Climate Bonds INITIATIVE

Financing a rapid, global, transition to a Low-Carbon Economy

DRAFT
FOR DISCUSSION
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"Our way is not soft grass, it's a mountain path with lots of rocks. But it goes upward, forward, toward the sun."

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Executive Summary

Climate change is a problem that must be solved

1. Climate change is an extraordinary challenge facing the world community, fuelled by a mix of continuing increases in man-made greenhouse gas emissions and environmental feedback loops that threaten uncontrollable change.

2. **The solution paths are largely understood**: a rapid *global* shift from emission-producing to clean energy generation; energy efficiency measures to buy time until that shift can be completed; and sequestering carbon through agriculture, forestry and other measures. It has been estimated that approximately **$10 trillion will be required in the coming decade**[1] to fund the transition to a low-carbon economy, at a pace rapid enough to head off run-away climate change.

3. There are three central aspects of the problem:

   - **Urgency** – the critical constraint on avoiding a 2ºC degree warming will be the time taken to develop and deploy the industries of the low-carbon economy.

   - **The Catch 22 of low-carbon industrial development** – many zero and low emission commodities are currently low volume and therefore high cost. They will naturally increase in volume and decrease in cost – even to the point of being cheaper than fossil fuels (as has already occurred with solar hot water, biomass and wind power in several countries). But the issue of urgency means that this process has to be short-circuited so that high volumes are developed and deployed even at high cost.

   - **Developing countries are where the climate challenge will be won or lost**, but the deployment of high cost, low-carbon solutions represents a real opportunity cost compared to short term poverty eradication, and a competitive disadvantage to third party funders.

Climate Bonds can fund the transition to a low-carbon economy

4. Analysis indicates[2] that the urgent need for deployment can be addressed by mechanisms that: (a) develop a suite of critical low carbon industries in parallel, (b) at annual growth rates averaging 25% per year until 20% of resources are harnessed and (c) are in place in key jurisdictions by 2014. The volumes of investment required is large — more than $10 trillion at about $1 trillion per year[3].

5. Bonds allow us to borrow against future economic benefits for the investment needed to reap those benefits.

   The past two hundred years have seen numerous successful initiatives at country levels to build infrastructure to meet environmental or social challenges: the vast sewer construction projects of the 19th and early 20th centuries that removed the spectre of cholera in Europe; the building of national energy grids to power the 20th century's economic booms; the building of hospitals as the foundation of modern health systems. Much of this effort was financed by the issuing of bonds – long-term debt repayable at pre-agreed rates, guaranteed by governments.

   Climate bonds are infrastructure bonds tailored specifically for financing climate solutions.

   Climate bonds, tied to specific climate change mitigation or adaptation investments, allow governments to raise capital, or support the private sector in raising capital to:

   - Build renewable energy generation and its associated infrastructure.

   - Widely implement energy efficiency measures in cities and industries.

   - Support adaptation measures that will boost the economic development of communities in the face of climate change.

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[1] *Climate Solutions II: Low Carbon Re-Industrialisation, A Report to WWF International*. Prepared September 2009 by Climate Risk Ltd. See www.climaterisk.net.

[2] Ibid

[3] Ibid

There is more than enough private capital in the world to fund the necessary transition.

The capacity of government to directly fund the transition to a low-carbon economy from current revenues (taxation) is limited. But, with some US$120 trillion of institutional funds under management plus retail investor and corporate funds, in principle adequate capital resources exist.

The scale of investment required will demand a constructive partnership with long-term investors, who manage the larger bulk of the world's deployable capital. (This can be seen as a new partnership between private capital and governments. And the City of London is uniquely placed to be the global headquarters of that partnership.)

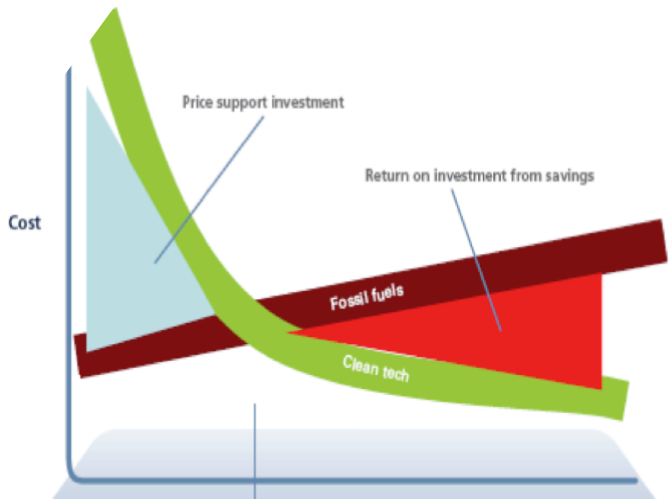
6. **Institutional investors will invest in long-term Climate Bonds given adequate and secure returns**.

Pension funds, for example, understand the importance of supporting the shift to a low-carbon economy. But they also have to ensure secure returns for their members. Long-term bonds are well suited to both the financing of long-payback period energy projects and to providing pension funds with security of returns over the longer term.

For investors, Climate Bonds will simply be new fixed interest opportunities, packaged to be more attractive than many existing options. Given of the scale off likely offerings, they can be expected to become a new asset class.

Because Climate Bonds will be novel, and because of the large scale of bond issuance required, government contingency guarantees backing repayment of Climate Bonds will be essential.

While capital may be available, the challenge is in constructing opportunities for that capital that will allow investors to meet their obligations while funding the essential low energy transformation.



Short-term price support to achieve economies of scale will be repaid with long-term returns from the cost savings

7. Investibility will be created by using accelerated economies of scale to bring forward cost savings from declining energy prices or from reduced energy consumption, then capturing the difference between business-as-usual costs (i.e. minimal investment in renewables and energy efficiency) and converting those savings into long-term revenue streams.

The investibility of specific initiatives will depend on delivering secure, long-term returns at competitive levels of risk, rather than on values arguments.

Investibility for long-term investors will also involve the aggregation of individual carbon saving initiatives into larger scale opportunities for investment. It will require a close engagement between government, investors and industry.

The investments required to address climate change can be profitable, for investors, for companies involved, and for economies stimulated by capital spending and clean energy innovation. They can help keep the planet inhabitable for billions of humans while funding our pensions.

8. The trajectory of renewable energy generation costs is downward, and has been for the past 20 years. Generation costs will continue to decline, eventually being lower than fossil fuel energy costs, especially if aided by the economies of scale of larger scale developments. Bonds can be used to borrow against longer-term cost reductions and pay for the scale of investment required in the immediate future.

9. **The transition to a low-carbon economy presents capital with what is likely to become the largest commercial opportunity of our time: investing in clean energy and low carbon infrastructure.**

10. **Achieving the scale and speed of development needed will require an active enabling role on the part of governments, at all levels.**

The Climate Bonds Initiative

The Climate Bonds Initiative, a project of the Network for Sustainable Financial Markets, is a **global civil society network** created to serve as a **catalyst** for the rapid emergence of Climate Bonds.

In order to implement the solutions identified above in a timely manner, the Initiative is:

- **Developing models and a financial architecture** for Climate Bonds designed to deliver accelerated low carbon industry development while creating returns for investors and no-cost, low-carbon inward investment for governments.

  International working groups are developing proposals for urban mitigation, country decarbonisation and a global standards architecture for definitions of Climate Bonds.

- **Bringing the three key actors to the table** – industry, investors and governments – to develop the basis of a tripartite agreement under the Climate Bonds concept.

- **Demonstrating how to engineer investibility** through large-scale mitigation and adaptation pilot schemes in both developed and developing countries.

The Climate Bonds Initiative is actively involved in developing financing for decarbonisation schemes in a number of countries and cities. These projects are intended as pilots for larger programs in developing and developed nations.

1 Introduction

Bonds are a set of financial products ideally suited to both the financing of long-payback period energy projects and to providing institutional investors with security of returns over the longer term.

Climate Bonds are intended to unlock 'patient capital': taking savings which require secure returns over long periods of time, such as those held by pension funds, and investing them in low-carbon projects that have high up-front costs but good payback rates over the long term.

Climate Bonds need not differ greatly from existing government and corporate bonds, save for their central purpose: the funds they attract are underpinned by real and verifiable energy efficiency and renewable energy projects that in some certifiable manner contribute to the mitigation of climate change.

At a minimum this has marketing benefits, allowing investors to report to their members on how their secure investments are also making a contribution to addressing climate change. At a maximum, investors could be offered the opportunity to convert their bonds to equity or, in the case of default in riskier economies, to take over the asset.

The Climate Bonds Initiative sees three areas of work required to use Climate Bonds as a mechanism to channel necessary investment funds:

1.1 Financial Instruments.

We propose that Climate Bonds need to be asset-backed, or tied to specific initiatives or portfolios of initiatives, such as energy efficiency or renewable energy generation for a region or country. The key benefit is that it creates assets to offset against the borrowing. This would also allow real marketing differentiation rather than spin, providing institutional investors some surety as they report back to their members on the value-adds of their otherwise sober investment.

As well, we find that certain types of Climate Bond schemes would have particular advantages in certain markets, whether it be securitization in markets where project finance has dried up, or sharia-compliant bonds for Islamic markets.

1.2 Structuring Initiatives for Investibility.

However, the main challenge will be to address the investibility of climate change mitigation opportunities. In particular:

- Initiatives need to be scaled up to reap the significant reduced unit cost benefits of economies of scale.
- Disparate and varied projects need to aggregated and pre-packaged to suit institutional investors.
- Risk profiles need to be reduced by a variety of government interventions, e.g. guaranteed long-term energy prices.

1.3 Institutional architecture

Finally, we believe that the long payback periods and unprecedented scale of necessary mitigation and adaptation projects will depend on:

- A range of government enabling measures, from providing legislative support for country-wide energy efficiency schemes to explicit or implicit guarantees for long-term renewable energy prices.
- Enabling institutions, such as multi-lateral and national "Green Investment Banks", that can serve as brokers or enabling intermediaries between government, finance and industry.
- Agreements on standards for the labelling of low-carbon projects, so that investors and governments can be on sure footing in their reports to their stakeholders, and to support international liquidity in what will become a special class of trade-able bonds.

These matters are further explored on the following pages. The further detail of implementation design in these areas is being pursued by specialist international Working Parties in close collaboration with trial projects.

Craig Mackenzie and Francisco Ascui, writing in their report on *Investor leadership on climate change*[1] describe Climate Bonds thus:

"The idea of a climate bond is an extension of the green bond concept. Green bonds are issued by a government or corporate entity in order to raise the finance for an environmental project. The issuing entity guarantees to repay the bond over a certain period of time, plus either a fixed or variable rate of return. Climate bonds would be issued by governments (or others) to raise finance for investments in emission reduction or climate change adaptation."

