



We are expanding our wind power activities to make more renewable electricity available to our customers.

# ACHIEVING NET-ZERO EMISSIONS



**Our Powering Progress strategy focuses on working with our customers and across sectors to accelerate the transition to net-zero emissions, in step with society.**

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# ENERGY TRANSITION

## OUR APPROACH TO CLIMATE CHANGE AND THE ENERGY TRANSITION

### POWERING PROGRESS

Working with our customers and across sectors to accelerate the transition to net-zero emissions.

- Our climate target is to become a net-zero emissions energy business by 2050, in step with society's progress in achieving the goal of the UN Paris Agreement on climate change.
- We have set targets to reduce the carbon intensity (Net Carbon Footprint) of the energy products we sell. This includes short-term targets of 3-4% by 2022, 6-8% by 2023 and 9-12% by 2024 (compared with 2016). It also includes medium- and long-term targets of 20% by 2030, 45% by 2035, and 100% by 2050 (compared with 2016), in step with society.
- In October 2021, we announced an absolute emissions reduction target of 50% by 2030, compared with 2016 levels on a net basis. This new target covers all Scope 1 and 2 emissions under Shell's operational control and complements our existing carbon-intensity targets.

In 2021, Shell reshaped and restructured its organisation to place our energy transition strategy at the heart of everything we do. Our governance is designed to effectively manage our transition to a net-zero emissions energy business by 2050, in step with society's progress towards achieving the goals of the Paris Agreement.

Becoming a net-zero emissions energy business means that we are reducing emissions from our operations and from the fuels and other energy products, such as electricity, that we sell to our customers. It also means capturing and storing any remaining emissions using technology, protecting natural carbon sinks and providing high-quality nature-based solutions to our customers to offset unavoidable emissions.

Because emissions resulting from customer use of our energy products make up the greatest percentage of Shell's carbon emissions, this is where we can make the greatest contribution to the energy transition, by increasing sales of low-carbon energy products and services.

We have set short-, medium- and long-term targets to track our performance against our overall climate target over time. These targets are measured using the net carbon intensity metric.

We follow the GHG Protocol's Corporate Accounting and Reporting Standard, which defines three scopes of greenhouse gas emissions:

- Scope 1: direct greenhouse gas emissions from sources that are owned or controlled by Shell.
- Scope 2: indirect greenhouse gas emissions from generation of purchased energy consumed by Shell.
- Scope 3: other indirect greenhouse gas emissions, including emissions associated with the use of energy products sold by Shell.

In October 2021, in support of our 2050 net-zero emissions target, we set a target to reduce Scope 1 and 2 absolute emissions from assets and activities under our operational control (including divestments) by 50% by 2030, compared with 2016 levels on a net basis.

We have also established **remuneration** policies which are designed to support us in achieving our short-term climate targets.

Read more about our climate target at [www.shell.com/energy-and-innovation/the-energy-future/our-climate-target](https://www.shell.com/energy-and-innovation/the-energy-future/our-climate-target) and in our **Annual Report**.

Read more about our approach to climate change in our Energy Transition Report at [www.shell.com/SET](https://www.shell.com/SET).



## Assessing climate-related risks

As Shell has operations both onshore and offshore, the potential physical impacts of climate change are important for us to manage. In this respect, we consider the physical risks to our assets and facilities to ensure they can operate and be accessed safely under extreme weather conditions.

Projects under development that are expected to have a material greenhouse gas impact must meet our internal carbon performance standards or industry benchmarks. Our performance standards are used for measuring a project's average lifetime greenhouse gas intensity or energy efficiency per asset type. Applying these criteria ensures that our projects can compete and prosper in the energy transition. An exception process is in place to manage specific incidental cases.

Read more about climate risk management in our [Annual Report](#).

**More in this report** [Our Powering Progress targets](#) | [Managing greenhouse gas emissions](#) | [Letter from the CEO](#) | [Performance overview](#)

**More on Shell websites** [Powering Progress – transitioning to net-zero emissions](#) | [Our climate target](#) | [Our Climate Target: Frequently Asked Questions](#)

## DELIVERING OUR CLIMATE TARGETS

### Net carbon intensity

Shell's net carbon intensity (NCI) provides an annual measure of the life-cycle emissions intensity of the portfolio of energy products sold. It is the average intensity, weighted by sales volume, of the energy products sold by Shell. It is tracked, measured and reported using the Net Carbon Footprint (NCF) methodology.

We express our net carbon intensity as the grams of CO<sub>2</sub> equivalent per megajoule (gCO<sub>2</sub>e/MJ) produced for each unit of energy delivered to, and used by, a consumer.

Shell's net carbon intensity in 2021 was 77 gCO<sub>2</sub>e/MJ. Although this is a 2.7% increase from the previous year, it represents a 2.5% reduction from the 2016 reference year, which means that we achieved our first short-term target of a 2-3% reduction in NCI by the end of 2021.

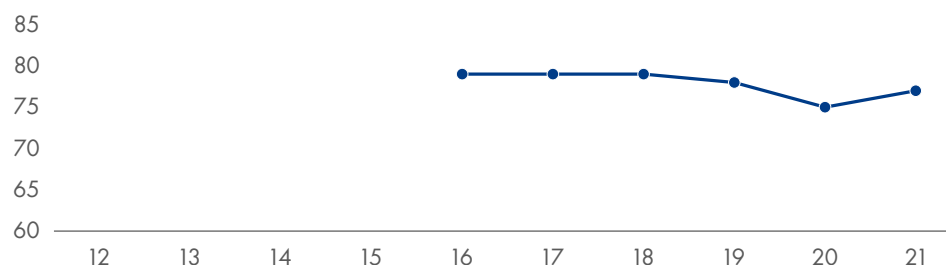
The increase in Shell's net carbon intensity in 2021 is largely due to the introduction of an improved approach for the estimation of the emissions intensity of power sold by Shell. The new approach is based on categorising power sales as certified renewable; own generation or power purchase agreement; or power purchased from the grid. Intensities are then assigned to each power sales category allowing a better estimation of the overall intensity of power sold by Shell.

We have received third-party limited assurance on our carbon intensity, measured and reported using the Net Carbon Footprint methodology, for the period 2016 to 2021. Limited assurance means nothing has come to the auditor's attention that would indicate that the greenhouse gas data and information as presented in the Greenhouse Gas Statement were not materially correct.

Read more about our Net Carbon Footprint methodology at [www.shell.com/ncf](http://www.shell.com/ncf).

### NET CARBON INTENSITY [A] [B]

gCO<sub>2</sub>e/MJ



[A] The NCI calculation uses Shell's energy product sales volume data, as disclosed in the Annual Report and Sustainability Report. This excludes certain contracts held for trading purposes and reported net rather than gross. Business-specific methodologies to net volumes have been applied in oil products and pipeline gas and power. Paper trades that do not result in physical product delivery are excluded. Retail sales volumes from markets where Shell operates under trademark licensing agreements are also excluded from the scope of Shell's carbon intensity metric.

