Corporate Finance and Climate Protection: A Beneficial Alliance

May 2010

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Foreword

The following proposal represents an attempt to redefine climate protection measures and to reset climate protection targets in accordance with what is scientifically necessary. In essence, this means organising business in such a way that successful economic activity and climate protection are not mutually exclusive. What is proposed is an evolutionary political process in which statutory regulations are implemented step by step which facilitate profitable financial investment in climate protection activities and technologies on the one hand and which, on the other hand, make climate-damaging actions and technologies appear increasingly to be more of a financial burden.

The financial services industry will play a key role in this process, not only as an investor in climate protection but as a political player calling for and implementing these political regulations.

Copenhagen has demonstrated that climate protection clearly cannot be organised on the basis of the targets and measures discussed and adopted thus far in the UN process. Since the necessary climate protection measures appear to conflict too deeply with the commercial interests of the fossil and nuclear energy industries. Therefore, an alternative solution has to be developed for and in conjunction with the financial industry to assure the branch that climate protection is not an obstacle to their goals, but rather an opportunity.

Ultimately this is about creating an economic system in which investment in climate protection generates a return, and not, as is the case today, investments in measures which cause harm to the climate.

A positive climate protection strategy of this nature would also be easier to implement in countries such as China or the USA. Current investments, in China in particular, confirm this argument. Positive goals with rapidly growing shares of renewable energies are easier to enforce politically than abstract emission reduction targets. Renewable energies create economic development while emission reduction targets, by contrast, are associated with economic burdens.

This paper is intended as a catalyst for further discussion. All contributions are welcomed so that the approach presented here can be further developed to increase the chances of its implementation.

1. Summary

The latest climate research paints a bleak picture: global warming is happening at a much faster pace than had previously been assumed. It appears to be too late to avert irreversible changes. The climate protection targets and measures discussed up to now are clearly inadequate to tackle global warming. Emissions reductions on their own will further increase the concentration of climate gases in the earth's atmosphere.

Instead of accepting the 2°C target for global warming, the international community should be seeking to reduce the current concentration of climate gases in the atmosphere to 330 ppm, well below today's level.

This is possible using a strategy based on two pillars:

Pillar 1: Ensuring there are no more new emissions
Pillar 2: Cleaning the atmosphere of carbon dioxide

This goal is achievable in just a few decades if the entire global community takes concerted action. It will necessitate converting the fossil and nuclear industries to an industry based on renewable energies, and introducing technologies and agricultural methods which filter out carbon dioxide from the atmosphere. This relates above all to the energy industry and agriculture, but also to the chemical industry and transport, as well as much more.
The key element of this new climate protection strategy is the total conversion of the world's energy supply to renewable energies. Scientists Jacobson and DeLucchi from the Universities of Stanford and Davis in California have shown in their plan published in November 2009 that this will be technologically and economically possible by 2030.

The profit interests of the biggest companies worldwide, which do virtually all their business with the fossil and nuclear energy industries, represent the main obstacle to this changeover.

The worldwide growth rates for renewable energies are already much higher than had been forecasted just a few years ago. Since the production of renewable energies, with the exception of biomass, does not involve fuel costs, renewables have a systemic advantage since they are not at the mercy of the rising prices of conventional fuels, which are becoming ever more critical as fuel becomes scarcer. For this reason alone climate protection technologies will find it increasingly easy to establish themselves in the market. Given active political measures, it is feasible to convert the world economy to zero emission technologies in a few decades. Together with technologies and ecological farming methods which remove carbon dioxide from

the atmosphere, it will be possible to reduce the CO_2 concentration in the atmosphere from today's figure of 387 ppm to 330 ppm[1].
Implementation of the appropriate political measures would open up many new investment possibilities with expectations of returns. This would release the financial sector from the need to generate returns from investments in technologies which harm the climate, and would instead enable them to turn to profitable investments in climate protection technologies.

It should be the aim of the financial services industry itself to find a way out of the dilemma of generating returns primarily from industries which harm the climate. Once the global finance industry demands corresponding political framework laws from parliaments and governments, these will be implemented without delay.

All societies around the world have suffered from the failure of climate protection policy to date. The interests of the fossil industry are leading the world ever deeper into global warming, local environmental destruction, economic and social crises provoked by a scarcity of resources, and into increasing political tensions and resource conflicts.

Shifting to a solar economy, on the other hand, would provide societies around the world with solutions for climate protection, economic development, poverty reduction, conflict resolution and local environmental protection.

Furthermore, changing over to renewable energies by 2030 would cost less than half the worldwide fuel bill for fossil and nuclear energy fuels up to 2030. According to Jacobsen und DeLucchi's calculations, changing over to renewable energies by 2030 would cost around 100,000 billion USD.[2] The Energy Watch Group estimates that the fuel bill for the same period would be around 200,000 billion USD.[3] The basis for the estimate is the world's fuel bill for 2008, plus an assumed price increase by 2030 of only 20%. Even without factoring in external costs such as damage to the climate, the environment and health, these figures clearly show that it will be far more expensive to continue to use fossil and nuclear energies than to shift to renewables. This is all the more true in view of the fact that the price of conventional fuels is likely to surge dramatically in the coming years as a result of shortages once peak oil is passed.

Initial estimates by Professor Markus Antonietti indicate that cleaning carbon dioxide from the atmosphere is also economically self-sustaining. Investments in HTC

[1] Average of 2009 according to the National Oceanic and Atmospheric Administration (NOAA), ftp://ftp.cmdl.noaa.gov/ccg/co2/trends/co2_mm_mlo.txtn.
[2] DeLucchi, Mark A./Jacobson, Mark Z., Plan für eine emissionsfreie Welt bis 2030, Spektrum der Wissenschaft, Dezember 2009, http://www.spektrumverlag.de/artikel/1010840 (German) (29.03.2010)
[3] Zittel, Werner Dr. 2010, Estimate of annual worldwide spending on energy supply, http://www.energywatchgroup.org/fileadmin/global/pdf/2010-03-23_EWG_Kosten_Weltenergieversorgung_D.pdf (29.03.2010)

(hydrothermal carbonisation) facilities, for example, will also pay dividends, alone by virtue of other effects such as energy generation, avoidance of fertilisers and increased agricultural yields. Together with the higher biomass yield possible from soil enriched with carbon dioxide through HTC, removing carbon from the atmosphere is not only possible but even economically self-sustaining. Biomass growth can be accelerated by afforestation. Particularly rapid successes can be achieved with forest seeds, which also enable high economic returns. One way to fasten this process is afforestation. Quick and profitable results can be achieved especially with forest seeds.

