

Mercatus Global Advanced Energy Insights Report





About This Report

The Mercatus Global Advanced Energy Insight Report is compiled to provide energy producers with key insight into conditions and trends that are emerging in the advanced energy power generation market. The following information is based on data consolidated on energy projects in various stages of development managed in Mercatus' Energy Investment Management (EIM) platform in 2015.

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A Tale Of Two Cities

The growing pains of a rapidly transforming energy industry were prominent throughout 2015. While the macro trend toward growth in advanced energy is increasingly clear, major energy companies are evaluating, if not outright struggling with, the most effective strategies to navigate in a changing landscape.

The Paris Climate Change Conference, COP 21, punctuated 2015 with a loud signal to the market that policy makers intend to support aggressive de-carbonizing initiatives on a global scale. For the power sector this means that public financing and market reforms will support the growth of advanced energy technologies all over the world.

Political commitments only highlight a competitive environment where advanced energy is re-configuring energy markets on its own. According to Bloomberg New Energy Finance, Investment into renewable energy in 2015 hit a record breaking \$329 billion. Irrespective of policy changes, 60% of the \$12 trillion of investment forecasted to meet electricity demand in the next 25 years comes from renewable energy.

At the corporate level, however, the story is more chaotic. While the trajectory of energy markets is increasingly clear, the path to success is full of challenges. Some of the world's largest energy companies undertook major corporate restructurings in 2015 in order to adequately re-align their strategies in an advanced energy future.

Yet, a focus on new technology alone does not seem to be sufficient. In the first half of 2015, renewable energy companies were rewarded for growth. US Solar stocks were at all time highs and board-room discussions hovered around corporate acquisitions to fuel more growth. However, in the second half of 2015, the bottom fell out. In five months the Bloomberg global solar stock index decreased by slightly less than 50%. Today, improving bottom line performance, efficiency, and growing more with the same set of resources has become a top priority for 2016 within this segment.

The clear message is that energy companies need strategy and execution to align. Building a business that is increasingly technologically and geographically diverse has unique challenges. Increasing operational complexity needs to be managed with adequate tools to manage information intensive processes. The most successful energy companies in 2016 will gain a competitive advantage by digitizing their business processes. Leaders will emerge with visibility into their operations, optimized cost structures, and the ability to move with speed.

Haresh Patel CEO of Mercatus

Executive Summary

- In 2015 there was rapid growth for advanced energy technologies in developing countries. In these markets, investment into renewable energy matched that of developed countries for the first time.
- Over the long run, emerging markets represent the largest source of growth in demand for electricity and growing investment opportunities for advanced energy technologies.
- Energy companies are increasingly diversifying across technology and geography in order to provide more complete energy solutions, mitigate risk and capture emerging market segments.
- Developed markets continue to attract investment into advanced energy technologies with legacy power generation capacity going into retirement, stable market conditions and ambitious policy commitments. Over the long term, these mature markets will be increasingly defined by the development of small and medium scale distributed resources comprised of diverse technology offerings that can meet the complete needs of consumers.
- Distinctions in solar project sizes between emerging and developed countries are becoming increasingly prominent. This trend suggests that smaller-scale solar distributed generation opportunities are more pervasive in developed electricity markets while utility scale solar development opportunities are more abundant in emerging markets.

The Global Overview **Rise of the Emerging Markets**

photo by: Andrea Boldiz

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The Importance Of Emerging Markets

With a record breaking \$329 billion of investment, renewable energy technologies took a major portion of new installed capacity in 2015. The growth of these technologies continues to be a year-over-year trend with some key highlights coming from emerging markets.

In 2015 there was rapid growth for advanced energy technologies in developing countries. In these markets, investment into renewable energy matched that of developed countries for the first time. This trend reflects an environment in which advanced energy is the most competitive means to meet growing global demand for electricity. Energy producers are increasingly entering these markets as they exhibited some of the most rich investment opportunities in 2015. The increasing focus on emerging countries is expected to be a sustained trend across all power generation technologies. Over the long run, these emerging markets represent the largest source of growth in demand for electricity.

