Novartis AG

Environmental Data Supplement

2017

NOVARTIS

Environment

Why it is important

As a global leader in healthcare, we take our responsibility to protect the environment seriously. Our business and our patient population are going to see significant changes in the next several decades. The combined impact of increased population, increased consumption, and climate change will create both challenges and opportunities. In order to help ensure future patient access to our products, we need to act now to stay ahead of global environmental challenges. In an effort to effectively meet the needs of our patients, we are working to anticipate these long-term changes, and we collaborate with international, industry and academic partners.

How we approach it

Environmental sustainability is an integral part of our strategy. Novartis strives to make efficient use of natural resources and to minimize the environmental impacts of its activities and products over their entire life cycle. Environmental impacts are assessed to help ensure that the benefits of new products, processes and technologies outweigh remaining risks.

Our environmental strategy has four priority areas: energy and climate, water and micro-pollutants, material and waste, and supply chain.

Energy and climate

We are committed to two major milestones on our long-term pathway to carbon neutrality. We established Greenhouse Gas (GHG) targets on Scope 1 and Scope 2 of –30% by 2020 and of –50% by 2030, versus the 2010 baseline. Novartis has made sustained progress in those areas and is examining how to achieve more rapid progress in alignment with the UN Sustainable Development Goals 7 (Affordable and Clean Energy) and 13 (Climate Action).

We have a dual strategy for GHG reduction, primarily from energy and fuel usage, i.e., to improve energy efficiency and to adopt renewable energy sources. Efficiency serves as the foundation for all other efforts, making implementation of distributed generation, distributed storage and demand response management more effective in reducing GHG emissions and building climate resilience in support of business continuity.

Water and micropollutants

In the area of water and micro-pollutants, our ambition is to generate no adverse effects on water quality and water depletion from our sites and products. We have set the target for 2020 to keep our drug substance effluents from our manufacturing sites ten-fold below the predicted “no effect” concentration in the receiving surface water.

While pharmaceutical manufacturing is not very water intensive compared to other industries, access to good quality freshwater is vital for production processes. For example, it is used in chemical synthesis, production of pharmaceuticals and excipients, cleaning of equipment

and products. Novartis actively manages its water consumption by monitoring amounts of water input, water use and water output throughout the organization. Where not sufficient, water is additionally purified depending on the required use in the process or in products. Several Novartis sites use large quantities of water to cool production processes, data centers or for comfort cooling. In these cases, water quantity and water temperature is more important than quality of freshwater for production processes.

Materials and waste

Our aim is to use raw materials as efficiently as possible and to manufacture our products in a way that conserves natural resources. Our waste management ambition is based on the principles of prevention, reuse, recycling, and energy recovery as opposed to disposal and landfilling. Ultimately, we aspire to establish closed material loops for our major materials.

By reducing the amount of waste we generate as a business, and decreasing the associated financial burdens on both site-operating budgets and long-term company liabilities, we will be better positioned to invest more in science and innovation.

Supply chain

Novartis aims to fully understand the materials supply chain and its environmental impacts based on assessments of materials, products and vendors. Since 2015, annual assessment studies have been conducted on the carbon footprint and risks related to water consumption of our direct materials supply chain. These studies have demonstrated that the impacts along the supply chain (corresponding to Scope 3 emissions) are significantly larger than those inside the organization. In 2017, the assessment studies were extended and now consider the carbon and water footprint of our direct material and indirect services. These efforts have enabled Novartis to report its Scope 3 emissions more accurately in accordance with the categories laid out in the GHG Protocol. A total of 6 out of the 15 categories were identified as relevant to Novartis. Because three of these categories (purchased goods and services, upstream transportation and distribution of capital goods) represent > 90% of our Scope 3 emissions, the accuracy and completeness of the data has been improved.

We also partnered with CDP to obtain primary data from select key suppliers. This has enabled us to gain valuable insights into collaboration opportunities which could improve our joint environmental performance and reduce our Scope 3 impacts.

Other key issues

Pharmaceuticals in the Environment

Most pharmaceuticals in the environment are a result of excretions from treated patients and the improper disposal of unused or expired medicine. However, very small quantities come from drug manufacturing effluents and Research and Development (R&D) facilities. We constantly strive to minimize any release of active pharmaceutical ingredients into wastewater from our operations.

To better understand and minimize the potential impact of pharmaceuticals on the environment, Novartis uses a four-fold approach that applies to all of our operations involved in R&D, production, marketing and disposal of pharmaceutical products:

- Environmental risk assessment: Novartis evaluates the potential impacts of new medicines on human and environmental health during the R&D process before the products reach the marketplace.
- Manufacturing: Novartis minimizes discharges of active pharmaceutical ingredients from operations into the aqueous environment. We monitor potential emissions on an ongoing basis and take appropriate corrective action if necessary. We work with our suppliers to ensure they are guided by our principles.
- Safe disposal: Novartis does not dispose waste containing active pharmaceutical ingredients into landfills. We recommend that patients and consumers of pharmaceuticals dispose of any unused or expired products or waste materials in accordance with applicable legal and regulatory requirements and any disposal instructions in the patient information materials provided with the product.
- Increase knowledge: We support research initiatives of academia and regulators to close data gaps, find new solutions and advance society's understanding of environmental effects of pharmaceuticals.

Antimicrobial resistance

The growing prevalence of antimicrobial resistance (AMR) is recognized today as one of the major threats to global public health. If uncontrolled, it is estimated that AMR could lead to an additional 10 million deaths per year by 2050 – more than the total current number of deaths from all infectious diseases worldwide.

In 2016, Novartis signed the Davos Declaration on Combating AMR, together with 100 other international companies and key industry bodies from 21 countries. Novartis and 12 pharmaceutical companies subsequently signed the "Industry Roadmap for Progress on Combating Antimicrobial Resistance" committing to more concrete measures to implement the Davos Declaration, including reducing the environmental impact from production of antibiotics; having antibiotics used only in patients who need them; improving affordable access to high quality antibiotics globally; and supporting collaborations between industry and public researchers. Novartis is actively involved in each of these areas.

How we perform

Impact on our daily operations

In 2017, we reduced our net GHG emissions by nearly 60 kilotonnes (kt) (Scope 1 and Scope 2 – market based method) compared to 2016 (–24% vs. 2010). Halogenated volatile organic compound emissions increased slightly to 56 metric tons (t), and non-halogenated volatile organic compound emissions increased from 478 to 503 t.

