

RENEWABLES 2022 GLOBAL STATUS REPORT

MASTER SLIDE DECK



REN21 Secretariat

secretariat@ren21.net





DRIVING THE SHIFT TO RENEWABLES – NOW!

The only **global community** of renewable energy actors from science, academia, NGOs, governments, and industry.

Our more than **3,000** community members co-operate collecting information, changing norms and debating.



We build upon a decentralised intelligence, ensuring high responsiveness to an ever-changing environment.

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CROWD-SOURCED ANNUAL REPORTING SINCE 2005

THE REPORT FEATURES:

- Global Overview
- Policy Landscape
- Market and Industry Trends
- Distributed Renewables for Energy Access
- Investment Flows
- Renewable-Based Energy Systems
- Renewables in Cities





A DIVERSITY OF BENEFITS

ECONOMICS, GEOPOLITICS AND SECURITY IN FOCUS

Clean air and a healthy environment

Climate change mitigation and adaptation

Reducing expenses and managing costs

Economic development

Industrialisation and innovation



Poverty alleviation and improved energy access



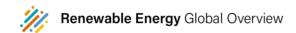
Stable and secure energy supply

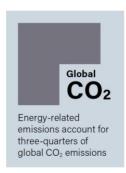
Energy security and sovereignty

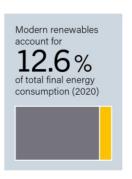


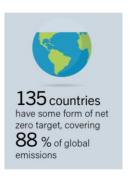
GLOBAL OVERVIEW

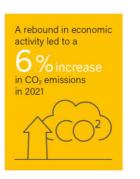
DEEP STRUCTURAL TRANSFORMATIONS ARE NEEDED

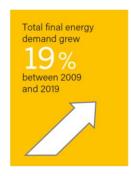


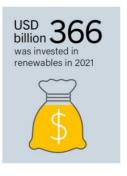


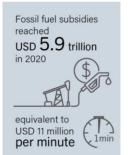


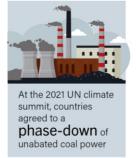












Renewable energy represented 28.3% of the global electricity mix in 2021, with solar and wind power providing more than 10% of the world's electricity for the first time ever.

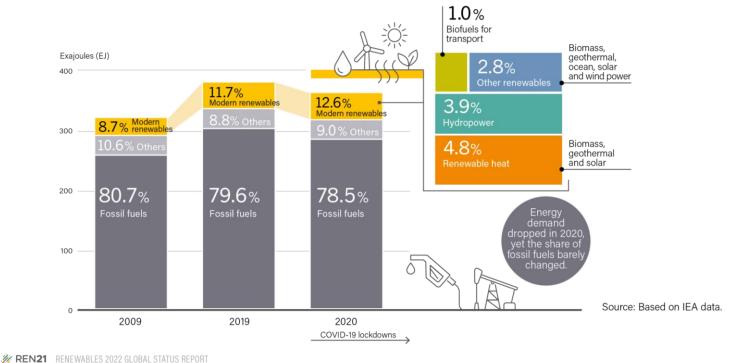
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THE ENERGY TRANSITION IS NOT HAPPENING

DEEP STRUCTURAL TRANSFORMATIONS ARE NEEDED





The numbers of 2020 reflect the impacts of the pandemic on energy demand. They clearly show that the interplay of energy demand reduction and renewables development works

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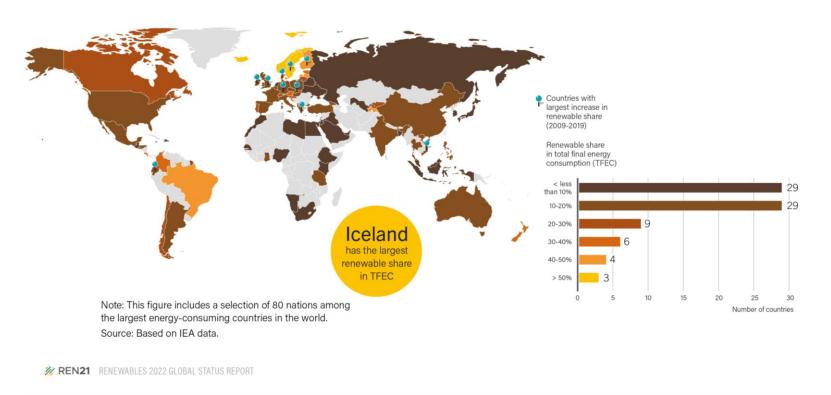


RENEWABLES UPTAKE UNEVEN ACROSS COUNTRIES

REAL NEED TO GROW



Renewable Energy Shares in Total Final Energy Consumption for Selected Countries, 2019



Only 3 countries have a renewable energy share in total final energy consumption above 50%.



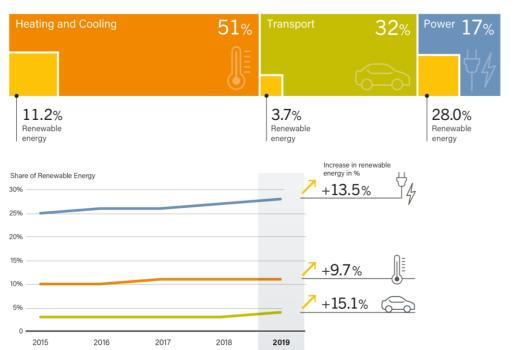
ENERGY, MORE THAN ELECTRICITY

RENEWABLES UPTAKE UNEVEN ACCROSS SECTORS



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Renewable Energy in Total Final Energy Consumption, by Final Energy Use, 2019



Note: Data should not be compared with previous years because of revisions due to improved or adjusted methodology.

Source: Based on IEA data.

No exponential renewables uptake despite increasing attention on electrification of transport, heating, and renewables-based hydrogen.

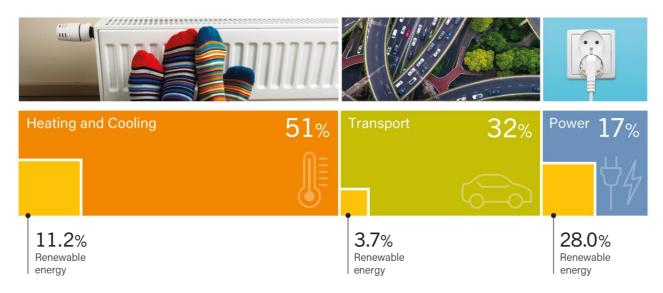


ENERGY, MORE THAN ELECTRICITY

RENEWABLES UPTAKE UNEVEN ACCROSS SECTORS



Renewable Energy in Total Final Energy Consumption, by Final Energy Use, 2019



Note: Data should not be compared with previous years because of revisions due to improved or adjusted methodology. Source: Based on IEA data.

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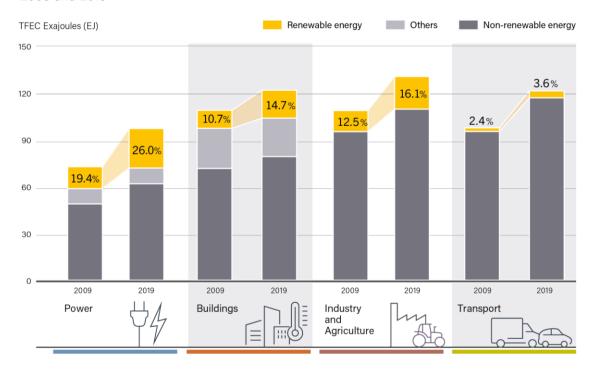
Most focus is on the power sector, but the greatest urgency is in heating and cooling and transport.



EVOLUTION OF RENEWABLE ENERGY SHARE

THE POWER SECTOR LEADS THE INCREASE IN RENEWABLES SHARE

Evolution of Renewable Energy Share in Total Final Energy Consumption, by Sector, 2009 and 2019



Renewables provided a slowly rising share of the energy use in all the sectors except in power with a growth of almost 7% points in the 2009-2019 period.

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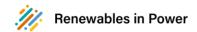
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Source: Based on IEA data

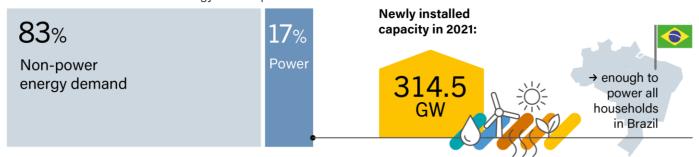


RECORD INCREASE IN RENEWABLE POWER CAPACITY

DESPITE SUPPLY CHAINS DISRUPTIONS AND GLOBAL RISE IN COMMODITY PRICES



Energy demand for power accounts for less than one-fifth of total final energy consumption



Renewable power capacity additions grew to 17% (314.5 GW) in 2021 led by solar PV and wind power.

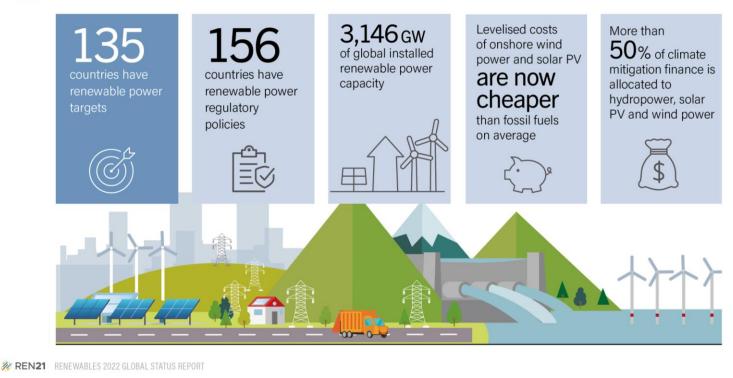
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RENEWABLES IN POWER RISING TRENDS

CONTINUED POLICY SUPPORT AND COST DECLINES



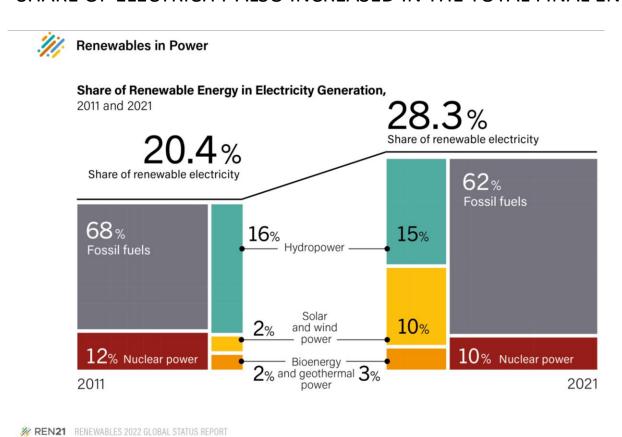


Rising energy consumption and a hike in fossil fuel use outpaced growth in renewables in 2021.



RENEWABLES IN POWER RISING TRENDS

SHARE OF ELECTRICITY ALSO INCREASED IN THE TOTAL FINAL ENERGY CONSUMPTION



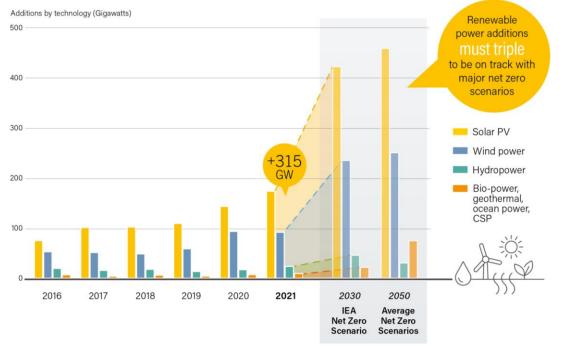
Renewable share of electricity generation increased by almost 8% points in the past decade.



RECORD ADDITIONS IN RENEWABLE POWER

LARGEST ADDITIONS IN SOLAR PV AND WIND

Annual Additions of Renewable Power Capacity, by Technology and Total, 2016-2021, and to Achieve Net Zero Scenarios for 2030 and 2050



Note: The Average Net Zero Scenarios comprises the average value between the values from 2050 coming from the IEA's Net Zero scenario and the World Energy Transitions Outlook scenario from IRENA. Record additions of **315 GW.**Growth in 2021 of **17%**. Electricity demand has grown by **6%**.

