

IEEFA Update:

Emerging Markets Lead Global Investment in Renewables

Strong Trends in China, India, and Brazil; Emerging Activity in Chile, Dubai, Jordan, Mexico, the Philippines, Russia, South Africa and Turkey



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Tim Buckley, Director of Energy Finance Studies, Australasia

Emerging Markets Are Leading the Global Investment Boom in Renewables

Last year saw a global record US\$286 billion¹ in new renewable-energy investment, with total transactions (including refinancing) in excess of \$US380 billion.

More than half of that activity occurred in developing countries.

Broad interest in renewables auctions is spreading—and taking root in more and more countries—a sure sign that global renewables investment is gaining momentum.

Electricity tariffs in recent auctions have achieved historic lows, and most of the auctions have been oversubscribed.

- Recent auctions in Mexico and Argentina have yielded prices far better than initial expectations. Mexico's recent auction yielded \$33-35 per megawatt hour (MWh) for wind and solar compared with \$39-45/MWh less than six months ago.
- A recent Argentina tender was for \$48-65/MWh for wind-powered electricity and \$60-75/MWh for solar, significantly below government expectations and six times oversubscribed.
- Chilean auction prices this past August averaged \$50/MWh², less than half the auction prices seen in 2014 (\$108/MWh) and below the cost of new imported-thermal-power generation.
- In May, Dubai Electricity & Water Authority received a record low bid at \$29.90/MWh to develop 800 megawatts of solar-power projects³, followed by an even lower bid at \$24.20/MWh for a 350-megawatt (MW) solar photovoltaic (PV) project for Abu Dhabi in September 2016.

What Are the Key New Emerging Markets in Renewables?

Among developing nations, China, India and Brazil have drawn the most renewable energy investment, a trend that has been supported by strong, clear policy ambitions⁴.

Chile, Mexico, and South Africa are emerging now as important players as well, while Argentina, Jordan, the Philippines, Turkey, and Russia are cited increasingly as attractive renewable-investment countries relative to expectations, especially in solar.⁵

On the wind-energy front, notable growth is occurring in Brazil, which has increased its capacity threefold in three years, from 2,788 MW in June 2013 to 9,810 MW in June 2016.

¹ Global Trends in Renewable Energy Investment 2016, UNEP+BNEF, p. 23

² 'The Chilling Impact of Renewables in Chile', 12 October 2016, UBS

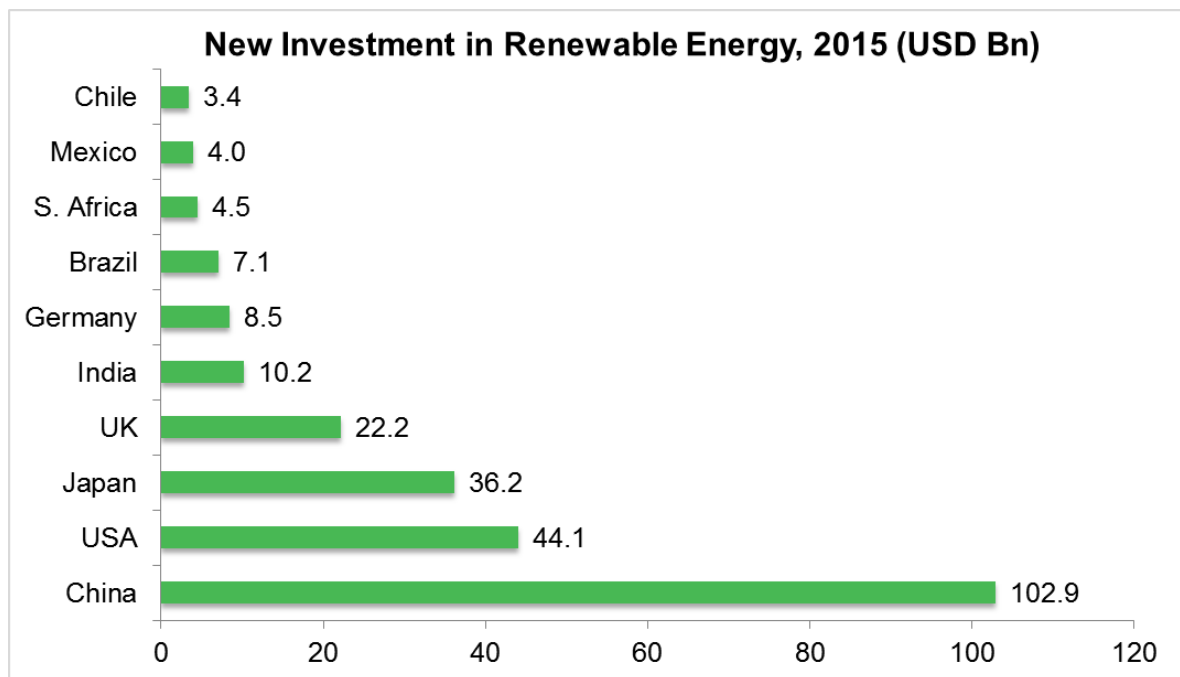
³ <http://www.bloomberg.com/news/articles/2016-05-03/solar-developers-undercut-coal-with-another-record-set-in-dubai>

