

HSE Report (Health, Safety, Environment)

Extracts from the 2017 reference document



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5.1 HUMAN RESOURCES INFORMATION

5.1.5 A safe and healthy work environment: workplace health and safety

One of the Group's key priorities is to provide a safe and healthy work environment for all employees, in compliance with applicable law, by monitoring procedures, preventing health and occupational risks and training employees.

Thales is committed to a deliberate, responsible approach to prevention and protection for the safety of the Group's employees. This commitment, included within its ethical principles, has been a driver for the Group for over 15 years and is reflected in a policy to reduce health and safety impacts and risks in its various activities worldwide, in its products and at the various levels of the organisation.

Independently of ensuring compliance with applicable regulations and anticipating future regulatory changes, this deliberate policy has two key areas of focus in terms of health and safety:

- providing a safe and healthy working environment for its employees, on its own premises and on external sites;
- design, purchase, produce and provide solutions, products and services which meet health, safety and environmental requirements.

5.1.5.1 A dedicated organisation

The Group has established a global organisation designed to prevent risks related to workplace health and safety, whether at Thales sites or external sites, and to manage major health crises that could occur internationally.

Within the Group, the Human Resources and Health, Safety and Environment Departments share the vast domain of health and safety (H&S). In collaboration with the Group's medical coordinator, they define the H&S strategy, policy and processes. They coordinate good practices, and associated frameworks, rolled out in the different countries in accordance with the national legislation and constraints. They also take concrete actions in terms of prevention, health and safety in the workplace by taking into account the situation of each of the entities as regards regulatory compliance, workstation risk analysis, training and awareness plans, equipment maintenance, operational control and technological risks, as well as exercises in relation to emergency scenarios.

With a view to constantly improving its performance in terms of health, safety, and risk prevention, thanks to a network of "Health and Safety site/operations" coordinators in each country and entity, the Group has put in place a global organisation to ensure deployment of prevention measures on sites (exposure and protection of employees, risk analysis and implementation of avoidance and tailored protection measures, etc.) and in the context of operations carried out (industrial processes, substances, external sites, etc.).

5.1.5.2 A key priority: prevention and employee training

With health and safety one of the Group's key priorities, for many years Thales has conducted regular analyses and updates of environmental risks to keep pace with changes in its business activities, scientific and technical developments and emerging challenges.

This analysis, formalised through risk mapping, is intended to:

- check the conformity of business activities and products used or placed on the market;
- ensure that employees are not exposed to specific risks;
- monitor that business activities are not likely to affect the environment through technological accidents;
- analyse and anticipate the impact of new regulations.

Risk mapping consolidates an overview of areas for improvement, which are addressed via action plans both at Group level and locally. Coordinated by the Risk Assessment Committee, the process to manage these risks likely to affect employees is monitored regularly.

Finally, international Health and Safety Steering Committees ensure coordination of these policies.

To underpin the Group's skills in health and safety matters, dedicated training modules are also advertised in the Thales Learning Hub brochure. As well as health and safety managers, these modules target the different job families: purchasing, design, operational managers, etc.

Thanks to these initiatives, in 2017, Thales pursued its programmes with a view to instilling a real "safety culture" by through the introduction of manager involvement.

Finally, as part of its deployment of certified management systems, at 31 December 2017 the Group recorded 107 OHSAS18001 certificates representing 82% of the worldwide workforce.

- **Change in number of employees working at ohsas 18001 sites**



5.1.5.3 Tangible measures and procedures

Practical measures in relation to employee health and safety in the workplace are also implemented by the Group's Human Resources Department and Health, Safety and Environment Department, specifically in relation to quality of life at work.

Accordingly, in France, the "quality of life at work" agreement of 4 February 2014 defined a general framework for Thales's health and safety policy and established a system for identifying and preventing occupational risks. The agreement is based on a preventive approach involving all players in occupational health. It is aimed at preventing the appearance of psychosocial risks (PSR) by paying particular attention to primary prevention, through the formalisation of actions to prevent their appearance, thanks to a unique risk assessment document for each establishment.

As the agreement of 4 February 2014 expired in 2017, negotiations were initiated in September 2017 with a view to concluding a new Group agreement on "quality of life at work".

To raise employee awareness of the importance of factoring quality of life at work into their daily activities, most Group companies in France now organise an annual "quality of life at work" Week, during which employees can attend a number of workshops and conferences in areas such as workplace well-being, the prevention of PSR and cardiovascular risks, balanced diets and sleep.

Tangible measures have also been taken to make it easier for employees to reconcile professional and personal obligations, including the creation of inter-company crèches and concierge services.

In 2017, a total of 328 management-level employees received training in psychosocial risks from Thales Learning Hub.

The Group framework agreement of 24 April 2015 on teleworking, which has since been supplemented by company agreements, is fully in line with this commitment to improve quality of life at work.

Lastly, a central "quality of life at work" committee supports all of these initiatives.

To increase employees' health and safety, as part of the annual Health, Safety and Environment campaign, an awareness raising initiative on road safety was rolled out to all Group sites. During the campaign, a series of posters was presented and distributed to employees to highlight the main dangers and train them in good habits to help to reduce risks.

Internal and external audits on working conditions are also conducted on Group sites and external sites abroad. The Corporate Health, Safety and Environment team carries out similar assessments thanks to a team of 23 qualified auditors who conducted various assignments in 2017 in several countries (India, Hong Kong, Middle East, Portugal, Norway, United Kingdom, Spain, Italy, Mexico, France, etc.).

This coincided with the actions taken to develop tools to contribute to safety management on external sites and project management.

Finally, the rollout of the LEAN culture continues within the Group with the integration of workstation cleanliness/safety.

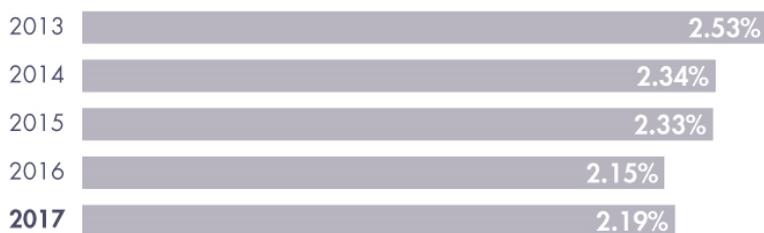
5.1.5.4 Information on work-related accidents and absenteeism

Worldwide, the Group's overall absenteeism rate is 2.54%.

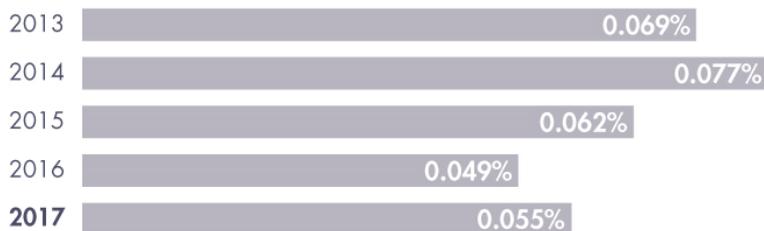
In France, the total rate of absenteeism calculated in accordance with the social report was 3.25% in 2017. This rate has been relatively unchanged for the last few years (3.27% in 2016, 3.18% in 2015). The absenteeism rate, excluding parental leave, also remained unchanged at 2.57%. The proportion of absenteeism relating to accidents at work, commuting accidents and occupational illnesses was similar to the proportion recorded in the previous year and remained consistently low.

