



2013 Clean Energy Ecosystem Summit

Introduction

In the past year, since our inaugural Clean Energy Ecosystem Summit in October 2012, we have witnessed an inflection point in the adoption of many clean technologies, with signs of greater momentum and growth.

- Clean technology stocks were up 50 percent in the last 12 months¹, outperforming the broader market by almost 35 percent
- A record number of solar panel modules were installed globally (32GW in 2012²), driven by steep reductions in price
- Clean tech companies continued to forge innovative partnerships with traditional utilities, delivering both greater performance and savings with environmental benefits
- Nearly \$270 billion flowed into the clean technology sector – a figure expected to double over the next decade³

Like any emerging market, however, the clean energy sector has experienced its fair share of volatility in recent years, driven by the macro environment, policy uncertainty, and a shale revolution that has made natural gas even more competitive and ubiquitous. But developments over the past 12 months suggest that we are truly at a tipping point for massive market adoption.

To further that momentum, on September 17 and 18, 2013 Goldman Sachs hosted the 2nd Annual Clean Energy Ecosystem Summit in Menlo Park, bringing together leaders of the world's most innovative energy start-ups, key decision makers of the largest energy, technology and industrial companies globally, influential investors and figures across research, government and finance to share insights and to foster a dynamic dialogue and partnerships and ultimately be a catalyst for growth and innovation in clean energy.

Key themes explored at this year's Summit included:

- 1) **Technology Innovation and Partnerships** – the degree to which disruptive technologies are reshaping how we think about energy consumption and the traditional electric utility model. A convergence of data and new financing structures are driving greater adoption of distributed renewable energy systems, increasing efficiency, and putting more information in the hands of electricity providers and consumers to enable smarter decision-making
- 2) **Power of Policy** – how the adoption of clean energy alternatives, sustainable products and new technologies are driving economic activity, creating jobs and protecting the environment. This particularly compelling value proposition for policymakers at all levels is catalyzed by the innovation and investments that come from a cohesive approach to tax policy, tariffs, legislation and regulation
- 3) **Capital Drivers and Headwinds** – the ways in which capitalism will drive clean energy development over the coming years. Innovative financing models being market-tested today are critical to ushering in more capital to fuel all aspects of the clean technology spectrum

¹ NASDAQ Clean Edge U.S. Index, As of 9/13/2013

² IHS

³ Bloomberg New Energy Finance – 2012 YE Data

Agenda

How Data Became a Virtual Power Plant

Opower
Baltimore Gas & Electric

Energizing the Network

Silver Spring Networks
CPS Energy

Engaging Partners Across the Ecosystem

Goldman Sachs – Head of Global Mergers & Acquisitions and Chairman of Global Technology, Media and Telecommunications Investment Banking

Catalyzing Change – Federal, State and Local Initiatives

The White House
The State of California
The State of Hawaii
The City of Long Beach, California

Global Energy Innovation

Columbia University (China Perspective)
Masdar Capital

NGOs: Protecting Nature, Promoting Change?

Brightsource Energy
The Nature Conservancy
Sierra Club

A Vision of Tomorrow's Grid

Google

Envisioning the 21st Century Utility

California Public Utilities Commission
Pacific Gas & Electric (PG&E)
SolarCity
SunRun

"The reports of my death are greatly exaggerated..."

MidAmerican Solar
NextEra
SunEdison
SunPower

Making Money in Clean Energy

Silver Lake Kraftwerk
Goldman Sachs – Global Head of Clean Technology and Renewables and Global Head of Venture Capital Coverage

Rethinking Risk, Realizing Opportunity

NextGen Climate Action and Advanced Energy Economy

Consumerization of Energy

Nest Labs

Energy Outlook and Investing in Energy Infrastructure

Energy Capital Partners
Goldman Sachs – Co-Director of Equity Research within Global Investment Research Division

Bioproducts: The Future is Now

Beta Renewables
Elevance
NatureWorks
TPG Biotech

Sustainable Living

Harvest Power
Philips Lumileds
Project Frog
Recyclebank



Technology Innovation and Partnerships

A central theme explored at the summit was how disruptive technologies are reshaping how we think about energy consumption and the traditional electric utility model. New technologies, including the convergence of data (“info tech”) and innovative financing structures (“fin tech”), are driving greater adoption of distributed renewable energy systems, increasing energy efficiency, and putting more information in the hands of electricity providers and consumers – helping each to make smarter energy choices.