In 2017, Novartis achieved its 2020 waste target, reporting a 31.3% reduction in total non-recycled operational waste relative to production quantities compared to 2010. The total amount of hazardous waste not recycled in 2016 for the Novartis Group was 58.8 kt compared to 49.2 kt in 2017. An additional 67.8 kt of hazardous waste, mainly solvents, were recycled. For non-hazardous waste (which includes mixed or household waste, packaging waste, compostable waste and inert waste) the total amount not recycled for the Novartis Group in 2017 remained stable at approximately 18 kt. An additional 65.5 kt of non-hazardous waste was collected for recycling. The recycling rate for non-hazardous waste remained at 78% in 2017.

Our total water use decreased from 79.1 million cubic meters (m^3) in 2016 to 76.4 million m^3 in 2017 as water efficiency improvements were implemented.

Recognition

Novartis was one of 73 companies worldwide to make CDP's Water A List in 2017. For Climate Change we maintained an A- rating from CDP and are recognized among category leaders in healthcare.

Novartis was ranked fourth in the 2017 Dow Jones Sustainability Index (DJSI) World (up from 7th in 2016), and re-entered the DJSI Europe Index for the first time in four years. The DJSI assessment has become the gold-standard for assessing the ESG (environmental, social and governance) performance of companies worldwide.

ENVIRONMENT INDICATORS[1]

	2017	2016	2015
Energy use (million gigajoules), on site and purchased	**16.48**	16.39	16.29
Greenhouse gas (GHG) emissions, Scope 1, combustion and process (1 000 tCO_2e)	**390.60**	399.67	396.82
GHG emissions, Scope 1, vehicles (1 000 tCO_2e)	**140.81**	135.57	138.83
GHG emissions, Scope 2, purchased energy (1 000 tCO_2e)	**728.50**	785.13	773.20
GHG emissions, Scope 3, business travel (1 000 tCO_2e)	**243.35**	148.14	217.70
Total GHG emissions, Scope 1 and Scope 2 (1 000 tCO_2e)	**1 259.91**	1 320.36	1 308.85
GHG offsets (1 000 tCO_2)	**61.8**	65.7	68.3
GHG emissions (Scope 1 and Scope 2) per sales (tCO_2e per million USD)	**26.10**	27.22	26.49
GHG emissions (Scope 1 and Scope 2) per associate (tCO_2e)	**10.67**	11.32	11.09
Halogenated volatile organic compounds (VOCs) (t)	**55.87**	43.59	66.40
Non-halogenated VOCs (t)	**503.20**	478.14	512.37
Non-hazardous waste recycled (%)	**78.5**	78.7	75.5
Hazardous waste recycled (%)	**57.9**	52.8	55.1
Non-hazardous waste not recycled (1 000 t)[2]	**17.98**	18.11	20.61
Hazardous waste not recycled (1 000 t)[2]	**49.24**	58.77	55.13
Water use (million m^3)	**75.87**	79.2	79.3
Water discharge (million m^3)	**15.38**	16.06	15.83

[1] 2017 environmental sustainability data published in the Annual Report are actual data for the period from January through September, and best estimates for the period from October through December. They will be updated with actual data in the first quarter of 2018. Significant deviations will be reported on our website and restated in next year's Annual Report. For more detail on environmental sustainability, see https://www.novartis.com/our-company/corporate-responsibility/doing-business-responsibly/health-safety-environment

[2] Reduction target is based on hazardous and non-hazardous waste intensity per tons produced

Novartis GRI Content Index

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GRI STANDARD	DISCLOSURE TITLE	UNGC PRINCIPLE	UN SDG	NOTES	PAGE
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Economic

201 Financial implications and other risks and opportunities for the organization's activities due to climate change

Novartis faces a range of physical, regulatory and other risks and opportunities driven by climate change. We provide information about these in our response to CDP. Our 2017 response to CDP Climate can be found here.

Environment

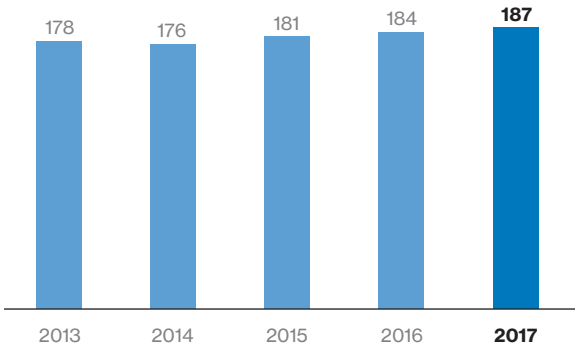
301-1 Materials used by weight or volume

As a large global organization, we are expected to manage, minimize and report on our environmental impacts and increase the efficient use of raw materials and natural resources. Novartis collects measured data on raw material use and packaging material use on a quarterly basis at key sites. However, due to the many thousand different materials used in our production, we believe it is not meaningful for our business to report on material types, their sources or the percentage of renewable content.

Novartis monitors and reports total production as the total weight of all products delivered from all manufacturing facilities. Total production covers all types of products including chemical and fermentation products, active pharmaceutical ingredients (APIs) and finished dosage forms, as well as eye care drugs, surgical equipment and vision care products. Total production for 2017 remained stable at 187 kt.

With respect to material and waste, total production is the denominator for our waste target for 2020: to reduce total non-recycled operational waste relative to production quantities by 30% compared to 2010. In 2017, Novartis achieved the 2020 waste target by reporting a 31.3% reduction in total non-recycled operational waste relative to production quantities compared to 2010. The focus now is maintaining or improving our performance in 2018.

