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Table of Contents

Angelo A. Calvello, PhD	<i>Prolegomena to Any Future Investigation of Environmental Investing</i>	4-5
William R. Atwood	<i>The Need for Climate Risk Disclosure</i>	6-9
C. Shawn Bengtson, PhD, CFA	<i>Environmental Investing for Insurers</i>	10-11
Keith H. Black, CFA, CAIA	<i>Assessing and Accessing Investment Opportunities in the Face of Regulatory Uncertainty</i>	12-16
Alan Brown	<i>Environmental Investing Post-Copenhagen</i>	17-18
Massimiliano Castelli, PhD	<i>After Copenhagen: Have National Policies Become the Drivers of Green Investments?</i>	19-20
Christine Chan, PhD	<i>Water Is Not the New Oil</i>	21-23
Paul Clements-Hunt	<i>A Climate Optic on the Lost Moment</i>	24-26
David Ehrlich, PhD	<i>Beyond Copenhagen: How Governments Can Increase Investment</i>	27-32
Robert A. Jaeger, PhD	<i>“Environmental Investing”: Let’s Be Broad-Minded</i>	33-34
Dr. Thomas Kabisch	<i>Climate Change and Sustainability: How Investors Can Profit</i>	35-36
Couro Kane-Janus, PhD, and Shilpa Patel	<i>Moving Forward: The Aftermath of Copenhagen for Green Investment</i>	37-41
Abyd Karmali	<i>What Copenhagen Means for Investors</i>	42-44
Edward J. Kearns, PhD	<i>What Copenhagen Means for Environmental Investing Today</i>	45-46
Dr. Matthew Kiernan	<i>Après Copenhagen, le Déluge?</i>	47-49
Andrew Mitchell	<i>Future Investing in Living Carbon</i>	50-54

Rick Navarre	<i>“Full Steam Ahead”</i>	55-58
Will Oulton	<i>The Future of Investing in Environmental Markets</i>	59-62
Jayendran Rajamony, PhD, CFA	<i>Attracting Private Investors: Behavioral Biases and Profit Motivation Must Drive Policy</i>	63-65
Alex Rau, PhD, CFA	<i>The Meaning of Copenhagen: Liquidity Horizons and Physical vs. Synthetic Environmental Value</i>	66-69
Russell Read, PhD, CFA	<i>How Copenhagen Paved a Bright New Path for Sustainable Investing</i>	70-71
Jürgen Weiss, PhD	<i>What Does Copenhagen Mean for Investments in Low-Carbon Technologies?</i>	72-74
Christopher Woods, PhD	<i>The Multi-Decade Marathon: Reducing Greenhouse Gases</i>	75-77
James A. Yoder, PhD, Charles H. Greene, PhD, and Christopher M. Reddy, PhD	<i>Green Energy from the Blue Ocean</i>	78-81
Dimitri Zenghelis	<i>Copenhagen Discord: Bottom-Up Investing in a Global Landscape</i>	82-86



Prolegomena to Any Future Investigation of Environmental Investing

Angelo A. Calvello, PhD
Editor in Chief

Welcome to the inaugural issue of the *Journal of Environmental Investing (JEI)*. The goal of this issue is to present preliminary discussions of environmental investing that introduce the considerably lengthier and more complex works of peer-reviewed scholarship that will appear in future issues.

Our choice of topic and format are deliberate; our choice of contributors intentional. Rather than begin our history with scholarly essays on environmental investing, we instead introduce the *Journal* with 25 short thought pieces by gifted thinkers who are affiliated with one or more of the fundamental drivers of return and sources of risk of environmental investing: science, economics, policy, and technology.

Each contributor was asked to address the same question, “What does the Copenhagen Accord mean to environmental investing?” and each faced the same spatial and temporal constraints (although some heeded these constraints more than others). While the essays tend to share a common view on the meaning, outcome, and ramifications of Copenhagen, they clearly manifest their respective author’s own creativity, expertise, and passion.

This is representative, in a larger sense, of the dynamic and complex nature of the *JEI*’s scope of inquiry: environmental investing itself. Environmental investing is a new field of study and its boundaries are still being tested and defined. The essays in this issue demonstrate rather than delineate the broad range of topics that fall within this diverse and evolving investment category.

And this is precisely the *Journal*’s intention: to provide a forum for the structured and rigorous exchange of ideas and information between investors, researchers, policymakers, and other stakeholders interested in the search for real solutions for the sobering state of global environmental affairs. Such solutions, while acknowledged as necessary, will best be created by an interdisciplinary examination of the manifold topical and critical issues of creating, deploying, financing, structuring, and managing successful investment solutions.

So, on behalf of our Editorial and Advisory Board members, welcome to the *JEI* and to the beginning of the discourse. I hope you join us on this exploratory and impactful journey.

March 31, 2010



The Need for Climate Risk Disclosure

William R. Atwood

Executive Director, Illinois State Board of Investment

The scientific community has spent decades gathering and interpreting data regarding the nature and condition of Earth's climate. The output of much of this work is that the global climate has changed, and will change, in a manner inconsistent with past experiences. While climate projections, like most scientific prognostications, lack unanimity, it is apparent that the consequences of climate change for investors will be historic and profound.

Given the magnitude of potential upheaval associated with global climate change, corporate managers would be wise to consider its possible effects on their businesses and contemplate their business plans in the context of such risks. Further, as a result of recent guidance issued by the Securities and Exchange Commission (SEC), management is now legally obligated to determine the materiality of any threat posed by climate risk to the enterprise and to disclose that risk to investors. Prudence dictates such analysis; probity requires its disclosure.

Being publicly traded brings with it obligations on the part of corporations to report to shareholders and to the public material information. As the future of global climate has become increasingly unpredictable, the business risk to companies has increased accordingly. Now, the nature of that risk needs to be shared with investors, just as are other risks through the course of public filings. One simple example is that of the expansion of carbon taxes. As such taxes expand across the globe, companies reliant on carbon-based fuels will be at risk, while those that are able to utilize other technologies will have certain advantages.

The purpose of these disclosures is to ensure that the investing public has access to the necessary information for making responsible investment decisions. Clearly, such disclosure requirements can be onerous. However, no company is required to seek investment from the public, and can therefore choose to remain private and not be subjected to the multiple ministerial burdens that accompany access to the public markets.

While the potential for favorable returns inevitably attracts the attention of investors, events since 2007 have reminded market participants that risks abound and need to be considered. Among other things, the precipitous disruption of global markets over the last few years reminds us that risk is simultaneously dynamic and nebulous. Risk factors are constantly changing, and the greatest risks are those about which one is unaware. For instance, few analysts in 2005 understood and quantified the risks associated with imbedding a small tranche of high-interest, mortgage-backed debt in securitized investments—and fewer still foresaw that such investments might threaten the global economy. Further, few holders of investment-grade mortgage-backed securities were aware they held sub-prime mortgages within those instruments, much less understood the consequences of their potential failure.

Investors must be able to process not only the risks that were realized in the past, but also other risks that might materialize today or in the future. Companies regularly disclose to investors volumes of data about the company, including information related to the corporate balance sheet, revenue projections, executive compensation, ownership, and taxes. This information helps investors evaluate a company in the context of the global market and the investors' own portfolios.

Disclosures related to climate risk will provide investors one more information set with which to make decisions. As investors manage portfolios, prudence will dictate that they understand and manage those risks and opportunities, not only within specific holdings, but across investment portfolios. If information disclosing climate risk is not sufficiently disseminated by corporations or investment management companies, investors will be left to seek out such data independently. Unfortunately, few investors have the capacity for this type of original research, and the quality and accuracy of their data would be suspect. While outsourcing such work might be a viable option, it would be costly. Also, each investor would have access to different types of information that may or may not be consistent. The consequence would be a bifurcation in the marketplace between those with access to climate data and those without, and a reduction in the overall efficiency of the public markets. Practically, it is unlikely that accessible, reliable, and usable information could be organically generated by the investment community under current circumstances. Unfortunately, that does not detract from the utility of the data.

Through public companies' standardized disclosure of data related to climate risk, investors will be able to make more-informed decisions. Not only will those investors be better-positioned to make efficient decisions about specific companies, but they will also be able to monitor climate risk across their portfolios just as they currently do with conventional risk metrics.

While assumptions regarding global climate have historically held fairly constant—it is cold in the Arctic, it is hot in Ethiopia, there is x amount of fresh water in the world, and there is y amount of annual rainfall in Kansas, etc.—it is becoming increasingly likely that such assumptions will need to be revisited going forward. As those assumptions change, and the extent to which global climate change is realized, investors will require new data with which to calculate the future values of investment opportunities. This constantly evolving data would be invaluable to investors—both asset owners and managers. It would enable them to better fulfill their fiduciary duty by improving their ability to quantify and manage newly identified climate risks as well as properly evaluate and access new investment opportunities. Ultimately, this would result in being better able to manage portfolios, achieve investment objectives, and meet liabilities. Further, as the climate changes and acknowledgement of climate change becomes universal, the whole investment landscape will be altered, as those conventionally assumed constants become variable.

History is littered with the bodies of investors felled by a lack of adequate, usable information. The hazard was clearly evidenced by the effects on market participants by the recent and ongoing recession. Such ignorance, a lack of material information about investment opportunities, presents the greatest possible risk to investors, as well as to corporate managers. Such risk can only be managed and mitigated by information, and through the disclosure of information. That is the ultimate utility of climate risk disclosure: to provide investors with material, critical information about current and potential investments.

The investing community requires straightforward data to evaluate the potential effects of climate change on their investment portfolios. The source of analogous data has been public companies themselves, and so should be the source of these new, critical data sets now and in the future.

Biography

Bill Atwood has served as Executive Director of the Illinois State Board of Investment (ISBI) since March of 2003. ISBI is responsible for investing assets totaling over \$12 billion for the State Employees' Retirement System of Illinois, Judges' Retirement System of Illinois, and General Assembly Retirement System of Illinois. Since joining ISBI, Bill has managed the restructuring of its investment portfolio, established an emerging manager program, initiated the utilization of a general consultant, expanded the portfolio's exposure to alternative investments, increased the Board's shareholder activism, and made improvements to the State of Illinois' Deferred Compensation Plan.

Bill has professional experience in both the public and private sectors, including service on the staff of U.S. Senator Charles Percy and service in the administrations of Governor Jim Thompson and Governor Jim Edgar, both of Illinois. In 1994 he joined Investment Counselors Incorporated, an institutional money management firm located in St. Louis, Missouri, where Bill served as its Vice President for Business Development. At ICI he was responsible for marketing, client service, and all functions of the firm not directly related to portfolio management. Bill formed Midwest Managed Money Services in 1997 through which he provided consulting services to money management firms working in the public and Taft-Hartley pension plan arenas. He worked closely with equity, fixed income, and real estate investment companies and a variety of institutional plan sponsors.

In addition to his duties at ISBI, Bill has served as a Director of the Chicago Stock Exchange, is a regular speaker at professional symposia, and has completed the Masters of Liberal Arts program at the University of Chicago. He lives in Chicago with his wife, Reagen, daughter Ainsley, and son William.



Environmental Investing for Insurers

C. Shawn Bengtson, PhD, CFA

Senior Portfolio Manager, Woodmen of the World Life Insurance Society

Although the Copenhagen Summit fell short of a fully binding accord, the conference solidified resolve to reduce behaviors that increase global degeneration. Developing countries, including China, India, and Brazil, have “taken note” of climate change issues. China is committed to reducing its greenhouse gases by 40–45% of 2005 levels by 2020.

Timing of binding accords aside, increased catastrophic events and continued strain on fresh water supplies and ice melt, coupled with a strong need for job increases globally, have set the stage for renewed investment in infrastructure, green technologies, and innovation. The US government is funding infrastructure in a variety of locations: domestically at the municipal level through the Build America Bond (BAB) program, as well as in Haiti and Chile. In addition, developed countries are committed to paying for a portion of developing countries’ climate change initiatives through dedicated funding, largely flowing through the Copenhagen Green Climate Fund.

The BAB program is widely considered a relative value to bond investors; however, municipalities are often hard-pressed to specify whether the funding is for water/sewer improvement, governmental building refurbishment, roads, transportation, or environmental reclamation. Regardless of the infrastructure commitment, documentation is limited to financial ability to repay. No explicit commitment to rebuilding standards in preparation for climate change is communicated. If such commitments exist, bond holders are not currently able to access that information.

Private equity investment is actively sought for a number of technologies, including biomass-, solar-, and wind-generated electricity, as well as wood pellet production (as an alternative heating source). Corporate investments include continuing technological improvements in extracting “greener” fuel sources. Warren Buffett’s Berkshire portfolio, for example, includes a Chinese fuel cell producer and pipelines for carrying natural gas. Green investment opportunities abound.

Non-Conformity of Climate Change Investments

As climate change investments experience loss, position in the capital structure offers little or no protection for investors. Risk is inaccurately valued when construction commitments are unavailable. That being said, the reality is that asset class is currently driving risk premia, with bond investors receiving few operational covenants—even among privately placed bonds. Issuers are showing preference for publicly traded funding when private lenders try to obtain such covenants.

This risk compensation imbalance ultimately motivates reconsideration of traditional portfolio construction methodology. Unfortunately, losses may be sustained by an unwitting investor group before risk premia are recalibrated. Until risk compensation appropriately rewards investors, extraordinary investment risks (e.g. Haiti and Chile) will be funded largely through public sources: donations and global government commitments.

Insurers Manage Climate Change Risk

For over a decade, insurers have used climate change product solutions to better assist in personal and business risk management. Demand continues to increase for broad-based policies that better address the climate change risk set. As markets continue to digest manifestations of climate change, insurers will continue to lead with policy solutions.

However, insurers with longer-duration liabilities and geographically diverse risk exposure can use investments as viable ways to manage this risk. As a result, global insurers can, through asset-liability management, utilize their standard business practices to optimize profitability.

Biography

C. Shawn Bengtson, Ph.D., CFA, CIOP is a senior portfolio manager for Woodmen of the World Life Insurance Society's Investment Division. Shawn is committed to bridging actuarial, accounting and finance theory and practice, and publishes applications in these areas. Her focus is on integrating enterprise risk management into investment decision-making. She has been employed in the insurance industry for nearly 20 years, but also spends as much time as possible in the classroom. Shawn is actively working with several nonprofit organizations that have education and conservation included in their mission statements.



Assessing and Accessing Investment Opportunities in the Face of Regulatory Uncertainty

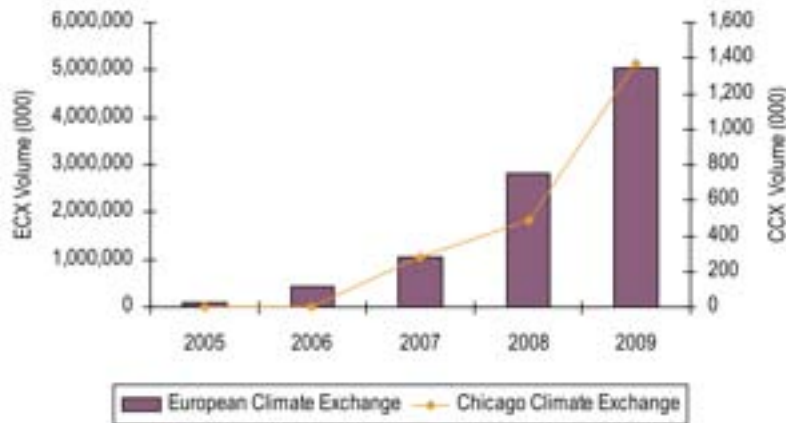
Keith H. Black, CFA, CAIA

Associate, Ennis, Knupp & Associates, Inc.

The world had high hopes for the Copenhagen Climate Change Conference, as many of the legal structures and initiatives set forth in the Kyoto Protocol will expire in 2012. These structures and initiatives gave rise to some market-based mechanisms for achieving the emission targets suggested in Kyoto—for example, emissions trading schemes (“cap-and-trade” systems) and the Clean Development Mechanism (CDM) arose directly out of Kyoto.

The European Climate Exchange is the most active cap-and-trade emissions trading system established after Kyoto. After commencing trading in 2005, exchange volume grew at a compounded annual growth rate of greater than 175%. European corporations exceeding emissions targets are required to purchase credits, while those who reduce emissions below their targets are allowed to sell credits. Pricing of emission credits has been volatile, as the balance of supply and demand has been uncertain. For a cap-and-trade system to be successful at reducing emissions, the number of available credits should decline over time and combine to an allowable emissions total at or below the target amount.

No such cap-and-trade system has been formally adopted in the United States (US). All trading on the Chicago Climate Exchange has been voluntary, with volume of less than 0.3% of European levels. Should the US ratify a cap-and-trade system, investment in emissions reductions projects are likely to grow as rapidly as those initiated by Europeans over the last five years?



Source: Chicago Climate Exchange

Development of Strategies

A number of other more traditional investment products have been developed to profit from trends in climate change. Public equity investors can invest in companies in industries such as low-carbon energy production; energy efficiency and management; and water, waste, and pollution control. Firms comprising 4% of the world's market capitalization earn greater than 10% of revenues from climate change-related activities (HSBC 2009). Venture capital investors can invest in firms working toward breakthroughs in clean technology, while private equity investors may participate in clean energy projects in emerging markets. The economics improve when the project is certified to earn credits from the United Nations Clean Development Mechanism. Hedge funds are offering investments in carbon futures trading and long-short equity funds designed to take advantage of the shifting fortunes of various climate change industries.

Some asset managers have committed substantial resources to the area of climate policy analysis. This focus comes from the realization that shifts in policy and the availability of governmental stimulus funds can make or break investment projects. After Kyoto, the European market had a stable regulatory regime, which led to a substantial increase in investment activity and carbon futures trading.