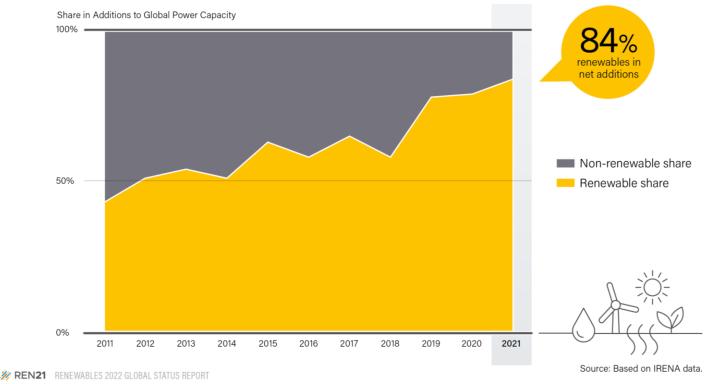
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MORE RENEWABLE POWER ADDED THAN FOSSIL FUEL & NUCLEAR

INCREASE IN NET RENEWABLE POWER ADDITIONS



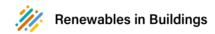


As the global energy markets rebounded, the share of renewables in net power additions continued to increase, reaching a record of 84%

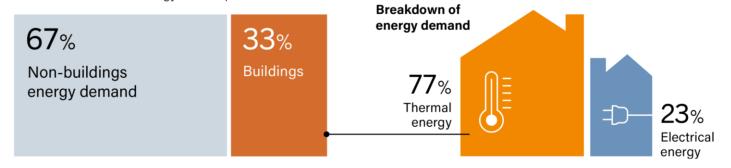


BUILDINGS ARE A MAJOR FINAL ENERGY CONSUMPTION SECTOR

ONE THIRD OF THE WORLD'S FINAL ENERGY IS USED IN BUILDINGS



Energy demand for buildings accounts for one-third of total final energy consumption



Increasing the uptake of renewables for thermal end-uses tends to be more challenging than increasing renewables uptake for electrical applications.

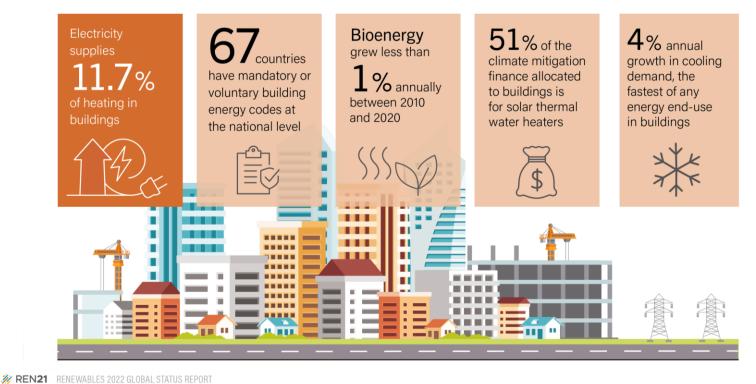
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RENEWABLE ENERGY IN BUILDINGS

MORE POLICY DEVELOPMENT REQUIRED





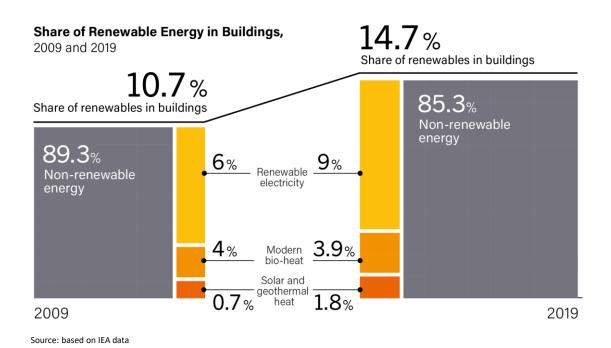
Renewables provide a slowly rising share of the energy use in buildings, with this growth driven mainly by renewable electricity.



RENEWABLES SHARE IN THE BUILDINGS SECTOR

RENEWABLES-BASED HEATING SYSTEMS ON THE UPSWING





Renewable electricity for heat generation in buildings has grown **5.3%** per year in a decade.

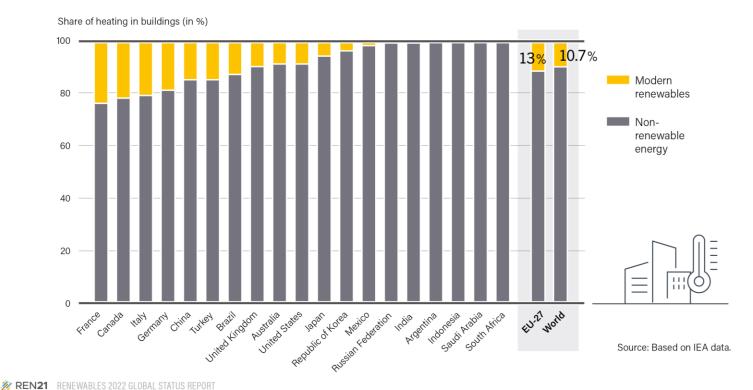
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RENEWABLE HEAT IN BUILDINGS UNEVEN

NATIONAL-LEVEL DATA SHOW VARYING SUCCESS IN PROVIDING RENEWABLE HEAT TO BUILDINGS





France is leading in the use of renewable heat in buildings with 24.1% followed by Germany with 19.5% in 2019.

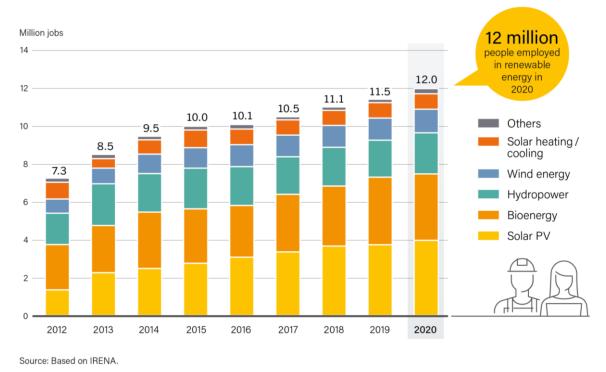
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JOBS IN RENEWABLE ENERGY

SOLAR PV LARGEST EMPLOYER AMONG ALL RENEWABLE ENERGY INDUSTRIES IN 2020





In 2020, solar PV created 4 million jobs, of which 2.3 million were in China – the leading country in solar PV job creation.

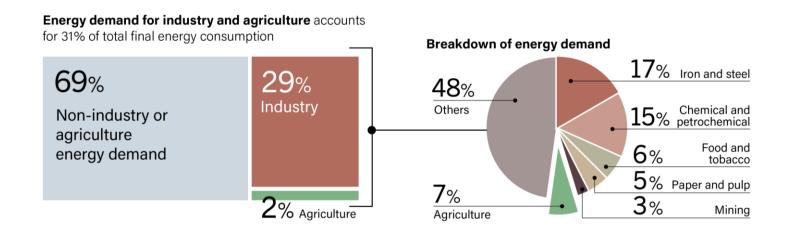
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RENEWABLE ENERGY IN INDUSTRY AND AGRICULTURE SECTORS

THE INDUSTRY SECTOR IS ONE OF THE LARGEST ENERGY USERS





Industry and Agriculture sectors account for a quarter of global GHG emissions.

Diverse energy needs where renewables have potential to replace fossil fuels.

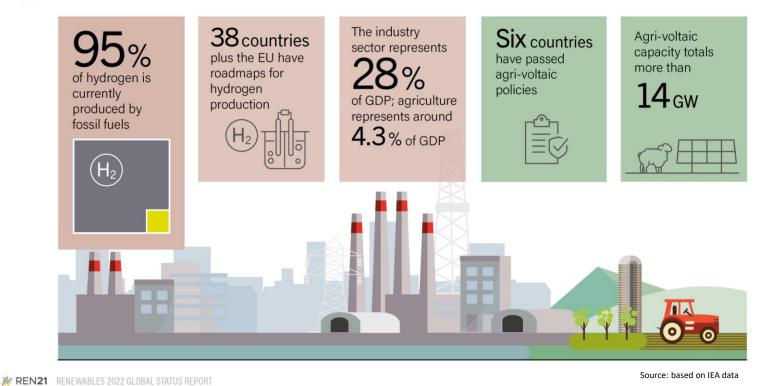
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RENEWABLE ENERGY IN INDUSTRY AND AGRICULTURE SECTORS

STRUCTURAL DEPENDENCE ON FOSSIL FUEL LIMITS THE SHIFT TO RENEWABLES IN INDUSTRY





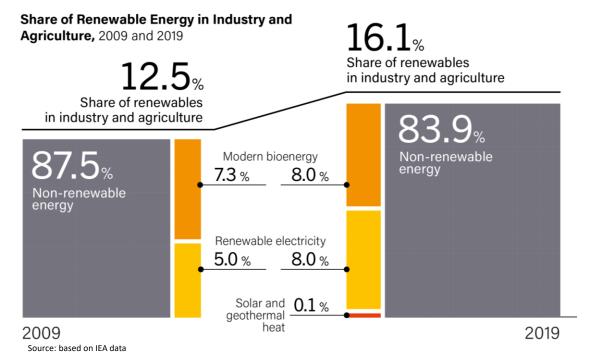
At least 10 governments and the EU have developed specific industry decarbonization roadmaps that include renewables.



SHARE OF RENEWABLE ENERGY IN INDUSTRY AND AGRICULTURE

ELECTRIFICATION OF INDUSTRIAL PROCESSES LEADS TO GROWING USE OF RENEWABLE ELECTRICITY





The share of electricity used in the industry and agriculture sectors increased from 24% in 2009 to 29% in 2019. Industrial heating with renewable electricity rose 80% in a decade.

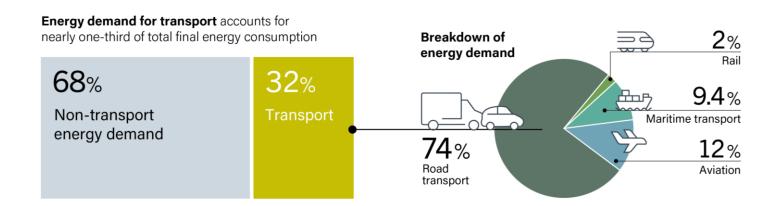
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ENERGY DEMAND IN TRANSPORT SECTOR

TRANSPORT ACCOUNTS FOR NEARLY ONE THIRD OF TOTAL FINAL ENERGY CONSUMPTION





As of 2019, **96.3**% of global transport energy needs were met by fossil fuels, **3.3**% biofuels, and **0.4**% by renewable electricity.

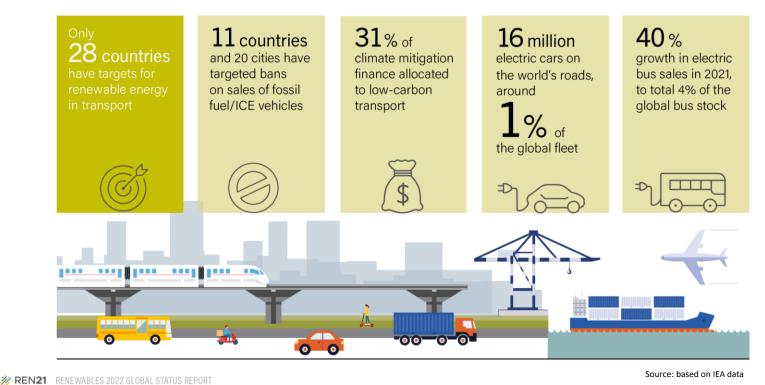
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RENEWABLE ENERGY IN TRANSPORT

MANY COUNTRIES LACK A HOLISTIC STRATEGY FOR DECARBONISING TRANSPORT



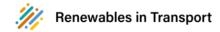


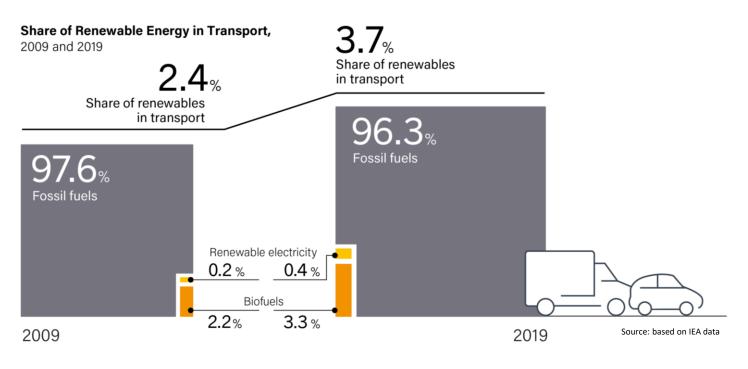
The lack of progress in the transport sector is particularly worrying as it accounts for nearly a third of global energy consumption.



TRANSPORT REMAINS THE SECTOR WITH LOWEST SHARE OF RENEWABLES

ENERGY DEMAND IN TRANSPORT RISES AS WELL AS THE USE OF RENEWABLES





Electric car sales tripled between 2019 and 2021.

