongoing monopoly over a captive market. The individual is made ever-more dependent on the centralized power of corporate entities, whereas, for example, water-tanks in the back yard and solar panels on the roof makes the individual conscious of their own consumption, and so able to take responsibility for regulating it responsibly. This exciting development in the evolution of democracy has so far been held back by practical difficulty that solar and wind power could not supply the base-load requirements of our industrial civilization. The potential development of geothermal energy has now changed that brute fact, and a society powered with 100% renewable-energy with zero carbon emissions is now no longer an idealistic dream, but a real challenge to our collective ingenuity. Although geothermal power stations remain centralized infrastructure, and so do not contribute to the decentralization of power crucial to the evolution of individual democratic responsibility any more than nuclear power stations do, the entanglement of the nuclear power generation in the armament industry, taken together with the permanent potential for unforeseen accidents, constitute an overwhelming case in favor of the geothermal option, given that geothermal and nuclear are about equally expensive in the long run.²

1 See the Chris Paine documentary "Who Killed The Electric Car?" now available freely on YouTube, and the entry online at <http://en.wikipedia.org/wiki/Who%20Killed%20the%20Electric%20Car?>

2 See Australian Geothermal Association website - <http://www.agea.org.au> - as well as
<http://www.greenerthenergy.com.au>
<http://www.hotrockltd.com>
<http://www.panaxgeothermal.com.au>
<http://www.investvictoria.com/240408VicGeothermalSpot>

But why pursue this radical overhaul of the industrial base of our production, when the danger of global warming remains, according to some, merely speculative? Climate-change skeptics point to the fact that it is impossible to prove *conclusively* that it is mankind's activity which is causing climate change, and impossible to know for certain that any real catastrophe looms. Looking at the history of glaciation phases over the past 500,000 years, it is indeed true that phases of global cooling and warming have alternated in a fairly regular pattern, when mapped against the precession of the Earth's rotation, the obliquity and eccentricity of its orbit around the sun, and the long-term fluctuation of the sun's intensity. These regular natural changes in climate are called Milankovitch Variation, named after Serbian civil engineer and mathematician who first described these interacting cycles, Milutin Milanković (1859 - 1978). "Milankovitch Theory" attempts to describe the collective effects of changes in the Earth's movements upon its climate over hundreds of thousands of years, as summarized in this graph:



(source: http://en.wikipedia.org/wiki/Milankovitch_cycles)

As can be seen, we are currently approaching a local maximum in global temperature, and all other things being equal, we could be confident in predicting that another phase of glaciation will be taking place over the next 30,000 years, as global temperatures gradually drop.

The anxiety however is that "other things" are not at all equal, but that we are in fact currently

<http://www.geothermal-resources.com.au>

<http://www.geodynamics.com.au>

<http://www.petratherm.com.au>

<http://www.aussiehotrocks.com>

and also the following University and government websites:

<http://www.publish.csiro.au/paper/ASEG2006ab039.htm>

<http://www.uq.edu.au/geothermal>

<http://pangea.stanford.edu/ERE/research/geoth>

<http://www.ga.gov.au/minerals/research/national/geothermal/index.jsp>

<http://www.pir.sa.gov.au/geothermal>

<http://www.sustainability.vic.gov.au/www/html/2120-geothermal.asp>

<http://wotnews.com.au/news/Geothermal>

in a rather delicate situation. Those of us who have at some point learnt to ride a bike, or a surfboard, or roller-blades or a skateboard, or to dance or to drum proficiently, have all had some very practical experience of the dangers of what scientists call the perturbation of regular oscillation. The kinetic energy of a moving system can be regulated by being discharged through rhythmic oscillation. Getting the feel of rotating your feet on the pedals as you slightly tilt the bike side-to-side, for example, is crucial to learning to ride, and likewise regulating the movements of your limbs in a smooth rhythmic pattern is what drumming's all about.

