Clean Energy Finance

Challenges and Opportunities of Early-Stage Energy Investing

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NREL INDUSTRY GROWTH FORUM
JISEA Joint Institute for Strategic Energy Analysis
Colorado Center for Renewable Energy Economic Development

Challenges and Opportunities of Early-Stage Energy Investing

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Overview

Characterized by a changing landscape and new opportunities, today's increasingly complex energy decision space will need innovative financing and investment models to appropriately assess risk and profitability.

This report provides an overview of the current state of clean energy finance across the entire spectrum with a focus on early-stage investing, and it includes insights from investors across all investment classes.

Further, this report aims to provide a roadmap with the mechanisms, limitations, and considerations involved in making successful investments by identifying risks, challenges, and opportunities in the clean energy sector.

Clean Energy

The term Clean Energy (CE) is used throughout this paper, encompassing multiple energy subsectors including renewable energy, energy storage, energy efficiency, smart grid, biofuels, and systems integration technologies.

In addition to the references cited in the main text of this paper we also found the following useful: Olmos 2012; Delina 2011; Hesser 2013; Bhattacharyya 2013; Sadorsky 2012; Gujba 2012; Wüstenhagen 2012; Masini 2012; Kann 2009; Managi 2013; Hofman 2012; Nelson 2013; Aguilar 2010; Kayser 2013; Mills 2010; Saunders 2012; Mills 1991; Abhyankar 2012; Pollio 1998; Bond 1995; Giebel 2011; Money Matters 2005; Fatemi 2013; The Energy Finance Handbook 1995; Olmos 2012.

Full references are provided on pages 57 to 61.

Key Observations

- Clean energy investors today face an increasingly complex decision space, needing to consider economic and policy realities and multiple developmental risks such as technology, market, and team risk.
- Global investment in renewable power and fuels was $244 billion in 2012. Although this was a 12% decrease from 2011's record $279 billion, 2012's total was still the second-highest ever (8% higher than 2010) (UNEP/BNEF, 2013).
- Global investment by venture capital and private equity investors fell 30% in 2012 relative to 2011 (to $4 billion)—the lowest since 2005. Investment in specialist renewable energy companies by public market investors also dropped to $4 billion (61%) (UNEP/BNEF, 2013).
- A large proportion of recent clean energy investment has been driven by growth in emerging markets, particularly in China. There was a shift in activity from developed, to developing, economies (UNEP/BNEF, 2013).
- Solar photovoltaic technology has experienced a significant reduction in costs from 2011 to 2012. This decline contributed to an 11% fall in the dollar value of overall solar investment even though capacity installed increased significantly; indeed, 2012 marked a record year for PV capacity installed at 30.5 GW (UNEP/BNEF, 2013).
- Policy uncertainty was a major contributor to a decline in investment in the United States, which was down 34% to $36 billion in 2012 (UNEP/BNEF, 2013).

Key Insights

- Funding gaps in technology innovation between the angel and venture capital investment stages, as well as in the growth stage between the pilot project phase of development and full-scale commercialization, have resulted from decreased venture capital investments.

- CE is frequently compared to the investment cycle for IT, but it relates more accurately to the chemical industry. Energy and chemicals are both commodity markets with strong incumbent players and high cost of capital for project and technology development.

- Challenges to CE investment range from economic and policy obstacles to development risks such as technology, market, and team.

- Opportunities to increase early-stage investing include improved government policies, partnerships, business model innovation, and multiple financing mechanisms including program related investments, efficient government loan and grant awarding, crowdsourcing, and efficacy insurance.

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- **Clean Energy Investment Current Situation**
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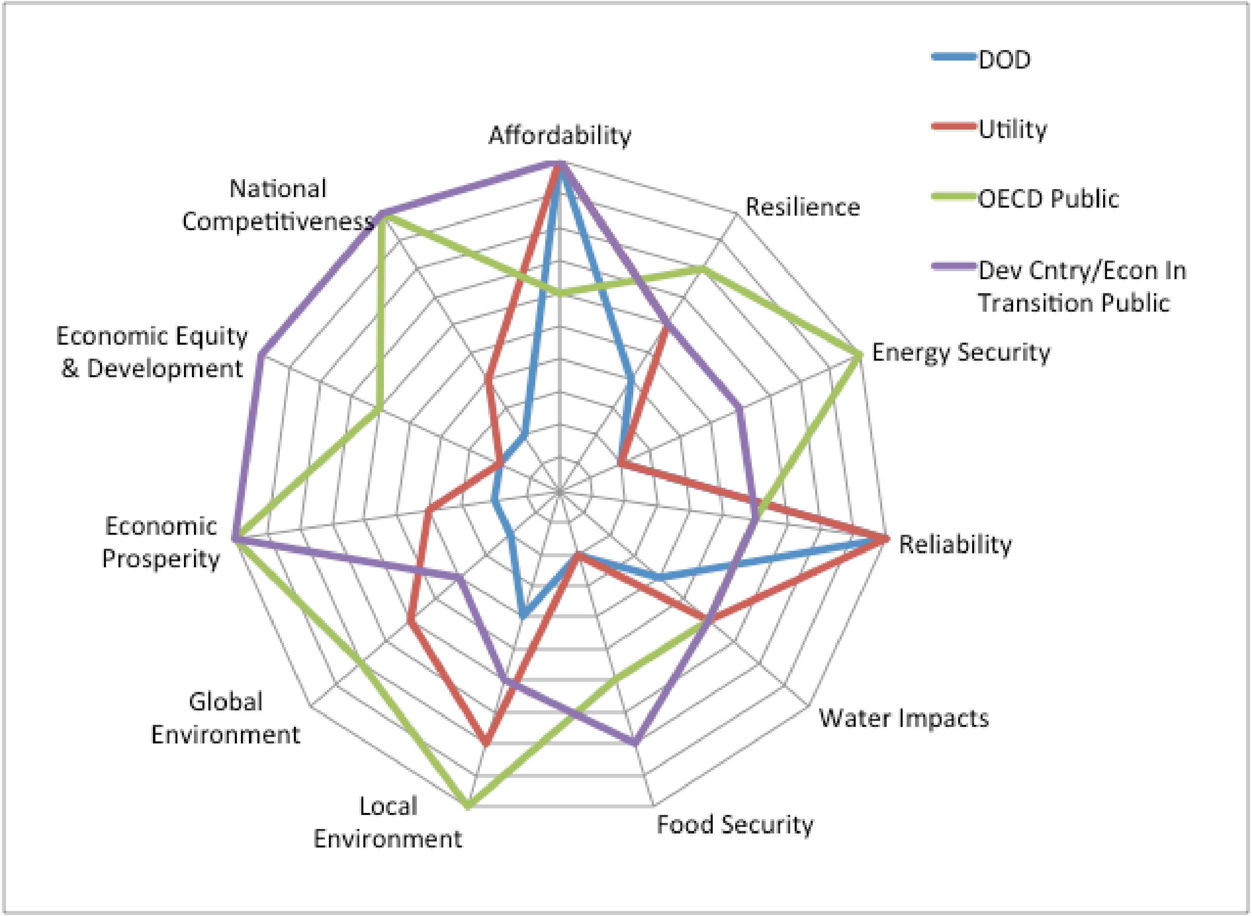
Complex Decision Space



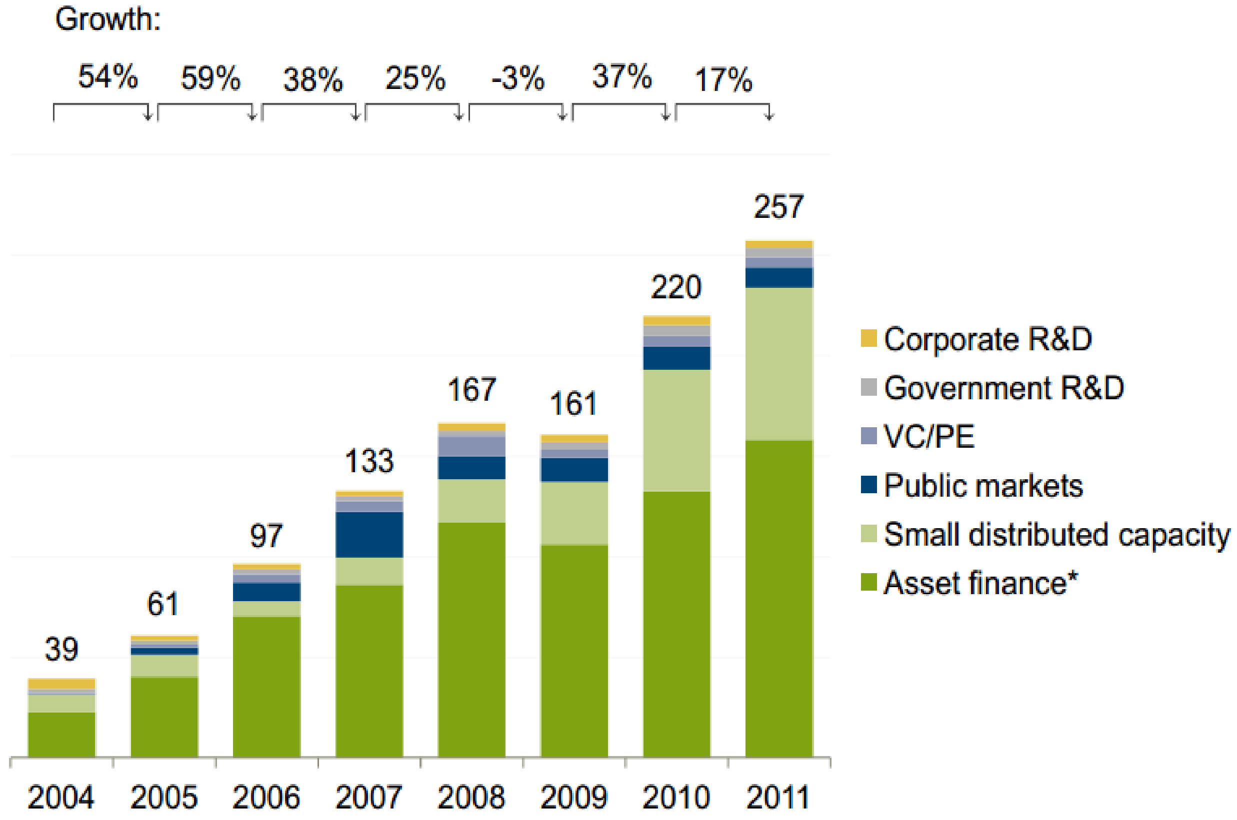
Investors today face an increasingly complex energy decision space; innovative models are needed to assess risk and profitability.

Today's energy decision space is increasingly complex, characterized by:

- Changing priorities
- Energy reliability and resiliency concerns
- Energy security considerations
- Quality of life requirements
- Water and food security implications
- Global market implications
- Increased access to economically viable natural gas resources
- Changing economics of renewables
- Policy uncertainty
- Environmental concerns
- Aging infrastructure.

Global New Investment in Renewable Energy By Asset Class, 2004-2011, $bn

Globally, there has been a continued upward trend in clean energy investment. Since 2004, RE investment has been resilient, with expansion even through the 2008-2009 recession (UNEP/BNEF, 2012).

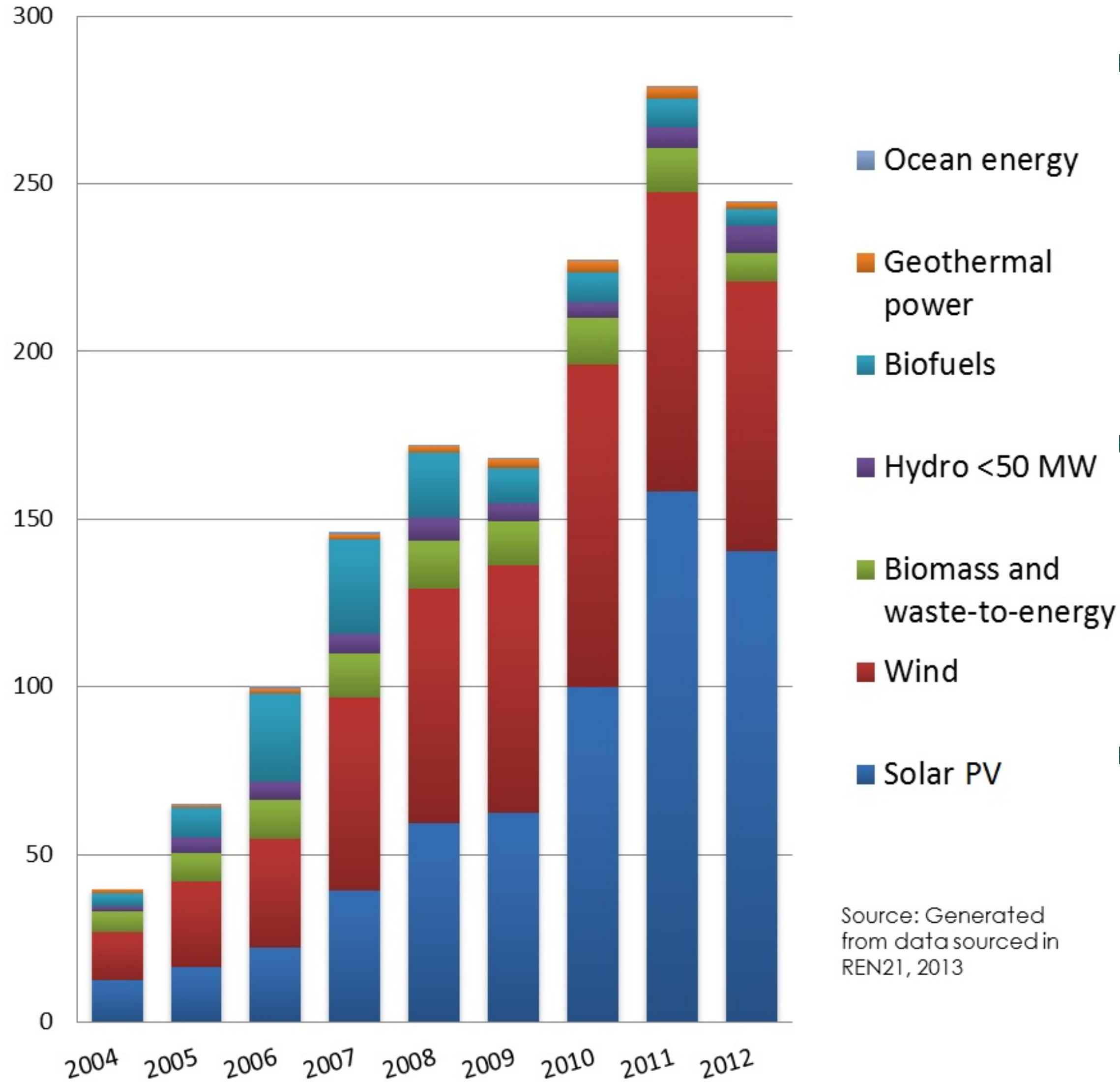


*Asset finance volume adjusts for re-invested equity. Total values include estimates for undisclosed deals.