For accidents at work, the overall frequency rate worldwide was 2.19 in 2017 and the severity rate was 0.05. The rates differ substantially for each country, depending in particular on the activities taking place there. In France, in 2017, the frequency rate of accidents at work was 2.56 and the severity rate was 0.08.

- **Change in frequency rate (working days lost due to accidents at work)**



- **Change in severity rate**



It should be noted that the inherent difficulty in defining the concept of occupational illness in the countries has not allowed this information to be consolidated across all countries in which the Group is established. The information on occupational illness is consequently shown only for France. In France, 1,637 working days were lost due to occupational illness in 2017.

5.1.5.5 Solid welfare cover

Offering employees quality health and death/disability coverage helps to support them throughout their working lives. Some countries have brought in specific measures in this regard. In France, since the conclusion of the Group agreement on welfare provisions on 23 November 2006, employees have had a harmonised collective status across all companies and identical welfare cover, whatever the legal entity concerned.

The agreement of 12 December 2016 adapted this system to reflect regulatory changes.

5.1.5.6 Working time

For the Group, the organisation of working time should allow a balance between work and personal life, with each country adapting working time according to the applicable legislation, regulations and agreements.

A total of 93.4% of Group employees are full-time; part-time contracts generally reflect the employee's choice.

A total of 93.4% of Group employees are covered by working time regulations, which in several countries (such as France, Spain, Germany and the Netherlands) result from collective agreements limiting working time. In all, 77.7% of Group employees are of a level equivalent to engineer, specialist or manager, which means that few employees are subject to unconventional working hours (nights, alternating shifts, etc.).

Many Group employees work on the basis of 40 hours per week. For example, Belgium, Spain, Italy, Norway, Austria, South Africa, the Netherlands, Poland, Portugal, Switzerland and China (including Hong Kong) operate a 40-hour week. In certain countries, the working week is shorter than this, pursuant to legal or contractual provisions. In the United Kingdom, most of Thales's activities are organised on the basis of a 37-hour working week. In Germany, branch collective agreements give a working time of 35, 38 or 40 hours per week, depending on the region. In France, most of the Group's companies have signed agreements implementing the 2000 framework agreement on working time which, for non-managerial staff, provides for working time of 35 hours per week on average over the year, with reduced working time days granted; for managerial staff, it provides for a flat-rate system in hours or days over the year based on 210 working days a year (excluding the country's "solidarity day").

The total amount of overtime worked in France was equal to 49,183 hours in 2017, as compared with 45,970 in 2016.

5.2 ENVIRONMENTAL INFORMATION

5.2.1 General policy on environmental issues

5.2.1.1 Long-standing commitments

Thales is committed to a deliberate, responsible approach to protection of the environment. This commitment, written into the Code of Ethics, has been a driver for the Group for over 15 years and is reflected in a policy to reduce environmental impacts and risks in its various activities worldwide, in its products and at the various levels of the organisation.

In addition to ensuring compliance with applicable regulations and anticipating future regulatory changes, the policy has four key areas of focus:

- preventing impacts on people and the environment from the Group's activities:
 - by reducing and controlling environmental risks and impacts on health,
 - by consuming fewer natural and energy resources,
 - by respecting biodiversity and cultural heritage;
- taking the environment into account in product policies and services:
 - by limiting their environmental footprint whenever possible,
 - by developing solutions that are beneficial for the environment,
 - by using the environment as a driver for innovation;
- significantly reducing our own carbon footprint, as well as that of our clients and civil society:
 - by reducing emissions from our own operations,
 - by promoting low-carbon solutions;
- fostering a spirit of innovation with regard to the environment:
 - by sharing expertise,
 - by communicating transparently,
 - by encouraging the involvement of employees, suppliers and other stakeholders.

To reinforce its commitment, the Group has set performance targets for all of its entities since 2007. Five years ago, these were extended to purchasers, and to staff involved in product policy and engineering, industry and projects.

The current goals have been set for the period 2015-2018 and relate to energy, climate, waste, environmental management of the supply chain and product design, in line with the Group's environmental challenges.

The Group is also organised to manage the anticipated gradual replacement of hazardous substances banned for use which could result in obsolescence of our products.

Finally, following on from previous actions, in particular those taken during the COP 21 events in 2015, in signing the French Business Climate Pledge⁽¹⁾ (11 December 2017), Thales confirmed its desire and its commitments to combating climate change (for instance by mapping direct and indirect emissions (scopes 1, 2 and 3), reducing its direct emissions and by developing innovative products and services to help its customers to reduce their emissions, etc.).

(1) French Business Climate Pledge: on the eve of the One Planet Summit on 12 December 2017, 91 French companies of all sizes and from all sectors announced the signature of a shared commitment to climate. Each of these companies put forward its actions as a committed player in the fight against global warming.

• **GOALS FOR 2015-2018**

	2018 target
Natural resources	
Energy consumption	-3%
CO₂ emissions	
Energy and substances (scopes 1 and 2)	-5%
Non-hazardous waste	
Quantity per person	-5%
Recycling rates	>60%
Responsible purchasing	
Evaluation of Class A and new suppliers	100%
Training for new buyers	100%
Eco-design	
Environmental impact assessment for all new products	100%
Training for <i>Design Authority</i> line managers	50%

Detailed values are given in the table in Section 5.2.7.

5.2.1.2 Commitment from employees

5.2.1.2.1 World organisation

Aiming to consistently improve its environmental performance and prevent risks, the Group has set up an organisation that reflects its challenges. This Group Health Safety Environment Department is responsible for setting out strategy, policy, processes, methods and associated standards, and for supervising and monitoring their implementation across the Group as a whole, with global facilitation of:

- a network of “site/operations environment managers” at country and entity level, responsible for the environmental aspects of sites (buildings, infrastructure, energy, etc.) and the operations performed (industrial processes, substances, waste, external sites, etc.), bolstered by a real estate management network;
- a dedicated network of “products and services environment” managers in the Group Business Units and Business Lines in charge of integrating environmental aspects upstream of and during offer and product development phases, supported by contacts in the cross-functional services (engineering, industry, purchasing, services, offers, projects, etc.). Its purpose is also to facilitate action to anticipate and research appropriate alternative solutions to substances that are not recommended or prohibited.

At end-2017, the “sites/operations environment” network involved close to 400 people and the “environment in product design” network around 200, either full-time or by sharing time with other assignments.

Given that the environmental risks and issues in the Group’s different business lines require employees with managerial or technical skills in environmental matters, the operational management relies on these networks which are seated within a dedicated job family to enhance their skills, determine the need for recruitment and training, predict future developments and share their expertise as part of a single community.

5.2.1.2.2 Employee training and information

E-learning modules are available to educate Group employees on the basic aspects of environmental risk control, general themes such as eco-responsibility or specific issues such as the REACh (Registration, Evaluation and Authorisation of Chemicals) regulation, the labelling system for hazardous chemicals or climate change.