In the US, however, regulatory certainty has not yet arrived. The emissions cap-and-trade scheme narrowly passed by the US House of Representatives in 2009 is currently stalled in the Senate. Passage of this bill, or similar legislation, would mandate carbon trading nationwide as well as serve to officially adopt the post-Copenhagen US target for a 17% decline in greenhouse gas (GHG) emissions by 2020. Rather than waiting for a single bill to pass that outlines a comprehensive climate solution for the US, Congress might make more progress by passing more targeted bills that focus on specific issues such as approving the proposed reduction in US emissions. Revenues from a cap-and-trade

system could be used to fund the US commitment to providing subsidies for emission-reducing projects in developing countries.

For now, climate change projects in the US are largely in a holding pattern, as Copenhagen did not remove the substantial uncertainty in the investment environment. Due to this uncertainty, carbon futures trading and installations of climate change projects in the US have been experiencing slower growth. These sectors, however, continue to attract significant investments in Europe and emerging markets. Without a nationwide climate policy in the US, investments to date have been driven by corporate initiatives or localized solutions, such as the Regional Greenhouse Gas Initiative where ten northeastern states and three Canadian provinces have built a regional cap-and-trade framework. Corporations are investing in projects that seem profitable given today's environment, with the hope of additional profits when regulations change as anticipated.

Collaboration is Key

In spite of this uncertainty, institutional investors continue to investigate the investment risks and opportunities associated with climate change. The scope of the challenge requires a collaborative response—from asset owners, asset managers, and asset consultants. At EnnisKnupp, we address this challenge by creating a cross-functional research team, which includes analysts covering private equity, real estate, public equity, and hedge fund strategies. This research team provides education and advice on the climate change investment landscape to field consultants and clients. The objective of this internal collaboration is to leverage resources and ultimately help clients develop a comprehensive understanding of climate-related investment risks and opportunities.

For example, say the private equity team is performing due diligence on a venture capital manager who has an explicit focus on clean tech. In the course of their research, the manager reveals that her investment thesis is founded upon a significant development in a regional cap-and-trade initiative that positively impact her investment decisions. The collaborative structure encourages and rewards the sharing of this information, potentially helping the hedge fund research team vet long/short equity managers and carbon managers and benefiting the real estate team in its assessment of the risks and opportunities associated with developers in the identified region. Working together allows the teams to leverage their collective knowledge, make more informed decisions, and ultimately better serve clients.

Investments in the US real estate sector are growing following the adoption of a set of standards—the Leadership in Energy and Environmental Design (LEED) Green Building Rating System. The growth in the real estate sector shows the potential for investment growth in the US once regulatory certainty, or at least a consistent standard of evaluating projects, is achieved.

For investors looking to profit from climate change investments, regulatory uncertainty makes it difficult to allocate funds to projects that might be unnecessary or uneconomic in a future regulatory regime. For energy companies and utilities, especially, projects might continue to be delayed until emissions reductions are required by law, further increasing the likelihood of additional GHG emissions. Understandably, investment dollars have been attracted to the regions with the greatest regulatory certainty. Until US industry sees the stability of the regulatory climate that Europeans enjoy, the US will continue to struggle to reach significant adoption of investment projects designed to slow climate change. But it is critical that asset owners and their consultants rigorously monitor and prepare for this expected clarity in policy and the possible investment risks and opportunities that will certainly follow.

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Biography

Keith Black leads consulting relationships for a select number of Ennis, Knupp & Associates, Inc., retainer and project clients. Keith is also a senior member of the firm's opportunistic strategies investment management research group.

Keith's notable activities include:

- Presented research on hedge funds and commodity investments at the EnnisKnupp client conference
- Serving on the retained speakers' bureau of the CFA Institute, where he presents on alternative investment topics, including hedge funds, infrastructure and 130-30
- Working with Ennis, Knupp clients on education and manager selection in the opportunistic strategies space
- Visiting and evaluating hedge fund managers including long-short equity, global macro, multi-strategy, event driven, commodities, managed futures, and fund of funds

Prior to joining EnnisKnupp in 2007, Keith taught at the Illinois Institute of Technology as an Assistant Professor and Senior Lecturer for the past eight years on several subjects, including investments, equity valuation, portfolio management, mutual funds, economics, hedge funds, global investment strategy, finance, and enterprise formation (venture capital). He has also authored a book entitled, "Managing a Hedge Fund: A Complete

Guide to Trading, Business Strategies, Risk Management and Regulations,” that was published by McGraw Hill in 2004, and has written several published research articles on issues facing hedge funds.

Keith holds a B.A. degree from Whittier College in mathematics/computer science and economics, and an M.B.A. degree from Carnegie Mellon. He is a CFA charterholder and also holds the Chartered Alternative Investment Analyst designation.



Environmental Investing Post-Copenhagen

Alan Brown

Group Chief Investment Officer, Schroders

If we ever needed reminding, Copenhagen certainly calls attention to the fact that the road to dealing with climate change will be far from smooth. Believers in climate change will judge the responses of governments to fall far short of what is required, while the hue and cry over the Intergovernmental Panel on Climate Change report and the University of East Anglia “Climategate” serve to remind us that there remains a strong sceptic camp, in spite of the overwhelming weight of evidence. The price performance of European carbon credits at around €13, down from €30 last summer, also highlights that carbon trading has yet to provide the desired incentives to curb consumption and invest in alternatives. With first-round quotas overly generous, and the recession naturally cutting demand, carbon prices have yet to make a real impact.

All of this could lead one to believe that climate change as an investment theme may have passed its “sell by” date. We believe that that would be a major mistake. The tipping point in public and political opinion has not been reversed—and, in our opinion, is unlikely to be.

We believe we are just at the start of what will prove to be a period of major growth in expenditure associated with mitigating or adapting to climate change. It has gone broadly unnoticed that a major achievement at Copenhagen was wresting climate change as an issue out of the hands of environment ministries, which was the status quo under the Kyoto Protocol. Governments around the world now realize that the challenge is one of industrial policy, requiring significant investment, and, as a result, must be well-coordinated by central economic and industrial departments. This bodes well for improved effectiveness of public policy in the future.

This is even more important as the main engines of economic growth post-World War II—expansion of global credit in general and of the American consumer in particular—are unlikely to come back any time soon. If we look for reasonably stable, non-cyclical sources of growth for the decades ahead, it is to emerging markets and themes like climate change that we turn. As an investor, it is clearly preferable to position oneself in the fast-flowing part of the river, and growth in climate change-related expenditure still appears to be one of the most reliable and long-term predictable changes in demand out there.

What then is the best way to play this investment theme? We believe that there are two guiding principles that need to be taken into account. First, along with the news flow,

environmental investing is likely to move in and out of fashion, with a high probability that some narrow sectors will reach excessive, unjustified valuation levels from time to time. Secondly, when we start to think seriously about the breadth of investment opportunities covered by efforts to mitigate and adapt, we should rapidly recognize that the field is incredibly broad. This is not just a story about alternative energy, wind farms, and solar panels. Almost every major area of economic activity (albeit perhaps not diversified financials and pharmaceuticals) will have its winners and losers: building materials/insulation, water in all its dimensions, drought-resistant seeds, agricultural equipment, videoconferencing and providers of bandwidth, nuclear energy and its suppliers...the list goes on. In a period of tight consumer and public spending however, it will be important to remain focused on the technologies that provide solutions in an affordable way, as it will be these industries that are allocated financial, regulatory, and public support.

The messages are simple: investors should cast their nets widely in the search for companies that will have a significant part of their revenues and profits linked to rapidly growing climate change expenditure; moreover, given the breadth of the opportunity set, there is no need to get stuck in over-heated, glamour sectors.

In these particularly uncertain times, environmental investing may, in fact, be more reliable, predictable, and rewarding than most other avenues. This is the first truly predictable industrial revolution. It would be nothing short of a crime to miss it!

Biography

Alan Brown is Group Chief Investment Officer and a Director of Schroders. Alan joined Schroders in 2005 with over 30 years of experience in the Industry

Previously he was Group Chief Investment Officer, Vice Chairman of SSgA and Executive Vice President of State Street. Alan started his career in 1974 with Morgan Grenfell.

He is a Member of the Group Management Committee. Externally he is Chairman and Treasurer of the CERGE-EI US Foundation (Centre for Economic Research and Graduate Education – Economics Institute), Chairman of the CFA Advisory Council for Market Integrity and a Member of the MSCI Barra Editorial Advisory Board, Trustee of the Carbon Disclosure Project, a member of the Board of the IMA (Investment Management Association) and a non-executive director of Pool Reinsurance Company

Alan has an MA degree in Natural Sciences from Cambridge University.



After Copenhagen: Have National Policies Become the Drivers of Green Investments?

Massimiliano Castelli, PhD
Executive Director, UBS AG

The recent resignation of Yvo de Boer, the top United Nations climate change official, was probably the clearest sign of the Copenhagen Summit's failure to produce a binding agreement to curb global greenhouse gas emissions. The big political uncertainty following the summit was further increased by the US administration's apparent drawback in the pricing of carbon dioxide (CO₂)—a necessary political advance for private investors to consider committing the investment needed in clean technology. The decision by some big energy corporations like BP, ConocoPhillips, and Caterpillar to quit the US Climate Action Partnership is an additional sign of the private sector's current unwillingness to engage further on the issue.

From an investment perspective, the ambiguity over the climate change policy agenda after Copenhagen is generally viewed as damaging, since investors want policies which are as unambiguous as possible, consistent across jurisdictions, long-term, and enforceable in order to have enough confidence to commit capital (Calvello 2009, p. 154).

Despite the general disappointment (which should be viewed within the context of the sky-high expectations attached to the Summit), there were some positive developments. First of all, the scientific community has become much clearer about the action required: defossilize the global economy over the next 40 years. The achievement of this goal has been basically accepted by the US administration as well—and just a few years ago this would have been simply unthinkable given the political atmosphere. These developments have allowed the magnitude of the investment required over the next few decades to be clarified. According to estimates by the International Energy Agency, investment in clean technologies should double by 2015.

Secondly, the failure of the Danish Summit has thrown the focus on national policies, particularly those of the emerging superpowers. The industrialized countries currently facing the fallout from the global recession are being “caught” in economic terms by a new set of superpowers, especially China, India, and Brazil, where the impact of the global recession has been much milder and capital for green tech investment is large, thanks to low debt levels and high reserves. China already made clear its intention to dominate the clean tech industry in the medium term and, along with other Asian emerging economies, is investing heavily in green projects. According to the UN

Framework Convention on Climate Change, of the 1,890 projects for generating credits under the Clean Development Mechanism, more than 70% are in Asia, and most are in China. China is already the biggest producer of solar energy and now aims to be the biggest producer of wind energy by 2012.

In line with this strategy, in November 2009, China Investment Corporation, the state-controlled sovereign wealth fund, spent \$2.2 billion of public funds to buy 15% of shares of AES Corporation, the US power company controlling 35% of the wind power business. In another example of the current appetite among emerging markets for clean tech technology in the wind arena, London Array, a large offshore wind farm, was able to replace Royal Dutch Shell with Masdar, an Abu Dhabi clean energy company, in its search for funding.

The failure of Copenhagen shows that what will happen in the private sector depends on national policies rather than diplomatic negotiations. So the key questions become: “Will the US administration, soon as the economic recovery is firmly established, finally accelerate the pricing of CO₂ as promised by President Obama? And are European Union countries politically ready to convince their citizens to pay more for green energy, or will they continue cutting subsidies to renewable energy as recently announced by Germany? The summit in Mexico, due by the end of 2010, could provide a new impetus, but ultimately the key policy drivers for private investors remain in the hands of the national governments.

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Biography

Massimiliano Castelli holds a PhD in Economic Policy and an MSc in Economics from the University of London. He has several years of experience in analysing economic and financial developments in Emerging Markets. Until 1997, he was a Lecturer in Public Finance at the Department of Economics, University of Rome, Italy. In 1997, he left academia and became a professional economist and worked as an international consultant on several assignments in Emerging Markets and developed countries. His main areas of expertise include macroeconomics, political economy and capital markets. He is currently an Executive Director at UBS AG in Zurich.



Water Is Not the New Oil

Christine Chan, PhD

Founder, Chan EC

Water is a prerequisite for human life and healthy ecosystems, as well as a necessary processing ingredient in most of the goods and services contributing to global GDP—from food and clothing to technology and energy. Oil currently plays a critical role in the economy, but mankind can survive without it, as it has in the past, and as it will in the future when oil reserves are depleted. Nothing, however, can replace water: it is the fundamental frequency with which all human endeavor resonates. Although water scarcity has led to regional tensions and national security concerns, its comparison to dwindling oil is short-sighted. The complexities surrounding water are enormous, encompassing policy, local and global politics, commerce, corruption, international law, human rights, poverty, health, demographics, ecosystem services, biodiversity, geography, geomorphology, and climate. To compare water to oil is to recognize neither the depth of these complexities nor the danger of mismanaging or underestimating them. Why, then, has investment in this sector lagged behind others of lesser import, despite all the attention paid to it by governments, multilateral institutions, and non-governmental organizations?

Surely it is not for lack of evidence of financing opportunities. These can be broadly imagined by naming the risk factors: of the 2.5% of the Earth's water that is fresh, 30% is groundwater and less than 0.4% comes from lakes, wetlands, and rivers—these four sources account for most of today's withdrawal but just 0.9% of the planet's water. Moreover, available supply has diminished due to unsustainable withdrawals and contamination. Meanwhile, global population has doubled in the past 50 years while GDP has grown by an order of magnitude. Wastage is problematic: it has been estimated that at least 20% of available water in the EU is wasted, mainly from inefficient agriculture and urban infrastructure leakage (European Commission, 2007). Furthermore, inconsistent pricing policies, subsidies, and lack of a framework for valuing environmental services at domestic and international levels complicate the need to incentivize investment. The greatest unknown in this already unwieldy equation is the pace of climate change, which will likely bring about variation in the hydrologic cycle not seen in the past 100 years—about the timeframe of reliable data collection. Testing procedures for climate models incorporate past physical data for conditions that may be quite different from those to come, making it more difficult to narrow the gap between best- and worst-case scenarios.

Thus the risks inherent in water sector investment are inarguably diverse. However, not only are the opportunities real, but the global and sectoral sweep of our water challenge impels investors to address these opportunities for reasons of both social stability and business risk. Policy, of course, is one filter that adjusts the panorama of investment risk. Yet governments alone cannot provide the necessary focus, innovation, and market mechanisms needed. Investors should be partners in public/private innovation centers similar to those found in Singapore and Israel, both strong economies with technical workforces and urgent water needs. Outside this arena, given the right decision-making tools, investor involvement includes roles as equity holders and lenders. Before committing funds, investors need country-specific, fact-based cost curves describing market solutions for broad categories of demand, including agriculture, industry, and municipalities.

The 2030 Water Resources Group makes an important contribution toward this end by calculating payback curves for a spectrum of options for India, China, South Africa, and the state of Sao Paulo—together projected to account for 42% of global water demand by 2030. For India, a cost-effective strategy for filling the projected gap between available supply and demand would focus on improving agricultural water use efficiency (“crop per drop”) via micro-irrigation methods, improved drainage, optimized fertilizer usage, integrated pest management, no-till farming, and seed development. The market for micro-irrigation systems, for example, is valued at \$400 million and grew 15% annually from 1999 to 2006. The value in adopting such systems includes reduced water consumption and salt intrusion into ground aquifers, reduced fertilizer requirements, and increased yields. Investor participation might include equity holdings in companies along the micro-irrigation value chain (including installation and maintenance). Another entry point would be as micro-financiers, as drip technology has a capital cost of \$1,000 per hectare—beyond the reach of smaller farms, yet has a payback period of just one year. In China, industrial and urban water demands are growing faster than agricultural demand. A cost-effective strategy would include water-saving regulatory reforms (with annual net savings of \$22 billion), and efficiency measures coming from the thermal power, wastewater, paper, textile, and steel industries (with annual net savings of \$24 billion) (2030 Water Resources Group, 2009). Industrial efficiency measures also play an important role in Sao Paulo and South Africa.

Clearly, the implications of our water challenge underline the need for investors to fluently speak the language of environmental risk. Companies using water for their operations or supply chains will be increasingly at odds with municipalities or rural communities who need it for health and survival. Moreover, because water connects our social, economic, and environmental ambitions, the imperative is on developing sustainable solutions that decrease waste, increase efficiency and information flow, and achieve improvement in one water management area without detrimental effects in another. More studies of the type previously mentioned are needed, with an expanded analysis of the effect of climate variability on costs, and further consideration of the US,

Europe, and Japan, where water scarcity issues are well-documented and critical. Water is not the new oil, but the original source of production, with nothing able to take its place. The grave challenges it presents for our future must be met with inspiration. Our best stewardship is required, with investors at the vanguard.

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Biography

Dr. Chan is the founder of Chan EC, an environmental consulting practice that helps develop sustainable strategies for responsible companies. Her research and interests include the role of sustainability in creating new markets and the effects of global climate change on corporate growth and competition strategies. A former NASA Global Change Fellow, she holds a PhD in Oceanography and an MBA with a concentration in corporate strategy. She serves on the advisory board of the US Pan-Asian American Chamber of Commerce, as well as on the editorial board of the *Journal of Environmental Investing*.



A Climate Optic on the Lost Moment

Paul Clements-Hunt

Head of the United Nations Environment Programme Finance Initiative

Very few know. Only a handful of people possess the negotiating experience and understanding of the Byzantine United Nations climate change process to have captured the moment. But, in Copenhagen, the moment did present itself when the Chair's gavel could have come down on a stronger agreement.

Reflecting some weeks after the chaotic conclusion of the Danish summit, a seasoned diplomat who has spent more than 20 years at the heart of the multilateral climate change process explained, "There were flags still raised in the room in Kyoto in '97 when the gavel came down. We could have had a stronger agreement in Copenhagen there's no doubt in my mind about that but the moment—that crucial second—was missed."