Source: Bloomberg New Energy Finance

Clean Energy Investment

New Investment by Technology ($bn)



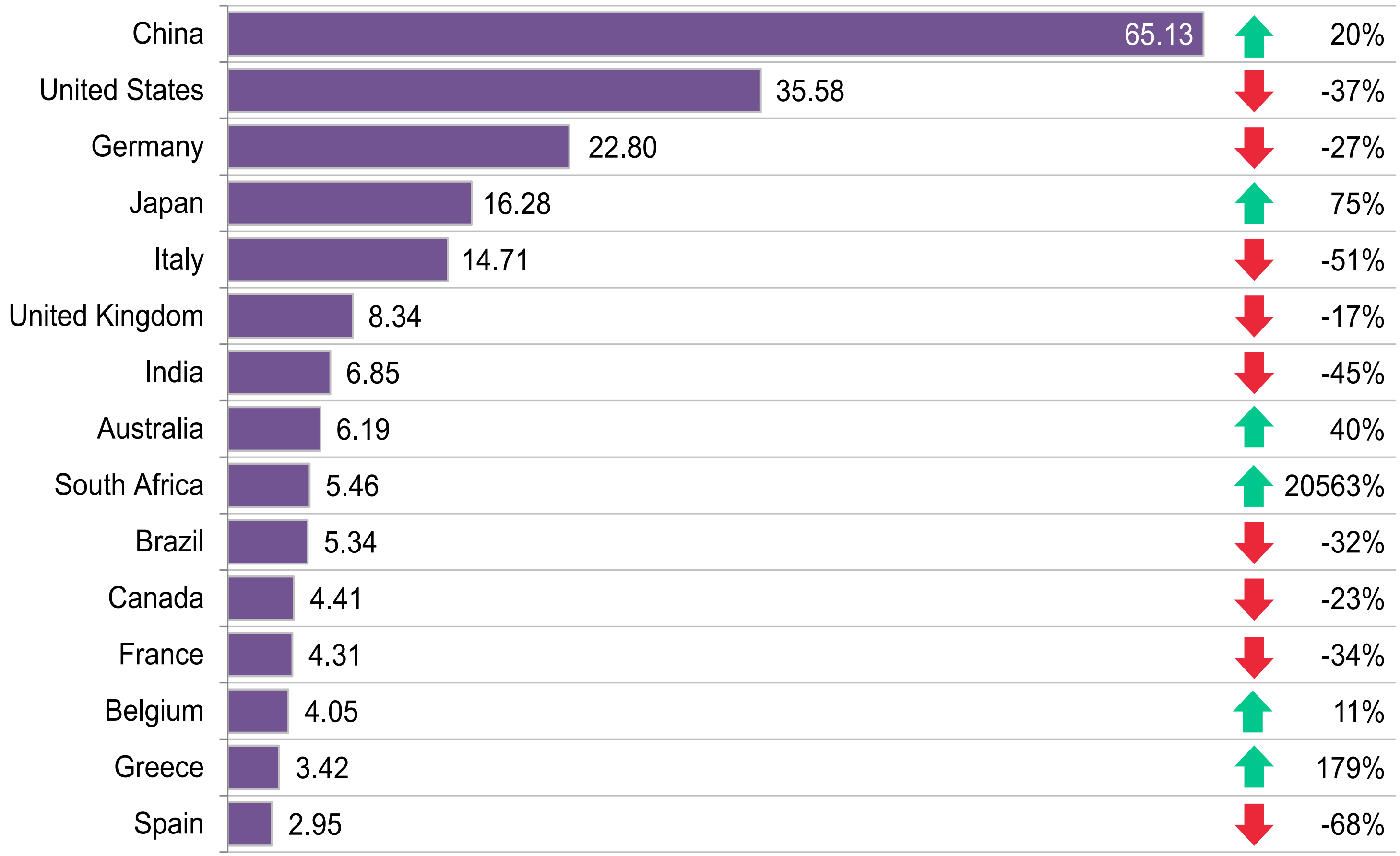
Source: Generated from data sourced in REN21, 2013

- Investment in renewable power and fuels was **$244 billion in 2012** (down 12% from 2011's record figure of $279 billion), representing declines in all renewable sectors except for small-scale hydropower and ocean energy (BNEF, 2013a). 2012 still marked the second-highest year ever, up 8% from 2010 (UNEP/BNEF, 2013). However, global new investment in Q1 2013 was down 36% ($40 billion) relative to Q4 2012 (the lowest level of any quarter since Q1 2009) (REN21, 2013).
- **Solar was the leading sector in terms of money committed in 2012**, accounting for more than 57% of total new investment in renewable energy in 2012 and totaling $140.4 billion (REN21, 2013). This was driven by falling PV costs, where the "China" price for a multicrystalline module was $0.78 per Watt in December compared to $0.93 in January (BNEF, 2012).
- **Wind** investment—coming in second—totaled $80.3 billion (about 33% of the total) in 2012 (REN21, 2013). The remaining 10% of renewable energy investment in 2012 was made in bio-power, waste-to-energy, small-scale hydropower, biofuels, geothermal, and ocean energy.

Global Investment

Top 15 Countries for New Investment in Clean Energy in 2012 and % Change on 2011 ($bn)

- China was the dominant country in 2012 for renewable energy investment, which was mostly attributed to a significant jump in solar investment (UNEP/BNEF, 2013).
- There were also sharp increases in other emerging economies, such as South Africa, Mexico, Chile, Kenya, and Morocco (UNEP/BNEF, 2013).

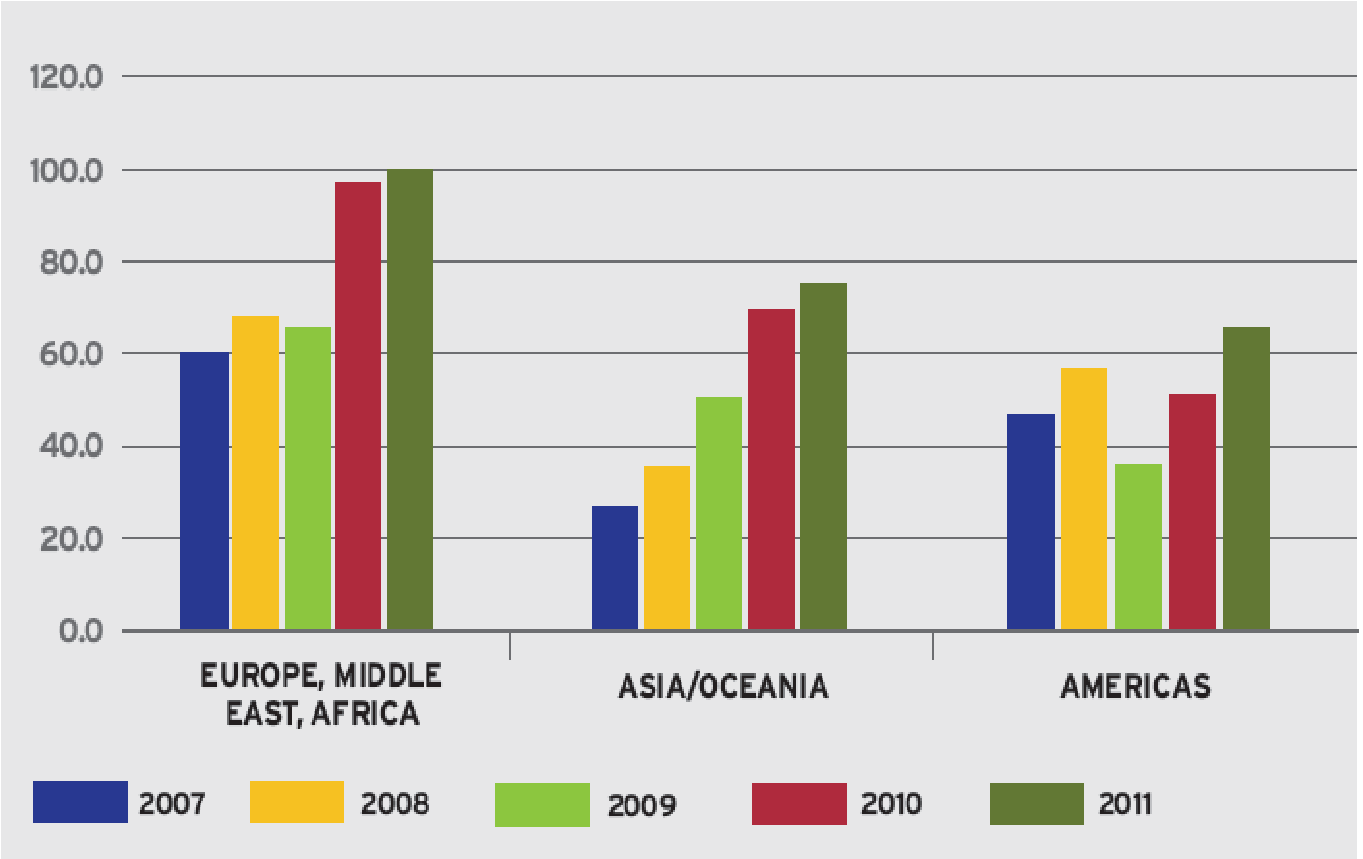


Note: excludes corporate and government R&D. Source: Bloomberg New Energy Finance

Investment Shifting to Developing Economies

Cumulative Power System Investment 2012-2035 Estimated at USD 16.9 Trillion
Non-OECD countries account for 60% of cumulative investment.

Total Investment in Clean Energy by Region, 2007-2011 ($bn)



In 2012, there was a further shift of investment from developed economies to developing economies. Total investment was down 29% at $132 billion while it was up 19% at $112 billion in developing economies (the highest ever) (UNEP/BNEF, 2013).

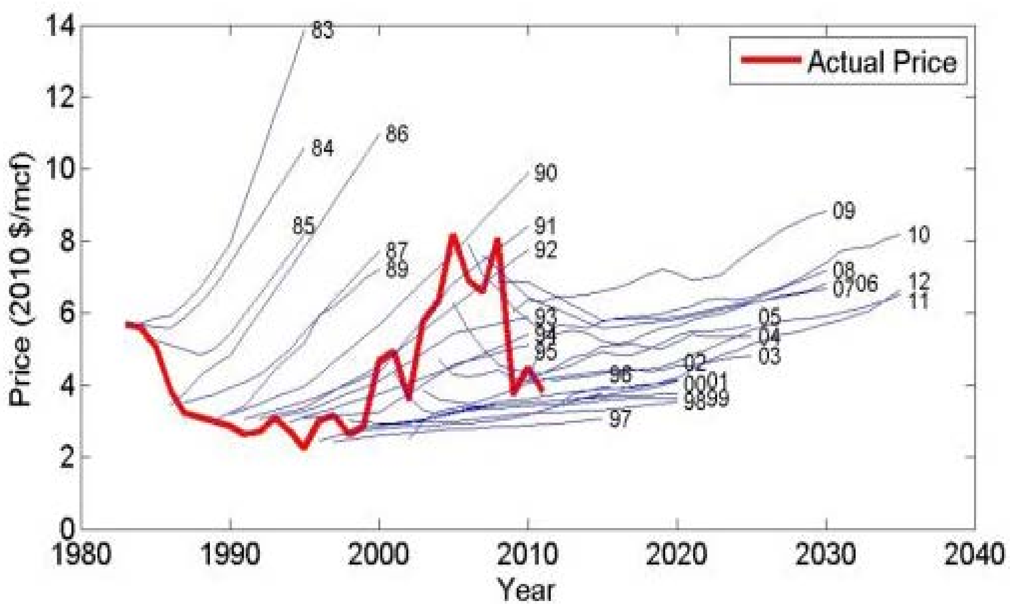
IEA WEO, 2012; BNEF, 2011

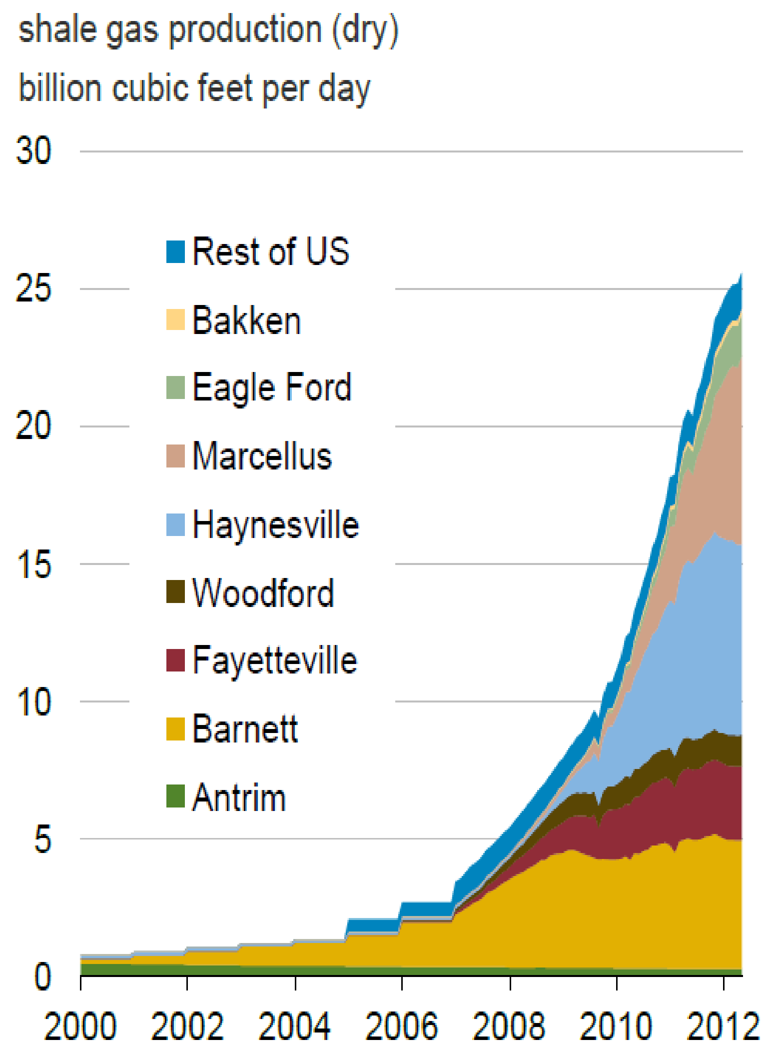
U.S. Natural Gas 'Revolution'

Unconventional natural gas has transformed the domestic energy outlook:

- Total natural gas production from 2011 through 2040 is projected to grow 44%, mostly driven by increased shale gas, tight gas, and coalbed methane development (growing by 113%, 25%, and 24%, respectively).
- EIA expects the share of total production from shale gas to increase to 50% in 2040 from 34% in 2011.
- Natural gas prices have declined significantly; however, lower prices also lead to less drilling and lower production, placing some upward pressure on prices.

Source: EIA Annual Energy Outlook 2013 with Projections to 2040





Source: Presentation by EIA Administrator

U.S. Investment Declining

- While some regions are experiencing increases in investment, total CE investment in the United States is declining.