HTC is of course only one method of incorporating atmospheric carbon dioxide into the soil. Biogas with incorporation of the fermentation substrate or composting is also equally important.

In order to implement these solutions there is a need for a clear policy which abolishes the privileges enjoyed by the fossil and nuclear energy industries and creates new privileges or at least a level playing field for the solar industry.
This will take more than just one single solution for climate protection policy such as emissions trading, which is currently under discussion. It will take a whole series of concerted political actions. These include laws on feed-in tariffs for renewable energies in the electricity and gas sector, as well as abolition of subsidies and tax breaks for conventional energies, conventional chemicals and intensive farming. It will be necessary to create tax breaks for climate protection technologies and measures, to mount an education and research offensive, to abolish privileges, e.g. in the licensing process in the fossil and nuclear energy industries, and to create similar privileges to promote the expansion of the solar industry.

The United Nations Department of Economic and Social Affairs published a technical report in December 2009 on the need to replace fossil energies with renewable energies. [4] In this paper, political strategies are discussed on ways to lower the costs of renewables. The main focus lies on feed-in-tariff laws. I have published a paper in Washington D.C. which describes the conditions for a successful feed-in-tariff law. [5]

It is also necessary to identify those solutions which are not real solutions at all and to end political support for them. These include in particular the use of nuclear power and reliance on so-called carbon-free coal power stations using CCS technology.

[4] United Nations Department of Economic and Social Affairs: A Global Green New Deal for Climate, Energy, and Development:
http://www.un.org/esa/dsd/resources/res_pdfs/publications/sdt_cc/cc_global_green_new_deal.pdf
[5] Washington Paper 2009 http://www.hans-josef-fell.de/cms1/index.php?option=com_docman&task=doc_download&gid=367&Itemid=77

Immediate step-by-step implementation of these measures will help build the self-sustaining forces needed for the implementation of climate protection and the development of the solar industry.

2. Accelerated global warming and the inevitable consequences

Self-amplifying forces not yet measured

Global warming and its consequences are happening faster and more dramatically than had been assumed in the past.

The melting of the Arctic ice cap is happening more rapidly than had been assumed a few years ago. David Barber of the University of Manitoba writes that while the IPCC predicts that the Arctic will be ice free in summer by 2100, in fact the whole system is changing much faster and much more comprehensively and this ice-free Arctic might happen by as early as 2015. This message, he says, must be communicated clearly and effectively to the politicians.[6]

Measurements and satellite pictures have shown that global warming and its effects have sped up massively and many estimates made 10 to 15 years ago have been substantially overtaken by the reality of the past few years.

At the same time we are experiencing an increase in terrible weather phenomena, which climate researchers had always predicted would increase in frequency and intensity.
The 2009 typhoon season in the Far East inflicted damage on a completely new scale. Forest fires are increasing dramatically in Australia, the USA, Venezuela, Greece and other countries. Floods and drought are afflicting ever more regions of the world. Failed harvests are already creating major refugee flows. In a few regions of the world there have already been apocalyptic events such as whole villages being engulfed by mudslides or whole settlements being burned down by huge, unstoppable walls of fire.

These are all effects of a 0.8°C warming of the earth's temperature compared with the preindustrial age resulting from an increase in CO_2 concentration from the pre-industrial level of 280 ppm to today's figure of 387 ppm.

All the political efforts in the area of climate protection (e.g. the resolution adopted at the 2009 G8 Summit) center on stabilising global warming at 2°C. The minimum consensus achieved at the otherwise failed World Climate Conference in

[6] Wolff, R. 2008, Das Arktis-Klima ist gekippt, taz.de, http://www.taz.de/1/zukunft/umwelt/artikel/1/das-arktis-klima-ist-gekippt/ (29.03.2010)

Copenhagen was the acceptance of the 2°C target. In agreeing to this figure, the world community's politicians have accepted a further warming of the earth. One can only guess that there will be a further increase in apocalyptic events in the coming years and decades in many regions of the world if the warming of the earth's atmosphere exceeds 0.8°C. The political goal of stabilising global warming at 2°C is an irresponsible policy not just for coming generations but for all the people living today.

Stabilising global warming at 2°C is often equated with the aim of achieving a CO_2 concentration in the earth's atmosphere of 440 ppm. The latest IPCC report, for example, says there is a 50% probability of stabilising at 2°C, given a CO_2 concentration of 440 ppm. This creates the impression that it would be acceptable for large volumes of greenhouse gases to be emitted into the atmosphere, increasing CO_2 concentration from today's figure of 387 ppm to 440 ppm. From the fact that any warming of the earth's atmosphere beyond 2°C would have irreversible effects, it is often concluded that 2°C and a CO_2 concentration of 440 ppm are acceptable targets and that until that point is reached, no irreversible effects will occur. Irreversible effects generally mean self-amplifying effects or tipping points.
Targets such as reducing CO_2 concentration to the pre-industrial level of 280 ppm or at least 330 ppm or reducing the current temperature of the world, on the other hand, are hardly discussed at all on the world's political stage.

Recent findings, however, indicate that the IPCC has underestimated the problem and that a CO_2 concentration of 450 ppm could correspond to a 4 °C increase in global temperature.
Irreversible self-amplifying processes will occur far before the 2°C limit is reached or indeed might be occurring already. Climate research has not yet been able to provide an exact scientific description of the major known effects of self-amplification. All that is known is that they have already begun to manifest themselves. Their actual influence on the speed of global warming is, however, largely unresearched. The dramatically faster melting of Arctic sea ice observed in recent years is an indication that these effects have up to now been completely underestimated.