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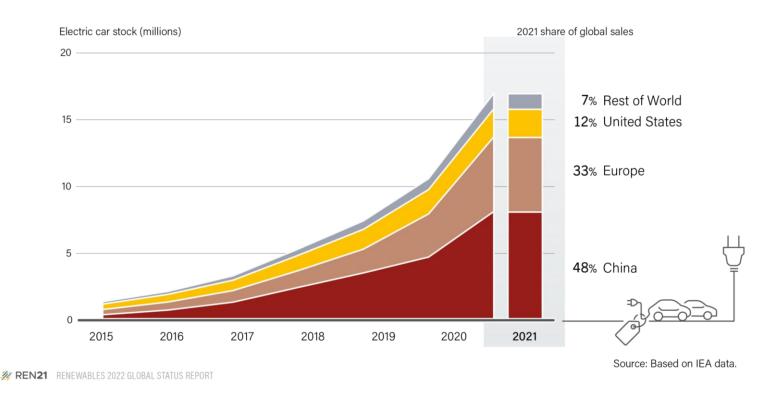


GROWTH IN ELECTRIC CAR SALES

ELECTRIFICATION HAS INCREASED ACROSS NEARLY ALL TRANSPORT MODES IN RECENT YEARS



Electric Car Global Stock, Top Countries and Rest of World, 2015-2021



Electric car sales reached **6.6 million** in 2021— more than **doubling** from 2022 and **tripling** from 2019.

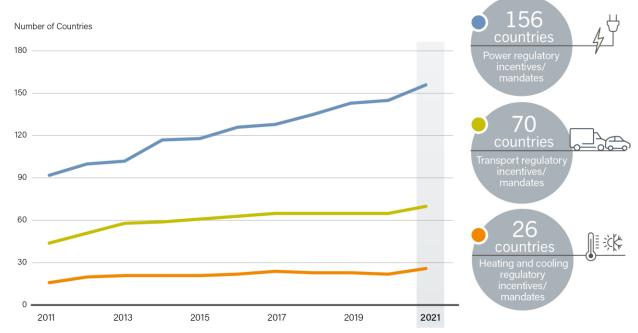


POLICY SUPPORT FOR RENEWABLES

POLICY SUPPORT FOR RENEWABLES IS NOT STRONG ENOUGH



Number of Countries with Renewable Energy Regulatory Policies, 2011-2021



Note: The figure does not show all policy types in use. For more information, see Reference Table R3 in the GSR 2022 Data Pack.

Source: REN21 Policy Database

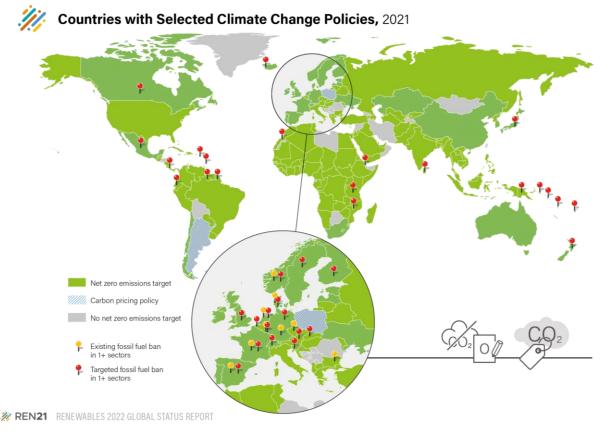
Policy support for renewables remained strong in 2021 but directed to the power sector.

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NET ZERO AMBITION INCREASING

COUNTRIES, STATES AND PROVINCES IMPLEMENTED ADDITIONAL CLIMATE CHANGE POLICY DURING 2021



Note: Carbon pricing policies include emission trading systems and carbon taxes. Net zero emissions targets shown include all levels of implementation (declaration/pledge, in discussion, in policy document, in law and achieved). Fossil fuel ban data include both targeted and existing bans across the power, transport and heating sectors. Jurisdictions marked with a flag have some type of fossil fuel ban in one or more sector. See GSR 2022 Data Pack for details. No cities with policies are shown; see Renewables in Cities chapter for more comprehensive city policies.

Source: Based on World Bank, Climate Watch, IEA Global Electric Vehicle Outlook and REN21 Policy Database. While commitments to decarbonisation have been gaining traction globally, this has not always led to the replacement of existing fossil fuels with renewable energy sources.

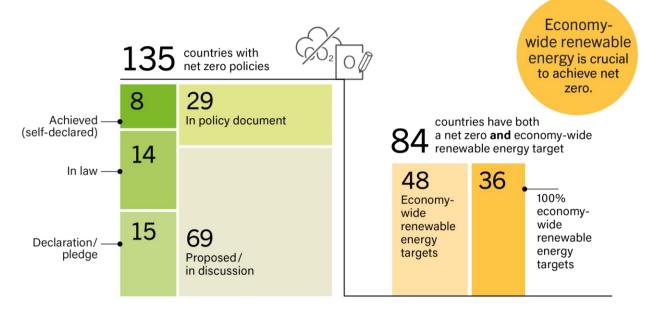


NET ZERO AMBITION INCREASING

DISCONNECT WITH ENERGY TRANSITION



National Net Zero Policies and Status of Implementation and Renewable Energy Targets, 2021



Note: Numbers exclude sub-national targets.

Source: Based on Climate Watch and REN21 Policy Database.

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Many net zero targets are not backed by specific legislation.

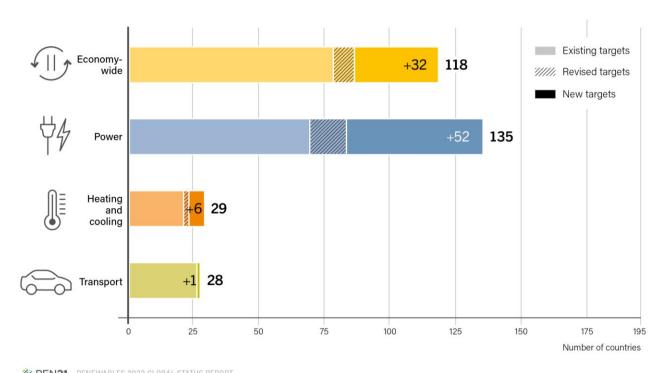
Over **40%** of countries have an economy-wide renewable energy target. Only **18%** have a 100% renewable energy target.



RENEWABLE ENERGY TARGETS BY SECTORS

TARGETS IN THE POWER SECTOR DOMINATE





Note: New targets were announced in 2021, revised targets can include a revised target date or a revision of the actual share of renewable energy for a future year. Transport target calculation excludes signatory countries to the Glasgow declaration calling on all new cars to be zero emission by 2040.

By the end of 2021, 166 countries had renewable energy targets at the national and subnational levels.

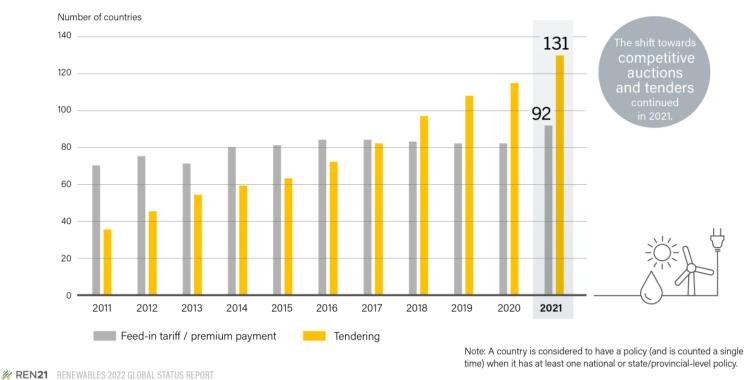
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THE RISE OF RENEWABLE POWER AUCTIONS CONTINUED

FEED-IN TARIFFS AND PREMIUMS MOST WIDELY USED POLICIES FOR RENEWABLE POWER

Renewable Energy Feed-in Tariffs and Tenders, 2010-2021



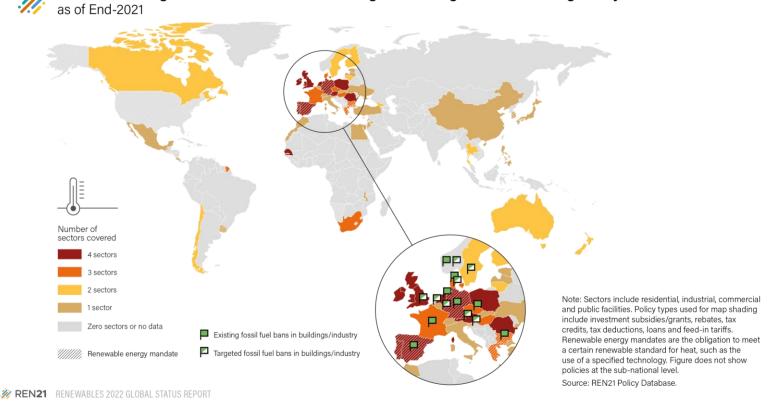
131 countries had used auctions or tendering as of end-2021, up from **116** countries in 2020.



RENEWABLE HEATING AND COOLING POLICY TRENDS

TARGETS AND FINANCIAL INCENTIVES MOST POPULAR FORMS OF SUPPORT FOR RENEWABLE HEATING



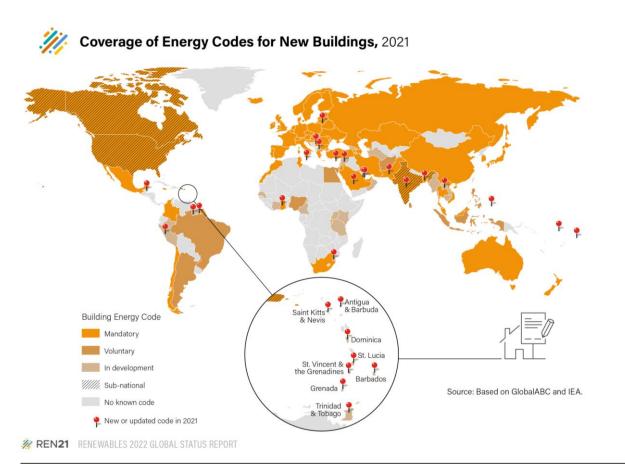


The supply of heat in buildings remains heavily dependent on fossil fuels, with renewable sources meeting only around 11% of global heat demand in 2020.



BUILDINGS ENERGY EFFICIENCY POLICY

BUILDING CODES NEEDED FOR LOW-ENERGY BUILDINGS

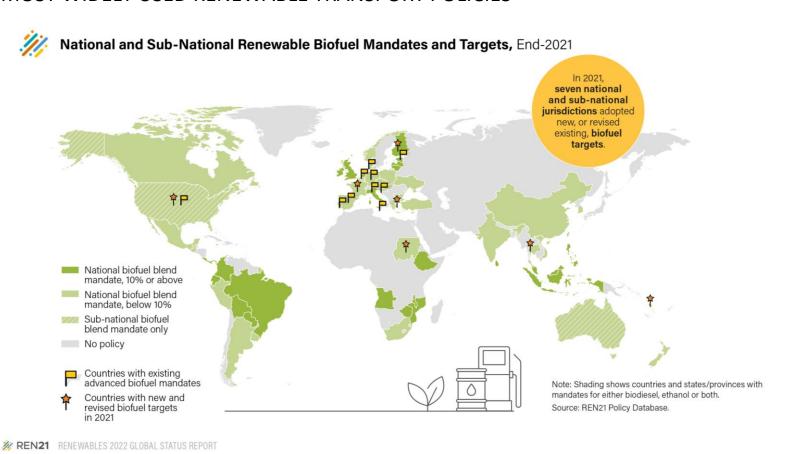


Not all energy efficiency policies support renewables but they can positively affect energy demand in buildings by mandating energy efficiency improvements.



BIOFUEL BLENDING MANDATES

MOST WIDELY USED RENEWABLE TRANSPORT POLICIES



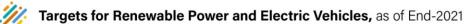
65 countries had national-level blending mandates; however, Argentina and Indonesia reduced existing requirements.