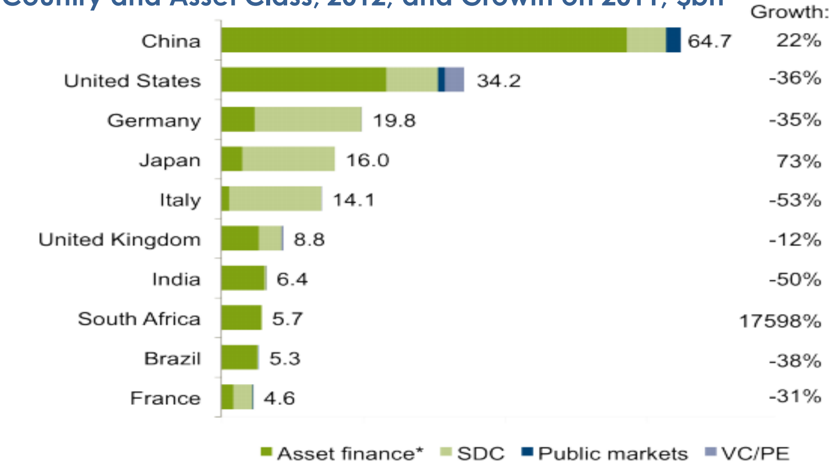
- According to Ernst & Young (2012), the United States' share of global PE/VC investment in cleantech companies declined to 50% in 2011 compared to 60% in 2010.

Asset Finance of Renewable Energy Assets by Country, 2012, and Growth on 2011, $bn

	2012	% growth on 2011
Ukraine	2.8	205%
Japan	3.0	230%
Canada	3.7	-17%
Germany	4.8	-58%
Brazil	5.1	-39%
United Kingdom	5.3	-10%
South Africa	5.7	23410%
India	6.4	-49%
United States	23.4	-49%
China	57.7	23%

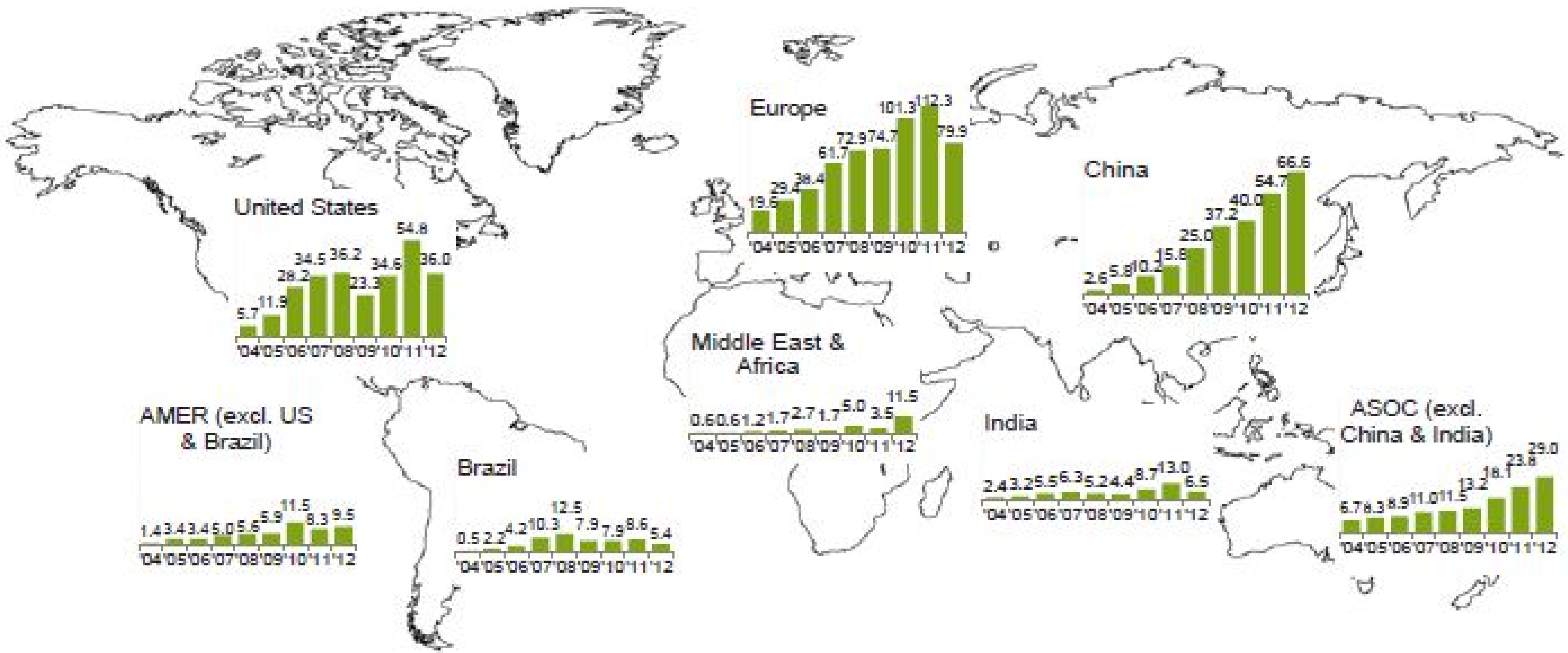
Top 10 countries. Total values include estimates for undisclosed deals
Source: UNEP, Bloomberg New Energy Finance

New Private Sector Investment in Renewable Energy by Country and Asset Class, 2012, and Growth on 2011, $bn



Top 10 countries. *Asset finance volume adjusts for re-invested equity. Excludes corporate and government R&D
Source: UNEP, Bloomberg New Energy Finance

Global New Investment in Renewable Energy by Region, 2004-2012, $bn



New investment volume adjusts for re-invested equity. Total values include estimates for undisclosed deals.
Source: UNEP, Bloomberg New Energy Finance

Investment Classes in Early-Stage Energy Investing

Angel Investors	• Wealthy individuals who provide financial capital for startup companies in exchange for equity. • Organize into networks or groups through which they collectively vet promising technologies and decrease risk. • Commonly one of the first sources of outside investment in a startup.
Venture Capitalists (VCs)	• Structured partnerships with hired managing members (general partners). • Raise money from large investors or wealthy individuals (limited partners) and identify companies in which to invest around a predetermined investment thesis. • Focus on specific industries, and invest in emerging companies that offer the potential to provide significant financial returns. • Also offer management expertise and industry connections.
Corporate VCs	• Venture arms of established companies. • Offer additional benefits beyond financial capital: industry expertise, supply chain knowledge, manufacturing capacity, brand marketing.
Corporate Strategic Partners	• Large corporations seeking to leverage technical innovation with core strengths. • Long time horizon and cash flow to allow technology to mature.
Private Equity	• Post-VC and pre-public markets. • Involved in growth stages, leveraged buyouts (LBOs), and taking companies to and through the IPO process.

The Changing Role of Venture Capital

- Venture capital has typically existed in the form of high-risk capital provided by institutions or wealthy families to aid early-stage businesses. Such capital is often provided when there is no other viable source.

- VC firms seek new companies with significant growth potential and help these companies succeed through not just cash investments, but also sharing management and technology expertise, networking, and helping with other tasks (US PREF, 2010). VC firms are selective---typically choosing only 1% of business plans they evaluate, and consider closely the technology, business model, management team, potential market size, capital requirements, required time to scale, and more (US PREF 2010). Further, many firms take on "follow-on" investments as the company grows, investing millions more over the lifetime of a company if it's successful. VC firms can also pool their resources together so that multiple firms invest in a company simultaneously (US PREF, 2010).

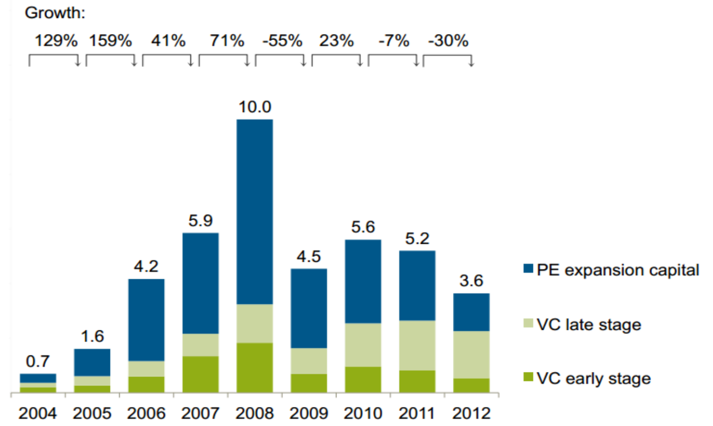
- Venture capital also plays a critical role in economic growth, especially in the United States (US PREF, 2010). Over roughly the last three decades, the U.S. VC industry has invested about $465 billion in approximately 27,000 companies – including companies that are now industry leaders such as Apple, Google, Amazon, and eBay (US PREF, 2010). New industries—such as information technology—have been supported, and in 2008, U.S. companies once supported by VCs employed roughly 12 million people, making up about 11% of the private sector and generating $3 trillion in revenue (about 21% of U.S. GDP that year) (US PREF, 2010).

- Investing opportunities fluctuate over time, shifting from sector to sector as industries mature—in recent years, industries such as telecommunications and information technology matured, allowing for increased venture capital investments in energy (US PREF, 2010).

- Venture capital investment in emerging U.S. renewable energy companies grew significantly in the late 2000s. Around 2005, the renewable energy sector only accounted for less than 2% of total VC investment in U.S. companies, but this figure jumped to 6% in 2006, 9% in 2007, and 15% in 2008 (US PREF, 2010). Out of $28 billion of total VC investment, more than $4 billion of total U.S. VC investment was invested in U.S. renewable energy companies in 2008 (NVCA/PwC).

- As illustrated on the right, VC investment in renewable energy has been declining since 2010. The next two pages provide more detail on this trend.

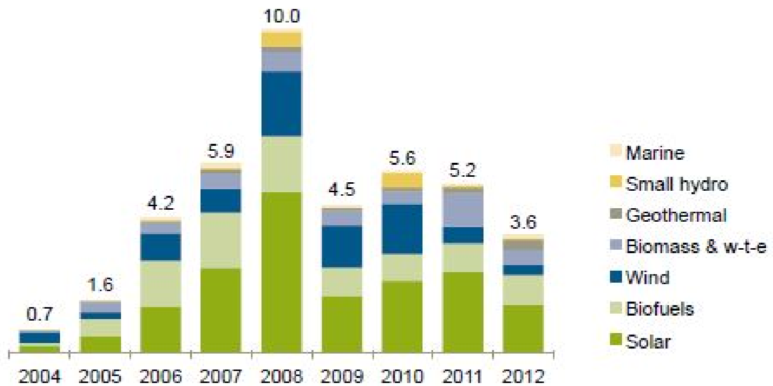
VC/PE New Investment in Renewable Energy by Stage, 2004-2012, $bn



Buy-outs are not included as new investment. Total values include estimates for undisclosed deals

Source: (UNEP/BNEF 2013)

VC New investment in RE by Sector (2004 to 2012 $bn)



Source: (UNEP/BNEF, 2013)

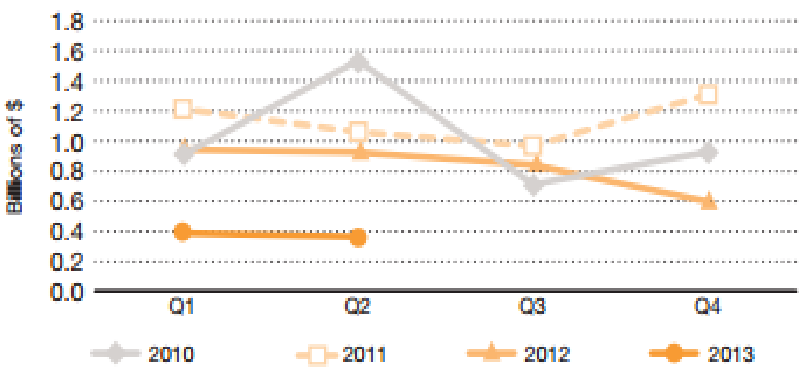
VC Funding Trends

Globally, venture capital and private equity (VC/PE) investment in renewable energy fell to $3.6 billion (30%) in 2012, which represents the lowest year since 2005. Such a decline reflects the difficulty of achieving adequate exits and a generally dampened investor appetite (UNEP/BNEF, 2013). Of this decline, 75% was in private equity expansion capital, while most of the rest was due to early-stage venture capital (down $300 million to $530 million). However, late-stage VC remained steady at $1.7 billion (down just slightly from $1.8 billion) (UNEP/BNEF, 2013). Contrary to the trend, seed funding—the earliest stage of VC—experienced a 145% increase relative to the previous year, and Series C funding rose 21%.

The decline in 2012 came as VC/PE investors faced bleak economic conditions and unattractive trading conditions for renewable energy stocks. Overcapacity, declines in product prices, continued policy uncertainty (particularly in the United States), and decreases in production subsidies in Europe contributed to this trend (UNEP/BNEF, 2013). At the same time, VC/PE investment across the economy as a whole—the aggregate value of all deals across every industry worldwide—fell 22% to $39 billion (UNEP/BNEF, 2013).

So far in 2013, clean energy and energy efficiency venture capital and private equity investments have declined significantly, totaling 68 venture capital and private equity investments in Q2 2013 (worth $1.3 billion) down from 86 deals in Q1 2013 that totaled $2.4 billion. The decline in Q2 2013 was most significant in early-stage venture capital, where there were 19 series A, B, and seed investments compared with 40 in the previous three months (BNEF, 2013). This totaled only $86 million, the lowest volume since BNEF started recording such figures in 2004. Late-stage venture capital was also down but not so significantly (totaling $519 million, which was 25% below the four-quarter average (BNEF, 2013)). However, Q2 2013's investment was only marginally below 2012's quarterly average of $1.4 billion (BNEF, 2013). Private equity expansion capital for clean energy companies was also lower in Q2 2013 than Q1 at $653 million (41% less than the first quarter). However, this was actually relatively robust more generally as it was higher than the quarterly average for all of 2012 (BNEF, 2013).