* Mackenzie, C and Ascui. F. *Investor leadership on climate change: an analysis of the investment community's role on climate change, and snapshot of recent investor activity.* Published by the UNEP Finance Initiative and UNPRI, 2009.

The Great Innovation

The bond market is the great innovation that distinguishes western capitalism from all previous economic systems.

Bonds issued by Renaissance Italian city states, such as the *prestanze* of Florence or the Venetian *prestiti*, proved to be financial innovations of the first order, in that they created debt securities that had the same status as traditional fixed property (Ferguson 2008). In time they came to be called 'mobile property' (as in the later French innovation of *credit mobilier*).

The initial issuer had to have the power to compel uptake of the bond issue (as in the first cases, where the bonds were a form of tax) or the sovereign status that inspire confidence that an assurance of paying a coupon (fixed interest) of, say, 5% per annum for 20 years, would indeed be complied with.

Eventually the bond market expanded to accommodate issues from private firms (known as debentures) backed by the reputation and market strength of the leading merchant banks (like Barings in London, or Goldman Sachs in New York) which acted as their under-writers.

2 Three areas of exploration

2.1 Financial Instruments

2.1.1 Options for Climate Bond structures

A range of options exist for structuring bonds to suit the needs of climate change mitigation while delivering investor security. Different options will work in different contexts. Some examples being explored are:

- **Index-linking bonds to inflation rates or carbon prices**. For example, Climate Bonds could be issued with a low base rate of interest, but have bonus payments if carbon prices reach certain higher levels. This is on the basis that low-carbon projects funded by climate bonds would increase in profitability as carbon prices rise.

  A twist on this approach, proposed by the London Accord's Michael Mainelli, is a bond where the interest rate payable goes up if the carbon price does not meet stated targets. This allows renewable energy investors to hedge their bets by buying such bonds as insurance — if the carbon price targets they base their investment plans on are not met, they can claw some of the loss back by getting a higher rate of return on these bonds.

- **Zero-coupon bonds that pay out a guaranteed rate upon maturity**, whether 10, 20 or 30 years in the future. These do not pay any interest (no coupons) until the end of the bond period. These are most suitable when new technology needs to be developed, embryonic technology needs to be scaled up, or existing technology has to be invested in high-risk countries. An "enabling institution" converts high-risk projects into low risk investments for institutions by acting as incubators until companies and technologies become large enough or low risk enough to sell off.

  Zero-coupon bonds can finance these outcomes because of the long-term time frame of debt, and by using qualified "enabling institutions" to diversify investments made with funds raised from bond sales. A key requirement is the support of government guarantees.

- **Convertible** bonds would allow investors to convert their bonds to equity stakes in an entity (in other words, become shareholders in a company), at agreed points in the development.

- **Islamic bonds – Sharia-compliant bonds** could attract investment from Islamic businesses within the UK and from across the Muslim world. These would have no interest payable (payments would be in other modes, such as fixed periodic payments, equivalent to a lease). Government guarantees would only apply in the context of projects benefiting from renewable energy feed in tariffs.

  "Banks need more high-grade paper (sukuk) to place their money in, but there is hardly any." - Farmida Bi, partner at Norton Rose in London[4]

  "There is a lot of pent up demand (for sukuk)" - Mohammed Dawood, head of capital markets at HSBC Amanah, the bank's Islamic arm[5]

- **Regulated Covered Bonds.** In this proposal, guaranteed revenue streams generated by energy generation projects that qualify **for** renewable energy feed-in tariffs are used as collateral for AAA bonds. This creates a deep and standardised Climate Bond market, modelled on Germany's 300 year-old *Pfandbrief* "covered bond" property market.

  Bond investors invest in AAA Covered Bonds issued by a financial intermediary. Bond investors receive 20 year annuity income. Bonds are secured at low leverage against the collateral of the renewable power generation infrastructure and its income stream, the latter guaranteed by a renewable energy feed-in tariff (such as the FiTs currently in place in Germany, Spain and Ontario).

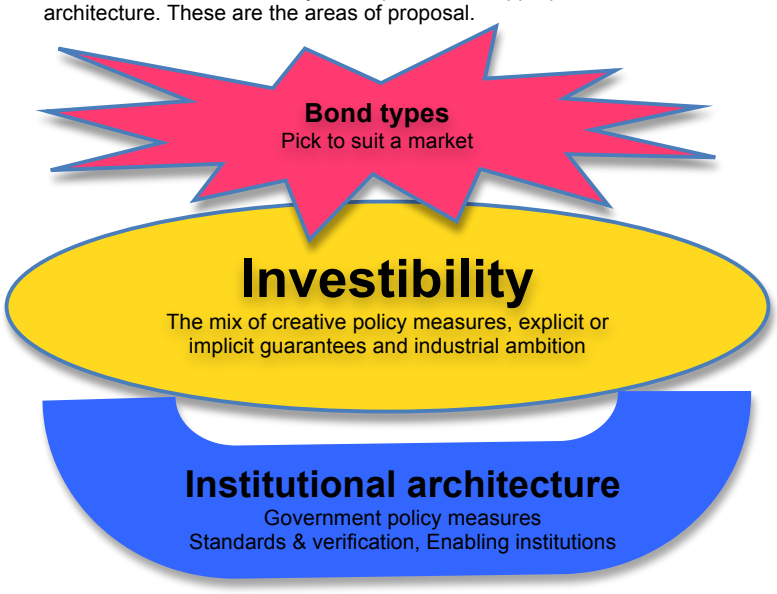
  Financial intermediaries access funds from financial markets and use their balance sheet and/or money markets to increase leverage.

  To pay for renewable energy generation projects, project developers combine investor equity with money borrowed from banks acting for the bond-issuing intermediary.

  This market would produce large amounts of standardised and long-dated, low-risk bond investments. This is just the category of investment product required by pension funds and other investors to balance their long-dated liabilities. It may be very useful for the fast-growing bulk annuities market.

The Story

We started looking at bond types, and quickly realised that *Investibility*, rather than financial structure, is the key issue to address in using Climate Bonds to large-scale finance mitigation and adaptation. We further found that Investibility will depend on an appropriate Institutional architecture. These are the areas of proposal.



[4] Financial Times *Markets and Investing* section, Tuesday 10 November 2009

[5] Ibid

Securitization – Back to Fundamentals[6]

In the current economic climate development financing has dried up, with many projects stalled as banks are unable to offload mature project investments to recycle funds for developments.

Renewable energy projects lend themselves to securitisation due to their stable income profile. Banks or other institutions could finance projects in their first few years of operation, then, after at least one year's operation, securitize them as proven and mature investments for institutional investors.

In this model a fund (bond holding vehicle) would purchase portfolios of debt secured against renewable energy projects from banks. The fund would finance this purchase by selling bonds into the market. The bonds could be in the form of c. 15 year amortising bonds which are suitable for annuities. Critical mass is important. The fund must be of sufficient size that its bonds are liquid in the market and can be subsequently traded by bond investors.

Defining securitisation

Securitisation is defined as the transformation of a pool of homogeneous assets (such as mortgages or loans for enterprises) into tradable securities.

The so-called "originator" (often a credit institution or an enterprise) sells parts of its assets to a newly founded special purpose vehicle. The special purpose vehicle finances the purchase of the claims by issuing the notes on the capital market. As the securities are backed by the respective claims, they are also called "asset-backed securities".

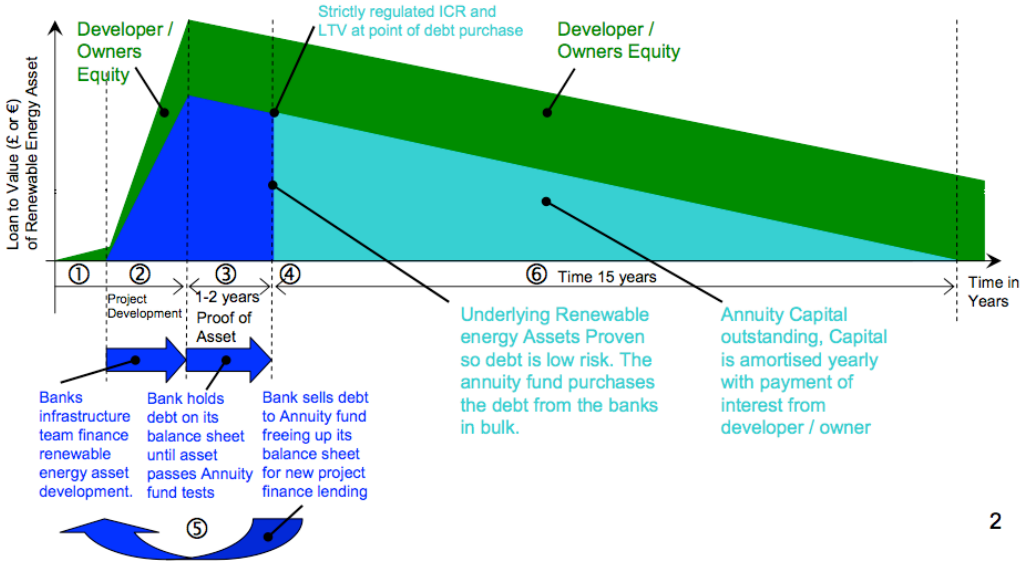
Going back to the first forms of securitisation, only quality senior loans would be purchased by the fund, and only a single type of bond would be sold by the fund to investors. The parameters should be transparent, predefined and regulated. This should produce a standardised quality bond for the bond-holders.

The bonds produced will have similarities to energy utility bonds but could be classified as Climate Bonds as they would not be associated with funding any thermal power (coal, oil or gas).

An advantage over energy utility bonds is that retail or institutional investment allocations can be made into the debt of pure renewable energy assets. The bonds could pay a coupon similar to that of the bonds of energy utilities 5% to 6%

This type of fund is designed to transfer to long-term investors the lowest risk part of the capital structure of renewable energy assets that have a track record. It will enable banks to recycle their capital and lend new riskier development finance to facilitate the building of new renewable energy assets, and so facilitate the long term funding requirements of renewable energy asset owners.

This principle could be applied to the idea of a green investment bank where the bank purchases debt and repackages it to produce bonds.



Securitization: Loan to Value over time of the development and the ownership of a renewable energy asset.