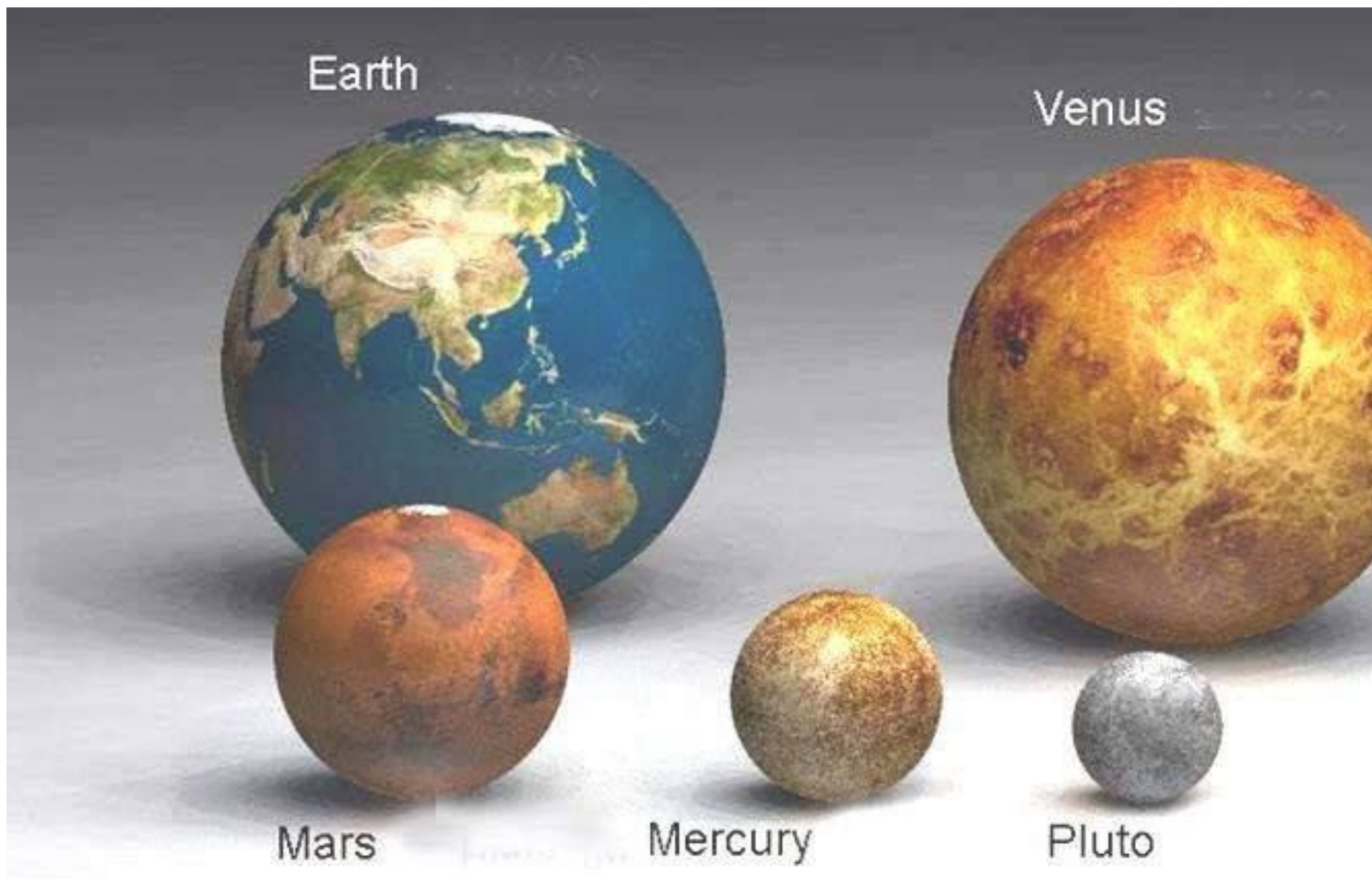
Getting the flow of such pulses without over-correcting is what we call balance. The space of movement of the rider, dancer or drummer is characterized by an inner or "comfort" zone of balance, surrounded by regions defined by an interacting set of "topple" points. Beyond these topple points is a surrounding region of chaotic instability, an outer "crash" zone. Learning to ride consists in finding and expanding your comfort zone by gradually swaying back and forth within it, learning to sense and to gently retreat from approaching topple zones. The size of the force it takes to throw us off balance depends on what point we are at in our rhythmic motion. Close to the mid-swing, things are stable, and bumps and hiccups can be absorbed easily. But at the edge-points of the swing, as the system approaches a topple-point and turns away from it, the force required to upset the system is much less. At a turning point, a relatively small stone on the road or bump in the wave can tilt you towards the crash zone.³

Obviously, the Earth as a whole and its atmosphere in particular is a dynamic system far more complex than these simple analogies can show. Extremely complex mathematical models still can't predict weather with any accuracy beyond a week or two. As the world reels from an economic crisis caused in part by too great a reliance upon the accurate predictive power of mathematical models for chaotic real-world systems, the climate-change skeptics are right to distrust the mathematical models of those doom-saying scientists whose models indicate that mankind's perturbation of the atmosphere's rhythms might lead to relatively massive climate alteration. It is to the real world that we must look if we are to learn how nature actually behaves.