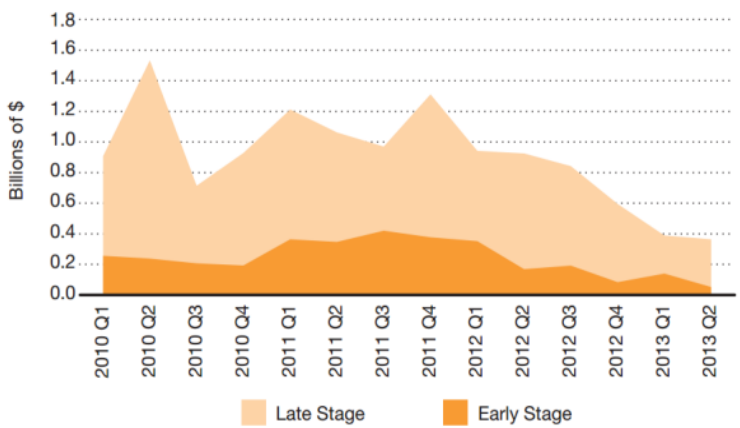
Clean Energy Funding Trends by Quarter 2010-2013



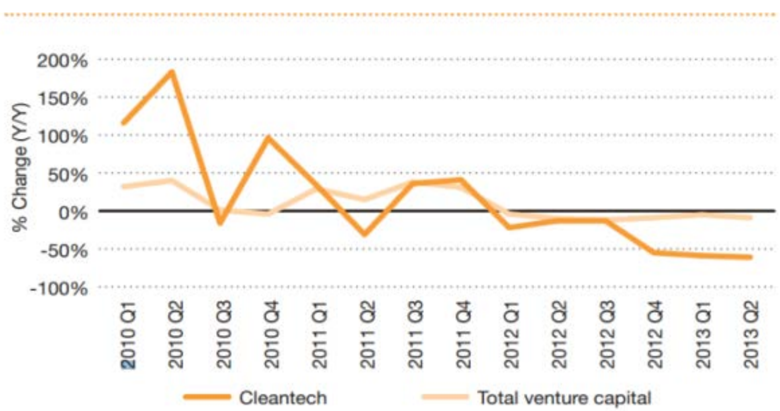
2013 Second Quarter Sequential Growth Factors (Q/Q Growth)

	% Change in deal Volume	% Change in avg deal size	% Change in investments
Early stage	-39%	-39%	-63%
Late stage	-26%	69%	26%

Clean Energy Funding by Stage Each Quarter, 2010-2013



Growth in Cleantech Funding Compared with Total Venture Funding



Source: PwC, 2013

VC Funding Trends

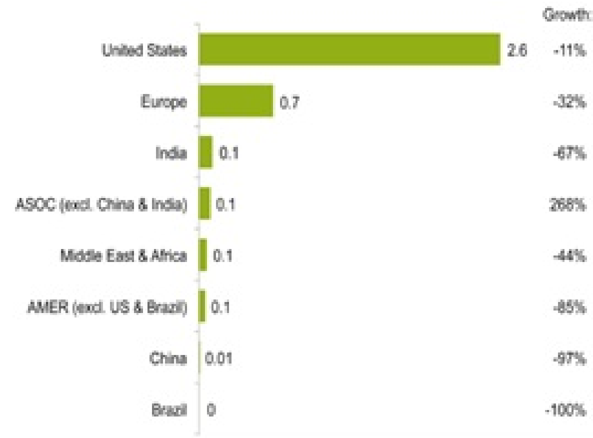
Declines in 2013 contradict the typical trend across all industries. Market watchers generally agree that venture investment increased across all industries in Q2 2013 (Preqin recorded a 14% increase in the global value of venture deals and Pitchbook notes a 12.5% improvement in the U.S. market) (BNEF, 2013).

Further, first-time funding in renewable energy decreased 95% to $3 million in Q2 2013 relative to Q2 2012. PwC reports that early-stage investment was just $52 million during Q2 2013, a decrease of 69% relative to a year prior, while cleantech investment for late-stage opportunities decreased by 59% to $312 million. Early-stage average deal size decreased 56% and late-stage average deal size decreased 50% over the same time period (PwC, 2013).

BNEF notes that trends reflect investor wariness of clean energy (BNEF, 2013). For instance, VantagePoint Capital Partners abandoned fundraising for a new $1.25 billion clean-tech fund earlier this year citing insufficient interest from limited partners. Others such as Draper Fisher, Silver Lake, NEA, and more have also pulled back from the sector (BNEF, 2013). One cited reason for investors being wary of the sector is a lack of exit opportunities (BNEF, 2013).

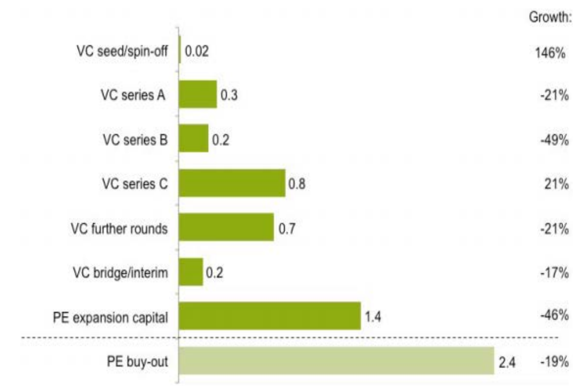
The broader picture is more positive according to BNEF. The U.S. National Venture Capital Association notes there were 21 venture-backed IPOs in the United States in Q2 2013, raising $2.1 billion—more than double the volume and dollars seen in the first quarter.

VC/PE New Investment in RE by Region, 2012, and Growth on 2011 $bn



Buy-outs are not included as new investment. Total values include estimates for undisclosed deals

VC/PE New Investment in RE by Stage, and Growth on 2011, $bn



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VC/PE New Investment in RE by Region, 2004-2012, $bn

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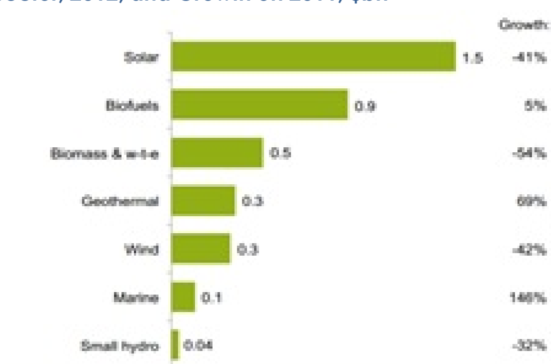
VC/PE New Investment in Renewable Energy by Sector, 2012, and Growth on 2011, $bn



Buy-outs are not included as new investment. Total values include estimates for undisclosed deals

VC/PE, Public Markets, and Asset Finance Investment in Renewable Energy in the United States by Sector, 2012, $bn

	Asset finance*	Public markets	VC/PE	Total
Wind	14.8	-	0.04	14.8
Solar	6.8	0.6	1.3	8.8
Biofuels	0.8	0.4	0.8	1.9
Biomass & Waste	0.7	0.01	0.2	1.0
Geothermal	0.1	-	0.3	0.4
Marine	-	-	0.003	0.003
Small hydro	-	-	0.002	0.002
Total	23.2	1.0	2.6	26.9

*Asset finance volume adjusts for re-invested equity

Source: UNEP/BNEF, 2013.

Technology Investing Stages + Funding Gaps

The Classic Investment Stage Progression for Technology Investing, Including Funding Sources and Development Processes/Activities (IRENA, 2013; UNEP, 2013)

<table>
<tr><td>Process</td><td colspan="3">Technology Research</td><td colspan="2">Technology Development</td><td colspan="2">Manufacturing</td><td colspan="2">Rollout (project finance)</td></tr>
<tr><td>Activity</td><td>Basic R&D</td><td colspan="2">Applied R&D</td><td colspan="2">Demonstration</td><td colspan="2">Market Development</td><td colspan="2">Commercial Diffusion</td></tr>
<tr><td>Funding Source</td><td colspan="2">Government and University Labs</td><td>Angel Investment</td><td colspan="2">Venture Capital</td><td colspan="4">Private Equity</td></tr>
</table>

There is now a funding gap between the angel investment round of funding and that of venture capital (the technology "valley of death"). Where venture capitalists typically would fund a Series B round, many have opted to move down the continuum to a later stage with less risk (Rosen, 2013). There is an additional funding gap in the growth stage (the commercialization "valley of death" or "debt-equity gap") as the capital requirements for commercializing CE technologies is beyond the risk tolerance and timelines of most existing debt and equity markets (BNEF, 2010).

<table>
<tr><td>Process</td><td colspan="3">Technology Research</td><td colspan="2">Technology Development</td><td colspan="2">Manufacturing</td><td colspan="2">Rollout (project finance)</td></tr>
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<tr><td>Funding Source</td><td colspan="2">Government and University Labs</td><td>Angel</td><td>**Technology Valley of Death**</td><td colspan="2">Venture Capital</td><td>**Commercialization Valley of Death**</td><td colspan="2">Private Equity</td></tr>
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Overview

Economic Conditions: Wider economic problems have had an impact on investment since 2008, despite growth, and they remain a threat (UNEP/BNEF, 2013). The euro area sovereign debt crisis started to impact the supply of debt for renewable energy projects in Europe, as well as increased cost of funding and upgraded risk assessments involved in lending to borrowers abroad. Natural gas prices also affect the attractiveness of CE investments.

Policy Complexity: Policy affects market demand, which in turn affects technological innovation. In the United States, Congressional support for clean energy and a price on carbon has ebbed in the face of low natural gas prices and new concerns about the cost of renewable energy support (UNEP/BNEF, 2013). However, state policy tends to drive local clean energy markets given the lack of federal movement in this area. Direct financial incentives can help make a project more economically attractive, while a Renewable Energy Portfolio Standard (RPS) may reflect a hospitable market and support. Nonetheless, policy environments and actions to either remove or create new ones are highly uncertain and often volatile. Further, regulatory uncertainty (access to the grid) can drive feasibility. This uncertainty increases investor risk.

Development Risks: For any technology to proceed through investment stages, it must have three components: solid technological advantage, a market for the technology, and a talented team to commercialize it. The challenges to CE development in each of these areas are unique.

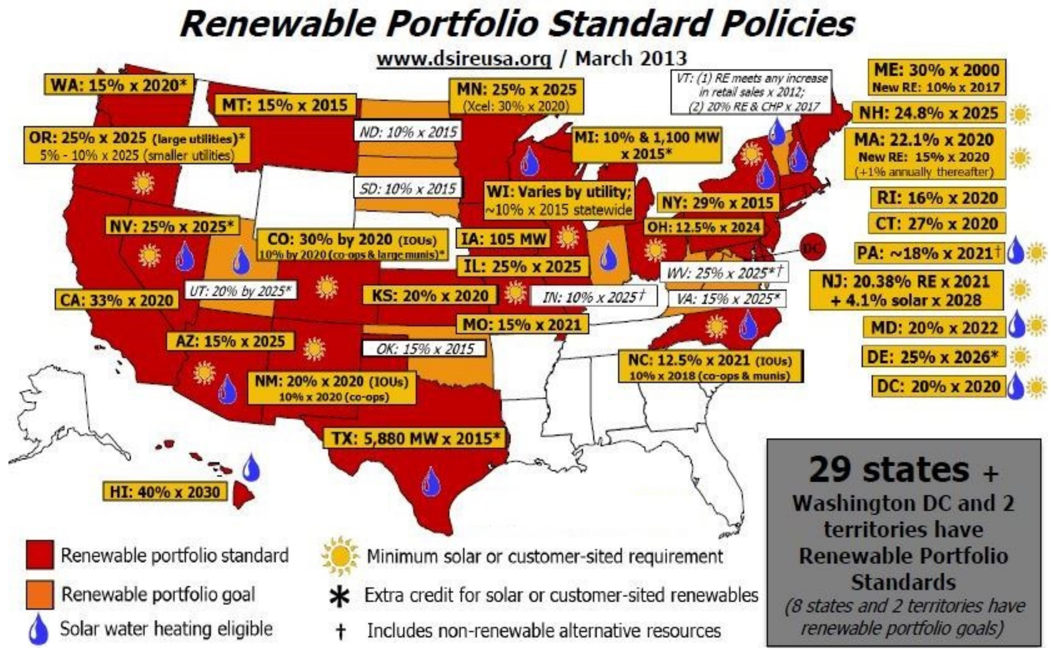
Policy Complexity

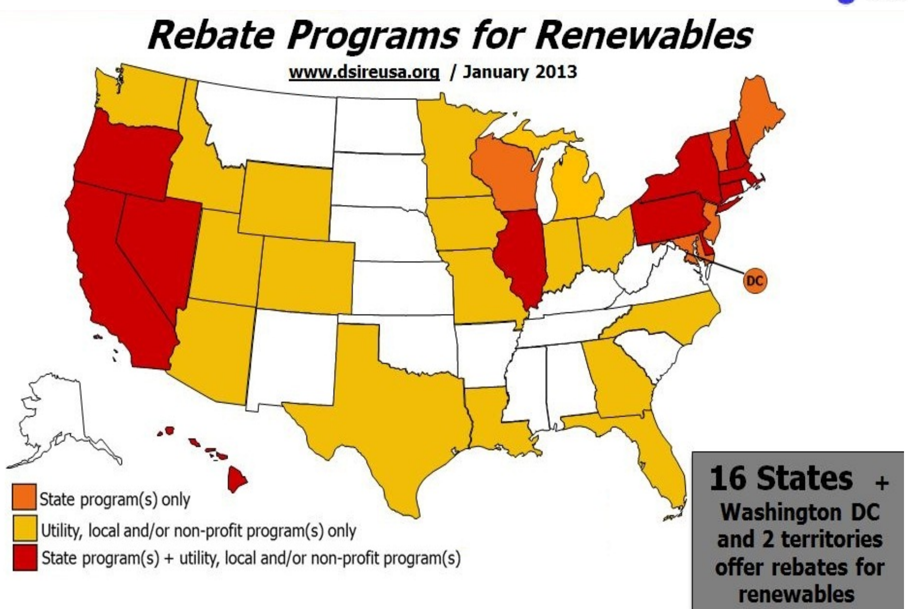
Stage of Development	R&D Innovation	Demonstration	Targeted Deployment	Untargeted Diffusion	Market Independence
Objective	Encourage innovation and entrepreneurship	Prove concept at scale	Support diversity of scalable technologies	Support resource efficiency and competitiveness	Stable and securing ongoing growth
Policy/Tax Mechanisms	• National targets • National research agendas • Fiscal incentives	• Regulatory and legal framework for specific developments/projects • Investment tax incentives	• Feed-in Tariffs • Portfolio standards • Grid development •Targets for specific industries/resources	• Technology neutral renewable energy targets • Carbon taxes • Carbon trading • BAT requirements	With or without: • Carbon taxes • Carbon trading

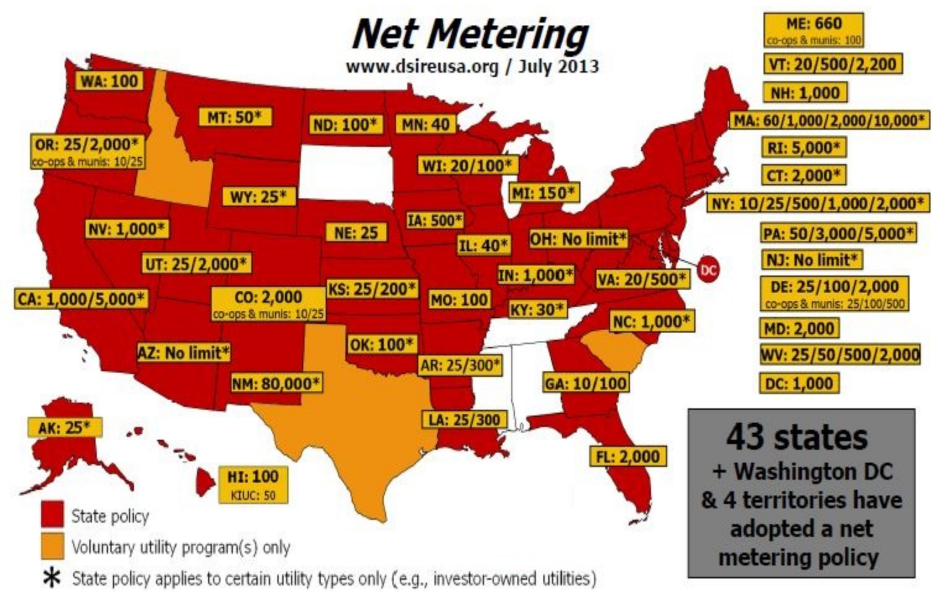
Source: Adapted from UNEP SEFI (2008); UNEP & Partners (2009); and UNEP SEF Alliance (2010)

Policy regime instability was the main issue dampening investment in 2012 in important developed economy markets (UNEP/BNEF, 2012).