To support the environmental skills within the Group, other dedicated training modules are offered (Thales Learning Hub) which, as well as environmental managers, target the different job families: purchasing, design, sales, etc. In 2017, the training of purchasers continued (on top of the 1,058 already trained) in addition to modules for engineering managers and product developers (35% on top of the 641 already trained prior to 2016) and those responsible for product policies, to ensure the environment is taken into account in their daily work.

The Group Health - Safety - Environment Department also attends various conventions in other business lines to present the HSE strategy, challenges, individual roles in terms of HSE: supplier auditor convention, Welcome Convention to welcome newcomers, product policy convention, engineering/industry hardware seminar, R&D days.

Given that an environmental approach necessarily requires buy-in from all employees, the aim is to keep a constant eye on this theme and take it into account in day-to-day business practices. Thales offers various communication tools and forums for all employees, including a dedicated intranet, notices, competitions and events.

A collaborative IT platform specifically for Group employees across the world provides a forum for exchanging news and information about the Group. Members include personnel working in areas such as design, communications, sites and operations, in addition to those involved directly in environmental management.

5.2.1.3 Relations with stakeholders

5.2.1.3.1 Involving suppliers

To extend its eco-responsible approach to all suppliers, Thales requires the companies with which it works to sign the Purchasing and Corporate Responsibility Charter, a contractual document intended to help them align their policies and internal processes with the principles that Thales is committed to respecting. At end-2017, 12,700 supplier sites around the world had committed to this charter.

Moreover, as part of the selection process, potential suppliers are requested to complete a self-assessment enabling them to measure the maturity of their environmental management and commit to a process of continuous improvement. This self-assessment may subsequently be verified during supplier audits conducted by Thales, which may also lead to a request for an improvement plan, or even to Thales deciding to remove a supplier from its list if certain essential criteria are not met.

To reinforce this approach, the Group Purchasing Department has set the target of assessing the environmental maturity of all of its new and class A suppliers at the end of 2018 (representing 80% of purchasing volumes). At end-2017, 7500 supplier sites underwent this assessment; 67% of the panel concerned were class A.

In the call for tenders phase, the environment is now included in the weighted criteria for supplier selection.

Thales has also maintained very close partnerships over many years with certain suppliers to work together on shared actions for progress.

5.2.1.3.2 Relations with other stakeholders

Thales is committed to communicating in a totally transparent way with local authorities, as well as with its local neighbours and civil society.

Where there are particular operational requirements, sites will volunteer information on its business news and challenges, and also when certain activities are going to be exceptionally noisy, when emissions have exceeded the authorised threshold, or when a pollution incident occurs. Procedures are also in place to receive, deal with and communicate reports and requests swiftly.

To meet the requirements of civil society, investors, rating agencies and clients, Thales provides its environmental data on its website and also participates in reporting for the Carbon Disclosure Project and the Dow Jones Sustainability Index. It is also possible to send questions to the Group's Environment Department using a dedicated e-mail address.

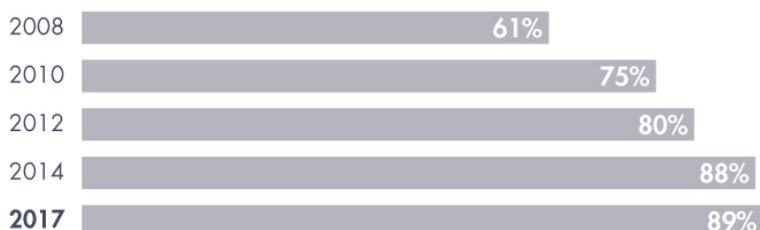
In the course of its partnerships, particularly with schools, Thales promotes preservation of the environment through programs on climate change and natural resources, or by working with universities.

5.2.1.4 Management and prevention of environmental risks and pollution

5.2.1.4.1 Continuous improvement and prevention process

Aware of its responsibility towards the environment, Thales has fully integrated the control of environmental impacts and risks in its Group management system, which is available to all employees and in all entities worldwide.

• EMPLOYEES WORKING AT ISO 14001 SITES



The Environmental Management System has been implemented at all sites as part of a dedicated process for ensuring the control and limitation of environmental risks and impacts of operational activities (buildings, industrial base, equipment and sites), the supply chain (purchases, supplier audits) and products delivered (product policy, design, bids, projects and services).

Integrated into the different processes governing the Group's activities, it defines good practices and methodological guides, as well as specifying the rules to be respected at all levels of the organisation.

It also defines the risk management and alert procedures in the event of an accident.

At end-2017, 124 Group entities were ISO 14001-certified, representing 89% of the Group's workforce. Of these sites, 86 were certified to ISO 14001:2015, which covers the management of environmental impacts of products among other things.

The planning of audits takes place on an annual basis. Audits are conducted by the internal audit teams (audit policy, maturity assessment) as well as by external auditors for ISO 14001 certification or prevention visits.

In addition, to provide support to the sites, the risk management software suite eHSE was adapted to changes in standards, particularly in relation to taking into account challenges, stakeholder demands, risks and opportunities within environmental analysis and the effectiveness of actions and associated resources.

5.2.1.4.2 Risk mapping

Environmental risks are one of the risk factors that may have an impact on the Group's financial position (see Section 1.1.2.1.4). For many years, Thales has conducted regular analyses and updates of environmental risks to keep pace with changes in its business activities, scientific and technical developments and emerging challenges.

This analysis, integrated into a risk mapping, is intended to:

- ensure the compliance of activities and products;
- ensure that employees and local residents are not exposed to health and environmental risks;
- check that activities do not present a threat to the environment;
- analyse and anticipate the impact of new regulations, including on product design.

Risk mapping consolidates an overview of areas for improvement, which are addressed via action plans either at Group level or locally.

Since 2007, the Group's Risk Assessment Committee has overseen an annual evaluation of the risk management system by each of the Group's operational entities, leading if necessary to the development of an improvement plan in collaboration with Group experts.

To enhance its risk analysis of Group sites, Thales has an active policy of prevention engineering with an external partner. It aims to improve the risk profile of industrial activities on strategic sites, thus limiting potential damages (fire, natural events, pollution, machinery breakdown, water damage, etc.) liable to cause major accidents and severely disrupt the supply chain. The prevention visits conducted on 139 sites lead to recommendations aimed at reducing the probability of incidents and preventing their consequences.

Risks related to natural disasters and water stress (risks associated with climate change) are also assessed (see Section 5.2.4.4).

Management of environmental risks also encompasses disposals or acquisitions of assets, in respect of which it is important to limit the type, value and duration of any guarantees provided or risks acquired.

Materiality of impacts	Industrial type activities	Tertiary type activities	Comments
Water consumption	Low ^(a)	Insignificant	(a) With the exception of an Australian industrial site for which this is significant (see paragraph 5.2.3.1.1).
Emissions in water	Low ^(a)	None	Tertiary sites discharge their sanitary waste water into local authority networks like any other municipal resident. Industrial sites collect and process their waste water before discharge.
Atmospheric emissions	Insignificant ^(a)	None	Industrial activities emit very few atmospheric pollutants.
Energy consumption	Low	Insignificant	Few energy-intensive processes. Alternative energy optimisation research work and promoting the development of eco-efficient products.
Greenhouse gas emissions (scopes 1, 2 and 3)	Moderate	Moderate	Contribution mainly to scope 3.
Production of non-hazardous waste	Low	Insignificant	Selective sorting in place
Production of hazardous waste	Low	Insignificant	Some particularities on industrial sites using hazardous substances or primarily producing WEEE (electronics industry). Collected and disposed of through authorised channels.
Management of chemical products (obsolescence)	Low	None	Anticipation and qualification of industrial processes in accordance with regulatory timetables.
Soil pollution	Moderate	Insignificant	Some sites with a legacy of historically polluted soils under management and controlled.