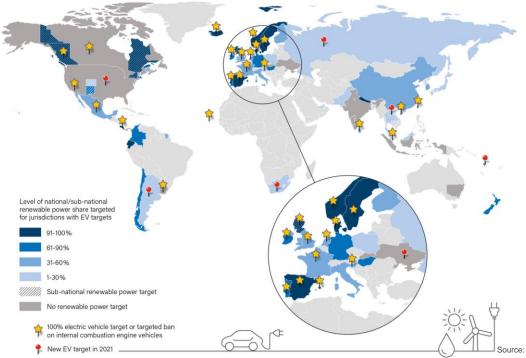
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RENEWABLE POWER AND ELECTRIC VEHICLES

POLICIES LACK A DIRECT LINK TO RENEWABLE ELECTRICITY





Note: All colour-coded areas of the map have electric vehicle targets or targeted bans on internal combustion engine vehicles.

EV = electric vehicle. Renewable power targets include only targets for a specific share of electricity generation by a future year. Where a jurisdiction has multiple targets, the highest target is shown. Nepal and Quebec show actual renewable power shares; both jurisdictions along with Iceland and Norway have already achieved nearly 100% renewable power. The European Union has a renewable target of 57% for all Member States. EV targets vary. In addition, over 100 cities have EV targets, see Renewables in

Source: REN21 Policy Database

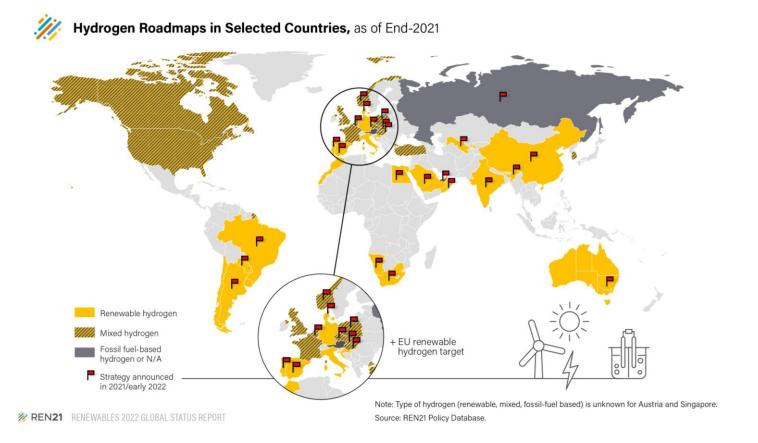
Only **9 countries** with electric vehicle targets also had a **100%** renewable power target.

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HYDROGEN AS AN ENERGY CARRIER

ITS PRODUCTION REMAINS FOSSIL-FUELS BASED



Several countries announced policies to support hydrogen in 2021, and at least 38 countries had a hydrogen roadmap or strategy in place.



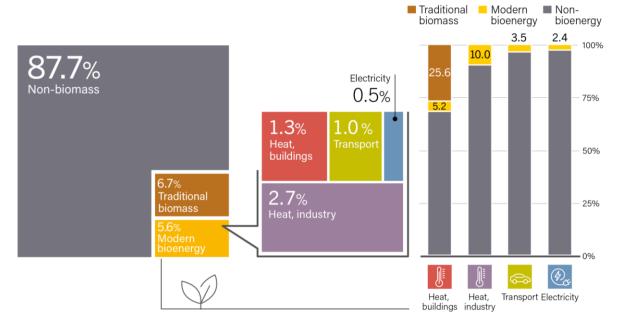
BIOENERGY IN RENEWABLE ENERGY SUPPLY

SUSTAINABLE BIOENERGY HELP TO PROMOTE ENERGY SECURITY AND PRICE STABILITY

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Estimated Shares of Bioenergy in Total Final Energy Consumption, Overall and by End-Use Sector, 2020



Note: Data should not be compared with previous years because of revisions due to adjusted data or methodology. Totals may not add up due to rounding. Buildings and industry categories include bioenergy supplied by district energy networks. Source: Based on IEA data.

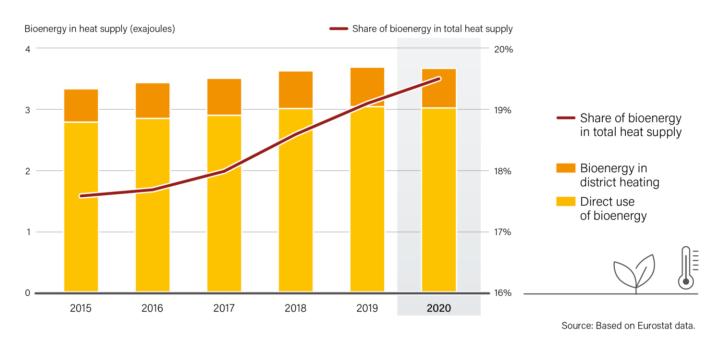
The traditional use of bioenergy – which involves burning biomass in simple and inefficient fires or stoves – has fallen 8% since 2011.



EU-27 SUPPORTS BIOENERGY USE IN HEATING

UPTAKE OF BIOENERGY IN HEATING DRIVEN BY THE EU RENEWABLE ENERGY DIRECTIVE (RED)





Between 2015-2020, the use of **bio-heat** in **EU-27** grew **10**%, the direct use of biomass for heat rose **8**%, while bioenergy in district heating system rose **18**%.

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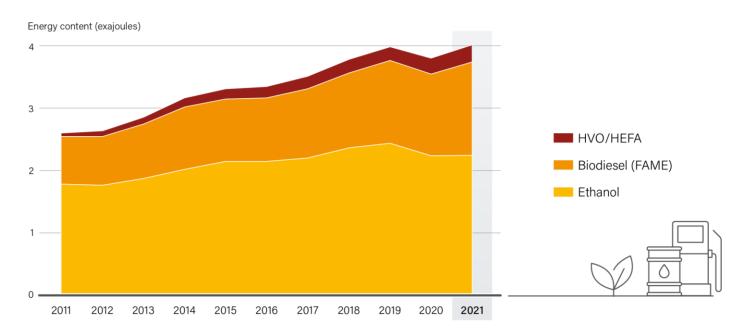


BIOFUEL PRODUCTION INCREASED

GLOBAL PRODUCTION OF BIODIESEL NEARLY DOUBLED BETWEEN 2011 AND 2021



Global Production of Ethanol, Biodiesel and HVO/HEFA Fuel, by Energy Content, 2011-2021



Between 2011 and 2021, the production of transport biofuels grew 56% (in energy terms), from 2.6 EJ to 4.1 EJ.

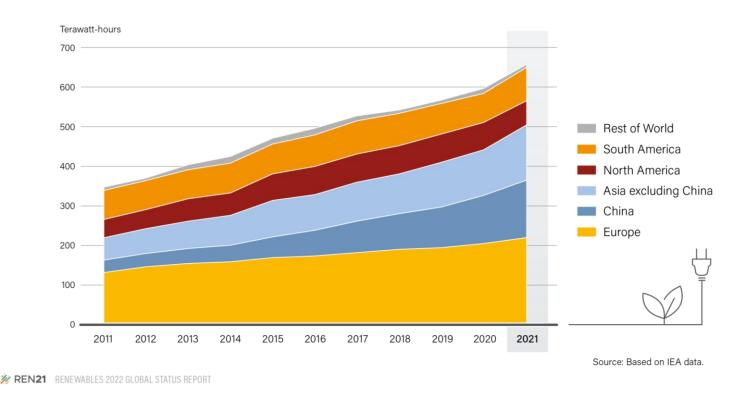
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BIOELECTRICITY PRODUCTION GROWING RAPIDLY

GLOBAL BIO-POWER CAPACITY AND GENERATION BOTH INCREASED SIGNIFICANTLY DURING 2011-2021



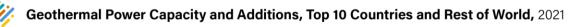


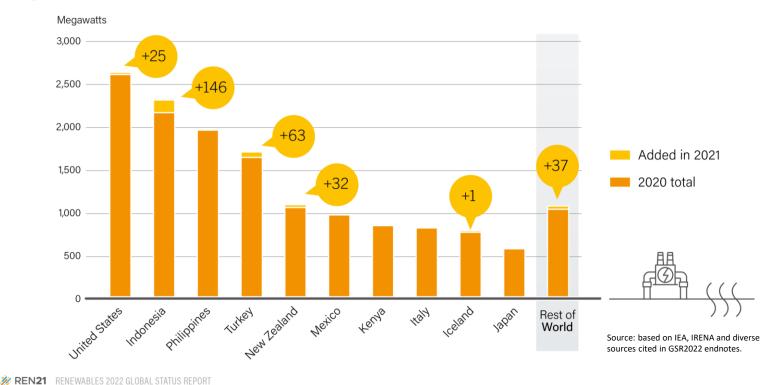
Bioelectricity generation increased **88%** to 656 terawatt-hours, with the majority of gains in China.



NEW GEOTHERMAL POWER INSTALLATIONS IN 2021

THE GLOBAL DISTRIBUTION OF GEOTHERMAL ENERGY USE FOR HEATING REMAINS UNEVEN AND SPARSE





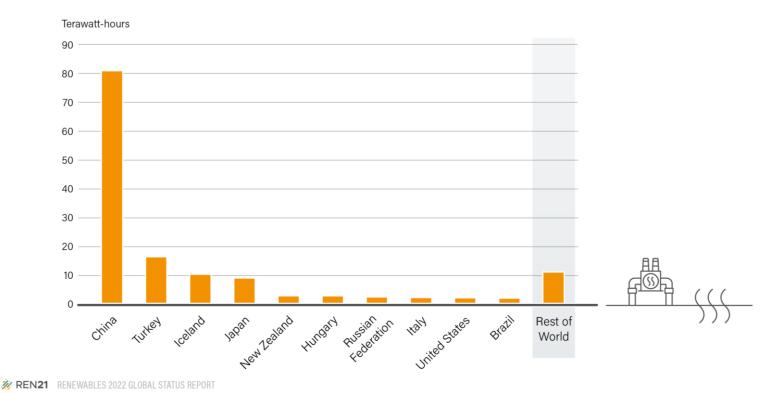
With over **146 MW** of added geothermal power capacity, **Indonesia** was leading the geothermal market in 2021.



GEOTHERMAL DIRECT USE

DIRECT EXTRACTION OF GEOTHERMAL ENERGY FOR THERMAL APPLICATIONS





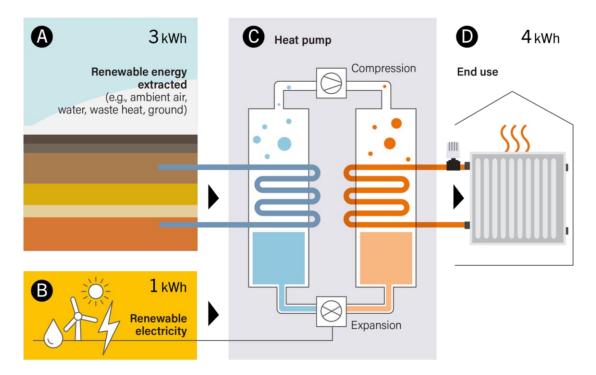
The capacity for geothermal direct use totalled an estimated 35 gigawatts-thermal (GWth) in 2021.



HEAT PUMPS OPERATIONAL PRINCIPLES

EXTRACTING HEAT FROM AN AMBIENT HEAT SOURCE

Example of a Heat Pump with a Co-efficient of Performance of 4



Heat pumps met only around 7% of the global heating demand in residential buildings. Fossil fuel-powered heaters and water heaters still accounted for around half of the heating equipment sold.

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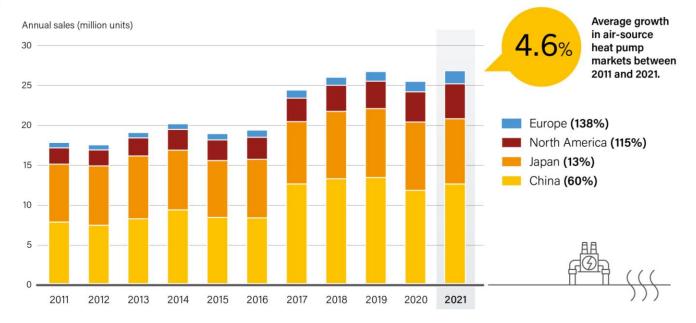


HEAT PUMPS SALES, A MAJOR GROWTH IN EUROPEAN COUNTRIES

GLOBALLY, AIR-SOURCE HEAT PUMPS CONTINUE TO DOMINATE THE MARKET

Air-Source Heat Pump Annual Sales, Selected Markets, 2011-2021

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Source: China total from ChinaIOL. Europe total from EHPA. Note: For China, data for 2011-2013 do not include air-water heat pumps.