Government support in the United States is complicated by a complex framework of varying state incentives, which can easily be changed or repealed depending upon the political winds. For example, of the 30 states to have RPS, eight considered legislation to repeal them in the summer of 2013 (*Midwest Energy News*, 2013).



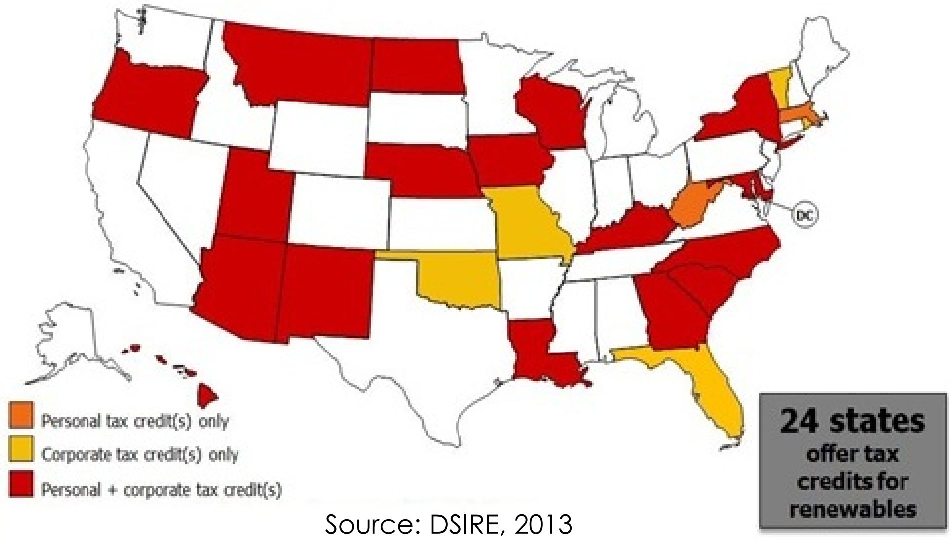




Policy Complexity

In addition to a complex web of varying state credits, the federal Production Tax Credit (PTC) and Investment Tax Credit (ITC) have gone through a repeating cycle of extensions, with credit horizons being different for different forms of generation. Whereas both wind and solar have a PTC of 2.3¢/kWh, wind projects will have the ITC of 30% until the end of 2013 (AWEA, 2013), and solar projects have the 30% ITC through to 2016 (SEIA, 2013).

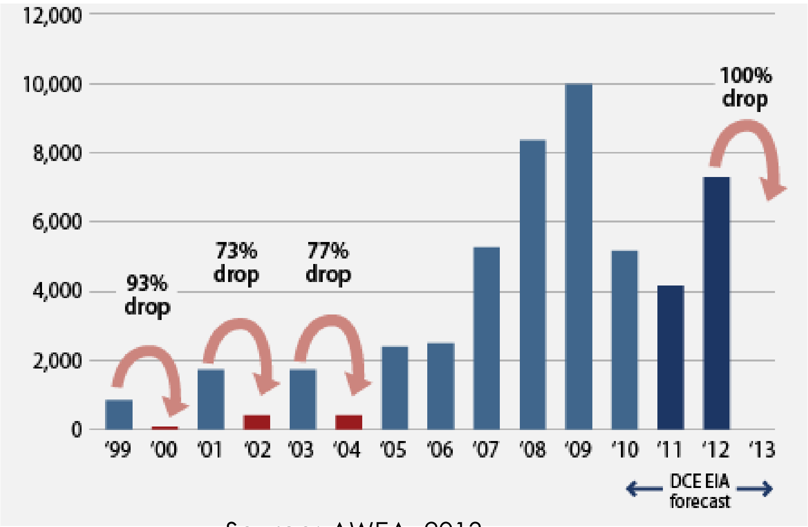
Tax Credits for Renewables



Source: DSIRE, 2013

Investors prefer to base investment decisions on longer-term policy. The PTC in particular has affected U.S. wind power development from 1999 to 2013. Investor confidence in policy allows for increased investment, as can be seen starting in 2005 through to 2010, and then in the decrease in investment as the policy future became uncertain in 2010.

U.S. Wind Annual Capacity Additions (GW)



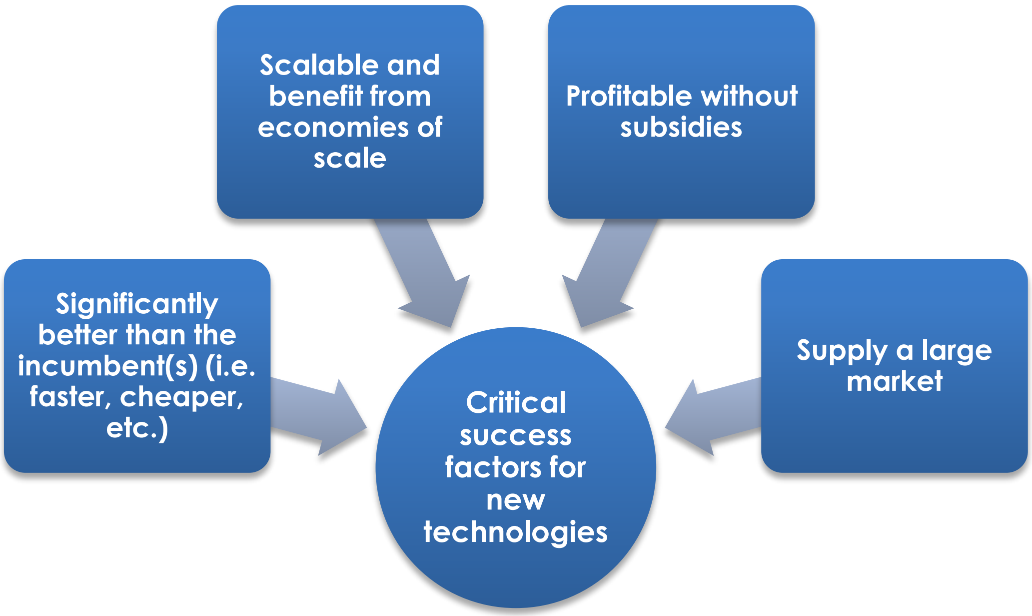
Source: AWEA, 2013

Development Risks - Technology

With a few notable exceptions, technology development in the clean energy space is complex, time-consuming, and capital intensive. Key challenges to technology development include:

- The incumbent utility industry has had public support for over 100 years, and therefore had time to perfect their business model.
- Unlike most consumer products that are tangible and with which consumers can clearly evaluate the benefits, the realities of "clean" versus "dirty" power can't be distinguished. Home and building occupants simply expect the lights to come on.
- Environmental stewardship is mostly a public initiative, and private investors are incapable of reaping all the returns that an innovative technology might offer (CEG, 2013).

Technology risk can include performance of the technology, potential equipment defects, financial strength of the manufacturer, and future technological change (GCPF & DB, 2012).



Development Risks - Market

When the cost of per installed MW of clean energy is still often higher than that of conventional energy production, risk is incurred, and investors consider the potential returns on investment. Clean energy related products and services mainly sell into highly regulated and entrenched marketplaces, such as power generation markets, commodity chemicals, or energy efficiency products. The returns and investment horizons of clean energy are fundamentally different from other industries. For instance, returns on software focused funds that closed before the early 2000's dot.com crash routinely saw 10X returns. These historical success stories are not prominent in clean energy's history. In fact, stemming from this dot.com crash, many of the funds that were still open were looking at a very bleak exit market for software companies and began to search elsewhere for places to allocate the funds. This led to an "unnatural bubble" of investment from about 2004 to about 2010. This last-ditch-effort strategy was bound to produce many more failures than successes, and it did, creating part of the current reluctance to invest in clean energy.

Although the general perception is that returns must be sacrificed when investing in clean energy, some argue that investors are now placing a greater premium on reducing overall volatility in their portfolios considering the wide swings in equity markets since the turn of the millennium. Thus, investors pursue different risk reduction strategies. While one approach is to reduce risk assets in a portfolio, another is to find ways to account for a broader spectrum of risks relevant to invested assets. A sustainability focus in investment portfolios can help address concerns about volatility and risk, but many investors still question performance results (assuming a returns trade-off for a focus on sustainability) (UBS, 2013).

However, although some sustainability-oriented funds have indeed generated mixed performance results, this also holds true for any active investment approach (UBS, 2013). Sustainable investing strategies perform approximately in line with mainstream benchmarks (UBS, 2013). Actively managed portfolios should diverge from the benchmark in proportion to the risk taken, and active funds are expected to underperform by investment costs, on average.

In addition, sustainable investing isn't always just about risk reduction—some investments are indeed more risky and require a more sophisticated fund holder. Thematic portfolios, for instance, are less well-diversified than broader portfolios since they focus on specific types of companies.

This figure shows that investors in the S&P Global Clean Energy Index indeed "sacrificed" returns, but this was because of the risks associated with the limited number of companies available to provide exposure to the theme. This indicates that investors shouldn't view the risks and opportunities associated with sustainable investing themes in isolation, but rather that they should consider them as part of everything that is relevant (UBS, 2013).

In addition to the risk of returns, other market risks can include off-take (demand/price and quantity), financial strength of the purchaser, and supply risk (availability of resources, resource costs) (GCPF & DB, 2012).

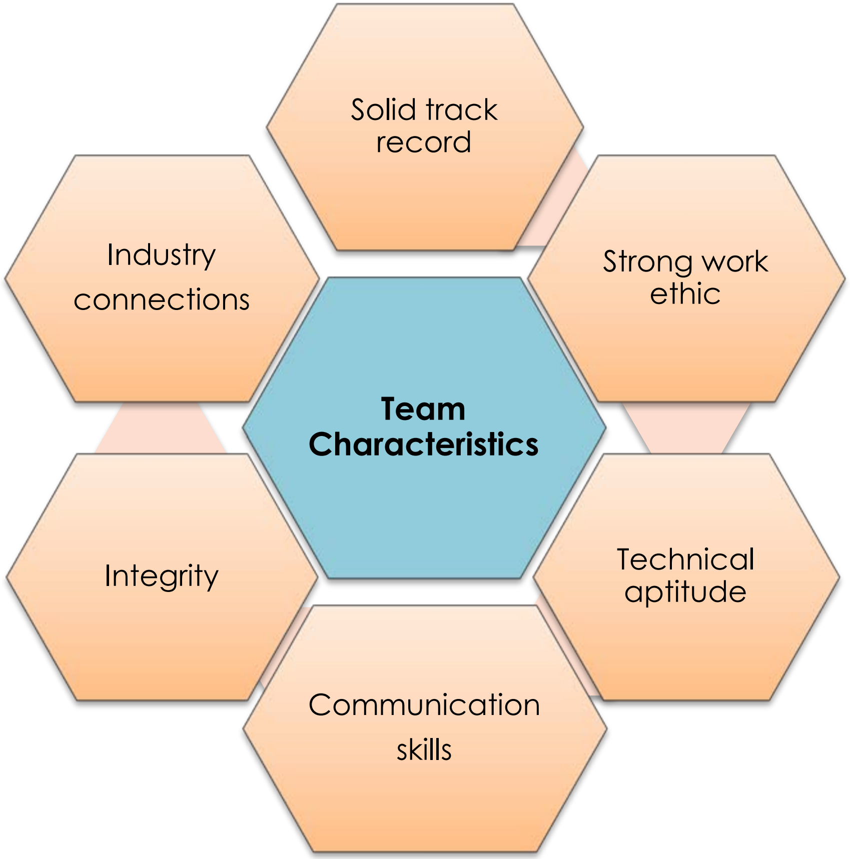
Thematic Funds Offer Different Risk/Return Profile

Source: UBS, 2013.

Development Risks - Team

As with most technology ventures, the technology inventors and company founders are not necessarily best equipped to grow the company to the size it needs to be to realize venture capital-type returns. In some cases, the direction and tactics of those who are best equipped to scale the company do not align with the founders. The vast majority of founders don't go the distance in growing companies up to and through IPOs, as the skillset needed to do so is different from those needed to start the company (Sangani, 2013).

Investors in most sectors, CE included, prefer to see geographically co-located teams. There are several characteristics a potential investor looks for in a management team to grow the company beyond the initial R&D phase. It is widely viewed as disadvantageous to install outside members to the team in order to execute an investment round, but if these characteristics are not evident in the current team they must be added.



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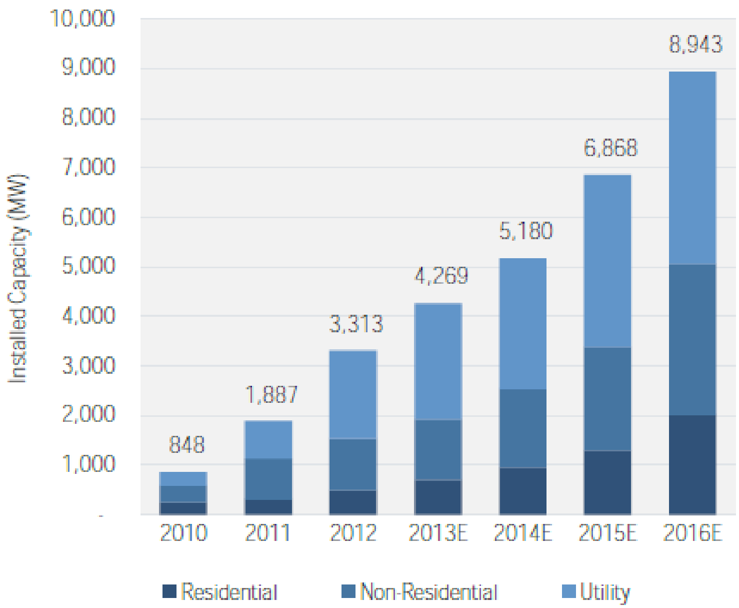
U.S. Solar PV Market – Past and Forecasted Installation Trends

- The capacity of solar PV installations in the United States has seen significant growth since 2010, driven by the significant cost reductions as well as other market and policy drivers. The most significant transformation from 2010 to 2012 was the growth of utility-scale solar as utility PV installations grew 670%. Solar PV installations increased 76% in 2012 relative to capacity installed in 2011, and 1,769 MW of utility PV was connected to the grid (57% more than the cumulative total in all previous years) (SEIA/GTM, 2012).
- Annual nameplate capacity of solar PV installations in the United States is expected to continue growing—total installed capacity of solar PV systems is expected to nearly triple from 2013 to 2016 (SEIA/GTM, 2013), although some note that this may be an optimistic projection considering BNEF predicts U.S. PV demand will be 5.2 GWs in 2015. Either way, significant growth is expected through 2016.
- Although installations in Q1 2013 declined 45% from Q4 2012, this is still 33% growth over Q1 2012—utilities generally experience booms in the fourth quarter of each year.
- When the federal ITCreverts to 10% in 2017 for commercial and third-party-owned systems and drops to zero for directly owned residential systems, 5,115 MW installed in total is projected, which is 44% below the 2016 total but still higher than what is expected for 2013. As developers look to take advantage of the ITC, 2016 will likely be an active year, depressing the 2017 total (SEIA/GTM, 2013).