Were the political "bears" and backroom dealers like John Prescott and Raul Estrada-Oyela missing in Copenhagen when they'd made the difference in Kyoto 12 years before?

For the finance and investment community, COP 15 careened from hopeful, to Monty Python-esque, and then on to despair. Despite more than two years of increasingly coordinated efforts to present the views of private finance and investment from, amongst others, groups such as the Institutional Investors Group on Climate Change, the Investor Network on Climate Change, and the United Nations Environment Programme Finance Initiative, the negotiators were in no mood to listen to private finance or the array of capital market actors gathered along with the other 30,000-40,000 international visitors in the Danish capital.

One of the most senior negotiators for the EU captured an intractable issue at the heart of negotiation as early as the evening of December 10, "Any effort to introduce private finance or even point to capital market mechanisms is seen by a significant group of developing countries as a coordinated effort to roll back overseas development assistance. Also, the developing countries have very little faith left in western financial institutions and capital markets after the crash. It's as simple as that and you won't see any reference to private finance in any communication from Copenhagen."

As the smoke cleared after the political and media frenzy of those caffeine- and adrenalin-filled wintry days in Scandinavia, it is becoming apparent to those in finance and investment prepared to retool for more infighting in the multilateral trenches in Mexico later this year and in South Africa in 2011, that all is not lost.

Clearly, many fundamental policy questions remain, but in the investment space there is a feeling abroad that a line in the sand has been crossed for carbon. The smartest investors understand a carbon-constrained future will be part of investment reality and are positioning for that despite the crucifying nature of 2007-2008, the uncertain rebound of 2009, and the crushingly difficult fundraising environment of the past few years. Also, President Obama did return from Copenhagen with something never before achieved: the BRICs all sat down together at the “emissions reduction table.” Together with the political momentum behind him following successful passage of the US healthcare bill, there is now a steady flicker in the embers of a meaningful US climate bill. Maybe, just maybe, the missed moment in Copenhagen won’t be such a lost moment after all.

Biography

Paul Clements-Hunt has been the Head of the United Nations Environment Programme Finance Initiative (UNEP FI) since November 2000. UNEP FI, based in Geneva, is the largest partnership between the United Nations and the financial services sector, counting more than 180 banks, insurance companies and investment firms as members. UNEP FI was instrumental in the 2004-06 development and launch of the UN Principles for Responsible Investment (PRI). The PRI is now backed by over 570 institutional investors representing more than USD 18 trillion in assets under management. Clements-Hunt was one of the two lead United Nations representatives throughout the PRI negotiations in 2005-06 and sits as the UNEP representative on the PRI Board.

In 2007, he was invited to join the Financial Times Sustainability Banking Awards panel of judges and the United Nations special climate change panel on finance and investment. Clements-Hunt is a Board Member of Sustainable Finance Geneva, a network of professional finance executives committed to pushing forward sustainability practice in the Swiss financial services sector.

Prior to joining the United Nations, Clements-Hunt spent 1998-2000 representing the Paris-based International Chamber of Commerce, directing the organization’s policy work in energy, environment and sustainable development. From 1991 to 1998, Clements-Hunt was based in Bangkok, Thailand, where he founded the country’s first environmental strategy consultancy which developed projects throughout Southeast Asia. In 1994, he took the idea for an Asia-Pacific-wide environmental strategy service to the world’s largest testing, inspection, and certification company, Société Générale de

Surveillance (SGS). He developed the business for the SGS Group as the SGS-Environmental Information Unit.

For over 17 years, Clements-Hunt has presented and lectured internationally on sustainable finance and responsible investment issues. Clements-Hunt graduated with a BA degree in Economics from the University of East Anglia, and completed post-graduate studies in journalism at University College, Cardiff.



Beyond Copenhagen: How Governments Can Increase Investment

David Ehrlich, PhD

Visiting Assistant Professor, DePaul University School of Public Service

International commitments will be helpful when nations and voters are ready, but there are many other ways to reduce greenhouse gas (GHG) emissions. Obviously, voters and leaders are not ready to make binding reduction commitments, particularly when spending is involved. But nations are feeling political pressure internally and externally; for the first time, China and India have signed the same agreement as the US and have publicly stated emissions goals. Until voters pressure leaders for larger commitments, the good news is that sharp emissions reductions can be achieved without binding international agreements.

Fortunately, several factors work in our favor:

- National, state, local, private, and nonprofit policies can help reduce emissions with or without international treaties, often with no new spending.
- Emissions can be reduced sharply through off-the-shelf methods and money-saving efficiency investments alone.
- Technology growth will eventually help reduce emissions dramatically, but the speed and deployment of technology will depend largely on private investment.
- The speed and scope of private investment will depend largely on government policies that facilitate property rights, markets, and incentives.

I want to focus on the last, least-obvious point above: what can governments do at low or no cost? Fortunately, from a policy perspective, it is much easier to convince people to act in their own self-interest and to save money than to ask people to spend money to help younger, foreign, or unborn generations. The challenge is to quickly convince governments to broaden the scope of working policies already in place; quickly adopt policies proven elsewhere; and to experiment with new, redundant, and hybrid environmental policy approaches that encourage both public and private investment. A range of environmental policies should be in place and tested as quickly as possible by states and municipalities, to lead the way for national and global efforts.

Successful approaches are many and diverse: creating markets through carbon pricing and selective cross-subsidized incentivesⁱ; reducing transaction costs such as environmental information asymmetries between buyers and sellers of polluting buildings, products, and services; requiring new buildings to meet emissions standards; and facilitating the long-term financing of GHG-reducing projects. Many other environmental policy approaches have proven successful, and many are being tested by governments at every level.

The range of environmental policies must extend beyond markets alone to include incentives and mandates. One example where such hybrid and redundant approaches will be frequently needed to encourage environmental investing is in the area of avoided deforestation. Deforestation causes 15–20% of world GHG emissions and is much more feasibly addressed with international cooperation. Avoided deforestation and reforestation efforts are unlikely to succeed on a global scale without national planning and enforcement, international satellite and other monitoring, and funding from industrialized nations. Copenhagen deforestation efforts within the United Nations Framework Convention on Climate Change Reducing Emissions from Deforestation and Forest Degradation (UNFCCC REDD) did not result in firm commitments, but negotiations are continuing. High wood values suggest that the market price of emission offsets for environmental services to avoid deforestation may not be enough, in many areas, to deter logging without both national and community efforts and, in some cases, outright bans. A more viable and affordable mechanism than market forces alone may be for the industrialized nations to fund national and regional government enforcement efforts, including improved measuring, reporting, and verification (MRV) alongside carbon markets, national mandates, and a variety of local community policies.

Post-Copenhagen international talks should first focus on the self-interested benefits that individuals, organizations, companies, investors, and governments can achieve by investing in efficiency. These are steps that, from a long-term investment perspective, will clearly pay huge dividends even at current energy prices. While energy efficiency investments may not always offer the highest short-term returns, they do offer very predictable and very low-risk long-term returns that, with or without governments' help to appropriately create and facilitate markets, could be very appealing investments for pension funds or other fixed income investors. These investments could be set up as local government efficiency bonds, utility-issued efficiency bonds, national investment vehicles, or other types of loan pools or securities.

ⁱ A cross-subsidy here refers to a dedicated Pigouvian tax, intended to internalize environmental externalities—the social costs of pollution. A dedicated cross-subsidy would likely attract more political support if required to be used only for environmental investment, adaptation, or remediation. Some politicians would likely want to use Pigouvian taxes to reduce other taxes, but doing so might reduce public support for a more limited and direct cross-subsidy.

If peak oil and growing demand cause oil prices to rise in the future, as many experts predict, GHG-reducing investments today will not only dramatically reduce emissions, but will pay even greater dividends in the future. Detailed climate change-oriented discussions of discount rates for spending to 2100 typically discuss climate change costs in terms of spending, not the benefits of 90 years of compound interest gained from efficiency savings.ⁱⁱ Broader analyses that estimate environmental risks, economic risks, the inherent uncertainty of estimates, the insurance value of efficiency investments, and appropriate estimates of the costs of business as usual seem more likely to assist in framing the debate over appropriate environmental investment policy.ⁱⁱⁱ

Until nations and voters are ready to make binding international commitments to reduce emissions, governments can still take action to increase environmental investments using property rights, developing cap-and-trade markets, creating consumer markets enabled by uniform green labeling, encouraging efficiency investments, and enacting mandates to increase environmental investment to preserve forests. These policy actions need not be expensive to taxpayers directly or indirectly. Whether or not international negotiations yield more significant results soon, the United Nations Framework Convention on Climate Change (UNFCCC) and affiliated UN organizations might choose to help governments by seeking to objectively research model governmental policies and to measure program and policy success. When a government wants to take action, these model statutes, good practices, program evaluations, and benchmarks would be a good first source as they research potential policy changes.

At the national level, solar energy will increasingly reach grid parity over the next several years in many regions. Electric cars will also likely reach price comparability in the next decade. Governments can encourage most of these investments through tax subsidies and higher fuel-mileage requirements. The US Congress can also increase these investments

ⁱⁱ Certain popular academic approaches assume just the opposite: that meeting emissions reductions targets will require GDP reductions from spending by governments and private firms. See the global carbon abatement cost curve developed by McKinsey & Co. and the Vattenfall Institute of Economic Research in: "The Carbon Productivity Challenge: Curbing Climate Change and Sustaining Economic Growth," The McKinsey Global Institute, June 2008, pp. 15–16. Available from: http://www.mckinsey.com/mgi/publications/Carbon_Productivity/index.asp. Accessed March 20, 2010. The firm finds that 70% of the emissions abatement potential for 2030 does not depend on new technology, and that energy efficiency measures alone could achieve dramatic GHG reductions over the next two decades. According to the analysis, these efficiency improvements, while requiring spending, could *raise* GDP, not lower it depending on substitution effects for current consumption. See also Deutsche Bank's "Global Climate Change Policy Tracker: An Investor's Assessment," DB Climate Change Advisers, Deutsche Bank Group (October 2007), a report that also highlights efficiency investments as sources of economic growth and jobs, not only as costs.

ⁱⁱⁱ For just one discussion of many on the assumptions of the economic modeling of climate change, see: Weitzman, Martin L., "A Review of 'the Stern Review on the Economics of Climate Change'." *Journal of Economic Literature*, 45 (3), September 2007, 703–724. For a broader discussion on choosing appropriate intergenerational social discount rates, see Moore, Mark A., *et.al.*, "Just Give Me a Number!: Practical Values for the Social Discount Rate," *Journal of Policy Analysis and Management*, 23, No. 4, Autumn, 2004, 789–812.

by setting a price on carbon itself, either through a carbon tax or a cap-and-trade system, or both. Voluntary carbon pricing, ideologically acceptable to all, should be popular. One easy Congressional measure to encourage the immediate growth of voluntary reductions and to reduce skittishness by investors caused by the uncertain treatment of voluntary credits under a cap-and-trade bill, would be legislation to guarantee that private emissions credits meeting certain requirements will be honored under any future energy bill that Congress passes to the extent they meet the new standards.

At the state and local level, standard home and building efficiency ratings—whether Energy Star, Leadership in Energy Environmental Design (LEED), or another standard—should be easily measured, widely recognized, and included in the Multiple Listing Service and similar comparisons, along with easily understood savings in percentage terms that could be expected from a specified building size, type, and efficiency rating. Governments can also use renewable portfolio standards (RPS) to induce energy investments. Net metering, feed-in tariffs, and other utility buy-back requirements from small producers do cost governments, but they can be carefully phased out and can help reduce utilities' required peak-load capacity requirements, saving some costs even for non-participating taxpayers. Subsidies such as feed-in tariffs and other incentives should be based on the differential between renewable and the least expensive fossil fuel source; in many cases these subsidies will decline rapidly while guaranteeing investors a fixed long-term return. If electricity prices for fossil fuels rise above renewable buyback prices, utilities and governments may make a profit for taxpayers in the future under fixed-return contracts.

If the general political environment does not support such investment, governments can create voluntary pools of citizen investors willing to pay an amount of their choosing into a pool to subsidize early adopters of renewable energy, to be paid back in reduced energy bills in the future should renewable electricity prices drop below those of fossil fuels. Governments and private investors can help to improve these methods' policy success through both public and private investment in an improved electricity transmission grid.

Voluntary investments by ordinary ratepayers, along with cross-subsidies from polluting energy sources, inefficient building property taxes, and gasoline-powered cars could sharply increase clean energy investments while making such policies relatively budget-neutral for governments. Incentives of this type would also help increase investments in efficiency while at the same time decreasing investments in high-emission facilities and technologies. Further, even small near-term cross-subsidies and investment-enabling policies, particularly if enacted by many states and localities, could have large effects in stimulating clean energy growth and development. Local governments are increasingly enacting low-cost policies such as accelerated approval of greener building projects and publishing planned schedules of increasing future building efficiency standards, mainly for new buildings.

Other large opportunities for environmental investment are created by government and building owners' management of their own facilities. Governments own 8% of all US office buildings, typically larger buildings, giving them the opportunity to be leaders in environmental investments while saving taxpayers future energy costs. Further, 83% of all US buildings are owner-occupied, typically in smaller buildings, making returns from energy efficiency more attractive through direct financial returns to owners.^{iv}

Long-term loans for efficiency improvements should be easier for banks and mortgage brokers to roll into new or even existing mortgages. Local and state governments might also create revolving loan funds to guarantee long-term, low-risk energy-efficiency loans to individuals and organizations, perhaps partly funded by federal loan guarantees that carry little cost and little risk. These types of loans have been successfully employed by states using federal funds to create clean water, wastewater, and transportation infrastructure revolving funds for public and private investments.

These are just a few of the government policy tools that are already increasing investment in low-polluting projects, and which together could help any national, state, or local government to reduce emissions to not only meet international environmental expectations or treaty standards, but also to reduce local pollution, increase local jobs, and help local economies compete both domestically and internationally through easily achievable efficiency savings.

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Biography

Dave Ehrlich teaches courses on environmental policy, policy design and analysis, policy implementation, program evaluation, and international development. He chairs the Leadership and Policy Studies degree program in the School of Public Service. Before joining DePaul, Dave previously taught in the Master of Public Administration program at the Illinois Institute of Technology, was a senior analyst for the US Government Accountability Office, and served as a senior legislative assistant for several members of Congress.



“Environmental Investing”: Let’s Be Broad-Minded

Robert A. Jaeger, PhD

Senior Market Strategist, BNY Mellon Asset Management

We’ve come a long way since April 2001, when then-Vice President Cheney declared that “conservation may be a sign of personal virtue but it is not a sufficient basis for a sound, comprehensive energy policy.” The current mood is almost exactly the opposite, as many people agree that sound conservation policies are essential to both our national security and our economic competitiveness.

This is therefore a great time to be launching the *Journal of Environmental Investing (JEI)*. The *Journal* has an important mission, and I hope that it interprets that mission as broadly as possible.

Some people think of “environmental investing” very narrowly, as a type of investing that is explicitly and obviously environmental: trading carbon credits, making venture capital investments in clean energy companies, and so forth. However, that’s only the tip of the environmental investing iceberg, and even then there is room to pursue the issues broadly. For example, the carbon markets are immature markets whose basic rules are still evolving. The *JEI* will certainly be interested in questions about how to make money in those markets, but should also be interested in questions about how to design those markets to serve the interests of investors and of society at large. Recent problems in the United States ethanol industry and in the European carbon markets demonstrate that there will be lots of opportunities to explore issues where the profit motive intersects with crucial policy issues.

Moving down from the tip of the iceberg, “environmental investing” also includes the type of socially responsible investing that imposes environmental screens on “regular companies”: natural resource companies, manufacturers, even financial companies and retailers. Here again, the profit motive interacts with policy issues, as more and more companies conclude that good environmental citizenship is good for business. When Wal-Mart decides to reexamine its entire supply chain through an environmental lens, it’s not because tree-huggers have staged a boardroom coup. For this reason, it’s naïve to assume that a “socially responsible portfolio” is destined to underperform an “unconstrained” portfolio. Careful attention to environmental issues may be part of a sound long-term planning process that actively seeks out hidden risks, costs, and liabilities. Sometimes the markets wake up to reward companies that follow that approach.

“Environmental investing” also includes the more “theoretical” idea of looking at investment issues through an ecological lens. For example, long-term investors have to think carefully about the “sustainable spending rate” of a portfolio. This problem is essentially the same as the key challenge in fisheries management and forestry management: what is the sustainable harvesting rate? In all these cases, the critical objective is to avoid running out of fish, trees, or money. Fish and trees may even teach us a thing or two about money.

This leads naturally to the idea that the financial markets may be viewed as a complex ecosystem in which myriad species are interconnected in complex ways. Andrew Lo and other academics have pursued this line of thought, and the Bank of England has even incorporated ecological ideas in some of its thinking about how to safeguard the stability of the financial system. An earlier generation of economists, suffering from physics envy, looked to thermodynamics for inspiration; the current generation is more open to ideas from ecology, evolutionary biology, and the other life sciences. Of course, biology won’t unlock the “secret of markets,” because it doesn’t address our distinctively human powers and foibles—after all, fruit flies and chimpanzees don’t have a market for credit default swaps, which saved them a lot of pain. Still, shifting attention from mechanisms to ecosystems is a step in the right direction.

“Environmental investing” isn’t just carbon markets and start-up battery companies. The *JEI* thus has an exciting opportunity to define the area in broad terms that will attract contributors with a wide variety of backgrounds, interests, and prejudices. Carpe diem!

Biography

Bob has been in the investment business since 1983, when he joined Evaluation Associates, Inc., an investment consulting firm that was just starting to build an investment management business. In 1984 Bob was one of the founding members of the small investment group that eventually developed into EACM Advisors LLC.

