CLIMATESCOPE

Emerging Markets Outlook 2020

Energy transition in the world's fastest growing economies

December 2020

BloombergNEF

Photo credit: https://www.esa.int/esearch?q=chile

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Section 1. Key findings

20%

Growth in emerging markets power sector CO2 emissions since 2012

79%

Spike in emerging markets installed capacity since 2010

44%

Coal's share of 2019 emerging markets power generation

The release of this year's Climatescope comes amid an unprecedented global crisis, making the discussion around energy transitions in emerging markets more relevant than ever. Power sector CO2 emissions in developing economies jumped 20% 2012-2019, and these markets will remain primary sources of emissions growth in coming decades. Meanwhile, Covid-19 has badly damaged developing economies and slowed critical investment from abroad. While the 2020 figures are not yet final, it is clear that emerging markets are seeing steep drops in clean energy investment and this could slow decarbonization in coming years.

The outlook is not entirely negative, however. In the last decade, developing countries made massive strides attracting clean energy capital and building unprecedented volumes of wind and solar capacity. Along the way, they have learned important lessons about which enabling environments and policy regimes can trigger clean energy investment inflows. Learnings from these major pre-pandemic achievements have the potential to illuminate a path to a greener economic recovery – if policy-makers act smartly.

Climatescope is BloombergNEF's (BNEF) public view on the energy transition in emerging markets. This year's outlook represents the collective effort of over 60 BNEF analysts who collected detailed data on 137 markets globally. Climatescope 2020 encompasses 108 emerging markets, as well as 29 developed nations. After nine years covering exclusively emerging markets, Climatescope 2020 expanded to include developed economies. This expansion aims to provide additional context on emerging markets' progress on their energy transitions and attractiveness for clean energy investment. It is not intended as a definitive ranking of developed nations' renewable energy environments.

Developed and developing markets follow divergent decarbonization paths

- **Power sector CO2 emissions trajectories have differed widely between the world's wealthiest nations and emerging markets, reflecting in part their very different stages of economic development.** Developed nations' power sector emissions have dropped 20% since 2012 but have risen 20% in emerging markets over the same period. Globally, CO2 emissions from the world's power plants slipped 2.2% 2018-2019, primarily due to lower generation from coal-fired power plants.

- **Rapidly growing power demand is the main driver of power sector emissions in emerging markets.** Emerging markets' annual generation spiked 54% over the past decade, while electricity production in developed countries remained nearly flat.

Figure 1: Developed countries' estimated power sector CO2 emissions by technology

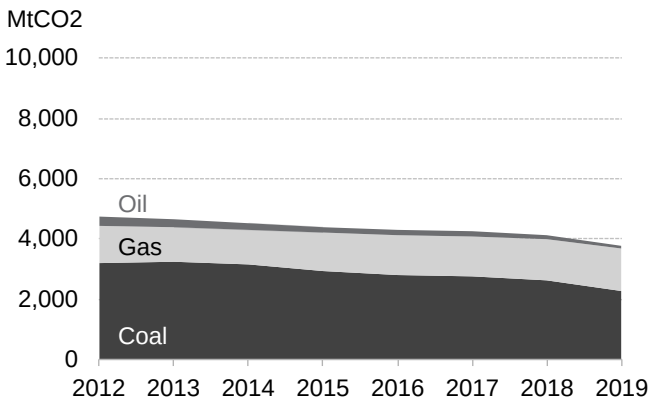
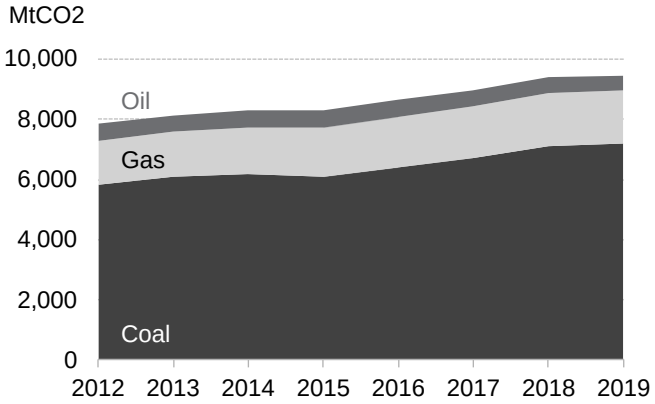


Figure 2: Developing countries' estimated power sector CO2 emissions by technology



Source: BloombergNEF. Note: Developed countries include OECD nations, minus Chile, Colombia, Mexico and Turkey. Developing markets include all other nations.

- **Coal still accounts for 44% of all power produced in emerging markets.** Hydro and gas follow as the second and third largest technologies, each responsible for 19% of electricity generation. Coal still meets 21% of power demand in developed nations, down from 25% in 2018 and 29% in 2015.
- **Emerging markets' installed capacity has spiked 79% since 2010 but grew by just 14% in wealthier nations over that time.** Coal led the jump in developing markets with 691GW of net capacity added in 2010-2019, up 66% over the period. In developed countries, coal capacity fell by 115GW or 18.6% over the decade.

Figure 3: Developing markets generation by technology

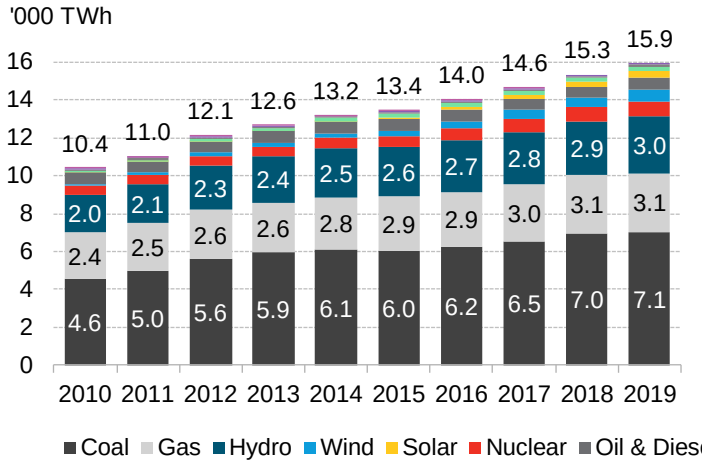
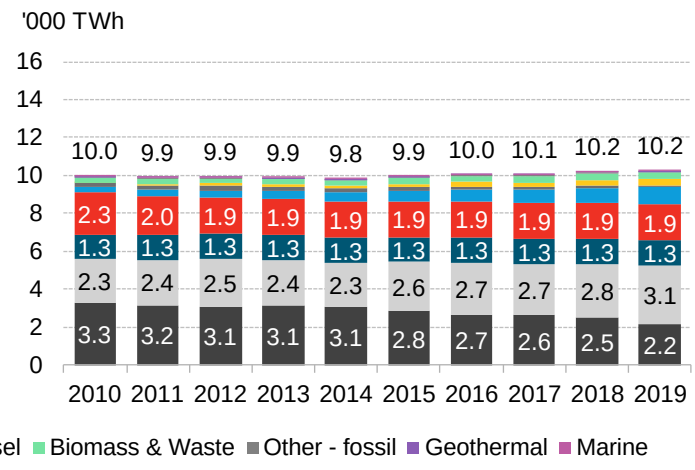


Figure 4: Developed markets generation by technology



Coal Gas Hydro Wind Solar Nuclear Oil & Diesel Biomass & Waste Other - fossil Geothermal Marine

Source: BloombergNEF. Note: Figures exclude energy storage technologies, such as batteries and pumped hydro. Developed markets include OECD countries, minus Chile, Colombia, Mexico and Turkey. Developing markets include all other economies.

Developing markets are clean energy's growth engine

- **Emerging markets are driving global clean energy's rapid expansion.** Since 2012, developing nations have accounted for over half of global clean energy investment, and since 2013 over half of new global clean capacity installed. Emerging economies accounted for 58% of the $249 billion asset finance invested in clean energy worldwide in 2019.
- **Developing markets led the world in clean energy build in 2019.** Emerging markets added 127GW of new renewable energy capacity, including 110GW of new wind/solar. This was 58% and 50%, respectively, of total global new capacity commissioned in the year.
- **Solar power is becoming ubiquitous in emerging markets.** Global installed solar in these markets went from 1GW a decade ago to an astounding 325GW as of year-end 2019. Three in ten emerging markets installed more solar than any other technology in 2019 with 69 total solar markets in 2019 attracting $48 billion. Solar is 8% of emerging markets' capacity and 2% of total generation (due to a lower capacity factor compared to fossil fuels).
- **Clean energy investment remains concentrated on certain markets, but new players are making waves.** Of $143 billion deployed in support of new clean energy projects in 2019 in developing markets, 91% went to just ten jurisdictions, but newcomers have emerged. Vietnam and Ukraine garnered more financing on the back of strong renewable energy policies. Less traditional investment destinations, such as United Arab Emirates, Cambodia or Burkina Faso saw deals in recent years.
- **Mainland China and India continue to be the biggest markets for clean energy investment with Mainland China far and away the largest.** Between them, the two nations accounted for $94 billion of new wind/solar investment and 76GW of wind/solar build in 2019. Mainland China led the world with 62GW of wind/solar added in 2019. India built 14GW.
- **But non-China/India emerging markets achieved an important milestone in 2019.** For the first time, renewables (inclusive of hydro) accounted for the majority of new capacity added in these economies. Gas-build fell to its lowest level since 2014 with just 17GW added.

Figure 5: Share of global asset finance for new clean energy power generation

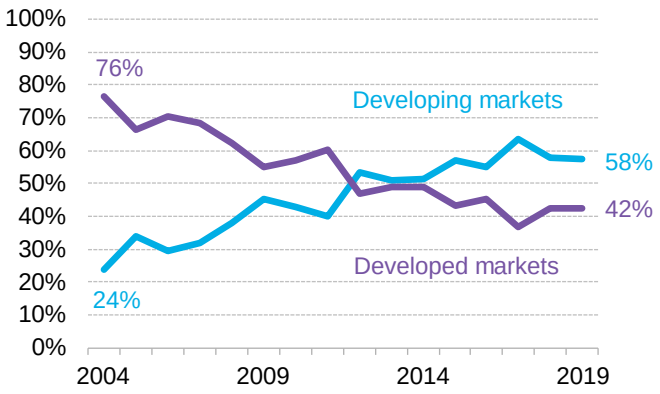
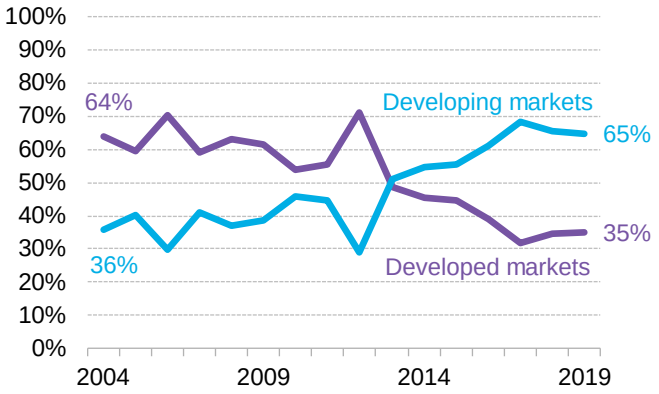


Figure 6: Share of global clean energy capacity additions by market type



Source: BloombergNEF. Note: Developed markets include OECD countries, minus Chile, Colombia, Mexico and Turkey. Developing markets include all other economies. Numbers are subject to change.

- **Emerging markets continue to build massive volumes of fossil-fuelled power-generating capacity.** With 60GW of new coal-, 24GW of gas- and even 2.3GW of oil-fired

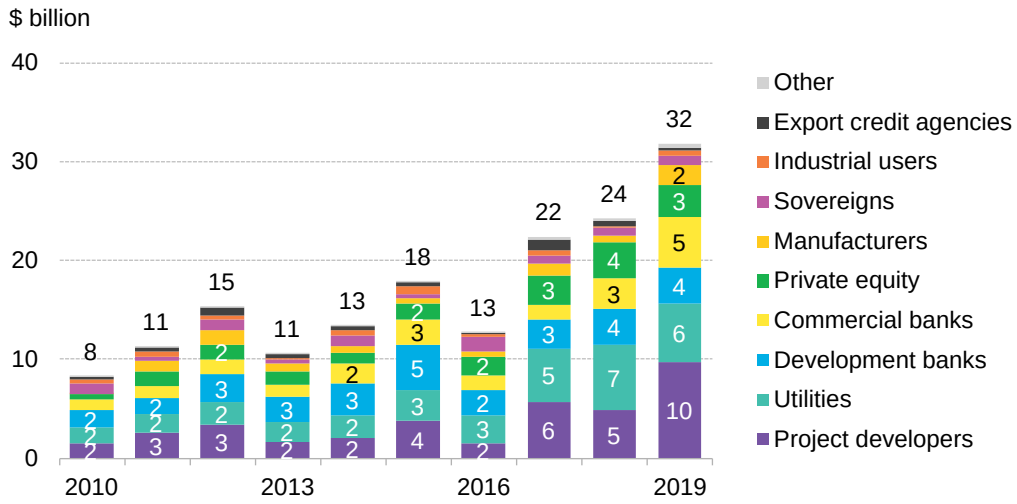
capacity commissioned in 2019, fossil fuels accounted for 40% of total emerging markets build. That was up slightly from 38% in 2018 and 36% in 2017.

- **By contrast, developed nations have effectively installed zero net new coal-fired capacity since 2012.** Retirements of coal plants hit a record in 2019, with 21GW decommissioned. Wind and solar alone accounted for 95% of all new capacity commissioned in developed nations in 2019.
- **Wind set a new record for financings.** Emerging markets' new wind investment reached a new high water mark in 2019 with $89 billion invested in projects in 30 jurisdictions. The number of markets attracting wind capital has remained relatively steady over the past decade.

Private capital flows from abroad into emerging markets were surging… Until the pandemic

- **Overseas investors and lenders deployed a record $32 billion to expand clean energy capacity in emerging markets in 2019.** Private capital accounted for 84% of the total, up from 70% in 2015 and 62% in 2010, reflecting the progress clean energy technologies and developing markets have made in reducing perceived risks. Despite numerous pledges from governments to be more supportive, contributions from their proxies – development finance institutions – fell to their lowest level in a decade at 11%. International project developers and utilities are increasingly leading the way.

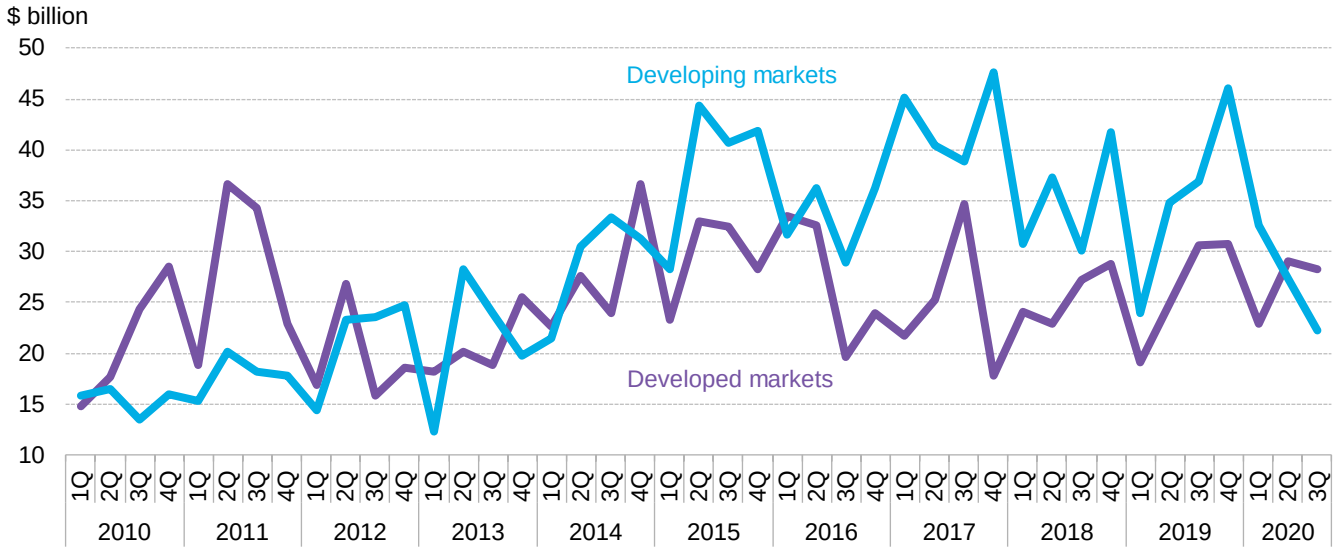
Figure 7: Emerging market clean energy foreign direct investment by investor type



Source: BloombergNEF. Note: Includes 104 non-OECD markets, plus Chile, Colombia, Mexico and Turkey. Only includes disclosed investment. Numbers are subject to change.

- **Pandemic-related disruptions now appear to be giving investors pause and slowing emerging markets clean energy investment flows.** While figures for 2020 are not final, the early results suggest a substantial downturn. For the first time since 2016, BloombergNEF has recorded an investment quarter when capital flows into developed markets exceeded flows into developing markets. While Covid-19 is by no means the only factor at play, the slope and consistency of the decline through three quarters of 2020 suggest that full-year figures will be down sharply compared to 2019.

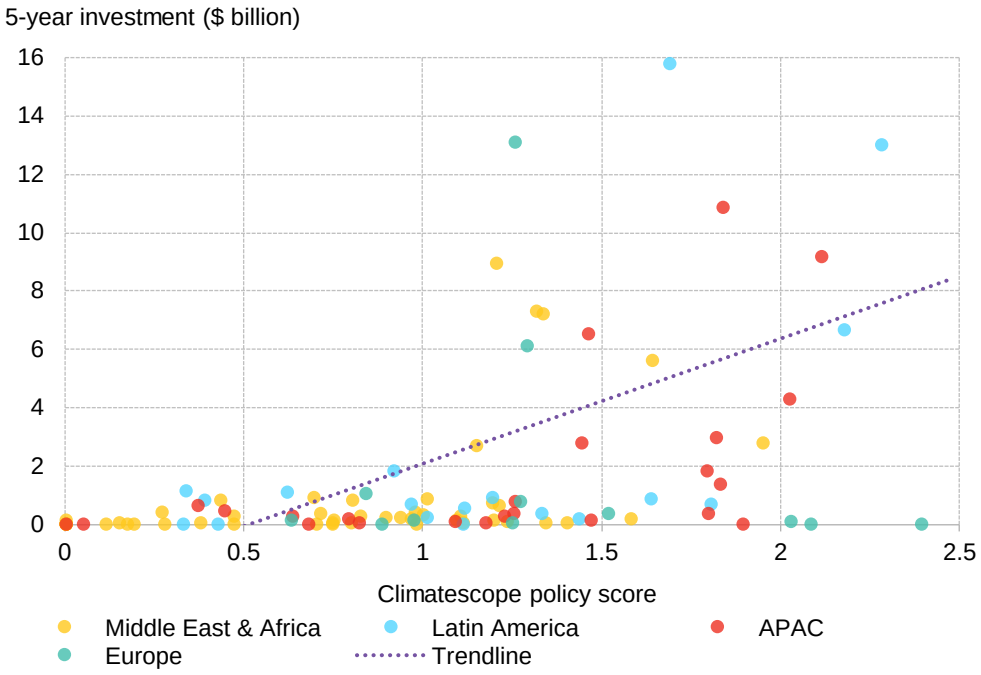
Figure 8: New-build clean energy asset finance by quarter



Source: BloombergNEF. Note: Developed markets include OECD countries, minus Chile, Colombia, Mexico and Turkey. Developing markets include all other economies. Numbers are subject to change.

- **Strong, stable clean energy enabling environments are key to attracting investment, particularly private capital.** The 47 emerging markets at the top of the Climatescope policy ranking attracted on average 17 times more investment in 2015-2019 than the ranking's bottom 60 countries. For countries wishing to kick off or progress their transitions towards cleaner power while recovering from the pandemic, the lesson is clear: improve your existing clean energy policy regimes and the capital can flow.
- **Government- or utility-organized reverse auctions for clean power delivery contracts generally succeed in adding clean capacity and attracting investment.** Markets assessed in Climatescope with auctions attracted five times more investment than those without such policies in force. Auctions, present in 45% of the emerging markets surveyed, have been critical to renewables growth globally and are currently the most successful clean energy policy for boosting investment in developing economies.
- **Despite evidence of what can work, a limited number of markets have the right policies in place.** Nearly three quarters of the emerging markets surveyed have clean energy targets in force. However, in only 41% of these nations has the renewable energy goal influenced the implementation of other, nuts-and-bolts renewables policies to spur build.