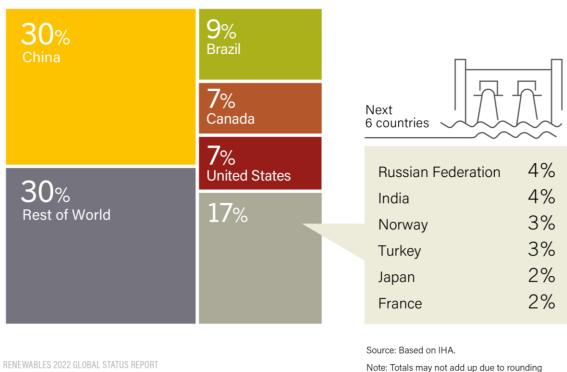
In 2021, most countries in Europe offered some type of fiscal or financial support to incentivise the purchase of heat pumps.



HYDROPOWER CAPACITY INCREASED, GENERATION SLIGHTLY DECREASED

CLIMATE CHANGE EFFECT IMPACTING GENERATION

Hydropower Global Capacity, Shares of Top 10 Countries and Rest of World, 2021



An estimated **26 GW** of hydropower was added in 2021, representing a total of 1197 GW in 2021. However, hydropower generation fell **3.5%** in 2021.

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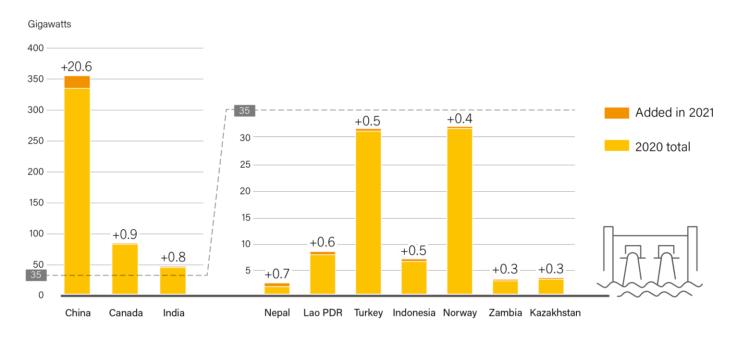


HYDROPOWER CAPACITY ADDITIONS

CHINA MAINTAINED THE LEAD IN COMMISSIONING NEW HYDROPOWER CAPACITY IN 2021



Hydropower Global Capacity and Additions, Shares of Top 10 Countries, 2021



With over **20.6 GW** hydropower global capacity, **China** was leading the market in 2021.

Source: Based on IHA.

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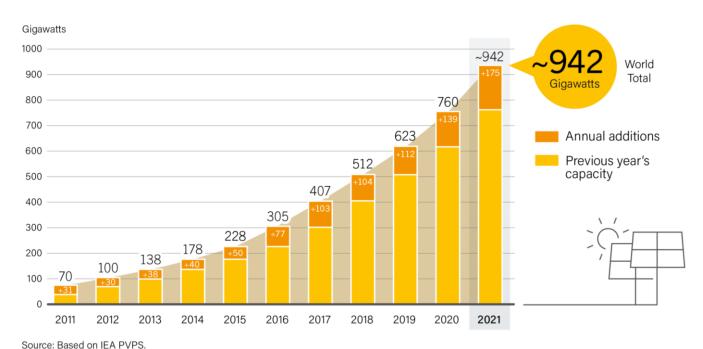


SOLAR PHOTOVOLTAIC CAPACITY ADDITIONS

THE MARKET CONTINUED ITS STEADY GROWTH DESPITE SUPPLY CHAIN DISRUPTIONS



Solar PV Global Capacity and Annual Additions, 2011-2021



Solar PV market installed a capacity of **175 GW** in 2021 – high record, brought the cumulative global solar PV capacity to **942 GW**.

Source, based of IEA F VFS

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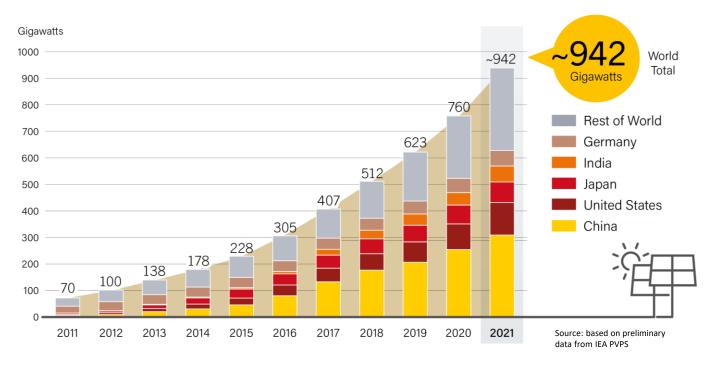


INCREASE IN SOLAR PV CAPACITY DOMINATED BY ASIA

ASIA'S NEW SOLAR PV INSTALLATIONS REPRESENTED 52% OF THE GLOBAL ADDED CAPACITY IN 2021.

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Solar PV Global Capacity, by Country and Region, 2011-2021



By the end of 2021, at least seven countries had enough capacity installed to meet at least 10% of their electricity demand from solar PV, up from only two countries in 2020.

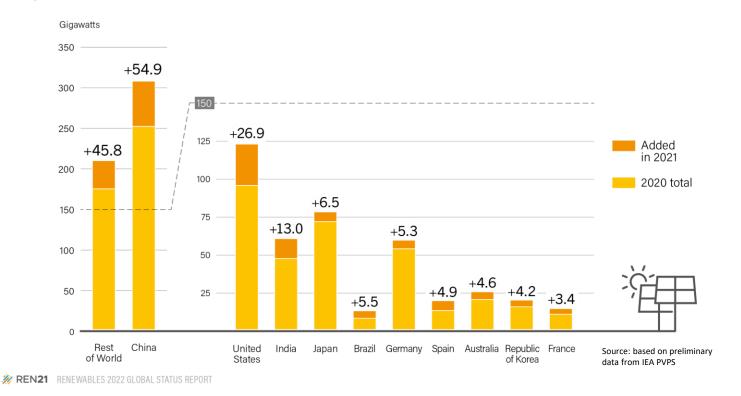
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SOLAR PV CAPACITY ADDITIONS IN 2021

CHINA LEADING SOLAR PV CAPACITY ADDITIONS





Over 54.9 GW of Solar PV capacity was added by China in 2021, more than the capacity added in the rest of the world.

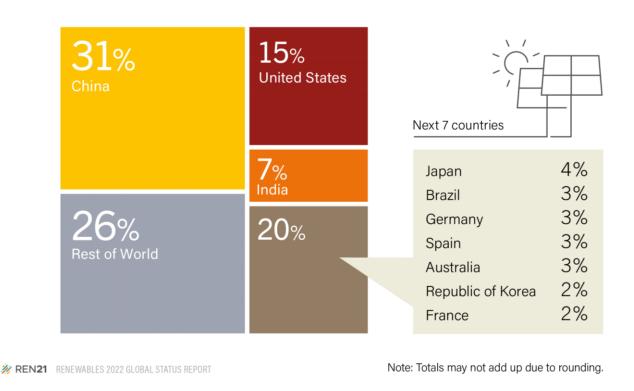


SOLAR PV CAPACITY ADDITIONS IN 2021

MORE PLAYERS ENTERED THE MARKET IN RESPONSE TO DECLINING CAPITAL AND OPERATIONAL COSTS



Solar PV Global Capacity Additions, Shares of Top 10 Countries and Rest of World, 2021



Europe followed the Americas for new additions in 2021, adding around **28 GW** for a year-end total of **191 GW**.

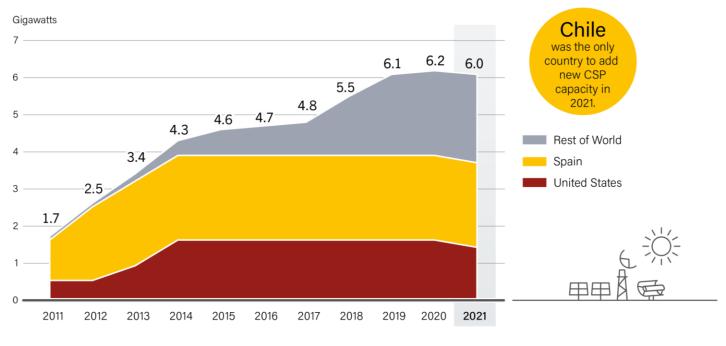


CONCENTRATING SOLAR THERMAL POWER (CSP) DECLINED IN 2021

HISTORICALLY LEADING MARKETS, SPAIN AND USA, HAVE NOT ADDED NEW CAPACITY SINCE 2015



Concentrating Solar Thermal Power Global Capacity, by Country and Region, 2006-2021



CSP market growth declined in 2021 due to the decommissioning of nearly 300 MW in the United States.

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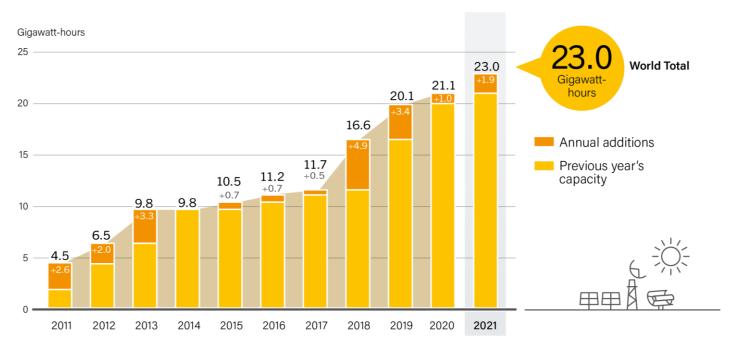


THERMAL ENERGY STORAGE (TES) MAINLY INSTALLED ALONGSIDE CSP

TES REPRESENTS NEARLY 40% OF THE GLOBAL ENERGY STORAGE CAPACITY, EXCLUDING PUMPED HYDROPOWER



Thermal Energy Storage Global Capacity and Additions, 2011-2021



By the end of 2021, an estimated 23 GWh of thermal energy storage was operating in conjunction with concentrating solar power (CSP) plants across five continents.

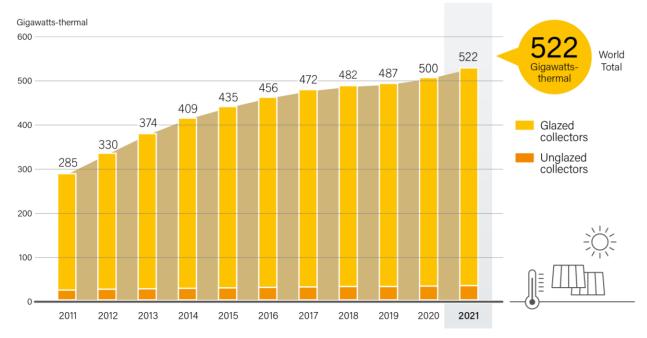
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SOLAR WATER HEATING INSTALLED CAPACITY INCREASED

TRANSITION FROM SMALL RESIDENTIAL SOLAR SYSTEMS TO LARGE CENTRAL PROCUREMENT OFFERS

Solar Water Heating Collectors Global Capacity, 2011-2021



Source: Based on IEA SHC.

Note: Data are for glazed and unglazed solar water collectors and do not include concentrating, air or hybrid collectors.

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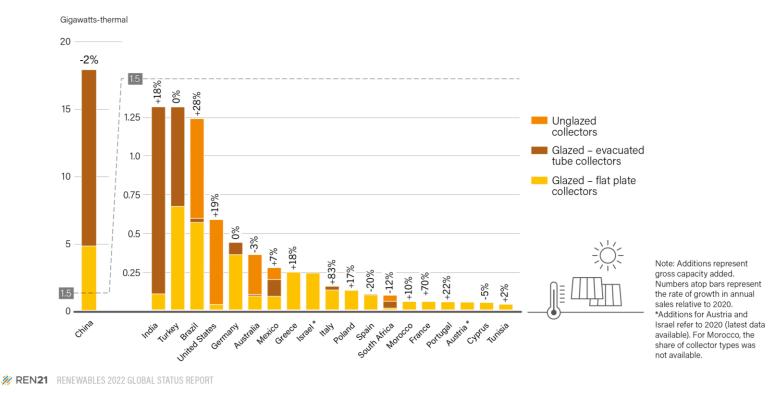
Global operating solar thermal capacity increased from 500 GW thermal to 522 GW thermal in 2021.



CHINA DOMINATED SOLAR WATER HEATING COLLECTOR ADDITIONS

PUSHED BY TARGETED HEATING POLICIES REPLACING COAL BOILERS





In 2021, the seven largest **Chinese** producers of flat plate collectors increased their combined sales volumes by **11%**.

