Assembly Committee on Jobs Economic Development and the Economy
Briefing on California's Cleantech Economy

Introduction

The clean energy economy (also known as the "Clean Technology economy" or "Cleantech economy") has become an ingrained and central part of the state, national and world economies. Over past few years, governments, corporations, investment funds and high-net worth families have committed hundreds of billions of dollars to develop and scale the technologies that enable the clean energy economy. To understand the significance and breathe of these investments, it is important to first establish the boundaries within which cleantech investors operate by defining what constitutes the clean energy economy. While there is considerable disagreement among investors over what exactly constitutes the clean energy economy, we will use the following working definition developed by the Pew Charitable Trust that both captures what the clean energy economy looks like today, while leaving room for what the clean energy economy will look like in the future. The definition:

> *""A clean energy economy generates jobs, businesses and investments while expanding clean energy production, increasing energy efficiency, reducing greenhouse gas emissions, waste and pollution, and conserving water and other natural resources"*[1]

As defined, the clean energy economy covers five categories:

- Clean energy
- Energy efficiency
- Environmentally friendly production
- Conservation and pollution mitigation
- Training and support

Clean Energy: This category of the clean energy economy includes the jobs, businesses and investments that are directly tied to the generation, transmission and storage of utility-scale clean energy resources including solar, wind, geothermal, marine and tidal, and bio-power. The technologies, associated jobs and investments that fall in this category must meet the strict standard of generating a positive net energy yield, meaning the technology generates more energy then was required to harvest it; mitigate the emission of greenhouse gases, and produce no negative externalities to the environment. For example, while an investment in a large-scale solar farm, a technology that produces more energy then is required to harvest it, leads to jobs and businesses that would be included in this category, an investment in a nuclear facility, and the associated jobs it would produce, would not. While nuclear power is an incredibly rich and plentiful energy source that produces more energy than is required to harvest it, the nuclear waste created as a result is extremely toxic to the environment.

Energy Efficiency: This category of the clean energy economy captures the jobs, investments and businesses that directly lead to reduced energy use. Technologies falling within this category do not attempt to eliminate or replace carbon-based energy sources, but rather empower users of those energy sources to lessen their use. For example, investments in smart meters and the electricians that install them would be considered part of this category because these meters enable power users to monitor their energy use remotely and disable "vampire" appliances that continue to use power even when not in use. A related technology, light emitting diodes

(LEDs), would also fall in this category because they are both more efficient, enabling users to immediately lower energy use, but they can also be integrated with software packages that allow them to learn the behavior of users (when, on average, they arrive in the office, take breaks, or leave the office) and optimize power use around them.

Environmentally Friendly Production: This category of the clean energy economy captures the jobs, investment dollars and businesses focused on reducing the environmental footprint of existing technologies across six categories: transportation, manufacturing, construction, agriculture, energy production and materials. Examples include biofuel infrastructure and hybrid vehicles (transportation), environmentally sound equipment and packaging (manufacturing), stucco products made with recycled inputs (construction), smart irrigation systems (agriculture), gasification technologies (energy production), and biodegradable products (materials). Similar to the Energy Efficiency category, these technologies do not attempt to replace existing products but rather make them more environmentally friendly.

Conservation and pollution mitigation: This category of the clean energy economy captures those technologies, jobs and investment dollars that enable the better use of finite, natural resources. For example, technologies that recover finite resources for reuse like aluminum harvested from scrap, or fats oils and greases (FOG) from water allowing for the full recycling of water resources, are included in this category.

Training and Support: This category address the human capital side of the clean energy economy, and captures the specialized services needed to allow the other four categories to properly function like investment banks that facilitate the financing of clean technologies; the engineers and researchers that develop the science that enables clean technologies (gasification, chemical deposition etc.); and the computer scientist that develop advanced algorithms to optimize energy and resource use, are all captured in this category.