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On the other hand electricity demand in developed countries like the US and those in the EU are forecast to plateau or – in some cases - reduce over the long term. However, this trend does not mean there will be a dearth of development opportunities. With legacy power generation capacity going into retirement, stable market conditions and ambitious policy commitments, advanced energy infrastructure will continue to attract investment. Over the long term, mature markets will be increasingly defined by the development of small and medium scale distributed resources comprised of diverse technology offerings that can meet the complete needs of consumers.

Despite the massive opportunity, these emerging market segments pose significant operational obstacles. Maintaining a clear picture of ongoing business risks in emerging markets contexts becomes imperative, but can be challenging given increasingly complex operations dispersed across geography and technology. Success requires effective management of multiple business lines with insight that is real time, accurate and efficient to gather.

Target Goals From The Paris Climate Change Conference 2015



What It Takes To Make COP 21 Conference's Goals A Reality

In the end of 2015, 195 countries adopted a legally binding agreement to fight climate change at the COP 21 conference in Paris France. While specific aspects of the agreement have varying degrees of legal enforceability, all parties have committed to implementing domestic plans that track toward limiting climate change to 1.5 degrees Celsius; specifically recognizing the importance of de-carbonizing electrification. This ambitious goal simply cannot be achieved without the prolific expansion of technologies like renewable energy, energy efficiency, and storage. Below are three independent forecasts that outline what is required to meet climate change targets:

According to Bloomberg New Energy Finance, there needs to be \$12 trillion of total investment into advanced energy by 2040

According to IRENA, there needs to be \$650 Billion of annual investment in renewable energy by 2030.

According to the International Energy Agency's Bridge Scenario, renewable energy will need to:

- Account for 37% of total global capacity by 2030
- Account for 70% of total global capacity additions by 2030
- Receive \$400 billion of annual investment by 2030

Emerging Markets Are Driving Diversification

Emerging market segments are driving diversification amongst major energy producers. With increasing opportunities in these growth markets, the distribution of new capacity additions based on geography changes dramatically in the next four years.



Commercial Operation Date Of New Capacity By Geography

Source: Mercatus Energy Investment Management (EIM) Platform Data



Commercial Operation Date Of New Capacity By Technology

This diversification is not specific to geography, but to technology as well. Increasingly, solar focused companies are entering new market segments in order to deliver more complete energy solutions and mitigate technology specific risk.

Key Takeaways

Total Capacity (%)

- Major energy companies are quickly growing pipeline in emerging market segments.
- Increasingly diverse development activity is not only specific to geography but technology as well.

Source: Mercatus Energy Investment Management (EIM) Platform Data

Utility Scale Dominates The Emerging Markets

A clear distinction between North American & European markets and the rest of the world emerges with respect to solar project sizes. North America and Europe have distinguishably smaller average project sizes compared to the rest of the world.

In developed country contexts, project opportunities are increasingly defined by distributed generation, while emerging countries absorb large amounts of utility scale and distributed generation development to meet growing electricity demand. Emerging countries absorb large amounts of utility scale and distributed generation development to meet growing electricity demand.



Average Project Size By Region (MWdc)

Source: Mercatus Energy Investment Management (EIM) Platform Data

Returns in most regions fall between 6%-8.5% while European returns average below 5% and Africa & Middle East returns are slightly above 10% on average. National markets have a huge influence on the mechanisms that influence these returns, however, on a regional basis some key themes are noteworthy.

On the low end, the relative maturity of European solar markets leaves proportionally less projects with high returns in the market. Additionally, more prominent use of Feed in Tariffs (FITs) contributes to low returns as regulatory policies set target returns for solar projects with guaranteed off-take rates. On the high end, favorable solar resources in Africa and the Middle East combined with national support for solar initiatives in key countries contribute to projects with higher returns.



Average Unlevered IRR (%)

Source: Mercatus Energy Investment Management (EIM) Platform Data

Commercial Operation Date Of New Solar Power Capacity By Region



Source: Mercatus Energy Investment Management (EIM) Platform Data

Key Takeaways

- Distinctions between emerging and developed countries are prominent with respect to project size. This trend suggests that smaller-scale distributed generation opportunities are more pervasive in developed electricity markets while utility scale development opportunities are more abundant in emerging markets. This trend can be attributed to high growth in electricity demand in emerging markets.
- Maturity and competition in the European electricity markets leaves relatively fewer high return projects, depressing average returns.
- With increasing opportunities in emerging markets, the distribution of new solar capacity additions based on geography changes dramatically in the next four years.