U.S. Solar PV Installation Forecast, 2011-2017



Source: SEIA/GTM , 2012

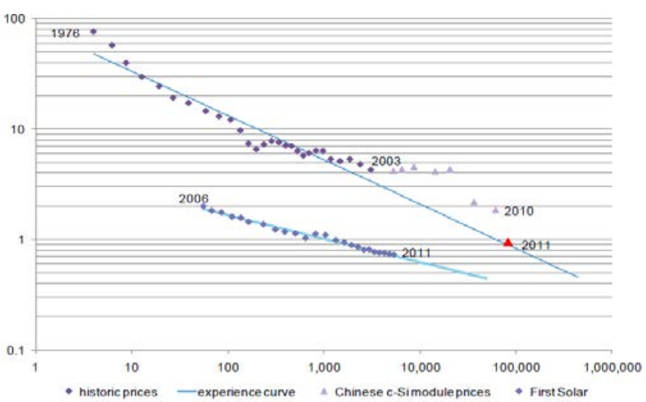
Key Economic and Policy Solar PV Market Drivers

- Significant cost reductions (discussed in detail on the next page)
- Federal tax benefits
  - ITC/Treasury 1603 grants
  - MACRS depreciation
- State policies, regulations, and incentives
  - RPS
  - Net metering
  - Interconnection standards
  - A range of financial incentives (rebates, loans, etc.)
- Financial incentives for utilities
- Electricity prices.

U.S. Solar PV Market – Declining Costs

- From 2004 to Q3 2008, PV module prices remained approximately flat—around $3.50-$4.00/W. This is largely attributed to German and Spanish tariff incentives allowing developers to buy at such a price, in addition to a shortage of polysilicon constraining production (preventing competition) (Bazilian et al., 2012). Thus, the 18 largest quoted solar companies followed by Bloomberg made an average operating margin of 14.6% to 16.3% from 2005 to 2008 (Bazilian et al., 2012).
- In 2011, solar prices dropped so much that deployment increased 54% over the previous year to 28.7 GW—which was 10 times the new build level of 2007 (Bazilian et al., 2012).
- As competition increased, prices fell dramatically from $4.00/W in 2008 to $2.00/W in 2009. Despite this 50% decline, manufacturers still made positive operating margins because of the reduced costs which were driven by scale and advances in manufacturing processes and improved performance (Wesoff, 2012).
- As of April 2012, the factory-gate selling price (ex-VAT) of modules from 'tier 1' or 'bankable' manufacturers was $0.85/W for Chinese multicrystalline silicon modules and $1.01/W for non-Chinese monocrystalline silicon modules (Bazilian et al., 2012).
- Regardless of module prices, system prices have also steadily declined since 2004 because of better racking systems (IPCC, 2012) and falling BOS costs (Bony et al., 2012).
- **Financing costs have also decreased as understanding and comfort with PV deployment risk have improved** (NEA et al., 2005; WEF, 2011).

PV Module Experience Curve 1976-2011



Source: Bloomberg New Energy Finance, 2012

Forecast Costs for Utility-Scale, Ground-Mounted PV Projects, 2010-2020 ($/W)

Source: SEIA/GTM, 2013

Solar PV Installed Costs by Market Segment, 2011-2012

	Q1 2011	Q2 2011	Q3 2011	Q4 2011	Q1 2012	Q2 2012	Q3 2012	Q4 2012
Residential	$6.34	$6.35	$6.15	$6.16	$5.88	$5.45	$5.22	$5.04
Non-Residential	$5.22	$5.09	$4.90	$4.92	$4.65	$4.35	$4.21	$4.27
Utility	$3.85	$3.75	$3.45	$3.20	$2.90	$2.60	$2.40	$2.27
Blended	$5.33	$5.15	$4.41	$4.10	$4.46	$3.47	$3.58	$3.01

Source: SEIA/GTM, 2012

Average Installed Prices by Market Segment, Q1 2011-Q1 2013

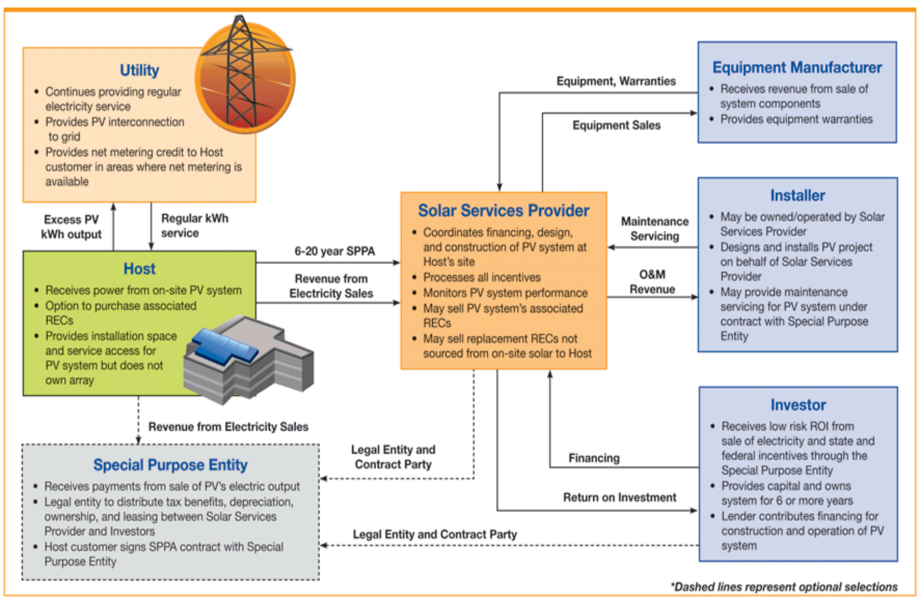
Installed Price ($/Wdc)	Q1 2011	Q2 2011	Q3 2011	Q4 2011	Q1 2012	Q2 2012	Q3 2012	Q4 2012	Q1 2013
Residential	$6.34	$6.35	$6.15	$6.16	$5.86	$5.43	$5.22	$5.03	$4.93
Non-Residential	$5.22	$5.09	$4.90	$4.92	$4.64	$4.34	$4.22	$4.26	$3.92
Utility	$3.85	$3.75	$3.45	$3.20	$2.90	$2.60	$2.40	$2.27	$2.14
Total	$5.33	$5.15	$4.41	$4.10	$4.45	$3.47	$3.59	$3.04	$3.37

Source: SEIA/GTM, 2013

U.S. Solar PV Market – Third-Party Ownership Model

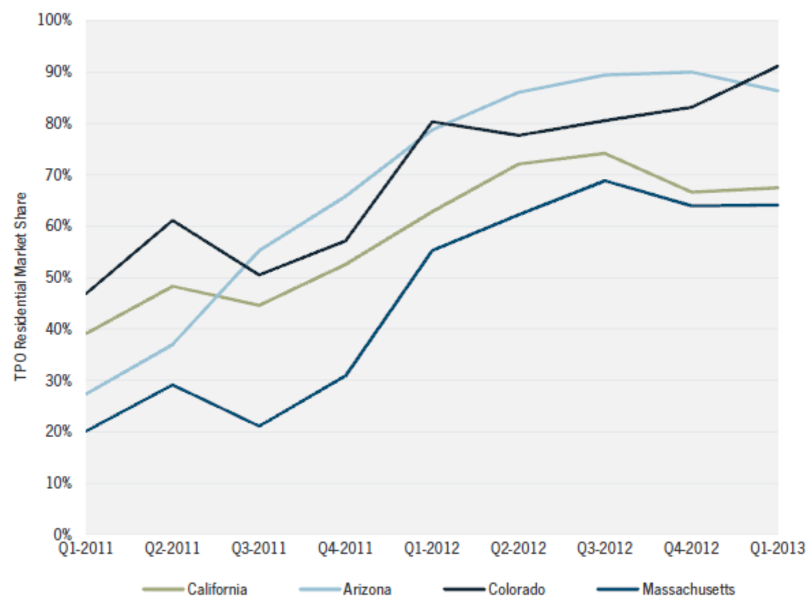
- One dominant ownership model in all sectors for distributed PV installations is third-party ownership, a structure that is most commonly referred to as a power purchase agreement (PPA) or a lease. Third parties own the systems while consumers make payments to the owner. Electricity is generated onsite at either the consumer's home or facility.
- This business model innovation allows consumers to avoid paying the large upfront capital requirements required for a PV system, and the consumer can experience the benefit of lower energy bills with little to no upfront cost (SEIA, 2012).
- Third-party ownership residential PV systems are an attractive option for homeowners in most state markets. Not surprisingly, residential leases and PPAs continued to gain momentum in 2012, increasing to more than 50% of all installations in most major residential markets (SEIA/GTM, 2012).
- However, some markets—California, Arizona, and Massachusetts—are starting to see a slight reversal of this market share growth as a result of increased PACE financing availability (California), systems being financed via mortgages with the housing market rebound (Arizona), and regional banks providing direct loans to homeowners to purchase and install solar systems (Massachusetts) (SEIA/GTM, 2013).

Roles of Solar PPA Participants



Source: EPA, 2012

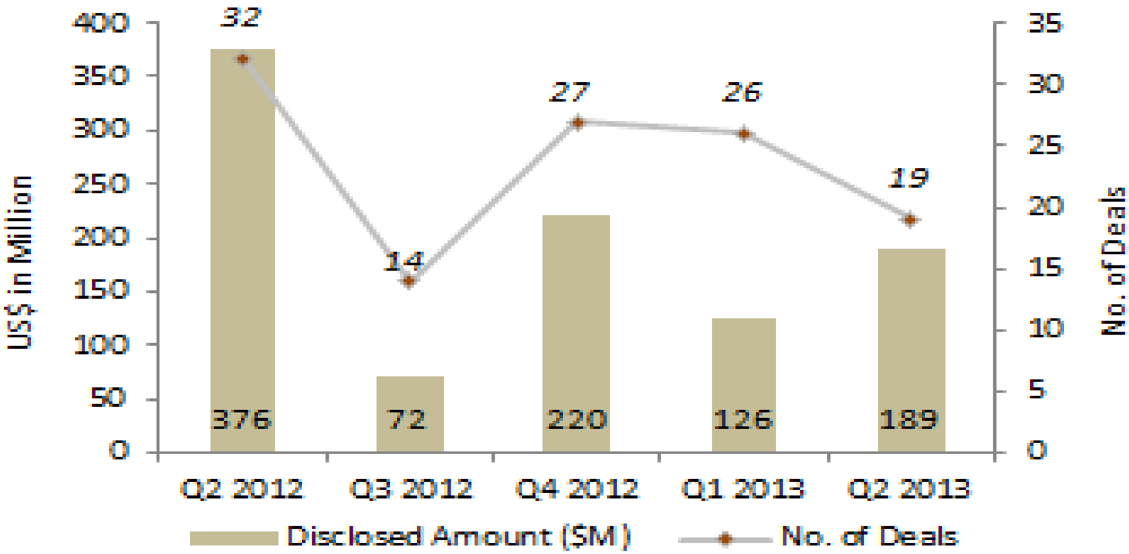
Percentage of New Residential Installations Owned by Third Party in CA, AZ, CO, and MA, Q1 2011-Q1 2013



Source: SEIA/GTM, 2013

- In 2008, the cleantech sector experienced $7.5 billion in 350 deals (all investment types).
- In Q1 2013, total solar investment (including all types of investing, ranging from angel to VC to private equity) fell to its lowest level in 5 years (with only 18 investments). Q12013 also marked the first quarter in the last 5 years with less than 25 financings (CB Insights, 2013).
- The decline is most commonly attributed to perception being poisoned following failures and asset sales.
- Despite the overall slowdown of solar deals, early-stage deals are continuing.
- Nearly 45% of investments in solar over the last year have been at the seed/angel and Series A stages (CB Insights, 2013).
- In Q2 2013, solar venture capital investments increased to $189 million in 19 deals relative to $126 million in 26 deals the previous quarter (Mercom Capital Group, 2013).
- Solar third-party finance companies raised $1.33 billion in disclosed residential and commercial solar project funds this quarter, which is a record (Mercome Capital Group, 2013).

Solar VC Funding Q2 2013



Source: Mercom Capital Group, LLC 2013

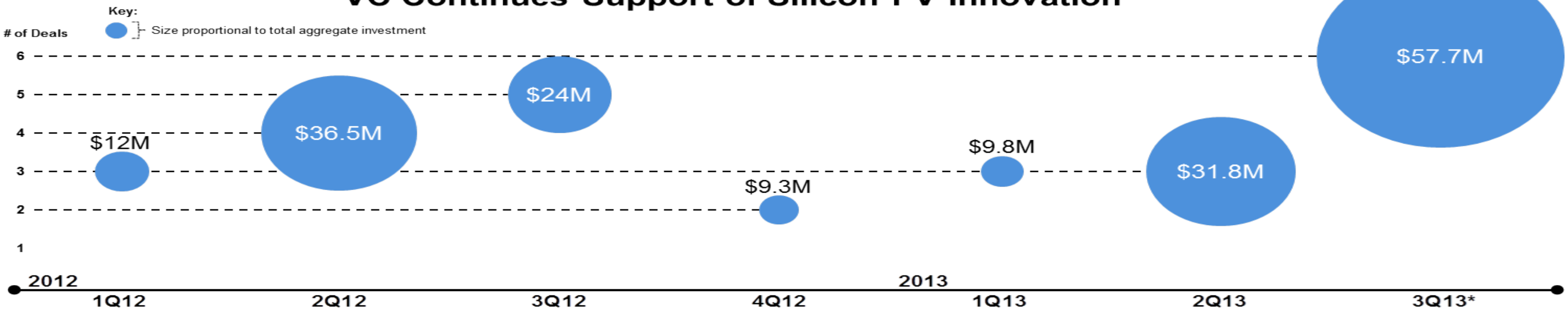
Solar Funding in 2012

	Seed / Angel	Series A	Series B	Series C	Series D	Series E+
% of deals	22.06%	22.79%	12.5%	13.97%	15.44%	13.24%
Avg deal size	$1.93M	$7.28M	$10.98M	$33.48M	$23.73M	$50.08M
Median deal size	$0.85M	$3.2M	$7M	$17M	$19M	$28.01M
Deal growth (yoy)	0	-59.09%	-58.33%	-10%	-68.75%	-20%

Source: CB Insights 2013

The solar industry's success can serve as a model for other clean energy sub-sectors. Transparency and knowledge-sharing will continue to be critical for reducing risks. Although the clean energy sector may never see investment intensity as it was in 2008, there is still activity and VCs are looking for new ways to invest (GTM, 2013).