5.2.1.4.3 Accidents and site pollution

Since 1998, the Group has also been engaged in an extensive pollution risk assessment programme. Few sites have shown significant signs of contamination, and where contamination has been identified, it is usually due to earlier industrial activities.

When available techniques allow, steps are taken to remove pollution even if this is not a regulatory requirement. The impact on the available environmental resources is then reduced to a minimum by preferring *in situ* treatment to transferring pollution to another site. The water table is periodically monitored at industrial sites and sites located in industrial areas.

Only one Group site is a Seveso upper tier establishment. In addition to the preventive measures mentioned above and in Section 5.1.5 "A safe and healthy work environment", a safety management system (including measures such as a major accident prevention policy, an internal emergency plan and risk assessment) is deployed and inspected once a year by the Regional Directorates of the Environment, Land-Use Planning, and Housing (Direction régionale de l'environnement, de l'aménagement et du logement or DREAL) in relation to Seveso classifications.

The insurance and compensation policies for victims of accidents, including technological accidents for which the Group may be liable, cover all sites insured by the Group including the upper tier Seveso site.

Risks arising from accidents (such as fire or pollution) are managed locally, with the support of the concerned Corporate departments if necessary. Accident prevention and management procedures, as well as procedures for handling specific complaints, are in place for such cases. An accident reporting tool makes it possible to analyse accidents that do occur and draw suitable lessons from them. In 2017, 15 accidents occurred; they had no significant impact on health and the environment as corrective measures were immediately taken.

5.2.1.5 Guarantees, provisions and compensation

Thales was not cited in any environmental dispute that gave rise to compensation in 2017, and only granted one generic guarantee in relation to the environment.

At 31 December 2017, the amount of reserves for environmental contingencies at Group level was €5.7 million.

5.2.2 Pollution and waste management

5.2.2.1 Limiting discharges

5.2.2.1.1 Industrial atmospheric discharges

In general, Thales's activities do not generate atmospheric discharges, except for those linked to site operation (in particular heating). A few sites discharge industrial atmospheric emissions which are channelled and treated where necessary (with filters, scrubbers, etc.) and regularly checked. This primarily relates to solvents.

5.2.2.1.2 Solvent discharges to the atmosphere

With the exception of the Mulwala propellant manufacturing plant in Australia, the use of solvents is mainly linked to isolated individual activities such as paintwork detailing or small-capacity component degreasing baths. The quantities used are therefore limited and it is difficult to measure atmospheric emissions as they are not channelled.

69 (out of 155) entities purchase solvents; three of these entities account for 89% of purchases. The Mulwala site alone accounts for 86% of purchases and 92% of discharges resulting from the manufacture of propellants requiring a large quantity of solvents.

It should be noted that several sites have stopped using solvents or replaced them with detergents.

5.2.2.1.3 Industrial wastewater discharge

Thales's activities generate little in the way of industrial wastewater: 91% of wastewater is discharged from six sites, and 65% from the Mulwala, Australia site alone.

Consolidated wastewater discharges have fallen by 17% compared with 2012, as a result of ongoing plant optimisation and modernisation measures and wastewater recycling.

Some sites that are not connected to public networks discharge their industrial wastewater into surface water, after treatment, in accordance with regulations, and with the approval of local authorities.

5.2.2.2 Fighting pollution

5.2.2.2.1 Noise

Noise is also a concern for Thales, despite the fact that its activities generate little in the way of noise pollution. Cooling systems are the most common sources of noise pollution, and precautions are taken to limit noise levels associated with this equipment. Sound levels are checked periodically. The few sites where noise is a particular issue are equipped with acoustic attenuation systems, or only conduct noise-generating activities within specific time periods. The increasing use of computer simulations for pyrotechnic testing, for example, also helps to reduce noise.

5.2.2.2.2 Odours

Thales's activities do not generally generate odour, except for one entity where systems to capture atmospheric emissions have been installed and are regularly checked. The redevelopment under way at this site will modernise the facility concerned and eliminate these odours.

5.2.3 Circular economy

5.2.3.1 Sustainable use of resources

For several years, Thales has been developing a specific strategy for natural resources and has launched various schemes to help manage and reduce consumption, including in relation to the energy efficiency of buildings and industrial processes, optimisation of water use and the reuse of materials. To support these measures, it is crucial to raise employee awareness of best practices.

5.2.3.1.1 Water consumption

Water is a vital resource to be protected. Accordingly, since 2000, Thales has been engaged in a far-reaching programme to reduce its consumption by, among other things, dealing with leaks, centralising the management of its networks, replacing water-intensive equipment, optimising industrial processes and reusing water in industrial processes.

	2012-2015*	2015*-2017
Water consumption (cubic metres)	-11%	3%

* At constant scope of consolidation over the period.

The increase in water consumption over the period 2015-2017 is due to one site which installed a geothermal facility pumping ground water at 12°C for process cooling (furnaces, test benches) which is entirely returned to the natural environment.

The Group's overall consumption is down 8% since 2012 confirming the collective efforts made by all sites (including the Mulwala site which alone accounts for 36% of the Group's water consumption). These achievements are due to increased employee awareness and to widespread use of best practices.

5.2.3.1.2 Consumption of raw materials

Thales designs, develops and supplies equipment, systems and services in aeronautics, space, transport, security and defence. The raw materials consumed by Thales are natural resources (see Sections 5.2.3.1 and 5.2.3.3) and various materials used in the manufacture of products by Thales and its subcontractors.

The search for new technologies and the design of new equipment involve restricting the use of materials to cut down on size and mass and to facilitate dismantling (see Section 5.2.6), as well as replacing the most toxic substances for health and the environment. These requirements are conveyed to suppliers of the equipment and components that Thales assembles at its sites.

The manufacturing processes are also optimised to limit loss of materials and amounts of discharge and waste. The process of additive manufacturing (also called 3D printing), for example, is now used by Thales to manufacture parts in the space domain (opening of its new Thales 3D Morocco site in Casablanca in 2017). Boasting a low consumption of raw materials, this new technology also makes it easier to repair parts.

The principle is based on the manufacture of parts, not by removing material, but by adding successive layers of powder (metal, plastic) agglomerated by means of a laser or electron beam, solely in places where material is necessary. Thales thus produces monobloc antenna supports in aluminium.

Thales has also reduced the use of materials such as wood, cardboard and plastic by limiting and reusing packaging either for supplies on Thales sites or for the transfer of equipment from one site to another and fully integrates the eco-design concept into the development of its new products to reduce the environmental footprint of Thales and the customers who use its products in all areas where it is technically and economically viable.