Figure 9: Climatescope policy score vs. 5-year clean energy asset finance in emerging markets



Source: BloombergNEF

Chile tops the Climatescope emerging markets ranking

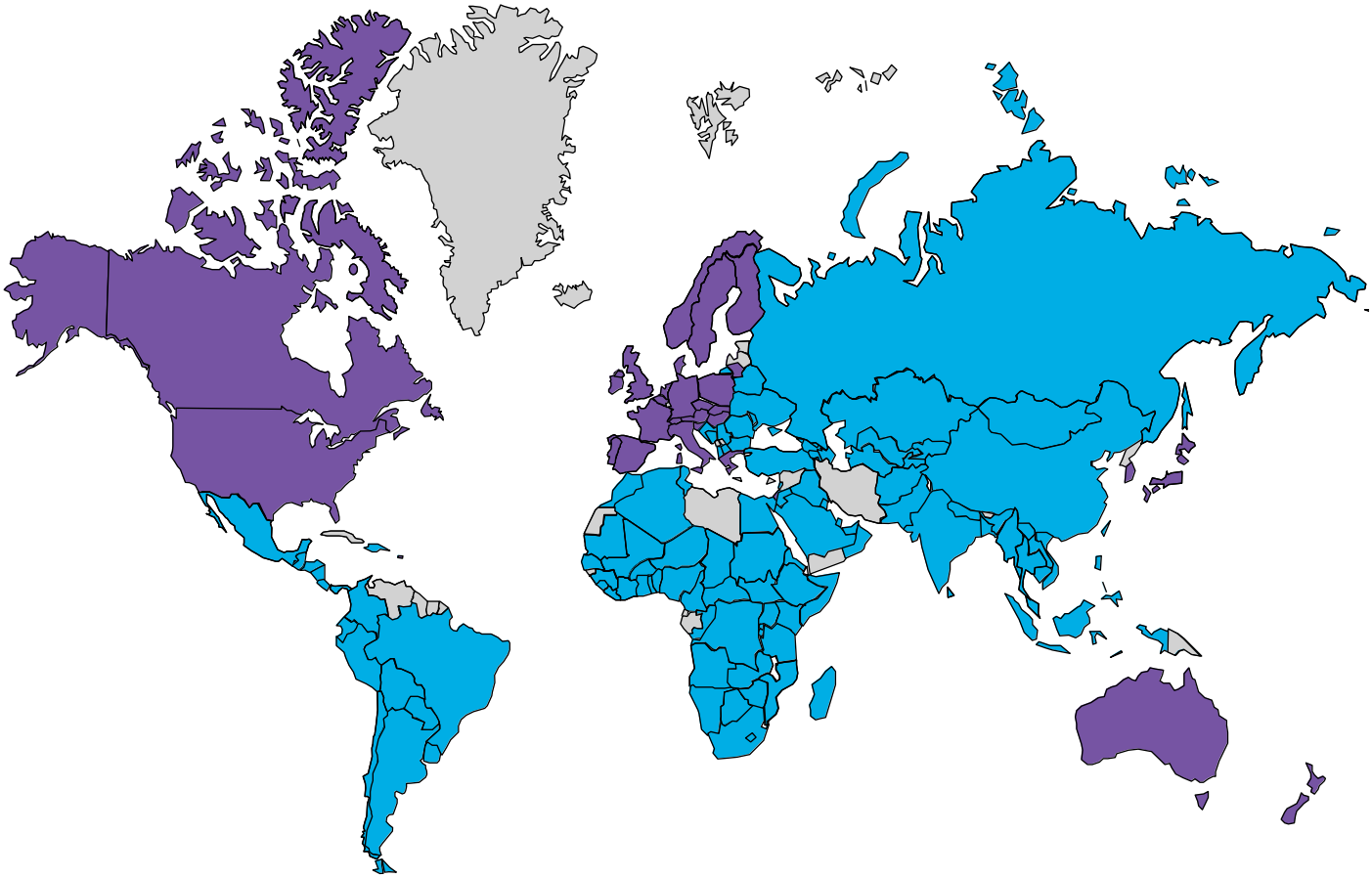
- **Chile has returned to the top spot in the Climatescope survey.** Through strong clean energy policies and its commitment to phase out coal generation, Chile remains determined to transition to a cleaner matrix. The country has already met its 2025 clean energy mandate target of 20% of generation for utilities and aims for 60% of its power generation to come from clean sources by 2035. Chile was ranked 2nd in last year's survey and 1st in 2018.
- **India dropped to second position.** India's ambitious policy framework and copious capacity expansions make it an attractive market for clean energy investment. The government has set one of the world's most ambitious renewable energy targets by aiming for 175GW by 2022. The country's drop to second position is mainly the result of a decline in clean energy investment, which fell 12% 2018-2019 and has plummeted 32% since 2017.
- **Brazil remains third.** Brazil continues to be one of the main emerging markets for renewable energy deployment and the largest power market in Latin America, with a total installed capacity of 171GW as of year-end 2019. Brazil has pioneered competitive auctions to contract clean energy, which led to 30GW of renewable energy contracted 2009-2019.
- **Jordan rose to fourth from sixth last year.** A stable clean energy policy framework combined with experience in deploying clean energy projects has helped Jordan become a regional renewables leader. Renewable energy installations have been booming over the past five years, with 1.5GW of PV and over 500MW of wind capacity installed 2015-2019.
- **Mainland China dropped to fifth from fourth in 2018.** Investment for mainland China clean energy projects has been sinking since 2017 as a result of policy changes, especially the removal of generous feed-in tariffs that were the norm for much of the past decade. Still, mainland China continues to represent a land of enormous potential for renewables.

Section 2. Scope

Climatescope 2020 encompasses 108 emerging markets and 29 developed nations (Figure 10). After nine years of surveying emerging markets exclusively, Climatescope this year has been expanded to include developed economies as well. The intent of adding these countries was to provide greater context on how emerging markets are faring in transitioning toward lower-carbon energy. However, Climatescope's intent is not to provide a single ranking comparing developed and less developed nations.

As result of the expansion, Climatescope now encompasses nearly every nation in the world with over 2 million inhabitants[1]. Developed markets are defined as OECD countries minus Chile, Colombia, Mexico and Turkey. These four are part of the OECD, but remain attractive emerging markets for clean energy development. Developing markets include all non-OECD nations, plus these four countries.

Figure 10: Markets covered in Climatescope 2020



Source: Climatescope, BloombergNEF. Note: The map above is an approximate representation, and should not be taken as accurate as far as international boundaries are concerned.

[1] Cuba, Iran, North Korea, Yemen and Libya are not in the coverage due to local conflicts or international sanctions that make them particularly challenging to research.

This Outlook summarizes the research undertaken by 57 BNEF analysts compiling detailed data on Climatescope markets. Readers are encouraged to explore complete datasets and profiles of each nation on the Climatescope website to leverage fully this deep-dive into how the world's fastest growing economies are driving the energy transition.

Section 3. Emerging markets at a crossroads

Global CO2 emissions from the world's power plants slipped 2.2% from 2018 to 2019, primarily due to lower generation from coal-fired projects, BNEF estimates (Figure 11). This is consistent with the conclusion in BNEF's New Energy Outlook 2020, which speculated that power sector CO2 emissions peaked in 2018.

Figure 11: Estimated power sector CO2 emissions by country

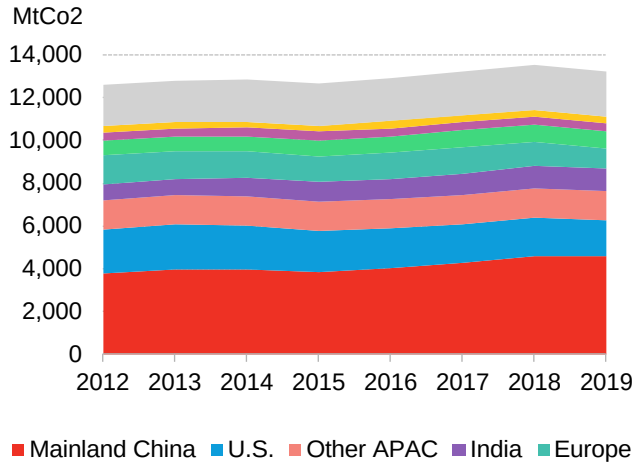
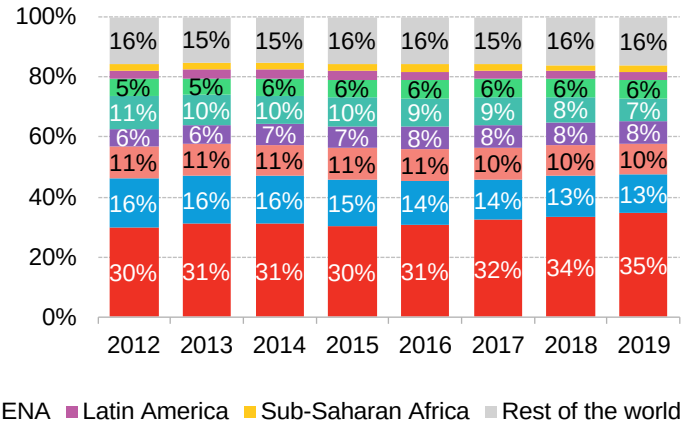


Figure 12: Estimated share of global power sector CO2 emissions by country



Mainland China U.S. Other APAC India Europe MENA Latin America Sub-Saharan Africa Rest of the world

Source: BloombergNEF.

The trajectory of power sector CO2 emissions has differed widely between developed and developing markets. In developed countries, power sector emissions have dropped 20% since 2012 to around 3,800MtCO2. While coal remains the main source of emissions, its role has diminished as coal-fired power plants have retired. Coal's contribution to total emissions has fallen, from 67% in 2012 to 60% in 2019 (Figure 13 and Figure 14). Oil's role as a fuel used in power generation in developed nations has also declined precipitously.

Figure 13: Developed countries' estimated power sector emissions by technology

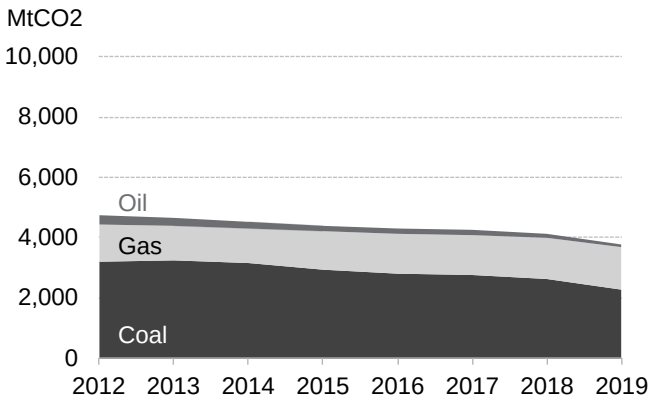
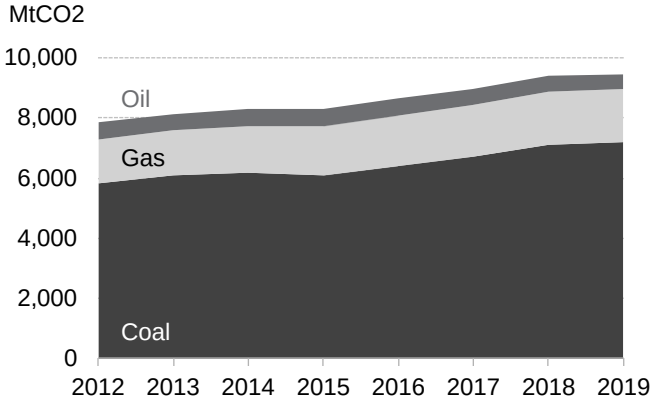


Figure 14: Developing countries' estimated power sector emissions by technology



Source: BloombergNEF. Note: Developed markets include OECD countries, minus Chile, Colombia, Mexico and Turkey. Developing markets include all other economies.

In contrast, developing economies' power sector emissions spiked 20% over the period to hit almost 9,500MtCO2 in 2019. Coal accounts for over three-quarters of power sector emissions in these nations.

Emerging markets' rapidly expanding appetite for electricity has boosted power sector emissions as new demand has been met often by generation from fossil fuel-fired plants. Global electricity production has grown, on average, 3% per year over the last decade. The net result: total generation in 2019 hit 26.1TWh, up 29% from 2010 levels. Emerging markets' annual generation spiked 54% while power production in developed countries remained nearly flat (Figure 15 and Figure 16).

Figure 15: Change in annual generation relative to 2010

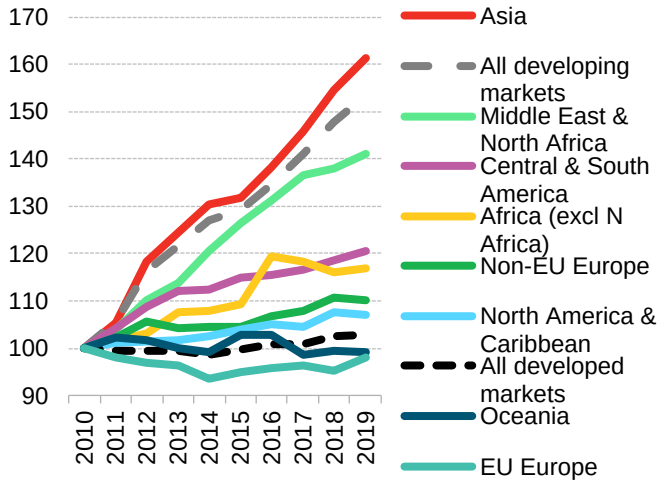
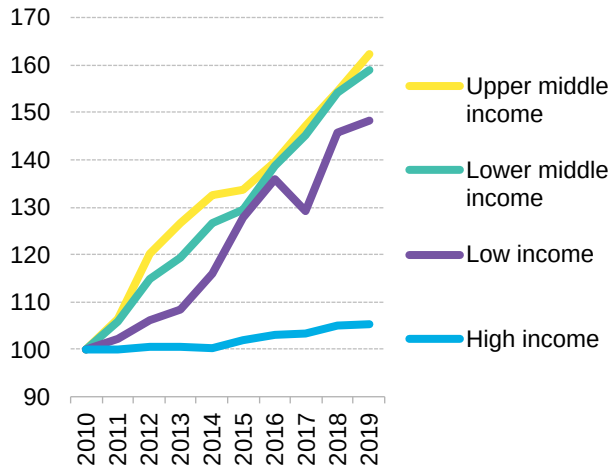


Figure 16: Change in annual generation relative to 2010, by country income level



Source: BloombergNEF. Note: Developed markets include OECD countries, minus Chile, Colombia, Mexico and Turkey. Developing markets include all other economies.

The trend is poised to continue. With rapid economic expansion and improving access to electricity, emerging markets are where power demand is expected to grow most in coming years. BloombergNEF's New Energy Outlook 2020[2] estimates that global power demand will rise another 57% by 2050 to nearly 41,000TWh. In OECD countries, demand is expected to expand just 19% to 2050, but in non-OECD markets, it is expected to jump 84%. By 2050, emerging economies will account for 68% of global power demand (Figure 17).

These markets are also on track to remain the source of 80% of power-sector emissions over the next three decades as their power matrixes decarbonize more slowly than wealthier countries'. BNEF projects emerging markets power sector emissions will drop 38% from 2019-2050. By comparison, OECD economies are projected to cut their power-sector CO2 emissions 61% (Figure 18).

[2] BloombergNEF's New Energy Outlook is a least-cost optimization exercise. Results are driven by the cost of building different power generation technologies to meet projected peak and total demand, taking into account seasonal weather extremes, on a country-by-country level.

Figure 17: Projected global power demand

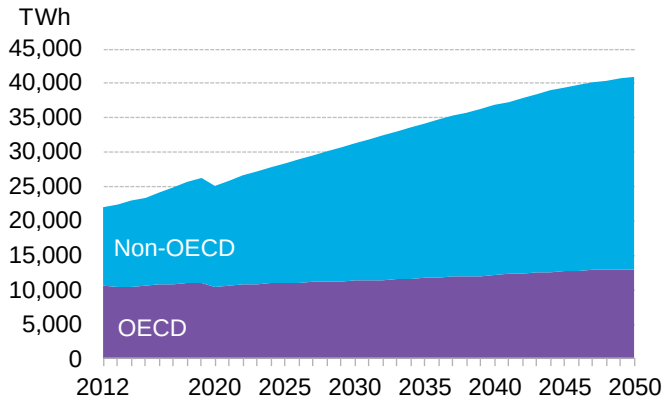
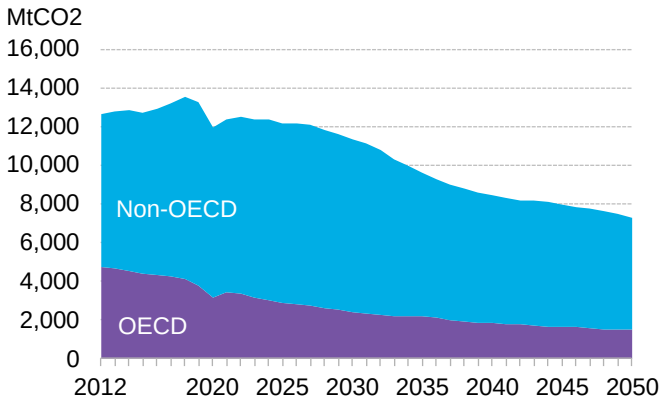


Figure 18: Projected power sector CO2 emissions



Source: BloombergNEF New Energy Outlook 2020.

The Covid-19 pain inflicted on emerging economies underscores the need for a green recovery and more international support

The Covid-19 pandemic has badly wounded the global economy and slowed growth in nearly every corner of the world. But the pain has been particularly acute in emerging markets where the tourism and commodities industries have struggled and remittances from workers abroad have slumped. GDP has contracted 3.3% across developing markets in 2020, hitting Latin America and the Caribbean the worst by shrinking 8.1%.

Governments in developing nations are now feeling pinched. On one side, they are seeing reduced inflows as slower economic activity has reduced revenues (taxes and fees collected from individuals and businesses, primarily) to one of the lowest levels ever. On the other side, many governments have boosted spending to stimulate their economies, creating unprecedented jumps in fiscal deficits and record high levels of public debt compared to GDP.

According to the IMF Fiscal Monitor, countries the IMF defines as “emerging markets” and “middle-income economies” have seen their net debt jump to 49% of GDP in 2020, from 26% in 2010 and 37% in 2018. Meanwhile, revenue has dropped to 25% of GDP in 2020, from 27% in 2019 and 28% in 2010 (Figure 19). In “low-income” developing countries as defined by the IMF, net debt grew to 45% of GDP in 2020, from 39% in 2019 and 15% in 2010. Revenue reached the lowest level in at least three decades at 13%, from 15% in 2019 and 16% in 2010 (Figure 20).

In addition, due to negative growth, capital flight and increased government spending, many emerging markets’ currencies have weakened, making it more difficult for some governments to repay debt, particularly debt denominated in foreign currencies[3]. Currency depreciation is straining government budgets and has prompted rating agencies to downgrade the sovereign credit ratings of certain nations. Borrowing could become even more costly and challenging if current conditions linger, raising the prospect of debt crises and defaults. All of this potentially leaves emerging market governments with little fiscal space to subsidize renewables. Choices these countries make today about energy infrastructure, however, will be with them for years.

[3] International Monetary Fund (2020) Fiscal Monitor: Policies for the Recovery

Figure 19: Emerging markets and middle-income economies' net debt and revenue as share of GDP

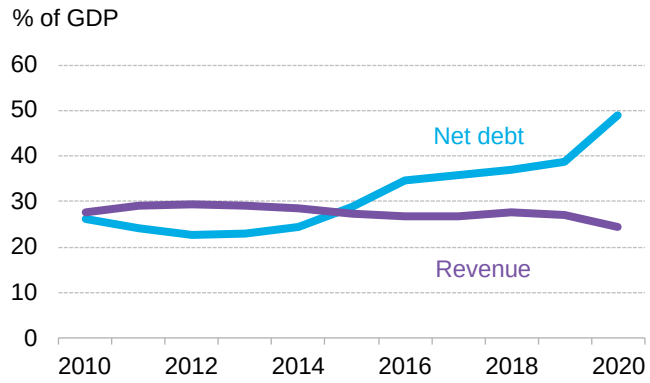
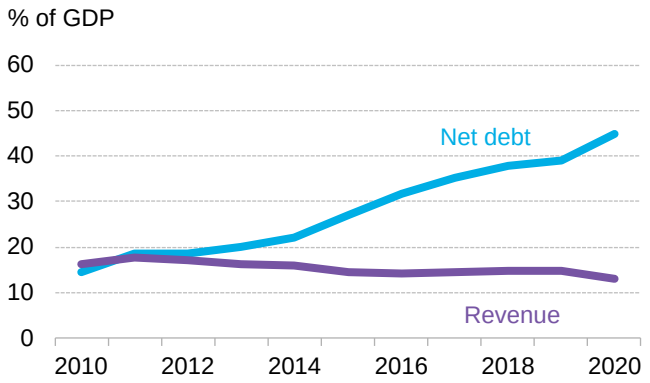


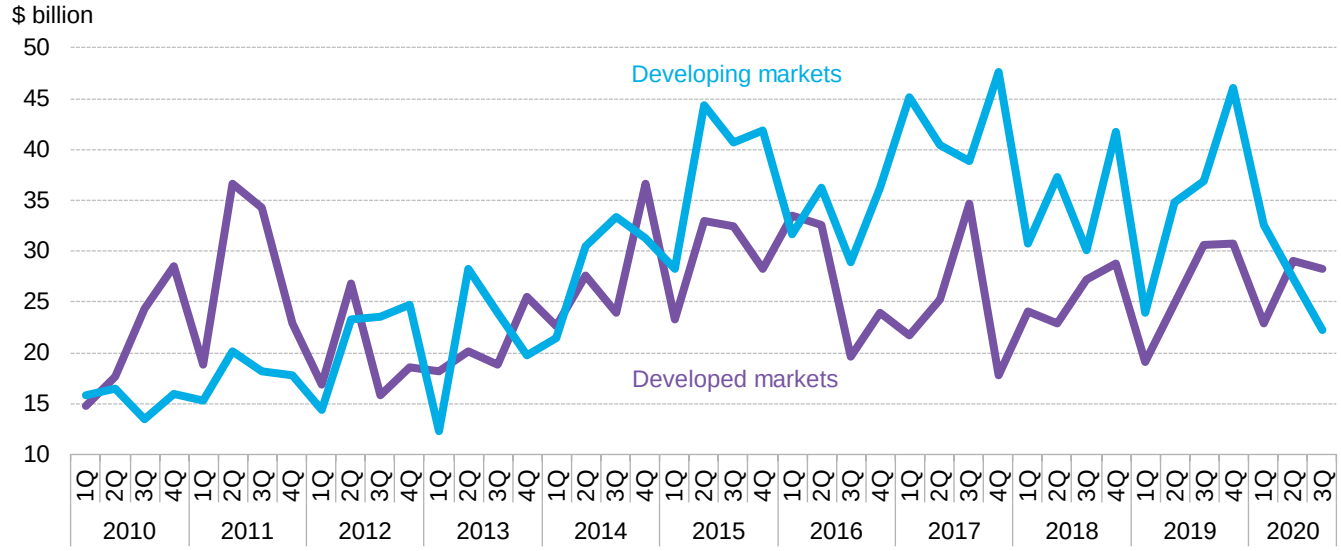
Figure 20: Low-income developing countries' net debt and revenue as share of GDP



Source: IMF (2020) Fiscal Monitor. Note: Revenue refers to government tax and non-tax revenues as defined by the IMF. Net debt refers to gross debt minus financial assets corresponding to debt instruments as defined by the IMF. Country groups follow IMF categorization.

All things considered, clean energy investment appears to be weathering the Covid-19 storm better than other sectors of the global economy so far. Headline investment figures conceal a major discrepancy between wealthier and less developed markets, however. Through three quarters of 2020, developed nations have secured the equivalent of 76% of the clean energy financing they attracted in 2019, putting them on track to match last year's total. By contrast, investment has been just 58% of last year's total through three quarters in emerging markets (Figure 21) and 3Q 2020 investment fell to the lowest level since 1Q 2014. Emerging economies could close 2020 with the steepest year-on-year drop ever recorded by BNEF. This trend is likely to be even starker for direct foreign investment to clean energy projects.

Figure 21: New-build clean energy asset finance by quarter



Source: BloombergNEF. Note: Developed markets include OECD countries, minus Chile, Colombia, Mexico and Turkey. Developing markets include all other economies. Numbers are subject to change.

A multi-year pandemic could bring an even more dramatic decline in investment and has the potential to disrupt the energy transition in many developing economies. This underscores the need for a sustainable recovery by making the best possible use of already strained public finances to attract private investment from both national and international investors. We further explore which conditions enable increased clean energy investment from private sources in Section 6 below.

Section 4. Global trends

4.1. State of the power systems

Total global power-generating capacity has spiked 44% since just 2010 to reach 7.3TW at year-end 2019. Coal accounts for the lion's share of the total at 2.1TW and continues to grow annually, but its share of the global matrix on a percentage basis has slipped from 31% at the start of the decade to 29% last year (Figure 22).

Thanks to 1.4TW of new renewable energy capacity (including hydro) additions over the past decade, renewables now account for 36% of global power-generating capacity, up from 25% a decade ago. Just two years ago, wind and solar surpassed 1TW of installed capacity globally. As of year-end 2019, they had climbed to 1.3TW.

