

# Sustainable Energy in America **2022 Factbook** **Executive Summary**



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## BCSE Sustainable Energy in America Factbook Executive Summary

The massive uncertainty and upheaval that plagued the U.S. in 2020 began to ease in 2021, offering the country's energy sector a chance to take stock of a new reality buffeted by a lingering pandemic, global supply chain bottlenecks and rising inflation, but powered by a strong economic recovery. Despite considerable uncertainty, the clean energy and energy efficiency transition continued, with a record-breaking year for deployment of renewable power, battery storage and sustainable transportation, an unprecedented injection of new capital into companies, technologies and projects, and a wave of supportive new policies.

Here are some of the key findings from this year's Sustainable Energy in America Factbook:

- **U.S. primary energy consumption grew 4.4 percent in 2021 as the economy recovered from COVID-19 business conditions**, but consumption was 3.19% below 2019 (pre-pandemic) levels.
- **Energy productivity improved by 1.3%**. The ratio of GDP growth vs. energy consumption grew again in 2021 suggesting that the long-term trend of the U.S. using energy more efficiently continued – despite two incredibly anomalous years.
- **A record-breaking \$105 billion in new capital went into new U.S. clean energy assets**, an 11% year-on-year jump; the figure has grown 70% in the last five years.
- **Developers built a record 37 gigawatts (GW) of wind and solar power-generating capacity**. Solar enjoyed its best year ever with 24.2GW added while wind had its third-best year at 13GW.
- **Corporate demand for clean energy endured, with a total of 351 companies pledged to procure 100% clean energy**. Companies signed 17GW in clean energy procurement contracts in 2021.
- **U.S. consumers allocated less than 5% of their proportional household spending to energy products**, despite high gasoline prices, supply chain challenges and overall inflation.
- **Renewables made another record contribution to the power grid with production rising 4.1% year-on-year**. Renewable sources accounted for just over one fifth of U.S. power generation in 2021.
- **Demand for U.S.-produced natural gas grew 9.4%**, with liquid natural gas (LNG) exports jumping 64% and industrial, residential and commercial heating demand rising 0.4%, 4.7% and 1.9%, respectively.

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- **Power from all zero-carbon sources electricity (renewables plus nuclear power) met 40% of demand**, despite lower hydropower output due to extreme droughts in the Western U.S.
- **Natural gas remained the largest source of U.S. power generation at 38%, however the fuel contributed 3.1% less than in 2020**, due primarily to higher gas prices.
- **Coal-fired power's contribution rose year-on-year for the first time since 2014 to provide 22% of generation.** Overall, however, coal's contribution is down nearly 40% from a decade ago due to weak demand, competition from lower-carbon power sources and coal plant retirements.
- **Over 8GW of new hydrogen-fired power-generating capacity projects were announced in 2021 in the U.S.**, positioning the country to potentially lead in developing the fuel for new applications.
- **Nearly 4.2GW of battery storage capacity was added to the U.S. grid in 2021.** Today, 81% of storage is provided by pumped hydropower projects, but batteries account for 89% of build over the last decade.
- **2021 was a breakthrough year for U.S. offshore wind with 8.5GW of new capacity awarded**, stemming from contracts in New York, New Jersey, Massachusetts and Maryland.
- **U.S. electric vehicle (EV) sales hit 657,000 units in 2021**, a doubling from the 325,000 cars sold in 2020.
- **Renewable natural gas (RNG) production capacity grew 12% year-on-year, with \$3 billion earmarked for investment in 2021.** RNG is predominantly used in transportation today, but has potential use in industrial applications and buildings.
- **Total U.S. CO2 emissions rose 5.8% year-on-year.** In the power sector, coal-fired generation rebounded. Transportation sector emissions also jumped as drivers returned to the roads. Economy-wide emissions finished 2021 15% below 2005 levels. Power sector emissions were down 35% vs. 2005.
- **Climate disasters caused \$145 billion in damage**, making 2021 the third most costly year on record after 2005 and 2017.
- **The Biden administration adopted a 2050 economy-wide net zero emissions goal for the U.S. as Congress approved \$80 billion for energy transition investment.** Congress ended 2021 with over \$300 billion in climate and clean energy policies pending in a tightly divided House and Senate.

These trends are discussed at a high level below then in far greater depth graphically in the Factbook itself.

