Executive summary

This report is BloombergNEF’s annual accounting of global investment in the low-carbon energy transition. It includes a wide scope of sectors, covering renewables, energy storage, electrified vehicles and heating, hydrogen, nuclear, sustainable materials and carbon capture. It also covers VC/PE and public markets investment in climate-tech companies, as well as thematic highlights such as sustainable debt and performance of clean energy equities.

- In 2021, global investment in the low-carbon energy transition totaled $755 billion, up from $595 billion in 2020 and just $264 billion in 2011. This figure includes investment in projects, such as renewables, storage, charging infrastructure, hydrogen production, nuclear, recycling and CCS projects – as well as end-user purchases of low-carbon energy devices, such as small-scale solar systems, heat pumps and zero-emission vehicles.

- The largest sector in 2021 was renewable energy, which attracted $366 billion for new projects and small-scale systems (up 6.5% from 2020), but the electrified transport sector grew the fastest and hit $273 billion (up 77%). The next largest sectors of spending were electrified heat, at $53 billion and nuclear energy, at $31 billion.

- The Asia Pacific region attracted the most investment, at $368 billion, and recorded the highest growth, at 38%. But investment rose to a new record in all regions: APAC, AMER and EMEA. Still, investment must triple in the next few years to get on track for net zero by 2050.

- In addition, climate-tech companies raised a total of $165 billion from global public equity markets and private investors in 2021. Two-thirds of this funding came from public markets, including SPAC reverse mergers, and the vast majority went to companies focused on the energy and transport sectors.

This is an abridged version of the report. BloombergNEF subscribers can find the full version on the client website and on the Bloomberg Terminal.
Energy transition investment

The first two sections of this report cover ‘energy transition investment’, our term for money spent to deploy clean technologies such as clean energy, electric vehicles, hydrogen and carbon capture.

In a word, these sections focus on funding for deployment.

With data going back as far as 2004, we track each of these sectors as much as possible from a bottom-up perspective, giving the most robust estimate available of investment in the deployment of net-zero aligned technologies.

*In 2021, global energy transition investment totaled $755 billion.*

Where to find the data

The underlying data for energy transition investment can be found here:

https://www.bnef.com/interactive-datasets/2d5d59acd9000005

Climate-tech corporate finance

The third and fourth sections of this report cover the raising of capital by ‘climate-tech’ companies, either via public equity markets or venture capital / private equity.

In a word, these sections focus on funding for innovation.

The scope includes technologies and business models to decarbonize the energy, transport, buildings & infrastructure, industry and agriculture sectors, or help better understand our planet and environment, assist in tracking greenhouse gas emissions, and mobilize financial (and consumer) markets toward greener investments.

Comprehensive data in this section only begin in 2021, though we do have corporate finance data for renewable energy and storage going back to 2004 (in the Renewable Energy Investment Tracker).

*In 2021, global climate-tech corporate finance totaled $165 billion.*

Where to find the data

Our Investment Radar provides the latest update on climate-tech investment trends.

Thematic highlights

The last section of this report covers notable narratives from the world of climate and energy transition finance over the last year.

Examples include:

- Public market performance of clean energy equities
- Climate-related SPAC deals
- The rise of sustainable debt and ESG-themed ETFs
- Investment in clean energy from oil & gas companies
- Investments in battery manufacturing plants
$920 billion was invested in energy transition deployment and climate-tech companies in 2021

Global energy transition investment, our measure of money spent to deploy low-carbon energy technologies, hit $755 billion in 2021 – a new record. The largest sectors were renewable energy, at $366 billion, and electrified transport, at $273 billion.

Separately, climate-tech companies raised $165 billion in equity financing from public markets and private investors in 2021, including SPAC reverse mergers. This capital will be used in the coming years to scale up these companies’ operations and further develop their technologies. The most-funded sectors were energy and transport.

There is probably some limited double-counting across these two totals, since some of the capital raised by companies may then be used to deploy technology. Nevertheless, by adding these two figures together we can arrive at a useful estimate of the total invested in low-carbon tech in 2021: $920 billion, or just short of one trillion dollars.

