Nutwood

IRENA: renewables are increasingly cost competitive

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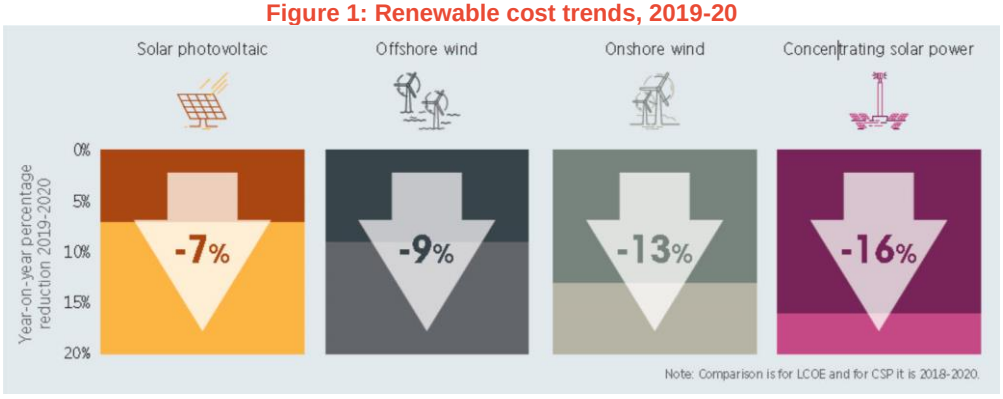
The latest report by the International Renewable Energy Agency (IRENA) points out that the share of renewable energy that achieved lower costs than the most competitive fossil fuel option doubled in 2020. Published in June, the *Renewable Power Generation Costs in 2020* report demonstrated that costs for renewable technologies continued to fall significantly year-on-year with the global weighted-average levelized cost of electricity onshore wind dropping by 13%, offshore wind by 9% and solar photovoltaics by 7% (see Figure 1).

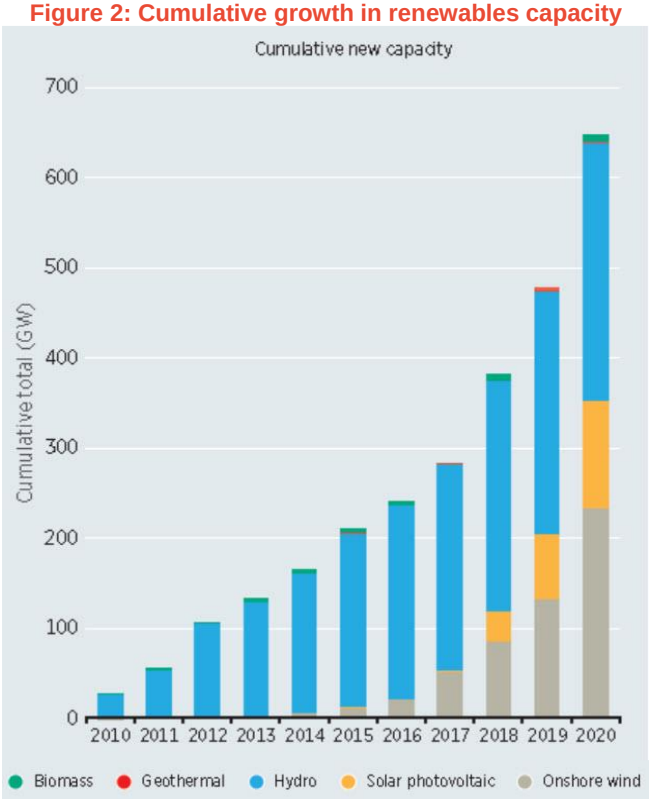
Figure 1: Renewable cost trends, 2019-20



Source: Renewable Power Generation Costs in 2020, IRENA, June 2021

The cost of electricity from solar and wind power has fallen to very low levels. Since 2010, globally, a cumulative total of 644GW of renewable power generation capacity has been added with estimated costs that have been lower than the cheapest fossil fuel-fired option in each respective year. In emerging economies, the 534GW added at costs lower than fossil fuels, will reduce electricity generation costs by up to $32bn (£23bn) this year.