⁴ See the graph below from Global Trends in Renewable Energy Investment 2016 Report

⁵ Top Solar Power Industry Trends in 2015, IHS, p 11

Cumulative wind installs have nearly doubled in the past three years in China, Poland and Turkey, according to the World Wind Energy Association.⁶

Other players are emerging as potentially large solar and wind markets. Among them: Taiwan, which has just upgraded its renewables target to 25 GW by 2025, mostly from solar (from almost nil today) and is working on streamlining regulations, power-grid infrastructure development, securing sites and promotion of large-scale bidding.⁷



Source: Global Trends in Renewable Energy Investment 2016, UNEP+BNEF

Why Are Developing Countries So Attractive Today for Renewable Energy Investors?

Most Developing Countries Are Lucky in 'Resource Quality'

The economic viability of renewable energy depends considerably on resource quality, especially in solar.

As the International Renewable Energy Agency (IRENA) says: 'Latitude is a key factor, and cloud cover also plays a role. The annual yield is up to three times higher in developing countries than in developed countries. This makes solar PV particularly compelling for developing countries.'⁸

⁶ <http://renewables.seenews.com/news/global-wind-additions-stable-in-h1-wwea-eyes-500-gw-at-year-end-542656#>

⁷ http://pv.energytrend.com/news/Taiwan_Officially_Sets_Renewable_Energy_Target.html

⁸ Letting in the Light, Irena, p.12

Growth Matters in an Environment of Globally Depressed GDP Rates

While global GDP growth has stayed at 3-3.5% annually, average growth rates in developing countries are relatively high and expected to remain so, at 4.6% compared to 1.8% in developed countries (according to the latest International Monetary Fund forecasts).

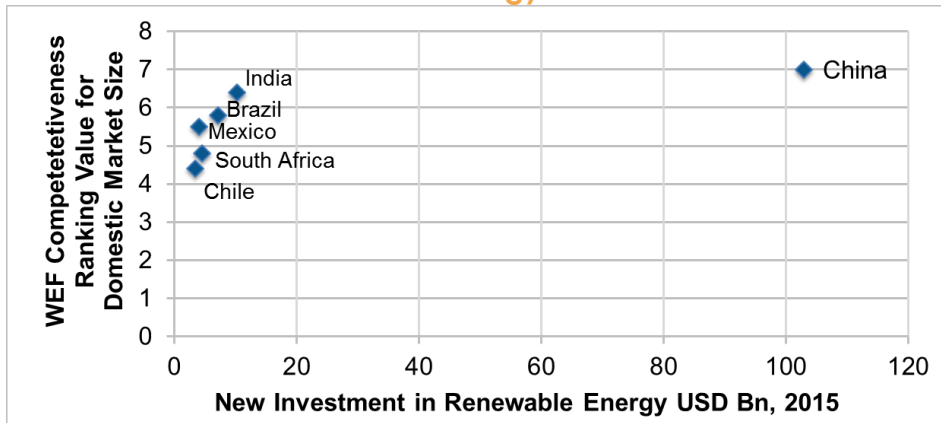
Relatively high GDP growth rates in developing economies and high energy-demand forecasts in these countries suggest that these markets are relatively attractive for new energy investments.