One of the panels featured a healthy debate among participants from the solar industry (SolarCity, SunRun), the California Public Utilities Commission (CPUC), and PG&E, one of the country’s largest utilities, about how the adoption of distributed solar generation is reshaping the utility industry. On the heels of Proposition AB327, recently passed in California, there was a thought-provoking discussion about incentive systems and how – especially with distributed solar, in which more affluent customers tend to be earlier adopters – the costs of a utility’s fixed assets (transmission, generation) are being borne disproportionately by low-income populations that rely on traditional sources of energy. Finding common ground, the solar industry, the PUC and the utilities sector agreed that they need to work in concert to continue the mission of providing safe and reliable clean energy at a fair and reasonable price to all. In a similar context, Summit participants also heard about The State of Hawaii’s innovative financing initiative, the Green Energy Market Securitization program (GEMS), which is designed to make solar energy technologies more affordable and accessible to underserved communities.

California Proposition AB327

Landmark legislation which will make changes to California’s solar energy policy to enable residents to more easily take advantage of net metering and switch to renewable energy.

The bill would lift a suspension of net metering that was to occur at the end of the year. Electricity customers will now be able to invest in solar power systems knowing that they’ll be able to sell excess electricity generated back to the grid, obtaining important feed-in tariffs to make investments more economical.

MidAmerican Solar, NextEra, SunEdison and SunPower also discussed the market dynamics for the utility scale solar sector at a time when natural gas prices are near historic lows and distributed generation continues to climb. Panelists noted that they don’t expect to see in the near term large scale development of utility scale solar (250 MW +) given higher costs for solar relative to natural gas-combined cycle plants – outside of the western states (with Renewable Portfolio Standards), not a lot of utilities are able or need to generate solar on a large scale in one region. However, the panel was more optimistic about smaller-scale utility grade solar (20-50 MW), with its more favorable risk/return profile in certain geographies. Participants also discussed views on the next wave of innovation in the solar sector, pointing to enhancements in battery storage and innovative public financing vehicles (such as NRG Yield Co’s and potentially an MLP/REIT type structure) as potential drivers to lower the cost of capital and encourage more investment in the sector.

Further, technological disruption is driving new partnerships between clean tech companies and more progressive utilities. We heard from Baltimore Gas & Electric (BGE), which discussed its recent partnership with Opower to help educate and engage customers on reducing power consumption during periods of peak energy demand. As a result of the build-out of BGE’s smart meter network, the utility has been able to go from an average 12 meter reads annually (once per month) to more than 35,000 by using an automated system that gathers data every 15 minutes. Opower is, in turn, using the information collected by the BGE smart meters to create customized communications via email, text and phone to alert customers of peak demand periods and to encourage more routine behavioral changes in their energy consumption. What was clear from the discussion is that this partnership works so well due, in part, to the regulatory framework of the regional transmission grid PJM, allowing BGE to monetize energy reductions and get compensated for its demand response. The pivotal difference here is that BGE and Opower are not driving reduced energy consumption through automated measures – but rather by focusing on behavioral change.

Nest Labs kicked off the second day by describing how the convergence of mobile technology and traditional energy infrastructure is changing the way consumers manage their energy use. Founder Tony Fadell talked about a newly established partnership that includes advertising alongside Reliant (an NRG Energy retail company) in print, television and other mediums to drive sales. Nest Labs has also developed an energy saving “opt-in” program whereby customers can allow Nest and their utility provider to automatically adjust heating and cooling controls in advance of peak demand periods. The program has shown increased savings for customers with little or no effect on household comfort.