These self-amplifying effects include, in particular:

- A decrease in the albedo effect: the melting of the white, highly reflective ice cap is revealing more dark areas of land and water which reflect less of the sun's rays and hence boost global warming.
- Thawing of permafrost: large quantities of methane with over 20 times the greenhouse gas potential of CO_2 are being released by the thawing of permafrost.
- The decreasing carbon sink function of the world's oceans: as a result of the rise in the water temperature of the world's oceans, less and less CO_2 can be

sequestered in the water. If the water temperature continues to rise steeply, CO_2 already sequestered in the oceans could bubble out again.

- Decrease in the world's biomass through active human destruction of nature such as logging operations, and through forest fires, drought and soil destruction. Plants, soil organisms, and humus store large quantities of carbon dioxide. This is released through forest fires, drought, soil breaking and soil erosion.

There is an urgent need to carry out more scientific research to establish how these self-amplifying effects occur. There is also a need for a preventative climate protection policy which takes greater account of these effects. This means that the target of a CO_2 concentration of 440 ppm can no longer be accepted.
Instead the focus of political efforts in the area of climate protection must be on reducing CO_2 concentration to 330 ppm or below.

The political demands with regard to climate protection have remained the same for years

Although the dramatic acceleration of global warming has become increasingly apparent in recent years, the political demands have lagged far behind scientific knowledge. For years political efforts have focused on achieving an 80% reduction in emissions in the industrialised countries by 2050 and around a 50% reduction in the world as a whole. Even many of the most committed climate protection activists continue to cling to these inadequate targets.

These targets were set some years ago on the basis of the knowledge of climate researchers at that time. From what we know today, particularly because of the largely unknown effects of self-amplification, it does not seem that they will be enough to stabilise global warming at 2°C. Even a figure of 2°C, it should be remembered, is already producing catastrophic effects.

Target: 330 ppm

In order to have a chance of preventing truly catastrophic effects and a 2^oC rise in temperature, there is a need to formulate new targets and from them new actions and climate protection measures.
A target of 330 ppm equivalent CO_2 would make it possible to realise new measures, hopes and opportunities. The measures that would have to be taken are technically and economically feasible, which means 330 ppm would be achievable in a few decades.
The prerequisite for this, however, is concerted action by the industrialised countries to implement the most important measures. Industrial mass production of climate

protection technologies, for example, could reduce costs rapidly and therefore ensure rapid worldwide market penetration. A resolution at the UN level would of course be helpful. It would not, however, be essential since the two key technological paths – firstly, a complete changeover to renewable energy and chemicals, and secondly, agricultural methods and technologies which return carbon dioxide to the soil to enrich it (humus) - are becoming increasingly economically sustainable through mass application and can hence develop their own self-sustaining dynamism.

Solution: Zero emissions and cleaning the atmosphere

Since 387 ppm is already too high a level of greenhouse gas concentration in the atmosphere, one pillar of the new climate protection strategy must be based on not only reducing but completely eliminating greenhouse gas emissions.
The second part of the strategy is based on measures designed to further reduce the concentration of greenhouse gases in the earth's atmosphere.

Pillar 1: zero emissions

By far the greatest share of greenhouse gas emissions (up to more than 80%) is created by the use of fossil raw materials - oil, natural gas and coal - primarily for world energy supply but also, although to a considerably lesser extent, for worldwide chemical production. Changing completely to renewable energies and raw materials would put an end to the majority of greenhouse gas emissions on the planet. Plants used as the basic material for bioenergies and renewable chemicals must be sustainably – ideally organically – grown and used. If not, they can indirectly cause emissions through fossil mineral fertiliser, pesticides and nitrous oxide emissions from intensive farming.
Preventing unnecessary use of energy and materials could considerably speed up the process of changing over completely to renewable energies and chemicals. A consistent strategy to save energy and material flows is an indispensable part of a zero emissions strategy.

Pillar 2: cleaning the atmosphere

Because of the danger that the oceans are losing their natural CO_2 sink function, a zero emissions strategy alone is not enough to reduce the current CO_2 concentration of 387 ppm, which is already too high. Zero emissions, once achieved, would largely maintain the atmosphere's carbon content at a high level. There would still be a danger of further uncontrolled global warming partly through thermal inertia and partly because of the self-amplifying effects described above. Scientists have long known about the effect of thermal inertia in relation to the increase in CO_2 concentration. This means that even if greenhouse gas concentrations were to be stabilised

immediately at 387 ppm, the temperature would continue to increase in all likelihood by 0.6°C (IPCC 2007).
The conclusion from these findings is that zero emissions on their own are not enough. It is also vital to remove large quantities of carbon dioxide from the atmosphere.
Plants take carbon dioxide from the atmosphere as they grow. Increasing the amount of biomass grown on earth, by reforestation for example, is therefore an important way of removing carbon dioxide from the atmosphere. Even given zero emissions, however, this would not be enough to reduce the amount of carbon dioxide in the atmosphere significantly below today's level.
There is therefore a need to remove atmospheric carbon dioxide permanently using large quantities of plant waste. This means that not all plant parts should be fermented or burnt. Large volumes of plant waste or fermentation substrate from biogas plants must be actively incorporated into the upper layers of the soil to promote the formation of humus and encourage soil organisms, thereby extracting increasing amounts of carbon dioxide from the atmosphere.
Large-scale humus formation has other possible positive effects: re-greening of arid areas and an increase in soil fertility and water retention. All these effects open up the possibility of securing world nutrition more effectively and making available additional biomaterials for energy and chemical production.

Climate protection has not yet become a political reality

Climate protection has been taken seriously by the international community at government level since Rio in 1992 and declared to be one of the world's most important political goals. Yet since then global warming has increased dramatically. The focus of efforts has been on reducing emission reductions, but worldwide emissions have continued to rise.

The utter failure of climate protection policy is only too apparent. All sides are keen to assign blame. Developing and newly industrialising countries point the finger at the industrialised countries. Those who signed the Kyoto Protocol criticise those who did not sign. In Copenhagen China and the USA were accused of not offering enough. Yet despite the failure of Copenhagen, there is virtually no serious discussion and analysis of whether climate protection strategies and climate policy are right.

One entreaty follows another, calling for everything possible to be done in the face of such a dramatic situation. Yet there is a scarcely a single head of government who is striving to put proactive and ambitious measures in place to protect the climate. Iceland and New Zealand are the only countries which have signed up to the goal of changing over completely to renewable energies.