VC Continues Support of Silicon PV Innovation



1Q12	2Q12	3Q12	4Q12	1Q13	2Q13	3Q13*
Nines Photovoltaics High-volume cell mfg. process $1M from Enterprise Ireland & Simple.ie	**Qcept Technologies** Wafer inspection technology $2.5M from Pittco Capital, Imlay Investments	Silicon Solar Solutions Process to crystallize a-Si $100K Seed round from undisclosed investors	**Xunlight Corporation** Thin-film silicon $6.3M from Emerald Technology Ventures, Trident Capital	**Silicor Materials** Upgraded metallurgical-grade silicon to lower cost $2M from undisclosed investors	**Bloo solar** Nanocrystalline silicon without p-n junction constraints $7M from Acadia Woods Partners	**Solexel** Kerfless silicon wafers and cells $40M round expansion from DAG Ventures, Technology Partners, KPCB
NovoPolymers Polymer-based PV encapsulant $7M from Capricorn Ventures, Gimv, SFPI-FPIM	**SiOnyx** Infrared sensitivity for silicon PV $7M from Harris & Harris, Vulcan Capital, Polaris Ventures	**Solexel** Kerfless silicon wafers and cells $11.5M round expansion from DAG Ventures, KPCB, Gentry Venture Partners, SunPower, Tech. Partners	**Scifiniti** Kerfless silicon wafer technology $3M from Alloy Ventures, Peninsula Ventures, I2BF Global Ventures	**Xunlight Corporation** Thin-film silicon $1.8M from Emerald Technology Ventures	**Scifiniti** Kerfless silicon wafer technology $10M from Alloy Ventures, Peninsula Ventures, I2BF Global Ventures, Firelake Capital Management	**Persimmon Technologies** Cell mfg. process optimization $5M from undisclosed investors
Qcept Technologies Wafer inspection technology $4M from Pittco Capital, Imlay Investments	**AE Polysilicon** High-efficiency polysilicon production $2M from undisclosed investors	**Bloo solar** Nanocrystalline silicon without p-n junction constraints $3M from Acadia Woods Partners		**Persimmon Technologies** Cell mfg. process optimization $6M from Intel Capital, others	**Solexel** Kerfless silicon wafers and cells $14.8M from DAG Ventures, Technology Partners, KPCB	**Silicor Materials** Upgraded metallurgical-grade silicon $6M from Hudson Clean Energy Partners
	Solexel Kerfless silicon wafers and cells $25M from DAG Ventures, KPCB, SunPower, Technology Partners, Gentry Venture Partners	**Utilight** Pattern transfer printing for high-volume Si-PV manufacturing $4.5M from I2BF Global Ventures, Waarde Capital, Bosch VC				**pv nano cell** PV metallization printing to lower production costs $3.5M from Infinity Group, Terra Venture Partners, Israel Electric Corp.
		Vitriflex Moisture barrier encapsulation film $5M from Draper Nexus, Kuraray				**Vitriflex** Moisture barrier encapsulation film $3M from SABIC Ventures
						BioSolar Bio-based films for Si-PV mfg. $200K Seed round from undisclosed investors

* as of September 4, 2013

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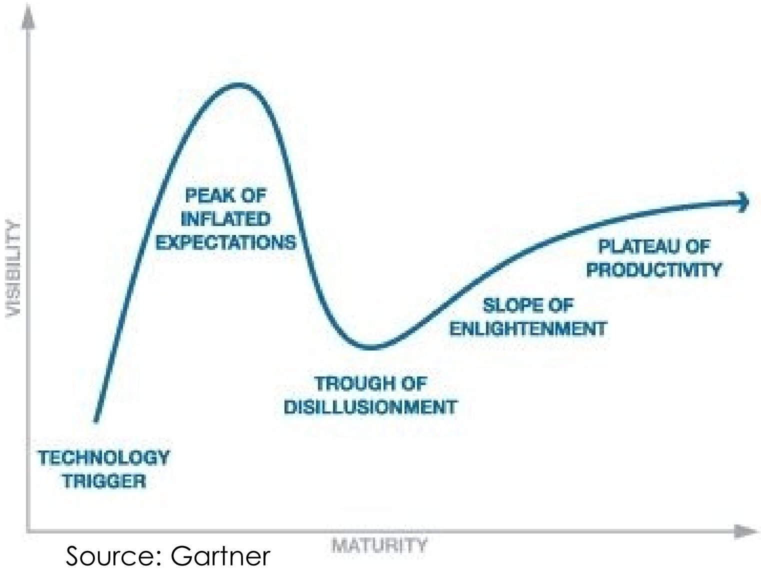
Hype Cycle

Developed by Gartner Research, the Hype Cycle categorizes the five key phases of a technology or industry's life cycle. This methodology offers a graphical representation of how development will evolve over time, and allow for stakeholders to incorporate the information into risk strategy.



Source: Gartner

Technology Trigger
- Technology breakthrough kicks things off
- Early proof of concept
- Media interest triggers publicity
- No tangible product or proven viability.

Peak of Inflated Expectations
- Publicity produces success stories
- Investments flood the space
- Some companies succeed, many do not.

Trough of Disillusionment
- Interest wanes as investments fail to deliver
- Companies shake out or fail
- Investment continues if the survivors improve products.

Slope of Enlightenment
- The technology/industry becomes more widely understood
- Second- and third-generation products appear
- More projects are funded, but not 100% participation.

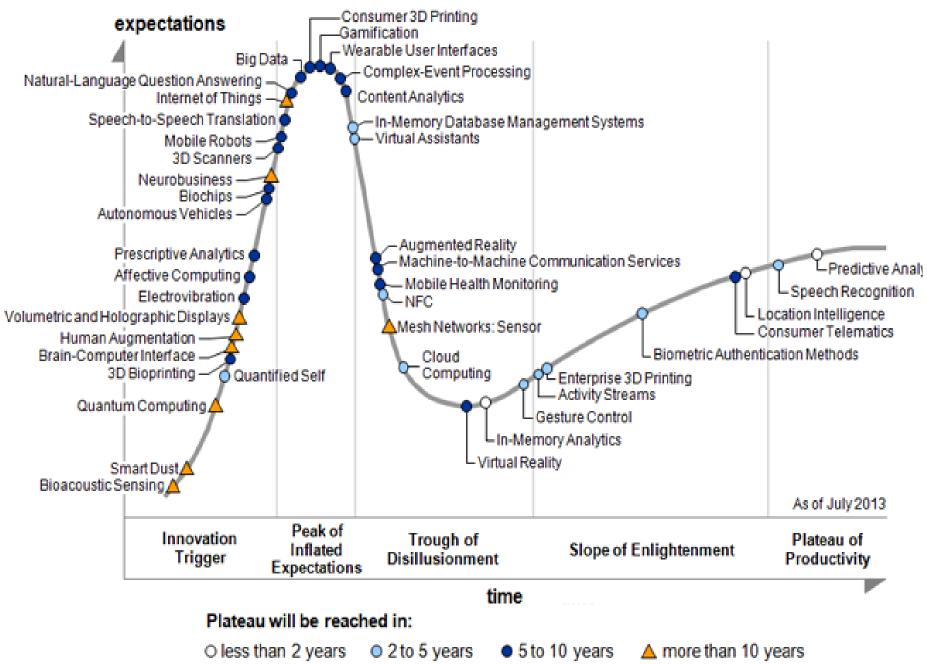
Plateau of Productivity
- Mainstream adoption
- Criteria for assessing viability are more clearly defined
- Market applicability and relevance pay off.

Contributing to the peak of inflated expectations of the Hype Cycle is the media attention devoted to specific subsectors. The amount of media a subsector receives isn't indicative of investor activity. In 2012 energy efficiency had approximately the same amount of media attention, but triple the number of VC investment deals (Dow Jones, 2013). This discrepancy paints a picture of the CE landscape that might not be accurate to the uninformed investor.

Hype Cycle Comparison

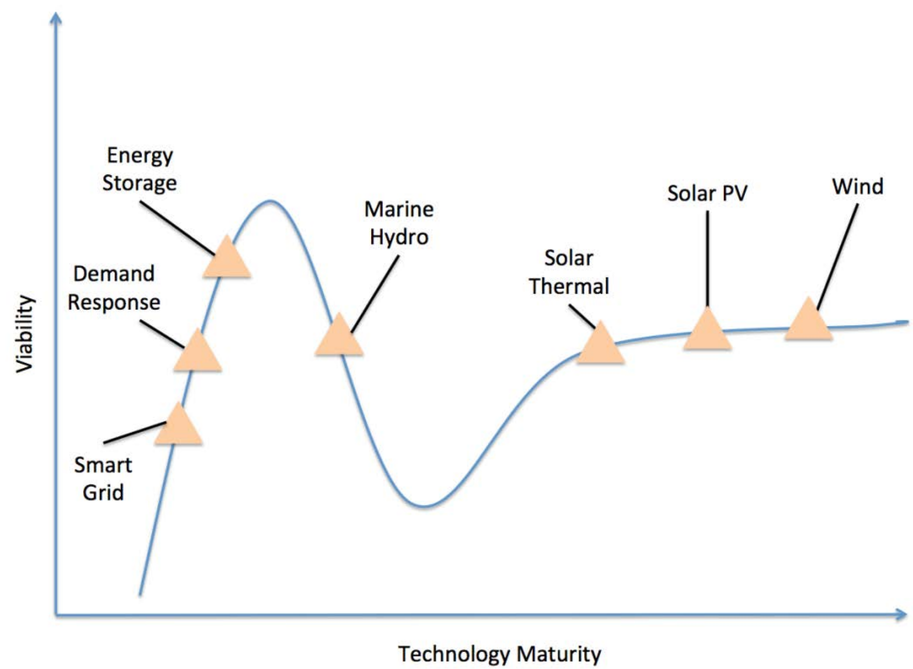
CE is being compared by early-stage investors to other more recent industries. The returns and investment horizons of these fundamentally different industries can't be compared favorably. Firms were able to invest in IT companies and expect a 10X return on investment (ROI) within a few years. These metrics don't exist for most CE companies, as their capital requirements and development horizons are fundamentally different from dotcom companies (Malone, 2013). As valuation increased with hype, a larger amount of under-qualified investors flooded the market with capital, thereby contributing to over-valuations, subsequent down-rounds, and eventually, a significantly more bleak fundraising environment.

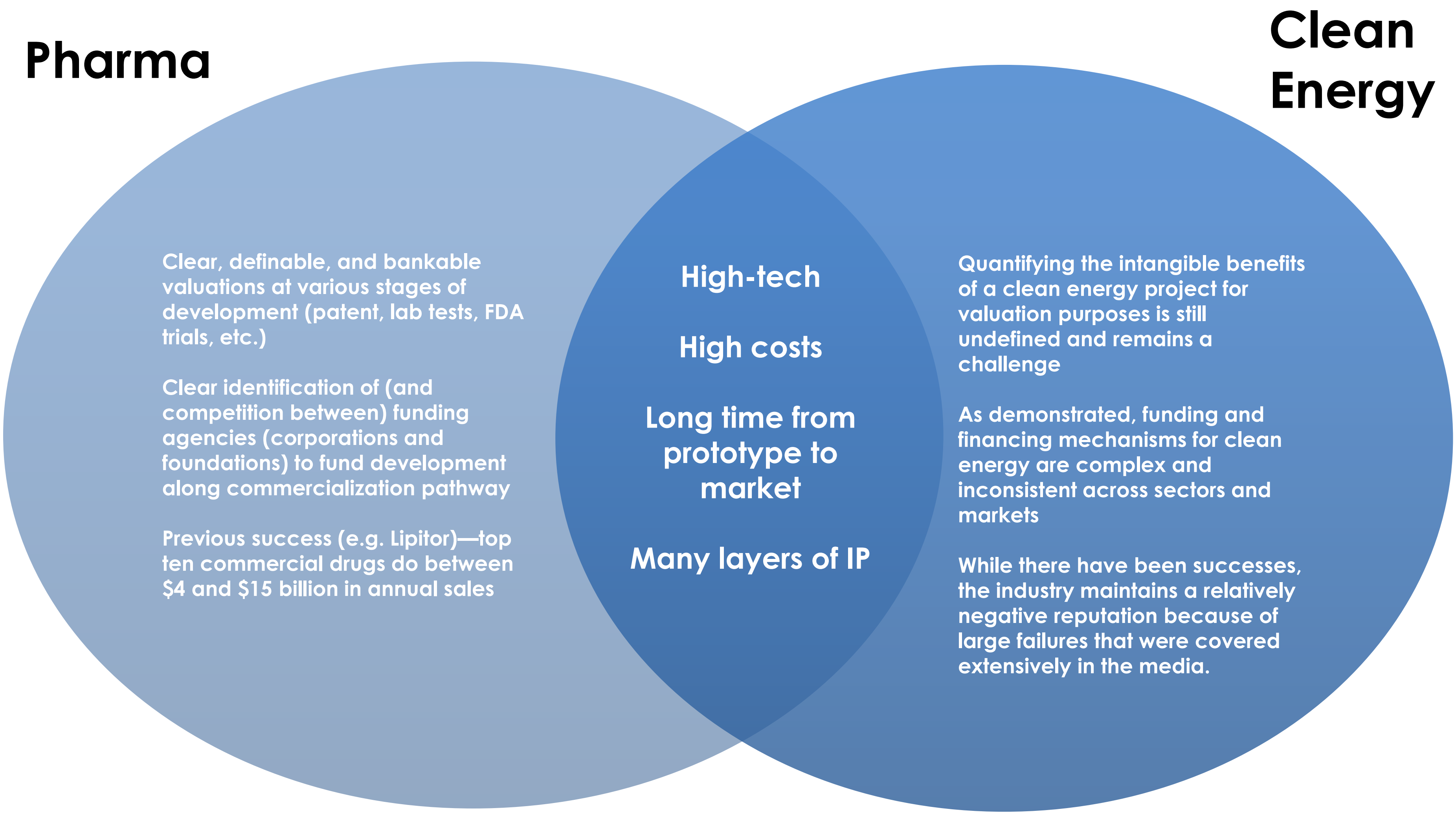
Hype Cycle for Information Technology



Source: Gartner

Hype Cycle for Clean Energy





Lesson Learned: Clear, definable, and bankable valuations are critical for reducing risk, especially for long-term, capital-intensive projects; proven successes help reduce risk perception.

