

# RENEWABLE ENERGY EMERGING CORE INFRASTRUCTURE

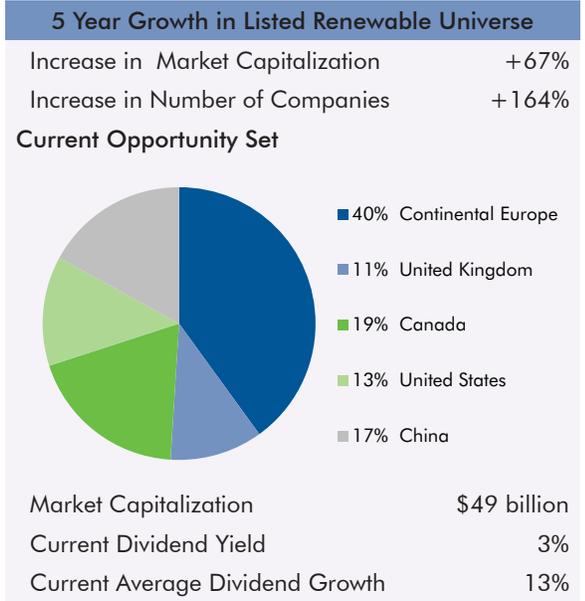


**A fundamental change is taking place in how electricity is produced:  
COAL IS OUT ... RENEWABLES ARE IN**

The word “infrastructure” conjures up thoughts of roads, bridges and tunnels. Increasingly, however, investors are including solar panels and wind turbines, otherwise known as renewable energy assets, as a growing category of core infrastructure.

The growth in the renewable energy infrastructure is driven by these factors:

- Governments across the globe have committed to increasing renewable energy at the expense of fossil fuels, supported by societies’ focus on the importance of green energy, requiring significant capital investment over the next several years.
- The cost of producing electricity from renewables is trending toward parity to traditional fossil fuel due to technological advances and sufficient scale in assets.
- Renewable energy assets possess some of the key attributes we seek in core infrastructure in that they are long lived real assets, generate predictable cash flows, and possess high barriers to entry.
- Renewable energy assets are being aggregated in new listed companies, where their value is best unlocked. This supports an efficient recycling of capital for renewables development, creating a virtuous cycle in this growing market. As a result, the listed renewable infrastructure market is growing rapidly.



Source: CBRE Clarion as of 02/28/2015.  
Note: The increase in market capitalization and number of companies is based on five years (2/28/2010 - 02/28/2015). Market capitalization is calculated using free-float methodology.

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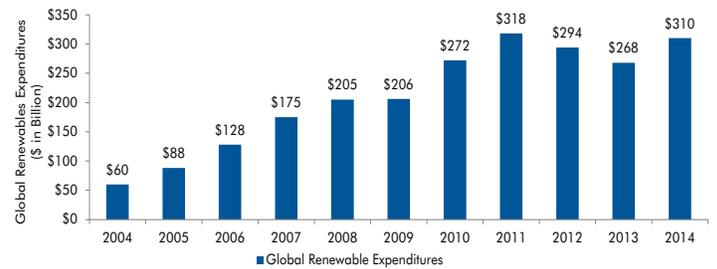
## THE COMPOSITION OF POWER GENERATION IS CHANGING GLOBALLY

Renewables are becoming an increasing source of electric production and represent a large percentage of new power generation capacity additions annually. In 2013, renewable energy made up almost half of the new generation capacity added among all technologies<sup>1</sup>. Just as renewables are being added, coal plants are also being retired, notably in the United States, due to more stringent environmental regulations. Electricity production is effectively being “decarbonized.”

This transformation in how electricity is produced is being facilitated by government policies focused on energy independence and security, as well as environmental mandates designed to reduce air pollution and carbon emissions. As a result, global expenditures on renewable energy and technology have increased substantially since 2004, from \$60 billion to \$310 billion currently<sup>2</sup>, reflected in Exhibit 1. Global capacity of renewables has increased from 85GW in 2004 to 560GW at year end 2013<sup>3</sup>. By early 2014, at least 144 countries had renewable energy targets and 138 countries had renewable energy support policies<sup>3</sup>.