Figure 2: Cumulative growth in renewables capacity



Source: Renewable Power Generation Costs, IRENA, June 2021

In view of the unprecedented recent floods, fires and extreme weather, the public opinion is changing in favour of immediate action – while it is too early to tell if the same public are willing to put up with the inevitable higher prices that are likely to ensue some of the necessary measures to combat climate change. Officials at IRENA, however, must be pleased that their message increasingly resonates with both the public and the politicians. Some in Germany, for example, are now pleading to politicians to expedite the country's coal phase-out to 2030 rather than 2038.

New solar and wind projects are increasingly undercutting even the cheapest and least sustainable of existing coal-fired power plants. IRENA analysis suggests 800GW of existing coal-fired capacity has operating costs higher than new utility-scale solar PV and onshore wind, including $0.005/kWh for integration costs. Replacing these coal-fired plants would cut annual system costs by $32bn per year and reduce annual CO_2 emissions by around 3 Gigatonnes of CO_2.

How to bolster the dwindling value of solar and wind

As the percentage of renewables in the electricity generation mix rises their value declines – it is the principle of diminishing marginal returns. But it is not an issue we can ignore or dismiss because in many parts of the world where wind and solar make up increasing share of power generation, sunny and windy days lead to a glut of electricity supply, driving down hourly prices and making it less attractive for renewable generators to increase investments in even more renewable energy. While lower prices are good for electricity consumers, this decline in market value is not as good for producers. It could potentially limit wind and solar deployment and thus endanger decarbonisation goals.

A new study from the Lawrence Berkeley Lab (LBL) titled *Solar and Wind Grid-System Value in the US: The Impact of Transmission Congestion, Generation Profiles, and Curtailment*, which appeared in the journal *Joule* examines how market value – defined as the value of energy and capacity in regional power markets – has changed over time at 2,100 utility-scale power plants have come online across the US through 2019.

The study looked at the three main determinants of market value:

- Output profiles: how the output of generators matches local market prices.
- Congestion: whether local prices are affected by transmission congestion.
- Curtailment: whether wind and solar generators were cut off due to over-generation.

It found that as of the end of 2019, output profiles and congestion had the largest impacts on market value, varying by region, while curtailment had little impact. The LBL study found that despite a decline over time, the average market value of wind and solar in 2019 was still higher than their average generation costs. It notes that future market, technology, cost, and deployment trends may affect the value/cost dynamic, either positively or negatively while examining ways to mitigate the decline in renewables' market value.

Wind power in windy Texas (ERCOT) and the Southwest Power Pool (SPP) saw market values at 46% and 42% below the flat block value of generation, due mostly to congestion and the fact that the generation tends to be localized.

Solar, on the other hand, saw a 37% market value penalty – i.e., reduction from flat block value – in solar-heavy CAISO. California's solar output is grown so large to drive down market prices during sunny hours, hence its market value. California vastly outpaces other regions in solar penetration, accounting for over 19% of total annual generation – it is even higher today. By contrast in regions with low penetration, solar enjoys a market value premium. In all cases, the primary driver of the value of renewables was the coincidence of the peak output profile with relatively high hourly market prices.

The good news is that while wind and solar market values have declined, costs have declined even more, which explains the continued investments and the long interconnection queues as more projects are planned.

The key question the LBL study examines is how will these two trends play out over time: will wind and solar costs decline even faster than their declining value as they continue to saturate many markets? If the future market value declines outpace future cost drops, what can be done to mitigate the value decline?

The answer is that it varies for in each region depending on what are the main drivers of value. For example, building more intra-regional transmission will relieve congestion but may provide only limited benefits where the output profile is mismatched with higher market prices. In many cases, shifting the output profile through energy storage, or by adjusting demand through innovative pricing, demand response or flexible loads such as charging EVs would be more effective. The value of solar is particularly sensitive to when it is generated – declining rapidly where there is too much solar generation, which explains why nearly all new solar plants are designed as hybrids, i.e., paired with battery storage.

As storage costs decline, solar-plus-storage plants become even more compelling. For wind, the shift towards larger blades relative to turbine capacity, allows for improved generation during low wind speeds, boosting capacity factors and effectively flattening the output profile. Progressive cost drops and performance gains have helped to maintain the value proposition of wind and solar, and are likely to continue, according to the LBL study.

Over the long run, additional solutions must be found to mitigate market value decline will be needed. Expanded transmission capacity can reduce congestion by connecting wind and solar to regions with higher market prices at advantageous times and regions. The increased electrification of transportation and buildings is also likely to increase he demand and the load profiles, allowing additional demand side flexibility. Ultimately, there is a race between cost and value as everyone searches for profitable solutions.