Economies of Scale Are Creating New Advantages

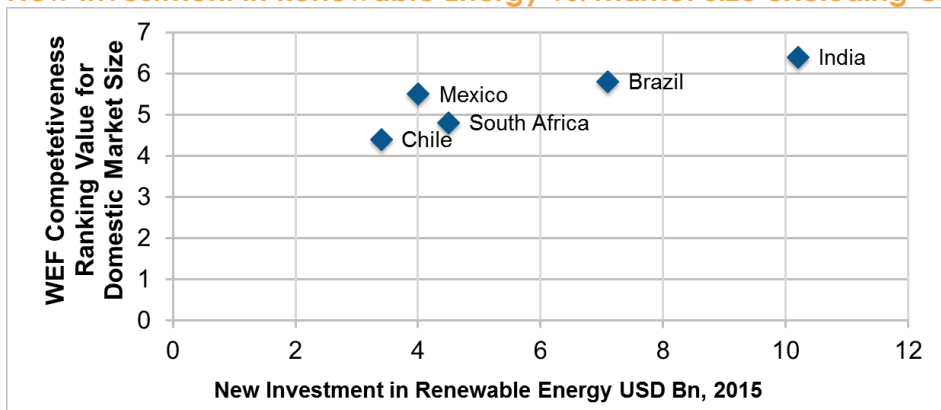
In an environment of exceptionally low interest rates in the developed world, growth potential for renewables in emerging markets is compelling, especially in countries where favorable policies and economies of scale have brought down total installation costs (in India, for example, solar tariffs have fallen 40% in just the past 18 months).

China and India are especially attractive markets, as is Brazil. The graph below plots the countries' position in the World Economic Forum's domestic market size index versus 2015 new investments in renewables. China is an outlier because of its size and in terms of the investment it attracts (given the exceptionally strong long term policy endorsement of the Chinese government as part of its war on pollution and aim to develop low emission industries of the future); but still there seems to be a correlation between market size and renewable investments per country.

New Investment in Renewable Energy vs. Market Size



New Investment in Renewable Energy vs. Market Size excluding China



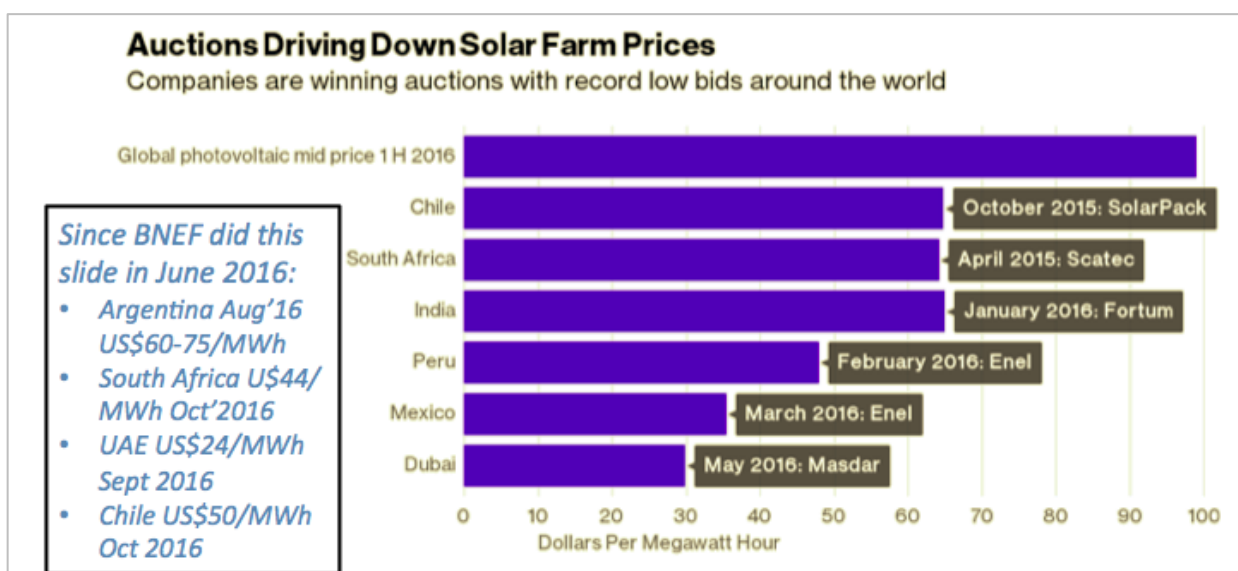
Source: IEEFA calculations based on WEF and UNEP statistics