Global Wind

In 2015, wind development accounted for one-third of total power capacity processed in Mercatus. This trend is attributed to relatively large average project sizes along with particularly strong development activity in North and South America.



Average project size by region for wind development fell between 24 MW in Europe and 148 MW in North America. In Central America, the Middle East, South America and Africa average project sizes landed between 45-100 MW.

Although North American projects were larger on average, returns in that region were the lowest, with average unlevered IRR hitting 8%. Despite relatively low returns, stability in the US power sector makes development attractive compared to other market segments.

In emerging power markets, where there is growing electricity demand, there are also higher risks – particularly those associated with off-takers - that dampen the attractiveness of project development. As a result, projects processed in Mercatus in emerging markets tend to have higher average returns. The highest regional average unlevered IRR was slightly under 16% for the Africa region while average returns in Central and South America were both above 10%.

Key Takeaways

- The US remains one of the strongest wind markets in the world, with the second most wind capacity additions in the world in 2015.
- Mexico is a driver of strong development activity in North America

Hot Markets

Hot markets are favorable national markets for project development based on a composite of project activity processed in the Mercatus platform and the Ernst & Young 'RECAI Scores and Rankings' which provide a comprehensive index on market conditions for renewable energy technologies.

Wind Market Highlight

Brazil - With a national commitment to spend \$53 billion on new generation and transmission projects in the next three years, Brazil anticipates the development of up to 6 additional GW of wind capacity by 2018. Today, Brazil is a fertile market for project development across many renewable energy technologies. The combination of a national ambition to strengthen renewable energy development and an energy crisis that inflated electricity prices by 20% in 2015 puts the Brazilian market in a unique position to proliferate project development.

🔾 Solar Market Highlight

India - The Indian government approved a 100 GW target of solar energy by 2022, setting an ambitious goal for the mass deployment of solar energy in the country. Estimates posit that foreign investment into the Indian renewable sector will be critical to meet their lofty national goals. Today, the government is working to consolidate their national plan to achieve their renewable energy ambitions under the comprehensive National Renewable Energy Act 2015.



photo by Daria Nepriakhina

The U.S. Overview In Investors We Trust

It's Time To Build Investor Trust

Today, the US maintains a position as one of the most favorable markets for advanced energy in the world, ranking first in the Ernst & Young *Renewable Energy Country Attractiveness Index.* While a stable market environment combined with comprehensive legislative support makes the US market particularly attractive over the long term, renewable energy producers should focus on investor trust in 2016.

Two key events in 2015 frame the ongoing strength of the US market for advanced energy. First, extension of the Investment Tax Credit (ITC) and the Production Tax Credit (PTC) will provide extended incentives for wind and solar development. For solar, all projects that begin construction before 2020 will While the overall outlook in the US is very strong, the energy industry will need to adjust to a market that is less defined by GW scale projects, but rather MW and kW scale projects; requiring timely and accurate financial disclosures and reducing the perception of risk across the industry.

receive a 30% tax credit with a gradual step-down of 26% and 22% tax credits for projects in 2020 and 2021 respectively. The PTC will continue to provide wind projects with \$0.023/ kWh for electricity generated for the grid this year. Beyond a year, the incentive will start phasing down at 80% of its present value in 2017, 60% in 2018 and 40% in 2019.

Second, over the longer-term, the Obama administration's implementation of the Clean Power Plan will require all states to reduce carbon emissions from the power sector by 32% of 2005 levels. This translates to about 28% of installed capacity coming from renewable energy by 2030, tripling the amount of non-hydro renewable energy in the country.

Despite these massive boosts to the US market, poor performance in the capital markets indicates that many US renewable energy producers struggled with the ability to grow pipeline while meeting investor's demands in 2015. While the overall outlook in the US is very strong, the energy industry will need to adjust to a market that is less defined by GW scale projects, but rather MW and KW scale projects; requiring timely and accurate financial disclosures and reducing the perception of risk across the industry.

