



RENEWABLES FOR MINES MARKET FUNDAMENTALS

What are the current projections for the levelized cost of energy (LCOE) for solar PV, wind and energy storage? And how do renewables stack up against diesel, coal and gas for mining offtakers? In this Q&A interview, **Rachel Jiang**, Senior Analyst, Environmental and Power Markets, Bloomberg New Energy Finance provides insight on these critical questions for miners and renewables leaders.

Renewables for Mines Market Fundamentals

Q&A with **Rachel Jiang**, Senior Analyst, Environmental and Power Markets, **BLOOMBERG NEW ENERGY FINANCE**



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Rachel Jiang is a senior analyst covering US power and utilities for Bloomberg New Energy Finance. She studies power markets and how utilities are trying to adapt to an era of rapid transformation driven by policy, emerging technologies, and falling profitability from traditional generation assets. She also analyzes North American carbon cap-and-trade programs.

In this Q&A interview, Jiang provides insight on declining prices for solar PV, wind and energy storage and the impacts of lower oil, coal and gas prices on renewables for mines.

Energy and Mines: We hear a lot about the improving economics of renewables and storage in the context of mining microgrids. Can you give us a sample of some of the price projections for renewables and storage that demonstrate this improvement?

Rachel Jiang: Costs for renewable resources and energy storage have fallen rapidly in recent years, and the declines are projected to continue. One metric we use to assess the total cost of a generation technology is the levelized cost of energy

Editor's Note: Jiang will be presenting on these topics at the upcoming Energy and Mines World Congress, November 27-28, Hilton Toronto, the annual event for senior mining energy decision-makers and renewable and low-carbon energy experts. Visit: www.worldcongress.energyandmines.com

(LCOE). The LCOE represents the fixed and variable costs of a new project, spread over the lifetime energy production expected from the project. The LCOE for Canadian utility-scale (1MW plus) solar PV without tracking is estimated to fall in the US\$70-80/MWh range in 2017, and forecasted to shrink 40% by 2025 to US\$42-\$47/MWh (all in real terms).

Similarly, we expect systems in Australia to see a 41% drop from US\$64-94 in 2017 to US\$38-55 in 2025. In the US, the Investment Tax Credit subsidizing solar is set to step down during that same time period, but even taking this into account, we still forecast an 8% decline in LCOE from US\$45/MWh to US\$41/MWh.

For remote off-grid mining sites, costs are typically higher as components such as

shipping and labor are more expensive, and these variables typically experience fewer cost reductions. In high-income countries, capex for remote, off-grid solar PV may cost about 50% more than in more urban locations, as a rule of thumb.

But in such remote areas, solar typically competes not with the cost of electricity on the grid, but rather with far costlier diesel power generation – so even though off-grid solar PV may cost more than PV in more urban areas, it can still be competitive compared to the other generation options available at mine sites. On top of this, there are some innovative approaches to lowering the cost of installing solar panels which may reduce the cost premium for remote sites in the next few years.

Wind costs are coming down as well. In Can-

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ada, we forecast a 22% cut in wind LCOEs between 2017 and 2025, from US\$46-60/MWh to US\$36-47/MWh. In Australia, we expect a similar percentage cut during this period.

Moving on to energy storage, we forecast the capital expenditure for a fully installed 1MW/1MWh lithium-ion project to decline 42% from US\$631/kWh in 2017 to US\$369/kWh in 2025 (in real 2017 dollars).

The continued cost cuts come on the back of technology improvements, economies of scale in manufacturing, competition between suppliers, the growth of turnkey solutions, and increasing industry experience. It’s essential though to recognize that the actual cost of a fully installed system can vary widely from benchmark figures due to factors including the size and particular use case of a project. BNEF observed prices in 2017, for example, in the \$400-\$1,400/kWh range, depending on the application and the specific demands on the system.

E&M: Oil prices are still relatively low - what impact is this expected to have on the uptake of renewables for off-grid applications?

RJ: At the moment, the typical approach to adding solar for an off-grid mining site is to hybridize a diesel asset. At current costs, it often makes most sense to keep the solar penetration below 20% of total consumption, which makes the system easier to manage.

But if diesel costs were to rise, it may become possible to economically justify higher penetrations of solar. With higher renewable penetration, some storage is typically required for frequency and voltage control. If solar penetration were to rise to such an extent that more solar energy is generated during the day than is consumed, additional storage can be incorporated to save the excess for nighttime use. This is currently not yet economically viable, given existing battery and diesel prices.

E&M: Similarly, how do lower coal and gas prices impact the adoption of renewables?

RJ: In grid-connected areas, cheaper natural gas or coal can depress wholesale power prices. As an example of the impact of low natural gas prices on the cost of power, take the US’ western Pennsylvania region, home of the shale gas boom. In that region, the average price of gas crashed nearly 70% from US\$5.63/MMBtu in 2010 to US\$1.72/MMBtu in 2016 (in real 2016 dollars).

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Over the same time period, the average wholesale power price tumbled 43% from US\$51/MWh to US\$29/MWh. For an on-grid mine, a drop in the cost of sourcing power from the central grid can disincentivize the mine from investing in on-site renewables, or procuring other forms of renewable energy. But in addition to any competition in terms of cost, renewables contracted under power purchase agreements (PPAs) also provide a hedge against power price volatility. Mines may seek renewable PPAs for this reason, even as power prices drop.

E&M: What are you looking forward to at the Energy and Mines World Congress, Nov 27-28, Hilton Toronto?

RJ: I’m looking forward to meeting leaders working at the intersection of low-carbon energy resources and mining. With the cost of clean energy and storage rapidly dwindling, mining companies are looking to implement new, low-carbon ways of powering their businesses. It’s an area with great potential for innovation. ■

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