Production total
(in kt)



301-2 Recycled input materials used

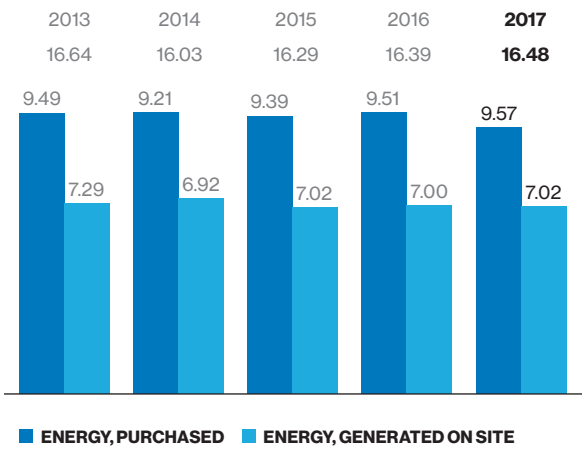
We strive to use recycled materials wherever possible. We favor raw materials with a reduced environmental footprint (i.e., materials that are less hazardous or that lead to less environmental impact during production) and prefer materials from renewable sources if technically feasible and economically viable.

The majority of the solvents we use are recycled, to a large extent within our operations and partly by contractors for third-party users. Solvents that are not recycled are either used as alternative fuels or are incinerated at waste facilities that recover the energy generated from combustion. The waste solvents reused at our sites constitute recycled input materials.

301-3 Reclaimed products and their packaging materials

Novartis maintains a Group-wide initiative on sustainable packaging, and seeks to design packaging that both minimizes environmental impacts and meets all regulatory, quality, functional and design requirements. We have developed and issued a sustainable packaging guide for packaging design teams. We also engage with clients and packaging material suppliers to determine needs and identify more sustainable packaging solutions. Best practice packaging case examples are collected and shared among packaging designers across the company. Improvements are quantified based on a set of packaging indicators.

Energy use
(in million GJ)



302-1 Energy consumption within the organization

Novartis has a longstanding, comprehensive energy program with two objectives:

- To improve energy efficiency for all industrial and commercial operations
- To use renewable energy sources where available and feasible

Energy consumption is reported quarterly at all Novartis sites. We monitor the purchase and use of all types of energy sources and fuels. In 2017, total energy use remained relatively constant at 16.5 million GJ when compared to 2016 figures.

On-site generated energy

A high proportion of our on-site energy use comes from low carbon-intensive and renewable energy sources. The data is separated into energy generated from fossil sources (natural gas, light oil, heavy oil and fossil waste), biomass fuels and renewable sources (photovoltaic, thermal solar, hydroelectric, etc.). Conversion and transformation factors for fuels are based on standards used by the International Energy Agency (IEA).

In 2017, our total on-site generated energy remained constant at approximately 7.0 million GJ in comparison to 2016. On-site renewable sources are primarily wood chips, sugar cane residues (bagasse) and biogas from mycelium waste.

Purchased energy

The use of purchased energy, including electricity, steam and hot water, is calculated from the net value of all energy acquired from external sources. Conversion and transformation factors for purchased energy are based on standards used by the IEA.

In 2017 our total purchased energy remained relatively constant at approximately 10 million GJ.

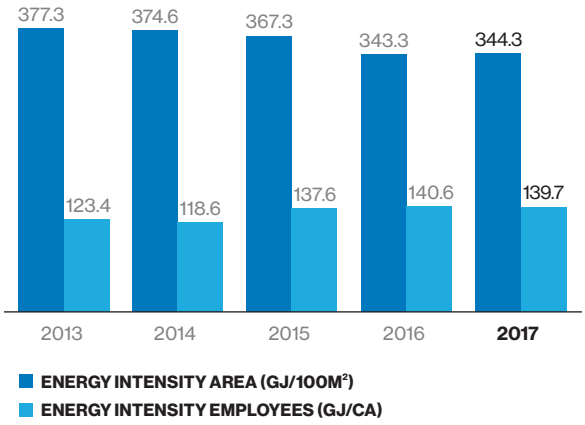
302-2 Energy consumption outside of the organization

We do not collect information on energy consumption for areas outside the organization. For the materials supply chain, we assess the carbon footprint and report this as Scope 3 GHG emissions. We believe that climate (GHG) impact is the most relevant aspect related to energy consumption and is therefore more important to report compared to energy figures.

302-3 Energy intensity

Energy intensity measurement supports site energy managers and management in evaluating progress against targets and considering further measures toward higher energy efficiency. We measure energy consumption in relation to sales, production quantity, number of associates and indoor areas conditioned for specified types of operations. These parameters may vary widely depending of the type and portfolio of products being manufactured in a certain operation, the use of a particular building and the climate zone where the operating unit is located.

Energy intensity



302-4 Reduction of energy consumption

The availability of resources, predominantly energy and fresh water, is becoming more constrained and prices are expected to increase in the longer term. Novartis makes every effort to protect the environment, limit the intake of natural resources and use them more efficiently.

Energy management program

In an effort to further increase energy efficiency, ultimately reducing GHG emissions, Novartis has a comprehensive energy management program in place to ensure energy considerations are given appropriate attention in investment projects. Major sites have been audited to assess energy systems and identify potential for improvement, for example through energy-saving measures and use of renewable energy.

New projects are a major focus for energy savings, as it is more effective to build in efficiency from the beginning than to redesign an existing system. Over the last seven years, Novartis has invested more than USD 150 million in energy projects with an average payback below 3 years.

Energy saving using Tri-generation

A Novartis facility in China installed and optimized a Tri-generation technology (Trigen) plant, which supplies the site simultaneously with electricity, heat and cooling. By utilizing the waste heat from power generation, the overall efficiency can reach up to 80%, which is significantly more than the energy which could be supplied by the city grid where the efficiency is 50%. Savings are possible because the Trigen plant is installed close to the point where the energy is needed which improves power supply reliability and efficiency of electric utility services, and reduces losses on the distribution grid. This project has generated annual savings of $1M and is expected to save 19 000 t carbon dioxide equivalent (CO_2e) per year.

302-5 Reductions in energy requirements of products and services

Pharmaceuticals and medical products in general do not require energy during use, and therefore we do not consider this indicator relevant for our business. Medical devices which today may include electronic features for a more effective use and for the support of patients are being developed following design rules that may include environmental aspects of energy efficiency and durability.