Source: BloombergNEF. Note: energy transition investment accounts for money spent to deploy low-carbon energy technologies. Climate-tech corporate finance accounts for money invested in climate-related companies.
Energy transition investment: overview

Top-level findings
Energy transition investment: overview

Energy transition investment: preface

This section presents our top-level findings on global investment in the low-carbon energy transition.

Brief definition and methodology

The figures in this section represent capital spent on deployment of low-carbon technology. This largely excludes capital invested in companies (see next section for that), and money spent on research, development and manufacturing (with an exception for CCS, where we include some of these sums).

For large infrastructure projects such as renewables, stationary energy storage, hydrogen production, EV charging, CCS, nuclear and sustainable materials, our figures are built based on bottom-up intelligence on individual projects and financial commitments. In general, we account for money that has been committed to a specific project, whether through a final investment decision, a government grant allocation, or a project proceeding to construction and commissioning. We don’t include money that hasn’t been explicitly committed to a known project (such as unallocated government grant funding), or projects that have not yet reached final investment decision. We apply cost estimates where project values are not disclosed.

For consumer- or end-user-led technologies, such as small-scale solar, heat pumps, and electric and fuel cell vehicles, we estimate the total amount invested (spent) based on our own benchmarks of the total costs of these products, including any relevant installation costs.

Coverage

The sectors covered are:

- **Renewable energy**: wind (on- and offshore), solar (large- and small-scale), biofuels, biomass & waste, marine, geothermal and small hydro
- **Energy storage**: stationary storage projects (large- and small-scale), excluding pumped hydro, compressed air and hydrogen. The majority are battery projects.
- **Electrified transport**: sales of electric cars, commercial vehicles and buses, as well as home and public charging investments
- **Electrified heat**: residential heat pump investments
- **Nuclear power**: reactors under construction and major refurbishments
- **Hydrogen**: hydrogen electrolyzer projects, fuel cell vehicles and hydrogen refuelling infrastructure
- **Carbon capture and storage (CCS)**: large- and small-scale commercial CCS projects, dedicated transport and storage
- **Sustainable materials**: circular economy (recycling) and bioplastics

These sectors encompass a broad range of low-carbon technologies and are a good representation of global energy transition investment. There are, however, areas that we have not yet included – such as energy efficiency and grid investment, due to lack of good bottom-up data.

The totals here can therefore be thought of as a conservative estimate of global energy transition investment.
The world committed a record $755 billion to decarbonize the energy system in 2021, beating the previous year by 27%.

Both renewable energy and electrified transport, the two biggest categories, rose to new records in 2021 as wind and solar installations and electric vehicle sales surged.

Companies, governments and households invested $366 billion in new renewable energy capacity in 2021, up 6.5% on the year.

They also spent $273 billion on electric vehicles and associated charging infrastructure, up 77%. On current trends, the EV sector should overtake renewable energy investment this year.

The next largest sectors of spending were electrified heat at $53 billion and nuclear energy at $31 billion.

Together, clean power and electrification (comprising renewables, nuclear, energy storage and electrified transport and heat) accounted for the vast majority of investment, at $731 billion. Hydrogen, carbon capture and storage and sustainable materials made up the rest, totaling $24 billion.

CCS was the only sector not to see rising investment in 2021, dropping slightly to $2.3 billion.

Source: BloombergNEF. Note: start-years differ by sector but all sectors are present from 2019 onwards; see Appendix for more detail.
All three regions (AMER, APAC, EMEA) hit all-time records for energy transition investment in 2021.

The Asia Pacific region was both the largest region for investment at $368 billion, and the region with the highest growth at 38% in 2021. Electrified transport was the biggest driver as it more than doubled its investment flows in 2021, but renewables investment was up too.

Energy transition investment in Europe, Middle East and Africa grew by 16% in 2021, reaching $236 billion. Renewable energy investment was flat, but electric transport spending jumped 46%.

The Americas saw energy transition investment grow by 21% to $150 billion in 2021. As in EMEA, renewable energy investment stayed flat, but electric vehicle investments grew by 84%.

APAC now accounts for 49% of global energy transition investment. EMEA is second with 31%, and AMER lags behind at 20%.

