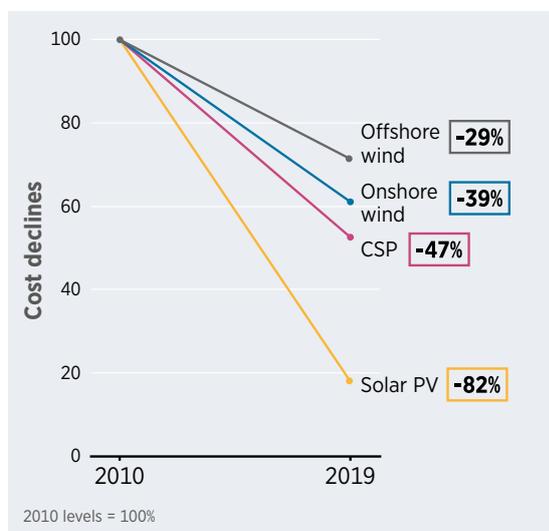


# RENEWABLE POWER GENERATION COSTS IN 2019

- Renewable electricity costs have fallen sharply over the past decade, driven by improving technologies, economies of scale, increasingly competitive supply chains and growing developer experience.** Solar photovoltaics (PV) has fallen 82% since 2010, followed by concentrating solar power (CSP) at 47%, onshore wind at 39% and offshore wind at 29%, according to cost data collected by the International Renewable Energy Agency (IRENA) from 17 000 projects in 2019. For 56% of all newly commissioned utility-scale renewable power generation capacity, the costs achieved in 2019 were lower than the cheapest fossil fuel-fired option.
- Renewable power generation continues to grow in 2020, despite the COVID-19 pandemic.** The steadily increasing competitiveness of renewables, along with their modularity, rapid scalability and job creation potential, also make them highly attractive as countries and communities evaluate economic stimulus options. Renewables can align short-term recovery measures with medium- and long-term energy and climate sustainability. Solar PV and onshore wind offer easy, rapid roll-out possibilities, while offshore wind, hydropower, bioenergy and geothermal technologies provide complementary and cost-effective medium-term investment options.
- Retiring the least competitive 500 gigawatts (GW) of existing coal-fired plants and replacing them with solar PV and onshore wind would reduce system generation costs** – and potentially also the costs passed on to consumers – between USD 12 billion and USD 23 billion per year, depending on coal prices. The 500 GW coal replacement would yield a stimulus worth USD 940 billion over and above the past year’s solar PV and onshore wind deployment, or 1.1% of global GDP.\*
- Costs for solar and wind power have continued to fall significantly.** Electricity costs from utility-scale solar PV fell 13% year-on-year in 2019, reaching USD 0.068 Kilowatt-hour (kWh). Onshore and offshore wind both declined about 9% year-on-year, reaching USD 0.053/kWh and USD 0.115/kWh, respectively, for projects commissioned in 2019. Costs for CSP – still the least-developed among solar and wind technologies – fell 1% to USD 0.182/kWh.

Renewable power technologies:  
Cost decreases since 2010



\* The calculation includes USD 0.005/kWh for integrating this additional variable power generation. The GDP stimulus is based on a contraction of global GDP in 2020 limited to 5%.

## Auction and PPA data: Increasingly cheaper than fossil fuels

Solar and wind cost reductions show no sign of abating. Recent auctions and power purchase agreements (PPAs) indicate solar PV prices could average USD 0.039/kWh for projects commissioned in 2021, down 42% compared to 2019 and more than one-fifth less than the cheapest fossil-fuel competitor, namely coal-fired plants. Onshore wind prices could fall to USD 0.043/kWh by 2021, down 18% from 2019. Offshore wind and CSP projects, meanwhile, are set for a step change, with their global average auction prices set to fall 29% and 59% from 2019 values, respectively, to USD 0.082/kWh for 2023 and USD 0.075/kWh for 2021.

## Solar PV

The cost of electricity from solar PV and CSP fell 82% between 2010 and 2019. Cost improvements since 2010 were driven mainly by the 90% reduction in module prices, along with declining balance-of-system costs. These pushed total solar PV installed costs down almost four-fifths over the last decade.

## Onshore wind and offshore wind

Onshore wind and offshore wind power costs fell 40% and 29%, respectively, over the decade, to USD 0.053/kWh and USD 0.115/kWh in 2019. Falling prices for onshore wind turbines – down 55-60% since 2010 – have reduced installed costs, while expanding hub heights and swept areas have boosted capacity factors at the same time as O&M costs have fallen. Offshore wind's installed costs fell 18% in 2010-2019, while its capacity factor improved by nearly one fifth over the last decade (from 37% in 2010 to 44% in 2019). Operation and maintenance costs similarly fell with larger turbine sizes, expanded service capacities, and the emergence of cost synergies across growing maritime wind-farm zones. Auction results, including subsidy-free bids, herald a step-change in competitiveness for offshore wind in the 2020s, with prices between USD 0.05 and USD 0.10/kWh.

## Concentrating solar power

Ongoing technological improvements and supply-chain competitiveness have reduced CSP's installed costs. Capacity factors have improved from 30% to 45% over the decade, with new CSP plants being built at better sites and in countries with more sunshine.

## Mature technologies: Bioenergy, hydropower and geothermal power

The global weighted-average LCOE of newly commissioned hydropower projects increased from USD 0.037/kWh in 2010 to USD 0.047/kWh in 2019. Despite this, hydropower remains very competitive, with nine-tenths of all capacity commissioned in 2019 producing power for less than the cheapest new fossil fuel-fired cost project. Power generation costs in 2019 were around USD 0.073/kWh for geothermal and around USD 0.066/kWh for bioenergy-based power, with those technologies providing firm electricity supply at the lower end-of the fossil-fuel cost range for new capacity.

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The findings outlined here are taken from:

**IRENA (2020), *Renewable power generation costs in 2019*,  
International Renewable Energy Agency, Abu Dhabi.**

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