### ***Investors, large corporates, and consumers poured record-breaking investment into the U.S. energy transition***

Investors became even more bullish about the energy transition in 2021. BloombergNEF tracked a record volume of energy transition capital deployed into virtually every asset class in 2021 -- \$755 billion in all globally.

This included record investment for technology start-ups through venture capital financings (\$53.7bn), for growth companies through offerings on public stock exchanges (\$111bn), and for clean power and storage projects through private loans and tax equity investments (\$366bn). In addition, BNEF tracked \$1.6 trillion in total sustainable finance for a wide range of assets through “green”, “sustainability-linked” and other bonds (\$894bn).

In the U.S. specifically, BNEF counted \$105 billion invested in energy transition assets, predominantly in renewable energy and electric transport. Given that capital invested today has the potential to make impact tomorrow, the private funds raised in 2021 foreshadow new build and progress on key technologies for years to come.

Large energy consumers, namely large corporations, continue to drive the U.S. energy transition by demanding more clean energy. A total of 351 companies have now pledged to procure 100% clean energy, with 65 new companies joining the list in 2021, including nine headquartered in the U.S. This is combined with 127 companies having pledged to increase their energy productivity and 121 companies having pledged to reduce the carbon emissions of their fleets.

### ***U.S. CO2 emissions rose, but not to pre-pandemic levels***

With the U.S. economy recovering from the Covid-19 pandemic, there were concerns that CO2 emissions might rebound to pre-pandemic levels. And rebound they did: economy-wide emissions hit 6,263 MtCO2 in 2021, up 5.8% from 2020 but still 4.4% below 2019 levels. Economy-wide emissions are down 15% from 2005 levels.

Power sector emissions also rose. Natural gas generation remained the largest source of power, providing 38% of electricity in 2021. This was a slight decline from the previous year due to higher natural gas prices, making other generating sources more competitive, including coal.

Renewable generation (biomass, geothermal, hydropower, waste to energy, solar, wind) represented 21% of the U.S total in 2021, about the same as in 2020, despite higher gross output. Wind and solar’s growth in output was largely offset by increased coal-fired generation, which rose by 21%.

Nuclear contributed 19% of generation, roughly the same as 2020 and hydropower output dropped 11% due to droughts in the West. Overall, power sector emissions remain 35% below 2005 levels due to a far cleaner and more diverse energy mix. Transportation-related emissions also rose as more Americans hit the roads compared to 2020 and air travel picked up. But transport emissions in 2021 did not return to 2019 levels.

### ***Despite uncertain economic condition, U.S. energy productivity continued to improve***

Over the last three decades, the U.S. economy has consistently improved on how efficiently it uses energy, due primarily to private sector investment and key policies. Given the unprecedented events of the past two years, it was far from clear whether this long-term trend would continue. Remarkably, U.S. energy productivity improved in 2020, when the economy dramatically contracted, and in 2021 when it dramatically expanded. This suggests a trend that is largely immune to short-term swings in economic activity.

### ***Energy prices rose sharply, oil and gas production increased more modestly – but energy costs remain relatively low for U.S consumers***

For energy consumers, 2021 was a year of sharp energy price hikes that contributed to higher overall inflation. Average gasoline prices for 2021 were up 75% vs. 2020, and reached their highest levels since 2014. The price trend for U.S. crude oil was almost identical. The average wholesale price for natural gas across 2021 was 84% higher than in 2020.

Price booms have historically created boons for U.S. oil and gas producers and spurred them to sharply ramp demand. Due to extraordinary circumstances and some fatigue on the part of investors with the sector, however, this did not occur.

Despite the strong economic growth, consumers similarly confronted higher prices for many goods, but particularly energy-related products and most specifically, gasoline. Nevertheless, U.S. households devoted less than 5% of monthly spending to energy goods and services. And Americans felt the energy price squeeze much less acutely than others elsewhere in the world.

***The impacts and costs of climate change continued to become more evident across the U.S.***

The impacts of climate change continued to proliferate in 2021 across the country. The U.S. experienced 20 separate climate disasters causing at least \$1 billion in damage apiece in 2021, according to the National Oceanic and Atmospheric Administration. The 2021 events, made up of tropical cyclones, severe storms, droughts and wildfires, are estimated to have cost \$145 billion, making 2021 the third most costly year on record after 2005 and 2017.