Figure 22: Global installed capacity by technology

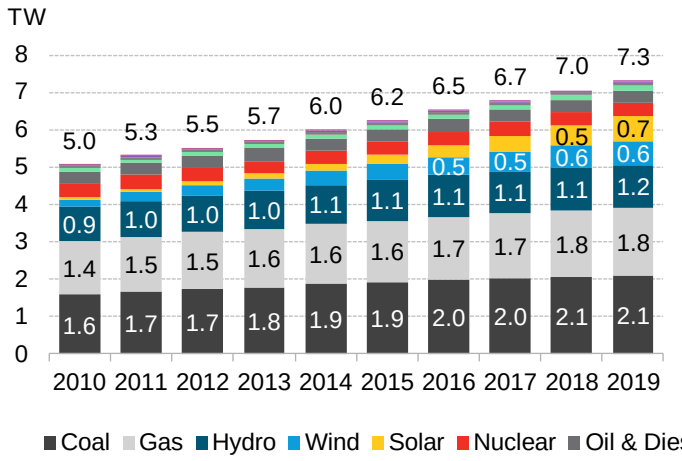
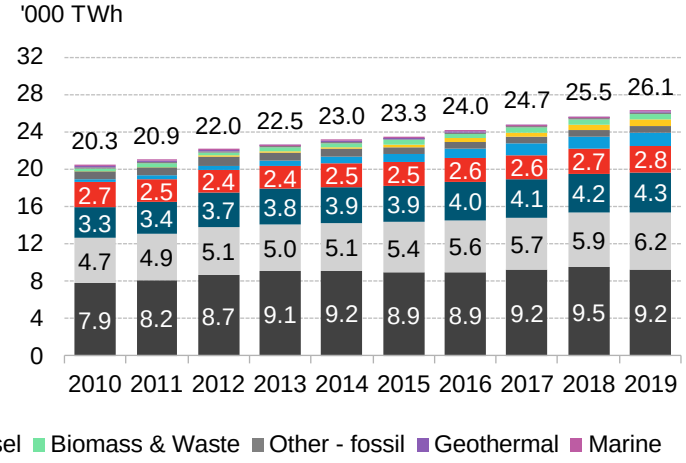


Figure 23: Global annual generation by technology



Coal Gas Hydro Wind Solar Nuclear Oil & Diesel Biomass & Waste Other - fossil Geothermal Marine

Source: BloombergNEF. Note: Figures exclude energy storage technologies, such as batteries and pumped hydro. Numbers are subject to change.

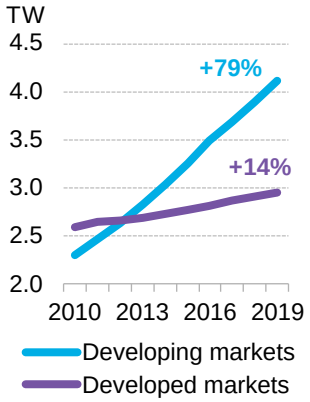
Electricity production has grown at an average rate of approximately 3% per year over the last decade. The net result has been that total generation in 2019 was up 29% from 2010 at 26.1TWh. Renewable energy technologies (including hydro) reached 27% of total power produced last year, up from 20% in 2010 (Figure 23). Wind and solar together represented 8.5% of all power generated in 2019, up from less than 2% in 2010. Renewable energy technologies also added more new power to the global grid than fossil fuel plants. Renewables accounted for 54% of new power produced globally in 2019, while gas was responsible for 37% and nuclear the remaining 9%.

Nonetheless, coal and gas still represent the largest sources of power generation globally. The two accounted for 35% and 24% of the 26.1TWh produced in 2019, respectively. Gas has grown consistently over the past decade and expanded 6% from 2018-2019. The share of nuclear dropped from 14% in 2010 to 11% in 2019.

Despite a 39GW net increase in coal capacity, coal plants actually produced 265TWh, or 3%, less electricity in 2019 than in the year prior. This represented the first year-on-year drop in coal

generation since 2014-15. Still, the 9.2 thousand TWh of coal-fired power consumed in 2019 represented a 17% jump from 2010.

Figure 24: Share of total installed power-generating capacity



Source: BloombergNEF

Power-generating capacity has jumped 79% in emerging markets since 2010 but remained nearly flat in wealthier nations

The evolution of power systems has diverged considerably between developed and developing markets over the past decade. In 2010, combined total installed capacity in developed economies was 13% larger than that in emerging markets. By year-end 2019, developing markets accounted for the majority of total online capacity, by far (Figure 24).

In emerging markets, installed capacity spiked 79%, from 2.3TW in 2010 to 4.1TW in 2019 while generation jumped 53% over the decade to just under 16,000TWh. Coal still accounts for the lion's share of capacity with 1.6TW online and was responsible for 44% of all power produced in developing economies in 2019. Hydro and gas follow as the second- and third-biggest contributing technologies, with 18% of capacity and 19% of power production (Figure 25 and Figure 26).

Spurred by strong growth in mainland China, India and Southeast Asia, emerging markets' coal capacity has jumped 66% over the past decade to 1.6TW. Coal accounted for over a third of the 1.8TW of new capacity emerging markets installed in 2010-2019. Solar was the second most-added technology with 324GW, or 18% of the total. It surged from less than 1GW of total developing economies' installed capacity in 2010 to 325GW in 2019 and now accounts for 8% of emerging markets' installed capacity. Still, due to low capacity factors, solar produced just 2% of the world's electricity in 2019.

Figure 25: Cumulative capacity by technology in developing markets

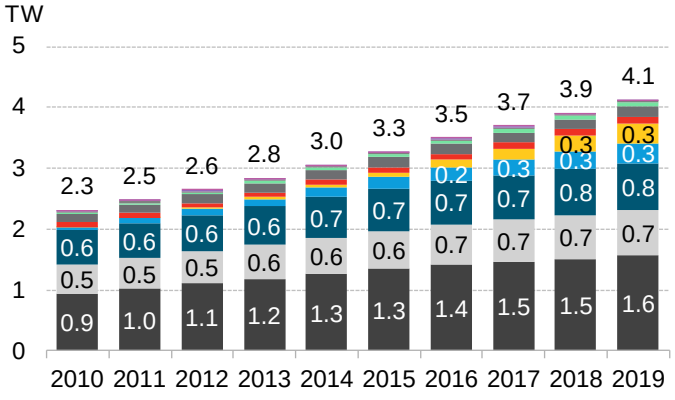
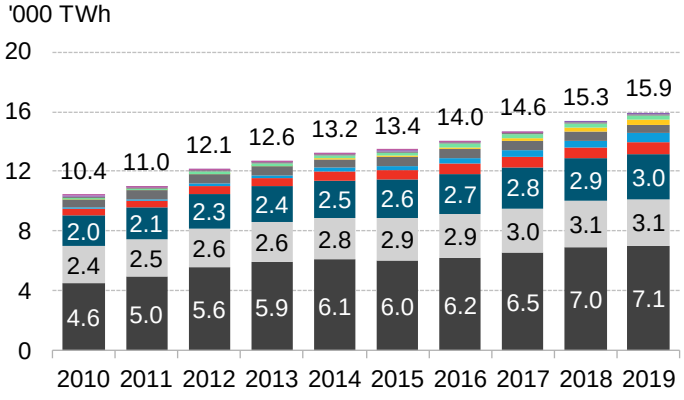


Figure 26: Annual generation by technology in developing markets



Coal Gas Hydro Wind Solar Nuclear Oil & Diesel Biomass & Waste Other - fossil Geothermal Marine

Source: BloombergNEF. Note: Figures exclude energy storage technologies, such as batteries and pumped hydro. Developed markets include OECD countries, minus Chile, Colombia, Mexico and Turkey. Developing markets include all other economies.

In developed countries, total power generation capacity grew just 14% from 2.6TW in 2010 to 3.0TW in 2019, with generation remaining virtually flat (Figure 27 and Figure 28). Gas was the main source of bulk generation and represented a third of total capacity and 30% of power produced in 2019. Coal's share fell over the decade due to around 115GW of plant retirements.

With 264GW installed over the past decade, solar jumped from 2% of total capacity in 2010 to 10% in 2019, but accounted for less than 3.5% of the power produced in 2019.

Figure 27: Cumulative capacity by technology in developed markets

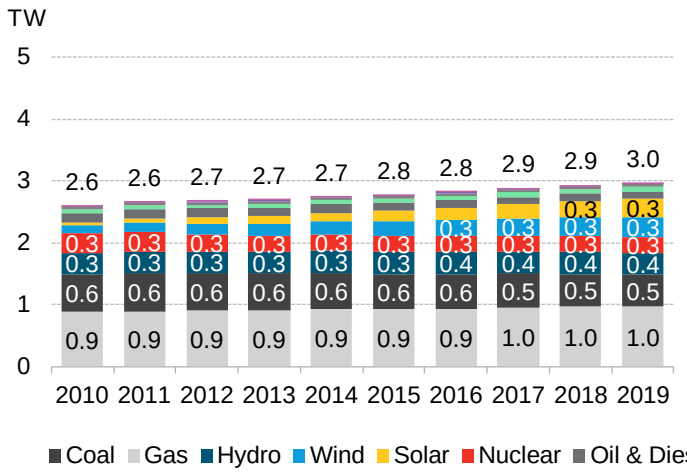
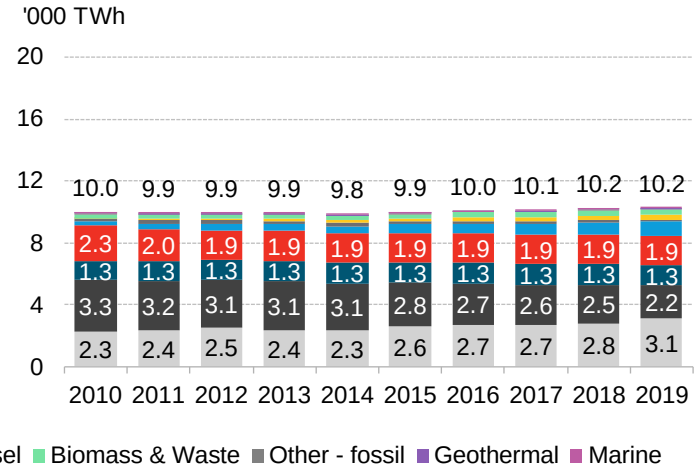
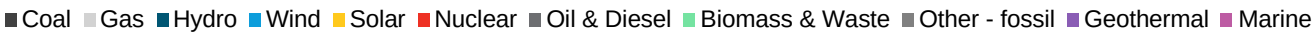


Figure 28: Annual generation by technology in developed markets





Source: BloombergNEF. Note: Figures exclude energy storage technologies, such as batteries and pumped hydro. Developed markets include OECD countries, minus Chile, Colombia, Mexico and Turkey. Developing markets include all other economies.

4.2. Investment destinations

Emerging markets are the engine powering global clean energy investment and deployment

The center of gravity for clean energy investment and capacity build has shifted from developed to developing markets (Figure 29 and Figure 30). Coming into the 2010s, wealthier nations accounted for the majority of both clean energy investment and new renewables build. However, since 2012, developing economies have secured over half of all global clean energy investment. Since 2013, they have been responsible for over half of all clean capacity installed worldwide. In 2019, emerging markets attracted 58% of global clean energy asset finance while nearly two thirds of all new wind and solar was built in these nations.

Figure 29: Share of global clean energy asset finance

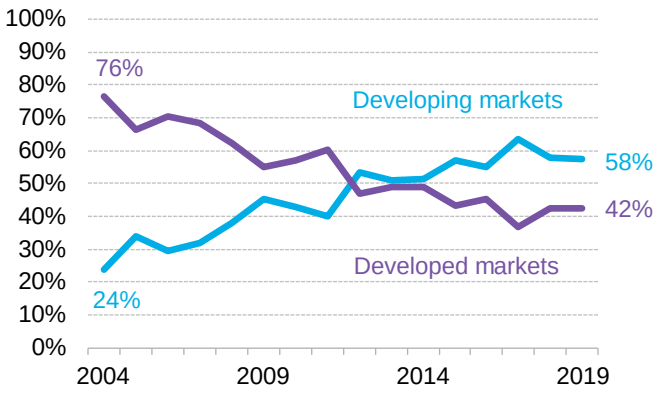
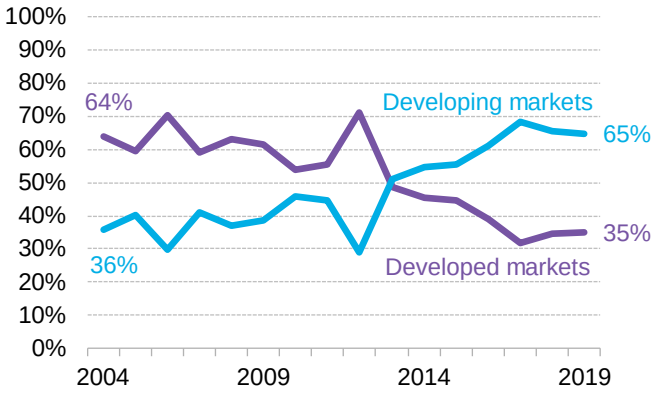


Figure 30: Share of clean energy capacity build



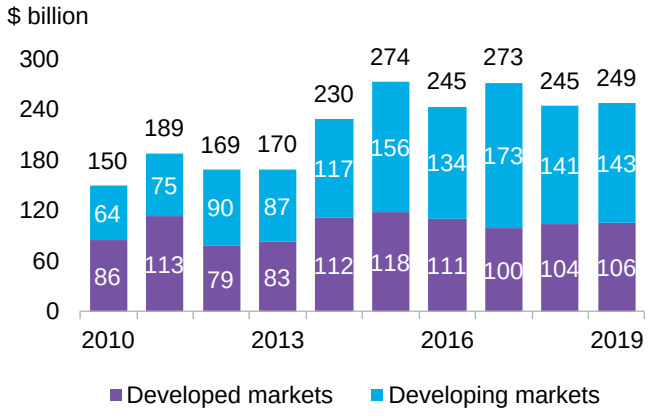
Source: BloombergNEF. Note: Developed markets include OECD countries, minus Chile, Colombia, Mexico and Turkey. Developing markets include all other economies. Numbers are subject to change.

Clean energy investment remains concentrated in just a few countries, but less traditional, developing markets are starting to make waves

In absolute terms, global clean energy investment has remained more or less level since 2014, with 2019 seeing a slight uptick from the prior year to $249 billion. Emerging markets accounted for $143 billion of this, up slightly from $141 billion the year prior. Wealthier nations attracted $106 billion in 2019, compared to $104 billion in 2018.

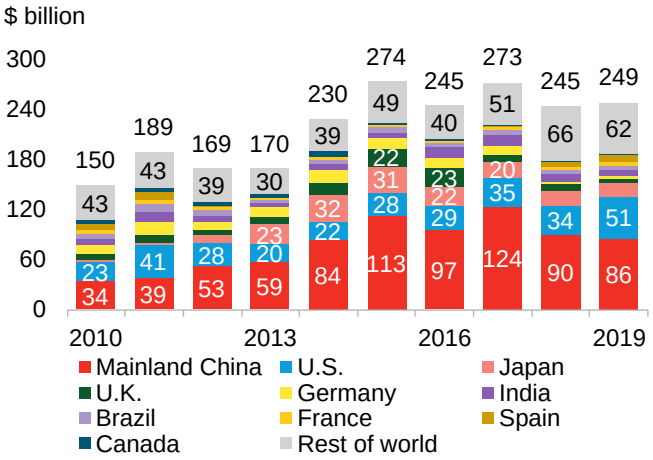
Mainland China has held sway over global investment flows as the country has accounted for over a third of capital deployed during the past decade. Since hitting a high of 45% of total investment in 2017, however, the nation's share has steadily declined. It hit 35% in 2019 at $86 billion (Figure 31 and Figure 32).

Figure 31: Global new-build clean energy asset finance, by market type



Source: BloombergNEF. Note: Developed markets include OECD countries, minus Chile, Colombia, Mexico and Turkey. Developing markets include all other economies. Numbers are subject to change.

Figure 32: Global new-build clean energy asset finance, by major markets



Source: BloombergNEF. Note: Numbers are subject to change.

Other traditionally strong renewables markets, like the U.K. and Germany, have also seen investment wane recently, recording their lowest investment levels of the decade in 2019 at $5.6 billion and $2.2 billion, respectively. Japan also saw its lowest volumes of new investment for clean energy projects since 2012 at $15.4 billion. While five years ago these three nations accounted for nearly a quarter of global investment volumes, their share was reduced to 9% in 2019.

By contrast, the U.S., France and Spain rebounded in 2019. The U.S. recorded its highest level of new clean energy investment ever at $51 billion. France and Spain posted their highest investment levels since 2014 and 2011, respectively at $4.6 billion and $8 billion.

Clean energy investment remains generally concentrated in a limited number of markets. The top 10 destinations for clean energy financing between 2010 and 2019 accounted for 79% of total

capital deployed. In 2019, they were 75% (Figure 33). This concentration is even more dramatic in developing markets, where the top 10 markets accounted for 91% of 2019 investment (Figure 34).

Figure 33: Global top 10 markets for clean energy asset finance, 2019

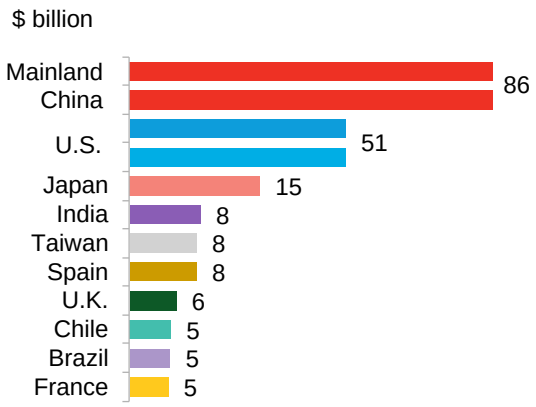
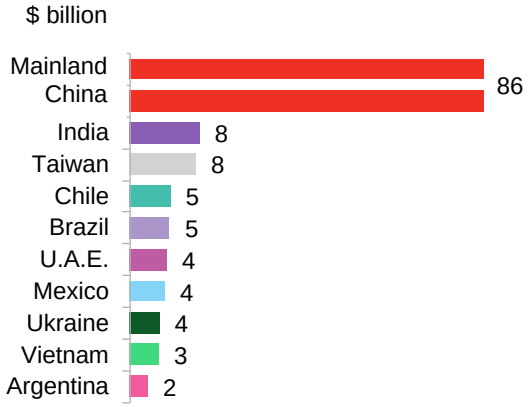


Figure 34: Top 10 emerging markets for clean energy asset finance, 2019



Source: BloombergNEF. Note: Numbers are subject to change.

Still, new markets are garnering more attention – and capital. Ukraine and Vietnam, for example, attracted $2.4 billion and $952 million respectively thanks in part to strong clean energy policy frameworks. Less traditional destinations have started securing their first major deals, including the United Arab Emirates, Cambodia or Burkina Faso. The U.A.E. has made its clean energy target and large-scale auctions more ambitious in recent years, resulting in $4.5 billion in investment in 2019 alone compared to $3.7 billion across the prior 10 years. Burkina Faso has raised the ambition of its national clean energy target and in 2019 kicked off its first large-scale solar tender. This led to $166 million in investment secured in the year compared to $133 million over the prior decade. Cambodia introduced long-anticipated reverse auctions for clean-power delivery contracts in 2019. This helped drive no less than $626 million in new clean energy investment during the year.

4.3. Capacity additions

Emerging markets are building more wind and solar plants, but also significant fossil fuel capacity

Growing renewables deployment in emerging markets is all the more critical as they also lead the world in adding fossil-fuel power generating capacity. Thanks to flat power demand, fossil fuel phase-out policies, carbon-trading schemes or other policy mechanisms, developed nations are decarbonizing their power systems at a fast pace. By contrast, emerging economies continue to add significant amounts of fossil fuel-fired capacity (Figure 35 and Figure 36).

Figure 35: Developed markets' annual capacity additions/subtractions by technology type

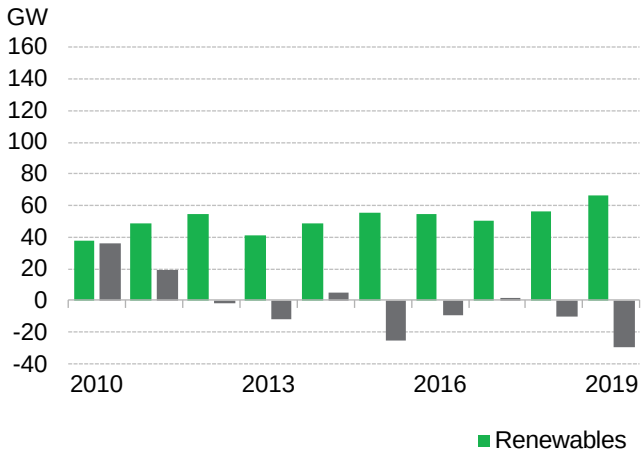
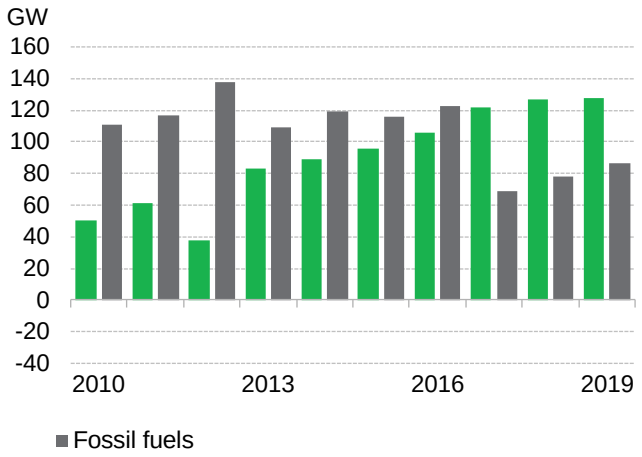


Figure 36: Developing markets' annual capacity additions by technology type



Renewables Fossil fuels

Source: BloombergNEF. Note: "Renewables" includes solar, wind, geothermal, biomass, and hydro. Figures exclude energy storage technologies, such as batteries and pumped hydro. Numbers are subject to change. Developed markets include OECD countries, minus Chile, Colombia, Mexico and Turkey. Developing markets include all other economies.

Globally, the world added 265GW of new power-generating capacity in 2019, down from 283GW in 2018. Renewables (including hydro) represented three-quarters of all power installed last year, while wind and solar alone accounted for two-thirds of new build. This was up from 56% in 2018 and just 24% in 2010 (Figure 37 and Figure 38). Fossil fuels were down from 61% of global capacity installed in 2010 to 25% last year, the lowest level ever.

Annual completions of solar power plants have risen every year since the start of the decade and hit a new high of 119GW in 2019, up from 109GW in 2018 and just 19GW in 2010. The technology accounted for 45% of all capacity commissioned globally last year. Wind saw 60GW of new plants installed worldwide in 2019, or 23% of the total installations. This is the highest figure since a peak of 62GW in 2015.

After two years of slower growth, net capacity additions of coal-fired generating capacity jumped to 39GW in 2019. In contrast, gas build slipped to its lowest level of the decade with just 25GW commissioned last year.