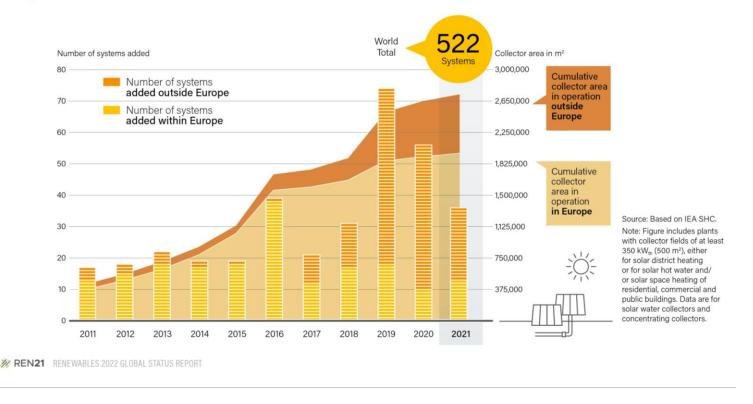


LARGE INCREASE IN SOLAR DISTRICT HEATING SYSTEMS

DESPITE MINIMAL ADDITIONS, DENMARK REMAINED THE LEADER IN SOLAR DISTRICT HEATING CAPACITY



Large Solar Heat Plants, Global Annual Additions and Total Area in Operation, 2011-2021



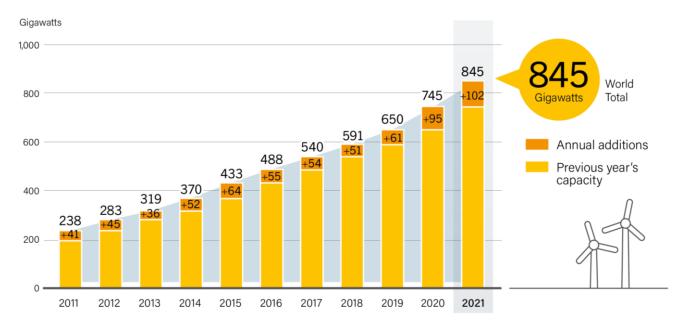
The top markets for solar industrial heat in 2021 were Mexico, the Netherlands and Austria.



WIND POWER CAPACITY ADDITION RECORD CONTINUES

NEARLY EVERY REGION SAW RECORD ANNUAL ADDITIONS IN 2021

Wind Power Global Capacity and Annual Additions, 2011-2021



Source: Based on GWEC.

Note: Totals may not add up due to rounding. Additions in 2021 are gross, but bar heights and numbers above bars reflect year-end totals.

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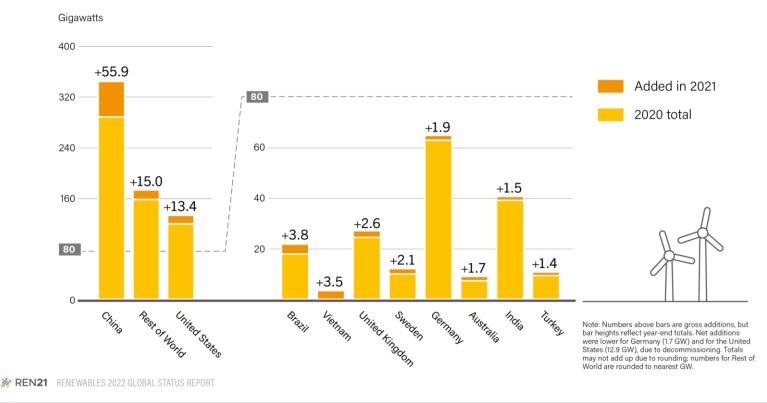
Wind power capacity in operation contributed an estimated 7% of total electricity generation in 2021.



MORE THAN HALF OF NEW WIND POWER CAPACITY IN ASIA

CHINESE TURBINE MANUFACTURERS ACCOUNT FOR AROUND HALF OF GLOBAL MANUFACTURING





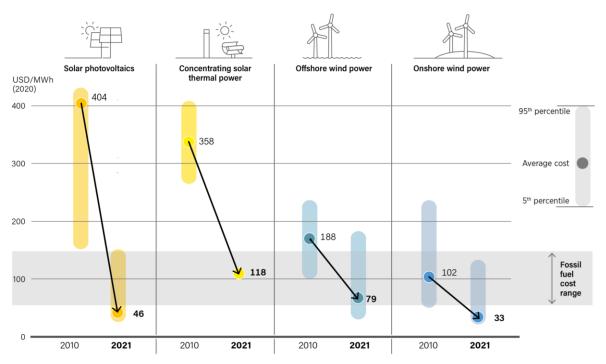
Unchanged since 2014, the list of the 10 leading countries for cumulative capacity changed in 2021 as Sweden was added and Italy dropped off.



RENEWABLE ENERGY COSTS

LEAST-COST OPTION FOR NEW POWER GENERATION GLOBALLY

Global Weighted-Average LCOEs from Newly Commissioned,
Utility-scale Renewable Power Generation Technologies, 2010-2021



Note: These data are for the year of commissioning. The thick lines are the global weightedaverage LCOE value derived from the individual plants commissioned in each year. The LCOE is calculated with project-specific installed costs and capacity factors, while the other assumptions are detailed in the Power Generation Costs 2021 report from IRENA. The single band represents the fossil fuel-fired power generation cost range, while the bands for each technology and year represent the 5th and 95th percentile bands for renewable projects. No price range available for CSP. In 2021 there was only one CSP plant comissioned, as many projects have been delayed. Source: IRENA Renewable Cost Database.

Global weighted-average LCOE of newly commissioned utility-scale solar PV projects falling 89% between 2010 and 2021.

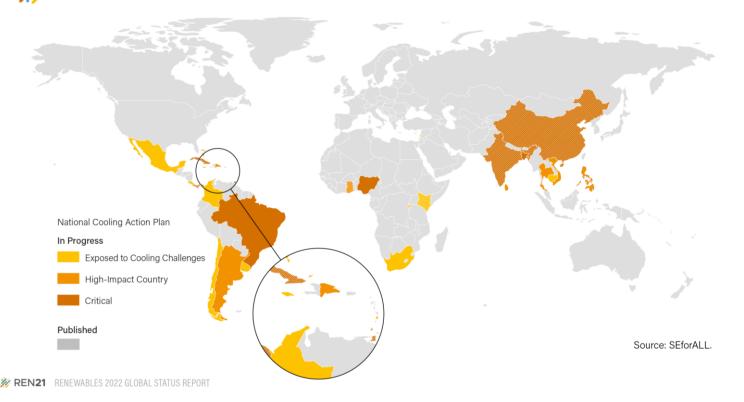
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ACCESS TO COOLING ACTION PLANS

LACK OF ACCESS TO COOLING IS IMPACTING AN ESTIMATED 1.1 BILLION PEOPLE

Countries Developing National Cooling Action Plans for Cooling Access, as of End-2021



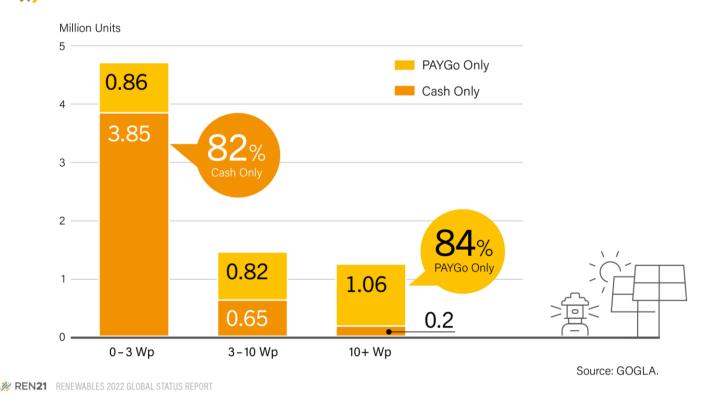
In Bangladesh, India and Nigeria, an estimated 40% of the total food produced is wasted due to inadequate refrigeration and storage.



OFF-GRID SOLAR PRODUCTS SHOW RECOVERY SIGNS

MORE THAN 100 MILLION PEOPLE BENEFIT FROM THESE PRODUCTS

Volume of Off-grid Solar Products Sold, by Size and Type of Sale, 2021



The majority of the solar home systems (84%) were sold under the PAYGo model, whereas most portable lanterns were sold as cash products.

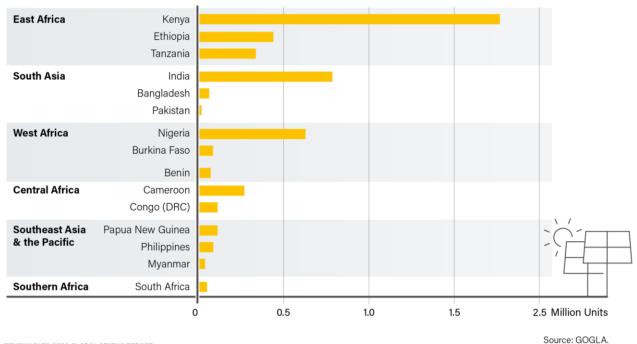


OFF-GRID MARKET DYNAMICS VARY ACROSS REGIONS AND COUNTRIES

EAST AFRICA LEAD THE MARKET GLOBALLY



Volume of Off-grid Solar Products Sold, PAYGo Only, Selected Countries, 2021



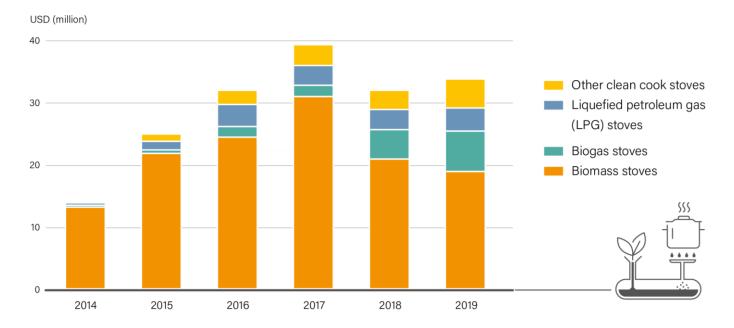
Nigeria recorded high sales (240,000 units) in 2021, with a significant increase in PAYGo sales.



CLEAN COOKSTOVES SALES INCREASED

NON-BIOMASS MODELS ACCOUNTED FOR A RECORD 42% OF THE CLEAN COOKSTOVES PURCHASED IN 2019





technologies available in the clean cooking sector reflects the diversity of customer types and is supported by a variety of business models.

The range of

Source: Clean Cooking Alliance.

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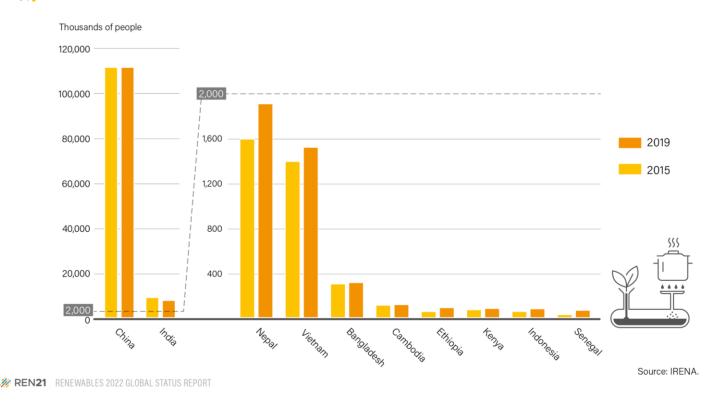


BIOGAS USE HAS GROWN STEADILY SINCE 2010

BIOGAS FOR COOKING FELL 18% IN INDIA OVER THE DECADE, WHEREAS IN CHINA IT WAS UP 4%



Number of People Using Biogas for Cooking, Top 10 Countries in Africa and Asia, 2015 and 2019



Technology use depends on the availability of locally sourced feedstock and processing facilities.

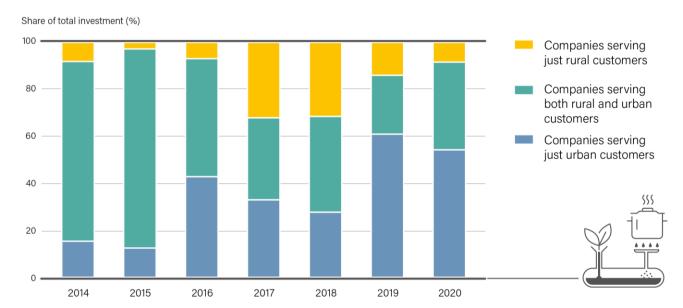


INVESTMENT BY CLEAN COOKING COMPANIES

AFFORDABILITY OF CLEAN COOKING APPLIANCES AND FUELS IS CRITICAL



Investment Raised by Clean Cooking Companies Based on Customer Location, 2014-2020



Note: The data rely on self-reporting by the companies and have been supplemented with publicly available investment data. The number of companies reporting has varied between 39 and 51 during the years 2014 to 2020.