***Federal policy embraced net zero targets and historic technology investments***

On the policy front, 2021 marked the first year of the Biden administration, which sought quickly to make up for time lost in addressing climate change. The U.S. re-entered the Paris agreement and sought to reassert leadership on the global stage with an extensive presence at the COP26 negotiations in Glasgow in November. The White House set a new target for cutting U.S. CO2 emissions economy-wide 50% by 2030 (vs. a 2005 baseline) and for eliminating them entirely from the power sector by 2035. The administration released new, more aggressive efficiency standards for U.S. cars and light trucks, outlined plans to make the federal government the world's most important clean energy buyer and established targets to kickstart demand for high-performance buildings.

The administration had mixed success pushing its energy transition agenda through a deeply divided Congress. The Infrastructure Investment and Jobs Act was signed into law and allocates an unprecedented \$80 billion for new energy technologies, including those that could prove critical to achieving "deep decarbonization" in the 2030's and beyond. Meanwhile, the clean energy and energy tax package that was part of the Build Back Better bill, which would support today's suite of economically-viable clean energy technologies, passed the House of Representatives but stalled in the Senate.

***Unprecedented financial support for next-generation technologies***

Capital invested today has the potential to make tangible impact tomorrow. In 2021, the U.S. made critical research and development commitments to technologies that could hold the key to "deep decarbonization" in the 2030s and beyond. This included \$80bn in new funding specifically for hydrogen, advanced nuclear and carbon capture and utilization and storage (CCUS) allocated under an infrastructure law passed with bipartisan support. The Biden administration also looked to take advantage of the authority it inherited with renewed efforts to issue loan guarantees through the Department of Energy's Loan Program Office. Meanwhile, companies around the world developing technologies and demonstration projects that might someday help the U.S. achieve its net-zero CO2 ambitions attracted \$165bn through private investment and IPOs.

***Renewable energy made record contributions to power generated and consumed***

The U.S. installed a record volume of renewable power-generating capacity with 37.3GW installed, just over the 35.5GW installed in 2020. Solar led the way with 24.2GW. Wind followed



with 13GW. The solar industry beat its own record for installations set in 2020 by a whopping 30%. Wind had its third-best year ever with total build, down from a record 16.6GW in 2020. Wind developers worked to complete projects before the start of a production tax credit (PTC) phase down planned for 2022. The primary difference in the performances of the two sectors was that solar has recently been able to expand into new markets more rapidly throughout the U.S. Solar additions outside California and the Southeast states more than doubled in 2021. By comparison, wind additions outside of MISO and Texas markets declined.

Renewables generated 21% of U.S. power, with wind, hydropower and solar being the largest contributors. Wind and solar each made record contributions to power generated and consumed in 2021, providing a combined 66 terrawatt-hours (TWh) of new generation. The two technologies accounted for record 13% of total U.S. power generated.

Achieving the Biden administration's climate goals will require U.S. renewable capacity additions to double from recent levels. Policies to expand and modernize transmission infrastructure as well as a broad range of federal tax incentives to accelerate deployment of renewable generation are pending enactment. These are some of the policies that will be required to make progress towards meeting this goal.

***Natural gas demand grew, along with demand for decarbonization***

Total demand for U.S. natural gas jumped 9.4% in 2021, a rebound from the minimal growth seen in 2020 due to the Covid-19 pandemic. Industrial, residential and commercial heating demand increased 0.4%, 4.7% and 1.9%, respectively, driven by weather and the economy. The increase in residential gas customers was the largest since 2006, with 900,000 more customer hook-ups in 2020. The average residential customer efficiency continues to improve, offsetting sectoral demand growth that would result from new customers.

While overall load grew, gas demand for power generation fuel dropped by 1.0 Bcfd (-3.3%) as high year-on-year gas prices led to more coal-fired power plants being online, which contributed to increased power sector emissions in 2021. LNG exports rose very significantly (64%) in 2021, driven mainly by a demand surge in Europe and Asia. In Europe, LNG has backfilled depleted domestic production while in Asia gas has met high demand from economic growth and replaced coal generation.

As the economy seeks to decarbonize, demand for decarbonized natural gas is rising. With the passage the new infrastructure law, the U.S. is poised to provide \$20.5 billion in federal funding for CCS and hydrogen efforts. Demand for RNG rose in 2021, with 33 states taking action to promote the use of the fuel for thermal heating purposes in the residential or commercial sectors, up from 26 in 2020.