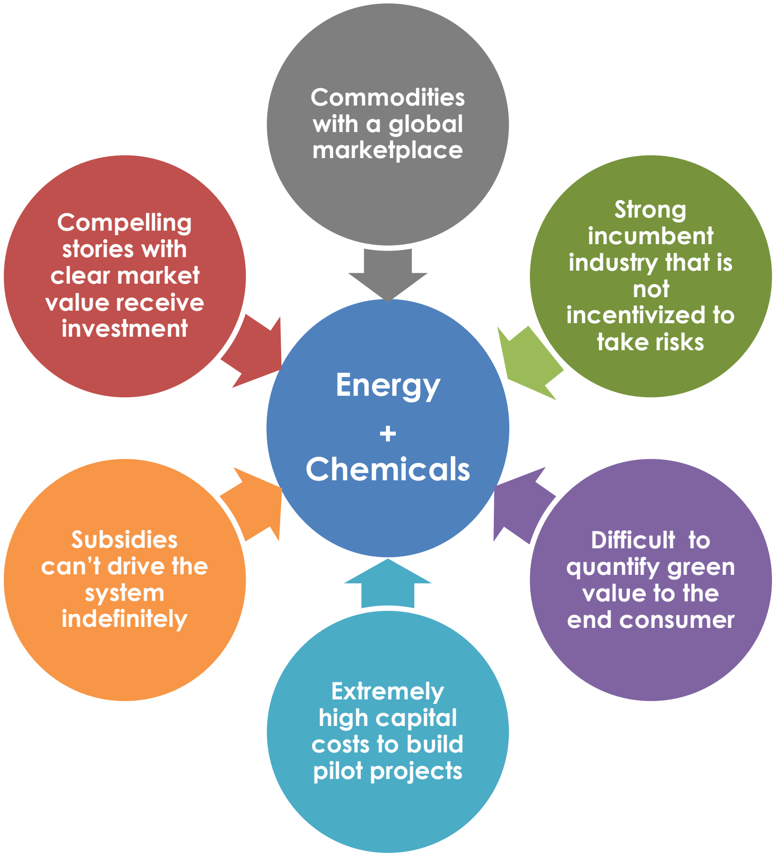
Industry Comparison: Pharmaceuticals

- The current state of cleantech can be compared to the biomedical and pharmaceutical industry of the late 1990s and early 2000s.
- During this era, it was quite reasonable for companies to raise significant amounts of capital with a firm IP position and demonstration that the drug or device resulting from the IP was effective.
- Quickly it became clear that even with defensible IP, and an effective product, a company could still fail to become profitable without a clear reimbursement strategy.
- Questions arose. It wasn't only who would use the device or drug, but who would pay for it. Medicaid? Insurance? Local government programs? Out of pocket?
- Biomedical companies showed that, without a clearly defined reimbursement pathway, a technology based business could have significant trouble scaling or raising future funding rounds.

Lesson Learned: To be successful in 2013, cleantech companies no longer need just exciting technology, defensible IP, and a compelling value proposition. Successful companies need to have a clear path to a reasonably large addressable market from the outset of fundraising.

Industry Comparison: Chemicals

The Energy Industry Compares Accurately to The Chemical Industry



Lessons Learned:

- Providing educational opportunities and access to information for all stakeholders, including consumers, workers, government representatives, and investors, increases transparency and enhances market confidence.
- Effectively communicating the benefits of such market development, and finding ways to appropriately quantify those benefits, will drive investment.
- In both industries, green alternatives were promoted through appropriate regulations and supporting policies (PERI, 2011). Subsidies and financial incentives can help promote initial market entry, but they will not drive the system indefinitely.

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Investor Insights

Over the course of one month (July/August 2013), interviews were conducted in person and via telephone with various early-stage CE investment participants, with the purpose of gathering commentary on the current investing realities and opportunities for increasing investment in the sector. Investor classes ranged from the initial sources of seed capital to the entrance of public markets. "Investor Insights" and their respective topics are listed in the following pages.

Angel Investors
- Impact Angel Group
- King Hill Capital

Family Offices and Advisors
- New Island Capital
- Elan Management
- Prime Fund

Governmental Organizations
- UNEP
- United States Department of Defense

Venture Capital
- Kholsa Ventures
- Kleiner Perkins Caufield & Byers
- Venrock
- DBL Investors
- Sail Capital Partners
- Southern Cross Venture Partners
- CalCEF Clean Energy Angel Fund
- Renewable Tech Ventures
- Aravaipa Ventures
- Lux Capital
- Nth Power

Corporate VCs & Strategics
- Saint Gobain
- IBM
- DOW
- BASF
- Siemens
- Delta

Private Equity
- Hudson Clean Energy Partners
- IMPAX Asset Management
- NEA
- Greetch Capital Advisors
- Hamilton Clark Sustainable Capital

Investor Insights – Development Risks - Technology

Unlike other sectors, energy must work 99.99% of the time. The end user expects the lights to come on when he/she flips the switch. It is a great burden that innovative CE technologies must overcome. Once reliability can be established, the sector can compete with fossil fuels and nuclear. What is important is for technology developers to learn from mistakes, including others than have preceded them. Developers and investors must understand the horizon needed to develop tech in this space.

Winning technologies aren't incremental innovations. Revolutionary ideas that challenge existing processes are what attract investment.

"Even if you don't reach your goal as quickly as hoped for, there is always something to learn and value in what's been done."

"Investors should look for technologies that will have a radical effect on the world. If you only number crunch and look for safe bets, you're missing out on the revolutionary opportunities. Some investments simply have an unknowable upside."

"IP is everything. If you can't protect that you don't have a leg to stand on."

"Clean energy has a problem with expressing the tangibility of green electron to the end user. Quantifying the environmental and social values of clean energy technologies will motivate demand and innovation."

Investor Insights – Development Risks - Market

With the rise of clean energy investment in the mid-2000s, there was a "feel good" attitude of investing in promising environmental and socially conscious technologies. When these investments didn't pan out similarly to earlier sectors such as IT, the green premium connotation was lost. There may even be a clean "discount". CE must now compete with other sectors on return expectations, but also reassure investors of their capacity to commercialize technologies, all while dealing with external factors such as competing energy commodities and varying government support.

However, energy has an enormous global market, and the boom/bust cycle has repeated itself many times. Oil and gas has already been up and down the curve in 1985 and 1999.

Furthermore, given the long development cycle of CE technologies, most past investments have yet to see their exit strategy come to fruition. Over the coming years we will see what has worked and what hasn't. With that wisdom the sector will progress.

"Energy always comes back, and so will clean energy. If it shows value it will make money."

"Don't underestimate the rate of sales adoption. It always takes more capital than you think it will."

"The market responds to sound economics. Compelling stories will get investment."

"There is a misconception that clean energy is dead. That VC is pulling out. There's no way that's true. It's a core part of industry growth across all sectors. More and more new products are coming onto the market, just maybe not defined as clean energy."

Investor Insights – Development Risks - Team

Finding the right team to commercialize an innovative technology is the most difficult part of development. A mediocre team can run a good idea into the ground, but a great team will find a way to make a concept succeed. There is a consensus that there is an abundance of promising technologies, but a disconnect with the talent available to bring them to market. Investors will walk away if they question the dedication or credibility of the team, or if there is litigation among stakeholders or customers.

Investors prefer to get involved when there is more than one founder. Multiple founders bring varied expertise, as well as an attitude of compromise. In CE it is very important to have industry expertise. The incumbents are very powerful. Knowing how to manage the landscape is tantamount.

"We run away from CEOs with big egos. It's a tough transition of running a company versus being in the lab."

"Bad behavior or questionable integrity of the team during due diligence is a reason to walk away."

"Management with energy industry expertise is invaluable. But talent is just as important."

"Team members with a track record are important, but they also need to have passion."

"The triple bottom line is starting to attract top talent from other industries."

Investor Insights – Industry Comparisons

Many CE investors came from the IT world, expecting similar returns and exit strategies. However, CE is fundamentally different from IT. Whereas an innovative software platform or device could be developed within a few years (and in some cases months) for millions or even hundreds of thousands of dollars, CE technologies can take more than a decade to develop and require millions in investment at multiple stages of development: proof of concept, prototype, pilot project, field trial, demonstration project, first commercial project, etc.

Additionally, many of those investors within the IT industry didn't understand the fundamentals of the energy industry: incumbent players, energy being a commodity under government regulation, etc. When considering customers, IT is mostly B2C, whereas CE is primarily B2B. The utility ultimately sells electrons to individuals and businesses, but the sale of a CE technology company is made with the utility, with a long associated sales cycle.

CE compares more favorably to the chemical and biotech/pharma industries: long development cycles, strict government regulations, and strong incumbent players.

"In the dot.com days, if you had $10m you could give 10 companies $1m each, and expect two or three to hit. With clean energy it's $10 to $20m just to get a prototype, and then another $30m or more to get to a pilot project. A full demonstration could be in the hundreds of millions."

"The VC world is encumbered by expectations of returns that don't like large-scale projects."

"There's been a disconnect between hard tech and soft tech. Hard tech can't be developed with 10 year LPs."

"It's still relatively early in the CE continuum. In a few years we'll see more opportunities enter the space."

Investor Insights – Opportunities – Government Policy

Governmental policies need to complement each other, and provide a clear statement of objectives as well as a defined horizon. Additionally, state initiatives should be coordinated with those of the federal government. Energy is a global commodity, but differences in state policies will increase risk and force uncertainty into demand.

Government should stay away from picking winners and losers. It should make it easy for a vetted technology coming from a university or lab, or with existing seed money, to get a second round of financing to bridge the first development gap.

"The proper policies can bridge the market to bankability."

"To be effective policy must be prudent and timely."

"Markets are regional, but influential policies are set by states. Coordinated state policies, especially in adjoining states, would do much to increase market development."

Investor Insights – Opportunities - Partnerships

Partnerships allow for energy ventures to de-risk development without losing economic potential. Investors at all stages considered strategic partnerships an instrumental part of CE progress, without which they would consider not investing in a company. Government partners help in the initial stages, in de-risking early stage development. Large corporate partners are essential in later stages of development, with industry wisdom, supply chain expertise, and most importantly, an existing customer base.

"It's very important for a startup to understand the culture aspect of a partnership. Misaligned values can derail even the most promising technology."

"Few startup companies fail because the tech didn't work. Usually it's because the sales cycle wasn't understood and they ran out of money, or the regulatory and tax process can't be navigated. This is where partnerships really add value."

"Innovators are usually clueless. They have no idea about commercialization costs or issues in the supply chain."

"Clean Energy 2.0 will be based upon strong partnerships between innovative companies and visionary incumbents."

Investor Insights – Opportunities – Financing Mechanisms

Developed decades ago, the current regulatory framework is not set up to take advantage of current investing realities. There are millions of unaccredited investors who are willing but don't have the mechanism to invest in promising CE technologies. Crowdsourcing offers the ability for the average citizen to get involved, but SEC rules must be changed. Additionally, SEC Rule 506, allowing the solicitation of investors, would allow companies seeking investment to pitch to a larger audience.

Significant opportunities are available with the philanthropic organizations/investors. Billions of charitable capital has been sitting on the sidelines, unable to navigate the IRS framework. Changing tax terminology to allow CE as a charitable effort (i.e., as was done for vaccines) would unleash billions in investment.

Mechanisms such as efficacy insurance and warranties could improve the bankability of technologies and projects.

"Philanthropic money can be the game changer. We need to create a mechanism by which a 501c3 can make a profit through environmentally beneficial risk taking."

"10 year terms are round pegs in square holes. We need innovative mechanisms."

"An extra 2 years crashes the IRR for an LP. Venture capital funds need to be setup for a 10+ year life cycle. Clean energy investing will require a recalibration by investor stakeholders."

- Overview
- Clean Energy Investment Current Situation
- Investment Classes and Stages
- Challenges
- Solar PV Market Analysis
- Industry Comparisons
- Investor Insights
- **Opportunities**
- Conclusion.

Opportunities – Government Policy

Contrary to undermining innovation, government policies can stimulate innovation. The various mechanisms should complement each other, be aligned with the public interest, and lead to mature markets that ultimately don't need the policy assistance and therefore become more politically sustainable (CPI, 2011).

A wave of new strategies has started to appear in the United States to drive down the cost of capital. Developers are turning to publicly-traded "yield cos," synthetic MLPs, self-help MLPs, REITs, foreign asset income trusts, and securitizations as new financing tools or exit strategies to raise capital around operating projects (Chadbourne and Parke LLP, 2013).

Policy Mechanisms Should…

Be "loud, long, and legal"
(Hamilton, 2009)

Loud

Clearly improve the economic bankability of projects or technologies

Legal

Confidence in the government's ability to ensure compliance and due diligence

Long

Duration should coincide with the financing horizons.

Incentivize market demand
(US PREF, 2010)

Incentivize Indirectly

- Real Estate Investment Trusts (REITs)
- Master Limited Partnerships (MLPs)
- Property Assessed Clean Energy(PACE)
- Income Trusts and Securitizations.

Incentivize Directly

- Investment Tax Credit (ITC)
- Production Tax Credits (PTC)
- Feed-in Tariffs (FiTs).

Government as a Consumer

- Purchase clean energy technology and components for use on government property and facilities.

Opportunities – Partnerships

Considering the market and technological challenges that CE investors face, partnerships frequently are attractive strategies as they allow for risk-sharing and the opportunity to leverage combined resources. Potential partners for collaboration include universities and national labs, government agencies, and corporate strategic partners.

Universities and National Labs

- Innovative hubs that can de-risk technology development.

- Capitalize on technology transfer capabilities via mechanisms by which private industry can license or purchase academic or lab IP.

Corporate Strategic Partners

- Ability to handle a longer investment horizon.

- Capital and revenue streams to make large capital investments.

- Industry know-how: supply chain, manufacturing, customer base, industry track record.

- Low cost scaling and path to market.

Government Partners

Department of Defense

- Largest single user of energy in the United States.

- Quantifies value beyond cost (security, reliability, resiliency).

- Congressional mandates (i.e., must meet a 25% target of total facility energy use from renewable sources by 2025. (NDAA, 2010)

- SERDP and ESTCP programs promote partnerships to develop innovative, cost, effective, and sustainable solutions.

Department of Energy

- Continue or re-establish agency programs.

ARPA-E → formed in 2007 via the American Recovery and Reinvestment Act and has funded over 275 projects for nearly $1 billion (DOE, 2013).

DOE Section 1705 loan program → $34B and more than 60,000 jobs created between 2005 and 2012.

(US DOE LPO, 2013)

Opportunities – Financing Mechanisms

Cost-effective clean energy will require the use of a broad range of financing tools, with roles across many aspects of the technology lifecycle. In particular, soliciting early-stage financing is especially challenging for clean energy companies because of inherent challenges, including costs and access to potential investors. However, proposed solutions such as crowdfunding, investor networks, and matchmaking could direct angel investors into clean energy—an investor segment with more than 300,000 angel investors that represent $22.5 billion in investments in 2012 (James, 2013). There are also opportunities to unleash the billions available in philanthropic funds which, so far, has largely been sitting on the sidelines of clean energy investing.

Program Related Investments

- Change IRS rules to allow clean energy as a charitable purpose.
- Allow tax exempt organizations to make investments in for-profit enterprises.
- Over $600bn available in private foundations and family offices.

Government Loans + Grants

- Match government funds to private investment.
- Keep the government from picking winners and losers.
- Expedited process, with action in weeks, not months or years.
- Government input should not exceed $50m per investment.

Crowdfunding

- New SEC rules to allow non-accredited investors to participate.
- Offers opportunities to a wider pool of investors.
- Limited to raising $1m per year per start-up company.
- Increases community participation and communication on CE benefits.

SEC Rule 506

- Allows a company to sell securities to an unlimited number of accredited investors and raise an unlimited amount of funds.
- Additionally can sell to sophisticated non-accredited investors .
- Financial statement requirements.

Efficacy Insurance

- Mitigate the risks of early-stage investments.
- Manage development risk on a public market.
- Roadmap to follow from preceding industries .

Conclusion

The are numerous challenges to the progress of the clean energy sector, including fluctuating economic conditions, government policy uncertainty, and various developmental risks.

However, opportunities exist for investors with the expertise and investment strategy to take advantage of market conditions and technological innovation.

Appropriate government policies aligned with innovative business models and financing mechanisms will allow investors to realize attractive risk-adjusted, long-term financial returns.

Strong partnerships between investors, start-up companies with innovative technologies, and the incumbent industry participants will allow all stakeholders to reap the rewards of a clean energy future.

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