Deflationary and 'Blended' Costs Create Advantages

Deflationary cost expectations in renewables are appealing in the context of investors' search for yield.

With expectations for a 3-4% annual increase in efficiency and 3-4% annual reductions in costs, solar tariffs on new projects will likely continue to go down by 5-8% year on year. For markets that provide a price guarantee and a valid growth story, deflationary costs make such infrastructure investments attractive.⁹

Additionally, cost-comparison models show that in some countries "blended costs," in which the electricity mix is built on additions in solar PV and wind and supported by "flexible" technologies, are lower than coal and nuclear costs. A model study by CSIR for South Africa (all amounts quoted in South African rand, broken down into cents) shows that, 'in combining the 62c/kWh from wind and solar PV, with flexible solutions such as gas, which are "pessimistically" assumed to carry a cost of 200c/kWh, the outcome is a "blended cost" of just 90c/kWh. Such an outcome is cheaper than both baseload coal of 103c/kWh and the 117c/kWh to 130c/kWh currently assumed for nuclear.'¹⁰



Source: BNEF June 2016, IEEFA estimates

Renewables Provide Investment Diversity

For investors and/or policy-makers, renewable energy provides an opportunity to diversify the energy investments, especially in countries that rely extensively on imported fossil fuels.

China is seeking to increase its renewable energy capacity from 508GW currently to 770GW by 2020. India plans to reach 225GW by 2022 from its current 97GW level (and aims to achieve 350GW of renewables capacity by 2030). Brazil's plan is to reach 174GW by 2024 from the 106GW reported at the end of 2014.

⁹ <http://www.renewableenergyworld.com/articles/2016/08/notes-from-the-solar-underground-the-solar-roller-coaster-and-those-along-for-the-ride-first-solar-sunpower-q-cells.html>

¹⁰ <http://m.engineeringnews.co.za/article/csir-cost-study-shows-new-solar-wind-to-be-40-cheaper-than-new-coal-2016-10-17#.WAUxoQnglwg.twitter>

India and China's commitment to renewables comes at the expense of coal and helps decrease the dependency of both countries on fossil fuels.

Recent examples from more developed markets such as Denmark,¹¹ Germany and South Australia suggest that rhetoric regarding base-load argument is changing fast^{12 13} as share of renewables investments targets are being revised upwards.

Renewables Can Be a Remedy to Grid Barriers

Connecting power generated by solar and wind can come at costs, given the need such connection creates for extending and enhance the grid, especially when utility-scale additions are made. Distributed renewable energy can be a remedy at smaller scales, however, where grid connections do not yet exist and are too costly to build. Recently in India, for instance, local governments in Gurgaon and Bhopal have started subsidizing households for installing solar panels.^{14 15}

What Are the Main Risks in Renewables Investment in Developing Countries?

Renewable-energy investment in emerging markets is not without risk, much of it driven by market structures and inefficiencies in policy implementation.

Risk–Return Profile

The most important question for renewable sector investors comes in the risk-return profile of clean energy investments versus risk-return parameters. When there is a poor match between investors' needs and the risk-return profile of a clean energy investment, the result is either a higher cost of capital or a lack of available capital altogether'.¹⁶ Factors that increase risks of renewable investments usually include uncertainty in public policies, interest rates and foreign currency-tariff mismatch risks, as well as existing fossil fuel subsidies and regulations in the infrastructure phase of deployment.

Public-Policy Risk

Public policy commitment to renewables creates a huge difference in appetite for investment. Countries that provide clear, strong renewable energy policies allow for more predictability.