The Green shows the developer / owners equity in the project. The Dark blue shows the bank finance. The turquoise shows the annuity debt funding. The evolution is as follows:

1. Project planning, developer injects funds.
2. Project development, bank satisfied with project injects debt for asset construction
3. Bank finances asset for 1 to 2 years so that asset has a proven track record and is suitable for transfer to annuity funding
4. Project passes proof of income, management and value tests and its debt is purchased by annuity fund
5. Bank has free balance sheet to project finance further renewable energy asset development
6. Asset owner pays interest and repayment of annuity capital yearly

[6] This section was contributed by Jason Langley BEng ACA AMIMechE

2.1.2 Retail Climate Bonds

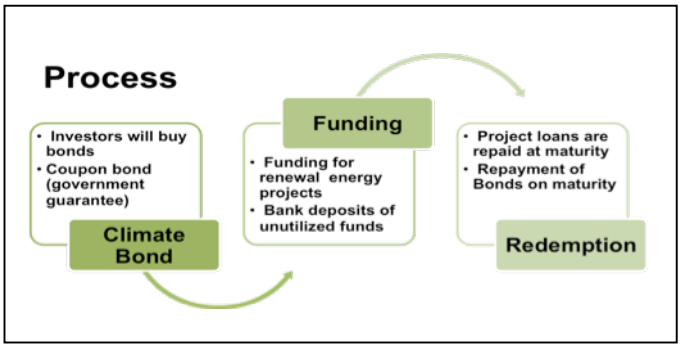
Most interest in Climate Bonds is likely to come from institutional investors, especially pension funds, for whom long-dated bonds exert a particular appeal. As well, only institutional investors will be able to deliver the levels of investment needed to develop renewable energy and energy efficiency measures on a sufficient scale.

However, in a time of heightened community awareness of climate change, many people may, if given the option, choose to invest in Climate Bonds that help green their energy supply or their cities. Just as during World War II, when millions ploughed their savings into War Bonds, so today many people might choose to invest in Climate Bonds to help fight climate change. Such retail bonds could be available for purchase over the internet or through post offices, providing an attractive alternative to Premium Bonds or existing savings accounts.

The asset-backed nature of Climate Bonds could be used to promote regional offerings, such as Welsh Wind Power Bonds, or Birmingham Energy Efficiency Bonds.

Whilst even the most successful retail fund-raising is likely to be modest in scale compared to the financing need, retail Climate Bonds would have powerful ancillary benefits:

- Engaging the public in a national effort to tackle global warming.
- Help build support for steps to address climate change, at a time when disappointment about the outcome of UNFCCC Copenhagen negotiations is likely to be realised.
- Draw attention to the constructive role of participating institutions, both government and financial, at a time when public confidence in those institutions needs bolstering.



2.1.3 Issuing bodies

Climate bonds would be issued by any organization with a sound credit rating, according to the rules that will govern their operation. For example:

- Climate Bonds could be **issued directly by national governments in the form of gilts tied to specific assets** (such as electricity grid infrastructure). The novelty of sector-specific, asset-backed gilts would attract investment and potentially increase the pool of money available to the government. Marketing opportunities alone could stimulate interest from pension funds.
- Developing countries could issue them as well as developed countries – but because many developing countries lack good credit ratings, these transactions would probably be managed by credit institutions in the developed world. Thus it is highly probable that countries such as Nigeria or Indonesia or Columbia would be able to issue climate bonds, through such entities as SEB (who managed the recent World Bank Green Bonds issue), Kleinwort Dresdner or HSBC, where the security of the issue would be based on the certainty that such countries will be able to effect a switch towards renewable energy sources, or would be able to introduce carbon sequestration initiatives such as forest retention programs that will themselves be facilitated by the funds raised via the bond issue.
- A **Green Investment Bank** (GIB) could be established at a national or international levels to issue bonds and direct investment. It could be either fully or partly publicly-owned, and be a separate entity, arms-length from government, allowing its transactions to stay off the public balance sheet. The functions of a GIB are explored in more detail in the later section on institutional architecture.
- In some jurisdictions Climate Bonds could be issued by quasi-independent government-owned bodies such as corporatised (government enterprise) power generators.
- **Municipalities** could raise capital through bond issues for low-carbon projects in their area.
- **Public-private partnership**. Government could make a 'cornerstone investment' in a low-carbon fund, putting in, say, the first 20%, and leveraging investment from the private sector. By providing a guarantee to step in and take the first hit on any losses, the government could create an attractive investment for the private sector, without exposing large amounts of public money to risk.
- **Purchase contracts**. Governments could provide an even stronger guarantee of good returns to a private developer by tendering a long-term purchase contract, which can then be used by the company as collateral for a bond issue. For example, a government could offer a 40-year contract to a renewable energy developer, guaranteeing a floor price for the energy generated across this timespan.

  Because the developer could rely on diminishing costs for constructing renewable technologies over this time period, they would have an incentive to frontload investment and reap greater rewards later, exploiting the difference between the costs of installation and the contract price. The developer in turn could raise funds by basing a long-dated bond issue on this contract. Whilst purchase contracts would appear as a liability for government, they would not feature on the public debt ratio. Long-term purchase contracts are in some ways simply a variation of policies such as the UK Conservative Party's offer householders of a 20-year price guarantee on renewable energy through a Feed-In Tariff.[7]

[7] See Conservative Party policy paper, *Power to the People*, December 2007.

2.2 Structuring initiatives for investibility

While asset-backed Climate Bonds provide a means to raise funds for investable projects. The key barrier to financing large scale mitigation effort is in fact the investibility of those mitigation efforts.

Kirsty Hamilton of London's Chatham House describes this as the need for "a focus … on unlocking finance by getting the underlying conditions right".

Here we propose three approaches for addressing the investibility of energy efficiency, renewable energy and adaptation. Similar such opportunities to address investibility exist in other of areas.

The basic premise

If the financial returns for an investment opportunity can be anticipated with certainty over a long period (e.g. 30 to 40 years for renewable energy), with the returns more than compensating for any financial outlays to create the opportunity (e.g. the government providing price support for renewable energy over the first decade that will level the energy playing field, increase demand and hence reduce unit cost, or cutting energy bills with energy efficiency measures), then a Climate Bond can provide the financial means of bridging the gap.

2.2.1 Energy Efficiency Financing

Aim

- Using private finance to create a rolling programme of energy efficiency and micro-generation
- To end energy poverty
- To provide energy security for the country
- To create green jobs

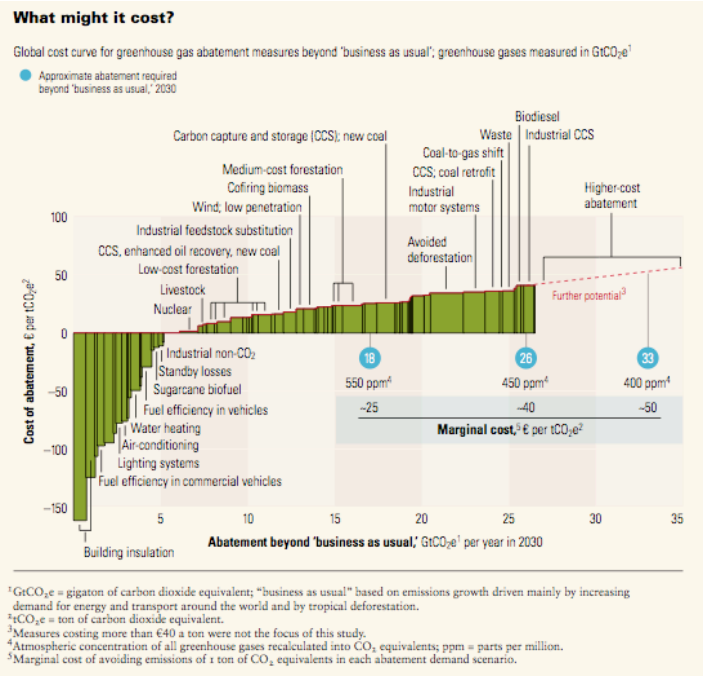
Background

In Iceland homes commonly use geothermal energy for heating. A rather shocking experience for the energy conscious climate campaigner is to visit an Icelandic home for dinner, and have the windows flung open when the room gets too hot — there is no shortage of energy when you're sitting on top of hot rocks.

In theory there is no shortage of renewable energy anywhere in the world: reports have recently appeared claiming that China has enough wind resources to power its whole economy and more[8]; Australia has enough geothermal to fuel the country's economy for 100 years[9]; and a series of large scale solar thermal plantations in the Sahara could keep the lights on in the whole of Europe and North Africa[10]. But the job of economically harvesting enough of that energy will take time; in the meantime we need to rapidly reduce energy demand as part of turning our emissions trajectory downward and to buy time while we retire our polluting energy sources.

Energy efficiency is a win-win idea: investment in reducing energy demand invariably has a relatively quick payback period, so the financial drivers are in theory clear.

Cost of transaction has been under-estimated in the McKinsey/Vattenfall abatement cost curve gap: despite the nominal attractiveness of returns suggested by the cost curve (below), energy efficiency measures are not being implemented at the required or expected speed and scale. We believe that this is because the *effective* cost of transaction, especially for households, has been significantly underestimated. But there is a way to reduce that cost.



[1] $GtCO_2e$ = gigaton of carbon dioxide equivalent; "business as usual" based on emissions growth driven mainly by increasing demand for energy and transport around the world and by tropical deforestation.
[2] tCO_2e = ton of carbon dioxide equivalent.
[3] Measures costing more than €40 a ton were not the focus of this study.
[4] Atmospheric concentration of all greenhouse gases recalculated into CO_2 equivalents; ppm = parts per million.
[5] Marginal cost of avoiding emissions of 1 ton of CO_2 equivalents in each abatement demand scenario.

Indeed, energy efficiency appears to be the lowest hanging fruit when it comes to climate change mitigation efforts. The McKinsey/Vattenfall abatement cost curve (see illustration below) places energy efficiency at the top of the list of high-return climate mitigation investments.

Yet, as economists such as Prof. Dieter Helm have noted[11], "In practice energy efficiency has not had a significant take-up and, in particular, individuals and companies have not been noticeable in their adoption of the claimed positive-NPV investments." McKinsey has also noted this shortfall in their report on *Unlocking Energy Efficiency in the US Economy.* [12]

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[8] McElroy, M., Lu, X.,* Chris P. Nielsen, C., Yuxuan Wang, Y. *Potential for Wind-Generated Electricity in China*, Science Magazine 11 September 2009: Vol. 325. no. 5946, pp. 1378 – 1380. See also http://www.livescience.com/environment/090910-china-wind.html

[9] Flannery, T., The Weather Makers-The History and Future Impact of Climate Change, p276. 2005, Text Publishing

[10] See http://www.desertec.org/en/concept/studies/

[11] Helm, D., *Climate-change policy: why has so little been achieved?* Oxford Review of Economic Policy, Vol 24 No 2, 2008, pp. 221-238

[12] Granade,, H.C., Creyts, J., Derkach, A., Farese, P., Nyquist, S., Ostrowski, K., *Unlocking Energy Efficiency in the US Economy*, McKinsey & Company, July 2009

Across all sectors of the economy energy efficiency is not delivering on the scale of its promise. The lack of progress is particularly an issue in the home or small business sector, where all sorts of energetic companies have been active and where many innovative financing solutions have been trialled.