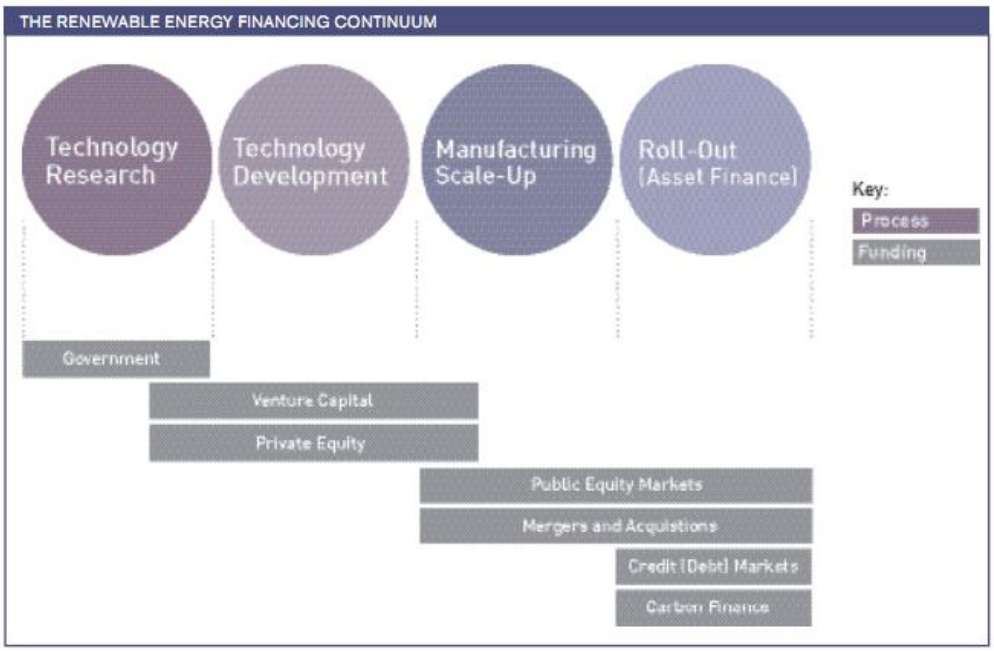
While the definitions and categories outlined above allow for considerable overlap, their design and description captures a basic reality of the clean energy economy—it is in the early stages of development and literally changes and expands with every new invested dollar. The categories and definitions will lend themselves to the evolution of the clean energy economy, and capture and categorize new technologies, businesses and jobs as they are developed going forward. Please see Figure 1, for a graphical representation of the five categories. [2]

Figure 1: The Categories of the Clean Energy Economy

Investment Overview

Investments in the clean energy economy can be organized into four primary categories: venture capital and private equity (VC/PE), public markets, asset finance, and merger and acquisition activity (M&A). The VC/PE category represents all monies invested by venture capital and private equity funds in the equity of private companies engaged in the clean energy economy. The public markets, on the other hand, captures all monies invested in the equity (individual stocks) of publically traded companies engaged in the clean energy economy. The third category, asset finance, represents all monies invested in large-scale renewable energy generation projects like wind and solar farms. This category encompasses balance sheet investments from corporations, and debt and equity financing. The forth category, M&A, is distinct from the first three in that it does not represent investments in new technologies, but rather the transfer of existing technologies from one market actor to another. Clean technology M&A is, however, an extremely important indicator of market demand for clean technologies and, by extension, directly drives the ability of private equity and venture capital firms to sell their positions in clean technology companies and generate returns for their investors.[3] See Figure 2 for a graphic representation of the clean energy economy financing continuum.

Figure 2: Investment Stages



Investment Landscape

Investments in the clean energy economy reached a record high in 2011 with $260 billion invested worldwide, a 5% increase compared to 2010 and a fivefold increase over the $53.6 billion invested in 2004.[4] Geographically, 2011 saw the reemergence of the United States as the leader in clean technology investments, moving past China for the first time since 2008 according to an analysis by Bloomberg New Energy Finance.[5]

Similar to past years, the largest source of capital for clean technology investments in 2011 came from asset finance, with $145.6 billion invested, representing a 5% increase over 2010. Of note, 2011 saw a 36% jump in solar investments in this category with $136.6 billion invested, two times the level of investments of investments secured for wind projects, a category that saw a 17% drop in invested dollars with $74.9 billion invested in 2011.[6] Some of the more notable projects receiving asset financing dollars included the 288 Mega

Watt (MW) Amrumbank West wind farm off the coast of Germany, a $1.3 billion project; the first and second phase of the 272MW Seigneurie de Beaupre wind farm in Canada, a $756 million project; and the 92.5MW Hanas Ningxia Yanchi Gaoshawo solar thermal plant in China, a $354 million project.[7]

A closely related category of investment, the finance of distributed renewable power technology, particularly rooftop photovoltaic applications, also saw a record level of investment with $73.8 billion invested in 2011, a 22% increase over 2010.