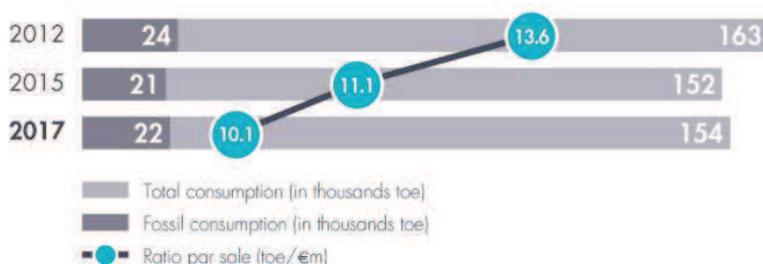
5.2.3.1.3 Energy consumption

Aware of the energy challenge, Thales sets goals to reduce energy consumption, which has declined even with production increases on the sites that consume the most energy (in 2017: increase in capacity, new facilities and/or site extension).

	2012-2015*	2015*-2017
Energy consumption (toe/€k)	-7%	1%

* At constant scope of consolidation over the period.

• CHANGE IN ENERGY CONSUMPTION *



* At constant 2012 scope.

To achieve this energy efficiency, various audits have been conducted at some of the sites with the highest consumption. These have given rise to reduction programmes being rolled out at all Group sites. The actions taken are mainly connected to lighting, office equipment, heating, air conditioning and process-related equipment. Thales is redoubling its efforts to manage parameters such as heating temperature, plant operating schedules and the replacement of energy-intensive equipment.

At the same time, some Group entities have taken steps towards ISO 50001 certification for energy management systems. At end-2017, 33 entities were ISO 50001-certified, representing 26% of the Group's workforce.

The Group's carbon footprint has also been reduced by restricting the use of fossil fuels (gas, fuel oil and coal), with their consumption in relation to sales continuing to fall in 2017 (down 7% compared with 2012). The percentage of electricity from renewable sources now represents 17% of electricity consumption.

5.2.3.2 Waste prevention and management

5.2.3.2.1 Preventing waste production; recycling, reusing, recovering and eliminating waste

In view of its waste targets, Thales has sought to reduce the quantity of waste it produces since 2012, as well as the amount sent to landfill and recycling.

CHANGE IN WASTE PRODUCTION



The increase in the production of non-hazardous waste in 2017 is thanks to a multi-year cycle for the disposal of process sludge and metals on the Mulwala site, and to multiple works on the sites generating exceptional quantities which could not be segregated from those produced through the sites' activities.

As a result of measures taken since 2007, 83% of all waste (excluding exceptional waste) was recovered and 51% was recycled in 2017.

To achieve this, various measures related to selective waste sorting, the search for recycling channels or optimum treatment channels and campaigns to change habits and behaviour (printing policy and reusing cardboard and other packaging, for example) have been introduced. These measures are aimed at reducing waste production and improving waste treatment.

For instance, the amount of waste paper and packaging fell by 9% and 2.5% respectively compared to 2012, with the Group increasingly adopting a digitisation policy.

Certain Group sites reuse packaging either for procurement on Thales sites or to transfer equipment from one site to another.

Hazardous waste has also been a specific target. Dedicated areas for collection and storage have helped to manage this type of waste prior to disposal. The quantity of such waste has decreased consistently since 2015.

5.2.3.2.2 Food waste

Food services companies manage the corporate restaurants at the majority of Thales sites. It is therefore their responsibility to communicate about eating habits and food waste management which are strongly encouraged to reduce food waste.

At the few sites in charge of their own food services, communication campaigns targeting employees have been carried out.

5.2.3.3 Land use

The Group considers environmental criteria when choosing locations for its sites, looking at climate and geological risks, the impact of its activities on the human and natural environment, and land use. The objective is to optimise compatibility between the Group's activities and the environment. Some activities, such as pyrotechnics, require a specific site due to the risks they generate and need to be bounded by extensive security areas and suitable geology. These areas account for approximately 80% of areas occupied by the Group (two sites in Australia and one in France). However, steps are taken to enhance their ecological value either by promoting biodiversity or by converting them into pasture or farm land. Due to their activity, the majority of other Group sites tend to be in industrial areas (53% of land area excluding pyrotechnics sites).

Soil erosion is another factor taken into account, locally via impact studies and associated control measures where required by the context.

For the past 20 years, the Group has also been engaged in an extensive pollution risk assessment programme for soil and groundwater (See Section 5.2.1.4.3). Action and control plans are developed for this purpose.

5.2.4 Fighting climate change

5.2.4.1 Commitment to climate

Climate change is a major challenge which Thales wishes to address in a consistent manner by reducing its CO₂ emissions at source, as well as by contributing to a better understanding of climate impacts and a reduction in its customers' emissions and those of civil society, thanks to its innovative solutions or through the design of eco-responsible solutions.

Since 2015, to assert its commitment to combating climate change, Thales, along with a number of other large companies and international organisations, has signed the "Business Proposals for COP21"⁽¹⁾, the aim of which is to confirm corporate commitments on climate. Thales has also exhibited its innovative solutions to combat climate change at the Galerie des Solutions (solutions exhibition) in Paris in 2015, at the COP22 in Marrakesh in 2016 and, through the signature of the French Business Climate Pledge⁽²⁾ (11 December 2017), the Group recently confirmed its desire and commitments to combating climate change.

Moreover, since 2005, Thales has chosen to communicate in a totally transparent way about its climate strategy to the Carbon Disclosure Project⁽³⁾, an association which aims to inform the investment decisions made by its institutional members, by telling them about the consequences of climate change for companies. In 2017, Thales's rating remained A- for its "climate change" performance, confirming its position as one of the best-performing companies listed.

5.2.4.2 Reduction of greenhouse gas emissions from operations

To measure its greenhouse gas emissions, for over 10 years Thales has developed a methodology that is consistent with its operations and is based on the Greenhouse Gas Protocol created by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD). The main material sources identified have been evaluated (see table below). Working methods are in place to evaluate other sources that could be material, such as procurement of products and services and use of goods and services produced (see Section 5.2.4.3.1). Thanks to this, in 2017 the mapping of emissions for scope 3 was completed and the reliability of methods put in place was assessed. This work will continue in 2018.

	2017	2016	2015	2012
Scope 1 ^(a)	85,563	81,870	87,720	96,845
Scope 2 ^(b)	136,114	134,372	136,451	153,312
Sub-total (1+2)	221,677	216,242	224,171	250,157
Business travel	77,355	80,898	79,012	81,238
TOTAL (in tonnes)	299,032	297,140	303,183	331,395
Use of products and services sold ^(c)	563,483			

The Scopes combine CO₂ emissions (calculated with emission factors from the GHG Protocol 2012) relating to:

(a) Gas, coal, fuel oil, substances, mobile energy sources.

(b) Electricity and steam.

(c) Not included in the total as only part of the scope is covered.

In order to reduce its CO₂ emissions, Thales is increasing efforts specifically with regard to energy, substances and transportation.