Silver Spring Networks and CPS Energy discussed a similarly innovative partnership, in which they are supporting the City of San Antonio in its development of smart grid technology. The alliance, which is helping to automate energy distribution, increase energy efficiency and improve grid stability requires close coordination among the public and private sectors as well as constant communication with energy customers.

In an especially forward-looking and visionary segment, Arun Majumdar, vice president of energy at Google, discussed how to build the energy grid of the future. With the advent of distributed generation alongside centralized generation, Majumdar sees a flexible, secure and integrated grid that allows utilities to analyze, monitor and forecast potential problems before they occur.



Technological innovations in smart metering and measurement are currently enabling the collection of large amounts of data that demonstrate how the grid is functioning. The next step is to harness this data to predict abnormalities and protect against systemic failures. The rising threats that natural disasters and cyber/physical security risks pose to the grid necessitate efforts to make it more resilient through advancements in utility grade battery storage, power electronics, transistors that are both smaller and more efficient, and grid automation software.

The day included CEOs from bioproducts companies Beta Renewables, Elevance and NatureWorks, who spoke about the imperative to innovate and scale to reach commercialization. They explained how flexibility in their supply chains enables them to quickly switch feedstocks depending on market conditions and near-term supply shocks, such as commodity price increases, or changes in agricultural growing seasons. They also discussed how success in their field has been rooted in working with government agencies, customers and the private sector to secure unconventional forms of financing to expand commercial operations. Finally, these leaders discussed how companies are increasingly pivoting from producing pure play drop in chemicals to producing higher-margin specialty bioproducts that enable renewable, more sustainable products at competitive prices.

Importantly, the conference highlighted how promotion and adaptation of these cutting-edge solutions doesn't just lie in the hands of innovators and utilities providers. A discussion focused on sustainable living was instrumental in highlighting how innovative companies are creating resource efficiencies and applying them to our everyday lives. Phillips Lumileds, which is designing higher-quality, lower-cost and more efficient LED lighting is partnering with a number of municipalities to replace city street lights that currently consume between 20 and 30 percent of a city's energy use. Recyclebank also shared how its business model uses rewards to incentivize behavioral changes and boost recycling efforts in the US. Harvest Power talked about the way in which they are capturing a larger percentage of food waste to drive energy production and other end-use products such as compost and fertilizers. And Project Frog detailed how it is partnering with municipalities, universities, schools and hospitals to provide more sustainable buildings that are modular, more efficient and more cost effective.

Power of Policy

A particularly compelling value proposition for policymakers, the adoption of clean energy alternatives, sustainable products and innovative technologies can catalyze economic activity, create jobs and protect the environment. To this end, international, federal, state, local and NGO partners are able to promote innovation and investments through thoughtfully integrated tax policy, tariffs, legislation and regulation.

At the federal level, the political dynamics in Washington have limited congressional action on energy legislation, but we have seen a proactive approach by the White House in using existing rules to further the adoption of clean energy solutions. In particular, the rules recently proposed by the EPA to limit emissions from new fossil fuel-based power generation, the use of renewable energy on federal lands through Solar Energy Zones, and the adoption of renewable portfolio standards are all fueling increased activity in the industry. In addition, the Department of Defense has set a new 3GW target for renewable energy development (1GW per service) by 2025. And international partnerships are promoting change as evidenced by the recent agreement between China and the US to reduce the production and consumption of hydrofluorocarbons (HFCs).

At the state and local levels, progressive states and municipalities around the US are promoting greater energy education for customers as well as frameworks for companies to grow and create jobs locally. For example, the State of California is pushing for the greater adoption of electric vehicles and sponsoring financing programs, such as its commercial PACE program (Property Assessed Clean Energy) and on-bill repayment mechanisms, to encourage greater energy efficiency. Such programs allow customers to finance the upfront cost of energy efficiency upgrades by allowing the consumers to pay off the capital investment over time, either through property tax or electric utility bills. The State of Hawaii's Energy Accelerator program provides energy start-ups with non-dilutive funding, strategic relationships, and a vibrant ecosystem to promote energy solutions. This program is being funded with \$30 million from the US Navy for inventive projects, such as experimental renewable energy micro-grids, a grid-connected wave power system and rainwater harvesting systems.