From 1970 to 1982 Bob was a member of the faculty of Yale University. In 1982-83 he was a member of the faculty of the University of Massachusetts at Amherst. He holds a B.A. from Princeton, a B.Phil. from Oxford, and a Ph.D. from Cornell. He is the author of *All About Hedge Funds*, published by McGraw-Hill in 2002.



Climate Change and Sustainability: How Investors Can Profit

Dr. Thomas Kabisch

CEO, MEAG MUNICH ERGO AssetManagement GmbH

Climate change is one of the greatest challenges of our time and it is one that investors, in particular global investors, have to confront. The failure of the Copenhagen Summit changes nothing about this incontrovertible fact; ecology and economy have long been inseparable elements in the climate change debate. Ever since the groundbreaking “Stern Review on the Economics of Climate Change,” published by the British economist Sir Nicholas Stern in October 2006, the question of the economic consequences of climate change has become one of urgent importance. Stern forecasts that the business-as-usual case for climate change will cause an annual loss of more than 5% of global growth up until the middle of this century—a figure that corresponds to \$2,200 billion. However, Stern assumes that these costs can be reduced to just 1% of global GDP per year (\$445 billion) if immediate action is taken at national and international levels, and carbon emissions from energy generation are reduced by at least 60% until 2050. If one compares the costs of taking such action with those of inaction, the only logical economic move is to invest in climate protection.

Not only risks but also opportunities

Climate change brings with it not only risks but also numerous opportunities. Stringent climate protection opens up considerable commercial potential for companies, and even entire economies. New technologies will prevail; new economic sectors will expand. Sustainable innovative solutions are needed, with “sustainable” meaning that we conduct ourselves in a way that satisfies the needs of this generation without costing the coming generations their livelihood. In the investment context, “sustainability” means retaining the value of assets and generating the most reliable and consistent returns possible from them. The focus of sustainable investment lies on its future prospects—not only economic, but also ecological, social, and ethical aspects. However, its primary objective is to minimize risk—a purely and unashamedly financial consideration, and not to appease the investor's conscience. Acting ecologically minimizes risk, lowers costs, and promotes a lasting positive development. One example of this is the conservation of energy and resources; the economic aspects here are plain to see. Good risk management safeguards the financial standing of a company in times of crisis, while social considerations help keep its employees healthy and productive, thus making it more competitive.

Climate change and sustainability

Climate change and sustainability have a long tradition at Munich Re. We began systematically researching climate change, from its causes to its consequences, in 1974—more than three decades before it became a topic of public interest. Today, our research activities in this field are concentrated in our Corporate Climate Centre. We recognized the benefits of sustainable investment very early on and consequently defined it as being a key consideration across all levels of investment management. Munich Re was involved in developing the United Nations Principles for Responsible Investment (PRI), presented at the New York Stock Exchange on April 27, 2006, and was the first German company that signed up to the PRI. As Munich Re's asset manager, we at MEAG observe the PRI in every strategic and tactical investment decision we make, right down to each individual sale and purchase. A large share of the equity and corporate bond portfolio we manage is invested sustainably. When dealing in government bonds, we account for sustainability aspects by using a self-developed rating system.

Climate change and sustainability are megatrends of the twenty-first century. Whether in reinsurance, primary insurance, or asset management, we analyze the risks and opportunities and make use of the insights gained, wherever they apply. Sustainable investment criteria help identify profitable, and ecologically and socially responsible corporate strategies that do not enter into incalculable risks and that can therefore succeed over the long term. For investors, the immediate payback lies in low performance volatility and a steeper growth curve, but at the same time, we are also helping to limit climate change by getting involved in activities at a political level, by establishing environmental standards within our own company, and by honing the awareness of our staff about ecological issues. Climate change is a social obligation for us all. At MEAG, we actively accept the responsibility we have with regard to the coming generations, while at the same time making the best of the financial opportunities that arise from these megatrends.

Biography

After studying business administration and economics in Germany and the US, Dr. Thomas Kabisch worked for four years at Lehndorff Vermögensverwaltung, before moving into the securities and funds division at Vereins- und Westbank. In 1992 he was elected into the executive board of listed ALBINGIA-Versicherungsgruppe. There he was responsible among others for the Investments, Finance and Internal Audit divisions until 1999.

Dr. Kabisch was chosen to set up and run MEAG as CEO in April 1999. He is responsible for mandate management and central functions. As Chief Investment Officer of the group, he is also in charge of research and the investment process. He served and serves on the boards of various institutions abroad and in Germany.



Moving Forward: The Aftermath of Copenhagen for Green Investment

Couro Kane-Janus, PhD

Senior Investment Strategist, Asset Allocation & Quantitative Strategies, World Bank



Shilpa Patel

Chief, Climate Change, Environment and Social Development Department, International Finance Corporation

One thing seems to be certain after Copenhagen: there is still a long way to go before we get a price on carbon emissions that can drive a vibrant and self-sustaining market for clean-energy investment, and before we get binding commitments on greenhouse gas emissions reductions at the national and international levels. In the meantime, it will be important to figure out how to use the limited amount of public finance available to mitigate political, market, and technology risks so as to attract large-scale, private funding for clean energy investment.

Institutional investors are viewed as potential saviors since they have significant resources available for investment and many have announced their intentions to help finance climate-change mitigation and adaptation activities. The big questions are whether they are really willing to jump in and invest at a meaningful scale, and, if so, what it will take to unlock their billions?

One of the outcomes of Copenhagen has been the recognition that there are significant limits to public financing and that private financing will be vital to any meaningful transformational investment in the mitigation and adaptation arenas. Pension funds are viewed as one source of this long-term private financing. However, these funds have fiduciary responsibilities and will invest in greenhouse gas mitigation activities only if they can do so in accordance with these responsibilities. Also, as voiced publicly by many heads of pension funds, the funds will invest in opportunities whose rewards properly reflect the risks. To foster a significant scale-up of these investments and the necessary financing, clear and reliable policies are essential.

A Range of Options Going Forward

Should people take the opportunity now to test some potential investment ideas that could be scaled up later once necessary legislation is enacted? Many ideas are being advanced as to how to leverage public money to attract more private investments (United Nations Environment Programme and Partners, 2009) and (Kidney et al., 2009). Smaller-scale investments or prototype projects could be a way to test the feasibility of different ideas, ranging from lower-risk investments such as green bonds to the higher risk-seeking instruments. For example, as an issuer of debt securities, the World Bank Treasury has mainly focused on fixed income products to finance public investment while the International Finance Corporation (IFC) has a broad range of products—ranging from debt to equity—available for private sector investment. Several investment forms that are being explored (Reichelt, 2009; World Bank Treasury, 2010), or could be worth investigating, include:

- Plain vanilla AAAA-rated, green-bond investments in which the investors have the possibility to support green projects. These investments represent a promising first step in forming ideas about how to finance mitigation projects and have attracted great interest among institutional investors looking to support climate change solutions within their high-grade fixed income investments. The World Bank green bond issuance has reached almost \$1.5 billion with 15 green bonds in several currencies. Some initial hurdles, such as (i) liquidity and secondary market trading, (ii) establishing enough issuers of green bonds to create an index, and (iii) establishing different credit ratings to cater to investors willing to take on more credit risk, will likely be overcome as more institutions issue green bonds, such as the upcoming IFC green bonds and the European Investment Bank's Climate Awareness Bonds issued in 2007 and 2009.
- Second-generation fixed income products. For investors interested in sovereign debt issued by emerging market countries, such products might be an interesting alternative. These instruments look at the need of a country with the right policies in place to foster a climate change agenda in areas such as energy efficiency or transportation. A current initiative, in partnership with government officials in two emerging markets pilot countries, is looking at possibilities for governments to finance energy efficiency activities through structures linked to green investments, such as "energy efficiency bonds." The World Bank, through its convening power and partnership with member countries, can play an important role in working with clients from different regions. Currency, structure, credit, and political risk need to be accounted for investors to achieve acceptable risk-adjusted returns; there may also be

some appetite for securitized products, such as forest bonds and index-linked green bonds.

These first-step initiatives, though promising, are far from taking us to the massive scale of investment needed. Given the magnitude of the problem, new means of financing and appropriate investment products have to be explored. Public funds can play a vital role to mobilize private financing to get to the necessary scale.

The Need for Public Funds to Mobilize Private Financing

The financing needs for low-carbon investment are large relative to the financing currently available. We believe that viable private sector projects should be able to attract the requisite financing, and the instruments mentioned above can help mobilize that funding. However, the necessary investments often carry—or are perceived to carry—much higher risks than can be mitigated by the market. Sometimes the problem is a lack of familiarity with a particular emerging market and concerns about contract enforcement, currency, and other sovereign risks. Market mechanisms exist in many cases to mitigate such risks and the multilateral development banks have significant experience in structuring viable financing packages to provide the necessary comfort.

In other cases, the available risk-reward profiles simply do not match private expectations and cannot subsequently attract the levels of financing needed. There can be many reasons for this: technology costs may not have come down the cost curve; appropriate domestic regulatory support may not yet be in place; the project cannot rely on a carbon revenue stream to boost cash flows and returns; and, there may be additional costs associated with being a first mover in market—costs that subsequent entrants may not face.

In such cases, even if institutional investors or other sources of investment were available, either directly or through the multilateral development banks, the private sector may still not venture forth into emerging markets in the scale required. This is where public finance can help fill the gap to cover transitional risks and costs, thus unlocking significant private financing flows toward low-carbon investment.

Project developers and investors will need some sense of certainty with regard to the public finance parameters that will apply before they expend resources and effort to build the necessary project pipeline. In this regard, a key priority should be to define the “rules of the road” for the “fast-start” financing announced in Copenhagen.

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Biographies

Couro Kane-Janus is a senior investment strategist, responsible for developing investment strategies and advising various internal and external clients of the World Bank Treasury on asset allocation and related policy matters. In addition, Couro gives advisory support to Central Banks on reserves management issues and Sovereign Wealth Funds, including oil funds, on asset allocation and investment strategies. She is currently focusing on the development of products with different risk-return characteristics to help mobilize large scale financing for climate change. Couro joined the World Bank in October 2005.

Before joining the Bank, she worked as a consultant in statistical arbitrage and equity derivatives at HypoVereinsbank in Germany. Couro holds a PhD in Applied Mathematics and was a post doctoral fellow at California Institute of Technology, Pasadena.

Shilpa Patel leads IFC’s Climate Change unit, supporting the corporation’s climate change agenda and commitment to increase its climate-friendly lending.

Ms. Patel has focused on building IFC’s analytical capacity to better understand the climate change impacts of its activities, and expanding IFC’s cleaner production initiatives. She is the key architect of IFC’s portfolio GHG accounting initiative, and is

currently working on developing metrics to better assess development and climate change trade-offs in developing countries.

Prior to this, Ms. Patel led IFC's Sustainability Business Innovator, an incubator for innovative business models, products and instruments to harness the power of the private sector in delivering environmental and social benefits. She contributed to the creation of IFC's Cleaner Production program and oversaw IFC's carbon finance activities, including the development of new financial instruments for private sector participation in carbon trading.

Ms. Patel joined IFC in 1997, and has managed IFC's investment activities in the Chemicals and in the Health and Education sectors. Prior to moving to IFC, she worked at the World Bank on private sector development across a number of regions and economies in transition. She has also held the position of Adjunct Professor at Georgetown University's McDonough School of Business, where she taught courses on Project Finance.



What Copenhagen Means for Investors

Abyd Karmali

Managing Director and Global Head of Carbon Markets at Bank of America Merrill Lynch and President of the Carbon Markets & Investors Association

Prior to the UN climate change negotiations in Copenhagen, consensus estimates were that the private sector would need to provide more than 85% of the roughly \$200 billion annual investment required to help meet global carbon emission reduction needs by 2020. Post-Copenhagen, has anything changed and what were the key implications for investors? I have always argued that the litmus test for Copenhagen was whether the resulting political accords or agreements succeed in mobilizing flows of private capital. After all, the core *financial* challenge for climate change is one of capital reallocation and timing, or, put another way, how to steer capital away from high-carbon investments and channel it quickly and with scale towards lower-carbon technology. So what are the main conclusions to be drawn from Copenhagen?

On the positive side of the ledger, Copenhagen affirmed the direction of travel. Investors received confirmation that we are heading, albeit at a pace yet to be agreed upon, towards a low-carbon trajectory. The largest-ever gathering of heads of state outside the UN annual assembly in New York did at least succeed in producing a coalition of the willing—most crucially, representing the 17 countries responsible for more than 80% of global greenhouse gas emissions. These leaders have now committed their nations to implementing new measures that should accelerate the uptake of low-carbon energy, products, and processes.

Those who viewed the outcome from Copenhagen in a strongly negative light have, however, been quick to highlight that the summit failed to provide any deadlines for, or guarantees about, the enactment of each country's suite of low-carbon policies and measures. Moreover, no clear roadmap to a legally binding international treaty emerged. This provides some uncertainty for investors in cleaner energy, unless, of course, such investors are using conservative assumptions and attributing zero value to the environmental externalities (such as carbon emissions) their investments are helping to address. Without clear policy frameworks setting out targets and timetables that allow a sustained price signal for carbon to emerge, there is a risk that capital will not flow towards low-carbon technology. Unfortunately, one scenario that investors must now contemplate is that the climate negotiations might emulate the endless loop of the World Trade Organization talks.

There are several metrics that investors should use to monitor investment trends post-Copenhagen. First, will 2010 bring an increase in the total investment flowing towards cleaner energy? In 2009, we saw the first year-on-year decline in the past decade. It will be important for this to tick back up again. The overhanging government stimulus funds will likely play a materially positive role here. Second, will 2010 bring an increase in funds raised specifically for carbon emission reduction projects in developing countries? As one proxy for this, 2009 saw a year-on-year decline in the issuance rates in the volumes of carbon credits registered by the Clean Development Mechanism. Third, will there be an increase in assets-under-management of funds characterized as low-carbon? It is conceivable that climate change is already a mega-trend for investment and continuing momentum in the allocation towards green products from institutional investors would provide more support for the theory that the direction of travel has already been internalized by investors.

What is crucially important for all investors to keep in mind is that one material macro-risk remains unchanged following Copenhagen. If credible pricing for carbon remains absent, some investors will continue to deploy capital in the high-carbon economy. The overarching and systemic risk for all investors could then be a scenario where a future financial crisis is caused by the premature and forced retirement of highly carbon-intensive assets.

Biography

Abyd Karmali is managing director and Global Head of Carbon Markets at Bank of America Merrill Lynch. He is the company's point person for carbon business opportunities and serves on Bank of America's Environmental Council. Karmali has provided strategic advice on the commercial risks and opportunities posed by carbon emissions constraints to scores of European, US, and Asian companies. In 2008, his team won *Environmental Finance* magazine's Carbon Finance Transaction of the Year and *The Banker* Award for Most Innovative in Sustainability.

Karmali has worked for two decades on climate change and the carbon markets and is serving as elected President of the Carbon Markets and Investors Association from 2008 to 2010. Additional appointments include: member of Her Majesty's Treasury Carbon Market Expert Group, member of the World Economic Forum (Davos) Steering Committee for Advancing Low-Carbon Finance, advisor to the Carbon Disclosure Project, and advisor to the Commission to establish Britain's first Green Investment Bank. Karmali was previously employed with ICF International in Washington DC, Toronto, and London. In 1996-97 he was Climate Change Officer at the United Nations Environment Programme's Industry office in Paris and participated in the Kyoto Protocol negotiations.

He is frequently called upon by the media and has been interviewed for TV/radio by BBC, CNN, NPR and CNBC as well as cited in print media such as the *Financial Times*, *The New York Times*, *The Australian*, *Financial Post* and *The Economist*. Karmali has also provided expert testimony on emissions trading and on forestry carbon – reduced emissions from deforestation and degradation (REDD) – to parliamentary hearings held by the British House of Commons’ Environmental Audit Committee.

Karmali’s voluntary sector activity includes serving as Chairman of Just Energy, a not-for-profit social enterprise recently set up by Oxfam, which works with low-income communities in developing countries to maximize revenues from medium-sized renewable energy businesses and to increase the supply of clean energy. He has also undertaken volunteer work with the agencies of the Aga Khan Development Network and a three-year stint on the Board of Trustees of Focus Humanitarian Assistance Europe Foundation. He holds an M.S. in Technology and Policy from the Massachusetts Institute of Technology.



What Copenhagen Means for Environmental Investing Today

Edward J. Kearns, PhD

Deputy Chief, Remote Sensing Applications Division,
National Climatic Data Center
National Oceanic and Atmospheric Administration,

United States Department of Commerce

A Movement Toward Climate Services

Many communities are still assessing what impact the Copenhagen Accord may have on international and national policies regarding greenhouse gases and climate change. However, a broader shift in the approach to the issues of climate adaptation and mitigation that was perceptible before the 15th Conference of the Parties (COP 15) has certainly gained momentum in the climate community. This shift is away from the debate about the ability to detect, measure, predict, or ascribe causation to climate change and towards the ability to provide the information necessary to take timely action to adapt to climate change and to mitigate its effects.

How should this information be provided? The unbiased and objective data that describe how climate is changing, where it is changing, and to what degree it will be changed in the future must find its way from scientists into the hands of businesses, resource managers, policy makers, and individuals. Information products that are understandable and inherently valuable to these users must be distilled from the observations and numerical model results provided by climate scientists. These products must also be delivered by services that are reasonably convenient and widely accessible. Recent events such as the so-called “Climategate” email controversy underscore the need for the processes by which these information products are derived to be transparent and independently traceable to original data sources.