Many governments have been mandating energy efficient building standards, and developing modest programs to support retrofitting of existing building stock. This is beginning to make a difference to new construction, although in most countries new construction only accounts for a small proportion of properties. But to avoid run-away climate change we need to dramatically and rapidly improve the efficiency of 80-90% of existing building stock.

So why haven't savings benefits driven rapid take-up of energy efficiency options?

Some commentators argue that a lack of available finance is a barrier to take-up. The UNEP Finance Initiative Working Party on Energy Efficiency, for example, identified in its report on *Energy Efficiency and the Finance*,*Sector* [13] "a lack of commercially available financing" as a barrier.

In theory, the capturable financial outcomes in the form of reductions on energy bills should be a clear candidate for debt financing. This, for example, is what underpins the idea of Energy Service Companies (ESCOs), which have had modest success in the US commercial property sector.

However, as the UNEP FI report[14] notes, "individual (energy efficiency) projects are considered too small to be commercially 'interesting' to mainstream private sector financial institutions."

Given that capital resources are greatest in the institutional investor sector, a requirement for gaining access to required capital will be effectively aggregating energy efficiency projects into investible scale opportunities. The scale of retrofit required would suggest this might be possible.

But the slow-take-up of energy efficiency to date suggests the economic case is not as clear as it's meant to be.

We suggest that a weakness in the McKinsey cost curve is that the "transaction cost" is not adequately factored in. That is, existing practice in the energy efficiency sector requires much higher sales and customer handling costs than have been suggested.

Behavioural economics has shown that, for individuals being called on to make a household or small business-level decision, there can be a major inertia factor when faced with complex decisions that deliver relatively marginal immediate benefit, despite a rational case for longer-term savings. In that context, a huge and very costly effort to educate and sell to individuals at home or work becomes necessary.

Finally, financing energy efficiency has been complicated by the disaggregated nature of solutions delivery. Energy efficiency may be just six compact fluorescent lamps for one house, £500 of ceiling insulation in another, or £5000 of advanced lighting controls in an office. It's fiddly to install which means that, while it offers extremely low risk of technology failure, it can be complicated to finance on a small scale. Loan offers that have been focused on households and small businesses consequently have high servicing costs.

We propose delivering investibility and scale through large, government organised schemes, instead of relying on the expensive marketing effort of convincing householders one by one.

The driver is to aggregate the work and put it into a reduced risk framework that will lend itself to bond financing.

These would be structured so as to be suitable for financing with municipal or national bonds, or with corporate (ESCO) bonds secured by purchase contracts from government. (In the US, asset-backed municipal bonds will have particular tax advantages for investors). Returns will come from loan repayments tied to dwellings, either via municipal tax bills or utility bills.

Aggregation would deliver two further important benefits:

- Opening up options for local facilities such as neighbourhood energy generation or community heat-pumps.
- Using the cost-efficiencies that come with scale to reduce per-unit costs.

Organ Donations and Opt-Out schemes

Behavioural economist Daniel Ariely[1] tells a useful anecdote about the power of opt-out schemes: he reminds us that getting enough organ donations to meet the needs of the critically ill has been a constant problem in countries like the US, the UK and the Netherlands.

For years health authorities have run campaigns and worked hard to convince people to "Tick the box below if you agree to participate in the organ donor program" on driver's licence forms and the like; yet volunteer rates still range from a low of 4% in Denmark to 28% in the Netherlands, where the Government mailed an appeal to every home in the country.

But in a number of EU countries rates or organ donations are very high: from 86% (Sweden) to 98% or more (Belgium, Poland, France, Portugal, Austria). When confronted with the graphs showing and asked to explain why, people typically suggest cultural differences.

The real difference? When people see the relevant question on their drivers licence application form it says "Tick the box below if you *don't* want to participate in the organ donor program". Very few people tick the box.

This is called an "Opt-out" scheme.

In research Richard Thaler (co-author of "Nudge") has done on such approaches in the US, he has found that opt-out schemes usually have very high participation rates — and very high popularity rates among those people enrolled. A scheme that previously required volunteering, presented afresh as an opt-out scheme, will have significantly *higher* popularity rates.

[1] mlAriely's presentation can be found at http://www.ted.com/talks/lang/eng/dan_ariely_asks_are_we_in_control_of_our_own_decisions.ht. The case study is originally from Johnson & Goldstein, *Do Defaults Save Lives*, Science magazine, http://www.sciencemag.org/cgi/content/short/302/5649/1338.

[13] *Energy Efficiency and the Finance Sector — A survey on lending activities and policy issues*. By Kirsty Hamilton. UNEP Finance Initiative Working Party on Energy Efficiency, January 2009.

[14] Ibid

HOW IT WILL WORK

Schemes would have the following characteristics:

The use of an opt-out model

An opt-out approach allows **large-scale projects** that will dramatically **cut transaction and building costs** and makes projects more attractive to institutional investors, **lowering the cost of funds** and increasing the pool of prospective investors. Reduced costs mean much more refit can be delivered per dwelling than with current schemes.

An opt-out scheme would mean that Governments automatically enrol whole areas in programs – neighbourhoods for residential energy efficiency, CBD blocks for building or office-tenancy upgrades, industrial zones for industrial energy efficiency.

Individuals and businesses have the right to opt-out: they are told they're included but asked if they want to drop out. This is in contrast to current models where individuals are required to make a positive decision to do something about energy efficiency – an "Opt-in" model.

Effectively, a municipality enrols local households in a "bulk purchase scheme" as part of "solving problems for its citizens". It means "lower costs for everyone", no effort required for householders apart from letting people in to do the work, their neighbours are all in as well, and if they do let the workmen in they get savings on their energy bills - they pay LESS not more.

As well they could be offered a modest cash payment up front for the inconvenience of workman being in their house. The payment would be recouped from the dwelling-attached loan.

An assessor would visit premises and make recommendations for action. Separate teams would undertake works once householders have signed off.

An opt-out scheme could make the difference between 25% and 85% participation and deliver aggregation of effort that will reduce roll-out costs as well as scale refit projects up to become more investable.

Not only would this approach deliver results through competitive tendering; it would also deliver through peer competition, at the residential or business level. Research has shown that householders are more willing to participate in energy efficiency refits if their neighbours are doing so as well[15]. Under the opt-out scheme, whole neighbourhoods would be done at the same time.

If a householder opts-out, they would still be able to organise their own retrofit and, subject to compliance with a set of public standards, take advantage of the loan program available. But it's unlikely the deal would be as good if they went it alone.

Householders can choose to opt-out and not to take action. However, if at some stage they sell their house they would be required to get an energy efficiency compliance certificate for their dwelling, so that the relative level of its energy efficiency is fully disclosed to prospective new owners.

Legislative changes may be required to achieve an opt-out scheme.

Financed with Climate Bonds

Climate Bonds would be issued by either the municipality, or by ESCOs using the security of a purchase contract from a municipality.

This will be facilitated through local authorities. Local authorities issue a Climate Bond in the market. The bond is a standard 10-15 year fixed payment bond, but it is **collateralised against household payments and guaranteed by the local authority**. Households would be automatically enrolled into the energy efficiency scheme, although they would have the right to opt-out. An assessor would visit the household and arrange for energy efficiency work to be carried out by an ESCO.

An alternative to the local authority issuing the Climate Bond, would be for them to support ESCO's in raising capital through **corporate bonds, secured by local authority purchase contracts** under the scheme and with the collections system guaranteed by the local authority or national government.

A useful model for bond financing has been developed by the Californian City of Berkeley, with its Financing Initiative for Renewable and Solar Technology[16] (FIRST) scheme. While the scheme is limited in local effectiveness by its "opt-in" nature (opt-out schemes are not currently allowed under the Californian Constitution), the repayment model is a useful one. It uses long-dated municipal bonds as a financing source, with repayments provided by charges against dwellings, linked them to the specific energy assets created under the scheme.

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[15] *Discounting Future Green: Money Versus the Environment*, Hardisty and Weber, Journal of Experimental Psychology: General, vol 138, p 329,,, http://www.apa.org/journals/releases/xge1383329.pdf; and
Dormitory residents reduce electricity consumption when exposed to real-time visual feedback and incentives, Petersen, Shunturov, Janda, Platt and Weinberger, Oberlin College, Lewis Center for Environmental Studies,International Journal of Sustainability in Higher Education, vol 8, p 16). http://www.luciddesigngroup.com/download.php?id=20070117

[16] http://www.ci.berkeley.ca.us/ContentDisplay.aspx?id=26580

Repayments would be via a loan charge tied to an individual dwelling.

Repayments would be collected either through utility bills (as per various policy proposals in the UK at present) or via Council or municipal taxes; repayments would be tied to the dwelling rather than the residents and would be spread of a number of years, up to 25. As people move out or change their utility provider, repayment charging would shift accordingly — the repayment is shifted to the new occupier.

The UK Green Building Council's *Pay As You Go* report[17] includes a useful outline of the pros and cons of utility bills and Council tax options, and how the mechanics of these would work.

The UK's Kirklees Council has developed a slightly different model under their RE-Charge scheme. The first of its kind in the UK, it offers interest-free loans secured against the property to install renewable energy and/or energy efficiency measures. Loans only become repayable when the property changes ownership[18].

Households are guaranteed savings on their energy bills.

Repayments are linked to the property over an extended period of time and are calculated to be less than the savings that will be made on household energy bills. The loan period can be adjusted to ensure savings are delivered to households immediately.

In US, trials of loan schemes found that an important means of getting householders to accept schemes has been to enshrine the idea that the householder saves money.

Typically, the loan repayment charge can be no more that 75% of energy bill savings. That means that householders keep 25% of any energy savings — without having to do anything except let assessors and then workmen into their house.

Use incentives tied to CO2 emission reductions.

At present contractors are paid for building work or, in the case of utilities, for nominal emission reductions calculated in the crudest fashion, with no verification. As the UK Green Buildings Council has observed, building focused refits often see energy use rise, or "bounce back", after a refit until the same cost levels as before are reached.