***State action on energy efficiency slowed due to Covid, but savings measures continued to deliver***

Energy Efficiency resource standards (EERS) are state-level policies that require utilities to invest in measures that improve end-user efficiency to meet energy-savings goals set by the government. In 2021, 26 states and the District of Columbia had EERS policies – down two states from the prior year as the New Hampshire and Arizona public utility commissions voted to end their efficiency standards.

In 2020 (the last year with complete spending data), the global pandemic significantly depressed total financing for energy efficiency programs. Total utility spending on energy efficiency dropped 9.3% drop from 2019 levels levels.

Despite 2020's challenges, the total annual impact of efficiency programs continued to grow, since most efficiency measures impact savings for years after their installation. The total impact of ratepayer-funded energy efficiency programs was a savings of about 286 million MWh in 2020 – equivalent to approximately 7.69% of 2020 electricity consumption.

In 2021, Hawaii and Virginia adopted updated building energy codes that stand to cut energy use and carbon emissions in future years. Colorado signed HB 1286 to become the second state, after Washington, to adopt a building energy performance standard for large buildings, a critical step forward for addressing energy waste in existing construction. Washington's program goes into effect in 2026, though an early-adopter incentive program started in 2021.

### ***Energy storage demand and battery capacity additions surged***

Pumped hydropower storage projects account for around 81% of installed energy storage capacity in the U.S. While pumped hydro will remain the bulk of energy storage capacity in the U.S., other technologies, such as lithium-ion batteries and thermal storage are being built. Close to 4.2GW of battery capacity was added to the U.S. grid in 2021, more than in all preceding years combined. The underlying driver is the growing need for batteries in energy-shifting applications, a need created by the rising penetration of renewables, particularly solar, in certain markets, particularly California. Additionally, regulatory changes in the wake of Federal Energy Regulatory Commission (FERC) Order 841 (2018) – which required regional power markets to revise their rules to allow storage to fully participate in energy markets – have removed barriers that would have otherwise stemmed the tide of batteries to the grid. State targets have also played a role in encouraging uptake.

While 2021 marked the start of an exciting transition as batteries moved into the mainstream in certain markets, it also put the technology under pressure to deliver. Higher penetration rates raise expectations that batteries can make meaningful system-level impacts on the grid and power markets, especially in resolving some of the challenges associated with renewable integration.

### ***A giant step forward for the U.S. offshore wind***

In September, Vineyard Wind secured \$2.3 billion in financing for its 806MW project planned for the waters south of Massachusetts, making it the first commercial-scale U.S. offshore wind project to reach financial close. Total U.S. offshore wind capacity stands at 42MW, but there is now a pipeline of 17.6GW of projects in very active development. Most are set to be commissioned post-2025. Vineyard Wind, on track to commission in 2024, demonstrates a large-scale project can navigate the complexities of permitting and financing in the U.S. It offers hope to projects further back in the pipeline while allowing the industry to focus on scaling local supply chains and achieving the economies of scale that have driven cost reductions in Europe.

### ***U.S. EV sales accelerated but not as fast as elsewhere***

Americans bought 657,000 electric vehicles in 2021, doubling the 325,000 sold the year prior. Lower battery costs, growing consumer acceptance and the roll-out of exciting new models all contributed. Tesla continued to account for by far the largest share of EV sales in 2021 with half. While the overall market expanded 34%, the market for electric cars *not made* by Tesla grew 83%. The ball is now very much in the court of other automakers to match Tesla's success. While signs are encouraging, much remains to be done.

Brisk EV sales in 2021 mask two sobering realities. First, for the U.S. to meet its 2030 nationally determined contribution on emissions EVs must be at least 30% of vehicles *on the road* by that time. For context, EVs were just 4.4% of total U.S. passenger vehicle *sales* in 2021. Second,

even with this progress the U.S. EV market is a third the size of the European Union's and one fifth of that in China. The U.S. market is growing, but not nearly fast enough to satisfy either the country's climate ambitions, or to establish the U.S. as an industrial leader in the field.

***The U.S. affirmed its major hydrogen production ambitions***

The U.S. is a global leader with over 8GW of planned hydrogen-fired power-generating capacity. State-level clean energy targets are clear drivers with nine of 10 planned projects due to provide electricity in states with clean energy mandates. Two-thirds of these projects have hydrogen-natural gas blend targets. Half expect to run on 100% H2 by 2045.



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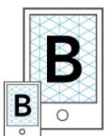
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