Source: BloombergNEF
Energy transition investment: overview

China topped the table again as Japan dropped two places

Global investment in energy transition by country, 2021

- China’s energy transition investment hit $266 billion in 2021, cementing its position as the leading country. This figure was up 60% from 2020.
- The U.S. was the second-biggest investing country once again, achieving a total of $114 billion in 2021 – up 17% on the year before.
- European countries invested $219 billion in 2021, with EU member states accounting for $154 billion of that. This would place the EU as a bloc in second place behind China, and ahead of the U.S.
- European countries also featured in the top 10 in their own right, with Germany, the U.K., France and Spain all exceeding $10 billion in low-carbon spending last year.
- Japan dropped from fourth to sixth in the list as its investment levels fell slightly – allowing the U.K. and France each to gain a place.
- India and South Korea entered the top 10 in 2021, at the expense of Norway and the Netherlands.

Source: BloombergNEF
To get on track for net zero, investment must triple to 2025, then double to 2030

Comparison: 2021 energy transition investment versus required annual investment in 2022-25 and 2026-30 in NEO 2021 net-zero scenarios

<table>
<thead>
<tr>
<th>Year</th>
<th>Renewable energy</th>
<th>Electrified heat</th>
<th>Electrified transport</th>
<th>Energy storage</th>
<th>Hydrogen</th>
<th>CCS</th>
<th>Sustainable materials</th>
<th>Nuclear</th>
</tr>
</thead>
<tbody>
<tr>
<td>2021</td>
<td>755</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2022-2025</td>
<td>2,063</td>
<td>1,750</td>
<td>1,745</td>
<td>2,695</td>
<td>4,189</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2026-2030</td>
<td>4,804</td>
<td>3,295</td>
<td>4,469</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To get on track for global net zero, according to our New Energy Outlook, energy transition investment needs to average $2,063 billion between 2022 and 2025, about three times the total in 2021.

About 60% of the spend in 2022-25 goes into renewable energy and electrified transport, which roughly double to a respective $667 and $583 billion in the New Energy Outlook scenarios, compared to actual 2021 levels. The transport sector may be on track to achieve this after growing 77% in 2021. However, growth in renewables spend averaged only 6% over the last five years.

There is another doubling of investments thereafter, to an average $4,189 billion per annum over the years 2026-2030. About one to two fifths of the spend is required for next-generation low-carbon technologies, such as hydrogen, CCS and nuclear. Nuclear in the Red Scenario sees $1,671 billion per annum, followed by CCS in the Gray Scenario with $622 billion. In the Green Scenario, PV and wind plants powering electrolyzers require $1,532 billion, in addition to $532 billion for hydrogen storage, transport and electrolyzers.

Source: BloombergNEF. Note: future values are from New Energy Outlook 2021, except electrified transport, which is from the Electric Vehicle Outlook 2021 Net-Zero Scenario. Please consult the latter for a description of the Net-Zero Scenario and the New Energy Outlook for the Green, Gray and Red scenarios. All three ‘color’ scenarios target global net zero by 2050 in line with 1.75 degrees Celsius of warming.
Climate-tech corporate finance: overview

Venture capital, private equity and public markets investment for the climate transition
Climate-tech corporate finance: overview

Climate-tech corporate finance: preface

Climate-tech companies have enjoyed an increasing flow of early-stage capital investment in the last two years, from sources such as venture capital and private equity. This has been complemented by a growth in public market fundraising, often via new ways of accessing public markets such as reverse mergers with special purpose acquisition companies (SPACs). This, along with other lucrative private exits, has recently attracted more private equity growth funding and late-stage venture capital funding.

Climate-tech in this report

- This section replaces the ‘corporate finance in renewable energy and storage’ section from last year’s Energy Transition Investment Trends report. That data can still be found in the Renewable Energy Investment Tracker (REIT), which is updated twice a year. (The latest version is published concurrently with this report.)
- This section now includes six climate-tech sectors. Alongside energy, these are transport and mobility, agriculture and food, industry and materials, buildings, and climate and carbon (see the grey box). The ‘energy’ sector has a broader scope compared to last year, now including not just renewable energy equipment deals but also software and systems deals, such as virtual power plants.
- The data in this section does not include mergers and acquisitions or debt funding.
- BNEF also publishes a bi-monthly Investment Radar, detailing all climate-tech VC/PE investment month-to-month, as well as including IPO, M&A and SPAC deals.