¹¹ https://www.agora-energiewende.de/fileadmin/Projekte/2015/integration-variabler-erneuerbarer-energien-daenemark/Agora_082_Deutsch-Daen_Dialog_final_WEB.pdf

¹² <http://reneweconomy.com.au/2016/south-australia-signalling-death-base-load-generation-43868>

¹³ <http://theconversation.com/south-australian-blackout-renewables-arent-a-threat-to-energy-security-theyre-the-future-66405>

¹⁴ <http://energy.economictimes.indiatimes.com/news/renewable/herc-increases-incentive-on-grid-connected-solar-power-generation-for-residential/54535693>

¹⁵ <http://energy.economictimes.indiatimes.com/news/renewable/mp-govt-approves-domestic-rooftop-solar-power-policy/54492118>

¹⁶ http://newclimateeconomy.report/2015/wp-content/uploads/2016/05/NCE_CleanEnergy_financing_final_web-Copy.pdf

Changes in renewable policy, preferential access to finance, subsidies and tariffs, taxation policy and restrictive regulatory system create barriers to the development of renewables.

Variations in Cost of Capital

Even with low interest rates prevailing globally, the price of renewable energy investments depends largely on the cost of capital. Vast differences in the cost of capital, ranging from 3%-20%, exist because of variation in political stability, currency volatility, ease of doing business, capital market access and off-take risk. Local interest rates are sometimes too high when financing comes solely from domestic sources. Lack of depth and expertise in domestic financial systems can create additional barriers.

Currency Risk

One of the largest challenges to emerging-market renewable investment is the foreign-exchange risk that arises when renewable contracts are negotiated in domestic currency and capital is foreign-sourced¹⁷. This risk is exacerbated—and can erode revenue estimates—with fluctuations in international energy prices. While hedging mechanisms exist in some markets, some countries lack the sophisticated means to mitigate such risk.

Project-Delay Risk

Grid topology, market structure, inadequate investment in grid modernization, and power system operation can cause delay in renewable energy deployment.

Risk Driven by Subsidies for Competing Fossil Fuels

Fossil-fuel systems in developing countries—which have looked historically to be the least expensive option to generate power to hold down costs for consumers—sustain uneven playing fields that put renewables at a disadvantage.

This is especially so where the environmental and public-health costs of competing fossil-fuel-based electricity aren't taken into account. However this is changing as certain events grow increasingly common, as when air pollution in Delhi just this month forced a rapid policy response – just one example of how outmoded power-generation holdings face increasing stranded-asset risk.

¹⁷ <http://www.greentechmedia.com/articles/read/Brazil-Announces-the-Winners-of-Its-833-MW-Solar-Auction>

What Are the Policy Best Practices Driving Renewables Investment in Emerging Markets?

Credible public policy commitment is a crucial component—perhaps *the* crucial component—in attracting emerging-market renewable energy investment.

The succession of record low electricity tariffs being awarded across emerging markets indicates the growing affordability of renewable capacity development.

These trends will continue to develop where the following practices are followed:

- Where governments commit to grid updates/modernizations and to policy that allow prioritization of renewables
- Where public policy is stable (and largely predictable)
- Where deflationary and blended cost calculations are encouraged
- Where regulatory changes are aligned with technology advances in renewables
- Where renewable energy is openly acknowledged as more cost-effective—including in terms of environmental, public-health, and social impacts—than fossil-fuel-fired electricity
- Where policy makers recognized that traditional base-load argument are evolving quickly around advances in smart-grid management and storage
- Where cost of capital and currency risk challenges are being met with modern mechanisms that mitigate such risk
- Where, policy makers openly embrace global capital market's appetite for renewable energy investment

Institute for Energy Economics and Financial Analysis

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Tim Buckley

Tim Buckley, Director of Energy Finance Studies, Australasia has 25 years of financial market experience covering the Australian, Asian and global equity markets from both a buy- and sell-side perspective. Tim was a Managing Director, Head of Equity Research at Citigroup for many years, as well as co-Managing Director of Arkx Investment Management P/L, a global listed clean energy investment company that was jointly owned by management and Westpac Banking Group.