[B] Acquisitions and divestments are included in the actual performance tracking with the target and reference year unchanged. Note that acquisitions and divestments could have a material impact on meeting the targets.

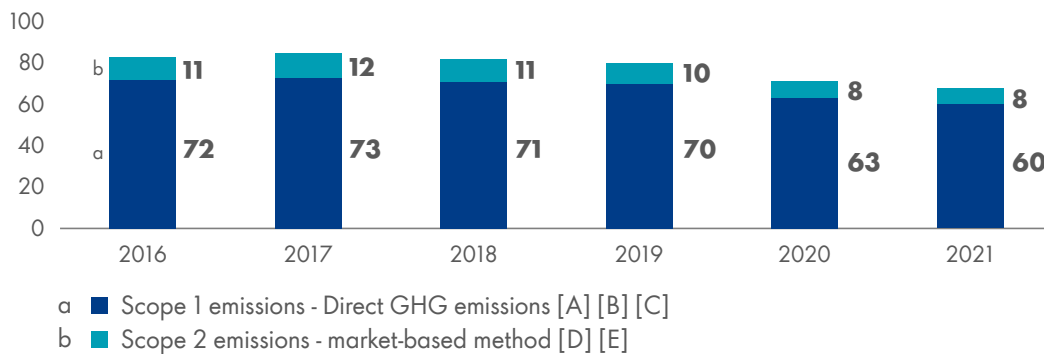


## Absolute emissions reduction performance

In 2021, our total combined Scope 1 and 2 absolute greenhouse gas emissions (from assets and activities under our operational control) were 68 million tonnes on a CO<sub>2</sub> equivalent basis, a 4% reduction compared with 2020, and an 18% reduction compared with 2016, the base year. Our Scope 3 emissions from energy products included in our net carbon intensity were 1,299 million tonnes CO<sub>2</sub>e.

### SCOPE 1 AND 2 EMISSIONS UNDER OPERATIONAL CONTROL

million tonnes CO<sub>2</sub>e



[A] Greenhouse gas emissions (GHG) comprise carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride and nitrogen trifluoride. The data are calculated using locally regulated methods where they exist. Where there is no locally regulated method, the data are calculated using the 2009 API Compendium, which is the recognised industry standard under the GHG Protocol Corporate Accounting and Reporting Standard. There are inherent limitations to the accuracy of such data. Oil and gas industry guidelines (IPIECA/API/IOGP) indicate that several sources of uncertainty can contribute to the overall uncertainty of a corporate emissions inventory. We have estimated the overall uncertainty for our direct GHG emissions to be around 4% for 2021.

[B] GHG emissions are calculated using Global Warming Potential factors from the IPCC's Fourth Assessment Report.

[C] GHG emissions in this chart do not include carbon credits.

[D] We have restated our 2020 Scope 2 emissions from 9 to 8 million tonnes CO<sub>2</sub>e following a correction of an efficiency factor for steam at one of our assets and a revision to how internal energy transfers of steam and electricity were accounted for at several of our assets to remove double-counting between Scopes 1 and 2.

[E] We have estimated the overall uncertainty for our Scope 2 emissions to be around 6% for 2021.

**More in this report** [Managing greenhouse gas emissions](#) | [Our Powering Progress targets](#) | [Letter from the CEO](#) | [Performance overview](#)

**More on Shell websites** [Our strategy: Powering Progress](#) | [Our climate target](#) | [Our Climate Target: Frequently Asked Questions](#)



# MANAGING GREENHOUSE GAS EMISSIONS

## GREENHOUSE GAS EMISSIONS

### POWERING PROGRESS

We aim to be net zero on emissions generated by our operations by 2050 or sooner, in step with society, as well as on emissions associated with the energy we need to power them.

In October 2021, we announced an absolute emissions reduction target of 50% by 2030, compared with 2016 levels on a net basis. This new target covers all Scope 1 and 2 emissions under Shell's operational control and complements our existing carbon-intensity targets.

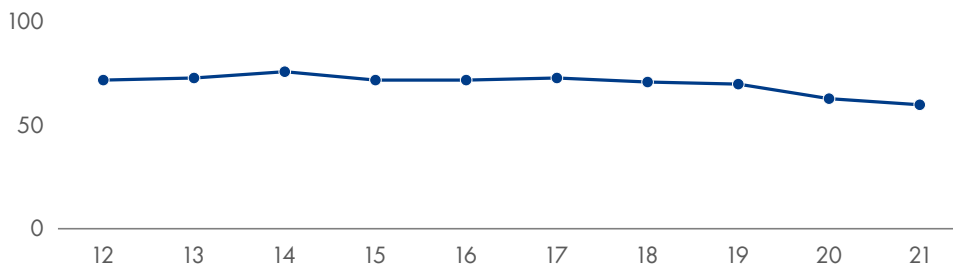
### Greenhouse gas emissions performance

Shell reduced Scope 1 and 2 emissions under its operational control from 83 million tonnes in 2016 to 68 million tonnes by the end of 2021 (see [Delivering our Climate targets](#)).

Our direct (Scope 1) greenhouse gas (GHG) emissions decreased from 63 million tonnes of carbon dioxide (CO<sub>2</sub>) equivalent in 2020 to 60 million tonnes of CO<sub>2</sub> equivalent in 2021.

### DIRECT GREENHOUSE GAS EMISSIONS

million tonnes CO<sub>2</sub>e

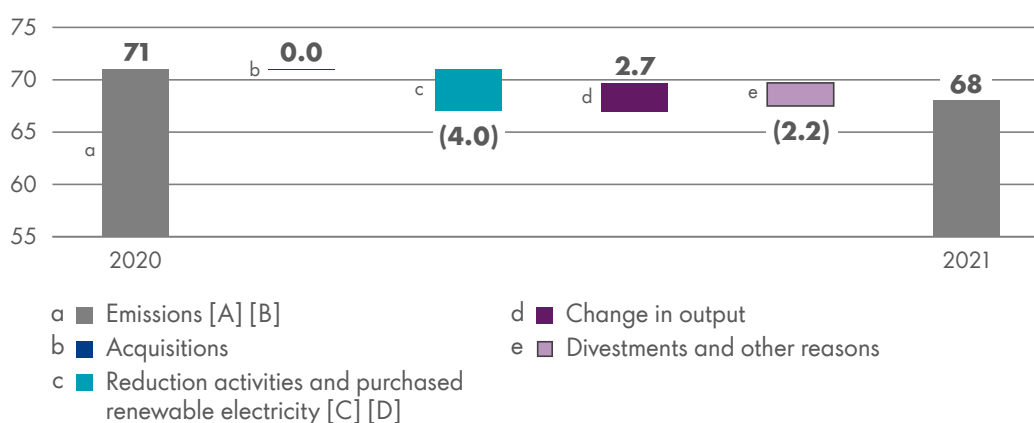


This decrease was in part driven by the shutdown of the Shell Convent Refinery (USA) in late 2020, lower production at the Shell Norco Manufacturing Complex (USA) due to Hurricane Ida, and divestments in 2020 and 2021, which included the Martinez and Puget Sound refineries in the USA and the Fredericia refinery in Denmark. These decreases were partly offset by higher emissions due to the restart of the Prelude floating liquefied natural gas (LNG) facility in Australia (which was shut down for most of 2020) and increased flaring at Shell Nigeria Exploration and Production Company Limited (SNEPCo) in Nigeria.

