On Ice, Bears and Markets in the Silicon Age

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Ladies and Gentleman,

No doubt some among you will be asking yourselves, “In what way has a Polar Foundation, a Polar explorer or a Polar research scientist any connection with what we are here to discuss?” “By what strange destiny do our paths cross those of this individual standing before us?”

You are for the most part from the World of economics and finance or business, more used to pacing the corridors of the vast organisations which oversee the financial well-being of our societies.

I, on the other hand, am more in my element scaling the high mountains, ranging the frozen ice caps or traversing the floating ice packs (you would be surprised how many people confuse the two). This year alone I have already spent several months out in the Arctic and in the Antarctic. And last year, I crossed the Arctic Ocean on foot from Siberia to Greenland, and possibly saw more polar bears than human beings during this time. This polar expedition, as most of my others, was not merely to collect another sporting achievement, and there was a very serious purpose which accompanied it. The expedition collected ground truth data, from an otherwise inaccessible area, to contribute towards the calibration of the new Cryosat2 satellite. This polar orbiting satellite which will be launched in autumn by the European Space Agency will be chiefly employed to detect changes in the ice cover of the planet as a measure of the speed of climate change. I’m content to think that I contributed, in this small way, to the physical understanding of the planet.

In March 2008, I returned from a four month expedition in Antarctica, where the International Polar Foundation, of which I am the founder, is building a new research station for the use of the international scientific community. This research station opens up a new area of the Antarctic to research in disciplines such as geology, seismology, biology, atmospheric chemistry and glaciology.

The Princess Elisabeth research station is an unusual structure which has been carefully studied for its optimal integration into a pristine environment, and it aims to be the first "Zero Emissions" station in the Antarctic.

This is a **novel** structure which has made the philosophy of **environmental impact reduction** its credo, in line with the environmental protocol to the Antarctic Treaty.
This is an **intelligent** structure which is creating new norms for energy use and efficiency.
This is an **innovative** structure which will manage operational systems for energy use, ventilation, and waste water treatment through a "virtual brain" – allowing for the installation to hibernate in winter when it can be monitored from a distance.

You may still not see the connection to yourselves, but we are getting there.

The International Polar Foundation, which was set up in 2002, has the aim to inform, and educate on the contribution made by research findings in the Polar Regions to the understanding of the Earth as a complex system, (and the role of climate change in this system). The IPF also undertakes to demonstrate possible approaches to living in the 21st Century, or what I have referred to in the Title as the "Silicon Age".

Hence, the scientific research that has been coming out of the frozen deserts and oceans of this planet has given us a new insight into how the various parts of the Earth system function. Polar research gives us a unique insight into the relationship between carbon-dioxide concentrations in the atmosphere and average global temperatures.

From deep ice cores extracted from the heart of the Antarctic plateau, it was possible to recreate the past climate on Earth. The ice cap consists of compacted snow which fell several millennia ago, trapping fragments of past atmospheres, as it fused into ice. Scientists have been able to demonstrate how these minute traces of gas may be correlated against past ambient temperatures. The clue to past temperatures also lies frozen in the molecules of water of which the snow is composed.

Ice core and other research has allowed us to recreate the normal cyclical pattern of changes between glacial and interglacial periods over several hundred millennia, and from there to link human activities to the rapid changes in climate and environment which have been observed by scientists, since the time that meteorological records began around the middle of the 1800s. Measurements of carbon dioxide concentrations from the 1950s onward further reinforce this link.

As polar research has contributed to the understanding of past climates and our influence on them, so it contributes to how we might predict future climates. Using mathematical models that are being continuously improved by the use of observational data, we can now forecast with a fair bit of accuracy how the climate might evolve in the future, depending on the choices we make today.

Now you may begin to see where we are heading.

At the Earth Summit in 1992, the UN enacted the Framework Convention on Climate Change to achieve stabilisation of the man-made greenhouse gasses in the atmosphere. This process was informed by the periodic reports of the Intergovernmental Panel on Climate Change, more commonly referred to as the IPCC, which was set up in 1988. The IPCC periodically brought together thousands of scientists from all over the World to make a synthesis of the research findings on climate change, published at the time each new review process began. This has meant that the assessment reports were often several years behind the most recent research findings available, and so their estimates are often quite conservative.

So, what is the accepted position on climate change, after the publication of four IPCC assessment reports addressing the situation?

Firstly: Observational data indicates that the Earth is warming, perhaps at different rates in different places, but still, on average, global temperatures are rising. Sea levels are rising, as oceans dilate. If the ice masses of Greenland and Antarctica begin to feed into this process, the rate of rise could accelerate.