All the other countries in the world are attempting to commit themselves to the minimum in terms of emissions cuts or to avoid making any pledge at all. Virtually all countries insist on their right to continue to emit greenhouse gases.
One argument used for this is that only fossil and nuclear energies can deliver security of energy supply.
Yet securing energy supply through the use of fossil and nuclear raw materials prevents the implementation of effective climate protection measures and targets. There is no use here in arguing about who has better or worse measures or haggling over a few percentage points more or less in terms of emission reductions. The only thing that can help is the acknowledgement that any greenhouse gas emissions cause further harm to the climate and that protecting the climate through the use of renewable energies is not a burden; rather it offers a way out of the increasingly pressing problems associated with the use of fossil and nuclear energy.

The main obstacles to effective climate protection

One of the key obstacles to effective climate protection are the commercial interests of businesses which are firmly entrenched in the fossil and nuclear energy industries. These are first and foremost the conventional energy industry and transport, but also the chemical and agricultural industries.

The conventional energy and transport industry

The conventional energy and transport industry is the most powerful branch of industry in the world. Business in crude oil, natural gas, coal and uranium is in the hands of a small number of conglomerates. Of the 16 biggest companies in the world, nine are oil companies. They and others supply the world's economy with fuel for transport and for heating, chemical raw materials and in part also electricity. A further six of the 16 are engineering conglomerates, first and foremost carmakers, whose business is based on technologies which use fossil energy.
A complete changeover to renewable energy and renewable chemicals would largely signal an end to this, the world's biggest business. The only energy resource which would then be traded would be biomass since the renewable energy sources of solar power, wind, waves or geothermal energy cannot per se be traded internationally.
Just how strong the forces to preserve the status quo in the fossil energy system are can be judged from the profit trends of the major oil companies in recent years. Worldwide oil shortages have sent world oil prices soaring, and with them the profits of the oil companies. The average price of crude oil rose from 20 USD per barrel in 2002 to nearly 100 USD per barrel in 2008. In the same period the worldwide profits of EXXON rose from around 12 billion USD to over 45 billion USD. The other oil companies recorded similar profit booms.

Apart from a few analysts, few people foresaw the explosive rise in the price of crude oil. In 2002, for example, the International Energy Agency (IEA) in Paris forecast an oil price of 22 USD per barrel for 2008, with a slight rise to just 30 USD by 2030.
In the belief that these favourable oil prices would last, governments around the world continued to gear their economic programmes to cheap oil; any climate protection measure, in particular renewable energies and energy savings, was felt to be and described as an economic burden.
Given a scenario in which the price of oil remains over 100 USD per barrel, most climate protection measures would already be more cost-effective than the use of fossil resources. Climate protection would then be the key to preventing further economic crises such as the financial crisis, in which the dramatic rise in oil prices was an important factor.

Failure to respond to the scarcity of resources and, as a result of this, to the rise in the prices of fossil raw materials, has already led to critical economic problems. A precautionary approach to the economy focussing at an early stage on climate protection would have prevented the worst effects of the economic problems. General Motors (GM), for example, went into insolvency primarily because many people in the US no longer wanted or could afford to drive gas-guzzling GM cars following the rise in petrol prices. Disregard for climate protection measures – fuel-efficient or, better still, zero emission cars – drove GM to bankruptcy, triggering an economic decline in Detroit and other cities, as well as rising unemployment. GM had already started developing electric cars at the beginning of the Nineties. Representatives of the petroleum industry on the board of the company, however, took active steps to block the market launch of GM's petrol-free zero emission cars.
The example of GM shows that disregard for and rejection of climate protection measures has already led to economic crises. The economic and social burdens caused by scarcity of resources will in the near future bring not just individual companies like GM but entire economies to their knees unless alternatives using renewable energies penetrate the market quickly.

An analysis by the Energy Watch Group stating that only approximately half of today's oil production will be available by 2030 has been indirectly confirmed by the International Energy Agency (IEA).[7] Without a swift changeover to renewable energies and chemicals, the world will be plunged into an undreamt-of economic and social crisis within the next two decades, which will dwarf everything that has gone before, even the 2008/2009 financial crisis.
In the future there will be similar scarcity problems with natural gas and uranium. Even in the case of coal the first indications of shortages are being seen, particularly in China.

[7] Energy Watch Group 2008: Zukunft der weltweiten Erdölversorgung, http://www.energywatchgroup.org/fileadmin/global/pdf/2008-05-21_EWG_Erdoelstudie_D.pdf

The nuclear industry wrongly has the reputation of protecting the climate. Firstly, large quantities of fossil energy are used in extracting uranium and processing it into fuel rods. Secondly, the central electricity generation interests of the nuclear companies are strategically blocking the way for renewable energies. Therefore It is little wonder, that the interests of the fossil energy industry are almost identical to those of the nuclear industry. Moreover, the nuclear industry is creating huge problems with radioactivity for which there are as of yet no effective solutions: disposal of nuclear waste, safety questions, the threat from terrorism, shortage of resources, proliferation, and many more.

Similar considerations apply to the capture and storage of CO_2 from coal-fired power stations (CCS). In principle carbon capture and storage is a futile attempt to throw a lifeline to coal in the face of growing competition from renewable energies. CCS cannot solve any of the pressing classic environmental problems such as the overexploitation of valuable drinking water reserves, destruction of the countryside through mining, water pollution, coal seam fires, damage caused by mining, etc. On the contrary, since CCS takes a third more coal to generate the same amount of electricity than is needed without CCS, the process drastically exacerbates traditional environmental problems. The increased demand for coal is also rapidly making the use of coal to produce electricity uneconomical in comparison with renewable energies which are free of fuel costs and are becoming cheaper all the time. The coal industry believes that CCS is necessary for climate protection. In reality CCS is shockingly expensive and therefore unviable.
Nuclear power and CCS are no solutions to climate protection. On the contrary, billions in public and private money is being falsely invested each year to support these two options, diverting the money away from the right solution: renewable energies.

Rigorous climate protection measures with renewable energies and other zero emission technologies are indispensable not only to save the planet environmentally but at the same time to stop further global economic crises, political and military conflicts over resources and social crises.