In 2021, we implemented a variety of measures to reduce the energy use and increase the energy efficiency of our operations. Examples of some of the principal measures taken in 2021 are listed in the 2021 [Annual Report](#).



## SCOPE 1 AND SCOPE 2 GHG EMISSIONS CHANGES FROM 2020 TO 2021

million tonnes CO<sub>2</sub>e

[A] Total Scope 1 and Scope 2 emissions, rounded to the closest million tonnes. Scope 2 emissions were calculated using the market-based method.

[B] We have restated our 2020 Scope 2 emissions from 9 to 8 million tonnes CO<sub>2</sub>e following a correction of an efficiency factor for steam at one of our assets and a revision to how internal energy transfers of steam and electricity were accounted for at several of our assets to remove double-counting between Scopes 1 and 2.

[C] In addition to reductions from GHG abatement and energy efficiency projects, this category also includes reductions from permanent shutdown of the Convent and Tabangao refineries and the impact of transformational activities at our Shell Energy and Chemicals Park in Singapore.

[D] Excludes 1.05 million tonnes of CO<sub>2</sub> captured and sequestered by our Quest CCS project in Canada in 2021.

Our indirect greenhouse gas emissions associated with imported energy (Scope 2) were 8 million tonnes in 2021 (using the market-based method), compared with 8 million tonnes in 2020.

We undertake external verification of our greenhouse gas emissions annually. Our 2021 Scope 1 and 2 greenhouse gas emissions have been verified to a level of limited assurance. Limited assurance means nothing has come to the verifier's attention that would indicate that the greenhouse gas data and information as presented in the Greenhouse Gas Statement were not materially correct.

Read our most recent assurance statements at [www.shell.com/ghg](http://www.shell.com/ghg).

**More in this report** Climate change and the energy transition | Delivering our climate targets

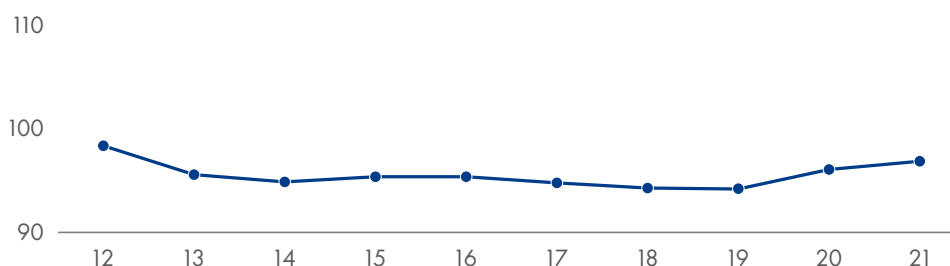
**More on Shell websites** Powering Progress – transitioning to net-zero emissions

## ENERGY EFFICIENCY IN OUR OPERATIONS

One of the metrics we use to measure our performance is energy intensity: the amount of energy consumed for every unit of output.

### ENERGY INTENSITY – REFINING

Refinery Energy Index [A]



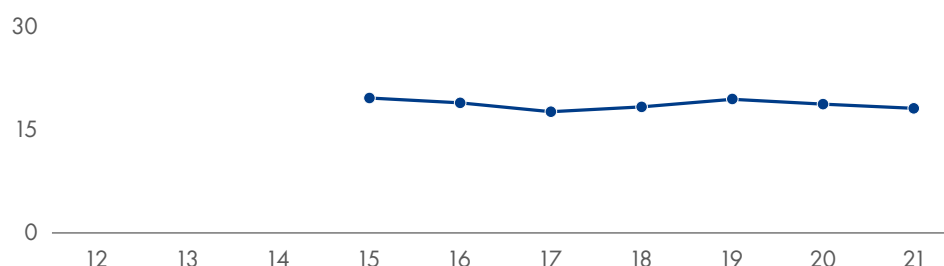
[A] Data are indexed to 2002, based on Solomon Associates Energy Intensity Index™ methodology.



The refinery energy intensity index increased from 96.1 in 2020 to 96.9 in 2021, in part due to the impact of Hurricane Ida in the USA.

## ENERGY INTENSITY – CHEMICAL PLANTS

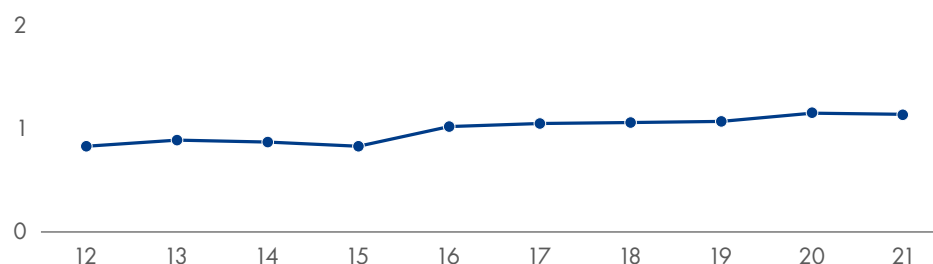
Chemicals Energy Intensity – GJ/tonne production



Chemical steam cracker energy intensity in 2021 was 18.1 gigajoules per tonne (GJ/tonne) of high-value chemical (HVC) production, down from 18.7 GJ/tonne HVC in 2020, in part due to good reliability and high utilisation at our Bukom chemical plant in Singapore and Deer Park in the USA.

## ENERGY INTENSITY – UPSTREAM

(excl. LNG and GTL) GJ/tonne production



In 2021, the overall energy intensity for the production of oil and gas in our Upstream and Integrated Gas businesses (excluding liquefied natural gas and gas-to-liquids) remained relatively flat at 1.14, compared with 1.15 in 2020.

We expect it will be difficult to maintain the energy intensity levels of recent years, as existing fields age and new production comes from more energy-intensive sources. This may increase our upstream energy intensity over time.

**More in this report** [Climate change and the energy transition](#) | [Sustainability at Shell](#) | [Our standards and policies](#)

**More on Shell websites** [Our strategy: Powering Progress](#) | [Reducing Methane Emissions in Shale Oil and Gas](#) | [Greenhouse gas emissions](#)



## METHANE EMISSIONS

### POWERING PROGRESS

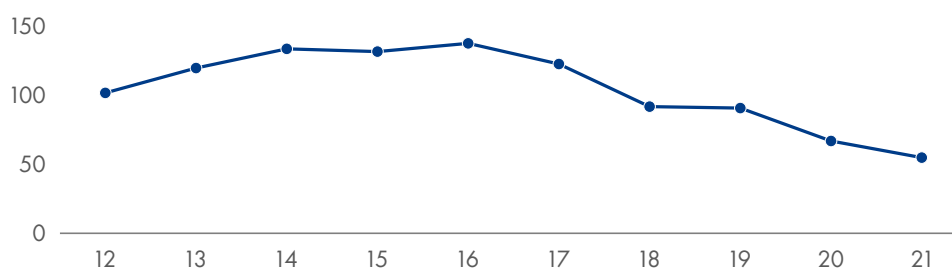
By 2025, we expect to have kept the methane emissions intensity of Shell-operated assets to below 0.2%.