We propose that the mix of remuneration for ESCOs include incentives tied to the reduction of greenhouse gas emissions. Geographical area baselines could be developed from existing local authority indicators or where smart metres have been installed.

The aim will be to allow ESCOs to think creatively about how best to reduce emissions over a 5+ year period, and to encourage competition between different ESCOs to find creative ways to emissions. This program would best suit well-capitalised ESCOs with the capacity to also export their services to other areas.

While an ESCO would look at building insulation measures, they might also consider micro-generation, heat pumps or even behaviour modification.

Higher-grade smart metres might be installed: for example, tests in Japan and Australia with ultra-smart meters show that significant energy use reductions can be achieved with simply making it very obvious where energy is being used in the house.

By providing sufficient scale of territories contracted to an ESCO, and including potential access to Council or community space in those territories, we open up the opportunity to include communal solutions where they most carbon and energy efficient. Communal solutions could range from larger scale heat pumps in Council car parks that serve a wide area, to neighbourhood solar, wind or biomass facilities.

The point is to focus outcomes on both sustained energy use reductions (and thus consumer savings) and emission reductions, rather than the currently common roll-out of insulation that may or may not lead to emission reductions. Of course emissions tracking will be a pre-requisite for such an approach; in many countries (e.g. Italy, the UK) this is already happening; in other jurisdictions it would need to be factored in to the program.

A competitive market for Energy Service Companies.

Governments or municipalities would run tenders for the area-by-area energy efficiency programs, as has been done through various demand management program in the United States, for example.

Tenders would be designed to provide adequate scale for ESCOs to aggregate refit projects and keep unit costs low, while ensuring a competitive market of tenderers.

Ensuring security of return

Investment in low-carbon infrastructure is unlikely to deliver high returns in the short term, but will provide secure and solid payback over the long term. Security of returns from Climate Bonds can be guaranteed through:

- A **cash-flow from sales** of renewable energy, or **revenues recouped from savings** made through energy efficiency measures ('negawatts').
- The bonds being backed by **assets of enduring value**, such as renewable energy infrastructure.
- **Government promises** to reduce carbon emissions (e.g. the UK's legally binding carbon budgets), price instruments such as Feed-In Tariffs that guarantee a price for renewable energy, and long-term purchase contracts.
- In the case of government-issued gilts, **the treasury provides a guarantee of payment**. In the worst case, government can honour its debt by diverting tax revenues or borrowing.

[17] UK Green Building Council, *Pay As You Go — Financing low energy refurbishment in housing*. August 2009

[18] http://www.kirklees.gov.uk/community/environment/green/greenliving/home/re-charge.shtml

The visible participation by local government, both as managers of programs and as verifiers of work carried out, will be important to ensuring trust in the program among building owners.

The opt-out aspects of the above proposals will require government leadership of a substantial order. We believe a central component of a strategy to maximize support and mitigate the political risks will be to trial proposals with receptive municipalities, and ensure that outcomes — notably reductions on energy bills — are well-explained.

Comment

There are certain features of this policy which might seem surprising but are the best alternative. Firstly involvement of local authority; it is important to stress that the local authority enables the programme, but the capital raised is from the private sector and delivery is by ESCOs.

It has been shown both by theory and practice that utility companies are set up to sell energy, therefore they will be reluctant participants in any scheme; we need to create a new market where new companies will survive (e.g. think IT 30 years ago, we do not want to rely on IBM to deliver internet services, we want to create the environment for the new Google).

The opt-out scheme is the only way of achieving scale. The alternatives are new coal power, the lights going off and/or very high energy prices, combined with massive infrastructure spend and the householder will win financially.

It's worth noting that Richard Thaler[19] has found in his studies of health plans in the US that opt-out schemes are more politically popular than fully voluntary schemes.

The program is ongoing, as ESCOs learn-by doing and new technology comes on line, households are continually upgraded.

2.2.2 Using Climate Bonds to fund a Feed-In Tariff

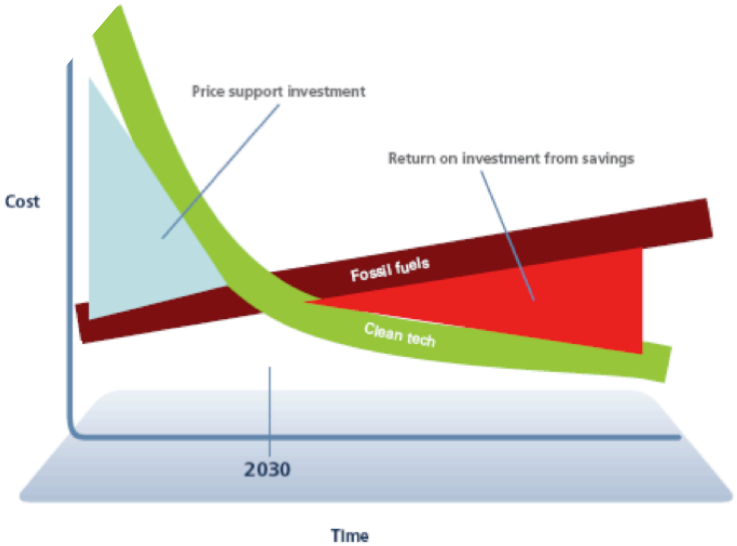
Electricity generation is responsible for 41% of global energy-related CO2 emissions. As the International Energy Authority (IEA) has said[20], decarbonising electricity generation is critical to meeting emission reduction goals. The IEA has called for mechanisms "ambitious new policies to push for a more efficient use of electricity". We propose such an ambitious policy that would borrow against future economic benefits for the investment needed to reap those benefits.

A common feature of new technologies is that their cost of application tends to drop with rollout and time. This has certainly been the case with renewable energy technologies such as wind and solar thermal. Photovoltaic technologies started their journey with a higher cost base than many other renewables, but have been dropping in cost at a faster rate — for example, the cost of manufacturing photovoltaic cells in China is reported to have dropped by half in the past year.

Philip Wolfe, former Director General of the Renewable Energy Association, explains that some technologies that still seem too high on the price curve have exceptional cost reduction potential. Photovoltaic cells, for example, are basically semiconductor components, he says, and should mirror computer chips in dramatically reducing costs as volumes build.

That falling cost curve means that electricity generated from renewable sources will eventually be cost-competitive with conventional fossil fuel sources – a cross-over point termed 'grid parity'. When is it likely to occur? In the case of solar photovoltaic systems, there are many estimates available in the open literature. It might come as early as four to five years in the case of solar PV installations[21], and 10 years in the case of wind, and in any case by the 2020s at the latest. The cross-over will occur at different times in different countries due the prevailing market prices and renewable resource levels.

There are many sources of evidence for such an assertion. Researchers from McKinsey (Lorenz, Pinner et al. 2008) estimate that even without subsidies, solar energy could become cost-competitive with conventional electricity in parts of the United



Short-term price support to achieve economies of scale will be repaid with long-term returns from the cost savings

[19] Thaler, R.H., Sunstein, C.S., *Nudge: Improving Decisions About Health, Wealth, and Happiness,* New Haven and London: Yale University Press, 2008.

[20] See http://www.iea.org/Textbase/press/pressdetail.asp?PRESS_REL_ID=288

[21] PV installations on homes and offices compete with the delivered price of energy which is considerably higher that the ex-power station price..

States (California and the Southwest) and in Italy, Japan, Spain and Australia within the next three to seven years. As shown in Figure 3, the cost curves of solar PV cross the retail electricity price curve as early as around 2008; and are largely competitive by 2020; even in the most unfavourable scenario the two cross around the year 2032.

The idea of using Climate Bonds to fund a Feed-In Tariff exploits the idea that the cost of renewable energy generation is continuing to drop, and will become cheaper than fossil fuel energy generation. Critically, it requires (or contracts) a constant, government-regulated energy price per kilowatt hour, paid by energy consumers to the utility company providing them with energy services and then "borrows" against future savings in renewable energy costs to pay for a premium energy tariff in the present.

For example, the government could fix electricity prices paid by electricity consumers for the next 30 years at the average inflation-adjusted electricity price of the past five years. This fixed price reflects the energy costs characteristic of today's electricity supply, which is mostly composed of fossil and nuclear energy.

Initially, the costs to a power producer of building and operating renewable energy power plants will be higher, on average, than the costs of building and operating fossil-fuelled power plants (absent a significant carbon emissions charge).

By issuing Climate Bonds to raise money for building and operating renewable energy capacity, an investment fund buying power from renewable energy providers (at a price premium over fossil power, in the near term) nevertheless achieves a positive return on investment, by effectively "borrowing" against future savings in energy generation costs. (The investment fund will profit from the difference between the lower cost of power produced from renewable energy infrastructure compared to the higher price of power produced from fossil fuels, in a future time when renewable power is consistently cheaper than fossil power). These future higher net revenues pay for a premium energy tariff in the present.

The intervention is also important since this cost reduction curve would be sharpened given an increased scale of investments, sufficient to provide rapidly escalating economies of scale. Renewable Energy Feed-in Tariffs and carbon prices can deliver increased investment.

The model could work either as a simple government bond whose revenue funds the Feed-in Tariff, or as a public-private partnership that does the same.

- An Energy Investment Fund, let's call it "EnerFund", enters into a long-term contract to supply renewable energy to the grid. The Government guarantees that a fixed (inflation-adjusted) price per kWh will be paid to EnerFund for any renewable electricity it supplies for 30 years. This price is inline with the regulators expectation for energy prices – not higher and not lower.
- EnerFund raises money, secured by the purchase contract, by issuing Climate Bonds to spend on a defined amount of Feed-in Tariff subsidies to support new renewable energy capacity designed to accelerate economies of scale. This is borrowing money to build generation now.

  A variation on the Energy Investment Fund model is that Govt would be involved in setting up the Fund or as a cornerstone investor (with the govt guarantees implied).
- EnerFund commissions a large solar thermal plant next year and arranges a contract with a local utility to take and supply the power under the contract it has with government.
- In the short term the power from the solar plant is more expensive than payment received from the utility via the governments contract. So the renewable power producer must be paid a higher rate per kWh than the price paid by power consumers (this is how a Renewable Energy Feed-in Tariff works).
- EnerFund absorbs these operating losses (the net cost of the Feed-in Tariff) until cost-convergence is achieved.
- The renewable energy cost reduction curve would be sharpened given the increased scale of investments, sufficient to provide rapidly escalating economies of scale.
- EnerFund is building many such projects around the world under similar contract and each time the costs go down. Fifteen years later it goes back and builds a new solar thermal plant next to its first, and this time the plant produces energy at considerably lower costs, so much so that it can earn a substantial profit from its government power contract. With these and subsequent projects it is able to repay the climate bonds used to fund the initial losses plus interest.
- Governments provide other forms of guarantees for specific renewable energy projects. For example, the World Bank currently agrees to take first the 20% hit on any losses on some selected developing nation projects; national governments could do the same with, for example, a big wave-power project that was seen as more risky but important to the development of the country's capabilities. This approach is unpopular in rich nations because it's seen as "picking winners" (and this is more traditionally done through targeted tax-break schemes), but it is common in developing nations, notably with big hydro schemes. Big hydro is now becoming unattractive; the model could switch to, say, big solar thermal in Rajasthan.