303-1 Total water withdrawal by source

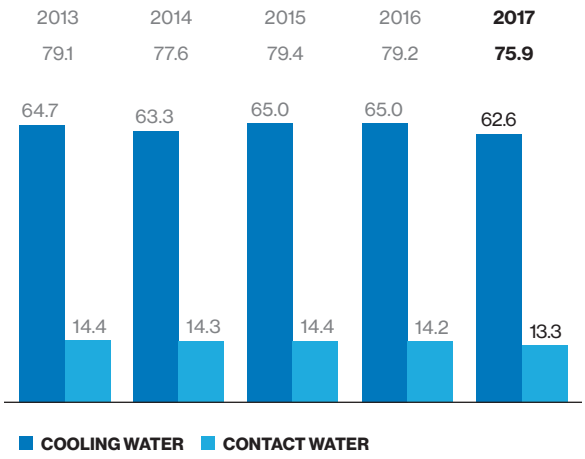
Novartis monitors water streams into its sites by source and out from the sites by discharge stream, as well as various types of water use at the sites on a quarterly basis. Water volumes are measured at all manufacturing sites and the majority of large administration sites. Water data is estimated at small administration sites based on associate numbers and average assumed consumption per person and per day. Such water balance methodology allows effective water resource and cost management, and helps achieve complete and accurate information on water use.

The water directly abstracted from the environment is used mainly for cooling purposes before being returned to the source. This water is primarily used for the cooling of fermentation and other biochemical processes, the cooling of computer servers of data centers, and comfort cooling of offices. Such cooling with water allows us to largely reduce the environmental impact related to energy consumption compared to using mechanical chillers.

Novartis achieved score level A for the CDP Water Scoring in 2017 and therewith is part of the Leaders Category for the Health Care Sector. Our 2017 response to CDP Water can be found here.

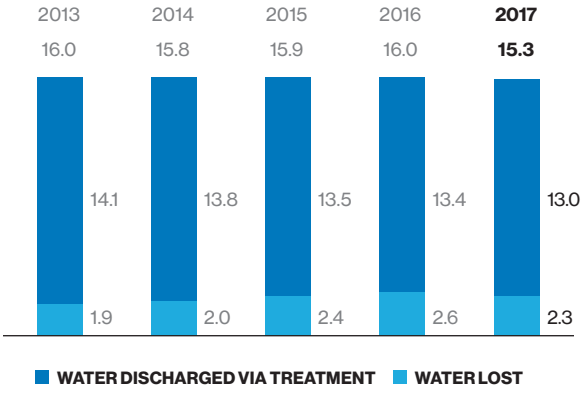
Water use

(in million m^3)



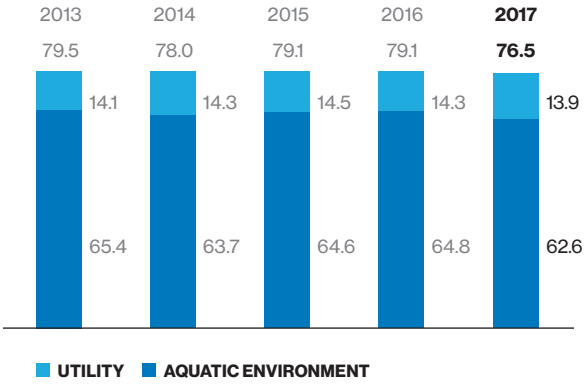
Water footprint

(in million m^3)



Water input by source

(in million m^3)



303-2 Water sources significantly affected by withdrawal of water

There are no water sources significantly affected by withdrawal of water from our operations: 18% of total water used is supplied by local public water utilities. The remaining 82% of total water used is drawn from groundwater wells or from surface water bodies and used for cooling before being returned to the source with negligible losses or variation in quality.

Water footprint

Novartis assesses the location of sites according to areas of potential water scarcity by 2025 using the WBCSD's Global Water Tool and the World Resources Insitute Scarcity Indicator.

Sites with a high level of water scarcity and significant water footprint are included in a global water-saving program. This program was initiated in 2013 at the top 10 sites with respect to water footprint and water scarcity and was extended to eight additional sites during 2014. These sites located in South and Southeast Asia, the United States and Europe, have conducted water audits, determined water flows, identified water-saving opportunities and implemented local water-saving targets through projects. The top Novartis sites in water-scarce regions have achieved approximately 16% savings of their total water footprint since 2010.

303-3 Water recycled and reused

The availability of resources, predominantly energy and fresh water, is becoming more constrained and prices are expected to continue to increase. Novartis makes every effort to protect the environment, limit the intake of natural resources and use them more efficiently.

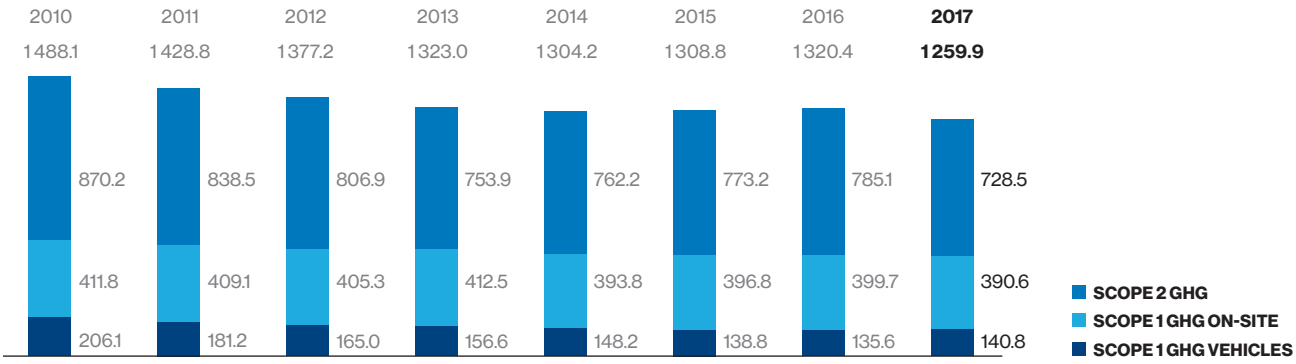
In 2017, Novartis recycled 21.5 million m^3 of water, which is 28% of our total water use, including contact water and non-contact cooling water (verses 25.9% in 2016).

305-1 Direct (Scope 1) greenhouse gas (GHG) emissions

Novartis reports its GHG emissions in accordance with the World Resources Institute's (WRI) and the WBCSD's Greenhouse Gas Protocol for all sites under its operational control since 2005 and via the CDP since 2003. The reporting structure includes Scope 1 carbon dioxide (CO_2) emissions from stationary combustion installations and from production processes, as well as Scope 1 CO_2 emissions from company-owned or leased vehicles. GHG emissions are reported on a quarterly basis and calculated in metric tons of CO_2 equivalent using emission factors provided by energy suppliers or factors from the IEA. Novartis uses the global warming potential (GWP) factors from the 2007 IPCC Report for GHGs other than CO_2.