### Methane emissions performance

Shell's methane emissions intensity target covers all Upstream and Integrated Gas oil and gas assets for which Shell is the operator. In 2021, our methane emissions intensity averaged 0.06% for assets with marketed gas and 0.01% for assets without marketed gas. Shell's methane emissions intensity ranged from below 0.01% to 1.5% in 2021 compared with 0.01% to 0.6% in 2020.

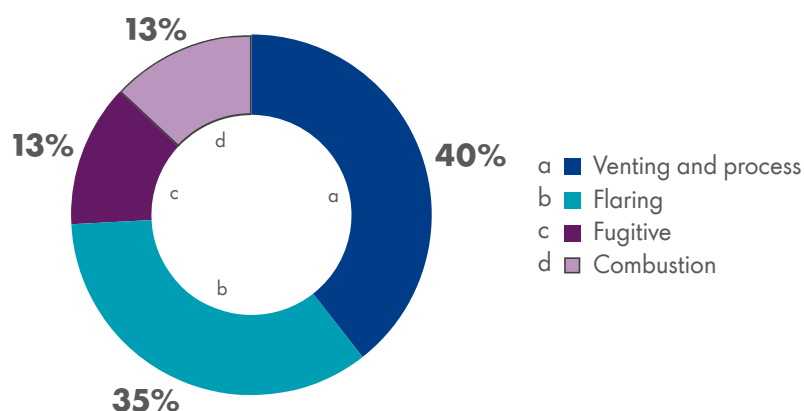
### METHANE (CH<sub>4</sub>) EMISSIONS

thousand tonnes



### METHANE EMISSIONS BY SOURCE IN 2021 [A]

percentage



[A] Percentages do not add up to 100% due to rounding.

In 2021, Shell's total methane emissions were 55 thousand tonnes compared with 67 thousand tonnes in 2020, in part due to reduced methane emissions reported for Malaysia because we relinquished the operatorship of two complexes (E11PA and E11PB) on December 31, 2020. We also implemented a more accurate method for calculating fugitive emissions at the Shell-operated QGC natural gas facility in Australia. Methane emissions were less than 3% of Shell's greenhouse gas emissions on a CO<sub>2</sub>-equivalent basis in 2021. More than 65% of our reported methane emissions in 2021 came from flaring and venting in our upstream and midstream operations.





We encourage industry-wide action on methane emissions reduction by participating in voluntary initiatives.

For example, we participate in multi-stakeholder groups, such as the Methane Guiding Principles coalition, which we initiated in 2017, and the Oil and Gas Methane Partnership (OGMP) 2.0, which seeks to improve measurement and reporting. In 2021, environmental organisations and energy companies, including Shell, developed policy recommendations to support European Union (EU) legislation for ambitious methane emissions reductions across the supply chain of natural gas consumed within the EU.

Read more about Shell and methane emissions at [www.shell.com/energy-and-innovation/natural-gas/methane-emissions](https://www.shell.com/energy-and-innovation/natural-gas/methane-emissions).

**More in this report** Climate change and the energy transition | Managing greenhouse gas emissions | Wind | Integrated power

**More on Shell websites** Our strategy: Powering Progress | Methane emissions | Reducing Methane Emissions in Shale Oil and Gas | Greenhouse gas emissions | Air Quality

## FLARING

### POWERING PROGRESS

We have committed to bringing forward the target to eliminate routine gas flaring from our Upstream operated assets from 2030 to 2025.

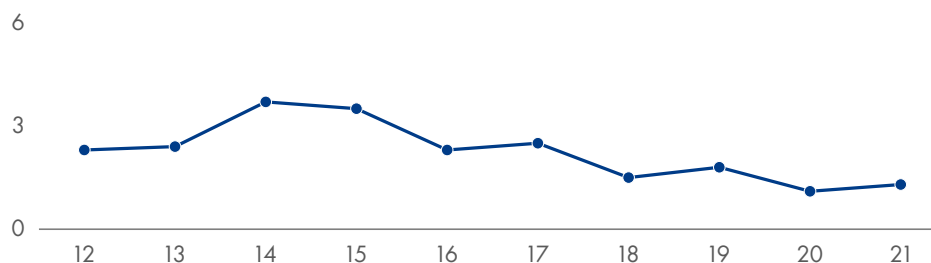
We are working to reduce flaring, which contributes to climate change and wastes valuable resources. We have committed to bringing forward our target. This accelerates our commitment in 2015 to end routine flaring as a signatory to the World Bank's Zero Routine Flaring by 2030 initiative. All of Shell's operated assets within the Integrated Gas business already comply with zero routine flaring, as they were designed to gather gas resources to sell and avoid routine flaring.

### Flaring performance

Flaring of gas in our Upstream and Integrated Gas businesses contributed around 7% to our overall direct greenhouse gas (GHG) emissions in 2021.

### FLARING – UPSTREAM HYDROCARBONS FLARED

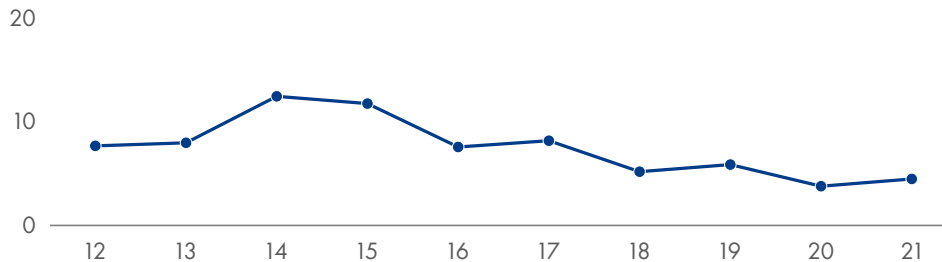
million tonnes





## FLARING – UPSTREAM CO<sub>2</sub> EQUIVALENT

million tonnes CO<sub>2</sub>e



Gas routinely produced with oil, known as associated gas, may be flared. In 2021, around 17% of greenhouse gas emissions from flaring occurred at facilities where there was no infrastructure to capture the gas (down from around 24% in 2020). Overall flaring increased to 4.5 million tonnes of carbon dioxide equivalent (CO<sub>2</sub>e) in 2021 from 3.8 million tonnes of carbon dioxide equivalent in 2020.