Figure 37: Global shares, net capacity additions

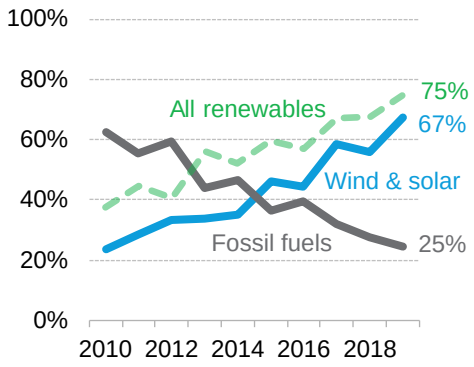
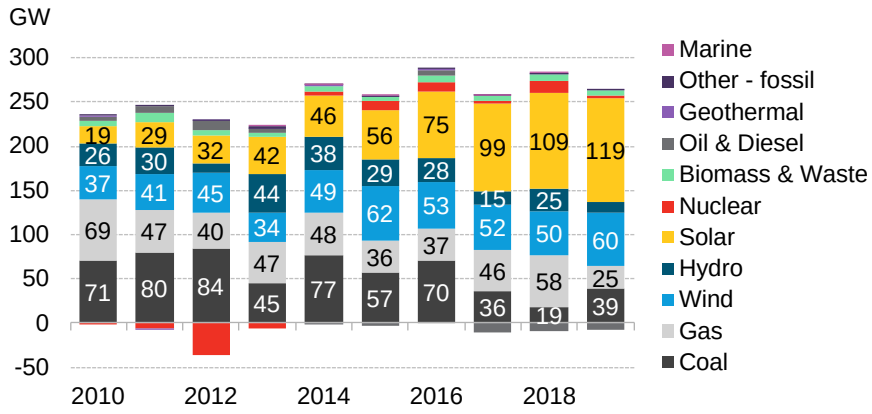


Figure 38: Global year-on-year capacity changes



Source: BloombergNEF. Note: "All renewables" includes solar, wind, geothermal, biomass, and hydro. Figures exclude energy storage technologies, such as batteries and pumped hydro. Numbers subject to change. Developed markets include OECD countries, minus Chile, Colombia, Mexico and Turkey. Developing markets include all other economies.

Both wealthy and less developed markets added more wind and solar capacity than fossil capacity in 2019, but they are in different stages of their energy transitions. In the world's most developed countries (defined for this report as all OECD nations minus Chile, Colombia, Mexico and Turkey), wind and solar have accounted for at least 60% of capacity installed each year since 2011. With 65GW of wind/solar installed in 2019 vs. 2.4GW of new fossil capacity, these technologies reached their highest ever share of annual additions at 95% (Figure 39 and Figure 40).

Developed nations have effectively installed zero net new coal-fired capacity since 2012, with retirements of coal plants hitting a record in 2019 at 21GW decommissioned. After years of growth, net gas installations hit their lowest level of the decade with just 1.3GW added.

Figure 39: Developed markets' share of global net capacity additions

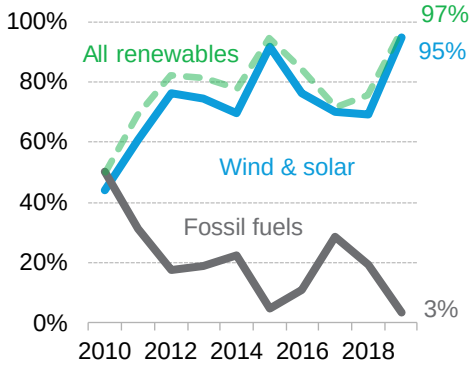
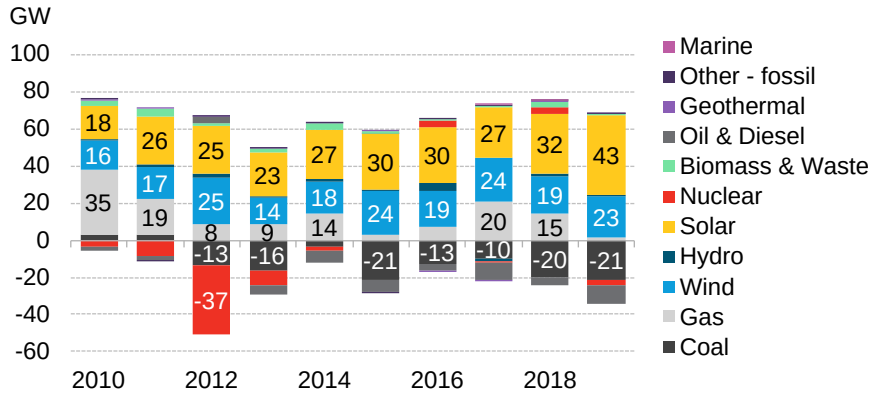


Figure 40: Developed markets' year-on-year capacity change



Source: BloombergNEF. Note: "All renewables" includes solar, wind, geothermal, biomass, and hydro. Figures exclude energy storage technologies, such as batteries and pumped hydro. Numbers subject to change. Developed markets include OECD countries, minus Chile, Colombia, Mexico and Turkey. Developing markets include all other economies.

By contrast, emerging markets have consistently added both fossil fuel and renewables capacity. However, renewables started to outpace fossil capacity on an annual new-build basis in 2017. Ever since, renewables have accounted for most capacity added each year, but levels have fluctuated (Figure 41).

In 2019, developing economies added 127GW of new renewable energy capacity including 110GW of new wind/solar alone. This represented 58% and 50%, respectively, of total new capacity commissioned last year. Solar has grown by approximately 70GW for each of the last three years while new wind installed jumped 24% year-on-year to 37GW in 2019 (Figure 42). With 60GW of new coal plants, 24GW of new gas and 2.3GW of new oil, fossil fuels accounted for 40% of total additions in 2019, up from 38% in 2018 and 36% in 2017. Nuclear plants accounted for the remaining 2%.

Figure 41: Developing markets' share of net capacity additions

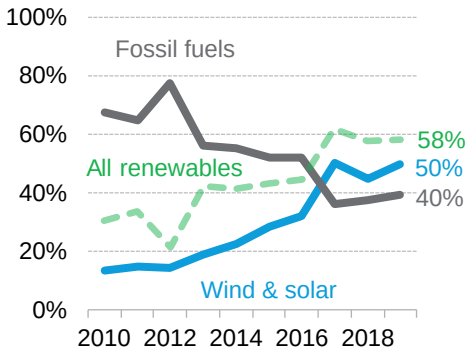
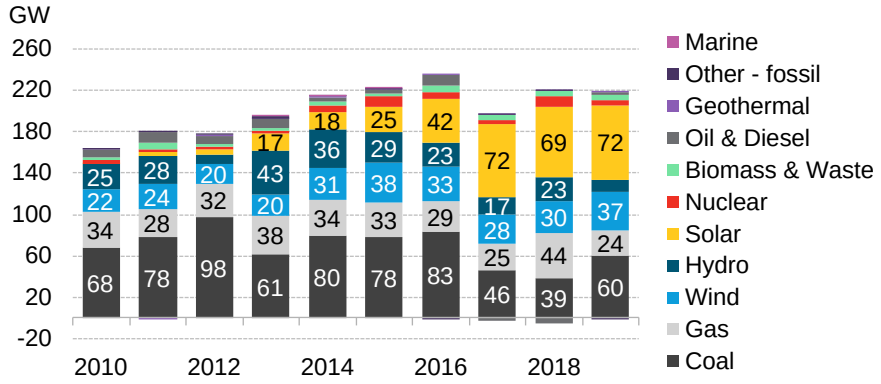


Figure 42: Developing markets' year-on-year capacity change



Source: BloombergNEF. Note: "All renewables" includes solar, wind, geothermal, biomass, and hydro. Figures do not include energy storage technologies, such as batteries and pumped hydro. Nuclear additions in 2019 account for the remaining 2%. Numbers are subject to change. Developed markets include OECD countries, minus Chile, Colombia, Mexico and Turkey. Developing markets include all other economies.

Globally, wind and solar installations have remained quite concentrated in a relatively small number of nations. The top ten countries for capacity additions accounted for 82% of the 606GW of solar built over the past decade (Figure 43 and Figure 44) and 84% of the 482GW of wind constructed (Figure 45 and Figure 46).

The concentration is even more dramatic when looking at just developing economies. Mainland China and India alone accounted for 92% of the decade's added solar capacity and 82% of its wind in these countries.

Figure 43: Top 10 markets for solar capacity additions, 2010-2019

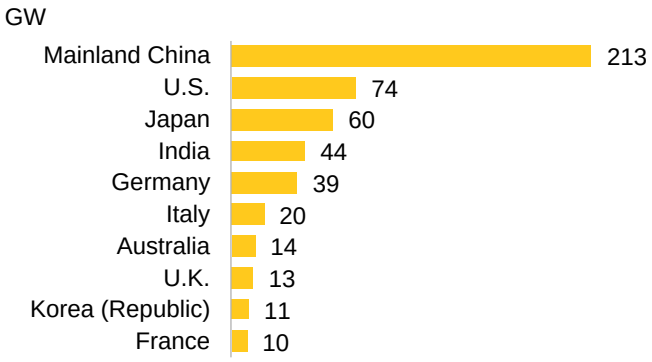


Figure 44: Top 10 markets for solar capacity additions, 2019

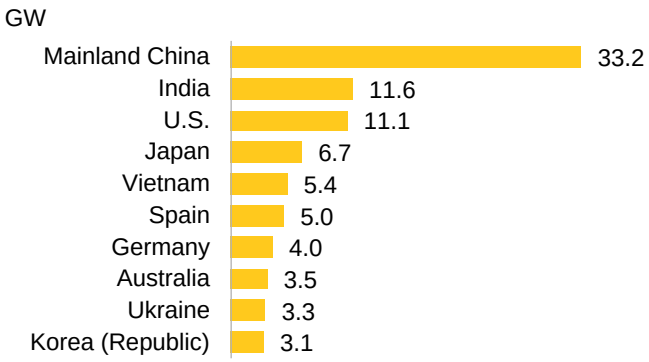


Figure 45: Top 10 markets for wind capacity additions, 2010-2019

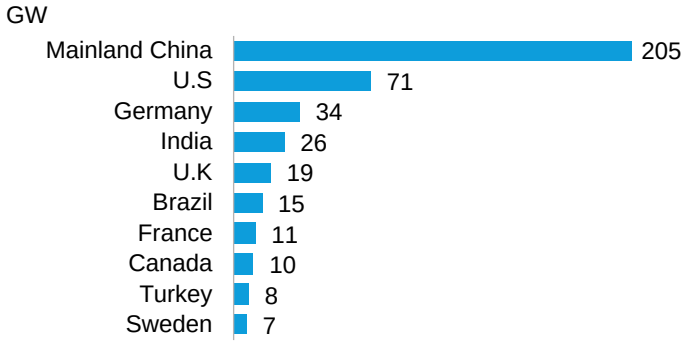
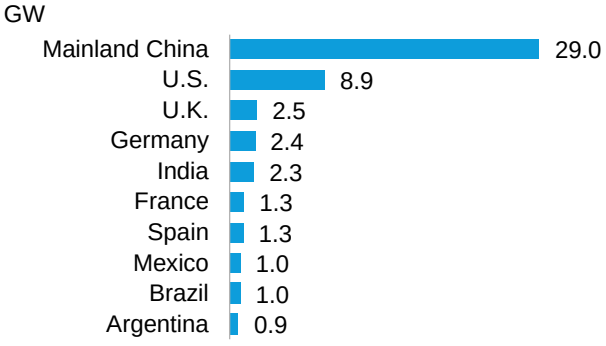


Figure 46: Top 10 markets for wind capacity additions, 2019



Source: BloombergNEF.

Consequently, mainland China and India are the two nations most responsible for developing markets achieving majority-build renewables. This is despite the fact that over the past decade these two markets have also installed more coal than other countries. Mainland China and India added a combined 478GW of coal capacity over the past decade and 45GW in 2019 alone (Figure 47 and Figure 48). The significant spike last year in coal-build came after much celebrated drops in installations of the technology in 2017 and 2018.

Figure 47: Major markets for net coal additions, 2010-2019

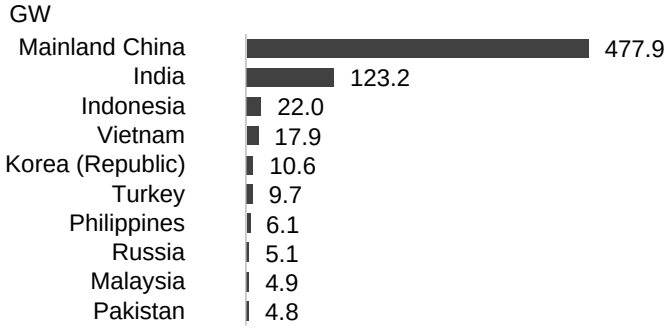
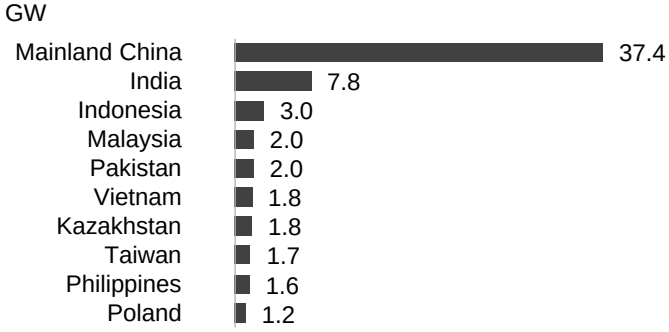


Figure 48: Major markets for net coal additions, 2019



Source: BloombergNEF.

Excluding mainland China and India, developing markets have never installed more wind and solar than fossil fuel capacity. Still, the share of wind and solar additions spiked from 25% in 2018 in those 106 markets to 44% in 2019, very close to the 46% of fossil fuel capacity commissioned in 2019. This quick progress is due to a jump in additions of solar, which more than doubled from 13GW in 2018 to 27GW in 2019 (Figure 49 and Figure 50).

Taking all renewable energy technologies into consideration (including hydro), emerging markets (excluding mainland China and India) reached the capacity additions crossover point for the first time in 2019, with renewables accounting for 53% of capacity installed. Gas-build fell to its lowest level since 2014 with just 17GW added, less than half the previous year's total. On the other hand, these economies commissioned more coal capacity than in any year in the past decade. Over 90% of the new build was in Asia.

Figure 49: Developing markets (excluding mainland China/India) share of net capacity additions

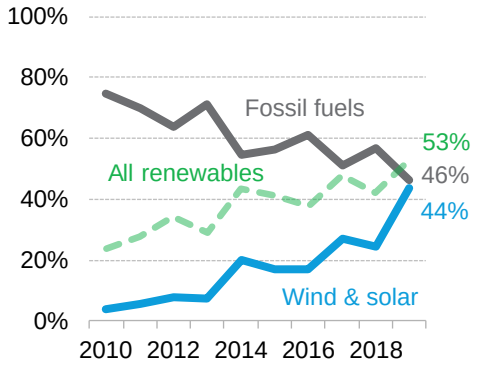
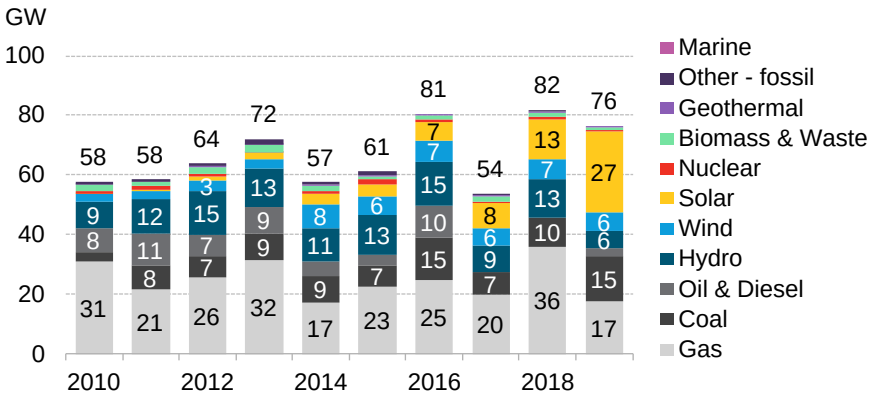


Figure 50: Developing markets (excluding mainland China/India) net capacity additions and retirements



Source: BloombergNEF. Note: "All renewables" includes solar, wind, geothermal, biomass, and hydro. Figures exclude energy storage technologies, such as batteries and pumped hydro. Numbers are subject to change. Developed markets include OECD countries, minus Chile, Colombia, Mexico and Turkey. Developing markets include all other economies.

4.4. Technology choices

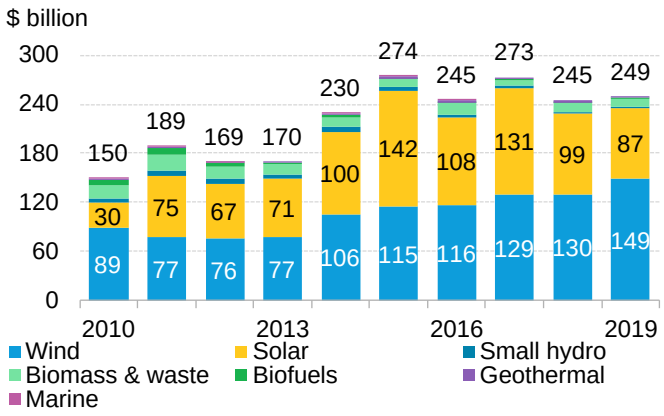
Wind and solar remain the most popular technologies for clean energy investment globally, accounting for 95% of clean energy asset finance last year and 90% since 2010. While at the start of the decade, other renewables technologies also drew investment, developers have homed in nearly exclusively on solar and wind in recent years (Figure 51).

Only four markets worldwide secured small hydro investment in 2019, with developed nations not seeing new small hydro deals since 2017. Likewise, only eight countries secured geothermal investments in 2019, with the number of markets opting for the technology shrinking in the past decade. Biofuels and biomass projects investment has also falling since 2011.

Wind accounts for 49% of all clean energy asset finance attracted globally over the past decade and has seen volumes grow every year since 2013, securing a record of $149 billion in 2019. By

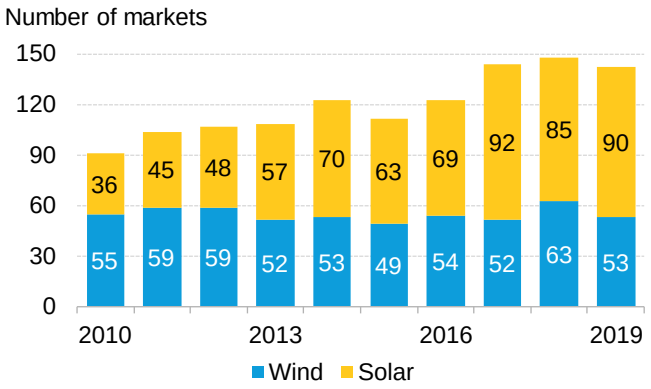
contrast, solar investment peaked in 2017 and hit its lowest level in six years in 2019 at $87 billion.

Figure 51: Global new-build clean energy asset finance, by technology



Source: BloombergNEF. Numbers are subject to change.

Figure 52: Global number of markets with new solar and wind investment



Source: BloombergNEF. Numbers are subject to change.

The number of markets securing asset finance for new clean energy project varies by technology. Globally, solar investments have reached ever more countries in the past decade, with 2019 seeing 90 markets with solar deals compared to 36 in 2010. This is mainly due to a quick spread of the technology to new developing markets. This stands in contrast to wind, where the number of markets securing wind investment has not changed much. In 2019, 53 economies secured wind deals compared to 55 in 2010 (Figure 52).

Wind is growing in volume, while solar is spreading to more markets

In emerging markets, asset finance for wind projects hit a new high in 2019, with $89 billion directed to new plants, up from $70 billion the previous year (Figure 53). In developed nations, however, wind investment levels remained similar to previous years at $59 billion (Figure 54). While solar investment was steady in developed nations in 2019 at $39 billion, the technology saw the lowest overall volume since 2014 in developing economies at $48 billion.

A 38% decline in solar investment in mainland China between 2018 and 2019 partially explains the drop in investment volumes in emerging markets, but does not tell the full story. Declining solar investment levels can also be attributed to both falling technology costs and increased maturity of the technology across an array of markets (see section 4.5 for more details).

Wind, in contrast, saw fewer, but larger deals. Brazil, mainland China and Vietnam recorded large jumps in onshore wind investment compared to 2018, totalling 42% of onshore wind investment globally in 2019. In addition, Taiwan secured a record of $7.7 billion offshore wind financing, accounting for a quarter of global offshore wind investment in 2019. Together, these four markets were responsible for half of 2019's global wind investment.

Figure 53: New-build clean energy asset finance in developing markets, by technology

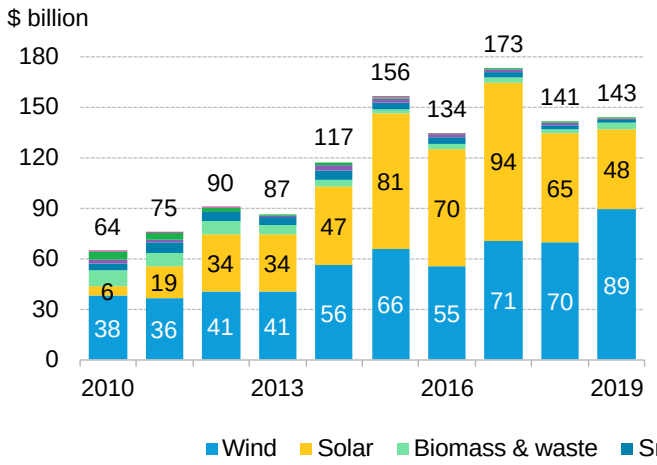
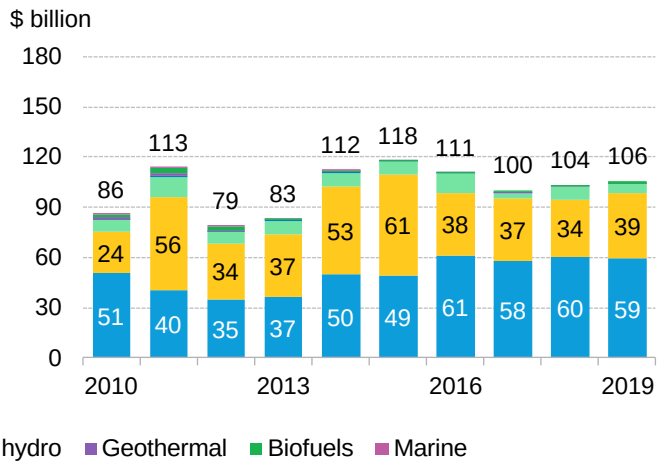


Figure 54: New-build clean energy asset finance in developed markets, by technology



Wind Solar Biomass & waste Small hydro Geothermal Biofuels Marine

Source: BloombergNEF. Note: Developed markets include OECD countries, minus Chile, Colombia, Mexico and Turkey. Developing markets include all other economies. Numbers are subject to change.