The agricultural and chemical industries

The dominance of the interests of the big agricultural companies in intensive farming, like the dominance of the conventional energy companies, is an obstacle to effective climate protection. The sales interests of the major agricultural companies are focused on mineral fertilisers, pesticides, seeds and in crop yields. Large quantities of crude oil are used in the manufacture of mineral fertiliser, particularly phosphate fertiliser, so that the production process alone creates high CO_2 emissions.
Most pesticides use crude oil in their manufacture. Apart from their damaging toxic effects, they therefore also have an effect on global warming. Direct emissions, e.g.

nitrous oxide from fields that are intensively farmed or methane emissions from livestock rearing, exacerbate the negative impact on climate.
The key factor impacting climate is the use of mineral fertiliser as a substitute for soil fertility. Instead of incorporating plant and animal waste into the soil, which then supplies the corresponding nutrients to boost plant growth, mineral fertiliser is used as a substitute. This lowers soil fertility and increases erosion, depletes humus and results in a significant decline in soil organisms, all processes which reduce the soil's carbon content. The result is increasingly nutrient-deficient soil, a growing problem for crop yields. Soils worldwide are losing more and more carbon dioxide so that instead of acting as carbon stores, they become carbon emitters. This problem is being dramatically exacerbated by the felling of virgin forests and crop farming which ploughs up more and more natural soil such as in grasslands or forests, releasing large quantities of carbon dioxide into the atmosphere.
Instead of farming methods which introduce increasing amounts of carbon dioxide into the soil in order to enrich it, the sales interests of the big agricultural companies are leading to a reduction in the amount of carbon dioxide stored in the soil. At the same time intensive farming methods are encouraging soil erosion, salinisation and desiccation, removing ever more areas of land from agricultural use.

Farming methods which do not involve the use of mineral fertilisers or pesticides rely on high soil fertility and the return of agricultural waste to the soil. Organic farming comes close to this, in a similar way to no-plough soil tillage and to traditional and new cultivation methods, e.g. intercropping or agroforestry. A substantial increase in the humus layer transports progressively more carbon dioxide from the atmosphere via plants to the soil, where it is safely stored. Farming methods which encourage this process are an active form of climate protection because they help to clean the atmosphere of carbon dioxide. In fact they are the key way of reducing the concentration of carbon dioxide in the atmosphere.

In addition to farming methods which enrich the soil with carbon dioxide, technical measures can also be developed to speed up this process of enrichment. In particular the process of hydrothermal carbonisation (HTC), developed by Professor Antonietti at the Max Planck Institute of Colloids and Interfaces in Potsdam, appears to be a promising approach. Using relatively simple technology, plants, plant waste and agricultural waste are converted in a short space of time into coal?? by the release of usable energy.[8] This coal can be incorporated in the soil and acts as a safe carbon sink for atmospheric carbon dioxide. Professor Antonietti explains how this process, in association with bio-carbon sinks such as afforestation, could clean the atmosphere within 30 years. In addition, soil fertility would increase dramatically around the world. Surprising findings from the Amazon with respect to terra preta indicate that the Incas were already using similar methods to improve soil fertility.

[8] Antonietti, Markus 2006: Zauberkohle aus dem Dampfkochtopf, Max-Planck-Forschung 2/2006

The highly carbonaceous terra preta soils produce agricultural yields which are up to 20 times greater than those of the natural wetlands of the Amazon Forest.[9]

3. Technological approach

Achieving 330 ppm in a few decades

The large-scale emission of fossil fuel-related greenhouse gases began with the industrial revolution. New technologies required power and this was provided by fossil energy: firstly coal-fired steam engines, followed later by countless combustion engines to power means of transport, and finally electricity generation. The history of climate destruction is essentially the history of technologies that use fossil energy sources.
It is not a law of nature that technologies can only be powered by fossil or nuclear energy. Market penetration of all societies by technologies which are driven not by traditional energies but by renewables is therefore the key to worldwide climate protection.
What is needed is a technological revolution in which solar technologies completely replace technologies using fossil and nuclear energy.

All the necessary technologies are already there. They can and must be further developed through research and development. The best way to achieve this is through an active policy to launch these technologies and help them penetrate the market. Companies which see markets for their products will make efforts to offer the best innovations and the best value for money in order to gain a competitive edge. Launching products on the market and enabling them to achieve market penetration is therefore the best way to drive innovation. This is superior to government research programmes, although the latter can and must play a supporting role.

2100 is often quoted as the year by which renewables will be able to supply all our energy needs. Such long timescales are completely at odds with what we know about the rapid pace of industrial growth. It has nearly always taken mere decades for new technologies to completely penetrate the market.
Flat screen televisions have replaced many old cathode ray sets in less than a decade. Laptops have conquered the world in roughly ten years. In Germany it took just 12 years to provide a full mobile phone service – nationwide coverage with mobile phone towers and mobile phones.

There is no reason to suppose that renewable energy technologies and other climate protection technologies cannot achieve similar growth rates and coverage as have been seen with mobile phone technology. The industrial potential is there, the

[9] Frenz, L. 2009: Amazoniens schwarze Sensation, In: Geo: Das neue Bild der Erde (03/2009)

technologies are ready, their R & D phase long behind them. A massive expansion of factory capacity for renewable energy technologies could supply markets rapidly. Every new factory that is set up drives innovation further forward.

These developments have already been happening around the world. In China there are already over 100 factories producing wind turbines. Factories for photovoltaics are springing up like mushrooms. This process needs to be sped up and expanded to all climate protection technologies – including in the chemical sector, transport and farming.

Despite all the resistance from the fossil and nuclear industries, the renewable energies sector has experienced an undreamt-of boom in recent years. Renewables have even withstood the worldwide slump caused by the financial crisis almost unscathed. If the growth forecasts of the past had not been so pessimistic for so many years, the upturn in the growth of renewables would not have seemed so unexpectedly steep. In 2002, for example, the International Energy Agency in Paris estimated that wind power would grow worldwide to around 100 GW by 2020. By 2009, however, over 150 GW of wind power output had already been installed. The self-sustaining forces for the expansion of renewable energies, particularly in the light of the rises in the price of conventional energy resources, are already on a steep growth path.