LOOKING FORWARD Non-Utility Wind Customers in the US

As wind power reaches grid parity in more and more markets throughout the US, non-utility off take agreements have become increasingly popular. In 2015, large corporations like Amazon, Google, Microsoft and Facebook became direct purchasers of new wind power for their energy-intensive data centers.

As Solar Regains Footing, IRR Adjusts

In the first half of 2015, like the previous year, a rush to fill pipeline in anticipation of the ITC stepdown created intense market competition for new projects. Combined with low cost of capital afforded by the growth of YieldCos, the market continued to experienced downward pressure on hurdle rates, which translated into low average returns on projects seeking financing.

However, in the second half of 2015, the solar industry's systematic poor performance in the stock

The second half of the year was an **abrupt shift for the US solar industry** as the capital markets questioned the expected returns set by frothy growth in the past year.

market appears to have dampened overly ambitious project development and confidence that YieldCos could sustain declining project returns. The second half of the year was an abrupt shift for the US solar industry as the capital markets questioned the expected returns set by frothy growth in the past year. In the US northeast and West, which comprise a majority of projects, average IRR increased in the second half of 2015 from the first half of 2015, reflecting more conservative overall pipeline growth and higher hurdle rates.



After Tax Unlevered IRR by Region

Key Takeaways

- Reduced growth in the US solar industry likely slowed development of projects with tight margins.
- Fewer projects with low returns were seeking financing in the second half of 2015, raising average project returns.
- YieldCos demand project volume but cannot sustain extended downward pressure on IRR, particularly if project returns are below the yield expected by the YieldCo.
- Investors are placing increasingly stringent demands on solar companies to have firm grasp on the expected returns of their pipeline and the ability to provide clear visibility into pipeline value.

Project Development Continues To Swing

Throughout the middle of 2015, projects in the US Northeast overtook projects in the West, while the US West accounted for the largest volume of projects in the first and last quarters of the year. Notably, the US South took an increasing share of projects in the final quarter of 2015.

In many states where the underlying market conditions have not drastically changed, swings in project volume demonstrate that solar developers Many companies had increased focus on closing deals, rather than originating new opportunities, in anticipation of the ITC step-down.

often have trouble maintaining the organizational bandwidth to both originate and close simultaneously. Swings in regional development activity are, therefore, exaggerated by an inability to continue to grow pipeline while also investing in projects. This effect was particularly strong in 2015, as many companies increased focus on closing deals, rather than originating new opportunities, in anticipation of the ITC step-down.



Percentage of Projects Originated by Region

Source: Mercatus Energy Investment Management (EIM) Platform Data

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Change In Project Volume From 1H 2015 to 2H 2015

Key Takeaways

- In the US Northeast, spikes in project volume are directly attributable to focus on Massachusetts and the steady development in markets like New York, Rhode Island, Vermont and New Jersey (while these states decreased their relative share from the first half of the year to the second half of the year, they still maintained a substantial portion of project development).
- SREC programs in states like New Jersey and Massachusetts assist growth in their respective markets as they contribute a large share of the US Northeast region's proportion of projects hosted.

Climbing SREC-2 prices in Massachusetts through the first half of 2015 contributed to increased development in the third quarter. Declines in SREC-2 prices, in the fourth quarter, contributed to waning project volume.

- In the US South, growth can be largely attributed to Texas and North Carolina.
- Strong market conditions with respect to energy prices, solar resources, and retiring capacity contribute to Texas' continued growth in solar energy.
- The ongoing strength of the California market continues to anchor the US West's market share.

Strong State Level Returns

From the 1H of 2015 to the 2H of 2015, trends in state's share of total projects processed tracked neatly with changes in average returns in key states. States with increasing returns tended to see more activity, while states with decreasing returns over the same period, experienced less activity.

While the correlation of average returns and market share makes intuitive sense, their relationship should not be overstated. In many instances, lags between average-IRR and the larger investment market's The strongest markets not only provide favorable yields, but also maintain a balance of strong economic returns within a stable environment.

ability to recognize higher returns in a specific region make correlation between returns and market activity irregular.

Furthermore, increasing IRR at the state level can also reflect a weak or weakening regulatory environment for solar projects. In these states, the risks and/or uncertainties related to project development become such that only the projects with very strong returns seek financing. This indicates that investors are extremely sensitive to non-financial risks. The strongest markets not only provide favorable yields, but also maintain a balance of strong economic returns within a stable environment.

