GHG Reduction Summit
Technology and Innovation Primer[1]

To cut greenhouse gas (GHG) emissions to targeted levels, new technologies will need to be disbursed on a vast scale. Historically, however, technology breakthroughs take decades to reach the mass market – entrepreneurs struggle to find much needed capital; investors painstakingly review the risk profile of new technologies and the potential return on their investment; IPR (intellectual property rights) is closely guarded; patents are created to prevent others from copying good ideas; regulatory changes are often required to encourage adoption; and end users, be they large energy companies or the average consumer, are hesitant to change from their existing technology.

The current research, development and deployment (RD&D) system in many sectors has produced many important and useful technologies over the years. However, this system is simply not well aligned to the task of the massive scale-up and technology innovation needed at the required speed to address climate change – the current system is characterized as underfunded, fragmented, lacking coordination and collaboration, disconnected from the market and lacking a strategy for addressing intellectual property rights (IPR) and finance issues, among other problems.

So how might we leverage and more efficiently coordinate existing physical and intellectual resources? One way is through distributed innovation, or DI.

Distributed innovation refers to the process of linking together numerous and disparate expertise in different institutions and countries, but united together in a single effort focused on product development and deployment. Business literature defines DI as "the process of managing innovation both within and across networks of organizations that have come together to co-design, co-produce and co-service the needs of customers."

The driving objective for distributed innovation is to accelerate the deployment of a specific technology by attacking the problem from multiple intervention points along the value chain, from upstream research to downstream deployment. DI involves addressing the technical, market, financial, policy, regulatory and legal issues that arise along this entire innovation chain. Distributed innovation uses creative approaches for reducing risks through targeted funding and finance strategies, and managing intellectual property rights in a manner that enables collaboration and preserves the power of the market and competition.

Distributed innovation does increase the speed of innovation and commercialization. It removes barriers between experts in specific disciplines that have typically been in "silos." It also bridges the public and private sectors. A review of existing projects using DI strategies concluded that well-structured distributed innovation processes result in reduced transaction costs and more efficient use of resources, among other benefits.

A distributed innovation strategy has three primary elements:

1. the use of internet-based open innovation tools,
2. coordinated funding and finance strategies and
3. intellectual property rights services.

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[1] Summarized from Clean Energy Group, *Accelerated Climate Technology Innovation Initiative (ACT II): A New Distributed Strategy to Reform the U.S. Energy Innovation System*, November 2009, http://www.cleanegroup.org/Reports/ACTII_Report_Final_November2009.pdf

The Use of Open Innovation Tools

The goal of DI would be to more effectively connect people who are encountering specific clean energy technology development challenges with "solution providers" who can help address those problems. Those posing the development challenges may be, for instance, engineers within small or large technology companies, government researchers or academics. The solution providers might include similar individuals as well as a range of other scientists and technical experts working outside of the energy sector. Open innovation platforms and other tools used to enable such collaboration are often called "matchmaking infrastructure." Such infrastructure would enable the potential of tens of thousands of people to review critical challenges and propose innovative solutions. A range of incentives would be employed, including financial rewards to solution providers and cash rewards or a negotiated value for intellectual property rights. More conventional tools, such as commissioned and competitive research projects, could also be utilized.

Such a technology infrastructure would facilitate effective, real-time collaboration among geographically dispersed players along the RD&D continuum, providing consumer-oriented market information to researchers, and provide product pipeline information back to the market makers. It would also breach institutional barriers and disciplinary silos.

Coordinated Funding and Finance Strategies

The second key element of a distributed innovation strategy is to focus on coordinating resources for funding (i.e., public money not seeking a return on investment) and finance (i.e., private capital seeking such a return) early on in the product development process. Typically, public sector funding tends to focus on upstream research efforts and does not generally support diversified financing products to move technologies into the marketplace. That financing is often provided through the private sector. However, promising technologies that do not meet high venture capital goals for return on investment may be "orphaned" and never receive the financial support they need to achieve market penetration. In addition, a lack of coordination between funders and financers creates two major potential financial gaps in the RD&D continuum. First, is the lack of resources for translating innovative research concepts into market-ready products; and the second is the lack of resources to move these products to large-scale, full-market deployment.

Two key goals of this finance strategy will be to reduce transaction costs along the RD&D continuum, and to mitigate risk for investors so that private capital can take an earlier "stake" in technologies identified. This approach lowers financial barriers to entry that currently deter some investors and increase the number of stakeholder pushing the technology forward to full deployment. Both early-stage (venture capital) and later-stage (project finance) professionals have attested to the importance of such a coordinated funding approach to accelerate their successful investment decision making and increase the volume of funding they can commit to innovative clean energy technologies. Creating effective incentives for this early involvement by financial players will require both creative financing approaches and innovative IPR strategies.

Intellectual Property Rights Services

Several key reports have underscored how a failure to resolve IPR issues can undermine the innovation and diffusion of clean energy technologies. IPR needs to be used as a tool for encouraging innovation, supporting collaboration between the public and private sector and navigating IPR challenges that may arise, and the leverage of early investment in the product development process.

Specifically, the creation and leverage of more financial incentives up the value chain, at the earlier research stages, enables companies to consider creative IPR paths to gain greater financial advantage downstream. As well, support could be provided for placement of the licenses, R&D collaborations and other agreements necessary to form strong partnerships to move clean energy technologies more rapidly to market. This IPR strategy should reduce transaction costs by supporting partnerships and consortia among multiple public- and private-sector organizations. It should also result in high-quality IPR information and analysis early in the research stage. Having IPR issues fully identified and systematically addressed early on can leverage additional investment from the private sector.

Conclusions

The current energy RD&D system's insularity and resistance to learning from other disciplines, fields and people has stifled innovation in many sectors including energy. Perhaps it's ironic that the solution to reforming the energy innovation system comes, in fact, from outside that system.

Clearly, the climate and energy problems we face today are too serious and severe to rely on the conventional thinking. To solve these problems in our lifetime, we must try a new approach. Distributed innovation is an option to effectively connect the brightest minds working in energy and tap the global brainpower of experts in other disciplines to help solve the climate technology problems we face.

Additional Reading Material

In addition to the article upon which this primer is based, please review the following material:

- Harvard Business Review:
    - *Can Technology Really Save Us From Climate Change?*: January-February 2010, http://www.carbon-capital.com/wp-content/uploads/2010/01/SCC-Technology-and-Climate-Change-R-Toker-HBR-Jan-2010.pdf
- Clean Energy Group:
    - *Innovation to Infrastructure: Clean Energy without Cap and Trade,* November 2010, http://www.cleanegroup.org/Reports/Innovation_to_Infrastructure_CEG_Paper_11.10.10_final.pdf
    - *Climate Crash Course for Copenhagen – The Six Simple Reasons Why We Need Global Technology Collaboration,* December 2009 http://www.cleanegroup.org/Reports/CEG_Climate_Course_Copenhagen_Dec2009.pdf
    - *Climate Choreography, How Distributed and Open Innovation Could Accelerate Technology Development and Deployment*, July 2008, http://www.cleanegroup.org/Reports/Climate_Choreography_July08.pdf