Source: Clean Cooking Alliance.

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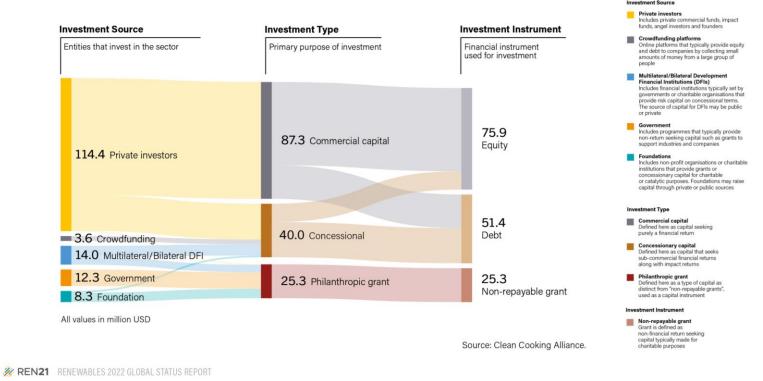
Member companies of the Clean Cooking Alliance that serve only urban consumers raised more capital than companies with rural customers.



A SHIFT IN CLEAN COOKING INVESTMENT

FINANCING IS SHIFTING FROM GRANTS TO CORPORATE EQUITY





80% of the capital raised during 2017-2019 came from private investors, while 20% came from multilateral finance institutions, development finance institutions and governments.

67

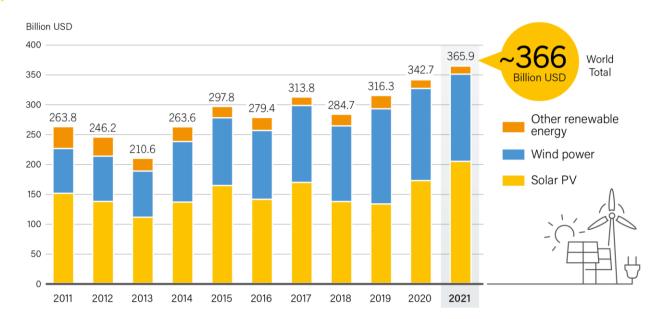


A DECADE OUTLOOK OF INVESTMENT IN RENEWABLE POWER

SOLAR PV THE ONLY RENEWABLE TECHNOLOGY WITH AN INCREASE IN INVESTMENT

111

Global Investment in Renewable Power and Fuels, 2011-2021



Note: Figure does not include investment in hydropower projects larger than 50 MW. BloombergNEF data for previous years have been revised since the publication of GSR 2021.

Source: Based on BloombergNEF.

Global new investment in renewable power and fuels reached an estimated USD 366 billion in 2021, a record high, despite impacts from COVID-19.

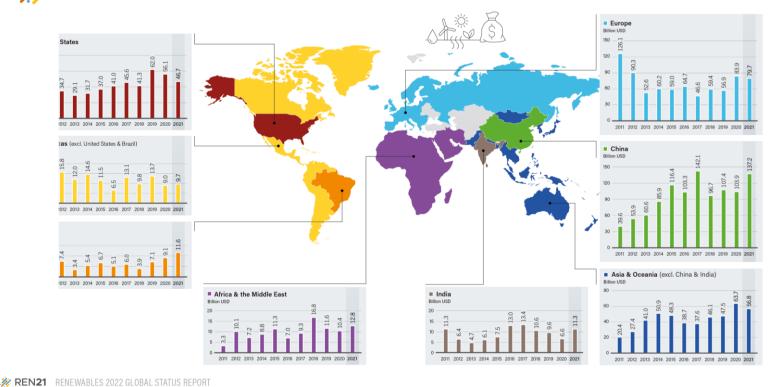
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A NEW RECORD IN GLOBAL INVESTMENT IN RENEWABLE POWER

GLOBAL INVESTMENT IN RENEWABLE POWER INCREASING

Global Investment in Renewable Power and Fuels, by Country and Region, 2011-2021

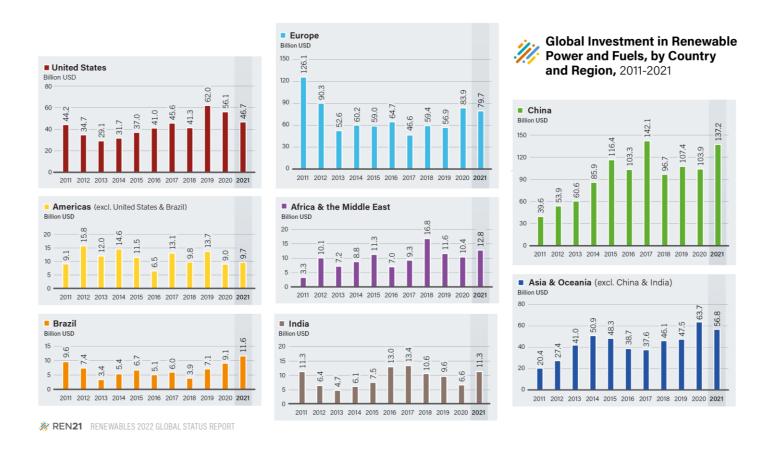


In 2021, China accounted for 37% of the share of global investment in renewable power and fuels.



A NEW RECORD IN GLOBAL INVESTMENT IN RENEWABLE POWER

INVESTMENT IN RENEWABLE POWER AND FUELS VARIED BY REGION



Since 2011, more than two-thirds of global investment in renewable power and fuels has been concentrated in China, Europe and the United States.

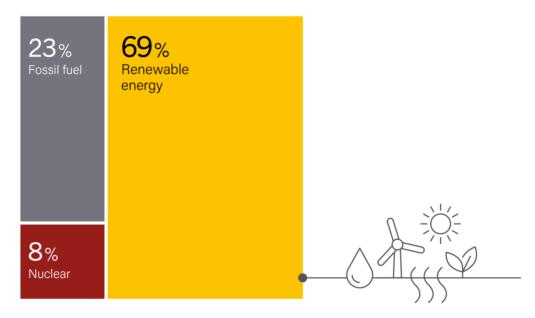


INVESTMENT IN NEW CAPACITY

NEW RENEWABLE POWER ATTRACTING FAR MORE INVESTMENT



Global Investment in New Power Capacity, by Type, 2021



Source: Based on IEA.

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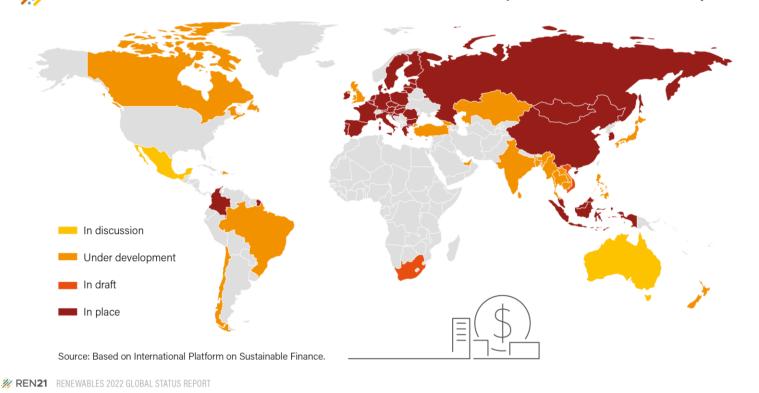
Between 2020 and 2021, the coal industry received as much investment as renewable power and fuels in 2021.



A LOOK ON WORLDWIDE SUSTAINABLE FINANCE TAXONOMIES

RAPID INCREASE SINCE THE PARIS AGREEMENT

Sustainable Finance Taxonomies Worldwide, in Place, Under Development and in Discussion, Early 2022



Seven countries and the EU have sustainable finance taxonomies in place.

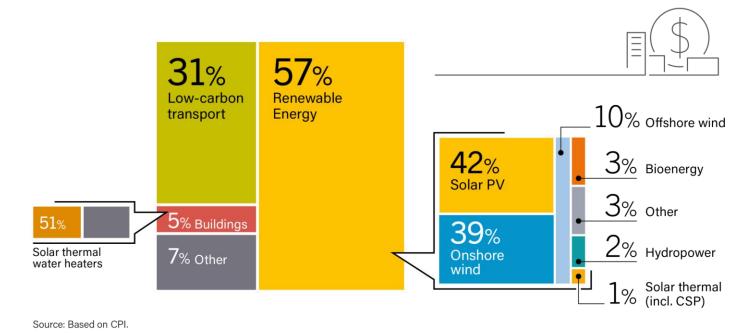


RENEWABLE FINANCING ATTRACTED ATTENTION

MOST MITIGATION FINANCE DEDICATED TO RENEWABLE ENERGY



Estimated Share of Mitigation Finance by Sector and Technology, 2019/2020



Mitigation finance is predominantly dedicated to solar PV and onshore wind power.

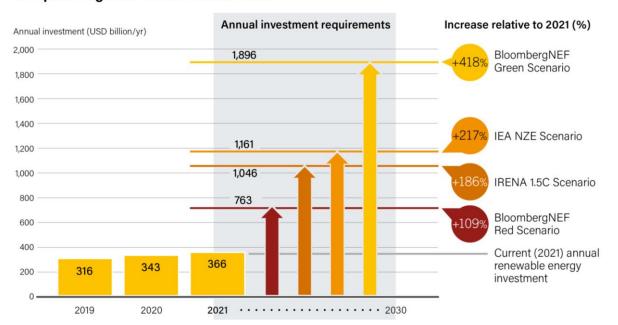
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INVESTMENT REQUIRED IS STILL FAR FROM WHAT WE NEED

SIGNIFICANT GROWTH NEEDED NOW

Range of Annual Renewable Energy Investment Needed in Climate Change Mitigation Scenarios **Compared Against Recent Investments**



Note: These scenarios quantify renewable energy differently than the BloombergNEF historical basis used in this chapter. The BloombergNEF scenario estimates here include only investment needed in wind power and solar PV, while the International Energy Agency and International Renewable Energy Agency estimates include only investment needed in renewable power technologies.

Source: Based on BloombergNEF and CPI.

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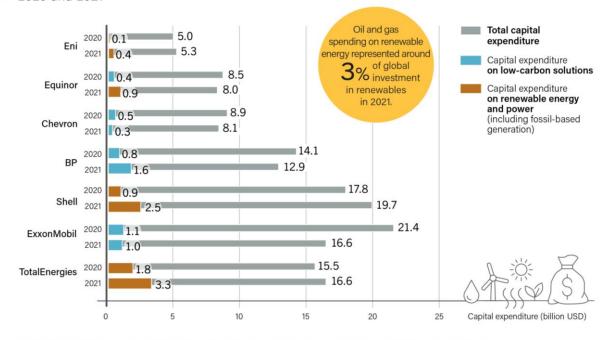
Investment needs to increase between 2-5 times to reach climate change mitigation scenarios.



OIL AND GAS INDUSTRY INVESTMENT

TIMID PARTICIPATION IN THE SHIFT TO RENEWABLES

Renewable Energy Spending as a Share of Total Capital Expenditure, Selected Oil and Gas Companies, 2020 and 2021



Note: Values cannot be compared to GSR 2021, data have been updated based on companies' annual reports and available data.

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Several companies plan to cut 40% of oil and gas production in the next 10 years.

However, some companies bet on carbon offsets to meet emission reduction goals.

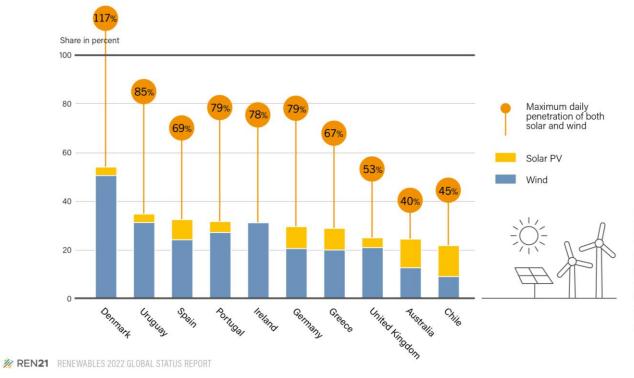


SHARE OF VARIABLE RENEWABLE ELECTRICITY GENERATION

ON AVERAGE THE DAILY MAXIMUM LEVEL OF VRE PENETRATION AND GENERATION EXCEEDED DEMAND



Top Countries for Share of Variable Renewable Electricity Generation, and Maximum Daily Penetration, 2021



Note: Figure shows countries among the top 10 according to the best available data at the time of publication. Several smaller countries with low total generation and/or high imports are excluded from this list.