Average	After	Тах	Un	levered	IRR	by	State	
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CALIFORNIA	TEXAS	MINNESOTA	MASSACHUSETTS
1H 2015 IRR: 7.61%	1H 2015 IRR: 6.96%	1H 2015 IRR: 7.48%	1H 2015 IRR: 8.28%
2H 2015 IRR: 8.44%	2H 2015 IRR: 7.13%	2H 2015 IRR: 6.79%	2H 2015 IRR: 11.11%
Delta: +.83%	Delta: +.17%	Delta:69%	Delta: +2.83%
NEW JERSEY	NEW YORK	MARYLAND	NORTH CAROLINA
1H 2015 IRR: 6.96%	1H 2015 IRR: 7.62%	1H 2015 IRR: 8.55%	1H 2015 IRR: 7.51%
2H 2015 IRR: 8.43%	2H 2015 IRR: 7.22%	2H 2015 IRR: 5.67%	2H 2015 IRR: 5.24%
Delta: +1.47%	Delta:40%	Delta: -2.88%	Delta: -2.27%

Source: Mercatus Energy Investment Management (EIM) Platform Data

Key Takeaways

- A strong increase in returns combined with a spike in project volume suggests that better returns contributed to increasing development in Massachusetts. California and Texas also gained market share over a period with rising average returns.
- Maryland, Minnesota, and New York all lost market share over a period with decreasing returns. New Jersey lost market share despite rising average IRR. Average IRR of projects seeking financing doesn't necessarily provide a coherent picture of market attractiveness at a state level.

Strong Performance Gains in Key States

The charts below show how various states performed in 2015 in terms of two key inputs used by investors to screen project-financing opportunities. Results are influenced by various factors, including: prevailing utility rates for energy, labor markets, maturity of regional solar industries, local taxes and incentives, solar resources and technology fit.

Average Total Turnkey Costs (\$/Watt) In Key States

Source: Mercatus Energy Investment Management (EIM) Platform Data

• Hawaii remained a relatively strong market with high off-take rates despites high installed costs.

• Net-Metering reform in Hawaii will substantially effect the ongoing off-take rates in Hawaii.

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The Impact Of The ITC Extension

The outlook of project volume beyond 2016 is highly influenced by the market's preparation for a step-down in the Investment Tax Credit (ITC). As a consequence, there is an abrupt drop in project volume by Commercial Online Date after 2016.

With the passage of the ITC extension in the end of 2015, this outlook will undergo dramatic changes in the upcoming months. Projects with tight development timelines will push their Commercial Operation Date into 2017, while an extended ITC provides the market time to develop more projects'.

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Regional trends in forecasted development should provide insight into pertinent markets despite the extension of the ITC. However, over the medium to long term, the Clean Power Plan will require more states to incorporate renewable energy into their fuel mix. The result will be that more markets across each regional segment will open for solar development, thereby, smoothing out the proportion of project distribution between regions.

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Proportion of Forecast Capacitiy By Commercial Operation Date

Key Takeaways

- Forecasts in project development after 2016 will change dramatically with the extension of the ITC
- The US West holds a steady grip on a major portion of project development planned for the first half of 2016 and 2017.
- The US Northeast projects a dominant share of MWs in the second half of 2015 as a result of a spike in projects originating in the middle of 2015, but with a corresponding tapering-off of relative development forecasted thereafter.
- Notably, The US South contributes a growing portion of project development by target COD. This trend is largely driven by states with Renewable Portfolio Standards. Texas accounts for the major share of the South's projects followed by North Carolina, South Carolina and Maryland.
- As states build policy mechanisms to comply with the federally mandated Clean Power Plan, the regional distribution of project volume will become more even as more states incorporate significant amounts of solar power.

Mercatus is a cloud-based software company that is digitally transforming the way global energy producers invest. The leader in Energy Investment Management solutions, Mercatus gives producers a competitive advantage by powering them to move faster, gain insight and increase compliance of their advanced energy portfolios. Mercatus' customers are some of the largest energy companies that collectively leverage the EIM platform to host over 80GW of projects, across 75 countries, using 8 advanced energy technologies.

We Help Energy Producers Thrive