This approach requires a constant, government-regulated contracted energy price per kilowatt hour, paid by energy consumers to the utility company providing them with energy services. It then "borrows" against future savings in renewable energy costs to pay for a premium energy tariff in the present.

Scale, aggregation and ubiquity

An obstacle to the raising of conventional funds is the relatively small-scale of many energy projects. While this small scale can encourage experimentation and innovation, it retards implementation and system transformation.

A Climate Bond can be used as a financial instrument that enables an issuing institution or government to aggregate many such initiatives and thereby equip them for commercial scale operation much earlier than would be achieved without such assistance. It can also be used as easily in developing countries as developed countries which again increase market and scale up.

For example, many renewable energy projects are rendered uncompetitive not because of technical inadequacies but because they are forced to pay higher interest rates for loans from very conservative banks.

A Climate Bond might raise funds that could then be disbursed as low-interest loans to renewable energy providers. The issuer of the Bond would need to be regulated in the same way as other financial institutions, to ensure probity and transparency, as well as compliance with climate bond procedures and standards.

We know this can be done because private institutions already issue bonds designed to aggregate and standardize aspects of economic activity such as provision of infrastructure. The Australian institution Macquarie Bank Ltd devised such a scheme in the way that it aggregated infrastructure assets up to the point where they could be used to underpin the issuance of a new fund which would attract investments from private investors; this was done initially with toll-roads, and then with airports; and then with fast-growth forests, and so on. Exactly the same thinking and principles would inform the issuance of Climate Bonds.

Climate bonds for feed-in tariffs could be structured financially in any number of ways. The bond could be designed as an instrument that pays an annual interest (coupon) at a competitive rate – like the World Bank 'Green Bond 2009'. Or it could be a 'zero coupon' instrument that pays no annual return but at maturity guarantees the repayment of principal plus some agreed amount (such as an amount that is, say, 1% in excess of growth in underlying GDP in the country concerned – like the EIB zero-coupon bond issued through Dresdner Kleinwort in 2007). Such an arrangement (where any excess accumulated by the issuing institution is redistributed to the bond holders on maturity) would be designed with a view to making it attractive to institutional investors who are required by fiduciary obligations to seek out such guaranteed investments. If the issuer itself is a government that is undertaking to reduce carbon emissions and build renewable energy industries, then the cumulative positive outcome is reinforced – the issuer has every incentive to make the circumstances of the issue come true.

2.2.3 Adaptation: water bonds

Climate scientists tell us we are now locked into a significant level of warming, requiring large investment in adaptation to minimize damage, especially in developing countries. Investment to date has been limited, with especially low amounts of private finance and expertise attracted to adaptation.

One of the main anticipated impacts of climate change is a reduction in availability of water. Water supply infrastructure is a "no regrets" investment: even without climate change, much of the world faces water scarcity. Water use is currently very inefficient, but efficiency technology is expensive.

A potential solution would be a Global Water Facility financed by water bonds, developed with governments of beneficiary regions. This could provide a guaranteed feed-in tariff for water supplies, i.e. if a company provided a needed and sustainable water supply, the fund would guarantee a minimum price level for this water. The price could be proportional to regional water scarcity.

As water provision-enabled economies grow, beneficiaries' ability to pay will increase, and they could eventually pay for the water themselves. The tariff would then become redundant.

This could attract private investment into providing sustainable water. It would also indirectly increase food security if the water is targeted at food-growing areas.

2.3 Institutional architecture

2.3.1 Models for the roles of Government

Government's role as an enabler of financing has been under-appreciated in discussions about climate investment. It has many options available to unlock private sector funding for climate change mitigation and adaptation.

Large-scale energy projects can become eminently fundable with institutional capital if steps are taken to reduce the risk profiles of projects and reduce the costs of making projects happen.

Government can reduce the risks of financing, either by issuing or guaranteeing bonds directly, by signing purchase contracts that allow companies to issue corporate bonds, or by providing implicit guarantees by being a cornerstone shareholder in a large renewable energy generation project. It could strategically use public procurement to boost mitigation efforts (as the Carbon Trust in the UK has been doing with energy efficiency). And it could remove distortionary policies (such as hidden fossil fuel subsidies) that work against new projects.

Richer nations might be called on to fund, as per existing World Bank schemes, partial guarantees for developing-nation projects.

Government can also reduce the costs of transactions for projects, by streamlining approvals processes for large renewable energy projects and cutting red tape; or designing energy efficiency schemes that collect whole cities into financeable projects, and facilitating the collection of loan repayments through utility bills or municipal taxes.

2.3.2 Enabling institutions

"Climate" or "Green" Investment Banks

Government-linked financial institutions, such as Climate or Green banks, have a major role to play in providing required funding for projects from both internal and external resources, and possibly in originating renewable energy projects. Such a bank would be an intermediary to link project developers with investors, and with relevant government agencies. Green Banks could provide services by:

- Origination and Funding, such as structuring projects with government or bank guarantees, funding projects directly, or arranging funding from other banks.
- Capital Raising. This might involve raising capital from governments and investors (debt or equity), or taking deposits from retail customers.
- Working with government agencies to find ways to reduce transaction costs and risk profiles of needed projects.
- Industry mobilisation, in particular project packaging and development. For example, Rob Lake, from Holland's largest pension fund, APG, has commented that there is a lack of bundling of small projects for appropriate scale and for performance of due diligence requirements. A Climate Bank could take on this role.
- Negotiating government guarantees.
- Championing and facilitating renewable and clean tech investment.
- Providing advisory services for bond issuance.
- Cut red tape for large renewable energy projects.

National institutions along these lines have been proposed recently in the US and the UK.

They could also be multi-lateral Climate Banking institutions, perhaps through expanding the brief of existing institutions such as the European Investment Bank, the World Bank (through its Carbon Finance Unit, for example), or the Asian Development Bank.

Early stage project development entities

Project approaches canvassed in this paper will need fresh effort in the project development stages. We believe that there is currently a lack of appropriate project development vehicles working in the space between government and the private sector to unlock private investment for renewable energy and other climate change mitigation projects.

Sector-specific structural banks are not a new idea

France's Crédit Agricole is one of the oldest. Founded in 1860, had a primary remit to supply credit to the French agricultural industry.

The European Investment Bank (EIB) is another example. Created in 1958, it facilitates the integration, balanced development and economic and social cohesion of EU Member States. It is policy-driven based on the views of its Member State shareholders and raises substantial funds on the capital market, which it then uses to provide loans and other financial products to projects furthering EU policy objectives.

In Spain, the ICO (Instituto de Crédito Oficial) is a State-owned, and guaranteed, bank which delivers the Spanish Government's economic and financial policy objectives and reports to Spain's Ministry of Economy and Finance. The ICO accesses domestic and international capital markets and focuses its financing activity focuses on boosting Spain's key policy-driven sectors such as transport, renewable energy[1] and energy efficiency as well as encouraging technological innovation.

Finally, the KfW Bankengruppe in Germany is a state-owned bank and supports investment in a range of sectors including environmental protection, housing infrastructure (such as delivering the national energy efficiency scheme). It also securitises loans for small and medium-sized enterprises.

These structures would bring projects to a stage where they are more attractive for investment by institutional investors and the wider private sector. This need has already been recognised for projects occurring in developing countries. However there would be great value for such structures in developed countries where a large number of projects cannot see the light although there is no shortage of capital available.

The role of these companies would be to focus on early-stage project development, to bring forward projects to a point and structure them in such way that fund managers would be prepared to commit capital. In cases of large infrastructure projects these Project Development Companies may be working alongside governments in particular in developing countries.

These companies are likely to be most effective if they are managed and run by the private sector. The skills for a successful execution of the role are typically found in private sector companies. Given the level of risk these companies will have to bear, some levels of governmental financial backing seem necessary to allow them to work efficiently and reach a scale able to make a difference.

These Project Development Companies should be structured so that it provides adequate enough incentive to efficiently bring a large number of valid projects to a point where they can win development funding.

2.3.3 International standards and verification

While investors' primary requirement from Climate Bonds will be security of returns, they will also require confidence that their money is genuinely supporting low-carbon transition projects; they will want to be sure that the terms of asset-backed bonds are not interpreted by unscrupulous parties so that funding ends up going to projects of dubious mitigation value.

Standards will need to be put in place that guarantee investors' money will deliver real emissions savings.

An example would be with biofuels, where debt-raising for projects such as dryland tree crops for jet-fuel production may well be seen to be appropriate to from both investment and environmental perspectives, but where a small extension of a project into forested areas would have highly negative environmental and thus public relations consequences. Investors will want both secure returns *and* environmental verification; this will be doubly so with retail bonds.

This will depend on:

- International standards for defining low-carbon projects.
- Transparency and carbon disclosure.
- Auditing of projects to make sure they live up to their carbon impact promises.

Having a means of comparing the low-carbon benefit of investment opportunities around the world will also help deliver greater liquidity of investment.

Climate bonds will work best as a kind of pact between government and investors: they need agreements (standards) on what is really green for example, so that investors can securely report to members on the social benefit of what they are doing as well as their investment returns.

Standardised, streamlined contractual models that remove complexities, and a similar shift to standardised supervisory regimes, may also assist the development of a global market for climate bonds and the flow of funds from investor-rich to investment-needy areas.

Recognised Audit, Legal and Consulting firms (e.g. PWC, KPMG) would be licenced by an International Climate Bonds Authority to check that projects comply with regulator rules in terms of risk and income, and that the bank is lending in line with them.

A Climate Bond-funded asset would be required to get an annually renewable Certificate of Compliance as a "low-carbon" project during the life of the Bond. That means it complies with agreed standards on what is a low-carbon project.

Standard approaches for dealing with non-compliance around environmental matters would also be developed as part of the international architecture.

While this a potentially tortuous part of the proposal, lots of work is already being done on this matter by various industry associations (e.g. biofuels, renewable). That work would need to be knitted together, perhaps by a "Coalition of the Willing" that included at least one major government.

