Gleneagles Dialogue, Berlin, September 9-11, 2007

Massive Climate Technology Innovation: A New Geometry of Complementary Strategies Post-2012

By Lewis Milford, President, Clean Energy Group, USA

Summary

Global climate change demands a new geometry of low carbon, technology strategies to complement cap and trade. Cap and trade alone will not stabilize carbon emissions. A robust process that establishes complementary policies, innovation strategies, and finance mechanisms that support rapid development and deployment of low carbon technology innovation must be initiated now to serve as a twin pillar of the post-2012 climate framework.

The complementary technology process must focus on innovative policies and strategies—collaboratively developed among the best and brightest thinkers and decision-makers in many fields—to both scale up existing low carbon technologies and create "breakthrough" disruptive technologies in many energy sectors, including renewables and CO_2 capture and storage. The current research, development, and deployment system in the energy field will not be enough to do the job. Willing partners must adopt a new, more nimble and effective cooperative framework from other market areas. We must develop more aggressive policies and strategies that can be implemented individually or jointly and that involve both the private and public sector in efforts to accelerate the innovation and deployment of low carbon breakthrough technologies at the scale and scope required to result in climate stabilization.

The international community must dedicate as much intellectual and financial capital to develop these complementary technology approaches as it does to cap and trade systems. This challenge requires reliance on new thinking from many market disciplines to spur technology innovation. Other industries facing technology challenges have developed new approaches to technology innovation that have not been applied to energy. Indeed, we need to rethink the energy research, development, and deployment process itself to create a new geometry of technology innovation and product development strategies to meet the climate challenges of the 21st century.

A complementary "climate technology innovation process"—which could be pursued effectively through the G8 Gleneagles dialogue process and other related multilateral initiatives, feeding into the post-2012 framework under the UNFCCC—requires three inter-related components described more fully in this brief paper:

1. *Technology policies, agreements, and other mandatory approaches that complement cap and trade, that commercialize new technologies, and that include but go far beyond voluntary strategies.*

2. *Distributed innovation strategies that purposely and proactively link together people across the product development continuum, from the upstream research community to*

downstream finance and commercialization experts, in order to accelerate low carbon technology change.

3. *New finance strategies that move emerging technologies from pilot projects to commercial scale deployment.*

Reasons for a Complementary Technology Innovation Track

> *The Earth's climate is nearing, but has not passed, a tipping point beyond which it will be impossible to avoid climate change with far-ranging undesirable consequences. . . This grim scenario can be halted if the growth of greenhouse gas emissions is slowed in the first quarter of this century.*
>
> Dr. James E. Hansen, Director, NASA Goddard Institute for Space Studies
> (December 6, 2005)

- We must closely match the enormous scale of the climate problem with the urgent need for large-scale commercial-ready energy technological solutions.

- We have very little time—about 10 to 15 years—to put global emissions on a path toward stabilization. Limiting warming to 2 degrees Celsius means stopping CO_2 emissions growth in the next decade with a rapid emissions descent to around half current levels by 2050—while projected global energy capacity is expected to grow three fold. If we are to meet world energy demands and stabilize climate change, *we must triple the planet's current energy-producing capacity by 2050, with all new additions to be carbon-neutral.*

- To achieve that unprecedented energy future, simply scaling up energy efficiency, renewables and other existing technologies alone will not offset the expected exponential increase in emissions from global energy growth. While we must scale up these readily available technologies, we also need to develop and demonstrate new technologies that can be rapidly deployed and serve as powerful new breakthroughs in the next two decades; developing new carbon free coal technologies is critical to long-term stabilization.

- Cap and trade price incentives alone will not call forth essential game changing technology innovation; cap and trade incentives are likely to only bring forward "on the shelf" least-cost technologies. To create massive innovation for new, more expensive breakthrough technology on the scale required, a portfolio of new and complementary technology polices and financing mechanisms will be required.