Investments by the public markets fell by 16% in 2011 with $11.9 billion invested. Notable public offerings included Sinovel Wind Group, China's largest developer of wind turbines, which raised $1.4 billion on the Shanghai Stock Exchange; Huaneng Renewable Energy, a subsidiary of China's state-owned Huaneng Group, which raised $800 million on the Hong Kong Stock Exchange; Gevo, a venture-backed producer of biobutanol from starch-based feedstock, which raised $107 million on the NASDAQ; and Solazyme, a venture-backed developer of algae-based renewable oils and green byproducts, which raised $227 million on the NASDAQ. It should be noted, however, that while investments in the public markets did fall relative to 2010 levels, when the right opportunities presented themselves, the public markets showed a strong willingness to invest in clean technologies. In fact, during the first two quarters of 2011, the public markets invested $7 billion in clean technology companies, a 53% increase over the same period in 2010.[8]

Venture capital and private equity investments in the clean energy economy reached $8.9 billion in 2011, a 4% increase over 2010. Notable deals in this category included the $112 million Series B round for US electric vehicle company Fisker Holdings; a $143 million expansion capital round for US biomass and waste-to-energy specialist Plasma Energy; and a $445 million round for agri.capital, the German Biogas specialist.

Corporate merger and acquisition activity in the clean energy economy took an increasingly prominent role in 2011, with M&A activity reaching a staggering $41.2 billion, a 153% increase over 2010 according to an analysis by the Cleantech Group. This was the highest level of corporate M&A in the sector since 2008, indicating a strong appetite for clean technologie acquisitions by corporate entities.[9] Notable deals in the category included Toshiba's $2.3 billion acquisition of Switzerland's Landis+Gyr, a leading developer of advanced electricity metering solutions, and Dupont's $6.3 billion acquisition of Denmark's Danisco, a leading industrial biotechnology company.

Relevant Clean Energy Economy Resources

Research

- GreentechMedia Research: Cleantech research and analytics (various reports) http://www.greentechmedia.com/
- Pike Research: Cleantech research and analytics (various reports) www.pikeresearch.com/
- Research and Markets**:** Generalist market research and analytics with strong competency in Cleantech (various reports) http://www.researchandmarkets.com/
- California's Green Economy: A Report by the California Employment Development Department www.labormarketinfo.edd.ca.gov/contentpub/GrSurveyRpt_1115.pdf

Investment Tracking

- CleanTech Group: www.Cleantechgroup.com

- Bloomberg New Energy Finance: www.BNSF.com
- CrunchBase : www.crunchbase.com/

[1] http://www.pewcenteronthestates.org/uploadedFiles/Clean_Economy_Report_Web.pdf
[2] http://www.pewcenteronthestates.org/uploadedFiles/Clean_Economy_Report_Web.pdf
[3] http://www.unep.org/pdf/BNEF_global_trends_in_renewable_energy_investment_2011_report.pdf
[4] http://www.unep.org/pdf/BNEF_global_trends_in_renewable_energy_investment_2011_report.pdf
[5] http://bnef.com/PressReleases/view/180
[6] http://www.energias-renovables.com/energias/renovables/index/pag/panorama/colleft//colright/panorama/tip/articulo/pagid/18711/botid/47/len/en/
[7] http://spectrum.ieee.org/energywise/energy/renewables/one-trillion-clean-tech-dollars-in-seven-years
[8] http://bnef.com/PressReleases/view/160
[9] http://www.cleantech.com/2012/01/05/corporate-cleantech-ma-grew-1536-percent-in-2011-totaling-41-2-billion/