GHG emissions

(in kt CO_2e)

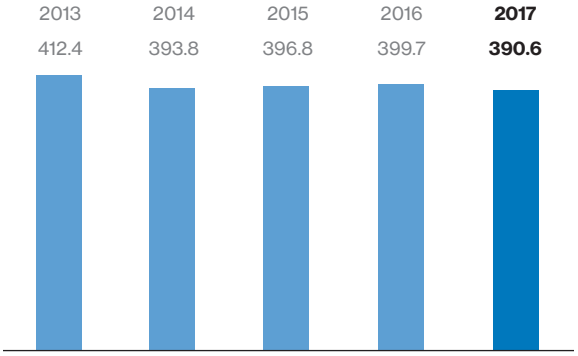


The total amount of on site Scope 1 GHGs, mainly CO_2, emitted from the combustion of fossil fuels at Novartis sites in 2017 was 390.6 kt, a slight decrease when compared to 2016 (399.7 kt).

Scope 1 GHG emissions from the use of company-owned or leased vehicles are monitored and reported separately. In 2017, these totaled 141 kt, compared to 136 kt in 2016, a 3.6% increase.

GHG emissions, Scope 1, combustion and process

(in kt CO_2e)

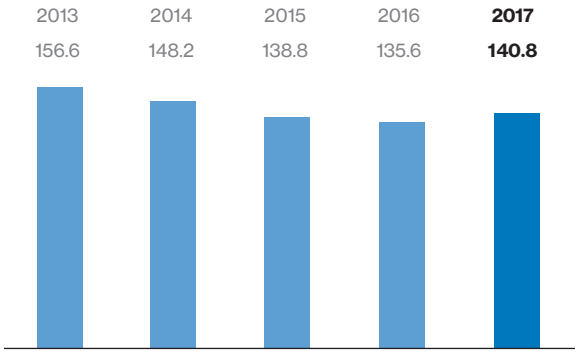


EXTERNAL FRAMEWORKS AND SCHEMES

Novartis currently operates six sites in the European Union that are included in the European Emissions Trading Scheme (EU-ETS). Additional sites in other regions or countries might become part of similar trading schemes in the future. With respect to regulatory schemes, commitments and agreements such as the 2015 Paris Accord, we have taken a proactive approach toward the implementation of those frameworks on GHG emissions in Novartis.

We report comprehensive energy and GHG data through the CDP climate program since 2003. Novartis achieved a score level A- for the CDP Climate Scoring in 2017 and is part of the Leaders Category for the Health Care Sector. Our 2017 response to CDP Climate can be found here.

GHG emissions, Scope 1, from vehicles
(in kt CO_2e)



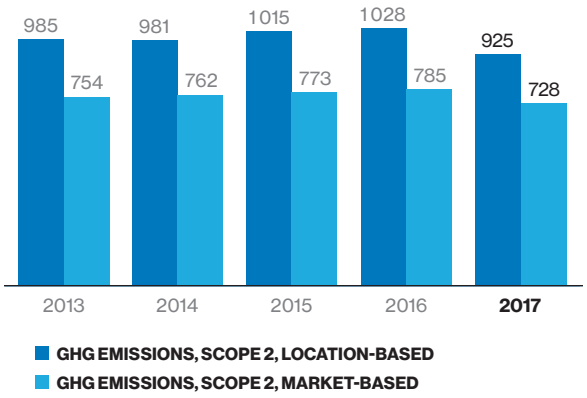
305-2 Energy indirect (Scope 2) greenhouse gas (GHG) emissions

Novartis reports its GHG emissions in accordance with the World Resources Institute's and the WBCSD's Greenhouse Gas Protocol for all sites under its operational control since 2005. The reporting structure includes Scope 2 GHG emissions from purchased energy sources such as electricity, steam and other purchased energy sources.

Novartis recalculated Scope 2 GHG emissions following the location- and market-based methods in accordance with the GHG Protocol Scope 2 Guidance released in 2015. These methods reflect the emissions from the electricity that a company is purchasing compared to the electricity that is generated locally.

Market-based Scope 2 GHG emissions are calculated using emission factors derived from contractual instruments or provided by energy suppliers, while location-based Scope 2 emissions are calculated using standard factors from the IEA. Both are reported on a quarterly basis in metric tons of CO_2 equivalent. In the absence of contractual agreements for the market-based method, we use location-based emission factors. This approach supports our strategy to increase our proportion of renewable-based electricity worldwide to reduce our Scope 2 GHG emissions

GHG emissions, Scope 2
(in kt CO_2e)



305-3 Other indirect (Scope 3) greenhouse gas (GHG) emissions

Scope 3 GHG emissions from the purchase of direct goods and material that are used in our products were estimated with an economic input/output model based on spend data to 4 008 kt. Most relevant spend categories based on absolute carbon footprint include contract manufacturing (39%), chemicals (35%) and packaging (12%).

Scope 3 GHG emissions from our global business flights in 2017 totaled 243 kt compared to 148 kt in 2016. This figure is based on detailed information from our worldwide travel agent who calculates the data in metric tons of CO_2 equivalents using the UK Department for Environment Food and Rural Affairs (DEFRA) emission factors. The increase was due to a resumption of business travel following severe restrictions in 2016. GHG emissions from the four company-owned or leased aircraft have been included in the Scope 1 company vehicle fleet reporting.

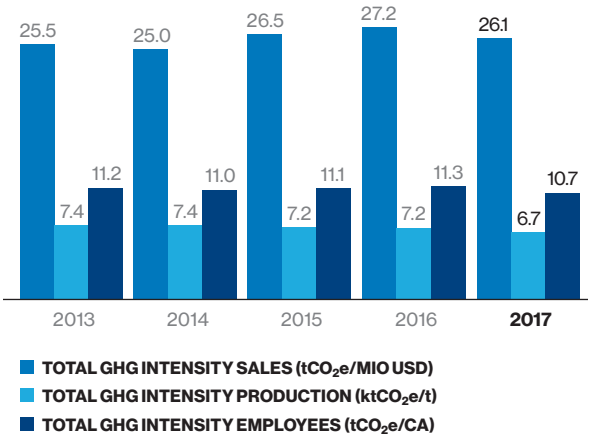
The use of Novartis products does not generally result in GHG emissions, with the exception of an inhaler product that uses HFC R134a as a propellant. The Scope 3 emissions from the use of this product in 2017 amounted to 124 kt of CO_2 equivalent, slightly more than in 2016.