Despite a steep year-on-year drop, solar investment has reached an expanded number of emerging markets over the past three years. In 2019, 69 developing markets secured financing for solar projects, up from 46 in 2015 and just 18 in 2010. In contrast, the total number of developing economies securing wind investment has stayed roughly level over the past decade. In 2019, 30 developing markets secured capital for wind projects, compared to 25 in 2015 and 27 in 2010 (Figure 55).

The number of developed markets garnering both solar and wind investment has remained fairly constant in the past five years, with 17 markets receiving solar and 24 receiving wind investments in 2015 compared to 21 and 23 respectively in 2019 (Figure 56).

Wind investment has become more concentrated in fewer economies but volume overall has grown. Financings have trended toward markets with track records of wind deals. The notable newcomers: El Salvador, Mozambique, Niger and Uzbekistan. Each secured a first major investment for wind in 2019.

Figure 55: Number of emerging markets with new solar and wind investment

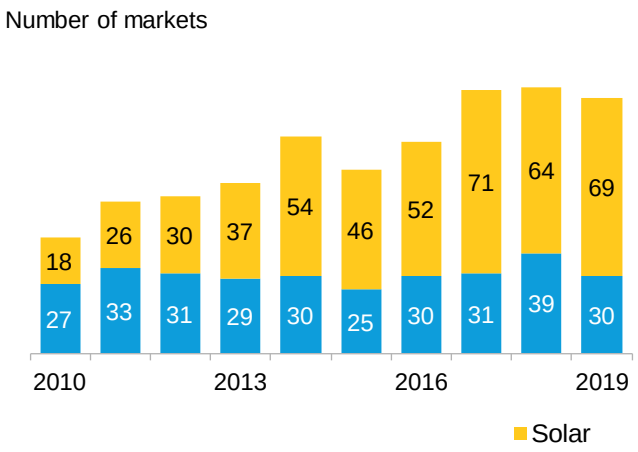
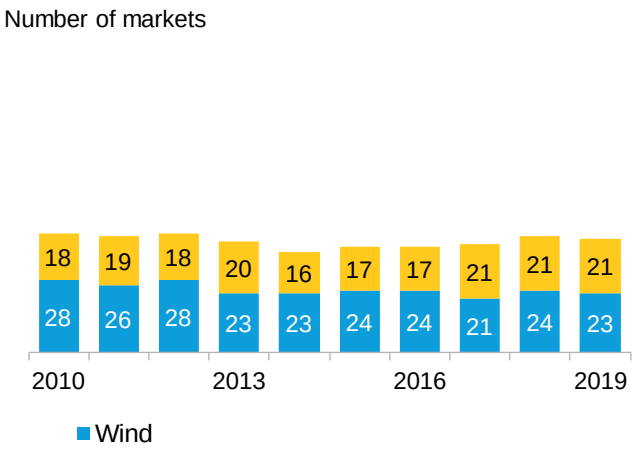


Figure 56: Number of developed markets with new solar and wind investment



Source: BloombergNEF. Note: Developed markets include OECD countries, minus Chile, Colombia, Mexico and Turkey. Developing markets include all other economies. Numbers are subject to change.

The proliferation of solar investment has translated directly into capacity additions. Consistent unit cost declines over the last decade mean solar is no longer a privilege available just to wealthier nations. In 2019, 81 markets installed at least 1MW of new solar capacity – around twice the number that installed at least 1MW of wind, gas or hydro capacity (Figure 57 and Figure 58). This is also over three times the number of markets that recorded new oil-fired power-generating capacity and four times the number of markets that commissioned coal-fired plants. This solar spread is most of all noticed in emerging economies, which saw the number of countries commissioning at least 1MW of PV capacity jump from 19 in 2010, to 55 in 2019.

Figure 57: Number of markets with over 1MW of solar installed by year

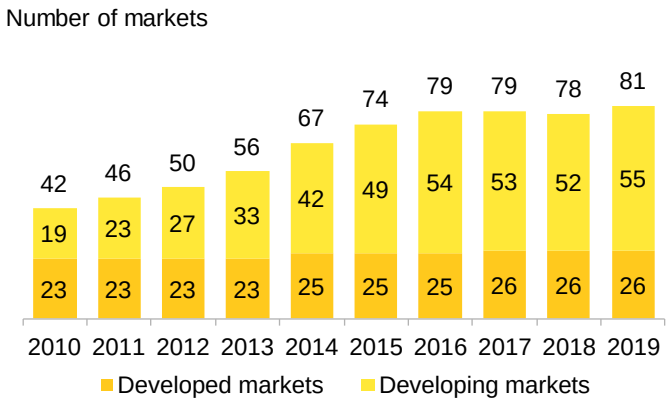
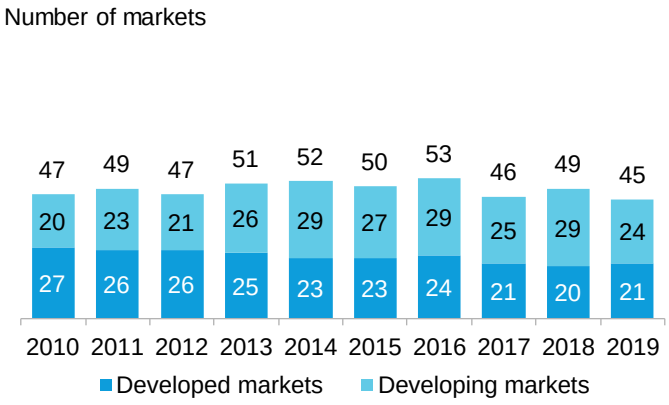


Figure 58: Number of markets with over 1MW of wind installed by year



Source: BloombergNEF. Note: based on country-level research for 137 markets. Developed markets include OECD countries, minus Chile, Colombia, Mexico and Turkey. Developing markets include all other economies. Numbers are subject to change.

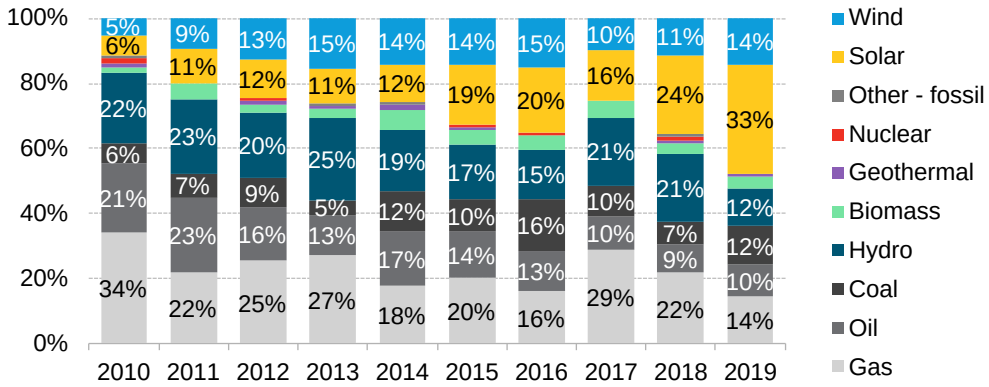
The modular nature of PV partly explains the technology spread as it is possible to erect 10MW or smaller solar plants and do so quickly. By contrast, wind, gas or hydro projects are larger and

typically take longer to plan and complete. Nonetheless, one of the most remarkable developments of the past decade is that solar-power generation is now truly a global phenomenon.

Solar has become the technology of choice in a third of the world's nations

Thanks to price declines, solar has become the technology of choice in a growing number of countries. In 2019, it was the primary technology installed in a third of the world's nations[4], up from just 6% in 2010, meaning these countries installed more solar capacity than any capacity from any other individual technology. Wind and gas followed with 14% each, while coal and hydro were the main technologies installed in 12% of the markets (Figure 59).

Figure 59: Share of the world's countries with most additions by technology build



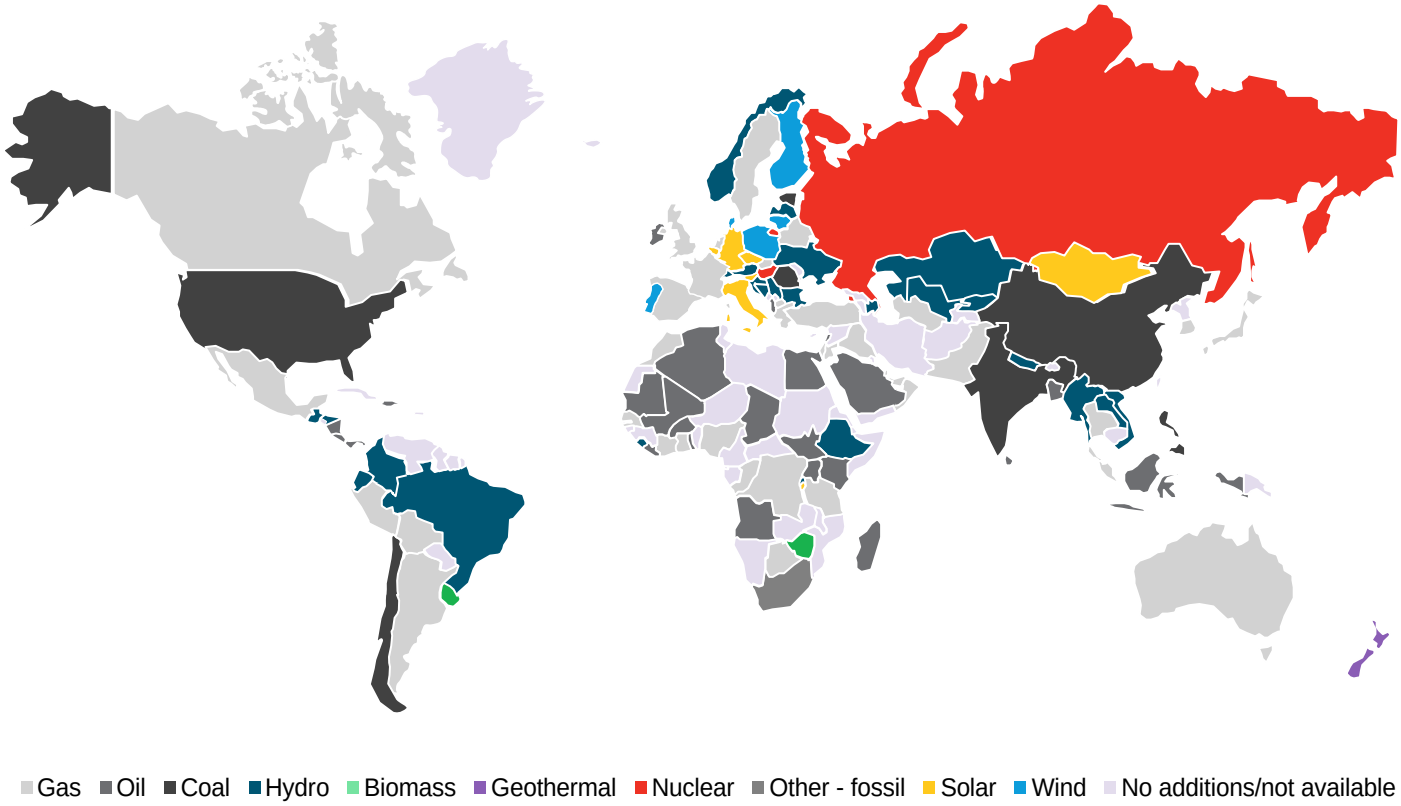
Source: BloombergNEF. Note: Chart depicts the percentage of nations that installed the most megawatts of each technology. For instance, in 2019 14% of nations installed more gas-fired capacity than any other technology while 33% installed more solar than any other technology. It is based on country-level data for 137 nations, but excludes countries that have not recorded any capacity addition.

The transformation of countries' technology choices over the past decades illustrates a real clean energy revolution. In 2010, gas was the number one technology installed in over a third of the world, as it presented the cheapest option for power-generating capacity in many places. Solar or wind, on the other hand, were the main technologies chosen in 13 countries, mostly in Europe.

As these technologies were still unable to compete purely on price with other power generation sources, ambitious clean energy policies were the main, and often the only, driver of wind and solar booms. For instance, Germany, Italy and the Czech Republic added more solar than any other technology in 2010. Propelled by generous feed-in tariff policies, these nations commissioned a combined nearly 13GW of new PV that year (Figure 60).

[4] Based on proprietary data for 137 markets

Figure 60: Most popular new power-generating technology installed in 2010



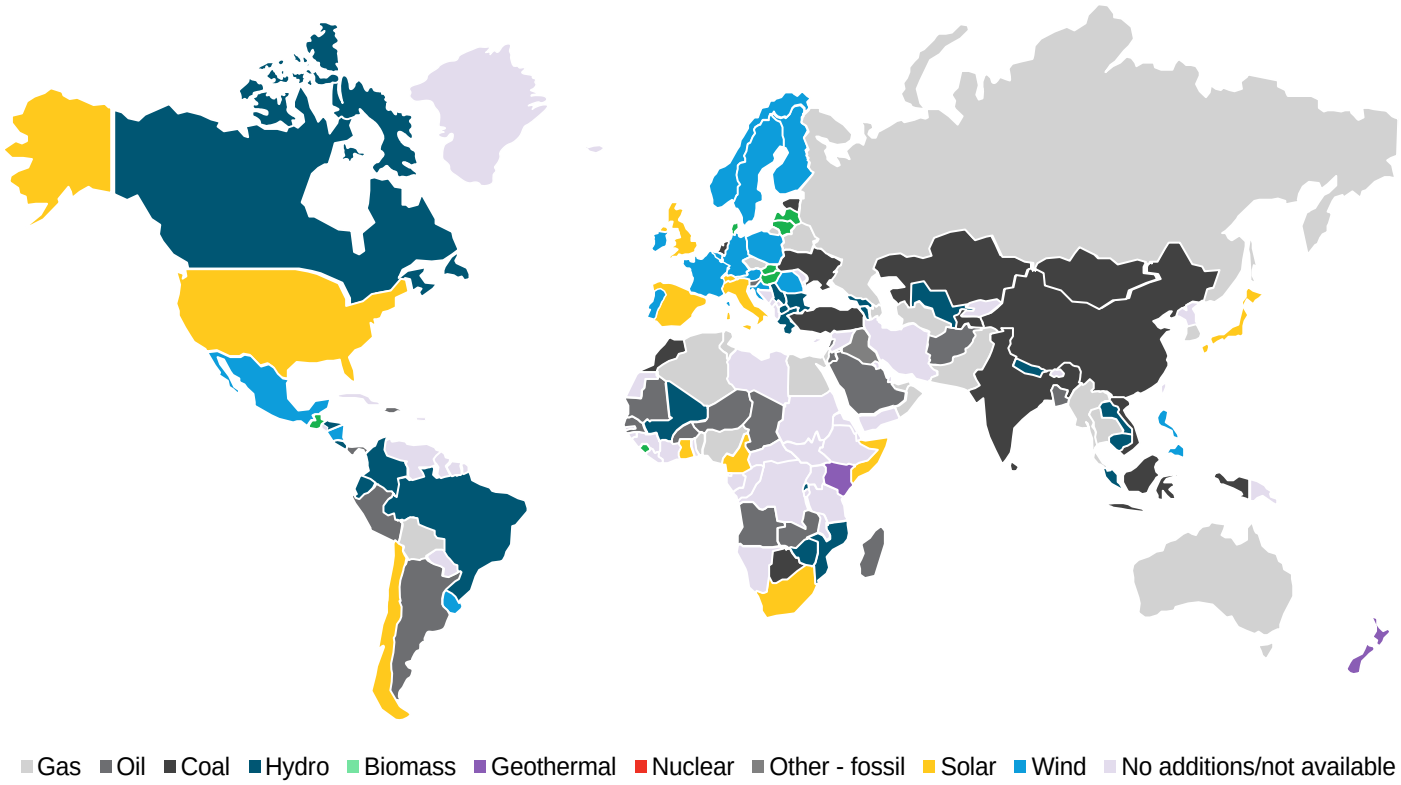
Source: BloombergNEF. Note: Map colored by which technology was most installed in 2010 alone. Solar includes small-scale PV. Map is an approximate representation, and should not be taken as accurate as far as international boundaries are concerned.

In 2014, solar had yet to become the cheapest source of power in any market, and only in Germany and Uruguay could wind under-price thermal sources. However, countries in other regions had started implementing new clean energy-friendly policies. In that year, wind and solar became the technologies of choice in 14% and 12% of the world, respectively (Figure 61).

Chile, South Africa and Mexico are examples of emerging markets that implemented successful policies that led to wind and solar boosts, even before these technologies became price competitive. Chile's Renewable Energy Mandate, for example, required utilities with up to 200MW of operational capacity to meet 20% of their contractual obligations with renewable sources by 2025. Approved in 2013, this was the country's first renewable energy policy and was one of the main drivers of almost 1GW of combined wind and solar capacity installed in 2014, making Chile Latin America's biggest solar market at that time.

In South Africa, an ambitious clean energy auction program drove completion of over 1GW of solar projects in 2014. Meanwhile, Mexico's 850MW wind boom in 2014 was propelled by incentives for large self-supply clean energy projects.

Figure 61: Most popular new power-generating technology installed in 2014



Source: BloombergNEF. Note: Map colored by which technology was most installed in 2014 alone. Solar includes small-scale PV. Map is an approximate representation, and should not be taken as accurate as far as international boundaries are concerned.

BNEF's 1H 2020 LCOE Update, published in April noted that today, at least two-thirds of the world's population lives in a country where either onshore wind or utility-scale PV (if not both) is the cheapest option for new bulk electricity generation. This trend is now directly influencing which technologies countries choose to install most.

In 2019, not only a growing number of nations installed more solar than any other technology, but PV also reached places previously dominated by other power sources. Nigeria, Bolivia, Colombia, Rwanda and Saudi Arabia represent the recent diversity of countries that have turned to solar as economics improved (Figure 62).

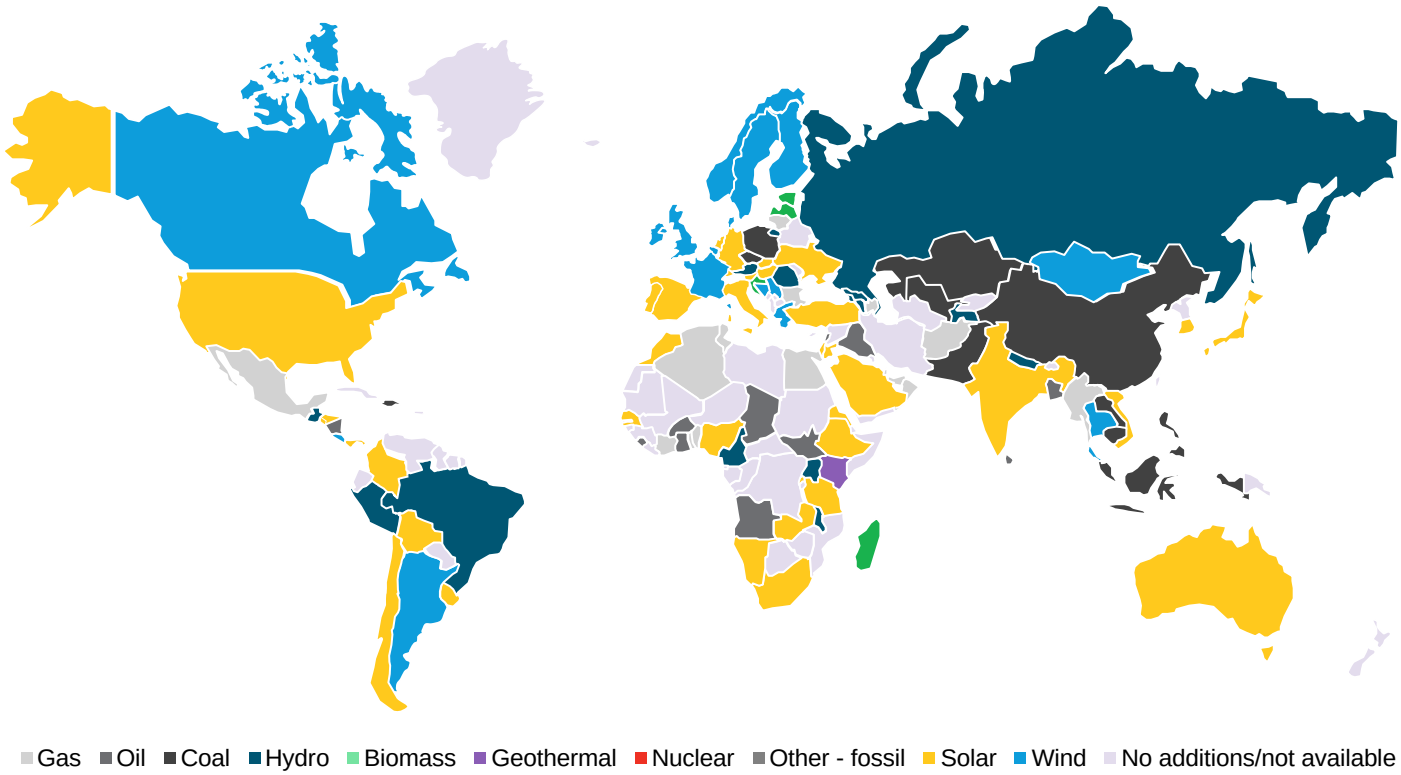
The share of nations where wind is number one has fluctuated between 10% and 15% since 2012. However, wind's share could rise in coming years as efficiency improvements are making wind more viable. Argentina, Belgium, Greece, Norway and Serbia, for example, not only installed more wind than any other technology in 2019, but also set record highs for wind build.

Japan, South Korea and Southeast Asian nations are among the relatively few markets where coal-fired generation today remains cheaper than clean power. Some of these countries, however, are making efforts to boost renewables through generous feed-in tariffs and ambitious government commitments to accelerate renewables deployment.

Despite being home to the world's highest LCOE for utility-scale PV, Japan's build has been dominated by solar over the past seven years. Since 2013 the country saw over 56GW of solar

capacity come online, compared to 2.4GW of coal, the cheapest power generating technology. Dominated by coal for years, Vietnam turned to solar in 2019 when it installed a remarkable 5.4GW of new PV capacity.

Figure 62: Most popular new power-generating technology installed in 2019



Source: BloombergNEF. Note: Map colored by which technology was most installed in 2019 alone. Solar includes small-scale PV. Map is an approximate representation, and should not be taken as accurate as far as international boundaries are concerned.

Despite major progress, emerging nations still have work to do to make sure that renewables become their main (and only) technologies of choice. While 90% of the 31 developed nations surveyed have made a renewable energy technology their top choice in 2019, 44% of the emerging markets continue to choose to install more fossil fuel-fired plants than cleaner technologies.