Municipalities are also working to ensure citizens have sustainable and reliable sources of energy. Mayor Bob Foster of Long Beach, California mentioned that they will look to invest some \$5 billion over the next decade, including control technologies, transportation systems and a fully automated port terminal. Long Beach's track record of investing in clean energy includes the installation of solar photovoltaic systems on both its convention center and airport.

Climate Action Plan

President Obama's Climate Action Plan is an all-of-the-above approach to develop homegrown energy and steady, responsible steps to cut carbon pollution, to protect our health and begin to slow the effects of climate change so we leave a cleaner, more stable environment for future generations.

The President's comprehensive Plan takes action to:

- Cut Carbon Pollution in America
- Prepare the nation for the effects of climate change
- Lead International Efforts to Address Global Climate Change

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These positive developments in the US are mirrored in international counterparts. China, one of the world's biggest consumers of energy, is also investing in energy efficiency and renewables, scaling its efforts as it transitions from an investment-based economy to a consumption-based one. David Sandalow, the inaugural fellow at the Center on Global Energy Policy at Columbia University and former acting US undersecretary of energy, spoke to how China is going through a major transitional period across all sectors, but in particular, is making large commitments to energy. Sandalow discussed the degree to which the world's energy infrastructure is already being scaled up, as seen in China's development of the world's most efficient fossil fuel power plants, high speed rail transport infrastructure, and the largest solar manufacturing facilities in the world. He also cited China's interest in international partnerships and the country's recognition of the mutual advantages of renewables development. For example, Chinese renewables companies are likely to forge partnerships that bring manufacturing prowess to complement the service-based innovation of counterparts in the US.

Even in the Middle East, where fossil fuel production drives the regional economy, an effort to diversify revenue through advances in renewable energy is underway. Anup Jacop, Partner at Masdar Capital, discussed how the Abu Dhabi Government anticipates a fundamental displacement of the energy value chain that will be the driving force for investing in renewables. Masdar has also been focused on furthering the research agenda through its joint partnership with MIT to help develop innovative technologies. Improving efficiency in how water is used in manufacturing and other processes is another focus in the region that is likely to create investment opportunities.

Another goal of this year's summit was to bring to the fore a perspective on how NGOs are working in partnership with the clean tech industry to promote change and protect nature. BrightSource Energy, The Nature Conservancy and Sierra Club were all on hand to talk about the role they and other NGOs play in promoting renewable energy while preserving pristine habitats. The CEO of Brightsource Energy talked about how the organization worked in conjunction with the NGO community during the development of Ivanpah, its large-scale solar project in the Mojave Desert, to help minimize any impact to the natural habitat for the desert tortoise. The Nature Conservancy described how it worked collaboratively with the US government to shape the Bureau of Land Management's Solar Energy Zones, which are priority development areas for utility-scale solar energy facilities based on locations that will have minimal impacts to natural landscapes. The Sierra Club expressed its support for a higher mix of renewables at both utility scale and distributed, but urged careful consideration of natural landscapes in the planning of where to undertake such projects.

Finally, in recognizing that it will take time for capital and investment to sustain growth in the clean energy sector over the long term, speakers highlighted the importance of various actors in the policy sector in providing coordination and direction. Tom Steyer, Founder of NextGen, described the enormous challenge posed by climate change and the lack of sufficient policy or market responses to address it. In the absence of a suitable federal policy, Steyer applauded state-level responses, such as California's cap and trade system, and urged the clean tech industry to develop and speak with a collective business voice, and to work collaboratively in identifying and implementing market-based solutions to climate change.

Capital drivers and headwinds

Over the course of two days, we heard from a number of leading investors, many of whom were optimistic that the forces of capitalism and the free market will drive clean energy development over the coming years. New financing models that are being tested today will be critical to enabling more capital to flow into the sector.