- *The optimal climate approach is to integrate complementary technology innovation strategies with emission caps; this is the most cost-effective path to climate stabilization because innovation can reduce the future costs of expensive "breakthrough" technologies, making future, tougher emissions caps easier to impose.*

New Technology Policy and Commercialization Strategies

- Despite the urgent need for this low carbon technological transition, not nearly enough is being done to develop complementary technology strategies. Academic discussions about technology innovation have not been translated into a practical climate strategy needed for the post-2012 framework.

- Many technology innovation strategies and approaches are emerging around the globe and must be incorporated into this post-2012 climate framework. These include short- and long-term no carbon emitting technology goals and targets, specific technology commercialization agreements, sectoral no-emissions goals, CO_2 and energy efficiency performance standards, niche market strategies, technology prizes, advanced purchase commitments, government procurement, new strategies to address intellectual property rights (IPRs), transition management polices, entrepreneurship activities, policies that bolster public and private research and development, and many other new and aggressive climate and energy strategies that require collective commitment.

- These new strategies go beyond the conventional approaches such as information networks, research, or demonstration projects that lack deadlines for commercial readiness and a clear support framework.

- An aggressive, complementary technology innovation approach is essential now. The Declaration of the 2007 G8 Summit in Heiligendamm recognizes this need for "an expanded approach to collaboratively accelerate the widespread adoption of clean energy and climate friendly technologies."

- These technology strategies can be developed nationally, bilaterally, or multilaterally, with new forms of linkages in a post-2012 framework. They need not be controlled by international regimes. Rather the foundation of a post-2012 framework should be policies, strategies and financing mechanisms that focus on "product-driven" and "distributed" models of innovation now common in other fields to accelerate commercialization of new technologies and scale-up of existing technologies in the next two to three decades. Applying alternative research and development models that are succeeding in other disciplines to climate technology will create new opportunities to increase market competition and address market failures.

- The purpose of a complementary technology policy and innovation strategy is to align emission limitation and reduction needs with the incentives to catalyze the delivery of scalable, commercial ready products. Climate technology programs must be comprehensive with deadlines for market readiness and flexible benchmarks for rapid program change if long-range plans fail. Market competition must be encouraged and market failures must also be addressed. The overarching goal of overcoming key barriers to greater scale and

innovation for select technologies cannot be lost in rigid program structures unable to respond nimbly to market needs and unexpected technological or institutional bottlenecks or opportunities.

- The post-2012 process must adopt a full range of short- and long-term commercial strategies for a selective group of market-ready technologies. To be most effective, this technology track must focus on massive scale up and commercialization of certain select technologies that require significant technological breakthroughs; these high-impact technologies would include the following five technology sectors: (1) CO_2 capture and storage (CCS); (2) biomass and biotechnology to improve the quality of biomass; (3) hydrogen systems; (4) renewables, including wind and solar power next generation systems; and (5) end use energy technologies. (Emerging areas of research such as nanotechnology may also offer as yet unrecognized opportunities.)

A New "Distributed Innovation" Strategy for a Climate Technology Transition

- Public interventions in the low carbon energy sector often have focused only on supporting information sharing networks that lack the incentives or infrastructure to drive massive innovation and then product development and deployment. To the extent public investments have extended beyond information sharing, they have largely supported long-term demonstration projects or prototype development. The current surge in venture capital is largely directed towards a relatively small number of sectors (e.g., solar); these investments are helpful but are insufficient to drive large-scale technology development in multiple energy sectors.

- The consequences of climate change are distributed globally; there is a global market failure to develop technologies at sufficient scale for a transition to a low carbon economy in the time required for stabilization.

- We propose a new global climate technology innovation initiative—a "distributed" model of climate innovation and commercialization—that will overcome these failures. Distributed innovation approaches bring together the people with the expertise needed to develop and deploy new technologies. Teams include people with business expertise to ensure that research and development are linked to viable commercialization strategies. Robust information technology tools support these teams, enabling people throughout the globe to collaborate together; the distributed innovation approach assembles the best people for a task regardless of their location. These strategies enable teams to tap innovative thinking from unexpected places; these tools could "open" the climate innovation process in the same way that a growing number of companies now supplement their own in-house research and development capacity in other areas.