Figure 63: Share of developed markets with most additions by technology build

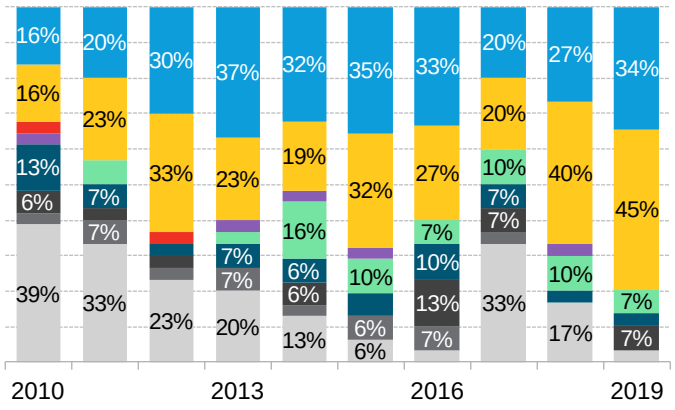
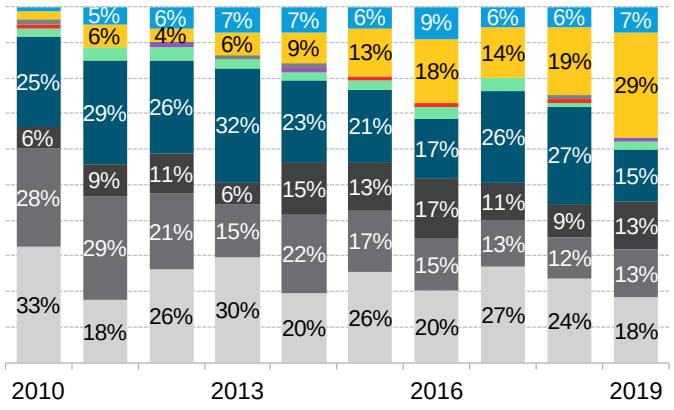


Figure 64: Share of developing markets with most additions by technology build



Gas Oil Coal Hydro Biomass Geothermal Nuclear Other - fossil Solar Wind No additions/not available

Source: BloombergNEF. Note: Note: Chart depicts the percentage of nations that installed the most megawatts of each technology. It is based on country-level data for 29 developed markets and 108 developing markets, but excludes countries that have not recorded any capacity addition.

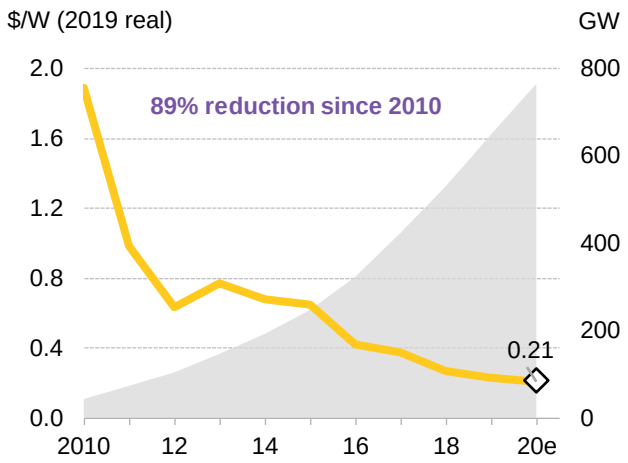
4.5. Technology costs

Falling costs allow PV to spread to new markets

Economies of scale and progress along the "learning curve" explain how investment in solar as measured in dollars deployed has appeared lacklustre even as the technology has proliferated. PV modules are nearly 90% less expensive today than in 2010 (Figure 65). Since 2015, PV capacity additions in developing markets have grown 30% per year on average while the volume of associated investment has only grown by 3% in real dollar terms. In developed nations, this trend has been flatter as PV capacity growth has been more muted.

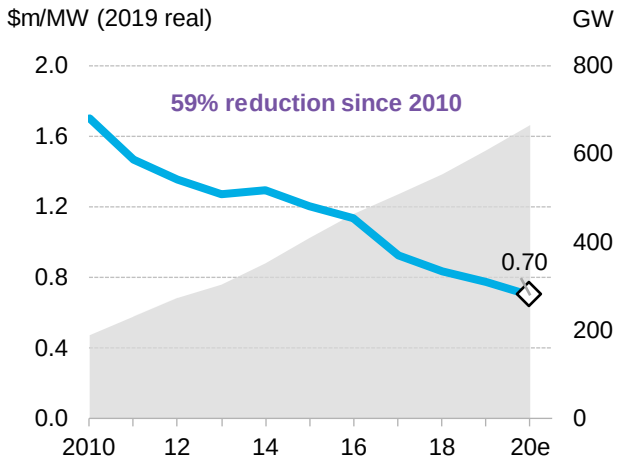
For wind, the story is more complex in emerging markets. To date, wind investments have nearly exclusively targeted onshore projects, with mainland China, India, Taiwan and Vietnam being the only developing economies to foray into offshore so far. The per-megawatt price of a typical onshore turbine today is 59% below where it was in 2010 (Figure 66), but utility-scale onshore wind projects are generally larger and therefore concentrated in a smaller number of markets. These size of these projects also make them potentially higher risk to financiers. This can negatively impact borrowing costs for developers and potentially lower rates of return on investment.

Figure 65: Benchmark PV module (left axis) price and cumulative installed capacity (right axis)



Source: BloombergNEF

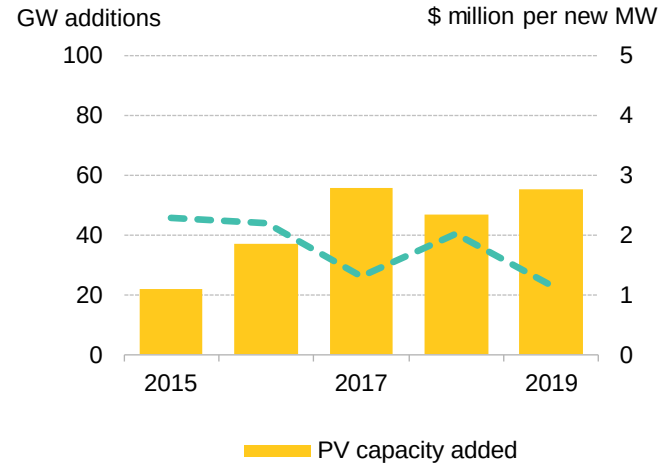
Figure 66: Benchmark onshore wind turbine price (left axis) and cumulative installed capacity (right axis)



Source: BloombergNEF

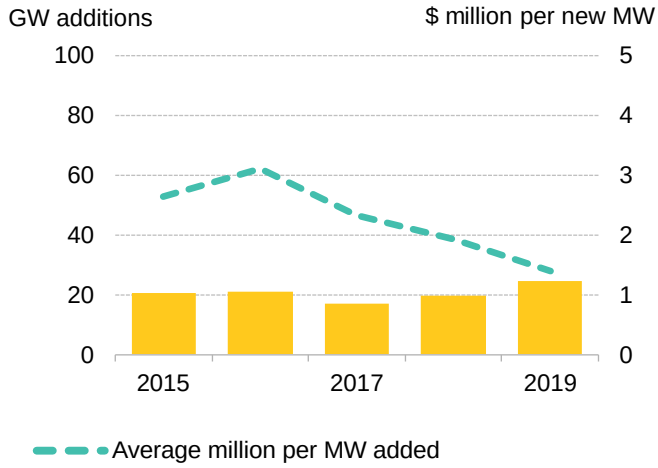
The capex decline for PV in emerging markets is still quite recent: when plotting overall PV investment volumes on new capacity assuming an average project lead-time of one year, emerging markets needed an average $2.3 million to add a new megawatt of capacity in 2015, but only $1.2 million in 2019 (Figure 67). The same story applies to developed markets, which required an average $2.6 million to add a new PV megawatt in 2015, but only $1.4 million in 2019. This trend also translates into the average volumes of annual solar investments in a given market, which have been declining on average since 2015 (Figure 68).

Figure 67: Emerging markets annual PV capacity additions and investment



Source: BloombergNEF. Note: Investment shown in 2019 real dollars. Assumes a lead-time of one year between investment and commissioning. Emerging markets include all non-OECD markets, in addition to Colombia, Chile, Mexico and Turkey,

Figure 68: Developed markets annual PV capacity additions and investment



Source: BloombergNEF. Note: Investment shown in 2019 real dollars. Assumes a lead-time of one year between investment and commissioning. Developed markets includes all OECD

which are counted as developing markets. Refers to utility-scale PV capacity. Numbers are subject to change.

markets apart from Colombia, Chile, Mexico and Turkey. Refers to utility-scale PV capacity. Numbers are subject to change

Overall expenditures for new PV projects have fallen in both emerging and developed markets, but for different reasons: while developed nations enjoy access to low-cost capital, developing markets benefit from much higher PV capacity factors.

Thanks to central banks keeping interest rates low, developers in OECD countries have been able to access relatively low cost capital. In those wealthier countries, the benchmark weighted average cost of capital (WACC) for PV projects ranged from 2-6%. By contrast, in emerging economies, the benchmarks were 5.4-15% (Figure 69). This trend is similar for onshore wind, with OECD countries having access to WACC ranges of 2.1-7.1%, whilst non-OECD markets faced 4.7-9.7% (Figure 70).

Figure 69: Financing cost impacts on levelized costs of electricity, utility-scale PV

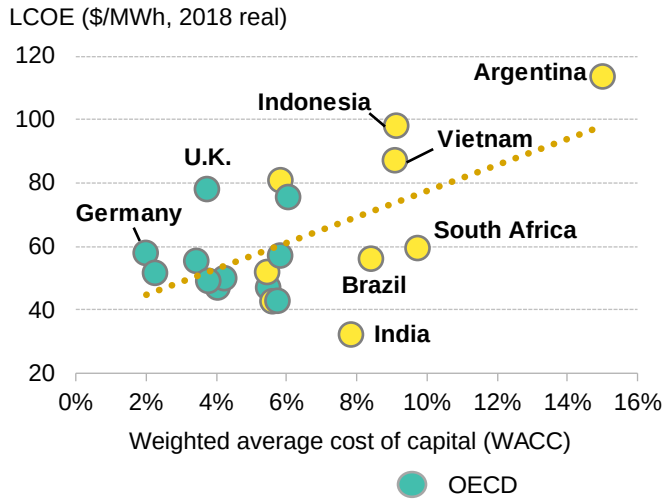
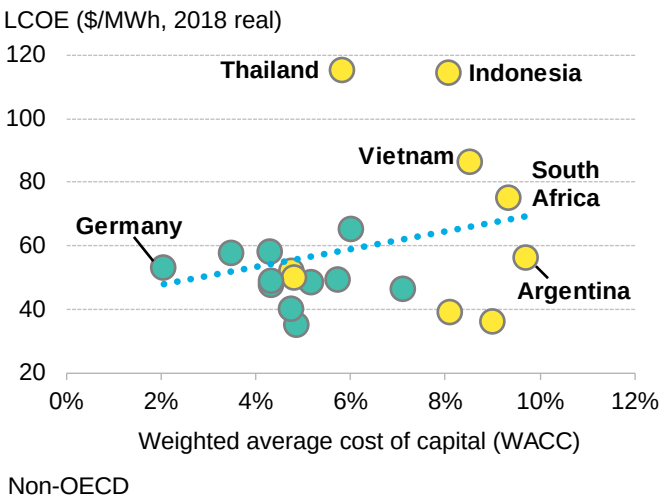


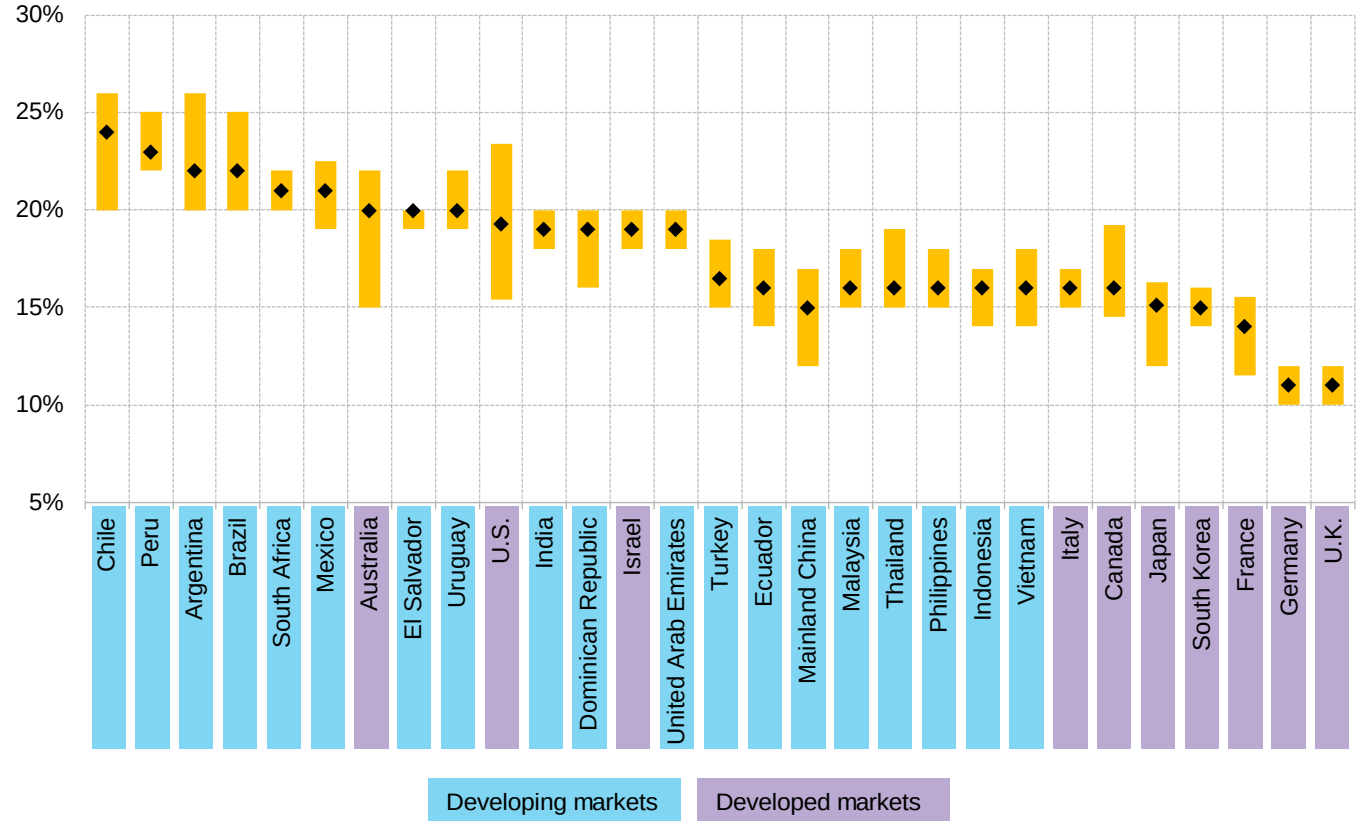
Figure 70: Financing cost impacts on levelized costs of electricity, onshore wind



Source: BloombergNEF. Note: OECD markets include Australia, Canada, Chile, France, Germany, Italy, Mexico, Spain, Turkey, the U.K. and the U.S. Non-OECD markets include Argentina, Brazil, mainland China, India, Indonesia, Peru, South Africa, Thailand and Vietnam.

In contrast, thanks to greater natural resources, developing markets enjoy significantly higher PV capacity factors. While the developing markets analyzed have an average PV capacity factor of 18.8%, the average capacity factor in developed nations is 15.6% (Figure 71). Chile, Peru, Argentina, Brazil, South Africa and Mexico are examples of developing economies that enjoy average capacity factors above 20%. In contrast, in Germany and the U.K., this figure is just 11%.

Figure 71: PV capacity factors of select markets



Source: BloombergNEF.

Despite barriers such as high financing costs and lack of locally-available capital, developers and investors operating in developing markets have gained greater understanding of how to build and generate cash from PV projects during the past five years. Yet, it is important to keep in mind that these numbers tell the story only of emerging markets which *have* secured clean energy finance. Many markets, particularly those that are least developed, have yet to secure financing of any sort for clean energy development.

Section 5. Foreign direct investment

Pre-2020, emerging markets were attracting an expanding share of foreign investment for clean energy projects

Global foreign direct investment (FDI) supporting clean energy development has grown steadily since 2013 and hit an all-time high in 2019 at $68 billion (Figure 72). While emerging markets accounted for less than a quarter of these investment flows at the beginning of the decade, they started taking a significant chunk of global clean energy FDI in 2017 and set a record at 47% in 2019 (Figure 73). In absolute terms, FDI specifically deployed into emerging markets also reached a new high in 2019 at $32 billion – up 27% from the prior year. While clean energy FDI to developed nations has remained generally steady over the past decade, activity specifically targeting emerging markets has been on the rise.

Figure 72: Global clean energy foreign direct investment by recipient market group

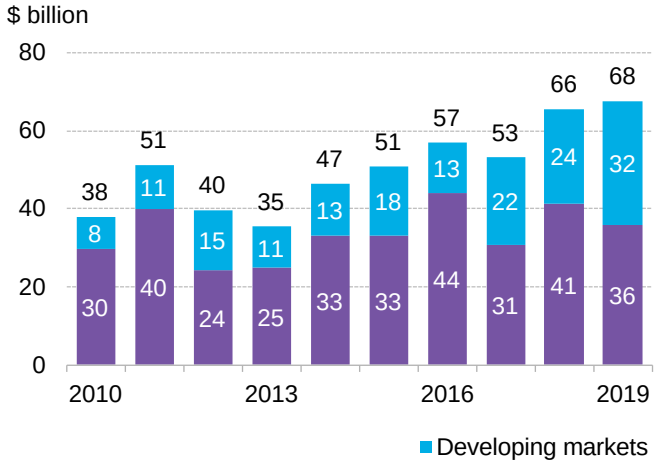
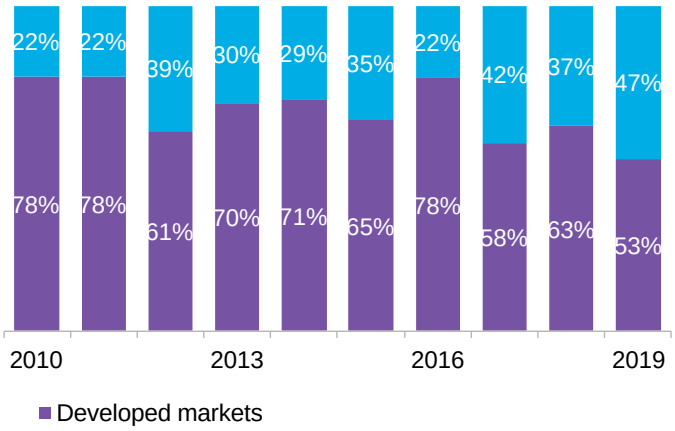


Figure 73: Share of global clean energy foreign direct investment by recipient market group



Source: BloombergNEF. Note: Includes 137 markets covered in Climatescope, of which 104 non-OECD markets (plus Chile, Colombia, Mexico and Turkey) in addition to 29 developed nations. Numbers subject to change.

Traditional recipients of clean energy FDI have been mature renewables markets like Brazil, India, mainland China and Mexico. In recent years, however, investors have been more willing to fund projects in more markets (Figure 74). The Ukraine and Vietnam, for instance, have attracted capital after implementing strong clean energy incentives. Similarly, Taiwan secured $6.4 billion in offshore wind investment through a generous feed-in tariff. Other nascent renewables markets to secure large-scale deals in the last two years include Argentina, Kenya, Serbia and Kazakhstan.

Both solar and wind set new records in 2019 for FDI at $13 billion and $18 billion, respectively. The growth in wind investment has been particularly striking, tripling within five years (Figure 75).

Figure 74: Clean energy foreign direct investment by recipient emerging market

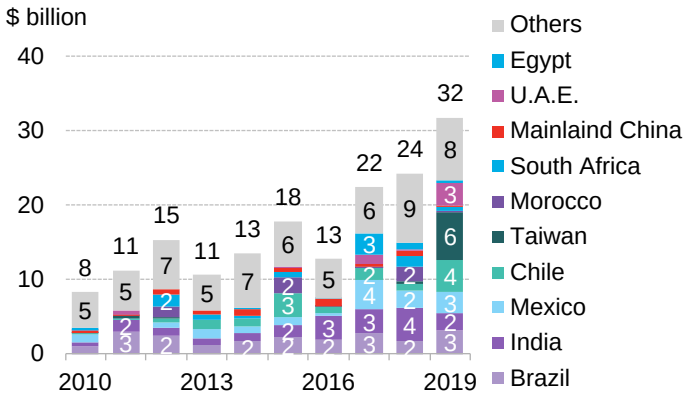
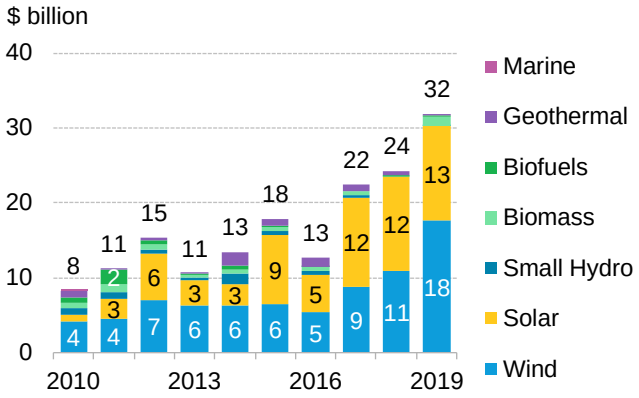


Figure 75: Clean energy foreign direct investment to emerging markets by technology



Source: BloombergNEF. Note: Includes 104 non-OECD markets, plus Chile, Colombia, Mexico and Turkey. Only includes disclosed investment. Numbers subject to change.

Who's investing? Europe, primarily

Finance flows from developed to developing markets reached a new high in 2019 with $25 billion deployed, representing 70% of total FDI (Figure 76). European organizations continue to be key providers of clean energy FDI. After two record years, 2019 saw a further 40% jump in financing from European-based investors at $19 billion. This represented nearly 60% of global new clean FDI. Outflows from investors based in the Americas and Asia-Pacific have remained constant in the past five years. As of 2017, outflows from the Middle East and Africa have picked up, reaching $3 billion in 2019 (Figure 77).