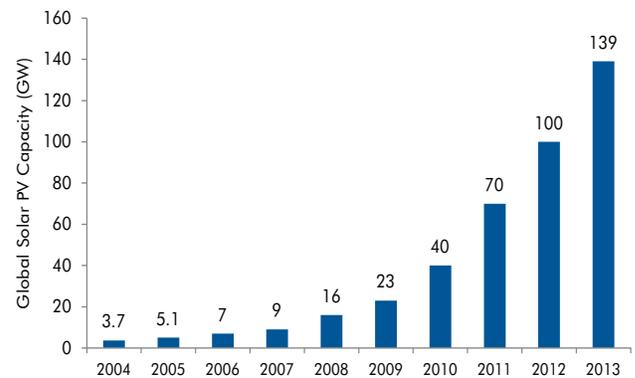
An example of increasing expenditures on renewables is highlighted in Exhibits 2 and 3; wind and solar power generation have been added rapidly. Even with this substantial growth, the potential penetration of these technologies is still in its infancy. In Denmark, an example of a forward-thinking market, almost a third of electricity was produced from wind in 2013<sup>4</sup>. Wind only accounted for about 3% of global electricity production in 2013<sup>3</sup>. While regions vary dramatically in terms of what renewable resource can reasonably be used, we believe that the potential for further wind and solar penetration remains significant. Based on existing policies alone, the EIA forecasts that global renewable power excluding hydro will increase from 11% in 2013 to 15% of generation in 2030.

Exhibit 1: Global Renewable Expenditures



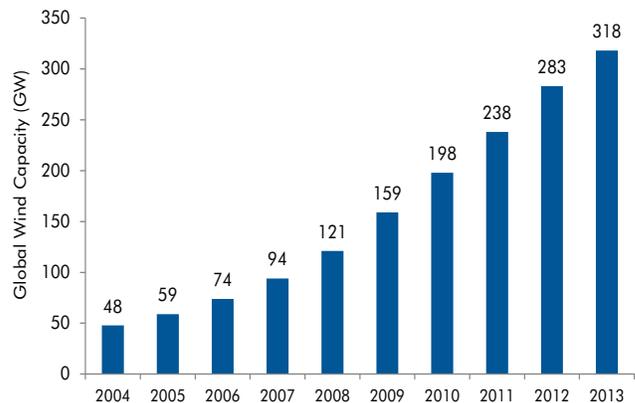
Source: Bloomberg New Energy Finance Fourth Quarter 2014 Report as of 12/31/2014.

Exhibit 2: Global Solar PV Capacity



Source: REN21.2014. Renewables 2014 Global Status Report (Paris: REN21 Secretariat). ISBN 978-3-9815934-2-6 as of 12/31/2013.

Exhibit 3: Global Wind Power Capacity



Source: REN21.2014. Renewables 2014 Global Status Report (Paris: REN21 Secretariat). ISBN 978-3-9815934-2-6 as of 12/31/2013.

<sup>1</sup> REN21.2014.Renewables 2014 Global Status Report (Paris: REN21 Secretariat). ISBN 978-3-9815934-2-6

<sup>2</sup> Bloomberg New Energy Finance, Fourth Quarter 2014 Report

<sup>3</sup> REN21.2014.Renewables 2014 Global Status Report (Paris: REN21 Secretariat). ISBN 978-3-9815934-2-6

<sup>4</sup> REN21.2014.Renewables 2014 Global Status Report (Paris: REN21 Secretariat). ISBN 978-3-9815934-2-6. Excluding hydro renewable power assets. Hydro power is a relatively older renewable technology that is not viable in many regions. Nearly all new renewable power generation is in wind and solar assets.

## RENEWABLE GENERATION DEPLOYMENT HAS LED TO RAPID COST DECLINES

The large scale deployment of renewables, combined with technological advances, is lowering their cost. As a result, renewable generation is becoming more competitive with fossil generation, especially as one considers externalities such as pollution and carbon emissions. Cost declines have been especially pronounced for solar generation where manufacturing prices of solar panels have been cut by half since 2006<sup>5</sup>. As an anecdote, a recently announced solar power agreement in Austin, Texas was signed at 5 cents per kWh price, which is competitive with gas fired generation in that market<sup>6</sup>.

The exhibits below illustrate the sharp decline in solar panel costs resulting in a trend toward parity in the cost of producing power compared to traditional coal-fired power generation. Note that coal power construction costs have generally been rising due to related “green” policies that have placed requirements on coal plants to reduce their impact on the environment.