Proving feasibility scientifically

In November 2009 the scientists Jacobson and DeLucchi at the Universities of Stanford and Davis in California presented a plan to demonstrate the technological and economic feasibility of completely changing over worldwide energy supply to renewable energies by 2030. The plan focuses primarily on wind power, solar energy and water power. According to the plan, approximately half of future global energy needs would be supplied by wind power. This would require around 3.8 million modern 5 MW wind turbines. Compared with an annual global production of over 70 million cars and small trucks, this seems a manageable industrial challenge, given the political will.

A switch to 100% renewables would be less expensive than the world's energy bill

The total investment of some 100,000 billion USD for all renewable energies is also only approximately half the figure of what the world would otherwise spend on fuel up to that time.[10] In 2008 between 5,500 and 7,500 billion USD was spent worldwide on fuel from crude oil, natural gas, coal and uranium. Assuming a price rise of 20%, the

[10] DeLucchi, Mark A./Jacobson, Mark Z., Plan für eine emissionsfreie Welt bis 2030, Spektrum der Wissenschaft, Dezember 2009, http://www.spektrumverlag.de/artikel/1010840 (Deutsch) (29.03.2010)

world's fuel bill for the next 20 years will rise to some 200,000 billion USD.[11] In the light of peak oil, it is also highly unlikely that price rises will remain so low. It is clear, therefore, that maintaining the conventional energy industry would cost around twice as much as changing over to renewable energies.

In return the world community would have an energy supply permanently without fuel costs which would rapidly make the necessary investment profitable. According to Jacobson and DeLucchi's plan, there would be no economic burden associated with changing over to renewables. On the contrary: the changeover would free the world economy permanently and completely from the burden of rising conventional fuel costs. Climate protection brought about by converting to renewable energies would not be an economic burden, as is still claimed, but would free economies from the costs associated with conventional energy supply. Economies would additionally be released from the large external burdens created by the fossil and nuclear industries.

Cleaning the atmosphere of carbon dioxide is economically and technologically feasible.

Preliminary calculations by Professor Antonietti:[12]

To reduce the current concentration of CO_2 in the atmosphere within 30 years from the present level of 387 ppm to 330 ppm, some 200 Gt of carbon dioxide will have to be removed from the atmosphere within that period, an estimate which is based on no new emissions. This corresponds to around 10% of current global biomass growth in these 30 years. This figure does not contain any estimates of possible oceanic biomass growth, which could increase considerably, for example through controlled algae growth.

Enriching the soil with 20 tonnes of carbon dioxide per hectare could increase biomass production by between 100 and 200 per hectare. The figure of 200 Gt of carbon dioxide quoted above could thus be removed from the atmosphere using around 10% of the earth's land surface.

Local models also illustrate that the procedure is fundamentally possible (1 country / 1 product). For Brazil's annual sugar production, for example (100 Mt/a according to production statistics), around 1 Gt of sugar cane is grown, the major part of which is simply burned. This intensive production depletes the soil, creating the need for new land clearances to maintain productivity. Converting the sugar cane waste (i.e. no competition with food) into terra preta coal would not only reduce world CO_2

[11] Zittel, Werner Dr. 2010, Estimate of annual worldwide spending on energy supply, http://www.energywatchgroup.org/fileadmin/global/pdf/2010-03-23_EWG_Kosten_Weltenergieversorgung_D.pdf (29.03.2010)

[12] Antonietti, Markus Prof. Dr. 2010, "Global Sustainability: A Nobel cause", Cambridge University Press

production, it would also increase biomass production through its incorporation in the neighbouring depleted soils and hence create either biological added value or additional biomass for carbon sequestration.

Around 8 million HTC facilities would be needed worldwide to implement such a strategy. After market launch and corresponding cost reduction, the cost would work out at roughly 1000 billion USD. This is without doubt a level of funding which the finance industry could shoulder within a few years.[13]

Afforestation with forest seeds is economically profitable

Afforestation offers CO_2 storage, a habitat with high biodiversity, and also sustainable food, energy and raw materials sources for the local population. The best and most cost-effective method of afforestation is the use of natural forest seed with which large areas can be rapidly and cost effectively forested to create a healthy, sustainable and natural forest. Since this yields up to ten times more trees than in a plantation, it is realistically possible to achieve a carbon sequestration of up to 300 t per year. The cost of afforestation can frequently be kept to below 500 USD per hectare.
Yields vary considerably depending on soil and climate. In tropical regions with good soil conditions yields of over 10,000 USD per ha are achievable in 10 years using sustainable management methods. In other latitudes and dry regions, too, yields of 5000 USD per ha are possible over a ten year period. It is particularly important, of course, to seek government permission for such large-scale forest seeding programmes. [14]

In sum: with determined government support for all climate protection technologies, industrial development which could reduce CO_2 concentration to 330 ppm in a few decades is both economically and technologically feasible.

Resistance to such development comes first and foremost from the fossil and nuclear industries. Their companies will be among the losers if they are not proactive and do not change over in good time to climate protection technologies. The big companies in the fossil industry in many instances use disinformation, lobbying, corruption and media control to defend their profits, thus obstructing rapid and effective climate protection. It is the job of the political community and the financial services industry to take a stand against the lobbying in order to put in place properly functioning laws to enforce climate protection and supply security with renewable energies, renewable chemicals and sustainable farming.

[13] More detailed research on the above figures is needed since these are only rough estimates. They do, however, give an idea of economic and technological feasibility.
[14] FSG Forest Seed 2010, http://www.forest-seed.com/ (29.03.2010)

4. The financial agenda

Regulating markets to make investment in climate protection profitable is key

The key to launching climate protection technologies and enabling them to penetrate world markets is a framework within which investments in climate protection technologies are better positioned than investments in technologies which harm the climate. This in particular is the job of an effective climate protection policy. As soon as investment in climate protection technologies starts to show returns, there will be more investment and then also innovation.
The whole environment of state regulations is the key to stimulating climate protection.
Many thousands of billions are channelled each year into investments which harm the climate, e.g. developing new oilfields, new gas pipelines, new coal and uranium mines, new cars with combustion engines, new fertiliser factories, new ocean liners powered by the dirtiest heavy fuel oil. These are profitable investments precisely because state regulations support them. Not only do they enjoy great privileges in the licensing process, they also receive tax breaks and direct subsidies. The worldwide subsidies for the fossil energy industry are estimated at around 300 billion USD per year. A particularly blatant example of this is Malaysia where direct subsidies for petrol and diesel paid for out of tax revenue exceed Malaysia's total spending on education.