Secondly: The science indicates that the increase in the temperature is a direct consequence of the activities of the human animal, and in particular his penchant for carbon-based energies, which contribute significant quantities to the carbon dioxide in the atmosphere. And if you've been asleep for the last twenty years, I will remind you that carbon dioxide is the chief culprit in the unusual warming of the planet. This warming is outside of the range that would be expected from the current position of the Earth with respect to the cyclical variations imposed by astronomical cycles.

Thirdly: Mathematical models indicate that if we continue to produce carbon dioxide at the same rate, we are likely to trigger off irreversible ecosystem shifts which would lead, among other effects, to a crash in food production, increasing water shortages, and loss of habitable areas due to sea-level rise.

However, mathematical models are not yet able to predict accurately the regional and local effects of climate change. Nor is there any certainty about the point at which the system goes into this so called "dangerous" area. There is some discussion about whether the average atmospheric carbon dioxide concentrations capable of triggering off irreversible change are above or below 450 ppm. A recent paper from a prominent NASA scientist claims that palaeoclimate records indicate that the Antarctic ice cap formed when atmospheric concentrations of carbon dioxide fell below 425 ppm during a previous glaciation 50 million years ago. If now going above this concentration triggers off a ***melting*** of the Antarctic ice cap, the sea level could rise 60m. Today we are already at 385 ppm, and at the present rate of emissions we will have reached 550 ppm long before the end of the century..

In the face of unavoidable uncertainty of when and how, what is our collective response to this serious threat? Our response to the potential loss of our ecosystem begins with the classic Kuhbler-Ross response phases:

- Denial.

- More denial.
- Anger.
- More denial
- Bargaining.
- Depression or apathy.
- And finally, acceptance.

Where could one put the human animal on this process gradient? Some of us are still stuck on the denial phase, but the number of hard cases is gradually decreasing.

Anger, when it happened, was a relatively short lived and localised phenomenon, as we gradually faced up to the fact that attacking each other was not going to make the problem disappear. We are all responsible for the past, and we are all responsible for the future. Apportioning blame is not going to make it easier to work together.

And then, while some people have jumped straight into depression, quite a few have begun to bargain.

The bargaining phase has been institutionalised in the Kyoto process, where we negotiate on what level of pain we are prepared to accept, forgetting that there is no negotiation possible with the inexorable inertia of the global climate system. It will continue to move towards a new order whether we manage to get everyone to sign up to a 5% or 10% cut in emissions or not. And the longer we prevaricate, the less time we have left for effective action. While we squabble over 5%, the information coming from the mathematical modellers and the climate forecasters is that a minimum of 60% in emission cuts might be needed, to avoid irreversible and damaging change.

The ingenious methods, by which we will lessen the pain of wholesale change, have gradually increased. We will capture carbon, trade it, pay others not to produce it, do whatever it takes, not to have to face up to the inevitable need for major cuts in emissions. "I'll trade your carbon credits for some of my cash." The idea is that market mechanisms will, if applied correctly, be able to save us. But how do you apply them correctly? How do you set the value of a tonne of carbon? It is not a conventional commodity. You cannot set a natural price, as defined by Adam Smith, on carbon, as it is a by-product of production, and not a finality in itself.

Using market mechanisms in an imperfect system inevitably leads to distortion. If you give away the right to emit carbon, some will naturally feel wronged. Who receives carbon credits? How many do you give? How do you deal with the negative impacts on strategic industrial sectors? The initial allocations to certain industries under the European Trading System were based on national estimates of emissions, and were vastly in excess of needs, leading to a crash in the price when the emissions were adjusted to reality. The European Commission has proposed a package of new post Kyoto measures for after 2012, including a new system for trading which proposes the possibility of auction. How can you auction credits? How will you prevent cash rich players from monopolising the market? How will you prevent speculation?

Can this system really deliver the major emissions reductions needed? Do we have time to wait for it to become fair and functional?

Following on the Stern Report of 2006, the costs to the World economic order of implementing mitigating measures as opposed to not implementing measures have been calculated for different stabilisation concentrations and the conclusion is, (what a surprise) that it would, be a good thing, for the global economy to try and prevent climate from running out of control. While ecosystems are analysed for the economic value of the services they provide, we tend to forget that calculating our potential losses still takes us nowhere towards dealing with the problem at hand.

Meanwhile, the growing World population, and the increase in demand for energy and resources in the newly burgeoning economies of Asia and Latin America who are not subject to the obligation to reduce emissions, will make any spurious cuts agreed upon under the Kyoto Protocol, even less effective.