- Given the capital intensive and competitive nature of the energy sector as well as the cross-border effects of climate change, innovative strategies for managing intellectual property

rights (IPRs) are needed to ensure strong participation of the private sector, while also ensuring that the benefits of innovation and carbon reduction are widespread. The initiative should include strong incentives that drive and accelerate product development and widespread deployment. This is not an information-sharing network or process designed to develop only demonstration projects or prototypes.

- Elements of this distributed innovation approach can be found in the information technology, industrial, agriculture, and health sectors. These approaches have been supported by companies, governments, and foundations. Through these efforts, NGOs, companies, universities, philanthropies and governments—working across sectors and transcending political boundaries—are solving global problems that have resisted market interventions for decades. These strategies are being used by Fortune 500 companies to develop new products and increase revenues and by governments and philanthropies to address global problems such as AIDS and food security in developing countries. Groundbreaking work is being done in these areas by foundations such as The Rockefeller Foundation and Bill and Melinda Gates Foundation.

- But surprisingly, these new approaches have never been applied to climate. We need to borrow lessons and promising new distributed innovation strategies from other fields and apply them to this climate technology innovation challenge; climate urgently needs new technology innovation approaches.

- The need for innovation is great—most current climate-related technology research programs involve long-term basic research that is not connected directly enough to commercialization pathways. The purpose of a new distribution innovation approach is to go beyond ubiquitous information sharing networks and conventional technology support mechanisms that have more often been ineffective: incremental, stove-piped, stymied by competing constituencies, and geared to single-point demonstration projects.

- In contrast, the driving objective for "distributed innovation" is to accelerate the widespread development and deployment of a specific technology; to identify barriers to those technology goals; to identify investment needs; and to create sustainable public and private models for rapid technology commercialization. This complementary "distributed" technology initiative would enable people to attack the problem from multiple intervention points including, but not necessarily limited to, technical, market and financial, policy, regulatory, legal, institutional, and intellectual property issues.

- Through the design of its infrastructure and incentive systems, the initiative would focus on product development and deployment by linking key players in the low carbon technology R,D,&D process; this will proactively connect the upstream research community (e.g. universities) with the downstream finance and deployment community (e.g., companies, investors, foundations, financial institutions and governments). Participants in these

distributed innovation projects would come from across the globe; teams of experts would be assembled around specific technologies and supported by a global innovation community.

- The initiative would include a diverse portfolio of technology strategies on different time scales—from short-term solutions to reduce emissions almost immediately to mid-range commercial opportunities in the next 5-10 years, to longer term, disruptive (or radical) innovations not yet imagined for energy—all designed to create the framework for a 50-year transitional plan *to stabilize greenhouse gas (GHG) concentrations in the atmosphere*.

A New Finance Strategy to Fund Breakthrough Technologies

- A complementary technology strategy requires an equally ambitious finance strategy. Moving promising new low carbon technologies from successful venture roll-out to large-scale deployment is a daunting challenge—and a critical need, if climate change is to be successfully addressed. While other industrial sectors face similar challenges, the energy sector has a unique and entrenched "locked-in" carbon infrastructure, requiring a massive investment to overcome technical and institutional inertia and shift to new low carbon energy solutions.

- Typically, professional project finance providers require new generating systems to have established 2–3 successfully operating commercial scale installations before they can be considered for routine (and relatively attractive) project finance terms. From the viewpoint of a start-up clean energy enterprise seeking to deploy its first commercial installation, reaching this level of operational maturity can be an insurmountable challenge. This financing dilemma is problematic if we are to support the billions (if not trillions) of dollars of new technological investment needed for a successful global low carbon energy transition.