Such economic benefits for using technologies which have been in development over a hundred years and whose price can be kept down by mass production make it impossible for climate protection technologies to have the strength to establish themselves against the market power of the fossil energy industry.

It is incomprehensible that tax revenue is still used to fund generous subsidies for measures and technologies which emit greenhouse gases. In view of increasing levels of public debt, this is the first area where cuts should occur.
Public spending on climate protection, moreover, cannot be effective while much larger sums of private money are still being invested in measures and technologies which contribute to global warming. Demands were made at Copenhagen for the industrialised nations to provide around 100 billion USD to support climate protection measures in developing countries. An estimated amount far in excess of 1000 billion USD a year, mainly from private money, however, goes into conventional energy projects and hence into creating yet more greenhouse gas emissions. Until the time comes that private streams of money are diverted into climate protection measures, public spending will never make an effective contribution to climate protection.

State regulations must therefore always have the aim of ending financial and other privileges for climate-damaging technologies and raw materials and creating economic incentives to invest in climate protection technologies. Once this has been achieved there will be plentiful investment in climate protection technologies. Every expansion of mass production will quickly reduce the cost of these technologies and encourage market penetration.

The Renewable Energy Sources Act (EEG) in Germany adopted in 2000 is a particularly good example of such state regulation. With additional costs totalling 3 to 4 billion euro per year - just another two euro per month on individual electricity bills (2009) - a new branch of industry has been created in Germany. Today there are almost 340,000 jobs in the renewable energies branch, up from only 30,000 in 1998, the same number as in the nuclear energy industry both then and now. New highly innovative technologies have been developed in wind power, photovoltaics, biogas, geothermals and water power. The share of renewable energies in electricity consumption has risen steadily from 6% to 16% in 2009. In 2000 there were doubts as to whether an increase to 12% would be possible by 2010. In Germany the Renewable Energy Sources Act has been the most effective political measure for climate protection.

The proof has therefore been established: when state regulations facilitate profitable private investment in climate protection technologies, a rapidly growing market is stimulated which brings new investment in climate protection.

5. The political agenda

Stimulating worldwide markets for climate protection technologies

The key political task now is to implement the political measures needed to make investments in climate protection technologies cost-effective and to dismantle obstacles in the licensing process and elsewhere.
There are still large amounts of private capital available for investment even after the financial crisis. With countries worldwide suffering from high levels of public debt, the state cannot provide sufficient capital to create the dynamism needed for the development of climate protection technologies.

The large multinationals, who rightly fear for the profits they earn from their climate-damaging business, will oppose the introduction of every statutory regulation of this kind. If legislatures and governments continue to bow to the interests of these large companies, there will be no effective climate protection in this world. Half-hearted measures will be of no use as the earth’s temperature continues on its upward climb.

If the political conditions are right, there will be enough private capital, particularly from the financial services sector as a whole, to achieve the 330 ppm target within just a few decades.

As costs fall as a result of mass production, climate protection technologies will quickly establish themselves on their own and achieve market penetration. As conventional resources become scarcer and hence progressively more expensive and the economic burden grows, climate protection technologies will increasingly be able to hold their own in the market even without state regulations.

It will therefore take only around 15 to 20 years of active political support in the form of effective state regulations until a self-sustaining economy develops in the field of climate protection. After that happens, climate protection will be able to sustain its own development.

The necessary political regulations for climate protection measures

Political demands for climate protection measures have to be addressed first and foremost to parliaments because they make the laws, and to governments because they determine how the laws are implemented, generally through ordinances.

The laws and ordinances must be based on two main guiding principles:

1. Tax breaks and other privileges for climate-damaging technologies must be ended. This applies to all technologies and raw materials which cause greenhouse gas emissions
2. Tax incentives, regulations for investment support (e.g. feed-in tariffs) and other privileges need to be created for climate protection technologies. This applies to all zero emission technologies, particularly in the energy, chemical, transport and farming sectors.

Re 1.) Measures to abolish privileges for climate-damaging investments:

- Ending of direct subsidies and tax breaks, as well as research assistance for all technologies and resource use in the fossil and nuclear energy sector: energy, chemicals, transport, building and intensive farming.
- Ending of all privileges in licensing practice, knowledge transfer and research for all technologies and resource use in the fossil and nuclear sector.

Re 2.) Measures to support investment in climate protection technologies:

- Regulations which make investment in climate protection technologies potentially profitable. This includes, above all, laws for feed-in tariffs on the lines of the German Renewable Energy Sources Act as well as the electricity sector. Such laws can also apply, for example, to biogas in the natural gas sector or to solar heat in heat grids. These regulations allow investors

privileged access to the grid as well as feed-in tariffs which make investments potentially profitable. It is also possible to consider regulations which would create a price advantage for organically grown foodstuffs over food produced by conventional farming, although no such regulations have as of yet been realised.

- Creation of tax breaks for climate protection technologies. Examples are tax exemptions for sustainably created biofuels or for eco-electricity. VAT relief on insulating materials or solar collectors, for organic foodstuffs or chemical products made from renewable resources.
- Direct subsidies paid out of taxes for climate protection technologies and measures. For example, grants for the purchase of climate protection technologies, aid to farmers to convert to organic farming or investment assistance for the establishment of bio refineries. Such subsidies will be limited out of necessity given the level of public debt. Subsidies which have tight constraints on them are counterproductive if they replace more effective measures such as feed-in tariffs or tax relief.
- The creation of funds receiving public and private money to support climate protection investments. Such funds are, however, no substitute for putting in place the political framework for private investment, since they can never generate the same volume of finance as can be achieved through the provision of private finance.
- An increase in research spending on all climate protection technologies and measures.
- An adoption by the public sector of a climate protection role model in its procurement practices.
- An education and training offensive at all schools and universities.
- An education campaign for climate protection measures for the general public and businesses.
- Establishment of licensing privileges, e.g. buildings on undeveloped sites for renewable energies or HTC technologies.
- Creation of privileges for the use of climate protection technologies, e.g. permission for the owners of zero-emission cars to use privileged car parks or traffic lanes.
- A thorough review of licensing laws to identify obstacles to investment in climate protection technologies and corresponding amendment of the laws.
- Creation of advantages for the use of renewable chemicals, such as exemption from waste disposal charges for compostable packaging or the introduction of a levy on resources for all chemical products, the level set according to the amount of emissions caused.