Fortunately for us, the Earth has a close sibling, if not exactly a twin. Not Mars, which is actually a third the size of Earth and a drastically different place. The planet Venus is in fact more or less the same size as the Earth, and by astronomical standards relatively close, so it can serve as a real-world case-study for a worst-case scenario for planet Earth. For in fact, at some yet-to-be-determined point in the distant past, the planet Venus underwent a massive runaway greenhouse effect - we know, because we've discovered that its surface is a mixture of continental land-masses and empty ocean-beds. Something - probably a meteor collision - boiled Venus's oceans, creating permanent global

3 The topple or "tipping point" concept has rapidly become a widespread notion in climate science: see
<http://www.time.com/time/health/article/0,8599,1885804,00.html>
<http://sydneygo.com/global-warming-tipping-point>
<http://www.youtube.com/watch?v=Citd9RH7kbU>
http://environmentalism.suite101.com/article.cfm/carbon_dioxide_tipping_point
<http://www.scientificamerican.com/article.cfm?id=global-warming-beyond-the-co2>
<http://www.pnas.org/content/105/48/18860.full>
<http://abcnews.go.com/Technology/Story?id=3223473&page=1>
<http://www.countercurrents.org/cc-mccarthy110206.htm>
<http://www.planetark.com/enviro-news/item/52096>
<http://researchpages.net/ESMG/people/tim-lenton/tipping-points>
<http://news.softpedia.com/news/Did-Earth-Pass-a-Clime-Tipping-Point-74005.shtml>
<http://corrosion-doctors.org/Climate-Tipping-Points/tipping-arctic.htm>
<http://e360.yale.edu/content/feature.msp?id=2012>

cloud-cover. It's because of this global cloud cover that the discovery of Venus's surface topography had to await the discovery of the radio telescope (Venus being a nebulous featureless disc to an optical telescope), but the sea beds and continental coastlines are now mapped in some detail. With a post-greenhouse surface temperature in the region of a steady 500°C, and a surface air pressure around 90 times that of Earth's atmosphere, the concentration of CO₂ in the atmosphere is 96% - a similar concentration to that on planet Earth, before three billion years of life got it all the way down to its current 0.024% (=388ppm, now rising rapidly again). Where did all that CO₂ go from the Earth's primordial atmosphere? The carbon went into making you, me, the wood in the frame of your house and in every plant on the planet; and the oxygen went into making up 21% of the air currently entering your nostrils. In terms of our earlier analogy, Venus has crashed into a new stable state, analogous to you on the ground, motionless, with the bike on top of you.



But there are also substantial differences between Venus and the Earth. Firstly, it's about 40 million kilometers closer to the Sun than we are. Also, it rotates much more slowly than the Earth, one Venus "day" (which is 243 Earth-days long) taking more than an entire Venus "year" (which is 224 Earth-days long). And most importantly, Venus has no magnetic field, and thus no magnetosphere shielding it from most of the Sun's radiation, as we do here on Earth. Yet despite all these differences, Venus is in fact our best guide to a "worst-case scenario" for the outcome of the "experiment" currently being undertaken on planet Earth: the carbon and the oxygen re-united into a 97% CO₂ atmosphere, global cloud-cover raising atmospheric pressure enormously, permanent toxic rain, and thus a population of, at most, microbes.

No-one really knows the location of the inter-connected series of topple-points determining the amount of fossil-fuel needed to be burnt to trigger such a chaotic "crash" phase of our climate, which would result in a new stable state, very different from our current one. But we *do* know that this is theoretically possible, and furthermore that the current juncture in planetary climate-cycles is the closest the Earth naturally comes to any such topple points. The relatively "slight" shove of the trillions of tons of CO₂ that we are putting into the atmosphere this year might perhaps be just enough to wobble the pendulum of climate change in some highly unpredictable way.

Now the point is: why would we *want* to know exactly where the topple-points are? Surely the wise thing to do is to thank our lucky stars that we've realized this possibility *before* we've discovered these topple points, and be back-peddling as hard as we can to make sure we do *not* find out exactly where they are? For once we're there, there is no turning back. There is no way to un-do loss of balance, as we find out painfully as we learn to ride.

Taken together, these considerations establish a strong imperative to employ geothermal power in Victoria, a clear possibility which we ought to be making actual as quickly as we can. This is not simply a scientific or technical question. It is also a cultural question concerning our ability to evolve into a mature and enlightened democracy able to take responsibility for itself, a society motivated by a realistic understanding of the dynamics of our situation, rather than the static delusion of an infinitely stable Earth. It was very difficult to prove conclusively to many in the middle ages that the Earth was not flat. Life is not about conclusive proofs, which is why we base our legal system on proof beyond reasonable doubt instead. This is just as well, for as philosophers have demonstrated for centuries, absolute proof is an elusive goal, never actually achieved in reality. Common sense tells us to avoid *strong possibilities* of danger, not absolutely proven dangers. Our culture as a whole must show sufficient unity and maturity to take geothermal power generation very seriously indeed, and meditate long and hard on the memories of Hiroshima and Chernobyl as we gaze at Venus, not only as the fearful sight of the setting Evening Star, but also as the hopeful one of the rising Morning Star in the hour before dawn.