To complicate matters, our chief sources of energy are mainly carbon based, and are finite. The most versatile of these energy sources is petrol. The most plentiful is coal, which is even more efficient in producing carbon dioxide and other greenhouse gasses. If we choose to continue to produce and consume petrol at the rate we are doing, we face serious consequences to social organisation, as known reserves begin to fall off. Drilling the Arctic Basin may extend the period of easy energy for a while longer. But at what cost to the ecosystem? If our erstwhile Polar bear is already recognised as a threatened species as his habitat disappears, what will become of the rest of the Arctic fauna under the oil slicks of a Northern oil boom? As pressure increases on fish stocks in the World's oceans, it is already observed that some key species are migrating into the Arctic Basin. Will the Arctic too become a backdrop for the battle for food over fuel?

But then who is going to **barter prosperity today against survival tomorrow**? Precious few it seems.

The energy situation is further complicated by the fact that we still have no effective way of filling the projected energy deficit. **No known form of energy**, in use today, can completely fill the gap between what can be produced and what we will require for our varied needs, from transport to the production of electricity, not even nuclear energy.

Renewable energies are still in the early stages of development and will require some time, and massive investment, before they can even begin to meet the 20% target put forward under the new raft of measures proposed by the EU for post 2020. And with superb irony, as we begin to suffer fuel shortages, the thermodynamic inertia in the climate system will lead to continued warming, even as emissions fall through penury, and not through design.

The recent increase in production of bio-fuels has led to further distortions at the interface between the economic order and the natural order. Is it really wise to clear forests to plant oil palms, or to turn

over agricultural land to ethanol production in a time of increasing ecological stress? What are our priorities: feeding people or fuelling cars?

As ethical and moral certainties come under pressure and blur under increased competition for resources, the way ahead appears to be even less clear.

While investment funds for actions to combat climate change are on the rise, the key priorities for action remain ill-defined, drowned in a multiplicity of actions which deliver only nominal effects.

Even as populations are ready to act, we cannot provide them with the effective means by which to apply significant modifications to their own emissions profiles. The ordinary person, the ordinary household, is responsible for a significant proportion of carbon dioxide emissions (as are transport and primary energy production) and an increasingly well informed public is seeking for ways in which to be a part of the solution. It is high time to deliver. Whilst not wishing to denigrate low energy light bulbs, we cannot expect their use alone to deliver the 60% emissions cuts required.

Stability in a changing World cannot be guaranteed, but a smooth transition can be assured firstly, by informing the individual of what lies ahead, and the **need to radically modify** their **lifestyles**; secondly, by empowering the individual to take the actions necessary, through **providing the means to act.**

While technological advances will deliver some solutions, this alone will not be sufficient without a more radical change in mind set and rethink of how we organise and function globally. Change and uncertainty are clearly on the cards. We must be able to think in terms of continuous evolution and not maintaining an economic status quo which serves no-one in the long run.

Climate change is a global problem, and to address it we need **cooperation**, not only between countries, but within countries, between government and the private sector, between different industrial sectors, between industry and academia, and between industry and the general public. To innovate towards a workable future we have to **forge unlikely alliances**, aimed at delivering new investment, new technologies, and new processes. Instead of seeking stability, the aim should be to seek change, innovation and economic choices to drive a new period of social development: a Silicon Revolution, a New Alliance for all humanity.

The Princess Elisabeth Station has shown how a partnership between the private and the public sector can deliver innovation outside of a “for-profit” environment. The team we put together to work on the structure and the active systems of the Princess Elisabeth station comes from sectors of industry which would normally never meet, but through the encounter, and by looking for complementarities they have been able to put in place innovations which will increase energy efficiency by 300%, while reducing energy consumption to levels not normally encountered in ordinary installations of comparable size.

We need to accept that there have to be wide ranging changes in our habits of production and consumption in order to **optimise the use of resources** and to **minimise the production of waste** and carbon dioxide. In designing the station, the key design drivers in the Princess Elisabeth Station project were: the remoteness, the local environmental constraints, the requirement for operational autonomy, and the requirements under the Antarctic Treaty to keep environmental impact to a minimum. Taken together, these drivers led, ultimately, to a unique solution for a unique place.

At the International Polar Foundation, we have demonstrated our integral approach to sustainable design for the Silicon Age. The strength of the concept developed for this project is that it can be adapted to other situations, other geographical location. It contains a number of general guidelines for action at the local level, namely:

- Build a vision of the end result
- Respect local conditions
- Promote cooperation
- Use intelligent solutions combining and optimising readily available choices
- Innovate to deliver missing elements
- Always be prepared to revise your plan in the light of improved information.

With every day that passes the need for a coordinated plan of action grows. If the threat is anything like as serious as the science predicts, are we capable of changing direction before we crash? Countless civilisations have gone into oblivion, blindly pursuing a doomed strategy. Are we next?

Ladies and gentlemen, thank you for your attention.