The availability of these climate information products and services will ideally encourage informed investments, aid decision-making, and promote the development of good policies. Thus, climate information could be expected to have a similar influence on business and society as weather information currently does, though with an emphasis on long-term rather than short-term influences. As an analogue to the weather industry that has grown dramatically over the past 60 years, it is likely that a “climate industry” will grow around climate data, information products, and services. The climate industry will play a major role in adding value to those basic services delivered by government agencies and developing tailored products to meet the needs of particular businesses and investors.

Less than two months after COP 15 closed, the US Department of Commerce announced that it would establish a Climate Service within its National Oceanic and Atmospheric Administration. The goal of the Climate Service was articulated by the Under Secretary of Commerce for Oceans and Atmosphere, Dr. Jane Lubchenco, to be “providing critical planning information that our businesses and our communities need,” and she said that it would “build on our success transforming science into useable climate services.” It is expected that other climate-related activities and research at different US federal agencies (Energy, Interior, Agriculture, Transportation, Department of Defense, Environmental Protection Agency, and National Aeronautics and Space Administration) will be coordinated with the Department of Commerce’s activities, much as the nation’s weather services are today. Such large-scale government investment in climate products and services should provide the on-going, stable information support required by businesses and investors that are engaged in climate adaptation and mitigation, as well as those who can benefit from long-range environmental predictions.

The outlook for environmental investing over the next five years must be regarded as excellent if one considers enhanced access to high-quality climate information to be vital for successful investment strategies. Assessments of climate change-related impacts to various business sectors, on regional to local scales, will be facilitated and should be better-suited to the challenges of investing than the global-scale assessments more commonly available today. Of course these challenges include more than just obtaining access to information, but also understanding the uncertainties inherent in this information. Investors that understand the implications for both the rewards and risks in the use of information should have a distinct advantage in the marketplace.

Biography

Dr. Edward Kearns is the Deputy Chief of the Remote Sensing Applications Division at NOAA's National Climatic Data Center. He earned a B.S. in Physics from the University of Miami, FL (1990) and a Ph.D. in Physical Oceanography from the University of Rhode Island (1996). Dr. Kearns was a faculty member at the University of Miami's RSMAS Remote Sensing Laboratory working on retrievals of ocean temperature and color from NASA satellites until he joined the National Park Service in 2005 to prepare for ecosystem restoration in the Everglades and Biscayne Bay. In 2008, Dr. Kearns joined NOAA to assist in the creation of climate data records from satellites.

He currently lives in Asheville, NC with his wife Wendy and their 3 children.



Après Copenhague, le Déluge?

Dr. Matthew Kiernan

Founder and Chief Executive, Inflection Point Capital Management

The question most frequently asked by the carbon cognoscenti after Copenhagen has become, “Is the glass 10% full or 90% empty?”

Good question—and certainly one that occupied a good deal of the discussion at our firm’s “Club of Davos” meeting in late January, with George Soros among others. Indeed, a general aura of gloom permeated the conversation. But the discussion was heavily tilted towards policy, regulation, the role of government, and the dim short-term prospects for an explicit (or even implicit) carbon price, so the despondency was perhaps quite understandable. My own take, however (and, I presume, that of many of the readers of this journal), is that while public policy frameworks are undeniably important, they are *not* absolute prerequisites for substantial progress on the ground. The *real* action, I believe, will be entirely elsewhere—with private sector and institutional investors. If that is indeed the case, perhaps an even *better* question would be: does the Copenhagen (non-) result really matter?

But let us deal with the first question first. Climate policy and carbon finance optimists rightly point to the fact that, for the first time in history, *all* of the major climate players were party to the global negotiations and some progress was unquestionably made. The “90% empty” crowd, for their part, emphasizes the obvious limitations of the “agreement” that was reached:

- It was utterly devoid of agreement on specific emissions reduction targets, never mind the mechanisms and targets required to actually get there.
- The first real deadline emerging from Copenhagen, the January 2010 deadline for announcing even aspirational *unilateral* targets, received only partial responses, and is being quietly de-emphasized.
- The defeat of the United States Democratic candidate for the late Ted Kennedy’s Massachusetts Senate seat has removed all but the faintest of hopes that President Obama can push through his cap-and-trade climate bill in 2010.

Enough said. Let us now turn to the second and perhaps more interesting question: does any of this really *matter*? This observer's answer would be an unequivocal "no"—at least from an investor's perspective. Why? Because while the Copenhagen non-result did undoubtedly set back the advent of significant global carbon trading, the *real* opportunities for environmentally savvy investors were never in the narrow carbon finance space in the first place. Nor will those opportunities likely be available any time soon. Why not? Because deep, liquid, sophisticated, and robust carbon markets require precisely the sorts of policy signals, and regulatory and tax frameworks which Copenhagen so conspicuously failed to provide—period, full stop. Let's revisit this space in another decade or so.

So, if carbon trading and carbon finance markets are likely to be fundamentally thin and uninteresting for the foreseeable future, where is the environmental alpha-seeker to turn in order to "play" the climate change theme? It's just a personal view, but the answer is not necessarily in the high-profile clean tech space either. Why not? How about frothy valuations; whiplash-inducing volatility; and relatively shallow, illiquid markets where there is arguably too much money noisily chasing too few opportunities, which are, in turn, too well-followed and therefore obvious? Indeed, if one uses carbon finance and clean tech as a crude proxy for "climate-aware investing," in general, even the most active, climate-savvy institutional investors in the world today are currently investing *well* under 1% of their total managed assets in those two areas combined. In other words, we currently have virtually 100% of the climate-savvy investors limiting their gaze to less than 1% of the total opportunity set!

So *where* should active, climate-savvy institutional investors look then? Briefly, I believe, in three places:

- Environmental infrastructure
- Thematic investing
- Large- and mid-cap stock picking

The first two have been extremely well-canvassed recently by Deutsche Bank Climate Advisors (DBCA 2010). The third, however, may be less evident, and has certainly received less commentary. Research by our predecessor firm Innovest Strategic Value Advisors and others have suggested that there may be a "carbon beta premium" available to large- and mid-cap companies (Innovest Strategic Value Advisors 2007). While far from being climate pure-plays, these premiums can nonetheless achieve genuine competitive and financial advantage from a superior ability to navigate both the risks and opportunities that the climate challenge presents. And precisely the same holds true for their *investors*.

Unbeknownst to all but the most esoteric, research-driven asset owners and managers, there exist company-specific climate-risk variances of 30 times or more, even within the

same industry sectors. Taking the trouble to discover which companies are which is likely to create significant—and growing—alpha opportunities for astute investors. What’s more, those opportunities will *not* be confined to the equity space; climate-driven risks and opportunities also abound in fixed income, real estate, infrastructure, and commodities.

To paraphrase the iconic Monty Python comedy sketch about the dead parrot, the climate investment parrot is most assuredly *not* dead. Indeed, I would argue that it is not even *resting*. It is alive and well, albeit somewhat camouflaged. So far, most investors are simply looking for the feathered critter in the wrong places.

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Biography

Matthew Kiernan is founder and Chief Executive of Inflection Point Capital Management, a multi-strategy boutique dedicated to sustainability-enhanced investment solutions. Prior to that, he had played similar roles at Innovest Strategic Value Advisors, a top-rated investment research firm. Dr. Kiernan’s latest book is Investing in a Sustainable World: Why Green Is the New Colour of Money on Wall Street.



Future Investing in Living Carbon

Andrew Mitchell

Founder, Global Canopy Programme and
Chairman, Forest Footprint Disclosure

“It's not what we eat but what we digest that makes us strong;
not what we gain but what we save that makes us rich.”

This quote by seventeenth century philosopher Francis Bacon seems a good starting point to consider how the climate debate and Copenhagen Accord are altering concepts of wealth creation and the twenty-first century economy.

While the 15th Conference of the Parties (COP 15) failed on most counts, one thing there was wide consensus about was that to keep below the climate change cap of no more than a 2°C temperature rise, decreasing deforestation offers one of the quickest, cheapest, and scalable means of curbing greenhouse gas (GHG) emissions this side of 2030. And the price tag is doable—around \$25 billion annually (United Kingdom Government 2008), only slightly more than one New York bank's estimated 2009 bonus pool.

At around 18% of the global total, emissions from burning tropical trees and soils exceed those from the entire transport sector (Nabuurs *et al.* 2007). Moreover, standing tropical forests provide a gigantic carbon capture and storage (CCS) system, removing 4.4 billion tonnes of carbon dioxide (CO₂) from the sky each year (Denman *et al.* 2007)—for *free*. The rainfall this ‘living carbon’ generates underpins not only global climate security, but food and energy security as well. For instance, 70% of Brazil's electricity comes from hydropower fed by rainfall regulated by Amazonian forests.

Tropical forests are an irreplaceable ‘eco-utility’ being destroyed at some 13 million hectares (m ha) per year (Food and Agriculture Organization of the United Nations, 2006), of which approximately 5.5 m ha are in rainforests (Hansen *et al.* 2008)—an area nearly twice the size of Belgium. Over 32% of this destruction is caused by expanding inefficient low-intensity agribusiness, which produces billions of dollars in short-term profits. A further 42% is caused by subsistence families degrading forests for food and fuel. Collectively, deforestation results in losses of ecosystem services such as climate and rainfall regulation, reduced biodiversity, and increased disease. Today, these are regarded as externalities, but if assigned a dollar value they would be in the range \$3–5 trillion per year (ten Brink *et al.* 2008). McKinsey and Company's (2009) greenhouse gas abatement cost curve clearly shows that to spend the next 20 years developing as-yet-

untested industrial scale CCS systems at \$150–500 per tonne of CO₂ equivalent (tCO₂e) abated, without saving forests at a potential fraction of the cost and with immediate impact, is economically irrational. It need not be either/or, but both. As this analysis makes clear, tropical forests are natural capital we simply cannot afford to do without.

If Bacon is right, will the value of such natural capital rise? The climate debate is pushing to center stage recognition of how nature underpins sustainable wealth creation; tropical forests are the vanguard of this change. It is crucial that the Copenhagen Accord for the first time commits the countries responsible for 80% of global emissions to fixing the problem and curbing deforestation. Currently, \$3.5 billion of interim financing for forests is on the table and awaiting the definition of an appropriate delivery system. The Accord commits signatories to contribute \$10 billion annually to 2012. After that, US and international carbon markets are likely to invest strongly in REDD+ credits (Reducing Emissions from Deforestation and Forest Degradation) *if* a compliance market develops in which such credits are included. The Copenhagen Accord makes that more, not less, likely.

Unfortunately, in global markets today, tropical forests are still worth more dead than alive. However, if over the longer term, a Kyoto II agreement can regulate even a modest carbon price, opportunity costs of conservation should be able to be met through REDD+. For example, in net-present-value terms converted to US dollars in 2005, the opportunity costs of conserving forests would require a REDD+ credit price of \$3–7/tCO₂e to equal revenues from palm oil in Indonesia, \$2/tCO₂e for Brazilian cattle ranching, and up to \$3.5/tCO₂e for Brazilian soybean farming (Olson and Bishop 2009). Such prices are reachable now in the voluntary carbon market. In 2007, it generated more than 2 million tCO₂e from avoided deforestation projects at an average price of \$4.80/tCO₂e.

This may not yet convince most farmers to stop deforesting or to restore degraded land, but should REDD+ be tradable in a future compliance market, prices could be much higher—making forests much more valuable. For comparison, the price of emission allowances in the EU Emission Trading Scheme in October 2008 ranged between €18–25 (\$23–33)/tCO₂e. Coupled with tightening government regulations on access to cheap land, such a scenario could create a significant alternative land use arbitrage opportunity. Today there is effectively only a market in carbon, but tomorrow the hugely valuable ecosystem services these forests provide may acquire a value too. If so, for the first time in history, natural forests might become worth more standing.

Asset managers recognize the game is changing. Investments in companies that drive deforestation may be at risk of regulation, tarnished reputations, and lowered future earnings. Investors representing \$3.5 trillion of assets have demonstrated their support of a new call for transparency initiated by the Forest Footprint Disclosure (FFD) project in the UK, which published its first Annual Review of corporate performance indicators in relation to five ‘forest risk commodities’ in January 2010 (Campbell *et al.* 2010b).

A snapshot of this changing economic landscape can be seen in the Brazilian cattle industry: following civil action led by Greenpeace in 2009 that highlighted links between the cattle industry and deforestation, one of Brazil's largest beef exporters lost a \$60 million loan from the World Bank's International Finance Corporation. At the same time, Carrefour, JBS Friboi, Walmart, Nike, and other global brands stated they will no longer use products such as beef and leather sourced from the Amazon, unless a 12-month sustainable chain of custody can be demonstrated. Currently, a federal public prosecutor for the state of Pará is pursuing legal action worth \$1 billion against 22 ranchers and 13 meat-packing plants for sourcing beef from farms in non-compliance with Brazilian deforestation laws.

As the January FFD briefing states:

“The implications of these policies on the private sector will be unavoidable; as developing countries move towards low-carbon development plans, which intrinsically value the natural capital stored in tropical forests, agricultural policies will need to shift towards more sustainable practices that don't rely on the conversion of tropical forests. Private sector participants that are behind the curve in their environmental policies will find ever-decreasing opportunities to grow, in a world where land availability is likely to be constrained” (Campbell *et al.* 2010a).

Of course, conservation will never out-compete commerce, especially with the global population rising to 9 billion by 2050. But what if the true cost of what we consume became factored into the products we buy? Markets today do not price tropical forest infrastructure, but tomorrow's markets might—and change in that direction is happening faster now than at any time in the past. The carbon market is the first faltering step in a wholesale re-calibration of the world economy in which doing business with natural capital in mind will be as commonplace as utilizing social and financial capital. Feeding and fuelling our growing world is one of the greatest challenges of the twenty-first century, but squandering ecosystems that support the process will erode the economics eventually. Businesses that understand this and move toward preserving and leveraging the globe's natural resources will be the rising stars of the future. Investors will want to spot them.

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Biography

Founder and Executive Director of the Global Canopy Programme, a UK NGO established in 2001, Andrew Mitchell has worked in the following areas by:

Ecosystem Services and Innovative Finance Mechanisms: • Building capacity for understanding forest canopy/atmosphere ecosystem services in government and academia in Latin America, India, SE Asia and China. • Instigating and developing of the 'Emergency Package for Tropical Forests' a \$25 billion innovative financing mechanism for forests with Prince's Rainforests Project. • Co-Founding Canopy Capital Ltd an investment company set up to pioneer rainforest bonds and tradable 'Ecosystem Service Certificates' to fund forest conservation.

Development and Management of International Science and Conservation Projects: • Establishing the GCP, a network of experts around the world involved in developing the science, policy and finance needed to maintain the world's tropical forests. The GCP catalyses, gathers and applies 'tropical forest intelligence' from its networks to create information and tools used by decision-makers. • Developing, with international Boards Earthwatch Institute from a US based science organisation to a global research, conservation, education institute directly engaging 4000 members of the public each year in the field, funding 260 scientists on conservation and research projects annually.

Climate Policy and Communications: Leading roles in development of policy related to REDD+ (UNFCCC), Green Development Mechanism (CBD), The Economics of Ecosystems and Biodiversity (TEEB). • Publishing of the Little REDD+ Book and Little Climate Finance Book in five languages. • Instigating of Inter Academy Panel Statement on 'Climate Change and Tropical Forests' (2009) and the 'Forests Now Declaration' (2007) presented at UNFCCC COP in Bali.

Corporate Engagement: • Founding and current Chairing of the 'Forest Footprint Disclosure' project (2009) backed by \$3.5 trillion of investor assets to reduce global corporate drivers of deforestation. • Advising companies on environmental policy and PR, and related marketing strategies with McDonalds, Barclays, British Airways and ELF. Co-Founder of the UK Corporate Environment Responsibility Group (CERG) involving over 30 blue chip companies.



“Full Steam Ahead”

Rick Navarre

President and Chief Commercial Officer
Peabody Energy

The recent Copenhagen Summit provides an excellent time to stop and reflect on the state of science, politics, economics, energy security, and human development. Three words may best capture the promise of energy use and technology development post-Copenhagen: full steam ahead.

By “full steam ahead,” I mean first that the world has turned the corner on the global financial crisis, and many countries have returned to development and energy expansion. Energy development is a good thing, a basic need met by fuels that advance lifestyles and drive economies. Energy is as basic as food, shelter, clothing, or oxygen. More is better, within reason and used efficiently.

By “full steam ahead,” I also mean that the disappointments of Copenhagen can be turned into positive energy, by redirecting efforts and capital into carbon capture and storage (CCS) technologies that are energy-efficient, cost-effective, and evolutionary.

Five statements summarize my views on the aftermath of Copenhagen:

1) *Copenhagen represented less than meets the eye.* Those who view Copenhagen as a disappointment quite likely had too-high expectations. Years of Oscars, Hollywood thrillers, demagoguing, and movements have turned a basic long-term challenge into a contrived near-term crisis. For these acolytes of climate orthodoxy, the temple was sure to be shaken and unrealistic expectations were sure to be dashed. And they were. For Copenhagen to have succeeded, the world needed to move beyond caricature positions and rigid groupthink, toward steady progress to a lower-emission world. And that takes me to point two.

2) *Advancing the means is far better than dreaming of the ends.* While goals are important, there is a fine line between a vision and a hallucination. It has long puzzled me that those who are willing to set impractical long-term goals for greenhouse gas reductions are commended, while those who set about the hard work of developing the technology to reduce carbon dioxide (CO₂) are criticized. We need to spend more time working on real technology solutions and less time dreaming of artificial targets to avoid modeled disasters.

It is also essential to be practical regarding what can and cannot occur. Calling for the death of fossil fuels may make some applaud, but the claim is dismissed by most policymakers as flippant posturing. And that leads me to point three.