One of the comments being made in the financial press is that international climate change negotiations and discussions have generally not included the investment sector. Given the role the sector needs to play in both mitigation and adaptation, this is unfortunate, and has perhaps contributed to the resilience of cost paradigms rather than thinking in terms of opportunities and returns. Involving the investment sector in the development of standards will be essential to their utility, and could promote their more active engagement in climate change discussions in general.

3 Context

3.1 Mission

There is more than enough energy in the world to meet our needs; what is required is to rapidly convert the currently unsustainable use of energy into a sustainable one. That requires investment in new energy generation and in energy distribution, in both converting developed world systems and in setting up new systems for the developing world. Energy efficiency provides a money-saving route to dampening demand in developed economies until the shift to clean power can be made.

But even as we do all of the above, we will be faced with an overhang of carbon in the atmosphere; to return our climate to a "safe" level we need to sequester on a large scale. We have the means to do this through large-scale reforestation and through changing agricultural practices.

We also need to deal with the consequences of the damage we have *already* done to our atmosphere; these take time to affect the weather, but in coming years we will see sea levels further encroaching on low-lying coastal lands, destructive changes to monsoon and cyclone patterns, and increased desertification. Adaptation will be needed.

All of these measures will require capital. That requires initiatives to demonstrate and deliver the provision of a risk return profile that is attractive to institutional investors.

The Climate Bonds Initiative promotes models for making climate change mitigation and adaptation projects investable.

3.2 Urgency

The financial crash of the past year has raised awareness of the threat of systemic failure to both economies and societies. While governments take steps to re-stabilize financial systems, scientists warn us that climate change now presents an even greater systemic threat to the world.

The IPCC is the body charged by the world's governments with diagnosing the extent of the problem of greenhouse gas warming. Their 2007 report, based on research up to 2004, posited a wide range of possible outcomes from trajectories of greenhouse gas emissions, from an upper range of warming of 6-7˚C, with disastrous implications for the world's geographies and populations, to a middle range prediction of 1-2˚C warming, still requiring significant adaptation effort in the face of increased coastal flooding, the spread of deserts, etc.

Governments around the world have generally based their policy responses, at most, on the middle range predictions.

But scientists now warn that we are seeing the first signs of climatic feedback loops coming in to play, such as the increasing loss of summer ice in the Arctic and increasing leakage of methane and CO_2 from melting permafrost in the tundra. These are being seen earlier than the IPCC's most extreme projections. As a result IPCC Chair Rejendra Pachauri has warned that the world has to see a downturn in emissions by 2015, and a stabilization of CO2 in the atmosphere at no more than 350 part per million (it's now at 390) if we are to avoid run-away climate change.

However, climactic developments since 2007, in the view of a wide range of climate scientists, suggest that current trajectories of greenhouse gas warming are at the higher range of IPCC predictions. As well, there is now a greater understanding of the impact on climate systems of "feedback loops", whereby raised global temperatures trigger physical activity that exacerbates global warming, leading to the phenomena known as "run-away" climate change.

That's because climate change is non-linear; climate scientists tell us that we are reaching a series of climate tipping points, after which we quickly enter uncontrollable and dangerous climate change.

Rapid action allows controlled change

The IPCC tells us we have a choice about the sort of world we have. We can have 'controlled' climate change, and aim to keep temperatures within the "safe" range that has prevailed for thousands of years, or we can continue on our current road to un-controlled or 'run-away' climate change.

Controlled climate change means global warming of no more 2°C, a consequent sea level rise of up to 2 meters by 2100, and a move to the stabilization of CO2 at less than 350 ppm.

The other choice is run-away climate change:

- Rapid, non-linear change to a new, much hotter, climate regime (IPCC 2007).
- Large temperature increases (6-7°C).
- Sea level rises of 7m to a possible 25m.
- Desertification of several major ecosystems: tropical forests and major granaries via drought, upper ocean waters via acidification.
- Massive species loss.
- Submerging of the most populous coastal cities.
- Large loss of human life and enormous changes in the world's political and economic geography.

This occurs when stabilising influences on the climate (e.g. oceans absorbing CO2) are outweighed by de-stabilising effects, such as methane and CO2 releases from melting tundra).

We lose any chance to control changes if we go 2°C above pre-industrial global mean temperatures, i.e. 1.2°C above current. Some 'tipping-points' may occur before that point, some after.

To avoid crossing this tipping point we need average global per capita emissions of no more that 2t CO2e per person per annum by 2050. Current averages are 24t CO2e per person in the USA and 4t CO2e in China.

Controlled climate change may be within the adaptive capacity of modern societies. Run-away climate change is not.

Over the past 10 years climate change has been persistently worse than predicted. In 1997, catastrophic climate events looked like remote theoretical risks; today, they increasingly look like certainties.

And scientists now warn that we are seeing the first signs of climatic feedback loops coming in to play, such as the increasing loss of summer ice in the Arctic and increasing leakage of methane and CO_2 from melting permafrost in the tundra. These are being seen earlier than the IPCC's most extreme projections. As a result IPCC Chair Rejendra Pachauri has warned that the world has to see a downturn in emissions by 2015, and a stabilization of CO2 in the atmosphere at no more than 350 part per million (it's now at 390) if we are to avoid run-away climate change.

The G8 meeting in Italy in June 2009 agreed that the world needed to limit global warming to a maximum of 2˚C, specifically because of the dangers of run-away climate change beyond this point.

Limiting global warming to 2°C will require the rapid growth of low-carbon industries: energy efficiency to quickly reduce demand and buy us time; clean energy industries for power, heat & transport; and farming and forestry industries for terrestrial carbon sequestration. To achieve the necessary emission reductions, low-carbon industries will need to grow 25-30% p.a. globally, year-on-year[22].

The necessary technologies and resources exist, and growth rates for individual companies can be much higher, but a global average of 30% p.a. growth is a real-world upper limit for low-carbon industrial expansion. This will be a rate three times greater than the 19thC's industrial revolution.

3.3 A complementary path to Copenhagen

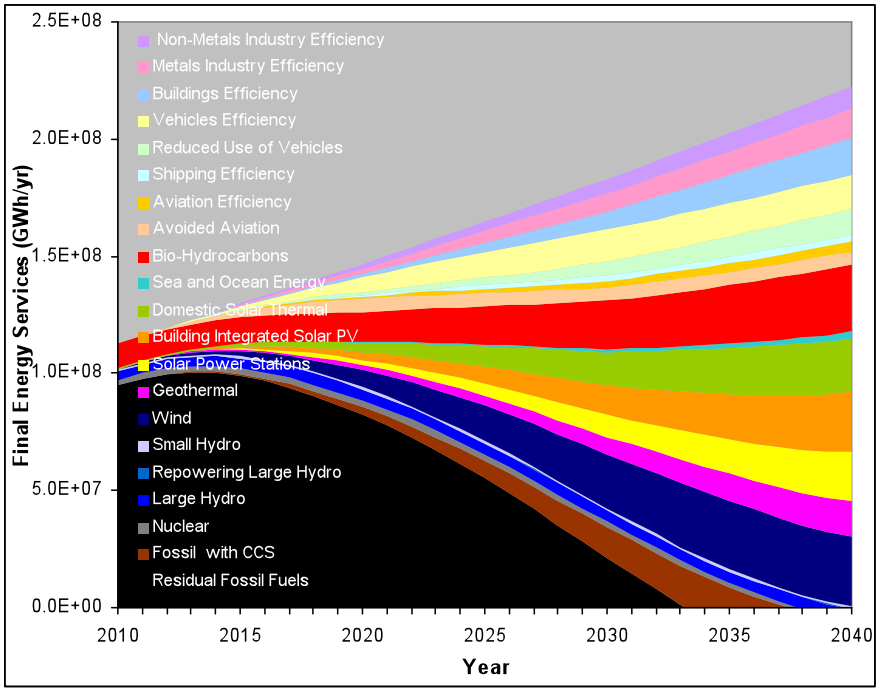
Most international effort — and hope — around addressing the problem of global warming has invested in the Kyoto Protocol and its proposed successor agreement, to be negotiated in Copenhagen in December 2009.

However, while global greenhouse emissions grew at a rate of 1.8% in the 1990s, in the past ten years of the Kyoto Protocol they have been growing at 3.1%. Over the past year, as a result of an oil price-spike and financial crash-induced contraction of economic activity, emissions growth has still been running at over 2%.

Worthy climate change mitigation efforts to date have patently not yet led to the global emissions change we need.

The argument has been that Kyoto was really a trial program, and now we a have the opportunity to design a robust agreement. There is some truth to this, but, in the light of the important but weakened nature of the USA's new Climate Change Bill, it is unlikely that an agreement at Copenhagen will deliver the emission cuts the IPCC and others say we need. A recent report on the impact of the US Bill from an EU investment analyst stated that the US Bill meant that the emission reduction cuts necessary to head of a global temperature rise of more than 2˚C was now not possible; they believe that investors should change focus from renewable energy companies to those that will be dealing with adaptation, such as environmental engineers. This is a grim prognosis.

As "Better Place" electric car company CEO, Shai Agassi, points out, pricing signals also do not necessarily lead to *rapid* change. He notes that in 2008 the world saw a massive experiment in pricing signals – the price of petroleum was increased to the equivalent of a carbon price of US$170 a tonne. Yet this had a relatively minor impact on energy generation, and, in the US, led to only a 0.1% change in driver behaviour. Agassi argues that a "paradigm shift" in thinking is required to achieve necessary changes in adequate time.



Fossil fuel energy generation can be displaced before 2050 if we engineer investibility so we can grow the low-carbon economy.

The graph above identifies the low-carbon industry segments that need to grow to avoid tipping points and models their individual contributions. The upward limit of average, global growth rates for the various industry segments is 30%; on that basis we have to see all (not just a few) low carbon industry segments growing at maximum rates by about 2014 to avoid 2 degrees. The sooner rapid growth starts the shallower the trajectory needs to be. The diagram is from the WWF Climate Solutions II report.

[22] Ibid.

3.4 The role of institutional capital

Largely absent from the table at international climate negotiations has been an appreciation of the role of capital, especially institutional capital, in addressing climate change.

Institutional capital has a lot to lose if the IPCC's gloomier scenarios are realized. The Stern Report posited economic contractions of up to 20% under selected emissions trajectories. Nicholas Stern has more recently been revising upward that estimate.

The scale of most institutional funds ties them to the general ups and downs of the global economy; avoiding the economic contractions involved in run-away climate change scenarios is of vital importance.