Around 60% of flaring in our Upstream and Integrated Gas facilities in 2021 occurred in assets operated by the Shell Petroleum Development Company of Nigeria Limited (SPDC) and Shell Nigeria Exploration and Production Company Limited (SNEPCo). Flaring from SPDC-operated facilities increased by around 5% in 2021 compared with 2020. Flaring at SNEPCo-operated facilities increased by 160% in 2021 compared with 2020. This was because repairs to a flexible joint on the gas export riser on the Bonga deep-water floating production, storage and offloading (FPSO) facility took longer than planned. A large amount of gas was therefore flared while the FPSO continued to produce oil.

Read more about our flaring reduction commitment at [www.shell.com/inside-energy/zero-routine-flaring-by-2025](https://www.shell.com/inside-energy/zero-routine-flaring-by-2025).

**More in this report** Climate change and the energy transition | Energy transition | Managing greenhouse gas emissions

**More on Shell websites** Our strategy: Powering Progress | Reducing Flaring in Shale Oil and Gas | External voluntary codes | Air Quality

## SECTORAL DECARBONISATION

### POWERING PROGRESS

Working with our customers and across sectors to accelerate the transition to net-zero emissions.

We are helping our customers to find ways to reduce their overall carbon footprint, including in sectors that are difficult to decarbonise such as aviation, shipping, road freight and industry. For example, we have an ambition to produce around 2 million tonnes of **sustainable aviation fuel** (SAF) a year by 2025 and increase its share to at least 10% of our global aviation fuel sales by 2030.

To help accelerate the transition to net-zero emissions, we will build on existing relationships with other stakeholders, such as energy suppliers, policymakers, infrastructure owners and consumers to support a sector-based approach. Transforming energy demand is the focus of our decarbonisation strategy. We are working with customers sector-by-sector across the energy system and will change the mix of energy products we sell to meet their changing energy demands.

Read more about sectoral decarbonisation at [www.shell.com/energy-and-innovation/the-energy-future/cutting-carbon-together-sector-by-sector](https://www.shell.com/energy-and-innovation/the-energy-future/cutting-carbon-together-sector-by-sector) and in the Energy Transition Report at [www.shell.com/SET](https://www.shell.com/SET).

**More in this report** Climate change and the energy transition

**More on Shell websites** Our strategy: Powering Progress | Reducing Methane Emissions in Shale Oil and Gas | Greenhouse gas emissions



## REALISING THE ROLE OF NATURE

### POWERING PROGRESS

Our aim is to use nature-based solutions to mitigate emissions of around 120 million tonnes of CO<sub>2</sub> per year by 2030.

Nature-based solutions (NBS) conserve, enhance and restore ecosystems – such as forests, grasslands and wetlands – to prevent greenhouse gases or reduce atmospheric CO<sub>2</sub> levels. NBS provide benefits for people and the environment by preserving biodiversity, preventing floods, improving air quality and building more resilient and healthy communities.

Carbon credits generated from NBS projects can be used by Shell to compensate for our own emissions and to allow our customers to offset their emissions in line with the mitigation hierarchy of avoid, minimise and offset. As part of our selection criteria for NBS, we look for projects that will have a net positive impact for biodiversity and communities.

Carbon credits can also be generated by other types of projects, for example cookstoves. Better cooking facilities that displace open fires reduce carbon emissions, prevent local deforestation and improve air quality and therefore health.

In 2021, we aimed to invest around \$100 million in nature-based solutions such as forests and wetlands that store carbon.

Projects may need different levels of funding at different stages of development. In 2021, investments were also affected by COVID-19, as site visits to potential projects were not possible. Establishing our new NBS team following a reorganisation also took some time. Nevertheless, in 2021, we allocated more than \$480 million to various projects, to be deployed across the length of the contracts. More than 95% of this funding is for NBS projects. We deployed \$37 million in 2021: \$26 million for NBS and \$11 million for cookstove projects and we retired around 6 million credits on behalf of our customers. These numbers exclude direct carbon trading activities.

In November 2021, Shell published its "Ensuring high-quality nature-based carbon credits" report that sets out our expectations and approach to quality across our NBS portfolio.

In 2021, we expanded our offer of carbon credits to drivers and business customers who wish to compensate for the life-cycle CO<sub>2</sub>-equivalent emissions generated by their use of the Shell fuel they buy. We have made this offer available to our fleet customers in 17 countries and to retail customers at more than 3,100 service stations in Austria, Canada, Germany, Hungary, the Netherlands, Switzerland and the UK.

Read more about nature-based solutions at [www.shell.com/energy-and-innovation/new-energies/nature-based-solutions](https://www.shell.com/energy-and-innovation/new-energies/nature-based-solutions).

**More in this report** Climate change and the energy transition | Carbon capture and storage | Managing greenhouse gas emissions | Energy transition

**More on Shell websites** Our strategy: Powering Progress | Nature-based solutions

## CARBON CAPTURE AND STORAGE

### POWERING PROGRESS

We seek to have access to an additional 25 million tonnes a year of carbon capture and storage (CCS) capacity by 2035 – equal to 25 CCS facilities the size of our Quest site in Canada.

Shell's ambition is to work with governments, customers and partners to unlock the potential for CCS to reduce emissions where there are no currently scalable low-carbon alternatives. In 2021, Shell's operating costs for and investment in CCS opportunities amounted to around \$146 million.

By the end of 2021, our Quest CCS project in Canada (Shell interest 10%) had captured and safely stored more than 6.5 million tonnes of CO<sub>2</sub> since it began operating in 2015. In Australia, the Gorgon CCS project (Shell interest 25%, operated by Chevron), which started operating in August 2019, had stored more than 5 million tonnes of CO<sub>2</sub> by the end of 2021. Gorgon is the largest CCS operation in the world.

The Gorgon CCS system has presented some challenges, which resulted in a carbon injection shortfall. The operator continues to work with the regulator and the venture partners, including Shell, to make adjustments where needed. The JV announced the



implementation of a package that includes greenhouse gas offset credits and investment in lower-carbon projects to compensate for the shortfall.

Read more about our CCS projects at [www.shell.com/ccs](https://www.shell.com/ccs).