3) *Mark Twain was right.* Rumors of the death of fossil fuels have been greatly exaggerated. Take coal, which has been the fastest growing fuel in the world for each of the past six years. Going forward, the energy from coal demand growth through 2030 is expected to exceed the combined increase from oil, gas, nuclear, solar, and wind power. In 2010 alone, 72,000 megawatts (MW) of new coal-fueled generating plants are expected to come online, using nearly 300 million tonnes of new coal per year. With the large appetite for energy from the developing world, future years should bring about a comparable buildout.

The question is not, “Can coal survive in a low-carbon world?” but rather, “Given that the world will use much more coal tomorrow than today, can we find ways to use it in a low-carbon fashion?” And that brings me to my fourth point.

4) *Let the past be prologue.* The US has a proven history of tackling emissions, since passing the Clean Air Act of 1970. Electricity use from coal and GDP has more than tripled since then and regulated emissions such as particulates, sulfur dioxide, and nitrogen oxides have been reduced 84% per MW hour.

We can make the same progress over time with CO₂. Carbon capture and storage technologies can place the ultimate green goal of near-zero emissions from coal within reach. World leaders have set aside more than \$30 billion for projects and President Obama has just asked a multi-agency team to accelerate CCS development. The European Union and International Energy Agency (IEA) have both stated that CCS is essential to achieve long-term climate goals. IEA says that the cost of doing so without CCS would be \$1.3 trillion higher than going the CCS route.

The trick is capturing and storing carbon while providing low-cost energy. That’s why we’re encouraged by research that suggests that coal with CCS will be the low-cost, low-carbon energy solution—some 15–50% less expensive than nuclear, wind, or natural gas with CCS according to Carnegie Mellon studies. And that leads to my final point.

5) *The first priority always remains human development.* This is exactly what the Copenhagen agreement says. And coal delivers. Coal is abundant and enhances the energy security of major nations such as the US, China, and India. It drives the largest and best economies of the world, and it also pulls hundreds of millions of people out of poverty.

For example, I can picture villagers in Indonesia using coal-fueled electricity for the first time, allowing them to stop burning fuel wood in unvented homes. They would

experience a leap in technology that propels their lives, creates economic growth, and improves their environment. While some debated higher-order concerns in Copenhagen, many of the globe's citizens went on with their lives, made a bit better by low-cost energy. Copenhagen came and went without their knowledge. But the next Copenhagen cannot succeed without the world's policymakers knowing and caring for the billions of people seeking a better quality of life through abundant and affordable energy. Copenhagen failed in part because it only addressed perceived future costs of greenhouse gas emissions while ignoring the enormous societal benefits that basic energy affords.

So, what does this mean for investors? The need for investment certainty has never been greater. For instance, it is this need that continues to drive US manufacturing offshore and create the major mismatch between developing economies and the more-dormant economies of the US and Europe.

This need for investment certainty also means keeping our feet planted firmly on the ground, as the path is littered with too many "next big things" that ultimately don't work out either in substance or in a timeframe that matters. The allure of eco-bling can be dazzling, but what shines brightest for investors may be that which satisfies growing energy demand in the near term—such as coal and other fossil fuels that will continue to drive developed and developing economies for a long time. This is where the lion's share of value will be created in coming years, even as some companies promising energy and environmental technologies, such as CCS, may provide outsized returns over time, many will not. Successful investors search for greater certainty, and this is challenging in the emerging technology field. History shows that many companies will come and go, and only a few will actually provide good investor returns. This, for investors, is the true hallmark for sustainability.

Promoting realistic solutions for real problems—that should be the promise of the next Copenhagen. To which I say, "Full steam ahead."

Biography

Rick Navarre is President and Chief Commercial Officer at Peabody Energy in St. Louis, Mo. He is a frequent speaker on energy, industry and company trends and topics.

Mr. Navarre has responsibility for global sales and trading; business development; strategic planning; resource development opportunities; international growth initiatives; business performance; investor relations and corporate communications.

With more than 25 years of financial experience, Mr. Navarre served as Chief Financial Officer from 1999 through 2008. He joined the company in 1993 and has held a series of financial and commercial positions with the company, including executive responsibility

for departments as diverse as Sales, Marketing, Trading and Transportation; Legal; Information Technology; Materials Management; and Post-Mining Reclamation.

Mr. Navarre led the company's financial and capital market initiatives through the company's leveraged buyout and subsequent initial public offering in 2001, and shaping of the capital structure, directed Peabody's largest acquisitions, and leads our initiatives to serve the fast-growing Asia market. During his tenure, the company has been one of the leading investments in the world.

Mr. Navarre also led the company's largest acquisition: the \$1.8 billion purchase of Australian coal producer Excel Coal in 2006. Mr. Navarre has been recognized as America's Best CFO in the Metals and Mining Sector by Institutional Investor Magazine. Since taking the company public in 2001, Peabody has also joined the S&P 500 list, Forbes Platinum List of America's Best Big Companies, and Fortune's ranking of Most Admired Companies.

Mr. Navarre is a member of the Hall of Fame of the College of Business at Southern Illinois University Carbondale; a member of the Board of Advisors of the College of Business and Administration and the School of Accountancy of Southern Illinois University Carbondale; a member of the International Business Advisory Board of the University of Missouri – St. Louis; a member of the Board of Directors of the Regional Chamber and Growth Association of St. Louis. He is a Director of the United Way of Greater St. Louis; a Vice Chair of the Missouri Historical Society; a member of Financial Executives International and the Civic Entrepreneurs Organization; Fellow, Foreign Policy Association and a former chairman of the Bituminous Coal Operators' Association.



The Future of Investing in Environmental Markets

Will Oulton

Director of Responsible Investment, FTSE Group

The impact of climate change is set to alter the shape of the global economy over the coming years and, as a result, there is an expectation that the environmental technologies sector will benefit and grow, providing attractive long-term investment opportunities for global investors.

It is important to note, however, that it is not only the renewable energy sector that will benefit from the changes required to deliver a low-carbon economy. Companies emerging in sectors such as energy efficiency, water infrastructure, and pollution and waste control also have important contributions to make in addressing not only climate change, but the interrelated wider environmental threats facing society as well. Growth in this sector will be partly dependent on access to capital and we are already seeing the start of this evolutionary phase with several governments across the globe pledging high proportions of their economic stimulus packages towards environmental technology investment.

The focus on climate change and its implications in terms of assessing economic cost and investment portfolio risks is increasing. This is highlighted by the United States and Chinese pledges to address the impacts of climate change on economic growth and prosperity despite current market conditions. Incentives derived from economic stimulus packages are expected to play an increasing role in this growth over the coming months and years. Therefore, global investors and their advisors should now be examining these investment opportunities as part of their asset allocation strategies.

Climate Change and the Birth of Environmental Markets

Although environmental technology businesses have existed for decades, it is in the last few years that they have begun to attract increased investor interest. In Sir Nicholas Stern's report on the economic impacts of climate change, the former Chief Economist of the World Bank argued radical and rapid cuts in emissions are needed to limit the effects of increasing the world's "stock" of atmospheric greenhouse gases. Following his report, the Group of Eight (G8) recently stated its call for a reduction in global emissions of 50% by 2050, which will require an 80% cut by developed countries.

In order to achieve such drastic cuts, investment capital will be required to develop, scale up, and bring down the cost of the key environmental technologies. In addition, public policy-derived market mechanisms such as carbon trading are likely to play a larger role.

Running parallel are numbers of initiatives, trade organizations, and alliances that seek to facilitate the flow of investment capital (for example, the Carbon Disclosure Project and the United Nations Principles of Responsible Investment).

Investing in Environmental Technology

A decade ago, very few environmental technology investment opportunities were available outside of those from a small number of pioneers specializing in this area. These opportunities tended to be strategies that focused on pure-play technology companies (which derive the majority of their business from environmental technology) and have primarily been in the private equity, venture capital, or small-cap investment space. There has been little in the way of products and services that provide investors access to larger listed equities that are adapting and transitioning their business models to exploit the path to a de-carbonized economy.

Today, this is rapidly changing. Index providers have entered the field to provide investors with much-needed visibility to the performance of environmental markets through both tradable and benchmark indices. Environmental indices such as the FTSE Environmental Technology 50 (ET50) Index have successfully provided index funds and exchange-traded funds with low-cost exposure to this exciting sector, while also providing transparent benchmarks and a framework of reference for investors.

In addition, such indices also define the environmental opportunity set because they attempt to remove a major hurdle: identifying or classifying activities of companies in environmental markets on a global scale. FTSE Group has developed a taxonomy for these emerging low-carbon sectors and services that can be used by investors to accurately identify, analyze, and measure the performance of homogenous groups of environmental technology and service businesses. This new Environmental Markets Classification System is used to create the FTSE Environmental Opportunities Index Series, which includes both sectoral and regional breakdowns. This increased transparency of the performance of sectors will enhance the ability for institutional investors to implement climate change-related investment strategies.

Today, with the advent of such methodologies and benchmarks, institutional and retail investors have access to a broad and expanding range of environmental and climate change investment options, with many billions of dollars invested into these funds.

The Future of Environmental Markets Investment

As many of the drivers of environmental markets continue to catch political and public attention—such as energy security and supply, water scarcity, and disruptive weather patterns from a changing climate, the interest in those companies and sectors providing solutions to these issues will attract the interest of global investors. It will become

increasingly clear that attractive returns may be achieved from the investment opportunities emerging from the leading companies in these sectors.

This increased investor interest will challenge the global financial services industry and, indeed, index providers, to develop a range of investment tools to reflect this growth and suit the needs of a variety of investment strategies. The challenge for the next decade, against a backdrop of recent recession in many developed markets and a contracting financial services sector, is to continue to build on these many successes. Global investors will have a key role to play in de-carbonizing economies, rewarding companies that adopt sustainable and responsible business practices, and creating a sustainable global financial market system—the latter being the biggest challenge of all.

Biography

Will is the Director of Responsible Investment at FTSE tasked with leading the development of FTSE's responsible investment services which include the highly acclaimed FTSE4Good indices. He has also led the development of FTSE's award winning Environmental Markets Indices and the FTSE Environmental Markets low carbon industry sector classification system. He is widely recognised as a leading thinker in the sustainable and responsible investment world and is a regular commentator in the media. He is also the Editor of Investment Opportunities for a Low Carbon World published in June 2009.

The Future of Investing in Environmental Markets

Will Oulton

Director of Responsible Investment at FTSE Group

Supplemental Data

Five-Year Performance of the FTSE Environmental Opportunities Index Series versus the FTSE Global All Cap Index



Source: FTSE Group data as of May 29, 2009



Attracting Private Investors: Behavioral Biases and Profit Motivation Must Drive Policy

Jayendran Rajamony, PhD, CFA

Partner and Portfolio Manager, Numeric Investors, LLC

To implement climate-change mitigation and adaptation technologies at sufficiently large scales, an investment of hundreds of billions of dollars per year is needed over the next 20 years. For clean energy alone, the International Energy Agency (IEA) estimates a need of \$10 trillion through 2030 (IEA 2009). It is often estimated that 85% of this investment must come from the private sector; such estimates seem to be based on current investment flows that may not hold steady. Nevertheless private investors (pension funds, insurance companies, foundations, endowments) with their roughly \$100 trillion in assets must play a major role in bringing to fruition the annual flows required, which amount to less than 1% of their assets. There is also no disputing that developed-economy governments with their debt at about 75% of GDP (Japan is north of 150% and the UK, Germany, and France are at 70–100% (Central Intelligence Agency 2009)) will find it increasingly hard to make these investments. While private investment seeks profit, government investment aims to maximize ‘social good.’ If asset owners are not involved at the policy-setting stage, and governments develop policies without the profit perspective, private investors will stay away and capital—in the necessary scale needed to make an impact—will not materialize.

Investors are no strangers to uncertainties and one might ask why the fuss about lack of clarity on policy. Why are investors not seeking profit by funding mitigation and adaptation technologies if they are truly viable investments, instead of whining about policy? One way to understand this is from the perspective of “Ambiguity Theory,” which is a behavioral economics concept that posits that investors are more averse to investments with unknown probability distributions. If we know there is, say, a 51% chance of success, we can invest with sufficient diversification to make a profit. But if the chance of success itself is unknown, ambiguity aversion contends that investors act as if they are up against someone spiteful who fixes the scenario to provide the investors with as poor an outcome as possible (Camerer and Weber, 1992). After all, if one had to make a choice under limited information, it is reasonable to fear that someone with special interests and political clout has the power to take advantage of one’s ignorance. The implication is that if climate-change policy is ambiguous, investors will not back the best-possible technology, but instead back the one that will leave them with the least probability of loss (Kahneman and Tversky 1979). This is a lose-lose situation for investors and society at large. Thus, we need policies that assure the asset owners that the

various governmental and international bodies are not ‘out to get them,’ if the spigots are to open freely.

After the fifteenth Conference of Parties (COP 15), a cohesive international policy seems even less achievable than before. This means that national- and local-level policies, to the extent they exist, will play an important role in attracting capital investments. The first-mover advantage will go to those nations that quickly adopt investor-friendly policies. For example, Europe, in general, has clearer policies than the US and has seen higher private funding. Local policies in various parts of the globe are, to some extent, a reflection of the popular perceptions of the ill effects of climate change. The recent recession, which affected the developed world more than the emerging one, has democratic implications for future evolution of national policies. For example, in the US, a recent Pew Research Center Poll showed a decline during 2008–2009 of people who believe there is solid evidence for climate change, its seriousness, and its anthropogenic cause (Pew Research Center 2009). This hardened popular attitude against climate change effects and policies lessens the possibility of strong policy action on this front. Thus, what COP 15 may have achieved is to put the spotlight on national and sub-national governments, which will build policies based not on altruism, but on attracting investment.

Besides policy, a relevant differentiator among nations as destinations of climate change capital is the disparity of fossil-fuel costs. Countries where fossil-fuel is costlier are naturally more conducive to the success of alternative energy investments, since the threshold for profit is that much lower.

From the perspectives of policy, higher cost of fossil fuels, and increasing thirst for energy, the emerging economies could well pull off a first by incubating nascent climate-change technologies (unlike waves of previous new technologies in the last century that all grew up in the West). Climate-change investment, however, is additionally subject to the same factors that control global investment flows in general: perceived political risk of economies, the home bias of investors (who are generally in the developed nations), etc. The *Journal of Environmental Investing* can make a valuable contribution to climate investing by pursuing the empirical relationship between climate-change funding and its determinants, from which can be drawn the potential investment benefit of marginal policy changes in various economies.

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Biography

Jayendran Rajamony is a partner and portfolio manager at Numeric Investors LLC, Boston, where he creates and manages strategies that exploit mispricing in the global equity markets. Earlier, he worked at Independence Investments in Boston as a quantitative analyst and at the student-run Cayuga M.B.A. hedge fund at Cornell University as a quantitative portfolio manager. Jayendran has an M.B.A. with distinction from Cornell University, a Ph.D. in Physical Oceanography from the University of Rhode Island, and a Bachelor of Technology (Honors) from the Indian Institute of Technology, Kharagpur, India. He is a member of the Chicago Quantitative Alliance, the CFA Institute and the Boston Security Analysts Society. Jayendran is a CFA charterholder.



**The Meaning of Copenhagen:
Liquidity Horizons and Physical vs. Synthetic Environmental
Value**

Alex Rau, PhD, CFA
Principal, Climate Wedge Ltd

The recent climate summit in Copenhagen was both disappointing and encouraging for the prospects of environmental investing. The lack of a binding global agreement to replace the Kyoto Protocol has thrown the existing international carbon markets into disarray. Political commitments to address climate change appear increasingly heterogeneous and timetables for their implementation remain uncertain. At the same time, the diplomatic magnitude of the event, and symbolic agreement for the first time by all the major emitters to reduce emissions with the long-term goal of avoiding a 2°C increase in global temperatures, should lend confidence that the political focus on the environment will only strengthen. More tangibly, the summit did lead to firm commitments by Western nations of \$100 billion per year in climate-related financing to the developing world, the bulk of which is expected to flow through carbon markets and the private sector.

From an investment perspective, the outcome of Copenhagen reinforces the general conclusion that there is a clear, strong macro trend towards environmental and clean energy investments, but that we can expect a continued period of near-term uncertainty in the exact nature and value of corresponding investment strategies. How then should investors best allocate to the long-term trend and manage the short-term noise and uncertainty?

Naturally, liquidity constraints will provide the dominant guidance. The environment itself is the ultimate illiquid asset (we have only one, after all), and returns from environmental investments can only be expected to materialize over longer timeframes. The absence of a coordinated global climate agreement has pushed out the horizon for large, liquid carbon markets beyond the existing EU Emissions Trading Scheme, which runs through 2020. Patience is required from capital providers seeking exposure to this and other dislocations in the energy and environmental orders while slow moving negotiations and legislative processes grind towards consensus on specific policy mechanisms. Long-term capital is best-placed to manage these constraints and generate risk-adjusted returns from environmental investment strategies.

Beyond liquidity issues, understanding the top-line attributes of target assets is critically important. Environmental investments ultimately derive their returns from revenue

streams and cash flows based on underlying projects, products, and infrastructure, or derivatives thereof. *Physical revenue streams* come from sources such as efficiencies and the sale of power, fuels, and environmentally friendly products, all of which have large natural markets. *Synthetic revenue streams*, on the other hand, are derived from the monetization of intangible environmental benefits and externalities within a policy framework. Examples of such synthetic revenue streams include carbon credits, renewable energy certificates, tax credits, as well as payments for so-called "ecosystem services."

Physical revenue streams generally have a sound basis and will continue as the baseline source of returns for this sector. The meaning of Copenhagen is that synthetic revenue streams will continue to grow in importance for environmental assets and investment strategies, differentially boosting returns to this sector and increasing its attractiveness versus alternative allocations. However, the short-term policy fragmentation increases the uncertainty around both the value of synthetic revenue streams as well as which specific investment activities will be eligible or "credited" for their environmental benefits.