Figure 76: Foreign direct investment in clean energy in developing markets, by investor market group

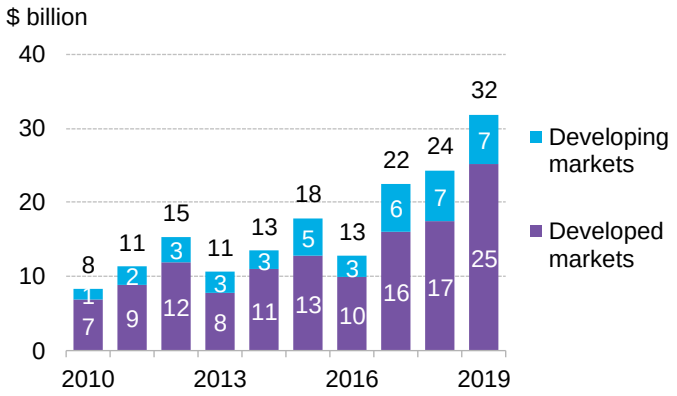
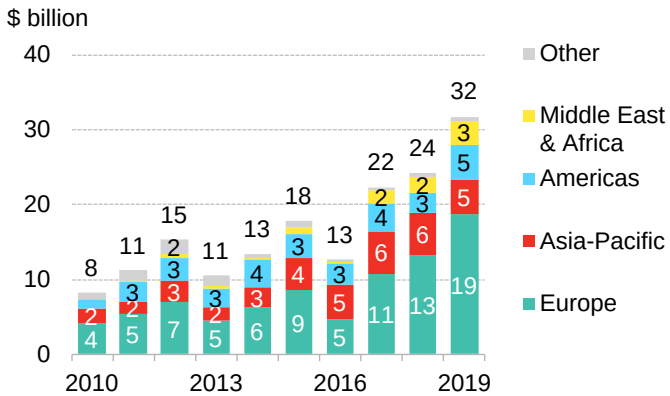


Figure 77: Foreign direct investment in clean energy in developing markets, by investor region

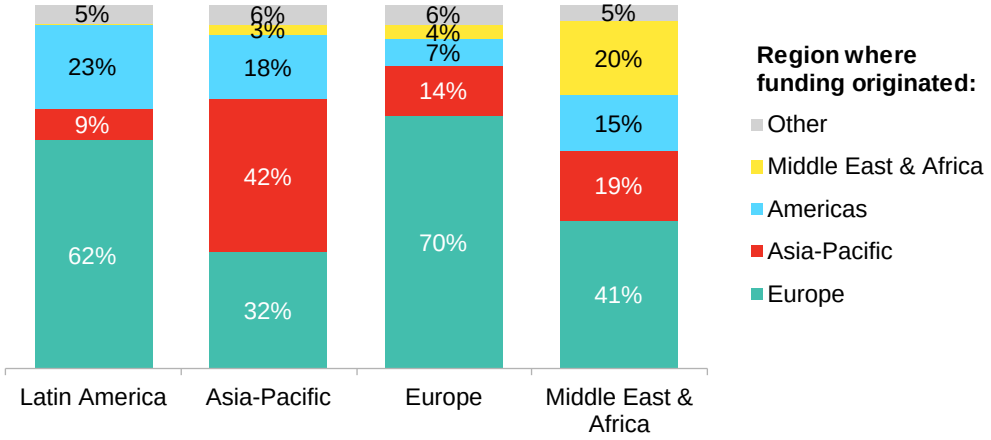


Source: BloombergNEF. Note: Developing markets include 104 non-OECD markets, plus Chile, Colombia, Mexico and Turkey. Developed markets include 29 countries. Only includes disclosed investment. Numbers subject to change.

FDI providers tend to favor clean energy projects in the regions where they are based. That said, European investors accounted for the largest shares of capital deployed in three of four major

regions. The Middle East and Africa drew substantial inflows from financiers of all regions (Figure 78).

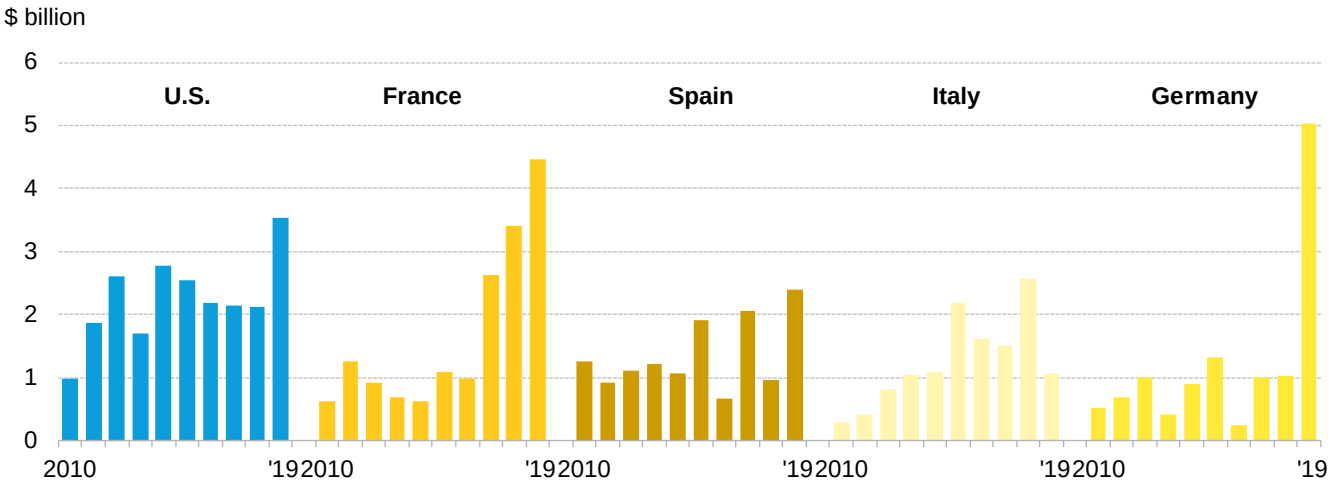
Figure 78: Emerging market clean energy FDI by recipient region and funding region, 2010-2019

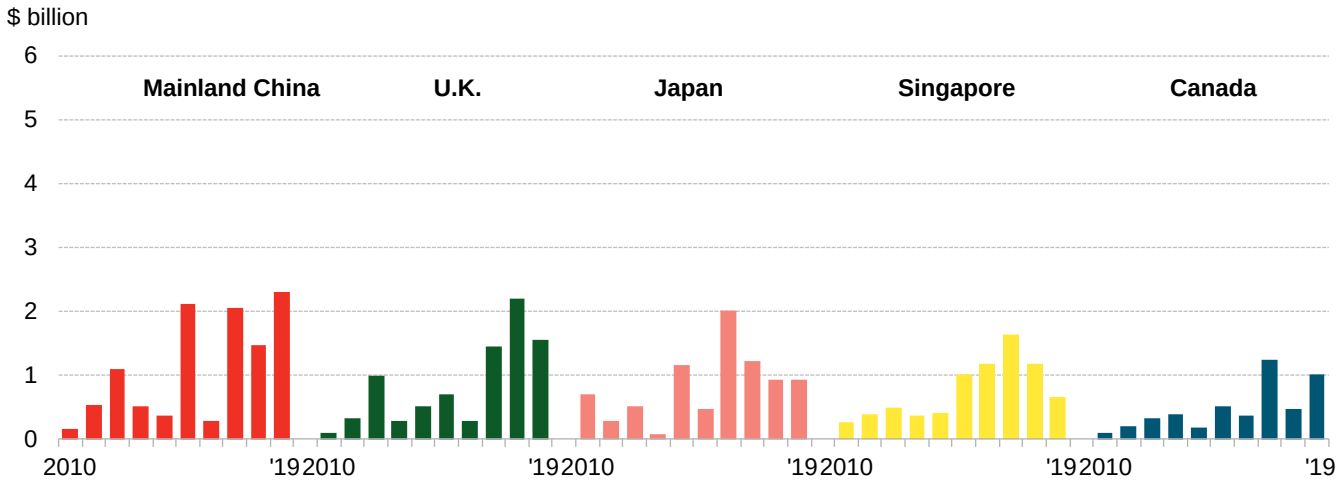


Source: BloombergNEF. Note: This includes 104 non-OECD markets, plus Chile, Colombia, Mexico and Turkey. Only includes disclosed investment. Numbers are subject to change.

Ten countries are responsible for 70% of the decade's FDI into renewables, with all but two OECD countries. Outflows from the U.S. have been greatest at $22.4 billion over a decade, with a record $3.5 billion in 2019. France, Spain, Italy and Germany have all accelerated investment in the last several years, with all but Italy posting record clean energy FDI in 2019. Between them, these four nations accounted for over a third of 2019 outflows (Figure 79).

Figure 79: Ten largest providers of foreign clean energy investment to developing markets, 2010-2019





Source: BloombergNEF. Note: Includes 104 non-OECD markets, plus Chile, Colombia, Mexico and Turkey. Only includes disclosed investment. Numbers subject to change.

Emerging markets are becoming more attractive to private investors

2019 saw a record year for private clean energy FDI into emerging markets, amounting to 84% of total flows compared to 70% in 2015 and 62% in 2010. The top investor types were project developers ($9.8 billion deployed in 2019) and utilities ($5.9 billion).[5] Commercial banks also saw their highest year on record at $5.2 billion. These three financier types accounted for two-thirds of 2019 clean energy DFI to emerging markets (Figure 80 and Figure 81).

By contrast, the relative share of capital deployed by international development banks was the lowest this decade at 11%. In fact, public financing sources – development banks, export credit agencies and sovereign wealth funds – accounted for just 15% of 2019 clean energy FDI, their lowest level since 2010. Five years ago, their share stood at 30% though against a much smaller total as capital invested that year was about half what was deployed in 2019.

[5] We classify project developers as companies whose activity primarily involves renewable energy project development, such as Orsted or Voltalia. We classify organizations as international utilities if their major activities also include power distribution and retail sales in parts of the world, such as Enel or Engie. Many companies are on the spectrum between the two.

Figure 80: Emerging market clean energy foreign direct investment by investor type

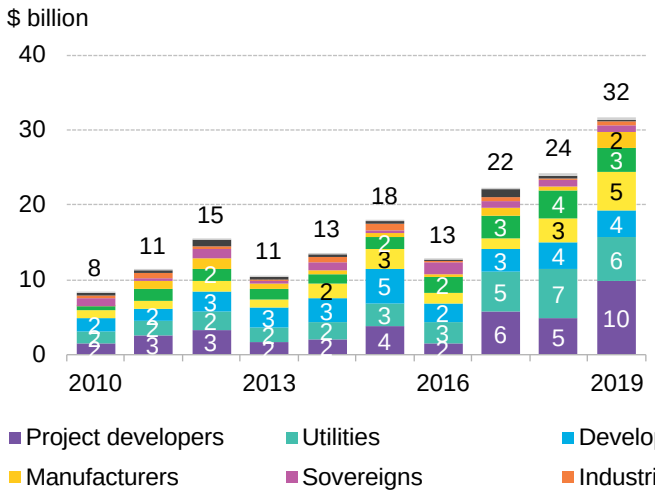
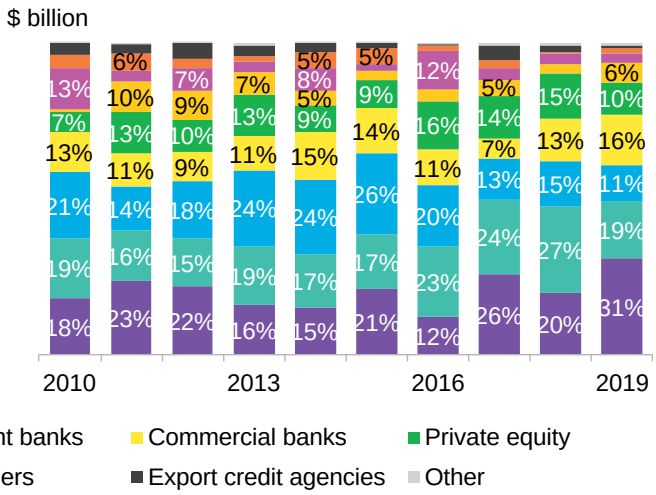


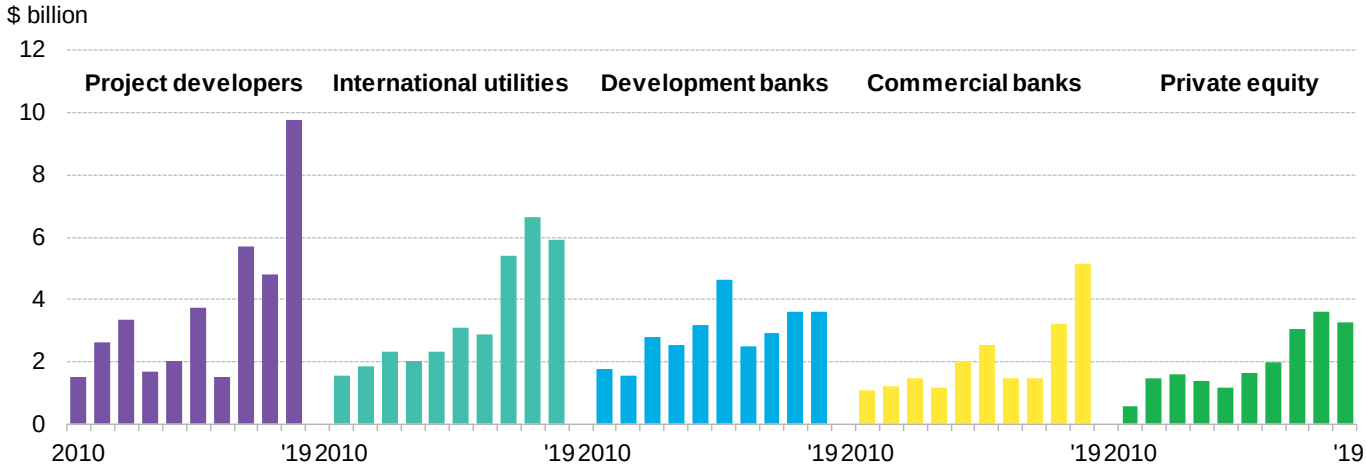
Figure 81: Share of total emerging market clean energy foreign direct investment by investor type



Source: BloombergNEF. Note: Includes 104 non-OECD markets, plus Chile, Colombia, Mexico and Turkey. Only includes disclosed investment. Numbers subject to change.

In terms of cumulative investment, 2019 marks the first time that project developers and utilities have overtaken development banks as the decade's top providers of clean energy FDI. Outflows from developers totalled $37 billion 2010-2019, with utilities providing $34 billion (Figure 82). Commercial bank fundings have also risen and set a record at $5 billion in 2019.

Figure 82: Top foreign direct investor volumes into emerging markets, by type

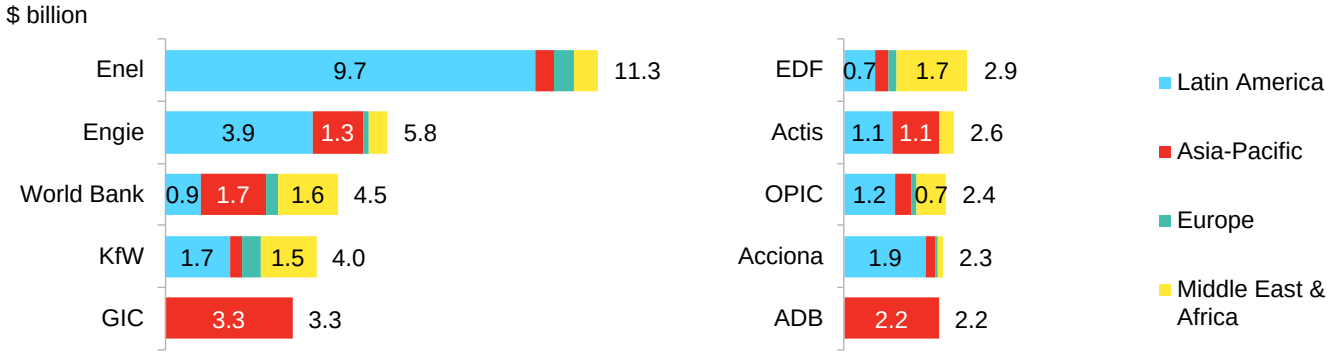


Source: BloombergNEF. Note: This includes 104 non-OECD markets, plus Chile, Colombia, Mexico and Turkey. Only includes disclosed investment. Numbers are subject to change.

On an individual funder basis, Italian utility Enel remains the clear leader with $11.3 billion in clean energy FDI deployed 2010-19. Originally focused mainly on Latin America, the company has started backing projects in all other regions since 2018. French utility Engie secured second place at nearly $6 billion through ample investments to Latin America (Figure 83).

It is noteworthy that the list now only comprises four development banks, compared to seven in last year's ranking. Through its private equity arm Cambourne Investment, Singaporean sovereign wealth fund GIC entered the league table for the first time through $3 billion invested in the Asia-Pacific region. The top investor companies overall tend to favor Latin American nations, with outflows to European developing nations lowest at 4% of the decade's investment.

Figure 83: Top 10 emerging market clean energy foreign investors 2010-2019 and region of investment



Source: BloombergNEF. Note: KfW = Kreditanstalt für Wiederaufbau, GIC = formerly known as Government of Singapore Investment Corporation, EDF = Électricité de France, DFC = United States International Development Finance Corporation (formerly OPIC), ADB = Asian Development Bank. This includes 104 non-OECD markets, plus Chile, Colombia, Mexico and Turkey. Only includes disclosed investment. Numbers are subject to change.

Section 6. The power of policies

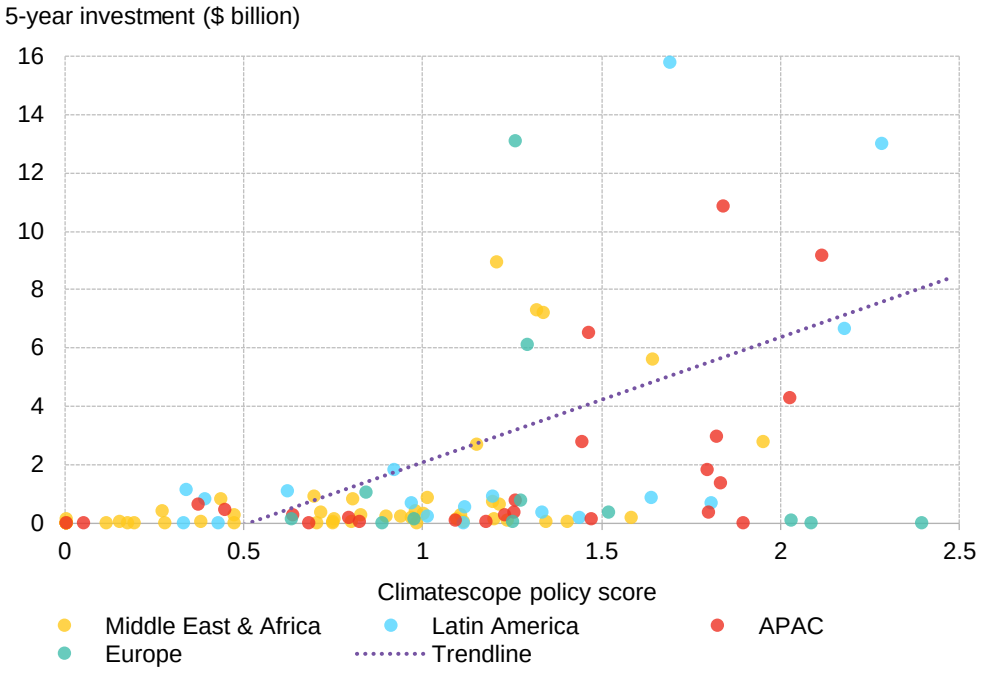
The message is clear: good policies produce clean energy investment

Clean energy costs have never been lower and clean power has never been more cost-competitive, even on an entirely unsubsidized basis. Still, stable, well-defined clean energy enabling environments remain critical to attracting investment, particularly private capital.

Such environments can include policy mechanisms explicitly to accelerate renewables deployment such as auctions, feed-in tariffs, tax incentives, or national targets. But they also include broader power sector policies to foster competition and transparency. Unbundled, un-monopolized power markets are best, particularly those where private players can sign transparent and long-lasting power-purchase agreements (PPAs).

Climatescope evaluates markets' clean energy policy regimes by analyzing the ambition, access, stability and success of each type of policy they have implemented. (For a complete description of Climatescope's methodology, visit the website.) Our research shows that none of the 60 markets at the bottom of our policy ranking received more than $2 billion in clean energy investment 2015-2019 and just four received more than $1 billion over the period. On average, these economies attracted $275 million over the 5-year period, or $55 million per year. In contrast, the remaining 47 markets surveyed (excluding mainland China), attracted on average $4.6 billion over the period, or $907 million per year (Figure 84).

Figure 84: Climatescope policy score vs. 5-year clean energy asset finance in emerging markets



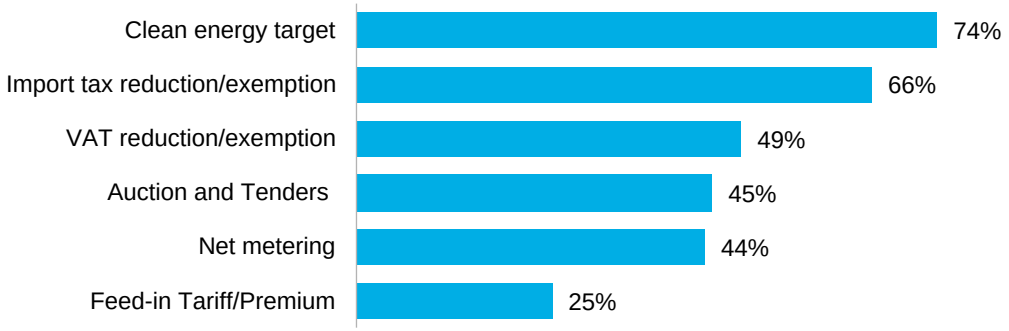
Source: BloombergNEF

Good policies also open doors to larger pools of private capital. The development of a new clean energy policy framework and its impact vary from market to market, but many successful economies have followed a similar trajectory:

- With international support, usually from development institutions, markets implement new policies that aim to provide clarity to investors on the nation's vision for the power sector, reduce the bureaucracy around clean energy build-out and provide incentives for the construction of renewable energy plants. The package tends to include at least a clean energy target, as well as a renewable energy auction or feed-in tariff.
- Once the policy is rolled out, developers tend to count on the support of international development banks to finance the earliest projects. These institutions play a key role in supporting the first-movers in these nations, as they are comfortable taking higher risks and can offer investment at lower cost.
- After the first projects are built and the country gains experience in a specific clean energy sector, overseas investors' perceptions of risk tend to diminish. As a result, private sources of investment start crowding-in and the need for development finance is reduced.

Still, a limited number of markets has the necessary supportive policies in place. Nearly three-quarters of the emerging markets surveyed for Climatescope have clean energy targets in force (Figure 85). However, in only 41% of these, the renewable energy goal has in fact influenced other renewable energy policies. Setting targets represents the starting point for most renewable energy policy frameworks, but an objective alone is not enough to create a vibrant local clean energy sector. Targets must be accompanied by more specific policies that ensure stakeholders have sufficient incentives to enter the market.

Figure 85: Share of Climatescope emerging markets surveyed where clean energy policy is present



Source: BloombergNEF, Climatescope. Note: Includes 104 non-OECD markets, plus Chile, Colombia, Mexico and Turkey.

Latin America is an example of a mature renewable energy region, with a strong track record of sound renewables policies, particularly auctions, and many national power sectors which have been liberalized and are open to private investment. All of this has enabled private foreign finance to take off in the region. Over the past decade, private foreign investment represented at least 60% of all inflows Latin America attracted. This hit high-water mark in 2019, with 92% of total funds deployed coming from private sources (Figure 86).

In contrast, relatively few emerging markets in the Middle East and Africa have embedded sufficient enabling frameworks to trigger new clean energy development. They thus remain largely dependent on financing from development banks (Figure 87).

Nonetheless, there have been successful efforts from outside that have allowed countries to jumpstart their clean energy sectors. The World Bank's Scaling Solar program provides countries with what is essentially a package of policies and programs which they can implement to successfully tender solar projects. This has included guidance on how to structure standardized power purchase agreements, how to prepare the projects and structure the tenders. The Bank then provides guarantees to backstop the contracts state-run utilities sign with developers. This has helped unlock private investment for lower middle-income countries such as Senegal and Zambia.