Refurbishing and renovating certain buildings to higher ecological standards and changing equipment and consumption habits are all measures taken to improve energy efficiency and thereby help to reduce direct CO₂ emissions. Environmental criteria are incorporated in the selection of buildings, new locations and equipment (architecture, materials, building management system, comfort, access, etc.), as is the case for the new Thales (parent company) head offices in Paris, Thales Austria GmbH, Thales USA Inc and Thales Deutschland GmbH, which are certified compliant with the LEED and BREAM standards and where energy performance has been optimised. The energy efficiency of industrial processes has also been optimised where possible.

Along with energy, products with high global warming potential, used mainly in refrigeration systems, are subject to monitoring and reduction plans. Several sites have replaced a number of high-emission refrigerants with equipment containing lower-emission refrigerant fluids.

Particular attention is paid to sulphur hexafluoride (SF₆). This gas, used in a specific industrial process to insulate electronic tubes during high-voltage tests, has very high global warming potential. It is used by very few sites; those that do use it have implemented ambitious plans to reduce emissions, such as manufacturing tubes without using SF₆ or modifying equipment using this gas. They have also rolled out training and awareness campaigns for employees concerned by the environmental impact of SF₆ and/or implemented specific monitoring of incoming and outgoing SF₆ by workshop. This helped reduce emissions by 71% between 2012 and 2017. In 2017, SF₆ only accounted for 11% of CO₂ emissions due to refrigerant fluids.

Thales is also increasing its initiatives to reduce emissions from business travel by making use of a travel policy, modern information technologies, carpooling, electric vehicles and travel diagnostics and by highlighting the benefits of alternative means of transport to its employees and efficient communication tools. These initiatives led to a reduction in CO₂ emissions of 4% and 26%, respectively, for company vehicles and rental vehicles between 2015 and 2017.

Through its employment policy, Thales also promotes the development of solutions for smart solutions to promote carpooling, the use of public transport and cycling.

- **AVERAGE VEHICLE CO₂ EMISSIONS (G/KM)**



5.2.4.3 Contribution to fighting climate change

5.2.4.3.1 Innovative climate solutions

Worldwide economic development, increasing urbanisation and changing lifestyles all have an impact on smart requirements in terms of travel, connectivity and resource management. At the same time, climate change has serious consequences for the planet and for the lives of its inhabitants.

Society, which is becoming increasingly technological, faces new environmental challenges as regards energy, air quality, noise, climate change, biodiversity and other issues, which governments, municipalities, economic and scientific operators and citizens must address, while offering an improved work/life balance.

Thales therefore puts innovation at the heart of its strategy, developing equipment that combines innovative technologies and a reduction in the environmental footprint. To achieve this, Thales leverages its technical expertise and its capacity for innovation in order to understand the environment, support the development of air traffic and create the right conditions for sustainable mobility and communication, and smart cities, while reducing the environmental footprint.

Section 5.2.6 discusses how Thales's solutions contribute to environmental protection and particularly to initiatives to combat and adapt to climate change. Because Thales supplies numerous solutions to clients for integration in other systems (B2B), it is difficult to measure their specific environmental footprint - particularly as concerns CO₂ - as the conditions of use and decommissioning are unknown. Examples include equipment embedded on board aircraft and trains. However, impact analysis based on environmental studies (simplified life cycle assessments) has been conducted on a wide variety of equipment produced by Thales using "average" hypotheses of the above-mentioned conditions. It emerged that the use phase accounts for around 90% of environmental impacts, with this impact strongly influenced by the equipment's long service lifetime. Work conducted during the design phase to improve energy efficiency and to reduce the weight of equipment built into mobile systems are the two main drivers in reducing their environmental impacts.

Working methods are in place to analyse this footprint including CO₂ emissions (see Section 5.2.6) and the translation of these elements into technical requirements allows for them to be taken into account in engineering and development phases. In addition, practices relating to eco-design have been defined and are currently being rolled out through the framework.

5.2.4.3.2 A key player in major programmes

Thales is present in the space market as well as the air, rail and road transport markets and is positioned as a key player in major national, European and international programmes such as:

Clean Sky

Thales is a founding member of the European aeronautics research program Clean Sky, whose environmental goals for 2020 include a 50% reduction in CO₂ emissions, an 80% reduction in NO_x (nitrogen oxide) emissions, a 50% reduction in perceived noise and a green life cycle for products (design, manufacture, maintenance and disposal/recycling).

In particular, Thales is leading a Clean Sky research initiative entitled "Systems for Green Operations" which should optimise aircraft fuel consumption by improving flight trajectories, in particular during the take-off and approach phases.

As part of Thales's activities, changes in cockpits, electricity generation, simulators, air traffic and satellite communication are all stakeholders in these European studies. Paper-based studies and demonstrator parts have been carried out for theoretical assessments of potential gains.

Based on models developed by the aircraft manufacturer, the results can be used to estimate and test changes arising from this programme for CO₂ savings in the aircraft with new materials and software on board or on the ground to generate results for all of the programme's stakeholders.

SESAR

In the air traffic sector, the European SESAR programme, in which Thales is a key player, should provide a response to the challenges posed by the doubling of air traffic and the tenfold improvement in flight safety by 2020, while reducing the fuel consumption of commercial aircraft by 5%, CO₂ emissions per flight by 10% and acoustic emissions from aircraft at take-off and landing by 20 decibels.

In particular, Thales is developing software for a flight management system to optimise descent and climb phases, in collaboration with air control, leading to a reduction in the consumption of kerosene. Ground stations will handle air traffic with new applications, based on information provided by the avionics system, to optimise the flow of aircraft descents and climbs.

Copernicus

Thales remains heavily involved in Copernicus, the European space programme. Formerly known by the acronym GMES (Global Monitoring for Environment and Security), the programme aims to provide Europe with an autonomous Earth observation and monitoring capability thanks to continuous, independent and reliable access to data in the areas of the environment and security. This involves monitoring of the marine environment, the atmosphere, land and climate change, as well as support for emergency and safety interventions. For its space component, the programme relies mainly on a constellation of *Sentinel* satellites.

ETCS

ETCS stands for the European Train Control System. It simplifies train operation, makes signalling smarter and more reliable, and ensures optimal safety. Thales has been a key player in defining and implementing this European standard, and continues to offer innovative solutions that comply with this standard.

Shift²rail

Aiming to convert a significant share of road users to rail, this European initiative reflects the policy goal of achieving a 60% reduction in greenhouse gas emissions by 2050. It also aims to make rail travel more attractive and to integrate it with other modes of transport. Thales is one of the programme's eight founding members.

GALILEO and EGNOS

GALILEO is a European project for a satellite-based positioning system (radio navigation). The EGNOS service is designed to improve GPS accuracy and also offers the Safety Of Life service, which can be used in civil aviation. From the outset, Thales has been a major player in both programmes.

Electric-Taxiing with SAFRAN

Thales and Safran Landing Systems joined forces to optimise the energy conversion of the Electric-Taxiing system. Electric-Taxiing allows an aircraft to taxi independently without the use of its engines and without the need for a tug tractor, thanks to electric motors located in the main wheels. The saving achieved in terms of fuel and CO₂ emissions of 3,000 single-aisle aircraft fitted with this technology, is equivalent to that produced by one million cars. The ATRU (Auto Transformer Rectifier Unit) extremely high-powered transformer designed and developed by Thales will be offered to airlines on an optional basis and as a priority for single-aisle aircraft.