Synthetic environmental assets that must be monetized in an uncertain policy context face the risk that the scope of the underlying asset, project, or investment will not qualify according to the regulatory requirements, and thus be deemed ineligible for crediting—even if a genuine environmental benefit is being created. The origins of this "monetization risk" stem from the fact that the monetization process is at best an incomplete way to capture and value intangible environmental benefits, as it must take place within an uncertain and imperfectly defined legal, regulatory, and market framework.

Qualitatively, the collective strength of various emission reduction targets at the national and state level will be a rough proxy for the value of unhedged synthetic revenue streams (equivalent to market price risk), while the likelihood of credit eligibility will determine the monetization risk. If this likelihood of ineligibility is high, markets will continue to value environmental benefits at or near zero and negative-return investment scenarios are the likely result. The figure below illustrates this risk/return profile and possible total-loss-of-capital scenario from investment strategies focused purely on synthetic revenue streams (here, a buy-and-hold strategy for carbon credits in advance of future cap-and-trade legislation in the US).

Probability Credits Eligible for Cap-and-Trade in 2015

	100%	75%	50%	25%	0%
\$5	0%	-6%	-13%	-24%	-100%
\$10	15%	8%	0%	-13%	-100%
\$15	25%	18%	8%	-6%	-100%
\$20	32%	25%	15%	0%	-100%
\$25	38%	30%	20%	5%	-100%
\$30	43%	35%	25%	8%	-100%
\$35	48%	39%	28%	12%	-100%
\$40	52%	43%	32%	15%	-100%
\$45	55%	47%	35%	18%	-100%
\$50	58%	50%	38%	20%	-100%

Representative returns from a long-only investment strategy focused purely on synthetic instruments (here carbon credits valued at \$5/ton in 2010) over a five-year holding period, at various future market prices and probabilities that the instruments will be eligible for monetization (i.e., monetization risk, here the likelihood that specific carbon credits will be grandfathered into a US cap-and-trade system in 2015).

Source: Climate Wedge Ltd

In the short term, environmental and low-carbon investment strategies focused on physical revenues will continue to prosper: efficiency measures, renewable infrastructure build out, as well as clean energy sources that are nearing cost competitiveness with fossil energy. The bond-like nature of these investments also will be suitable for leveraged strategies and traditional fixed income-focused investors (so long as technology risks have been baked out of the system).

Synthetic revenue streams, on the other hand, face a period of continued uncertainty, until there is resolution in the policy disorder, either by a future international climate agreement or more loosely coordinated regional regulations. The zero-value/negative-return profile eliminates synthetic revenue streams as a stand-alone opportunity for all but the most risk-tolerant investors, such as those accustomed to investing in venture capital, mining stocks, or option-like strategies.

The policy fragmentation resulting from Copenhagen does provide some measure of diversification of monetization risk for investors open to global asset allocations. But in general, investors should focus on strategies that develop renewable or environmental assets, which will generate both physical and synthetic revenue streams, as opposed to simply trading synthetic credits. In this case, the environmental attributes become an equity kicker to otherwise modest, but steady physical returns.

In a world of generally increased uncertainty, the overall trend of increased value from environmental strategies provides investors with room for optimism in the decade ahead. Those investors with a long time horizon and a keen eye for value from both physical and synthetic revenue streams will be well-placed to manage the near-term uncertainty and take advantage of opportunities resulting from the global transition to a low-carbon economy.

Biography

Alex Rau is a founding partner of Climate Wedge Ltd, an independent firm providing carbon finance and emissions trading related advisory and asset management services, and pursuing principal investments and project development in the carbon markets. Alex has nearly a decade of experience in carbon finance, emissions trading, and environmental commodities. He was previously part of the Climate Change Services team in PricewaterhouseCoopers's Energy Corporate Finance practice in London, developing and structuring portfolios of carbon assets during the early stages of the Clean Development Mechanism market as well as designing Kyoto response strategies for multinational corporations. Alex has worked with numerous clients such as Cheyne Capital, McKinsey & Company, Rio Tinto, News Corporation, Electricite de France, the California Public Employees Retirement System (CalPERS), and CSIRO on carbon-related issues. He also coauthored the original version of the Voluntary Carbon Standard, the most widely accepted trading standard for non-Kyoto carbon assets, and has published in journals ranging from *Science* to the *Harvard Business Review*. Alex has a Ph.D. in physics from Oxford University, a B.A. from Cornell University, and is a CFA charterholder.



How Copenhagen Paved a Bright New Path for Sustainable Investing

Russell Read, PhD, CFA

Chairman and Managing Partner, C Change Investments

The widely held perception among many environmentalists, policymakers, technologists, and green investors is that the recent summit in Copenhagen was a disaster, potentially setting back international environmental policy for years. However, the reality going forward may be quite positive for sustainable investing, and Copenhagen may come to be viewed increasingly as *the* critical inflection point for environmental policy.

How so? Although the Kyoto Protocol of 1997 established a template for international coordination among many nations, it had also become increasingly clear that future agreements could not simply expand on the Kyoto model, given that emerging markets countries had been excused from meeting many of the binding emissions targets, measurement and incentives had proved problematic, and key countries like the US had simply elected not to participate. Indeed, the Kyoto Protocol had likely been much more successful in shifting *where* greenhouse gases are produced rather than actually controlling *how much* total emissions are produced.

Despite the limitations inherent in the Kyoto Protocol, many policymakers had clung to the hope that Copenhagen would simply ratify and expand the Kyoto framework. Indeed, the theme of the pre-Copenhagen meeting at the United Nations in September was “seal the deal,” which conveyed neither openness to new ideas nor willingness to consider new directions.

In spite of this reticence, the Copenhagen Summit had the immediate impact of making regional solutions a more practical approach to controlling global greenhouse emissions. Regional solutions have the virtue that they can meet the specific needs of key countries and regions such as China, the United States, India, and Europe, but also face the challenge of greater potential complexity in international coordination. What became especially striking at Copenhagen, however, was that in contrast to Kyoto some 12 years earlier, virtually all conference participants were credibly committed to improving the world’s overall greenhouse footprint. In this sense, Copenhagen has already proved to be the essential ingredient in allowing a coordination of regional solutions to move forward.

So what do these regional solutions look like? Although it is too early to tell what the final set of incentive systems will look like for every country/region (especially for the US), Europe and Japan will continue to develop their regional cap-and-trade systems, and

China has committed to lower the energy intensity of its GDP by 45%. In contrast, solutions for the US—including utilities-based systems (patterned after the very successful acid rain cap-and-trade system), building energy efficiency initiatives, and consumption-based incentives—can now be developed in ways that make the most sense for the US economy. Before the Copenhagen meeting, progress towards creating effective regional solutions had simply stalled.

Unlike the adoption and implementation of the Kyoto Protocol that was incomplete and had limited effectiveness, the regional solutions made possible by the Copenhagen Summit are likely to be both more comprehensive and have much more rapid implementation. For example, a utilities-based national renewable power system could be implemented in short order in the US to the extent it leveraged the existing framework for the acid rain cap-and-trade system. In 2002, *The Economist* proclaimed that the acid rain cap-and-trade system had been “probably the most green success story of the past decade” by reducing sulfur dioxide (SO₂) emissions by over 25% and ambient SO₂ concentrations by 40% at an estimated annual cost average of only \$1.8 billion.

This utilities-based cap-and-trade system for renewable power could now be applied in the US, for example, to replace the hodge-podge of state renewable power targets with a more efficient and effective national standard. Such a national system would result in torrent of new energy-based projects (including renewable, nuclear, and carbon capture and storage) in exactly those regions and for those utilities where they are most economically advantageous. Moreover, the experience of the acid rain cap-and-trade system proves that the national incentive market is necessary for such projects to be initiated in the most cost-effective and sensible manner possible.

Although such utilities-based solutions are natural, effective, politically viable, and low-cost approaches to addressing important emissions issues in the US, such solutions could simply not be part of the political dialogue prior to Copenhagen. Rather than being a setback for controlling the world’s greenhouse emissions, Copenhagen thus represents the essential breakthrough, allowing effective country/regional solutions to develop and thrive.

Biography

Mr. Read leads C Change Investments which is dedicated to identifying, developing, and commercializing game changing technologies related to energy and natural resources. Prior to founding C Change, Mr. Read served as Chief Investment Officer of CalPERS, North America’s largest pension fund, where he spurred the successful investment of over \$3 billion in green-related technologies and projects. He is a member of the Board of Governors for the New York Academy of Sciences and has (Statistics) undergraduate and (Finance and International Business) masters degrees from the University of Chicago and his (Political Economy) doctorate from Stanford University.



What Does Copenhagen Mean for Investments in Low-Carbon Technologies?

Jürgen Weiss, PhD

Principal and leader of the climate change practice of The Brattle Group

It is difficult not to call the outcome of the Copenhagen conference a failure from a political perspective. But it is unclear how much this has shifted the appetite for investments in low-carbon technologies. It was reported that clean-tech stocks suffered following the conference, indicating there was likely some downward adjustment of the investment community's expectations for the profitability of companies in the clean-tech space.

However, since Copenhagen is far from being the first example of wavering and fragile legislative and regulatory commitments to climate change, it is also unrealistic to think that a successful conclusion to the negotiations would have meant private capital fully trusted that any agreement reached there would mean reliable long-term price signals to support low-carbon technologies.

Theoretical arguments clearly support government intervention in the climate change space through measures on both the supply and demand sides. Market failures exist, after all, on the research and development, deployment (otherwise known as “the Valley of Death”), and the demand sides, due to the externalities of greenhouse gases. However, it is questionable how effective government intervention is (or is expected to be) from the perspective of a potential investor. After all, government intervention is rarely, if ever, the result of rational economic analysis, and is more likely driven by a messy political process with often very poor and uncertain outcomes.

The consequence is too-little investment in low-carbon technologies relative to some contemplated optimal policy framework. Of course, we should continue to look for policy mechanisms that result in more rational and predictably stable regulatory frameworks, which, in turn, would lower the riskiness of investments that at least partially depend on price signals tied to government regulation. But, for now, investing in low-carbon technologies needs to take place in an environment with continued uncertainty regarding the ability of the political process to create stable price signals and related regulatory frameworks. I believe this suggests that the most-promising areas for investments are those that don't primarily (or exclusively) depend on fragile regulatory support, but rather are (also) driven by non-climate-related opportunities.

Among the low-carbon technologies on the way, some will ultimately be successful whether or not we ever come up with meaningful climate treaties or even meaningful domestic climate legislation. For instance, the changing supply and demand balance for oil suggests that renewable substitutes for oil will be able to count on a huge market even without a carbon price, and the supply and demand dynamics may provide enough signs that oil prices will increase over time. Furthermore, some power-generation technologies, such as solar, are on a path towards grid parity and will ultimately prove disruptive to the existing mix of power generation, again without carbon pricing or renewable portfolio standards. Additionally, battery innovation will make electric cars more practical, and electric cars have the potential to be much cheaper to drive than cars powered by internal combustion engines, even without any price on carbon. I am hopeful that progress can be made in those areas that have the potential to solve our climate problem almost as a byproduct of solving other problems.

However, one further caveat is merited. Unfortunately, the regulatory incentive structures for new and environmental technologies resulting from the political process may not only be too weak to provide meaningful support for those technologies, they may provide subsidies for the *wrong* technologies. The US backing for corn-based ethanol is a recent example of this problem and it is one that points to an important consideration for potential investors in low-carbon technologies. Successful investments in this field may not only have to be viable in the absence of meaningful carbon prices (or related support), they may also need to be able to survive in an environment in which inferior solutions receive subsidies to push some powerful political group's pet technology. Therefore, successful investment in low-carbon technologies in the absence of a relatively stable and well-defined regulatory framework post-Copenhagen will not only require an understanding of which technologies are least dependent on stable carbon prices and related incentive structures, but also of the political pressures to favor, at least in the near term, technologies that may not be optimal from a purely technical or economic perspective.

Biography

Jürgen Weiss is a Principal with The Brattle Group, an international economic consulting firm, where he heads the firm's climate practice. He specializes in climate change and carbon market analyses, renewable energy, and electric utility economics. He advises clients on climate change policy, strategy and risk, changes in the value of existing assets, integration of renewables, market design and performance analysis, and efficient retail incentives and rate design. Dr. Weiss has consulted and written substantially on issues related to carbon pricing and the demand side of electricity markets, including topics such as efficiency, conservation, storage, retail rates, renewable power, and Renewable Portfolio Standards.

Prior to joining The Brattle Group, Dr. Weiss was a co-founder and managing director of Watermark Economics. In addition, he was previously the managing director of Point Carbon's global advisory practice, a director at LECG and a consultant with Booz. He holds a Ph.D. in business economics from Harvard University and an MBA from Columbia University.



The Multi-Decade Marathon: Reducing Greenhouse Gases

Christopher Woods, PhD

Investment Consultant

Twenty years ago, I participated in a pan-European project sponsored by the European Commission (EC) to evaluate the lowest-cost methods of reducing greenhouse gas emissions. The project built on earlier work on the cost-effective reduction of sulphur dioxide (SO₂) and nitrogen oxide (NO_x) emissions and involved the collection of data on the energy costs and carbon dioxide (CO₂) emissions of both conventional and alternative energy-producing technologies, and the costs of implementing various energy-efficiency technologies. The data was fed into a vast linear program that determined the most cost-effective way to reduce CO₂ emissions given forecasted energy needs.

The project was ambitiously broad in scope, but nevertheless suffered deficiencies in its design. The costs of alternative and renewable energy technologies were known with even less certainty than they are now; just as with portfolio optimizers today, garbage in meant garbage out. Further, the project focused solely on the costs of production, ignoring the even less certain, but potentially much higher costs of the environmental damage caused by high emissions. Unlike SO₂ and NO_x emissions, the damage from CO₂ was not quickly visible in scarred buildings, poisoned children, and dying forests. Nevertheless, the project clearly showed that the most cost-effective action was to reduce energy demand rather than increase alternative supply.

Several examples of energy-saving technologies were highlighted that could be implemented at negative cost. It was a mystery to us then, as it may still be to efficient markets proponents today, that supposedly rational, profit-maximizing consumers would refuse to invest in positive net-present-value projects. With the benefit of hindsight, and the lessons of behavioural economics, we might rationalize that homeowners would be reluctant to invest in efficiency technologies if the value of the investment wouldn't be reflected in the future selling price of their homes. To overcome this, some form of "nudge" would be required, for example the UK homesellers' mandatory Home Information Packs, which summarize homes' energy efficiency, and which now must be obtained by all house sellers in the UK.

In the 1990s, the EC decided to focus on a corporate nudge and moved to create an emissions trading scheme. The great advantage of a permit-based scheme was that the cost-benefit trade-off could be left to the emitters to calculate, not to a central body of researchers. And, as a consequence, the price set for the emissions permits could adapt in line with evolving policy goals.

Two decades later, it seems the world has not moved on; a global concord to limit emissions remains elusive. The great sense of excitement we felt as scientists at the time has been replaced with a pervasive sense of fatigue. There is fatigue amongst politicians who, worn down by late nights at Copenhagen, see no votes in advocating policies with uncertain and long-term payoffs. There is fatigue amongst voters who believe that big government is obsessed with creating more regulation and is incapable of making good decisions. There is fatigue amongst consumers who feel hectored about making changes to their lifestyles when their immediate concern is for their jobs. And there is fatigue amongst our scientific successors who, surprised at finding themselves at the focus of a global debate, have discovered that the press would rather give undue attention to a rare, but sloppy, factual error in a report and a naive email exchange, instead of the great factual body of work that underpins the essential argument.

To this agglomeration of climate change fatigue, we might add a similar level of financial system fatigue. The world has just gone through one of the greatest financial busts of all time in which an artificially low interest rate environment promoted a leverage-induced boom in asset prices. Whilst the music kept playing, everyone enjoyed the party, but then the dancing emperors were found to have no clothes and leverage rapidly left the building.

Once leverage vanished, smart investors—those still standing—recognized that asset prices had become sufficiently depressed to make it a good time to go “risk-on.” Those who did reaped handsome returns, but now, those still in the trade must worry what the future holds as budget deficits start to translate into higher taxes and yields, and central banks debate the appropriate moment to turn off the liquidity taps.

Where does this leave the future of environmental investing? Those who may once have hoped for a new environmentally themed boom, similar to those for railways in the nineteenth century and the internet in the twentieth, are likely to be disappointed. Similarly, those hoping that a global agreement to tax emissions will yet emerge in Mexico with the potential to suddenly transform unprofitable environmental technologies into profitable propositions likely will also be disappointed.

Instead, investors must do what they, as distinct from traders, should always have been doing: focus on the long term. This means all investors, large or small, should form their own view on the probability and consequences of climate change, and adapt their investment stance accordingly. Institutional investors, particularly those with long

horizons, should engage with companies that are vulnerable to climate change, perhaps because their operations will suffer as the environment changes. Investors should equally engage with companies with potential technology solutions, keeping them grounded and not reliant on a putative global commandment that will limit emissions and so make their technology profitable. Investors without the requisite size to engage with public companies may wish to avoid the lottery of the public equity markets and instead engage with earlier-stage companies that are developing energy-efficiency technologies.

And all investors may wish to look in the mirror before complaining too much about the disappointments of Copenhagen. As we showed 20 years ago, the biggest impact can come from the mass adoption of small actions: more cycling and walking, less car use; more home insulation and biomass-fired boilers, less oil-fired heating; more domestic solar, wind, and water electricity generation, and less reliance on central generators adopting these technologies. Installing smart meters and paying attention to energy ratings when replacing appliances will be a part of reducing our profligate consumption. Consumers may be hesitant working out the return on these investments, but there is no reason for professional investors to be the same. In the absence of global political leadership, this is one global problem that needs to start with local solutions.