Conversely, if the global economy is to successfully make the transition to the low-carbon economy necessary to reduce emissions to a safe level, it will require massive investment in energy infrastructure, carbon sequestration and, to buy the world time as these changes are made, in energy efficiency. Luckily, all these investment requirements can de constructed as profitable investment opportunities. Energy efficiency investments, for example, generally have rapid payback periods at current energy prices; the high-capital and low running cost of renewable energy infrastructure makes it, in principle, attractive for long-term funding.

It seems likely that, as renewable energy costs drop and consumer markets become more focused on shifting to low-carbon options, financial markets would over time move to meet these investment needs. A real carbon price would push this along.

But, as the climate scientists tell us, time is very short. We have only a small window in which to rapidly grow the low-carbon economy to successfully head off run-away climate change; we have a climate emergency.

In these circumstances, the only way we will make progress at the speed required is if governments are able to work closely with investors and with industry to quickly scale up low-carbon economy initiatives. These initiatives need to encompass high volume renewable energy generation, associated energy infrastructure builds, large-scale energy efficiency measures and also infrastructure adaptation.

In principle, governments could simply tax and spend their way to addressing climate change. But one of the difficulties with climate change is that its negative impacts are likely to be felt in 10, 20 or even 50 years from now, yet the steps required to avert those impacts are immediate.

All governments have a political duty to explain to their citizenry the scale of the climate challenge before them; yet in our real world this is both a slow realization for governments to gain (with the exception of a very small number of jurisdictions around the world), and the process of educating national populations is anyway slow – in the absence of immediate threats. In a global war, raising the necessary funds is easier: you have to do something because there are people trying to shoot you; in a global climate crisis it's people on the other side of the planet in very poor countries, or 40 years in the future, that will be most directly affected. That makes climate change danger an abstract and thus secondary priority for most people.

We can achieve rapid industrial mobilization – we've done it before

There are numerous examples of such mobilisation of industry, financed by debt instruments and strong central planning efforts to direct investment.

As Lester Brown from the Earth Policy Institute has pointed out[1], whether in World War II mobilisation, the post-war Marshall Plan, the rebuilding of Eastern Europe after the fall of the Berlin Wall, or even China's current Highway Program, when the world chooses it's able to respond to urgent need.

All of these examples rely on a close working relationship between industry, finance providers, and government. This is what is needed now.

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[1] Brown, L. R., *Plan B 4.0: Mobilizing to Save Civilization* http://www.earth-policy.org/index.php?/books/pb4

3.5 Notable climate or green bond issues

3.5.1 World Bank Green Bonds in 2007, 2008 and 2009

The World Bank has successfully issued a number of green bonds over the past few years.

The first green bonds it issued were for smaller amounts targeted at retail investors.

In December 2007 the Bank issued Euro-denominated, six-year "Eco 3+ bonds" through ABN AMRO, targeted at retail investors in The Netherlands, Belgium and Luxembourg. The bonds pay a floating rate annual coupon of at least 3% per year. The coupon is linked to an equity index, the ABN AMRO Eco Price Return Index, made up of companies that produce alternative forms of energy, engage in water and waste management, or are involved in the production of catalysts used to reduce pollution.

In June and again in September 2008 the Bank launched five-year bonds linked to certified emission reductions ("CER"). Daiwa Securities Group managed the first and Mitsubishi UFJ Securities second. The total offering was $31.5 million. The bonds will pay a fixed rate coupon for an initial period and then a coupon linked to future CER market prices and the actual volume of CERs issued by a hydropower plant located in the Guizhou Province in China and a bio-energy project in Malaysia.

The first green bond designed for institutional investors was issued in November 2008. It involved SEK 2,700 million (roughly $350 million) issued through the Scandinavian bank SEB, with Credit Suisse and Landesbank Baden-Württemberg as co-managers, to be used to support projects in client countries that met criteria for low-carbon development; another SEK150 million was issued in February 2009. Interest payable

on the bond was 0.25% above current Swedish government bond rates, giving investors a yield of 3.15% p.a. Investors included Swedish National Pension Funds AP2 and AP3, Skandia Life and the United Nations Joint Staff Pension Fund.

A second, dollar-denominated, bond issue of US$300 million in April 2009, with a maturity of six years, was purchased by the State of California as a sign that California wanted to contribute tangibly to climate solutions. It had a floating rate.

A third bond issuance of US$130 million in early December 2009, co-managed by SEB and Credit Suisse, matures in December 2013 and pays a coupon of 2% per annum. It was followed quickly by another $50 million later in the month. Among the investors who purchased the latest bonds were the California State Teachers' Retirement System, the Swedish life insurance provider SEB Trygg Liv, and Swedish National Pension Funds AP2 and AP3.

Christina Kusoffsky Hillesöy, Head of Communication and Sustainable Investments at AP3 (Third Swedish National Pension Fund), commented: "For us as long-term investors, it is important to find responsible investments targeted at the global climate challenges. The green projects supported by the World Bank green bond are an important step in that direction".

3.5.2 European Investment Bank: Climate Awareness Bond 2007 and 2009

The European Investment Bank's (EIB) first 'Climate Awareness Bond' issue was in 2007, with a five-year zero-coupon bond for Euro 600 million, issued by through merchant bank Dresdner Kleinwort. The funds raised have been used in EIB renewable energy and energy efficiency projects.

In 2009 the EIB issued a second Climate Awareness Bond in Swedish Krona, targeted at EIB's Scandinavian investor base. The proceeds are being used for projects in the fields of renewable energy and energy efficiency. The lead manager was Swedbank.

The bonds issued in fixed and floating rate format for a total amount of SEK 2.25 billion, will mature on 17 February 2015. The SEK 1.7 billion fixed rate tranche will pay an annual coupon of 2.95%. The SEK 550 million floating rate tranche will pay a quarterly coupon of 3-month Stibor +10bps.

3.5.3 US Government Clean Renewable Energy Bonds

The US Treasury in its stimulus package of 2009 issued Green Bonds to a value of US$2.2 billion to generate financing for renewable energy initiatives. These are known as 'Clean Renewable Energy Bonds' function as low-interest loans to renewable project owners, providing them with an alternative to traditional sources of finance, many of which had dried up as a result of the recession.

The Bonds are similar to production tax credits awarded to renewable projects, and apply largely to the same projects. However, they differ in that they serve as a financing tool rather than providing post-implementation tax relief; they are intended to help get planned projects, such as wind or solar farms, into construction.

Under a scheme, the borrower, in this case a government agency or a utility, sells the bond to a lender, which then becomes the bondholder. In normal bond conditions, the issuer then has to pay interest to the bondholder. But with Clean Renewable Energy Bonds the Federal government picks up most of the tab, paying interest in the form of a tax credit to the bondholder.

3.5.4 'Build America Bonds'

In 2009 US Government introduced a program to encourage municipal bond raising as an economic stimulus. They "topped up" bond yields by 35%, leading to a boom in issuance, in many cases for local green energy projects.

3.5.5 Triodos Bank climate change bonds

In December 2009 green banking specialist Triodos launched a range of retail climate change bonds. The two, three- and five-year bonds offered interest rates of between 2 and 3.25 per cent.

3.6 Notable calls for green or climate bonds

3.6.1 UK Shadow Chancellor announces green bonds policy

The UK Conservatives are generally expected to win government early in 2010. Their Shadow Chancellor announced in November 2009 that, if they win government early in 2010, he will set up a Green Investment Bank to: "design frameworks that provide the certainty and incentives to attract private sector investment in green technologies". He also said that they will issue "green bonds, or some other type of securitised financial instrument". His stated aim is to help "decarbonise our economy".

3.6.2 Environment bonds proposal from UK's Climate Change Capital

Climate Change Capital has been advocating the issuance by the UK government of 'environment bonds' or 'green bonds' similar to those issued to fund the war effort during World War II. The bonds would offer

secure but modest returns, and be invested in renewable energy and low-carbon industrial initiatives (Cameron and Blood 2009; CCC 2009).

3.6.3 Canada: Green bonds proposals

In January 2009 an influential Canadian group, PowerUP Canada (backed by four former prime ministers) issued a call for a 'green' stimulus package of Can$41 billion, funded largely by the creation of 'green bonds' that would be floated by the government. The Green bonds would be modelled on existing Canada Savings Bonds and would pay a comparable rate of interest. A private funds management company in Canada, VCi Green Funds, has been developing the proposal, and has issued a Green Bonds public policy proposal document.[23]

3.6.4 UNFCC: Developing country carbon emission bonds

In numerous speeches Yvo de Boer, head of UNFCC, has proposed green bonds issued by developing countries where the investors would be from developed countries, and the pay-off would be carbon emissions saved (UNFCC 2008). The bond would work on the principle of securitization of future revenue streams.

These items of financial news and proposals carry a clear and distinct message, namely that the financial system is finally being harnessed as a player in this most demanding of challenges. They mirror discussion in the wider press and in papers issued by such bodies as the OECD.[24]

In this paper we generalize these scattered references to a new kind of financial entity and label the phenomenon as 'climate bonds', treating these as new species in the rapid evolution of financial forms.[25]

We outline the underlying rationale for climate bonds; their possible (and probable) mode of operation; means for their governance, particularly at an international level through a proposed International Climate Bonds Authority; and prospects for their being taken up in a serious and substantial way by institutional investors. As compared with the global bond market, where new issues amounted to $2.4 trillion in 2008 (and were even higher at $3.0 trillion in 2007), we envisage a situation where $0.5 trillion per year or more will be raised by climate bonds, in the period leading up to 2020, as a means of channelling finance and savings towards renewable energies and accelerating their uptake.

We anticipate that climate bonds will become one of the most important non-government debt securities to be found in the global financial system.[26]

[23] *Green Bonds: A Public Policy Proposal*; see www.greenbonds.ca

[24] See for example the Discussion paper *'What role for public finance in international climate change mitigation*', prepared under the auspices of the Round Table on Sustainable Development by Richard Doornbosch and Eric Knight (OECD 2009), especially the discussion of climate bonds in pars 71, 72 and 73; and the UNFCC report issued by the Office of the Secretariat, "Investment and Financial Flows to Address Climate Change' (UNFCC 2008); as well as calls for greater involvement by the financial system by Avato and Coony (2008); Spratt 2009; Ward et al (2009) and McKinsey & Co. (2009).

[25] Other terms used include 'green bonds', 'environment bonds' and, in a similar vein, 'development bonds' or in some specific instances, 'rainforest bonds'. We judge 'climate bonds' as being the optimal form of nomenclature for what promises to be a very broad category of financial instrument.

[26] The global bond market reached a level of $83 trillion in 2008, according to IFSL Research (International Financial Services London 2008). Climate bonds could be issued each year up to a level of $0.5 trillion for 20 years and still not exhaust the capacity of the global market.

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