Measures such as these are often described as being too radical. It is important to bear in mind, however, that their implementation would offer effective climate protection and protection from future economic crises. All (non-radical) compromise measures to date have served only to contribute further to global warming, putting the world further at risk from the destruction of our fundamental means of survival. To this extent there is no alternative to the concerted implementation of the above measures. Not implementing them will lead the world ever deeper into economic and ecological disaster.

Flexible political mechanisms: emissions trading, CDM and others

The Kyoto Protocol provides for “flexible mechanisms” by means of which climate protection is to be achieved at the lowest cost. What these have in fact done is prevent any concerted effort being made to tackle the problem of climate change and put off the inevitable process of bringing in necessary changes to the economy. Statutory conditions have been feverishly conceived, called for and in part implemented at international and national level. Central to these is emissions trading which has been accepted, by a process of seemingly sustainable and overriding arguments, as the key political instrument for climate protection. The aim of the system, which imposes strict conditions and obligatory targets, is to cut emissions step by step. Emissions rights are allocated in order to create an economic incentive to bring about a gradual reduction in emissions.

Emissions trading is often conflated with climate protection. This misconception hampers other effective measures such as the abolition of subsidies or the introduction of a carbon tax or feed-in tariffs.

Emissions trading suffers from fundamental flaws. Those in possession of emissions rights will make no further efforts to reduce their emissions until the next trading period and will agitate politically to retain their rights. Valuable time is being lost. Serious emissions cuts are being undermined by successful lobbying, rendering them almost useless, since the argument that climate protection measures represent an economic burden is a powerful one in political terms.

Since emissions trading is basically designed to limit emissions, it offers no incentive for technical innovation. Preference is given to those measures which enable the greatest emissions reduction with the lowest financial outlay at the time of the investment. Coal-fired power stations with a 3% improvement in efficiency fit the bill better here than investment in photovoltaic power plants. In principle emissions trading reinforces the fossil energy system at a slightly lower level of emissions.
Moreover, the clean development mechanism (CDM) creates investment possibilities which are a substitute for and hence prevent national investments in climate protection.

The ineffectiveness of emissions trading is compounded by the fact that its theoretical benefits do not manifest themselves in reality. Interested parties from the fossil energy industry with their lobbying power have been adept at influencing the system wherever it has been introduced to render it virtually ineffective by preventing full auctioning of emissions certificates. In Germany in 2007, for example, emissions trading led to a reduction in CO_2 of around eight million tonnes at an estimated cost of € 5.6 billion. The electricity companies passed on these additional costs to their customers in the form of price increases, thereby increasing their profits. By comparison, in 2007 some 57 million tonnes of CO_2 were cut under the Renewable Energy Sources Act at an additional cost of € 4.3 billion, creating 100,000 new jobs in the process, generating a large amount of innovation and giving a further boost to zero emission technologies. [15]

6. Implementation strategy

The key role of the financial sector

Implementing the necessary political measures

The financial services industry is obligated to generate returns. Since economic conditions are still geared towards benefiting the fossil energy industry, most investment worldwide still goes into climate-damaging technologies and measures.
Those working in the financial services industry are not indifferent to the fact that the problems of society as a whole are becoming ever more urgent and unmanageable. Once the majority of those in the world's financial sector intervene actively in the political process and demand conditions which enable cost-effective investments in climate protection technologies and measures, political implementation will happen quickly.
Parliamentarians will devise laws and governments will bring in ordinances which will make investments in climate protection technologies cost-effective as soon as the financial world demands this.

It is not a matter of making sacrifices: money can certainly be earned just as well, possibly better, in a climate-friendly investment environment as in a climate-damaging one. It is a matter of changing the rules of play to make the funding of survival measures more cost effective than investments in measures that are destroying the climate. That is true conservatism.

[15] A detailed description (in German) of how the law works and its political basis was published in a paper in Washington in 2009: http://www.hans-josef-fell.de/cms1/index.php?option=com_docman&task=doc_download&gid=365&Itemid=77 (29.03.2010)

A concerted, courageous worldwide effort on the part of important financial investors in favour of an active climate protection policy as described above will develop more political power than all the international climate conferences to date.

There are already various efforts in this direction. These include:

- The Institutional Investors Group on Climate Change, set up in 2001. The IIGCC members' funds administer around 3.5 billion euro of investments.

- P8, a group of ten major pension funds, was brought together under the patronage of Prince Charles in 2008 to tackle the issue of climate change.

- Various leading financial institutions, including Deutsche Bank and Münchner Rück. These have their own climate change departments. Others support initiatives with notable environmental organisations, such as the HSBC Climate Partnership. Important financial information and service companies such as Bloomberg are now offering special climate-related financial analyses and special skills. There are investment funds such as Climate Change Capital which focus exclusively on climate-friendly investments and consultancy services.

- The International Monetary Fund (IMF) is discussing an annual issuance of special drawing rights, to provide large-scale funding for climate-friendly investments in developing countries. This potentially important approach has already been proposed by prominent progressive thinkers such as George Soros and also Jakob von Uexküll, founder of the World Future Council.

- There are also academic research groups dealing with issues of climate finance working, for example, at New York University and the London School of Economics.

Further steps need to be taken now. It would therefore be appropriate and valuable if important leading figures in the financial sector were to make a serious personal commitment to undertake a thorough reconfiguration of investment conditions in all climate-relevant sectors and work to push forward progress.
A new initiative with a corresponding institution will be needed to define the necessary political framework and provide political advice.
In the coming months this message will need to be communicated to relevant target people so that they may feel ready to make the necessary wholehearted personal commitment to this cause.

I am grateful to the following for their advice and contributions in the preparation of this paper:

Prof. Dr. Jasper Sky
Dr. Michael Weltzin
Prof. Mark Z. Jacobson
Prof. Mark A. DeLucchi
Prof. Dr. Markus Antonietti
Dietmar Gottfriedsen
Dr. Werner Zittel
Carsten Pfeiffer
Milena Oschmann