Exhibit 4: Solar is Becoming Increasingly Competitive with Coal

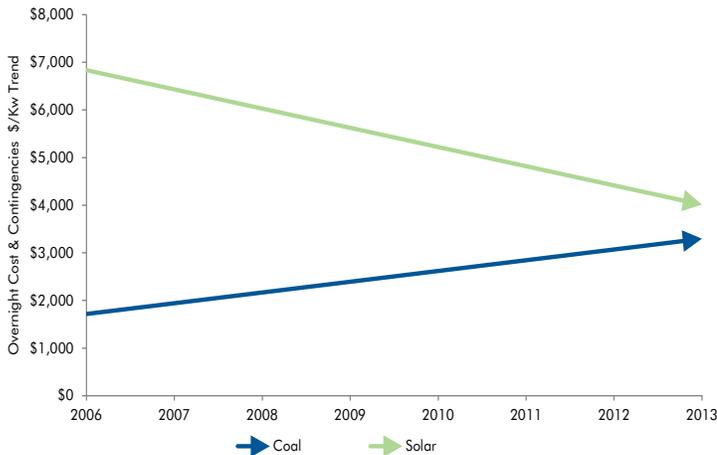
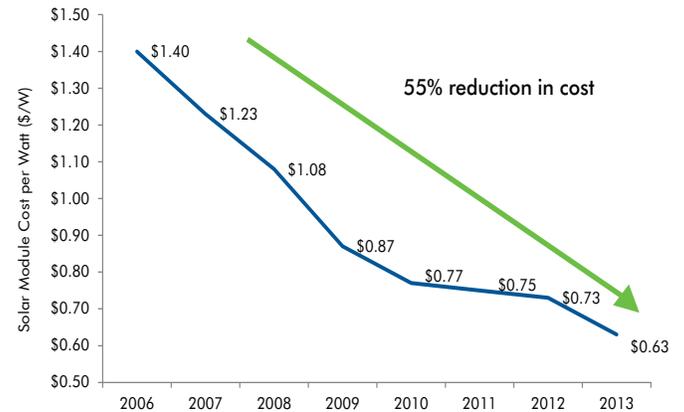


Exhibit 5: Costs for Solar Components are Declining Rapidly



Source: CBRE Clarion, EIA, FirstSolar as of 12/31/2013. Solar and coal trendlines based on linear regression of annual estimates of total overnight costs from EIA Annual Outlooks. Solar module cost from FirstSolar annual report.

## LISTED INFRASTRUCTURE IS ENABLING THE DEPLOYMENT OF GLOBAL RENEWABLES

Publicly traded companies are among the entities funding and building renewable generation globally. This is exemplified in the United States and Europe where electric utilities have been prolific developers of merchant renewable power. However, a dedicated group of listed renewable energy infrastructure companies has emerged, and they are buying completed and contracted renewable assets from utilities and developers. The listed universe of renewable energy companies numbers 24 with a market cap of \$49 billion today versus just 11 with a market cap of \$16 billion five years ago. We expect continued growth as these companies provide capital needed for future renewable investment.

## RENEWABLE PROJECTS GENERATE STRONG AND PREDICTABLE CASH FLOW, WHICH IS HIGHLY VALUED BY INVESTORS

Renewable projects generate stable and predictable cash flows, which is what makes them such good candidates for publicly traded renewables energy companies. These project cash flows are secured via long term purchase power agreements with the end user, offset by very modest operating costs leading to high (>80%) margins. Unlike fossil power, wind and solar generation does not require purchasing fuel; thus, it should not be surprising that these projects are highly valued by public market investors for their income security and are considered core infrastructure.

## MORE RENEWABLE ASSETS WILL FIND THEIR WAY INTO THE LISTED MARKETS

Wind and solar generation capacity has been growing for a number of years and is forming a large and growing pool of attractive assets that can be aggregated and sold to the public markets. Moreover, developers have a strong incentive to sell these assets and benefit from the pricing and liquidity that the public markets ultimately provide. The developer is then able to reinvest proceeds into its core development business, creating a virtuous cycle of growth in the renewables space. The current \$49 billion market cap of the listed renewable energy market is dwarfed by the roughly \$300 billion in annual global investment made in renewables. We believe there is clearly room for growth of listed renewable energy companies as the renewables industry matures in the near to medium term.

<sup>5</sup> FirstSolar 2013 10K

<sup>6</sup> <http://www.greentechmedia.com/articles/read/Cheapest-Solar-Ever-Austin-Energy-Buys-PV-From-SunEdison-at-5-Cents-Per-Ki>

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