Biogenic CO_2 emissions are not considered relevant and are not included in the Scope 3 figures calculated above.

305-4 Greenhouse gas (GHG) emissions intensity

In 2017, total Scope 1 and Scope 2 GHG emissions per associate remained constant at 11.0 t CO_2 equivalents per person. A slight decrease in total Scope 1 and Scope 2 GHG emissions per sales was recorded, with 26.0 t CO_2 equivalent per million USD in 2017 compared to 27.0 t CO_2 equivalents per million USD in 2016. There was also a slight decrease in energy intensity for production, falling from 88.9 GJ per ton in 2016 to 88.0 GJ per ton in 2017.

GHG intensity



305-5 Reduction of greenhouse gas (GHG) emissions

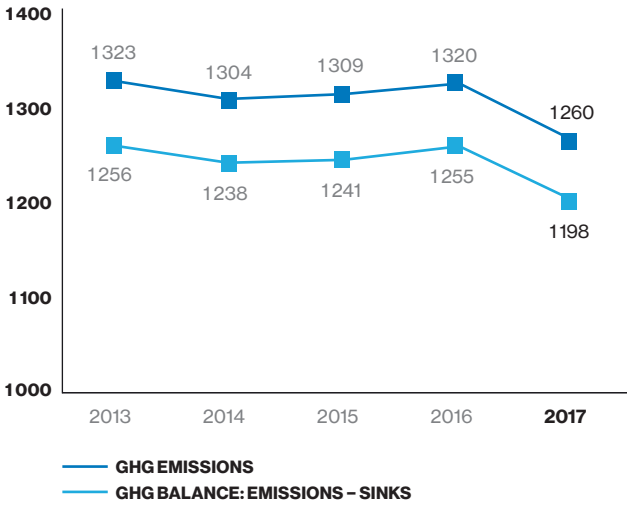
As in previous years, the Novartis Group achieved an absolute reduction in total Scope 1 and Scope 2 GHG emissions in 2017, decreasing from 1320 kt of CO_2 equivalent in 2016 to 1260 kt of CO_2 equivalent in 2017, excluding sequestration from our forestry carbon-sink forestry projects.

Throughout 2017, a cross-divisional team began to select major facility and infrastructure projects and measures necessary to achieve our 2020 goals, driven by business benefit derived from efficiency and bolstered by the future benefit as determined by our internal shadow carbon price of USD 100/tCO_2e.

Novartis pursued rapid reductions in carbon footprint that would minimize disruption to individual research or production sites by capitalizing on opportunities for contracting renewable wind and solar electricity. This procurement strategy will continue to increase our demand for renewable energy in global markets, concentrating in our markets with the highest consumption and the highest carbon intensity.

GHG emission balance

(in kt CO_2e)



Forest carbon sinks

While our main focus is to lower GHG emissions through internal operational improvement programs, we also take advantage of carbon sinks which are generated by owned forestry projects. These forestry projects are implemented in accordance with certification schemes such as the UN-CDM and voluntary schemes. These schemes are designed to quantify the amount of carbon dioxide removed from the atmosphere through sequestration into the forest's biomass. They are accounted for compensating part of the GHG emissions generated from the use of fossil energy in our operations.

Novartis has established four forest carbon-sink projects, located in Argentina, Mali, China and Colombia. A report on these project can be found here and here.

305-6 Emissions of ozone-depleting substances (ODS)

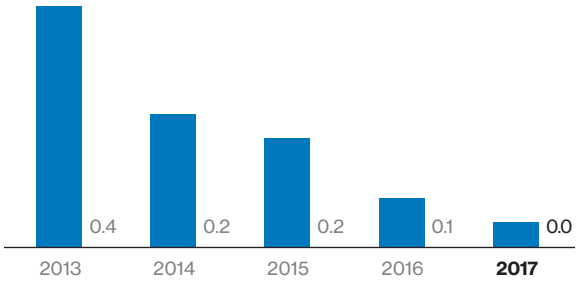
CFC refrigerants have now been completely phased out of all Novartis facilities. Additionally, HCFC inventories are continually replaced with chlorine-free HFCs or with natural refrigerants. In 2017, HFCs, which have an ODS factor of zero, amounted to 167.3 t for Novartis. Novartis does not produce ODS through its processes or products.

Emissions caused by ODS losses in 2017, reported in metric tons of CFC-R11 equivalents, were 44 kg compared to 82 kg in 2016. ODS are not included in any Novartis product. Novartis intends to minimize the use of synthetic refrigerant materials, and natural refrigerant materials are the preferred alternative in new equipment.

Data is calculated into CFC-R11 equivalents using the factors from the 2007 IPCC Report.

ODS inventories

(in tons of CFC R11e)



305-7 NO_x, SO_2 and other significant air emissions

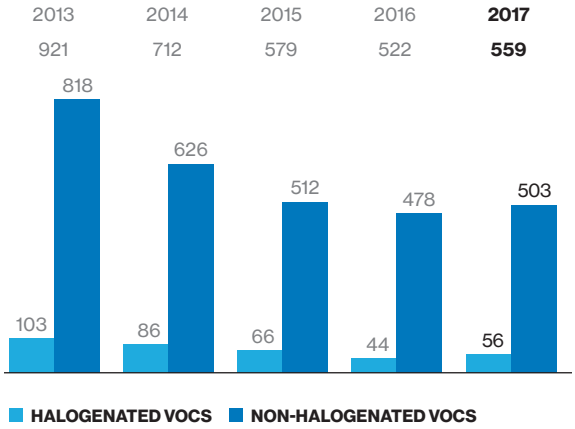
As a further disclosure of air emissions, Novartis reports halogenated and non-halogenated Volatile Organic Compounds (VOCs), sulfur dioxide (SO_2), nitrogen oxide (NO_x), inorganic pollutants and particulates. VOCs mainly originate from the use of halogenated and non-halogenated solvents in various production processes and are either measured or calculated using mass-balance equations. Inorganic pollutants and particulates arise primarily from the combustion of fuels for steam generation and heating and are either measured or calculated using standard emission factors from the IEA.