Methodology

- BloombergNEF defines ‘climate tech’ as technologies and business models that act to decarbonize the energy, transport, buildings & infrastructure, industry, and agriculture sectors. The term also encompasses technologies that help better understand our planet and environment, assist in tracking greenhouse gas emissions, and mobilize financial (and consumer) markets toward greener investments.
- This data has come from a variety of sources: Bloomberg Terminal, Bloomberg proprietary datasets, Pitchbook and public news announcements. In this analysis, we only use disclosed deal values, and do not make estimates for undisclosed deals. This differs from the REIT publication.

Climate-tech sector coverage examples:

**Energy**: Wind power, solar power, geothermal, nuclear, energy storage, virtual power plants and distributed energy resource management systems, biofuels, hydrogen, fuel cells, batteries

**Transport and mobility**: Fuel cells, EV charging, electric aviation, ride-sharing, micro-mobility, route efficiency, batteries

**Agriculture and food**: Precision agriculture, indoor farming, increasing crop yields, decreasing food waste, cultured meats

**Industry and materials**: Biochemicals, process electrification, circular economy, recycling, innovative materials

**Climate and carbon**: Satellite imagery, carbon offsetting, carbon accounting, weather forecasting, climate modelling

**Buildings**: Insulation, energy efficiency systems, heat pumps, waste heat reuse
Definitions

Private markets: VC/PE

Funds raised by privately owned, earlier-stage companies, in exchange for company equity. The investors could be government, accelerators, incubators, private individuals, sovereign wealth funds, VC/PE firms, corporates or banks.

- **Angel and accelerator**: Usually a small round with investors including individual angel investors, angel investor groups, friends and family. Includes funding through an accelerator program.

- **Seed**: First rounds of funding a company will receive. Round sizes range between $10,000 - $2 million. Typically comes after an angel round (if applicable) and before a company’s Series A round.

- **Early-stage and late-stage venture capital**: Investment typically come from a venture capital firm. Early stage is Series A, B and C, and late-stage can be Series C, D, E, F etc.

- **Private equity growth**: Investment led by a private equity firm or a hedge fund and is a late-stage round. Rounds are typically upwards of $50 million.

- **Crowdfunding**: Includes equity and product crowdfunding (individual users’ investment in companies in exchange for equity or a company will provide its product)

- **Grant/corporate**: Grant includes when an investor provides capital to a company without taking an equity stake in the company and a corporate round occurs when a company, rather than a venture capital firm, makes an investment.

Public markets

Funds raised by publicly quoted or OTC pure-play companies on the capital markets. This may be through IPOs, SPACs or follow-on offerings like secondary offerings or PIPE.

- **Initial public offering (IPO)**: The first sale of stock by a private company to the public. IPOs are often issued by smaller, younger companies seeking the capital to expand, but can also be done by large privately owned companies looking to become publicly traded.

- **SPAC reverse mergers**: A publicly-traded blank check company (special purpose acquisition company, SPAC) raises investment funds in the form of blind pool money through an initial public offering (IPO). The purpose is to complete an acquisition of an existing private company, sometimes in a specified target industry. When a target has been identified, the target raises equity through a PIPE (see below) before reverse merging with the SPAC and acquiring the cash in trust.

- **Secondary offering**: A secondary offering is the sale of new or closely held shares by a company that has already made an initial public offering.

- **PIPE (private investment in public entity)**: A private investment firm’s, fund’s or other qualified investor’s purchase of stock in a public company at a discount to the current market value per share for the purpose of raising capital. PIPE can also be raised by private companies that are about to go public.
Climate-tech funding totalled $165bn in 2021, 82% to transport and energy

$165 billion in corporate finance was raised across all climate-tech sectors in 2021. June, July and November were the most active months, raising $63 billion (38% of total).

- **The energy sector** raised the largest amount of capital — $68.5 billion. The most popular sectors were wind and solar power, as well as hydrogen.