## CCS projects

Project	CO <sub>2</sub> source	Country	Shell involvement	Shell interest	Total capacity (100%), million tonnes per annum	Shell-operated
<b>CCS projects in operation</b>						
Quest	Bitumen upgrading	Alberta, Canada	Technical developer, Operator, JV partner	10%	1 mtpa	Yes
Gorgon	CO <sub>2</sub> in gas	Australia	JV partner	25%	Up to 4 mtpa	No
Technology Centre Mongstad (TCM) test and research facility	Gas-fired power, refining and chemical production	Norway	JV partner	8.7%	Test site	No
<b>CCS projects under construction</b>						
Northern Lights (Phase 1)	Industrial sources	Norway	JV partner	33.3%	1.5 mtpa	No
<b>CCS projects pre-FID options</b>						
Acorn	Industrial sources	Scotland, UK	Technical developer, JV partner	30%	Around 6 mtpa	No
Aramis	Industrial sources	Netherlands	JV partner	25%	5 mtpa	No – transport Yes – storage
Northern Endurance Partnership	Industrial sources	Teesside and Humberside, UK	JV partner	TBC	4 mtpa	No
Polaris	Refining and chemical production	Alberta, Canada	Operator	TBC	0.75 mtpa	Yes
South Wales Industrial Cluster	Industrial sources	Wales, UK	Operator JV partner	TBC	1.5 mtpa	Yes
Pernis CO <sub>2</sub> capture (for transport and storage by the third-party Porthos project)	Refining and chemical production	Netherlands	CO <sub>2</sub> capture	100%	1.15 mtpa (Shell capacity)	Yes – capture No – transport and storage
Pernis SPeCCS CO <sub>2</sub> capture expansion	Refining and chemical production	Netherlands	CO <sub>2</sub> capture	100%	0.5 mtpa (Shell capacity)	TBC

**More in this report** [Climate change and the energy transition](#) | [Realising the role of nature](#) | [Energy transition](#)

**More on Shell websites** [Our strategy: Powering Progress](#) | [Carbon Capture: The technology we cannot afford to ignore](#)



# PROVIDING LOWER-CARBON ELECTRICITY

## INTEGRATED POWER

### POWERING PROGRESS

We aim to increase our power sales to 560 terawatts a year by 2030.

For consumers and business customers to decarbonise their activities, lower-carbon electricity will be part of their energy mix. We believe Shell can become a leading provider of clean power.

In 2021, we sold 251 TWh of power and cash capital expenditure in Renewables and Energy Solutions amounted to \$2.4 billion. In 2022, we aim to invest \$3 billion in our Renewables and Energy Solutions business.

By 2030, we aim to supply electricity to more than 15 million retail and business customers worldwide and increase our power sales to 560 terawatt hours a year.

We are providing more renewable and low-carbon energy options for customers through investments in wind, solar, electric vehicle charging, hydrogen, and more.

In 2021, we signed a number of deals to supply businesses with renewable electricity, including with [Amazon](#) and T-Mobile US. Shell is also supplying [Microsoft](#) with renewable energy as part of our strategic alliance launched in 2020 to accelerate innovation in support of decarbonisation.









Find out more about our power business in the [Annual Report](#).

Read more about lower-carbon and renewable power at [www.shell.com/res](https://www.shell.com/res).



## OFFERING CUSTOMERS LOWER-CARBON AND RENEWABLE ENERGY SOLUTIONS

a selection of investments, acquisitions and ventures

2021	 SOLAR	<ul style="list-style-type: none"><li>■ Unveiled Qabas solar plant, Oman</li><li>■ Signed deals to build two solar photo-voltaic projects (pre-FID), UK</li><li>■ Acquired Savion, USA</li><li>■ Acquired solar-konzept Italia, Italy</li></ul>	 Hydrogen	<ul style="list-style-type: none"><li>■ Signed Letter of intent to build a 100 MW hydrogen electrolyser, Germany</li><li>■ Signed MoU with BlueScope to build a 10 MW electrolyser, Australia</li><li>■ Opened heavy-duty hydrogen stations, USA</li></ul>	 Mobility	<ul style="list-style-type: none"><li>■ Acquired ubitricity, UK</li><li>■ Launched EV mobility hub in Paris, France</li></ul>
	 Wind	<ul style="list-style-type: none"><li>■ Partnered with Simply Blue Group to develop Emerald and Western Star floating wind projects, Ireland</li><li>■ Shell and CoensHexicon formed the MunmuBaram JV for a 1.3 GW floating wind project, South Korea</li></ul>	 Trading	<ul style="list-style-type: none"><li>■ Acquired Next Kraftwerke, Germany</li><li>■ Acquired Inspire Energy Capital, USA</li><li>■ Announced Powershop acquisition, Australia (completed 2022)</li></ul>		
2020	 SOLAR	<ul style="list-style-type: none"><li>■ Final investment decision to build Gangarri solar farm, Australia</li></ul>	 Mobility	<ul style="list-style-type: none"><li>■ Masabi*, UK</li><li>■ InstaFreight*, Germany</li><li>■ Spiffy*, USA</li></ul>	 Wind	<ul style="list-style-type: none"><li>■ Shell and Eneco awarded tender to build 759 MW Hollandse Kust (noord) offshore wind farm, NL</li></ul>
	 NBS [A]	<ul style="list-style-type: none"><li>■ Select Carbon, Australia</li><li>■ Climate Bridge*, China</li></ul>	 Hydrogen	<ul style="list-style-type: none"><li>■ Announced plans to build 20 MW hydrogen electrolyser and refuelling stations, China</li><li>■ ZeroAvia*, USA</li><li>■ Opened hydrogen bus station, NL</li></ul>	 ENERGY SOLUTIONS	<ul style="list-style-type: none"><li>■ Palmetto*, USA</li><li>■ GreenCom*, Germany</li></ul>
2019	 Mobility	<ul style="list-style-type: none"><li>■ Acquired Greenlots, USA (now Shell Recharge Solutions)</li><li>■ Ravin.ai*, UK</li><li>■ Revel*, USA</li><li>■ Aurora*, USA</li><li>■ Nordsol*, NL</li></ul>	 Wind	<ul style="list-style-type: none"><li>■ Acquired EOLFI, France</li><li>■ Joint Development Agreement with CoensHexicon, South Korea</li></ul>	 ENERGY SOLUTIONS	<ul style="list-style-type: none"><li>■ Acquired sonnen, Germany</li><li>■ Acquired Hudson Energy, UK (rebranded to Shell Energy Retail in 2020)</li><li>■ LO3 Energy*, USA</li><li>■ Corvus Energy*, Norway</li></ul>
	 NBS [A]	<ul style="list-style-type: none"><li>■ Nature-based solutions projects under way in Australia, Malaysia, Netherlands, Spain and UK</li></ul>	 ENERGY ACCESS	<ul style="list-style-type: none"><li>■ Orb Energy*, India</li><li>■ PowerGen*, Kenya</li><li>■ d.light*, Kenya</li></ul>	 Trading	<ul style="list-style-type: none"><li>■ Acquired ERM Power, Australia (rebranded to Shell Energy in 2020)</li><li>■ Acquired Limejump, UK</li></ul>
2018	 SOLAR	<ul style="list-style-type: none"><li>■ ESCO Pacific*, Australia</li><li>■ Cleantech Solar*, Asia</li><li>■ Opened Moerdijk solar farm, NL</li></ul>	 Hydrogen	<ul style="list-style-type: none"><li>■ Announced plans to build Rheinland hydrogen electrolyser, Germany</li><li>■ Opened hydrogen stations, Germany and Luxembourg</li></ul>		
	 SOLAR	<ul style="list-style-type: none"><li>■ Silicon Ranch*, USA</li></ul>	 Wind	<ul style="list-style-type: none"><li>■ Atlantic Shores Offshore Wind*, USA</li><li>■ Mayflower Wind Energy*, USA</li><li>■ TetraSpar*, Norway</li></ul>	 ENERGY SOLUTIONS	<ul style="list-style-type: none"><li>■ Shell Energy Inside, USA</li><li>■ Shell Energy Retail, UK (acquired as First Utility)</li></ul>
2017	 Hydrogen	<ul style="list-style-type: none"><li>■ Opened light-duty hydrogen stations in California, USA, and Canada</li><li>■ HyET Hydrogen*, NL</li></ul>	 ENERGY ACCESS	<ul style="list-style-type: none"><li>■ Husk Power*, India</li><li>■ SunFunder*, Kenya</li></ul>	 Mobility	<ul style="list-style-type: none"><li>■ Ample*, USA</li></ul>
	 Mobility	<ul style="list-style-type: none"><li>■ Acquired NewMotion, NL (now Shell Recharge Solutions)</li><li>■ Connected Freight*, Philippines</li></ul>	 ENERGY SOLUTIONS	<ul style="list-style-type: none"><li>■ Innowatts*, USA</li></ul>	 ENERGY ACCESS	<ul style="list-style-type: none"><li>■ SolarNow*, Uganda</li><li>■ SteamaCo*, Kenya</li><li>■ Sunseap*, Singapore</li></ul>
	 Trading	<ul style="list-style-type: none"><li>■ Acquired MP2 Energy, USA</li></ul>	 Hydrogen	<ul style="list-style-type: none"><li>■ Opened light-duty hydrogen station, UK</li></ul>		