Gene Sykes, Head of Global Mergers & Acquisitions and Chairman of Global Technology, Media and Telecommunications Investment Banking at Goldman Sachs, launched the conversation on clean tech investing in an engaging presentation on today's mergers and acquisition landscape. He proposed that there is actually more capital available for taking risk in new ventures than what's represented in the transactions we see today, due to increasing risk aversion among investors and corporate boards. Specifically, shareholders have been pushing boards to be especially cautious because they want immediate return. This set the foundation for many lively discussions on optimal investing strategies and the balancing act between risk and reward in clean tech investing.

Stuart Bernstein, Global Head of Clean Technology and Renewables and Global Head of Venture Capital Coverage at Goldman Sachs and Adam Grosser from Silver Lake Kraftwerk talked about the investment landscape for the clean energy sector. Grosser detailed their firm's innovative model for evaluating companies across the clean tech industry, identifying differentiated business models with proven technologies on a clear path to profitability. Grosser talked about clean tech





investors needing to recalibrate their return expectations to anticipate a longer investment horizon, more akin to the biotech industry than the IT sector. The ensuing discussion explored how some investment firms fell prey to believing they were going to “solve climate change” in tandem with generating a profit in the short term, and the need to balance the practicalities of a particular clean tech investment with the return expectations of its limited partners.

Richard Lim, Director of the Hawaii State Department of Business, Economic Development and tourism also contributed to the dialogue by sharing how Hawaii is working across a diverse ecosystem of government, NGOs, private sector and capital providers to develop financing mechanisms that drive greater adoption of renewable energy. For example, Hawaii’s Green Infrastructure Loan Program – to be backed by over \$200 million in state bonds – seeks to make clean energy improvements more affordable and accessible to underserved communities. State residents can recoup the upfront cost of solar installation through an on-bill repayment arrangement that allows consumers to repay the premium with the energy savings.

Of course a critical component of the “new” ecosystem is the presence and importance of the existing “conventional” energy ecosystem. In this regard, we heard from sector analysts at Goldman Sachs who provided their own views on the global energy outlook, as well as representatives from Energy Capital Partners who shared insights into how they are thinking about investing in the US energy infrastructure.

Arjun Murti, co-director of Equity Research in the Global Investment Research Division at Goldman Sachs, addressed the “shale revolution” that is driving domestic production of shale oil in the US and dramatically changing the investment landscape for energy globally. Murti noted that the US has gone from virtually no shale oil production at the start of 2010 to roughly two million barrels per day – and that some expect US production to outpace Brazil, Iran and Iraq by 2017, resulting in far-reaching geopolitical implications. Greater shale oil production in the US could also have a big impact on infrastructure, as pipelines built largely to support US oil imports would have to be revisited and refineries would need to be adapted to process shale gas and oils domestically.

Doug Kimmelman from Energy Capital Partners discussed their investment thesis pertaining to conventional power generation in the US, with the view that we are on the front edge of a massive supply shrinkage driven predominately by low cost natural gas and environmental and political headwinds for existing power generation. Even without demand growth, Kimmelman noted, the amount of conventional power generation supply in the US could be reduced dramatically and drive a consolidation in the industry, creating interesting investment opportunities among fossil fuel power plants in certain regions. Such plants would likely offer an attractive risk return profile over the next decade, particularly for reserve margins, and provide enhanced grid reliability. Along these lines, it was suggested that some institutional investors increasingly are looking to increase portfolio allocations to traditional natural resources to offset the thesis around renewables.

While conventional fossil fuel energy will likely be a part of the power generation mix for the near term, there is optimism that the clean energy industry will continue to grow as necessitated by a number of pressing global challenges. Increasing energy demand per capita, risks of climate change and extreme weather events, and the depletion of our natural resources will require a strong collective ecosystem to solve these global problems. Like any large challenge there will be headwinds, but the adoption of clean energy driven by disruptive technologies, innovative financing mechanisms and progressive policy signals is believed to be tipping the balance towards a cleaner and more sustainable future.

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