- **Transport and mobility** raised the next largest amount — $67.4 billion. Firms building EVs, electric airplanes, e-scooters and batteries have been popular with public and private investors, as the startups look to raise large amounts to build manufacturing hubs.

- **Agriculture** technologies, ranging from alternative meats to vertical farming to drones, had a strong year for a nascent sector, raising $14.9 billion.

- **The industry, materials and buildings sectors** raised lower totals, reflecting their slower progress to decarbonize. Companies decarbonizing industry raised $9.1 billion in 2021, and low-carbon buildings firms raised $1.4 billion.

- **Climate and carbon** startups have also had a successful year for a nascent sector. The small overall sum of $3.8 billion is partly due to a higher share of software startups (requiring less capital), and earlier-stage tech in general.
Two-thirds of climate-tech funding came from the public markets

In 2021 there were 483 public markets climate-tech deals, compared to 2,806 VC/PE deals.

Two-thirds ($111 billion) of all investment came from the public markets. Public investors poured the most money into the energy sector, which pulled in $53.8 billion. This is coincidentally the same amount as was spent on all climate-tech startups by private investors in 2021.

IPOs and secondary offerings raised $62.4 billion in 2021, across 316 deals. The largest IPO of 2021 (and in fact the largest overall deal) went to electric truck company Rivian, in November, for $11.9 billion.

SPAC reverse mergers for climate-tech raised $35 billion in 2021, particularly popular with transport startups.

Private (VC/PE) investors spent $53.7 billion on climate-tech in 2021. Energy and transport were the most-funded of the six sectors. However, the VC/PE markets played a more important role for the more nascent sectors. Agriculture and food startups raised $3.5 billion more in private markets than public markets in 2021. Climate and carbon startups raised 94% of their money from private corporate finance investors in 2021.

**Source:** BloombergNEF, Bloomberg Terminal, Pitchbook, news sources.
Thematic highlights

Trends and themes in low-carbon investment
Clean energy and EV stocks gained in 2021, but oil & gas outpaced them both

2021 full-year performance of clean energy and other equity indexes (normalized)

Source: BloombergNEF. Note: Respective tickers are BGSCET, BBEVT, SPGOGUP and MXWO.
Climate-related SPACs hit $35 billion in 2021, driven by the transport sector

Global SPAC reverse merger deals across climate-tech, 2021

- SPAC reverse mergers were a popular way to access capital markets for a range of industries in 2021. This is particularly true for climate-tech, where 50 startups raised $35 billion from SPACs and PIPE investments to go public.

- Transport was the most active climate-tech sector, raising $23 billion from SPACs (66% of SPAC deals). 29 reverse merger deals were for low-carbon transportation companies and 19 for EVs or electric aviation. The largest transport SPAC reverse mergers were Lucid Motors ($4.4 billion), Grab ($4.4 billion) and Joby Aviation ($2 billion).

- The industry and agriculture sectors each saw four reverse mergers, raising $2.3 billion and $3.5 billion respectively. For agriculture, these deals were a mix between alternative proteins, crop data analytics platforms and bio-engineering.

- 22 SPACs listed in 2021 and are currently searching for a climate-tech target. While the SPAC process is complex, it offers a faster and cheaper way for startups to go public compared to traditional IPOs. SPACs have been most popular with companies that are pre-profit, or even pre-revenue.

- Redemption rates (the % of SPAC shares that are redeemed by shareholders rather than invested into the merged entity) have reached 50% for some climate-tech companies in 2021. This means that the actual proceeds available to the company can be significantly lower than the announced total.

Source: BloombergNEF, Bloomberg Terminal, Pitchbook, news sources. Note: assuming no redemptions.
Copyright and disclaimer

Copyright
© Bloomberg Finance L.P. 2022. This publication is the copyright of Bloomberg Finance L.P. in connection with BloombergNEF. No portion of this document may be photocopied, reproduced, scanned into an electronic system or transmitted, forwarded or distributed in any way without prior consent of BloombergNEF.