[A] Nature-based Solution  
\* Minority investments

[A] Nature-based Solutions  
\* Minority investments



## WIND

We have wind power interests in several countries, including onshore in the USA and off the coasts of the USA and the Netherlands. We are expanding our wind power activities to make more renewable electricity available to our customers. This includes developing wind projects on floating platforms in deeper waters off the coasts of Ireland, Scotland, France, Norway and South Korea.

At the end of 2021, the Shell share of total installed capacity combined from onshore and offshore wind was 466 megawatts alternating current (MWac), with a further Shell share of 838 MWac under construction.

Read more about wind power at [www.shell.com/wind](https://www.shell.com/wind).

### Wind projects at the end of 2021

Project	Theme	Country	Shell interest	Total capacity (100%), MWac	Shell-operated
<b>Wind projects in operation [A]</b>					
Brazos, TX	Onshore	USA	100%	160	Yes
Whitewater Hill, CA	Onshore	USA	50%	61.5	No
Cabazon Pass, CA	Onshore	USA	50%	41	No
Blauwwind [B]	Offshore	Netherlands	20%	731.5	JV-operated
NoordzeeWind [C]	Offshore	Netherlands	100%	108	JV-operated
<b>Wind projects under construction</b>					
Brazos Repower [D]	Onshore	USA	100%	182	Yes
CrossWind [E]	Offshore	Netherlands	80%	759	JV-operated
Pottendijk (wind)	Onshore	Netherlands	100%	50	Yes
<b>Wind projects pre-FID options (including seabed licences)</b>					
25+ projects [F]	Onshore and offshore	4+ countries [G]	Varies	More than 8 GWac [E] [F]	Shell- and JV-operated options

[A] Rock River wind farm in the USA (50 MW, Shell interest 50%) closed down at the end of 2021 and is not included.

[B] Brazos Repower represents the complete replacement of the Brazos turbines, increasing capacity from 160 MW to 182 MW.

[C] Offshore options include GBI, Mayflower, Atlantic Shores and MunmuBaram pre-FID seabed licenses.

[D] Including France, South Korea, the USA and now the UK.

[E] In addition, in January 2022, Shell and ScottishPower secured joint offers for seabed rights to develop MarramWind and CampionWind, large-scale floating wind farms representing a total of 5 gigawatts (GW) off the east and north-east coast of Scotland.

[F] Also, in February 2022, the proposed total capacity for the Atlantic Shores project was increased from 3,000 MW to 4,500 MW."

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## SOLAR

We are expanding our solar power generation capability by investing in the development and operation of long-term commercial and industrial solar projects, including at our own sites. At the end of 2021, our share of installed solar power capacity was 734 megawatts direct current (MWdc), with 1,484 MWdc under construction.

Read more about solar power at [www.shell.com/solar](https://www.shell.com/solar).

### Solar projects at the end of 2021

Project	Country	Shell interest	Total capacity (100%), MWdc	Shell-operated
<b>Solar projects in operation</b>				
Silicon Ranch [A]	USA	46.72%	1,130	No
Cleantech Solar	Asia-Pacific	24.50%	364	No
Moerdijk	Netherlands	100%	27	Yes
Sohar Solar Quabas	Oman	100%	34	Yes
Emmen	Netherlands	100%	12	Yes
Heerenveen	Netherlands	100%	14.5	Yes
Sas van Gent	Netherlands	100%	30	Yes
<b>Solar projects under construction</b>				
Gangarri	Australia	100%	144	Yes
Silicon Ranch [A]	USA	46.72%	2,487.90	No
Cleantech Solar	Asia-Pacific	24.50%	228.4	No
Pottendijk (solar)	Netherlands	100%	50	Yes
Koegorspolder Tractaatweg	Netherlands	100%	41	Yes
Koegorspolder Sluiskil [B]	Netherlands	100%	31	Yes
<b>Solar projects pre-FID options</b>				
200+ projects	14 countries [C]	Varies	Around 30 GWac	Varies

[A] The Silicon Ranch diluted equity share is now 44.33% following an equity raise that completed in February 2022.

[B] Koegorspolder Sluiskil moved into construction in February 2022.

[C] Including Brazil, China, France, Germany, India, Italy, Japan, Netherlands, Oman, Philippines, Singapore, Spain, UK, USA.

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# FUELLING MOBILITY

## BIOFUELS

### POWERING PROGRESS

Our aims include producing:

- Eight times more low-carbon fuels than in 2021 by 2030 (including Raízen production)
- Around two million tonnes of sustainable aviation fuel a year by 2025

We are producing and supplying low-carbon fuels such as biodiesel, bioethanol, renewable natural gas (also known as RNG, biogas or biomethane), renewable diesel (also known as hydrotreated vegetable oil or HVO) and sustainable aviation fuel to help lower the carbon emissions from transportation. These fuels can be blended with existing fuels, such as gasoline and aviation fuel, and do not require costly investment in new infrastructure, which means they are a practical option for reducing transport emissions.