Maximum penetration refers to the maximum daily share of production from variable renewable electricity divided by daily electrical load. Six countries relied on **100%** renewable electricity by the end of 2021.

The share of variable renewable energy sources in the global electricity mix increase to 10% for the first time in 2021.

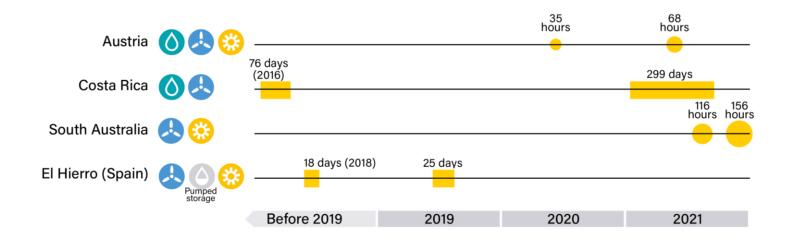


100% RENEWABLES IN THE POWER SECTOR

GRIDS, STORAGE, AND DEMAND-SIDE FLEXIBILITY ENABLE RELIABLE, AROUND-THE-CLOCK ENERGY SUPPLY



Longest Uninterrupted Stretch with 100%-plus Renewable Electricity, Selected Countries or Regions



South Australia, Scotland and Denmark – met more than 100% of their total electricity demand with wind and solar as of April 2022.

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100% RENEWABLES IN THE POWER SECTOR

GRIDS, STORAGE, AND DEMAND-SIDE FLEXIBILITY ENABLE RELIABLE AND AROUND-THE-CLOCK ENERGY SUPPLY



Longest Uninterrupted Stretch with 100%-plus Renewable Electricity, Selected Countries or Regions

				100%
	Population served	Technology	Year	Duration (7)
Quebec (Canada)	N 8 million	0	^{since} 2012	Continuously
Paraguay	7 million	()	^{since} 2019	Continuously
Norway	5 million	0 	^{since} 2019	Continuously
Uruguay	3.5 million			88% on an annual basis
Iceland	366,000	0 0		Continuously
Graciosa (Portugal)	†† 4000		2020	128 days
King Island (Tasmania)	** ~2,000		2015	33 hours
Taʻu (American Samoa)	† 790	* •	since 2016	Continuously
Eigg (Scotland)	† 87	0 	^{since} 2008	Continuously

Battery storage costs have **fallen 90%** since 2010.

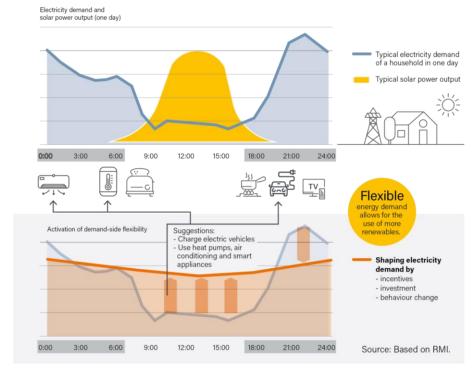
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ENERGY SOURCES DISTRIBUTION REQUIRES NEW ROLES

INTEGRATION OF RENEWABLES REQUIRES MAKING ENERGY DEMAND MORE FLEXIBLE

/// Illustration of Demand-side Flexibility at the Household Level



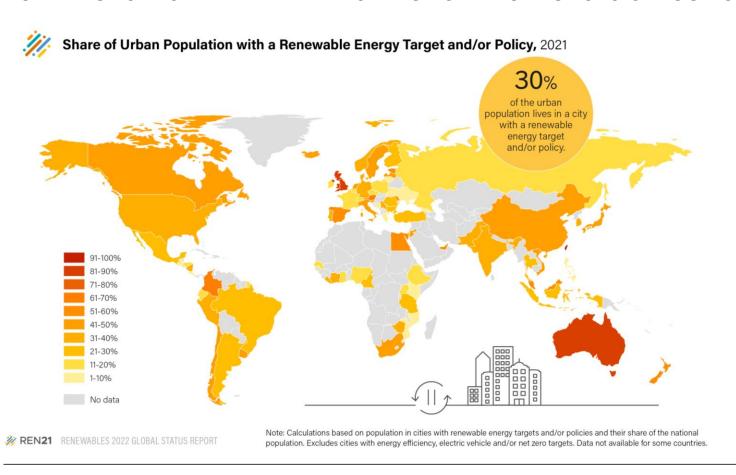
As of early 2022, more than **30 GW** of renewable energy capacity was connected within VPPs around the world, up from less than **100 MW** in 2012.

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HOPEFUL INTEGRATION OF RENEWABLES IN CITIES

NUMBER OF CITIES WITH RENEWABLES TARGETS AND OR POLICIES IS PROGRESSING



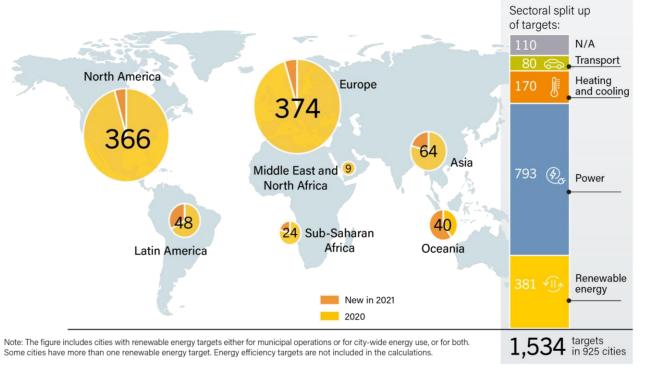
Cities are home to around 55% of the world's population.
Energy use in cities accounts for three-quarters of global final energy use.



CITY GOVERNMENTS SUPPORT RENEWABLES WORLDWIDE

DEVELOPMENTS VARY BY CITY AND DEPEND ON THE LOCAL CONTEXT

Number of Cities with Renewable Energy Targets, by Region and Sector, 2020 and 2021



More than 1,500 cities have a renewable energy target or policy in 2021, up from 1,300 in 2020.

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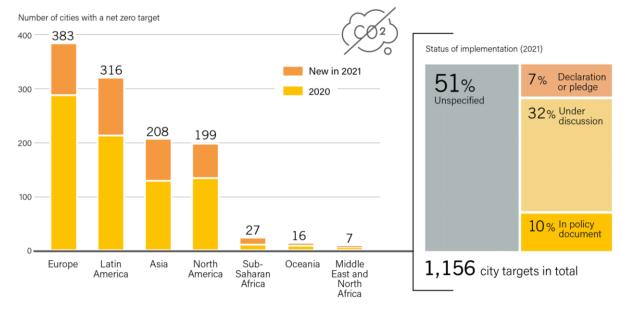


MOMENTUM TOWARDS NET ZERO EMISSION TARGETS IN CITIES

FEW CITY GOVERNMENTS ANCHOR THEIR NET ZERO PLEDGES IN POLICY DOCUMENTS



Cities with Net Zero Emission Targets and Status of Implementation, by Region, 2020 and 2021



Note: Calculations include the following: targets reported by the UNFCCC as either targets under discussion or in policy documents; emission reduction targets of 80% and more; net zero buildings targets; and other targets including climate neutrality and zero-carbon targets in buildings. Calculations exclude targets for 1.5°C, fossil-free targets and 100% energy self-sufficiency targets.

Source: Based on C40 Cities.

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Over **1,100 city** governments announced net zero targets.

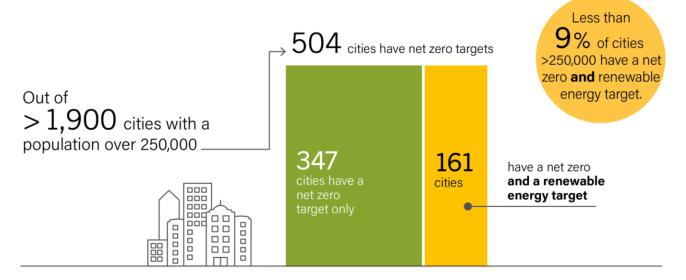


MASTER PLAN NEEDED TO ADDRESS THE NET ZERO EMISSIONS TARGETS

TARGETS CAN STIMULATE UPTAKE OF RENEWABLES

. Not Zoro Emission Towards and Denousehle Energy

Net Zero Emission Targets and Renewable Energy Targets in Cities with More Than 250,000 Inhabitants,



Note: The figure covers only cities with populations over 250,000 inhabitants. In addition, hundreds of smaller cities have also passed net zero emission and/or renewable energy targets.

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City net zero targets are most prevalent in Europe and Latin America and the Caribbean, followed by East Asia and North America.

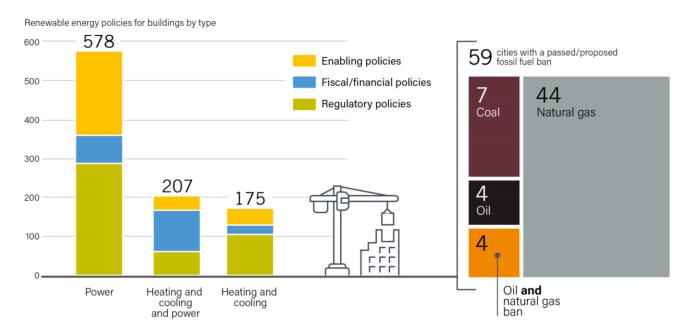


CITY POLICIES TO SUPPORT RENEWABLES IN BUILDINGS

MOST MEASURES FOCUS ON SOLAR ROOFTOP RENEWABLES



Urban Renewable Energy Policies in Buildings, by Type, 2021



59 cities passed or proposed a ban or restriction on fossil fuels.

Note: Data should not be compared with previous years, due to revisions and adjusted methodology. Fossil fuel bans are categorised as enabling policies.

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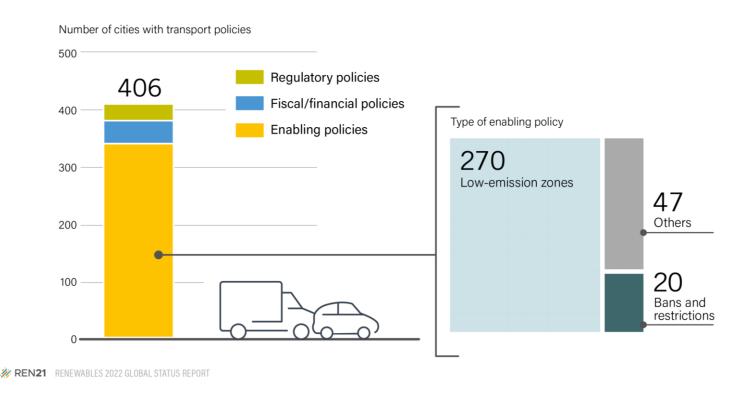


CITY TRANSPORT SHIFT TO MORE RENEWABLE

PRIVATE VEHICLES ACCOUNT FOR MOST OF THE ENERGY DEMAND AND EMISSIONS FROM URBAN TRANSPORT



Urban Renewable Energy Policies in Transport by Type, 2021



Only Barcelona,
Bristol, Shanghai
and Stuttgart
have implemented LEZs
and passed vehicle bans.

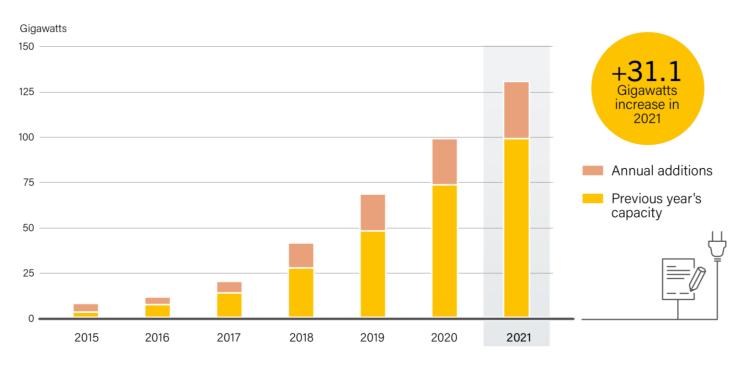


PPAS RENEWABLE-BASED GROWTH

CORPORATIONS HAVE A ROLE IN RENEWABLE POWER EXPANSION



Corporate PPAs Global Capacity and Annual Additions, 2015-2021



The Americas continued to lead in corporate-sourced renewable power, with around 20 GW, up 35% from 2020 levels.

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