Disclaimer
The BloombergNEF ("BNEF"), service/information is derived from selected public sources. Bloomberg Finance L.P. and its affiliates, in providing the service/information, believe that the information it uses comes from reliable sources, but do not guarantee the accuracy or completeness of this information, which is subject to change without notice, and nothing in this document shall be construed as such a guarantee. The statements in this service/document reflect the current judgment of the authors of the relevant articles or features, and do not necessarily reflect the opinion of Bloomberg Finance L.P., Bloomberg L.P. or any of their affiliates ("Bloomberg"). Bloomberg disclaims any liability arising from use of this document, its contents and/or this service. Nothing herein shall constitute or be construed as an offering of financial instruments or as investment advice or recommendations by Bloomberg of an investment or other strategy (e.g., whether or not to "buy", "sell", or "hold" an investment). The information available through this service is not based on consideration of a subscriber’s individual circumstances and should not be considered as information sufficient upon which to base an investment decision. You should determine on your own whether you agree with the content. This service should not be construed as tax or accounting advice or as a service designed to facilitate any subscriber’s compliance with its tax, accounting or other legal obligations. Employees involved in this service may hold positions in the companies mentioned in the services/information.

The data included in these materials are for illustrative purposes only. The BLOOMBERG TERMINAL service and Bloomberg data products (the “Services”) are owned and distributed by Bloomberg Finance L.P. ("BFLP") except (i) in Argentina, Australia and certain jurisdictions in the Pacific islands, Bermuda, China, India, Japan, Korea and New Zealand, where Bloomberg L.P. and its subsidiaries (“BLP”) distribute these products, and (ii) in Singapore and the jurisdictions serviced by Bloomberg’s Singapore office, where a subsidiary of BFLP distributes these products. BLP provides BFLP and its subsidiaries with global marketing and operational support and service. Certain features, functions, products and services are available only to sophisticated investors and only where permitted. BFLP, BLP and their affiliates do not guarantee the accuracy of prices or other information in the Services. Nothing in the Services shall constitute or be construed as an offering of financial instruments by BFLP, BLP or their affiliates, or as investment advice or recommendations by BFLP, BLP or their affiliates of an investment strategy or whether or not to “buy”, “sell” or “hold” an investment. Information available via the Services should not be considered as information sufficient upon which to base an investment decision. The following are trademarks and service marks of BFLP, a Delaware limited partnership, or its subsidiaries: BLOOMBERG, BLOOMBERG ANYWHERE, BLOOMBERG MARKETS, BLOOMBERG NEWS, BLOOMBERG PROFESSIONAL, BLOOMBERG TERMINAL and BLOOMBERG.COM. Absence of any trademark or service mark from this list does not waive Bloomberg’s intellectual property rights in that name, mark or logo. All rights reserved. © 2022 Bloomberg.
Energy transition investment trends

Albert Cheung
Divya Sehgal
Camilla Ivory Brown

Climate-tech corporate finance

Claire Curry
Sarrah Raza

Sectoral and thematic contributions

Kwasi Ampofo (battery materials)
Meredith Annex (heat)
Julia Attwood (sustainable materials)
Corey Cantor (electrified transport)
Ryan Fisher (electrified transport)
Chris Gadomski (nuclear)
Kyle Harrison (sustainable finance)
Luxi Hong (oil & gas)
Matthias Kimmel (net zero)
David Lluis Madrid (carbon capture & storage)
Siyi Mi (electrified transport)
Aleksandra O’Donovan (electrified transport)
Mallory Rutigliano (sustainable finance)
Yayoi Sekine (energy storage)
Nikolas Soulopoulos (electrified transport)
Martin Tengler (hydrogen)
BloombergNEF (BNEF) is a leading provider of primary research on clean energy, advanced transport, digital industry, innovative materials, and commodities.

BNEF’s global team leverages the world’s most sophisticated data sets to create clear perspectives and in-depth forecasts that frame the financial, economic and policy implications of industry-transforming trends and technologies.

BNEF research and analysis is accessible via web and mobile platforms, as well as on the Bloomberg Terminal.

Coverage.
Clean energy
Advanced transport
Commodities
Digital industry

Client enquiries:
Bloomberg Terminal: press <Help> key twice
Email: support.bnef@bloomberg.net

Learn more:
about.bnef.com | @BloombergNEF