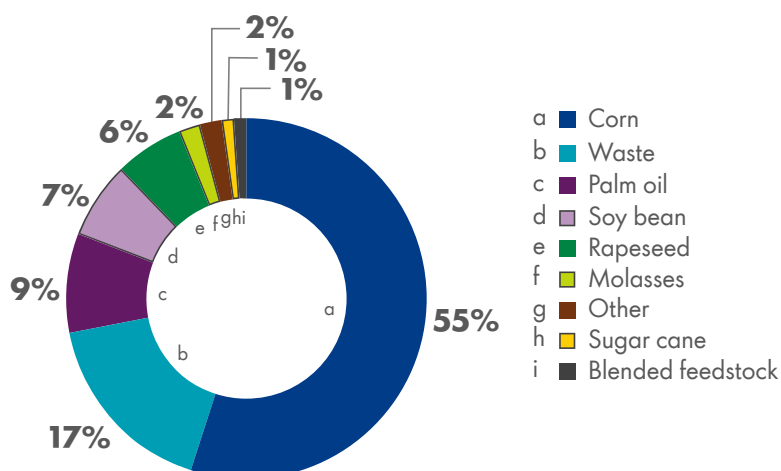
The Raízen joint venture (Shell interest 44%, not Shell-operated) in Brazil is one of the world's largest biofuel producers, with one of the lowest-CO<sub>2</sub> biofuels available today. In 2021, Raízen produced around 2.5 billion litres of ethanol from sugar cane. In 2021, Raízen's Costa Pinto mill in Brazil also produced 19 million litres of second-generation cellulosic ethanol made from inedible agricultural waste or forestry products.

In September 2021, we announced a final investment decision to build an 820,000-tonnes-a-year biofuels facility at the Energy and Chemicals Park Rotterdam, the Netherlands, which was formerly known as the Pernis refinery.

In 2021, around 9.1 billion litres of biofuels went into Shell's petrol and diesel worldwide, which included 3.2 billion litres through our joint venture Raízen on an equity basis. In 2020, around 9.5 billion litres of biofuels went into Shell's petrol and diesel worldwide.

### GLOBAL BIOCOMPONENT PURCHASE BY FEEDSTOCK [A]

percentage



[A] Does not include purchases by Raízen.



## Sustainability of biofuels

We purchase biocomponents to blend into fuels and/or to trade. Some biofuel feedstocks are considered higher risk with regard to human rights, biodiversity or the release of carbon into the atmosphere. To help mitigate these risks, all the palm oil, sugar cane and South American soy feedstock we purchase is certified as sustainable under credible sustainability standards like the Round Table on Responsible Soy, the Roundtable for Sustainable Palm Oil and Bonsucro.

Read more about our approach to the [sustainable sourcing of biocomponents](#).

Read more about biofuels at [www.shell.com/biofuels](http://www.shell.com/biofuels).

## Sustainable aviation fuel

We have the ambition to produce around 2 million tonnes of [sustainable aviation fuel \(SAF\)](#) a year by 2025 and aim to have at least 10% of our global aviation fuel sales as SAF by 2030.

Read more about SAF at [www.shell.com/business-customers/aviation/the-future-of-energy/sustainable-aviation-fuel](http://www.shell.com/business-customers/aviation/the-future-of-energy/sustainable-aviation-fuel).

## Renewable natural gas

As cleaner-burning fuels than diesel, liquefied natural gas (LNG) and bioLNG can help the road transport industry lower emissions and costs. In 2021, we planned to grow our European LNG refuelling stations to 50 sites by the end of 2021 for bioLNG distribution. By the end of the year, we had 44 Shell-branded LNG refuelling stations across seven countries. This is an increase on the 26 stations we had in 2020. As we grow our LNG refuelling network, we aim to offer bioLNG as a blend for further emissions reductions for our customers.

Read about LNG at [www.shell.com/energy-and-innovation/natural-gas/lng-for-transport/lng-for-road](http://www.shell.com/energy-and-innovation/natural-gas/lng-for-transport/lng-for-road).

Read about renewable natural gas at [www.shell.com/energy-and-innovation/new-energies/low-carbon-fuels](http://www.shell.com/energy-and-innovation/new-energies/low-carbon-fuels).

**More in this report** [Climate change and the energy transition](#) | [Driving innovation](#)

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## ELECTRIC VEHICLE CHARGING

### POWERING PROGRESS

Our targets include operating:

- more than 500,000 EV charge points by 2025, of which more than 30,000 charge points are owned directly by Shell
- around 2.5 million EV charge points by 2030

Today we operate around 87,000 public and private electric vehicle (EV) charge points, including almost 8,000 public charge points at Shell service stations, on-street and at destinations like supermarkets. In 2020, we operated around 60,000 electric vehicle charge points.

In China, for example, Shell already operates more than 850 public charge points at Shell service stations as well as dedicated EV Mobility Hubs. In 2021, we announced an ambition to install 50,000 on-street EV charge posts in the UK by the end of 2025, through ubitricity, part of the Group.

Read about electric vehicle charging at [www.shell.com/electric-vehicle-charging](https://www.shell.com/electric-vehicle-charging).

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## HYDROGEN

### POWERING PROGRESS

Our ambition is to capture a double-digit share of global clean hydrogen sales by 2035.

Hydrogen is a versatile energy carrier that can play a significant role in the transition to a lower-carbon world. We are investing in producing decarbonised hydrogen for our own facilities and, in the future, for customers in industry and mobility where direct electrification is challenging.

In 2021, we started production at the electrolyser at our Shell Energy and Chemicals Park Rheinland in Germany. The 10 megawatts (MW) proton exchange membrane (PEM) electrolyser uses renewable energy to produce up to 1,300 tonnes of decarbonised hydrogen a year, which we are using to make lower-carbon fuels at the park. Our joint venture Zhangjiakou City Transport and Shell New Energy Co., Limited (Shell interest 47.5%) started up a hydrogen electrolyser in China with 20 MW production capacity in January 2022.

We are also expanding the network of hydrogen refuelling stations. By the end of 2021, there were around 50 hydrogen refuelling stations at Shell-branded outlets in the USA (California), Canada, Germany, the Netherlands and the UK.

Read about hydrogen at [www.shell.com/hydrogen](https://www.shell.com/hydrogen).

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## DRIVING INNOVATION

In 2021, we spent \$815 million on research and development (R&D), compared with \$907 million in 2020. In 2021, we started work on 182 R&D projects with universities, compared with 124 in 2020.

Our R&D activities are key to achieving our net-zero emissions target, in step with society. In 2021, our R&D expenditure on projects that contributed to decarbonisation was around \$328 million, representing around 40% of our total R&D spend. This includes expenditure on reducing greenhouse gas emissions:

- from our own operations, for example by improving energy efficiency and electrification;
- from the fuels and other products we sell to our customers, for example biofuels, and synthetic fuels and products made from low-carbon electricity, hydrogen produced using renewable sources or using natural gas combined with carbon capture utilisation and storage (CCUS);
- by CCUS; and
- by creating nature-based solutions (NBS) to offset emissions.

Read more about technology and innovation at [www.shell.com/energy-and-innovation/the-role-technology-plays/technology-for-a-sustainable-energy-industry](https://www.shell.com/energy-and-innovation/the-role-technology-plays/technology-for-a-sustainable-energy-industry).

**More in this report** Sectoral decarbonisation | Fuelling mobility

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