Volatile Organic Compounds (VOCs)

VOCs are the precursors of photochemical (tropospheric) ozone creation that leads to smog and related detrimental effects on health and the environment. Halogenated VOCs are greenhouse gases and contribute to GHG emissions. Emissions are strongly influenced by products that require solvent-based production processes and by the significant lead time to change production processes.

VOC emissions

(in tons)



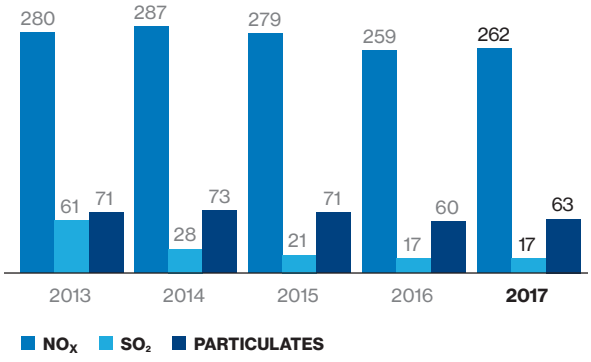
Inorganic air pollutants and particulates

NO_x emission levels from company-owned or leased vehicles are not included in these figures.

Inorganic air pollutants have long been a focus of environmental improvement at Novartis. We have implemented measures to increase energy efficiency, replace fuel oil and use best-in-class controlled furnace technology, managing to continuously decrease inorganic air pollutants including SO_2, during the last couple of years. We expect a further decrease in the coming years.

Inorganic air pollutants

(in tons)



306-1 Total water discharge by quality and destination

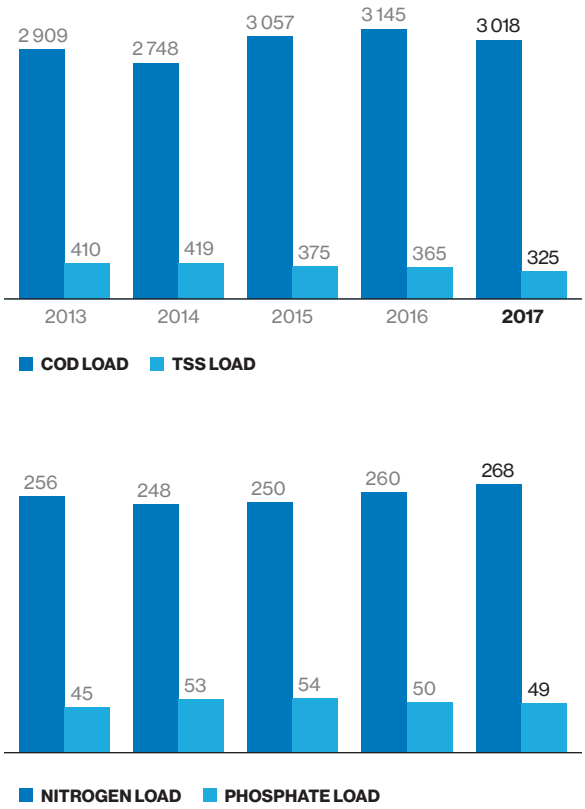
Novartis monitors water streams into its sites by source and out by discharge stream, as well as various types of water use on a quarterly basis. Water discharge is reported in volumes released to the environment, sent for treatment, entering products, evaporated or used for other purposes. Discharge volumes to treatment closely match input and contact water usage volumes, and amounted to 13.1 million m^3 in 2017.

More than 99% of all non-contact water used for cooling is released back into the environment, which accounts for 80% of all water outputs. The rest of the cooling water, together with the contact water used in processes for example, is sent to water treatment plants, accounting for 17% of our water outputs. The remaining water is used in products, evaporates, or is used for other purposes, such as irrigation.

With regards to the quality of water discharged, Novartis reports total effluent load using the standard chemical oxygen demand (COD) and total suspended solids (TSS) parameters. The amounts reported are the loads that finally reach surface water bodies. In cases where discharged wastewater is treated off-site, for example in public wastewater treatment plants, the specific removal efficiency of such treatment is considered for the amounts reported.

Emissions into water

(in tons)



Water treatment and reuse

A manufacturing site in Turkey experienced a lack of cooling water during the hot summer period. This led the site to develop a system that purifies process water allowing it to be reused. The purification system was equipped with a reverse osmosis – ultrafiltration system followed by an activated carbon filter. This water was used to supply around 40% of the water needed by its cooling tower which enabled the site to reduce its fresh water consumption by more than 20% during the summer.

Pharmaceuticals in the Environment

A major area of concern is the prevention of pharmaceuticals entering the aquatic environment. We monitor the levels of active pharmaceutical ingredients (APIs) in Novartis effluents and in the aquatic environment as a result of Novartis activities. The levels of pharmaceuticals in environment do not present a health risk for humans, who are exposed predominantly via drinking water (WHO 2011). According to current knowledge the levels are significantly below the doses approved as safe by medicinal regulatory agencies.

Since 2016, all sites generating wastewater, which potentially includes APIs, conduct a detailed assessment of their effluent. Sites which have identified drug substances concentrations in effluents with potential risk, are working on mitigation plans to meet the global target by 2020.

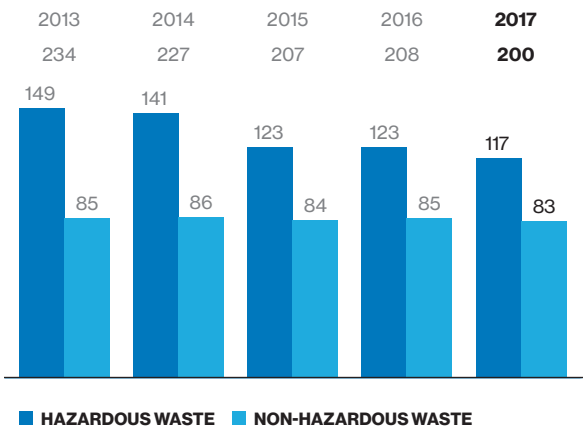
In addition, Novartis participates in Europe's largest public-private initiative IMI iPiE (Innovative Medicine Initiative on intelligent assessment of Pharmaceuticals in the Environment), which is developing a framework to identify the potential risk of pharmaceuticals to the natural environment and methods to perform appropriate environmental assessments. This predictive tool will be applicable for new and existing products and will support the continuous scientific and political discussion worldwide.