Figure 86: Public vs. private clean energy foreign direct investment to Latin America

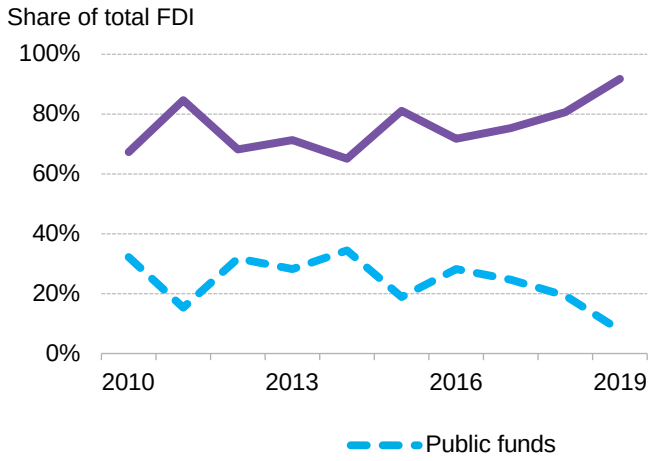
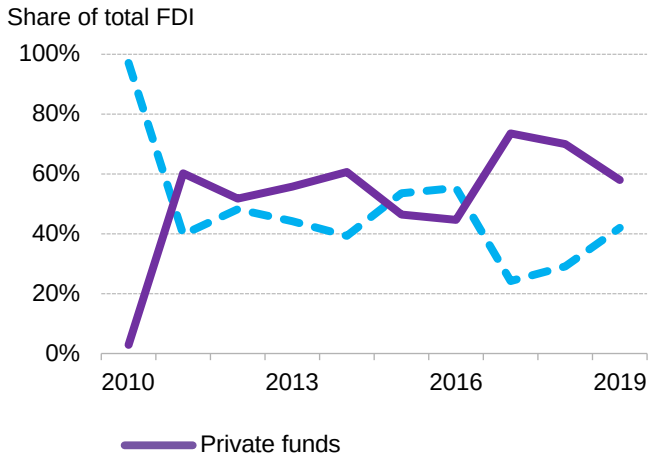


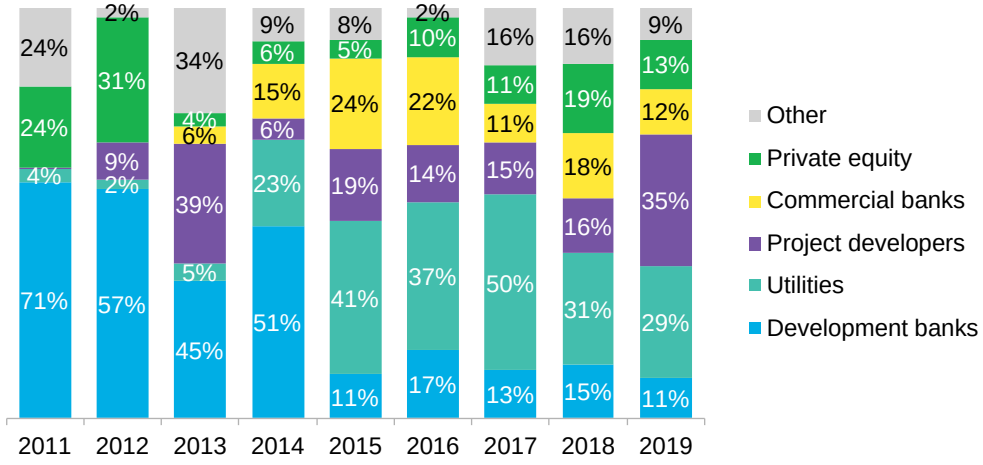
Figure 87: Public vs. private clean energy foreign direct investment to Middle East and Africa



Source: BloombergNEF. Note: Public funds include investment from export credit agencies, national and multinational development banks and sovereigns. Does not include non-defined investment, which amounts to 1% of the FDI in this time frame (left chart) and 3% (right chart). Only includes disclosed investment. Numbers subject to change.

The trajectory of solar investment in Latin America illustrates the importance that sound policies and public funds can play in creating an inviting environment for private investors. In 2011, development banks provided 71% of solar FDI to the region. In 2019, this dropped to one-tenth, with developers, utilities and commercial banks sufficiently comfortable with the technology and the region to provide most of the capital (Figure 88).

Figure 88: Latin America solar project investment by investor type



Source: BloombergNEF. Note: Only includes disclosed investment. Numbers are subject to change.

Markets with state-organized auctions attracted five times more investment than those without such policies

Auctions, present in 45% of the markets surveyed, have been a critical contributor to the growth of renewables globally and have proven to be the most successful clean energy policy for boosting developing market investment.

The 49 emerging markets with auctions in force combined (excluding mainland China) attracted $42 billion in clean energy asset finance in 2019, or an average of $873 million per market (Figure 89). This is almost five times the average investment that economies with no auctions attracted in 2019. Markets with auctions also received on average over four times more foreign capital than those without such mechanisms in place (Figure 90).

Figure 89: 2019 new-build clean energy asset finance by auction/tender status (excluding mainland China)

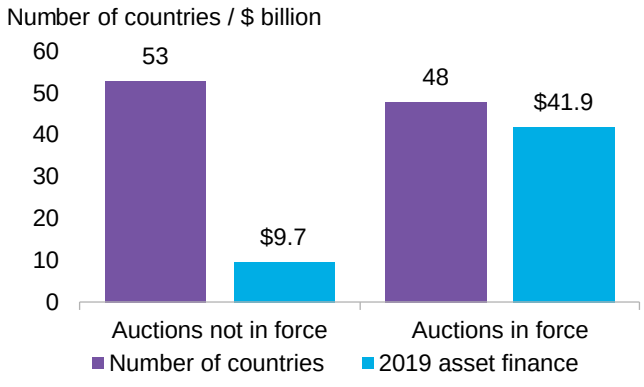
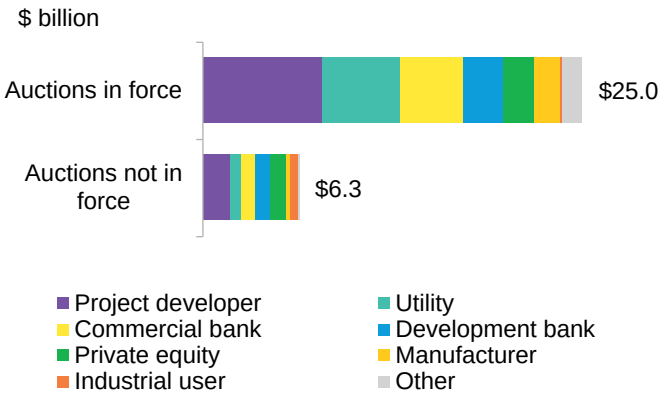


Figure 90: 2019 disclosed foreign investment by investor type and auction/tender status (excluding mainland China)

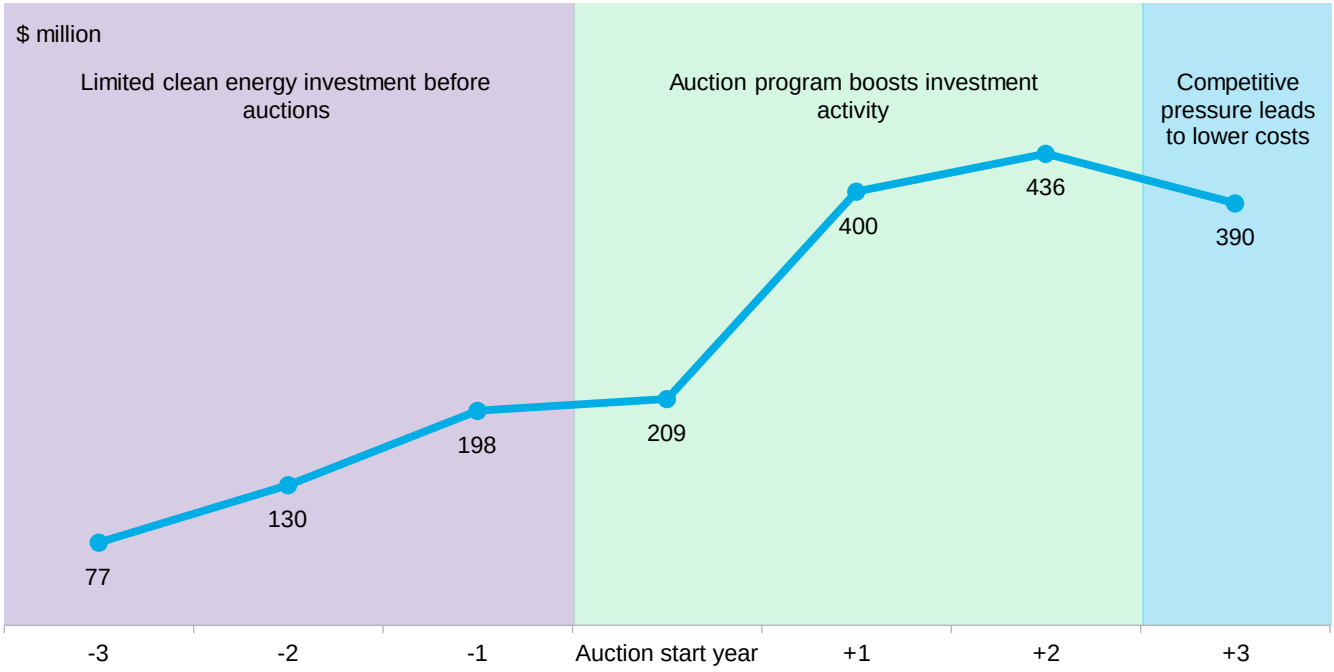


Source: BloombergNEF, Climatescope. Note: Includes 104 non-OECD markets, plus Chile, Colombia, Mexico and Turkey.

Auctions have also been shown to drive a nearly immediate response in triggering investment. A total of 31 emerging markets started auctions between 2012 and 2018. On average, these countries received less than $200 million per year before auctions were enforced. In the two years immediately after launching auctions, investment doubled (Figure 91).

Auctions also promote price competition, resulting in significant drops in clean energy tariffs and project costs. As a consequence, the average investment received by developing nations in their third year after launching auctions actually dropped by around 11%.

Figure 91: Average emerging market clean energy investment preceding and following the introduction of reverse auctions for clean power delivery contracts



Source: BloombergNEF, Climatescope. Note: The chart includes 31 markets that launched auctions 2012-2018.

Thanks to successful policies, wind and solar already account for significant shares of power produced in certain emerging markets, including Uruguay (32%), Mauritania (24%), Namibia (21%) and Honduras (19%). Expanding generation from these intermittent power producers will likely require other resources that provide “flexible capacity” to facilitate clean energy’s accommodation on the grid. These countries and potentially others could soon require greater deployment of batteries to allow for wider wind/solar deployment.

Unfortunately, today few developing nations have even the most basic subsidies or targets on their books to support battery build. For countries that have made significant progress growing their wind/solar portfolios but now seek to advance to the next level of penetration, implementing policies that support flexible capacity will be critical. These, in turn, will ensure that developing economies can continue to grow rapidly while at the same time decarbonizing their power sectors.

BNEF will explore the role that batteries and battery-supportive policies play in emerging markets in substantially greater depth in next year’s update to Climatescope.

Section 7. Methodology

The Climatescope 2020 methodology includes 123 indicators and sub-indicators split into three key topic areas that encompass each market's previous accomplishments, its current investment environment, and the future opportunities it presents. These are the following:

1. **Fundamentals.** This topic area encompasses a market's clean energy policies, power sector structure and regulations as well as local barriers that might obstruct renewable energy development. A market with comprehensive and strong policies and a more liberalized power sector tends to be more welcoming to private investment than one with weaker frameworks and less liberalization. This topic area seeks to assess the fundamental structures that can help clean energy flourish.
2. **Opportunities.** This includes a market's current and future electricity demand, its energy consumption, and its CO2 emissions from the power sector, along with overall price attractiveness, short- and medium-term opportunities for renewable energy procurement, history of corporate commitment with sustainability and existing electrification rates. This topic area seeks to encapsulate future opportunities for clean energy growth available in a market.
3. **Experience.** This includes a market's volume of installed clean energy and historical levels of renewable energy investment. Markets with greater experience deploying renewable energy capacity typically offer lower risks, lower technology costs and lower costs of capital for investors.

It is important to note that several key indicators are "levelized" against a market's gross domestic product, population, installed capacity and generation. The methodology seeks to take into account and then discount the fact that some markets attract larger volumes of capital simply because they are bigger. For a complete description of Climatescope's updated methodology, visit the website.

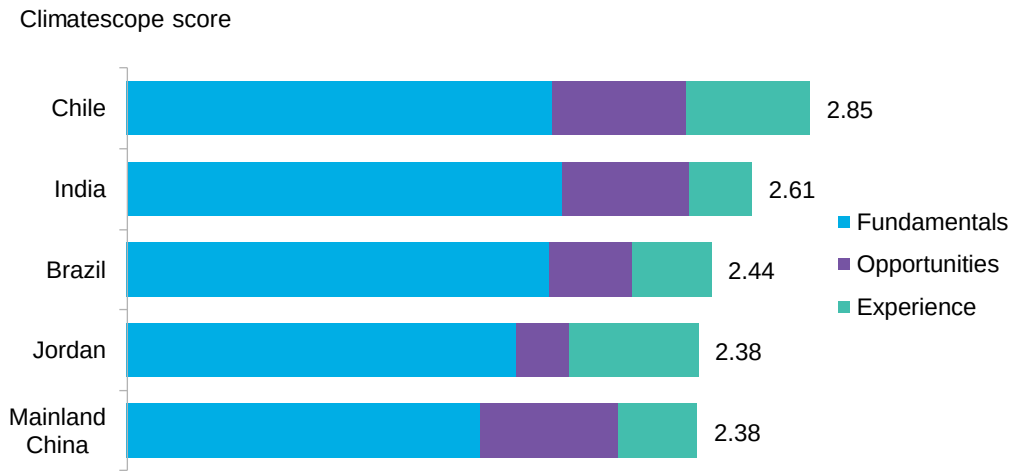
Section 8. Score review

The Climatescope indicators create a composite overall score for each of the markets in the survey. This marks the third edition in which the project covers over 108 emerging markets, to encompass virtually all developing economies on earth.

After nine years surveying exclusively emerging markets, Climatescope in 2020 has expanded to include 29 developed economies as well. This expansion aims to provide additional context on emerging markets' progress in the energy transition and their attractiveness for clean energy investment. The intent is not to provide a definitive ranking of developed nations' renewable energy environments or to directly compare developed countries with emerging markets.

As result of the expansion, Climatescope now encompasses nearly every nation in the world with over 2 million inhabitants. We define developed markets as OECD countries, minus Chile, Colombia, Mexico and Turkey, which are part of OECD, but remain attractive emerging markets for clean energy. Developing markets include all non-OECD nations, plus these four countries.

Figure 92: Climatescope score of top 5 markets



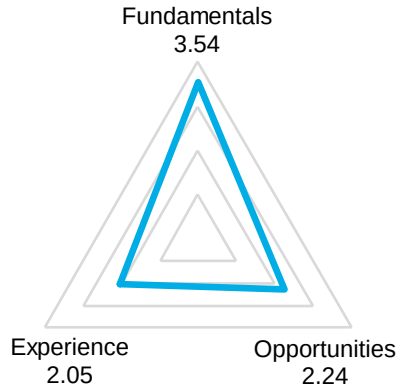
Source: Climatescope. Note: for full ranking see https://global-climatescope.org/results

Top 5 emerging markets

Below are the five markets that received the highest overall composite Climatescope scores.

1. Chile

Figure 93: Chile Climatescope scores



Source: Climatescope, BloombergNEF

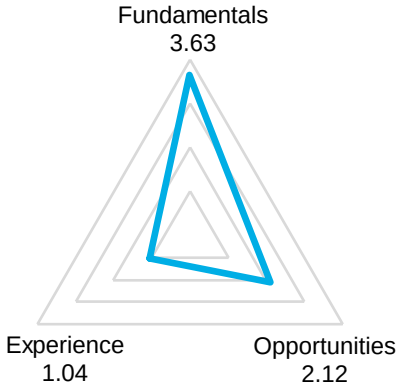
Chile's well-established clean energy policies, bold targets and overall commitment to greening its grid, as well as significant volumes of renewable energy investment have combined to make the country attractive to clean energy investors.

Chile has already met its 2025 goal of 20% generation from renewable energy sources. It now aims for 60% clean power by 2035 and 70% by 2050. While the majority of the country's generation currently comes from thermal sources (60%, with more than half of that from coal), the country has committed to shutter 1.7GW of coal-fired power by 2024, and completely phase out coal by 2040. To replace coal generation, the government and private utilities have committed to develop new renewable energy projects. These are some factors that pushed Chile back to the 1st position of the Climatescope ranking, after declining to 2nd in 2019.

Chile attracted $16 billion of clean energy investment in the last seven years. In 2019 alone, the country registered a record $4.9 billion, up four-fold from the previous year. At year-end 2019, Chile had 3GW of solar and 1.8GW of wind online. This represented 18% of total installed capacity, a growth of 2% compared to the previous year. Renewables (excluding large hydro) accounted for 22% of all power generated.

2. India

Figure 94: India Climatescope scores



Source: Climatescope, BloombergNEF

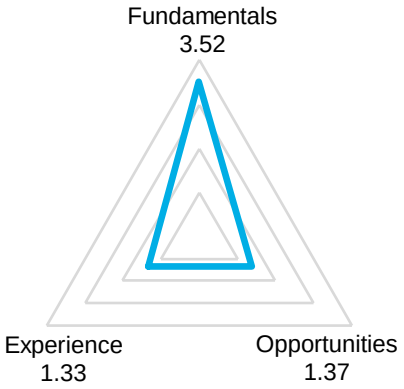
India's ambitious policy framework and copious capacity expansions make the country attractive to clean energy investors. The Indian government has set one of the world's highest renewable energy targets of 175GW by 2022, with 100GW to come from solar, 60GW from wind, and 15GW from other sources.

India's drop to the 2nd position in the Climatescope ranking from 1st last year mainly reflects declining clean energy investment, which fell 12% in 2018-2019 to $8.5 billion and has plummeted 32% since a peak of $12.6 billion in 2017.

Renewables, excluding large hydro, account for a fourth of India's 377GW installed capacity, and since 2017, capacity additions from renewables have exceeded those of coal. While wind capacity additions of 2.25GW in both 2019 and 2018 were below 2017 levels, PV additions have risen every year since 2014, and solar posted its best year to date in 2019 with 11.5GW installed. This includes utility-scale, rooftop and off-grid capacity. Wind's 2019 decline was partly due to a switch in the market from a reliance on feed-in tariffs to reverse auctions.

3. Brazil

Figure 95: Brazil Climatescope scores



Source: Climatescope, BloombergNEF

Brazil continues to be one of the most vibrant emerging markets for renewable energy deployment and is the largest power market in Latin America, with a total installed capacity of 171GW in 2019.

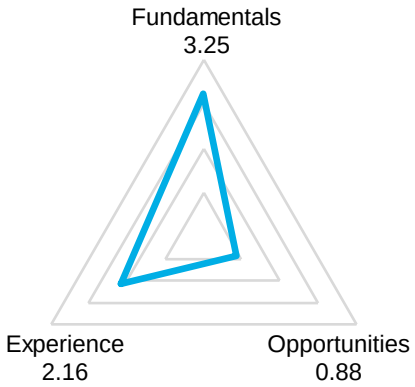
The country has one of the most comprehensive and inviting clean energy policy frameworks among emerging markets. In addition, it has pioneered competitive auctions to contract renewable energy projects, which led to around 30GW contracted 2009-2019.

Brazil's power matrix remains highly reliant on hydropower, accounting for 63% of total installed capacity and 64% of the generation in 2019. Still, wind and solar penetration has been growing every year. With over 10GW commissioned 2015-2019, wind jumped from 5% of the country's total capacity to 9% last year. Led by a steep growth in distributed PV over the past two years, the solar sector is experiencing a more recent boom and jumped form nearly zero in 2015 to 3% of total capacity in 2019.

After recording its lowest annual total for clean energy investment of the decade in 2018 at $3.3 billion, the sector has started recovering. The country attracted $4.8 billion for clean energy projects in 2019, a 47% jump from the previous year.

4. Jordan

Figure 96: Jordan Climatescope scores



Source: Climatescope, BloombergNEF

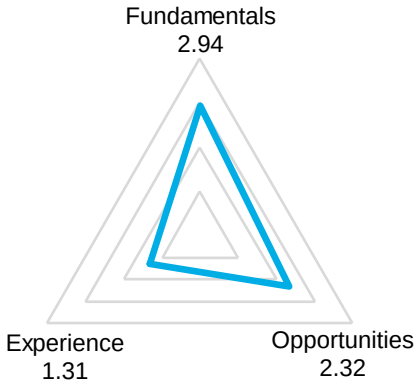
An exceptional policy framework and experience deploying clean energy projects have helped Jordan become a regional leader in recent years and has pushed the country into the Climatescope top five in 2020.

Jordan's clean energy policy framework encompasses clean energy targets, auctions and tax incentives to support the industry as a whole, plus net metering to support distributed solar specifically. Its National Energy Strategy foresees the country generating 14% of power from renewable sources by 2030. The plan, launched earlier this year, follows on from the country's previous goal of 10% renewable generation by 2020. To achieve the earlier goal, the country has held three rounds of auctions supporting 550MW of capacity.

Renewables build has boomed in Jordan in the past five years. The country installed 1.5GW of PV and over 500MW of wind 2015-2019. The two technologies together today account for nearly a third of Jordan's total capacity.

5. Mainland China

Figure 97: Mainland China Climatescope scores



Source: Climatescope, BloombergNEF

Investment into mainland China clean energy projects has been sinking since 2017 as result of policy changes, particularly the removal of generous feed-in tariffs that had been in place much of the past decade. Clean energy asset finance fell 5% in 2018-2019 to $86 billion and is off 30% since a peak of $124 billion in 2017. Still, mainland China continues to represent a land of enormous potential for renewables.

Coal dominates mainland China's power system, accounting for 52% of capacity and 62% of generation in 2019. After two consecutive drops in coal annual additions, the country saw coal build rebound in 2019 with 37GW of new projects commissioned, compared to 25GW in the previous year. In 2019, wind installations reached the second highest volume of the decade, with 29GW added, up from 21GW in 2018. PV additions fell 25% from 2018 but still totalled 33GW. Solar build is down 38% since a peak of 53GW in 2017. In 2019, wind and solar together accounted for 21% of capacity and almost 9% of generation.

Generation from renewables continues to grow, not only due to a growth in capacity, but also because curtailment of online projects has been declining. National curtailment rates were below 3% for both wind and solar in 1H 2020, the lowest in history and in line with the government's 5% target, diminishing the risks to renewable project developers.

Limited opportunities for foreign players make it harder for mainland China to top the Climatescope ranking. The country's strong local manufacturing capacity for wind and solar leaves little space for overseas players to compete and many auctions only accept bids from companies with a significant track record in the market.

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