5.2.4.3.3 Defining international standards

Thales encourages its partners to adopt a responsible attitude regarding climate change. To illustrate its commitment, Thales is joint chair of the Carbon working group of the French Aeronautics and Space Industry Group GIFAS and is participating in the greenhouse gas working party of the International Aerospace Environmental Group (IAEG) to define international emissions accounting standards.

5.2.4.3.4 Partnerships

Thales is also engaged in partnerships with other industry players as well as research laboratories.

The industrial chair dedicated to the challenges of greenhouse gas emission monitoring systems, inaugurated in December 2011, is a perfect example of this. It brings together scientific partners such as the French Climate Sciences and Environment Laboratory (LSCE), the French Atomic Energy Commission (CEA), the University of Versailles Saint-Quentin-en-Yvelines (UVSQ) and the French National Centre for Scientific Research (CNRS) along with industrial partners such as Véolia Eau and Thales Alenia Space.

A true innovation hub, the Joint Research Unit in Urban Sciences (UMR-SU), inaugurated in Quebec City in 2015, brings together the complementary skills of academics, manufacturers, planners and urban managers. Managed and hosted by Thales Research & Technology, this one-of-a-kind research laboratory aims to develop smart solutions for the city of tomorrow in areas such as sustainable mobility, management of drinking water and wastewater, electricity, urban spaces and infrastructure, with the city of Quebec providing public facilities for field tests.

5.2.4.4 Adapting to climate change

The approach adopted by Thales for adapting to climate change is designed to reduce the Group's vulnerability to such related impacts as extreme weather (storms, floods, etc.), seismic events or resource scarcity.

Over the past several years, Thales has assessed the exposure of Group sites to natural disasters as part of annual site visits focused on prevention. This analysis consists not only of identifying the potential risks of flooding, storms and earthquakes, but also of identifying the consequences of these events in terms of environmental impact, property damage, business continuity, etc.

Thales has thus mapped its risks related to water at around 160 sites worldwide. The analysis of existing and future risks included the social dimension (access to water and sanitation, availability of water for local inhabitants), economic aspects (conflict of use) and environmental concerns (water consumption relative to the level of water stress in the river basin). The risk was scored based on a series of indicators, using international data to ensure a uniform assessment. This mapping process revealed that 10 sites were located in vulnerable zones. The majority of them are offices, whose low water consumption only has a very minor impact.

Thales is currently looking into extending this analysis to the mapping of its critical suppliers and to be in a position to assess its exposure to the risk of natural disasters for its supply chain.

5.2.5 Protection of biodiversity

The preservation of species, their habitat and ecosystems, the preferential use of areas dedicated to flora and the protection of historical and natural heritage are taken into account in all decisions with a view to contributing to environmental protection.

As early as 2006, Thales drew up a preliminary inventory of its sites in France near or within protected areas for flora and fauna and their habitat and, on certain sites, assessed the impact of activities on biodiversity and the degree of dependence on the ecological services provided by nature.

At the same time, Thales embarked on biodiversity risk mapping at 140 sites in 26 countries in order to obtain, as part of a macroscopic approach, a homogeneous overview of Group sites situated in the most vulnerable areas in terms of biodiversity. The indicators defined are used to analyse the risks for any project and integrate constraints for future developments, within a 2-km radius of sensitive sites.

Although the overall impact of the Group's activities on biodiversity is low, flora and fauna are of particular concern and the Group encourages its sites and employees to preserve and promote actions to protect biodiversity.

Various initiatives are taken across the world, and inventories are carried out at some sites by volunteers or in partnership with local authorities or biodiversity protection agencies, and ad hoc management measures are put in place.

Several Australian sites have put in place a habitat management plan which partly involves enclosing several natural habitat areas to control access to herds. This helps to reestablish the natural biodiversity and restore the region's original characteristics. Some species of flowers and animals have been registered on the site as well as some protected habitats such as that of the flying squirrel.

Other sites will focus on outdoor features to preserve the natural habitat and protect fauna (with bird boxes, feeders, species survey by an expert, etc.) or to re-establish native species, thereby guaranteeing a balance of habitats in terms of biodiversity, and offering a relatively safe and protected habitat for a wide variety of plants, fungi and animals.

Furthermore, as part of the grouping together of two of its sites near Bordeaux, France, between 2015 and 2017 Thales built a new 16-hectare site in line with the Avoid-Reduce-Mitigate principle. The impact of the new site on biodiversity informed its location and building procedures. Environmental compensation measures put in place during the site's construction continue to apply, in addition to a management plan for green areas which was also introduced.

For sites with large areas of plains or forests, particular precautions are taken for fauna and flora by promoting environmentally-gentle natural techniques for mowing and grazing and by eliminating phytosanitary products.

At other sites, employee awareness will be raised through photographic exhibitions of the forest, agroforestry and the species present on the site; programmes with bee-keepers; a register of species and a dedicated online review.

5.2.6 Solutions to support the environment

5.2.6.1 Environment and products

Continuous efforts are made to incorporate the environment into the entire product life cycle from cradle to grave while maintaining the strictest standards of security, safety and reliability expected by the Group's customers. The systems and high-tech products and services offered to the aeronautics, space, defence, transport and security markets are fully equipped to limit their environmental impact but are sometimes hard to square with this approach due to high technical constraints.

Nevertheless, Thales is committed to a responsible, proactive approach aimed at limiting as much as possible the impact of its products and services on the environment in order to comply with the increasing number of regulations along with the demands of the market and civil society. This is true of products that are eco-designed, i.e. that have an improved life-cycle environmental impact, or solutions with features that support the environment, for example by providing an understanding of extreme weather events.

Incorporating environmental factors into design generates the creativity and dynamism needed to make progress and to promote green innovation in areas such as developing new materials, saving energy and reducing weight.

To help in this approach, Thales applies skills throughout the Global Business Units (see Section 5.2.1.2.).

The Group's guidelines integrate the environmental aspect, from bids to product policies, design, development, maintenance and end-of-life phases. To ensure regulatory compliance, anticipate future regulations and requirements in this area, and guarantee traceability during the life cycle by looking ahead to dismantling, Thales is developing methods and tools to help product designers and architects make responsible choices and access environmental information. Resources include guides, questionnaires, checklists, computers and dedicated software tools such as the database on hazardous substances in components, regularly updated following regulatory changes, such as in REACH, or environmental impact analyses. Practices linked to the eco-design approach are defined in the engineering framework and made available to developers.

One example in the area of medical imaging are the developments carried out on a pre-treatment unit, in relation to the detector part, which led to a reduction in mass of 30% and in consumption of 70% between versions 1 and 3. Projections for 2018 and beyond aim for this mass to be phased out completely through integration of the software into the customer's computer and for consumption to be divided by three.

Thales is also a key player in national, European and international programmes to reduce the environmental footprint of products (see Section 5.2.4.2).

Lastly, Thales has been selected to take part in the European Space Agency's GreenSat study. This study is focused on the eco-design of a satellite to reduce its environmental impacts as much as possible. The study will include material aspects and manufacturing processes, as well as methods for the management of operations and the implementation of a mission in space. The eco-design approach will be compared to the conventional design approach, to estimate differences in the environmental impacts and in the costs and planning. Thales also takes into account requirements allowing it to prioritise the reduction of environmental impacts by looking to the future. As part of the Scorpion-EBMR programme, baseline conditions for the initial version were established and will be used to define targets for improvement during changes in the system.