306-2 Waste by type and disposal method

Novartis follows a clear waste management strategy. The aim is to prevent, reduce, recycle or use waste as an energy source, before selecting safe disposal as an option. Waste prevention and reduction is always preferred to treatment, incineration or disposal. This helps ensure the overall environmental impact related to waste remains minimal, while energy use from waste is maximized. Opportunities for recycling and energy recovery from both hazardous and non-hazardous waste are always considered. All Novartis sites report waste data on a quarterly basis. Novartis classifies waste by type and according to the disposal routes: recycling, treatment, incineration with and without energy recovery, and landfill. In 2017, Novartis achieved its 2020 waste target by reporting a 31.3% reduction in total non-recycled operational waste relative to production quantities compared to 2010. The focus now is maintaining or improving our performance in 2018.

Total operational waste

(in kt)



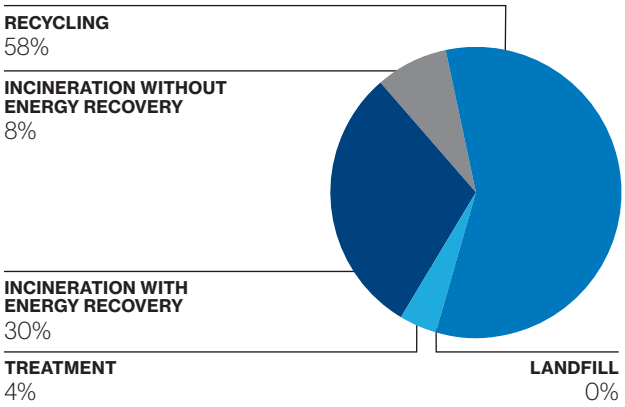
Success story in waste management

Prior to 2016, more than 8 000 tons of solvent were incinerated each year from a Novartis eye care production site in the USA. In 2017, the manufacturing site implemented a closed loop for all solvents used. Now, the site only needs to purchase 30% of its solvents, with the rest being returned to the site after recycling. In addition to recycling, a cross-domain collaborative effort enabled the site to optimize its manufacturing process to significantly reduce its need of solvent in the process, while the number of production lines doubled. This project was achieved in less than 2 years, and enabled the site to reach a 77% reduction in hazardous waste.

Hazardous waste

Novartis has had a strict policy of not sending any operational hazardous waste to landfill regardless of local regulations that may still permit this. Waste contractors are audited on a regular basis to ensure adherence to our standards. The recycling rate for hazardous waste increased from 52% in 2016 to 58% in 2017.

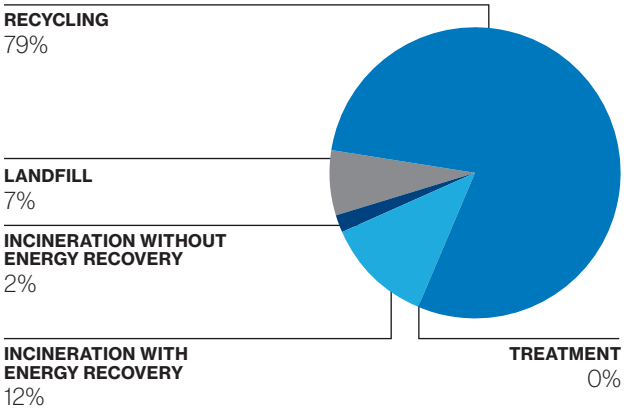
Disposal of hazardous waste in 2017



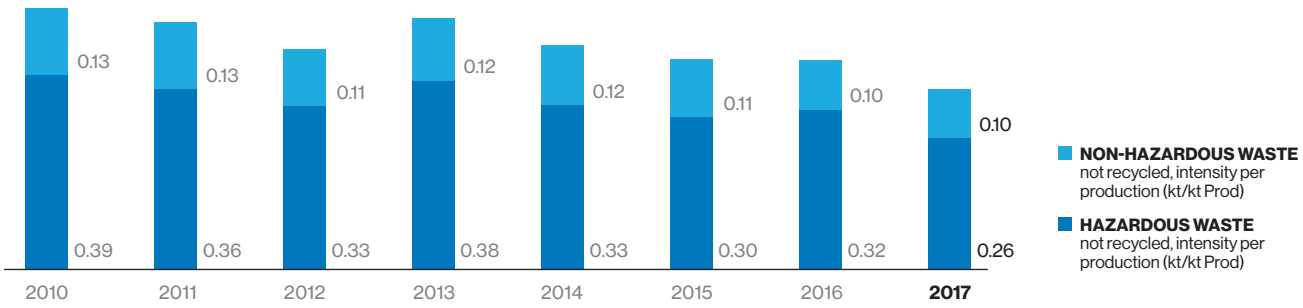
Non-hazardous waste

Keeping non-hazardous waste to a minimum and maximizing its recycling rate is a constant focus. Novartis has ongoing efforts at its operations globally to minimize the quantity of non-hazardous waste that cannot be recycled. Non-hazardous waste reported includes mixed or household waste, packaging waste, compostable waste and inert waste. Total amounts of non-hazardous waste not recycled in 2017 was at 18.0 kt compared to 18.1 kt in 2016. An additional 65.5 kt of non-hazardous waste was collected for recycling. The recycling rate for non-hazardous waste for 2017 remained at 79%.

Disposal of non-hazardous waste in 2017



Waste not recycled, intensity per production



306-3

Significant spills

Three significant spills (above regulatory limits) were reported in 2017 which resulted in the release of 222 kg of material.

307-1

Non-compliance with environmental laws and regulations

Novartis paid a total of USD 1250 in fines for a minor environmental violation in 2017.

Management systems

We operate using robust environmental management systems to drive good practice and regulatory compliance across our sites. A total of 42 Novartis facilities have ISO 14001 or Eco-Management and Audit Scheme (EMAS) certification for their environmental management systems, remaining constant from 2016.