Biography

Chris Woods is an independent investment consultant, currently retained by FTSE Group where he sits on a number of FTSE Committees and advises on new product developments.

Prior to becoming a consultant, Chris held a number of senior positions in the asset management industry including Chief Investment Officer of Man Global Strategies, a division of Man Group plc, and Chief Investment Officer, SSgA London and Chief Investment Officer, SSgA Capital Management LLC at State Street Global Advisors.

Before moving into finance, Chris was a scientist at the UK Atomic Energy Authority's Harwell Research Laboratory. Here he conducted pure research into atomic collision physics and applied research into ion-surface interactions. After a stint in the Laboratory's commercial department, Chris joined the UK Government's Energy Technology Support Unit where he collaborated on the European Commission project referred to in his article.

Chris has an MA from Cambridge University and a D.Phil from Oxford University. The transition to finance was made with the help of an MBA degree from London Business School.



Green Energy from the Blue Ocean

James A. Yoder

Dean

Woods Hole Oceanographic Institution



Charles H. Greene

Director

Ocean Resources and Ecosystems Program, Cornell University



Christopher M. Reddy

Director

Coastal Ocean Institute, Woods Hole Oceanographic Institution

“Energy is the lifeblood of modern society.” But it doesn’t all have to be based on fossil fuels. To mitigate global warming, our future world will have to rely on a mix of strategies—including nuclear power and new non-carbon sources such as wind, solar, wave, tidal, and geothermal. Geo-engineering will also be required if we are to achieve the goal of reducing carbon dioxide (CO₂) concentrations to 350 parts per million (ppm) from today’s level of 387 ppm. The ocean, as well as ocean scientists and ocean engineers, have a role in all of these future energy strategies.

Northeastern states are keenly interested in offshore wind farms because the strong and low-turbulent winds over the coastal ocean from Cape Hatteras north into the Gulf of Maine are ideal for this renewable energy source. Installing large offshore wind farms will provide investment opportunities in construction companies as well those involved in land-based and offshore support. Governor Carcieri of Rhode Island (RI), whose motto for new sources of energy for his state is “spin, baby, spin,” is pushing hard to have RI become the first state to have power provided by an offshore wind farm. Deepwater Wind initially plans eight turbines near the coast of Block Island, RI with more ambitious plans

to follow. Governor Carcieri believes that if RI can show investors that offshore wind power works, then RI could become the center for manufacturers of wind farm components serving the entire East Coast.

Chinese companies have quickly become the leading domestic producer of wind turbine blades to support the very aggressive Chinese wind power initiative. But there are other components for offshore wind farms besides just the blades that will provide additional investment opportunities. American Superconductor Corporation (AMSC), whose subsidiary Windtec builds complete electrical systems (control, converter, and pitch) for wind turbines, announced in January 2010 that it will design and co-develop five-megawatt (MW) offshore wind turbines with one of China's largest wind turbine manufacturers, Dongfang Turbine Company, Ltd. Thus, US companies are involved in the US and abroad in the offshore wind power industry providing domestic investment opportunities for those who see potential in this source of renewable energy.

Nuclear power is gaining new attention and was specifically mentioned in the US President's recent State of the Union speech. Russia is considering small nuclear power plants deployed on 150-meter-long non-self-propelled floating vessels with the first to be completed by 2012. Each vessel can provide up to 70 MW of electricity and up to 300 MW of heat—enough to serve cities of 200,000 people. One advantage of small plants is that they can be deployed closer to the users than large, land-based plants, thus reducing transmission losses. Small, floating nuclear plants may seem like a far-fetched idea, but more than 150 nuclear-powered vessels have been built and many are operating today. Thus, there are well-tested designs, as well as a database available for risk analysis. The same technology could also be developed for energy-intensive desalination. More than half of the world's population lives within 200 kilometers of the coast and will be increasing its demands for power and fresh water. Successful and safe designs for small, floating nuclear power and desalination plants potentially have a large international market.

Geo-engineering approaches that extract carbon dioxide from the atmosphere or otherwise mitigate the warming effect of greenhouse gases are another strategy to help stabilize CO₂ at 350 ppm by the end of the twenty-first century. Geo-engineering was the elephant in the room at the recent Copenhagen Summit. We are particularly enthusiastic about growing marine algae in facilities on land. Marine algae produce at least ten times more lipids (or oils) per acre than soy and other terrestrial crops, may not require freshwater, use plant nutrients very efficiently, and can be grown on non-arable land. Calculations show that growing algae on 7% of the non-arable land projected to be available in 2050 could produce enough biofuels to replace all of the oil needed in the transportation sector. These estimates have been extrapolated from small-scale demonstration projects (acres or less). Transitioning to large-scale production of algal-based biofuels will face numerous hurdles. Ocean scientists with their vast experience in

coastal ecosystems and phytoplankton ecology are well-suited to overcome these challenges.

Algae cultivation can have a significant environmental impact, such as a demand for fertilizer. Using wastewater as a source of plant nutrients could offset much of the environmental burdens associated with algae cultivation. Assuming that algae can be grown and then burned with little or no net increase in greenhouse gases or other significant environmental impacts provides a strong argument that algal-based fuels should be excluded from carbon caps or carbon taxes.

As for all technologies, the impact of constructing the type of facilities mentioned above will require assessing and monitoring environmental impacts. New sensors and ways to remotely handle and interpret large amounts of real-time sensor data will be required. Companies involved with developing, installing, and operating sensor networks in the ocean and in land-based algal farms to support new energy technologies also offer investment opportunities.

Our energy portfolio must be diversified to reduce society's carbon footprint on the Earth. The ocean can provide a diverse array of opportunities. Investments in ocean-based energy sources are needed, and ocean scientists and engineers will be essential for progress in this endeavor of such importance to society.

Biographies

Jim Yoder is currently the Vice President for Academic Programs and Dean at the Woods Hole Oceanographic Institution (WHOI). Before moving to WHOI in 2005, Dr. Yoder was a Professor at the Graduate School of Oceanography (GSO), University of Rhode Island, where he conducted research, taught graduate courses and advised MS and Ph.D. students. He served 5 years as GSO Associate Dean in charge of the graduate program in oceanography and 1.5 years as Interim Dean of the School. Dr. Yoder has also held temporary positions in the Federal Government including as a Program Manager at NASA Headquarters (1986-1988 and 1996-1997) and as Director of NSF's Division of Ocean Sciences (2001-2004).

Dr. Charles Greene is Director of the Ocean Resources and Ecosystems Program and a Professor in the Department of Earth and Atmospheric Sciences at Cornell University. He received his PhD in Oceanography from the University of Washington in 1985 and was a postdoctoral fellow at the Woods Hole Oceanographic Institution (WHOI) in 1985-86. Dr. Greene maintains a visiting scientist position at WHOI and coordinates the new Cornell-WHOI Masters of Ocean Science and Technology (MOST) Program. Presently, his primary research focuses on assessing the impacts of climate forcing on

marine ecosystems. He is also working with colleagues at Cornell's Energy Institute on new approaches to algal bio-energy with carbon capture and storage.

Christopher Reddy is the Director of the Coastal Ocean Institute at Woods Hole Oceanographic Institution. He studies the production and environmental impacts of bio- and fossil fuels. Chris has advised members of the US House of Representatives and Senate, Department of Homeland Security, Department of Defense, and the President's Council on Environmental Quality on renewable energy sources. He received his BS in chemistry from Rhode Island College and PhD in chemical oceanography from the University of Rhode Island.



Copenhagen Discord: Bottom-Up Investing in a Global Landscape

Dimitri Zenghelis

Advisor to Cisco Systems; an Associate Fellow in the Energy, Environment and Development Programme of the Royal Institute of International Affairs in London; and a Senior Fellow at the Grantham Research Institute, London School of Economics

One of the original aims of the Copenhagen Summit was to negotiate an agreement that would be in place when the first commitment period of the Kyoto Protocol expires in 2012. However, against a backdrop of little shift in positions over 2009, denunciations from developing countries in Barcelona in November, and slow progress on US climate legislation, it was quickly acknowledged that there would be no legally binding treaty. In the end, what we got was the Copenhagen Accord, a minimalist agreement made by 29 countries through their Heads of State. From a legal perspective, the United Nations Framework Convention on Climate Change (UNFCCC) parties agreed only to “take note” of the Copenhagen Accord, which in essence means very little: it neither acts upon nor agrees with its content. As a matter of international law, the Copenhagen Accord does not bind the Contracting Parties to the UNFCCC to anything. It amounts to less than the sum of most ambitious deals already agreed upon on the table.

Nevertheless, if looked at as a stepping stone towards an agreement in 2010, then the political declaration was encouraging. With the right signals and with a clear US lead, China could have gone further. Three years ago, the notion of major developing countries taking on mitigation plans of their own, with or without targets, would have been unthinkable. Now that this has been agreed to in principle, the stage is set for eventual targets. The Copenhagen process and the Summit itself have also generated, for the first time, commitments on emissions reductions from the world's two largest emitters, China and the US, and they have both acted to produce proposals for action. These two results also represent an important breakthrough, even though these targets will not be subject to an international compliance mechanism like targets under the Kyoto Protocol.

Because it was informally reached in the margins of the Conference of Parties (COP) to the UNFCCC, the Copenhagen Accord can be regarded as a political declaration of intent from a number of well-identified countries. However, these 29 countries matter. They include all the major emitters (US, China, Brazil, South Africa, and India), and representatives from all UN regional groups (including the Least Developed Countries and the alliance of Small Island States) accounting for more than 80% of global emissions. By contrast, Kyoto Parties account for only 30% of emissions with the US and

China notably missing. Additional countries are likely to associate themselves with the Accord.

The approach is more country-driven and “bottom-up” than would have been the case with a comprehensive legally binding treaty. On the one hand, this frees countries to pursue domestic approaches immediately knowing they will be recognized. On the other hand, success depends on the degree to which countries take the lead in a race to develop new technologies rather than succumb to lowest-common-denominator politics.

Some positive proposals did emerge.

1. **Monitoring, Reporting, and Verification.** Agreement was reached for the first time on international monitoring and verification of developing countries’ actions, which subjects all reductions to “international consultation and analysis.”
2. **Developing Country Finance.** The Copenhagen Accord recognized that developing countries must receive significant financial assistance to tackle greenhouse gas emissions (GHGs) and to adapt to those impacts of climate change. Prime Minister Meles Zenawi of Ethiopia, speaking for the African Union, put forward a plan of financial support built on analytical support from Lord Stern. This included the collective commitment by developed countries to provide new and additional resources approaching \$30 billion for the period 2010-2012. Developed countries committed to a goal of jointly mobilizing \$100 billion a year by 2020 to address the needs of developing countries. The funding is expected to come from a wide variety of sources: public and private, bilateral and multilateral, including alternative sources of finance. A “significant portion” of such funding is earmarked to flow through the Copenhagen Green Climate Fund accountable to the COP.
3. **Reducing Emissions from Deforestation and Degradation (REDD).** Parties to the Accord agreed on the need to provide positive incentives to halting deforestation through the immediate establishment of a REDD mechanism, to enable the mobilization of financial resources from developed countries. However, the UNFCCC work on this issue was not finalized, so there is uncertainty about the nature of this mechanism at this stage.
4. **Technology.** A technology mechanism will be established to accelerate technology development and transfer in support of adaptation and mitigation that will be guided by a country-driven approach and be based on national circumstances and priorities. As is the case for the REDD mechanism, there is little clarity on how the technology mechanism will work. It most likely represents the institutional structure that monitors, advises, and guides the allocation of the technology finance to developing countries.

5. **Commitment to a 2°C Target.** There was also reaffirmation of the necessity to reach a deal sufficient to keep a strong likelihood of temperatures not rising above the 2°C target relative to preindustrial times. This was not new, and the partial irony was that such a commitment would require action significantly more ambitious than anything already on the table.
6. **Mitigation Commitments in Appendices.** Annex I (developed) Parties have committed to implement individually or jointly quantified economy-wide emissions targets for 2020. These fall short of the 2020 target of 44 billion tonnes necessary to have a shot at a 2°C target by several billion tonnes. Non-Annex I (developing) Parties will implement mitigation actions, outlined through national communications every two years. They will be subject to domestic measurement, reporting, and verification. Nationally Appropriate Mitigation Actions (NAMAs) seeking international support will be recorded in a registry along with relevant technology, finance, and capacity-building support.

With the focus on a bottom-up process, it is easy to forget why a global deal is still in everyone's interest. A global accord can give domestic action much greater traction, even if the agreement is limited to a smaller group of major emitters (as with the Accord).

1. It establishes a common purpose and makes it much easier for politicians anywhere to persuade the public that their efforts form part of a collective global effort.
2. It allows for the diffusion of competitiveness concerns, which tend to be overblown but politically very influential, and establishes conditions for a 'race to the top' on deploying and exporting climate technologies rather than a 'race to the bottom' in avoiding action for fear of job losses.
3. It allows for common methodologies and institutions, and makes emissions reduction more efficient. For example, linking or allowing international access to carbon markets, enables the private sector to cost effectively pick out the most efficient opportunities for emissions reductions, regardless of where they reside geographically.

The UNFCCC remains the primary post-Copenhagen global process, with the main event being Mexico COP in November/December 2010, (though there is talk of increasing the scope of the Bonn "intercessional" scheduled for June). However, given the problems of attaining a strong detailed proposal for action to be drafted from meetings of delegates of 193 Parties, and in view of the fact that strong radical action on climate change cannot easily be constructed on the basis of unanimity, further simplification and consolidation

of process is likely to be required. With the Accord to be “operational immediately” and delivering substantial amounts of finance by 2012, the pace needs to pick up quickly.

So what does all this mean for investors? Overall, the Copenhagen outcome provided a weak signal to investors, being widely perceived as a missed opportunity. The Accord omitted firm targets, many of which had already been agreed to in principle. These included 50% reduction of global emissions by 2050 and a peak in emissions by 2020, as well as political reaffirmation of the commitment by developed economies to reduce emissions by 80% by 2050 (figures all expressed relative to 1990 levels).

Businesses continue to need a clearer sense of direction to commit the substantial investments required to shift towards a low-carbon economy. Energy companies like E.ON and Centrica warned that they would hold off investing the tens of billions of pounds to build expensive new nuclear reactors and clean coal plants at today's carbon price. But broader evidence suggests that the private sector did see Copenhagen as part of a slow but positive forward step. Although the WilderHill New Energy Global Innovation (NEX) Index of clean energy stocks fell in the immediate aftermath of the Conference, shares across a range of sectors rose from December 1 to early January with the NEX rising a further 4.1% in the first week of 2010, before falling back again amidst weak global trading.

In the days immediately following COP 15, the European Emissions Trading Scheme benchmark price (for December 2010 contracts) tumbled by more than 8% to €12.41 and has recovered only slowly since. This doubtless reflected a correction in market expectations, but in the context of recent carbon price trends, the impact seems marginal. However, national policies still present substantial investment opportunities. Deutsche Bank has identified 270 climate policies around the world, including Renewable Portfolio Standards in various US states, feed-in tariffs in Europe, and energy-intensity targets in China—all of which have the potential to drive profitable new markets (Deutsche Bank 2009).

Perhaps most worryingly, from a global business perspective, the Accord failed to broaden access to global carbon markets. Little clarity was provided in respect to new market mechanisms for post-2012, (although the Accord did record a decision to pursue various approaches, including opportunities to use markets to enhance the cost effectiveness of mitigation). This is a major omission as the private sector will ultimately be the main source of international finance and technology transfer. Indeed, focus on bottom-up actions, especially if heralding the end of the Kyoto Protocol, calls into question the practicality of integrating broad global carbon markets. New implementation mechanisms to link carbon markets or allow one-sided access will need to be found, replacing and scaling up the Joint Implementation (JI) and Clean Development Mechanisms (CDM). A single international carbon market is looking less and less likely, with a patchwork of regional price mechanisms likely to emerge instead.

In short, Copenhagen did not provide the step change necessary to forge a critical momentum in favor of low-carbon investments. Doubts about the speed of the global transition to a low-carbon economy will continue to delay clean-tech deployment. But it did at least clarify some key national 'bottom lines' on which progress can now be made. The focus is now country-level action, as governments rebuild trust in the science and make the low-carbon investments tangible by pursuing quick wins such as green stimulus plans, smart energy-efficiency measures as well as carbon pricing, standards, regulations, and carbon technology support. But in the end, global action requires international collaboration. This must acknowledge that US levels of consumption and China's 30-year economic miracle have come at the cost of a rapidly deteriorating environment. China and the US continue to adopt positions that are unsustainable; they cannot avoid their responsibilities indefinitely.

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Biography

Dimitri Zenghelis recently joined Cisco's long term innovation group as Chief Economist of the Climate Change practice in the Global Public Sector organization. He moved from heading the Stern Review Team at the Office of Climate Change, London. Previously, he was a senior economist who has spent a year working with Lord Stern on the Stern Review on Economics of Climate Change, commissioned by the then Chancellor Gordon Brown. He continues to act as an external advisor to the UK Government and works closely with Lord Stern at the LSE where he is a Senior Visiting Fellow at the Grantham Institute on climate change. He is also an Associate Fellow at the Royal Institute of International Affairs (Chatham House). Dimitri joined HM Treasury in 1999 providing economic advice for the UK Government as Head of Economic Forecasting and Head of the European Monetary Union Analysis Branch.

Prior to joining HM Treasury Dimitri has worked as a consultant with Oxford Economic Forecasting, and was a Senior Economic Advisor for the Liberal Democrats, House of Commons, London.

His university education was at St Hugh's College Oxford and Bristol University. Dimitri is an artist and published photographer, his interests range from architecture to philosophy of science and despite being born with two left feet, he enjoys rock climbing, skiing and nitrox scuba diving.