- In its *Global Clean Energy Investment Overview*, prepared for the Clinton Global Initiative in September of 2006, New Energy Finance (NEF) highlighted the need to "develop mechanisms to support pilot projects which require (financing) but still have technology risk." And in his recent U.S. Senate testimony, NEF founder Michael Liebreich noted the "role for loan guarantees, or for other sorts of pooled technology insurance mechanisms or long-term state or federal purchase guarantees" to help close this commercialization gap.

- New finance tools will be needed for technologies from energy mitigation options, including carbon capture and sequestration, to second- and third-generation solar technologies, and extending to various innovation challenges required for agricultural adaptation and new technologies for resilient buildings and structures.

- There has not been sufficient coordinated and systematic thinking on how to address these larger scale-up finance problems, especially given the urgency of the low carbon energy access need. The low carbon technology deployment financing gap represents a critical issue in the effort to effectively address climate change and energy security. This issue calls for

urgent, creative, and long-term work to develop consensus proposals addressing these barriers to commercialization finance of low carbon technologies on a scale fitting the scope of this global challenge.

A Complementary Technology Process in the Post- 2012 Framework

- Cap and trade can continue to be negotiated through the UNFCCC and overseen by the UN. *However, a new complementary technology initiative can be developed and executed through a public-private partnership involving the G8 Gleneagles Dialog and other multilateral forums. This complementary technology initiative will inform and reinforce a comprehensive post-2012 agreement under the UNFCCC. A robust linkage between the Gleneagles Dialog, which provides a venue for Ministers representing the largest economies to dialogue and take action, and the proposed UNFCCC post-2012 climate process, which will bring all key stakeholders in the technology innovation process to the same table, will accelerate the establishment of an international technology innovation process over the next few critical years. Agreements reached through Gleneagles and other forums and initiatives can be "codified" in the UNFCCC post-2012 agreement.*

- As part of this post-2012 framework, there should be a dedicated, well-funded process committed to developing a "complementary climate technology policy innovation strategy" to scale up existing technologies and creating new "breakthrough" disruptive technologies needed for climate stabilization, including new financing tools for rapid commercialization. This process should focus on developing: 1) complementary technology innovation policies to cap and trade; 2) distributed innovation strategies for technology development and deployment; and 3) finance mechanisms that support commercialization.

- This process should enable all stakeholders—governments, companies, NGOs, academics and others—to work directly together. The process would create space outside the formal UN framework for all players in the value chain on select technologies to work toward accelerated product development, and thereafter feed into the UNFCCC as part of a comprehensive post 2012 agreement. Some of the lessons from the Montreal Protocol, which included the participation of the private sector, should be considered for climate.

- This process would create parallel, technology-based strategies, complementary to cap and trade, but not requiring a global, top down strategy for every technology innovation policy and approach. A robust and ambitious framework of product driven innovation for multiple key technologies would be established for developed and developing countries, with key milestones for commercial deployment. National and sub-national governments as well as other stakeholders would work together on joint technology policies and strategies through new mechanisms, including protocols, agreements and other approaches. An array of interconnected, parallel, and complementary approaches would emerge in a new climate change geometry.

- This process should recognize that entirely new technology implementation strategies are needed to match the scale of the problem with the need for massive technology innovation. Bold, new organizational and institutional mechanisms will be needed to meet these unprecedented technology challenges. Status quo networks, voluntary demonstration projects, technology transfer and information sharing, while useful, are insufficient to the task at hand. This new process should develop nimble and market responsive technology information organizations and other institutional systems to support this new global innovation framework.

- The process should complement cap-and-trade and be linked to the UNFCCC processes. How to structure and implement this complementary and linked approach—the strategic, organizational, and design challenges it entails—should represent a key part of a working plan for this complementary track for the next few years. To these ends, the same level of intellectual and financial capital that supported the design of the cap and trade system should be dedicated to creation of this complementary technology track; it should form the global basis for collective climate technology innovation and new technology policies in the next few critical decades.

- Such a complementary technology innovation process could be an important “bridging” strategy that enables developed and developing countries to commit seriously to participate in the post-2012 climate framework. It could well determine whether the stabilization of GHG emissions actually occurs in this century.