5.2.6.2 Eco-responsible products and innovation

Several group companies are engaged in various initiatives to reduce the environmental impact of commercial and military products starting from the design stage. A number of product lines already incorporate strict environmental criteria assessed during life cycle analyses.

Thanks to its capacity for innovation, which is central to its strategy, Thales develops breakthrough technologies and new architecture that help to promote "green" innovation.

One example is *Stratobus* (a project launched in 2016), an autonomous geostationary stratospheric platform designed for a wide range of applications such as border and maritime surveillance, boosting GSM network capacity for public events and augmenting GPS over areas of dense traffic. This platform offers tangible environmental benefits. It runs on solar energy only and does not require a launcher to be put into position. It is made from recyclable subsystems and the use of hydrogen or helium considerably reduces the risk of pollution in the event of an accident. It is designed among other things to harness the sun's rays in all seasons and features a number of technological innovations, such as a power generation system coupling photovoltaic panels to a solar power amplification system patented by Thales and an energy storage system based on an ultra-lightweight regenerative fuel cell. The project underwent a review by the interested parties in November 2017, who confirmed its feasibility.

The Reality H helicopter simulator can reduce the number of flight hours and energy consumption (five times lower than the previous generation model). This gain has been achieved through the development of a simulator motion system, based on electric power rather than on a hydraulic system and offering much better performance without the risk of pollution. Life cycle analysis has led to the use of lighter, recyclable materials, as well as a reduction in size and weight, thus enabling easy transportation and lower CO₂ emissions.

Thales also lends its support to encourage the deployment of renewable energies. Wind farms interfere with civil aviation, defence and weather radars by creating a masking effect and triggering false alarms. This problem has led many countries to defer their plans to build wind farms. To address this situation, Thales has developed a material that absorbs broadband radiofrequency.

This material reduces the Equivalent Radar Surface (ERS) of the objects coated with it, attenuating or eliminating the interference. The radar signature of wind turbines is reduced by 99%. This solution has now been added to an existing solution consisting of a series of algorithms enabling radars to determine whether an echo has been sent by an aircraft or a wind turbine, thus reducing the risk of transmitting erroneous information to air traffic controllers.

In transport, Thales offers a predictive maintenance system to metro network operators, consisting of a data analysis service in the Cloud thanks to a secure platform. When they deviate from the norm, warnings are triggered, and recommendations are made as to the best course of action to take. This helps to improve reliability and reduce maintenance impacts.

Thales is also careful to identify replacement products if a substance presents a risk or might be banned. A dedicated programme has been launched to manage this issue, in light of the potential impact a ban on certain chemicals could have on the Group's processes and products. Conducted internally or with industrial partners, substitution surveys are intended to validate the characteristics and implementation processes of a new substance and to ensure that the product will continue to perform as expected. In some cases, it is necessary to redesign products and interfaces and rescope industrial tools.

In the case of chromates for example, Thales carried out the qualification, for its applications, of more than 30 alternative industrial processes and verified the capacity of its subcontractors to manage these processes to meet its requirements. Thales set aside €5 million for this work and for the deployment of replacements in equipment and systems to reduce the use of authorisations under the REACH regulation.

5.2.6.3 Innovative solutions for the environment

5.2.6.3.1 Understanding the environment

Thales is a key player in space-based Earth observation programmes, providing high-resolution optical and radar imaging systems that promote a better understanding of climate change and more effective environmental monitoring. The Group, in partnership with global agencies, contributes to most European climate missions, and is positioned in:

- the collection of essential information for climate forecasts and monitoring of the general status of plant life: topography of the surface of the oceans, ice floes and land surfaces; observation of ocean currents, pollution and marine life; the increasing temperature on the surface of the sea and land; and the overall status of vegetation to better manage its development (Sentinel 3 satellite);
- observation and anticipation of extreme, sometimes violent weather events, (hurricanes, floods, etc.), and long-term monitoring of climate change via *Meteosat* satellites;
- greenhouse gas monitoring, particularly carbon dioxide. This monitoring specifically includes the pinpointing of anthropogenic sources and the study of carbon sinks, and how they evolve in response to climate change. The complementary nature of the French (*Microcarb*) and European (*CarbonSat*) space-based observation initiatives means that all monitoring goals can be addressed.

As an example, the Poseidon technology, developed by Thales Alenia Space in partnership with CNES, has significantly modified the tools used in the world of oceanography. The accuracy of measurements has highlighted the thermohaline circulation of the world's oceans - an energy transport system as regards the global climate - as well as the rise in sea levels due to global warming. All satellites in the Jason mission are fitted with a Poseidon altimeter. Jason 3 focuses for instance on measuring the height of the oceans that supply the monitoring and prediction models for climate change.

For the future, the KaRin project, born out of a collaboration between NASA/JPL-CNES-Thales Alenia Space, should result in the delivery of a wide-swath radar interferometer, a key element in the SWOT (Surface Water and Ocean Topography) altimetry mission. This will ultimately allow for the use of hydrology to measure the topography of bodies of fresh water, lakes and flood zones with a surface area as small as 250x250 sq. m and rivers as narrow as 100m, and following on from the Poseidon altimeters, to measure the level of oceans with better global coverage.

5.2.6.3.2 A cleaner sky

From flying to air traffic management, for over 30 years, Thales has developed features that improve performance and lower the environmental impact during all flight phases:

- navigational aids to optimise flight paths, take-off and landing phases in particular and taxiing that take weather conditions into account, thus reducing noise, emissions and consumption;
- systems for more fluid air traffic management with less waiting time in airport stacks;
- solutions to supply electric power to a number of aircraft systems which were previously supplied with hydraulic or pneumatic energy;
- lighter, less bulky and more efficient equipment.

These initiatives help to reduce kerosene consumption, carbon footprint, and nitrogen oxide emissions as well as to improve reliability while reducing maintenance costs.

An example of this is the Flight Management System (FMS), which calculates the optimal flight path according to aircraft data, weather conditions and the desired arrival time, while ensuring less noise, fewer emissions and lower consumption during take-off, ascent, cruise, descent and approach.

New avionics system architectures help reduce energy consumption, limiting the amount of on-board equipment and making it more compact so that it is easier to transport, thereby cutting CO₂ emissions. The integrated modular avionics featured on the A380 made it possible to streamline computing requirements and reduce the weight of hardware by 15-20% while increasing computing capacity and the useful life of equipment.

Through its participation in these programmes, Thales integrates the taking into account of its customers' increasingly high demands to reduce environmental impacts.

5.2.6.3.3 Sustainable mobility

In today's increasingly urbanised world, creating sustainable conditions for urban mobility and inter-city travel is one of the most effective ways to reduce CO₂ emissions. Thales plays an important role in this by supplying transport operators with systems that optimise operational efficiency while limiting their environmental impact. Thales solutions provide:

- simpler access to transport with interconnected public transit that allows passengers to use different modes within and between towns and cities, at regional or national level, with a single ticket;
- smoother traffic flows thanks to urban traffic management systems that make it possible to regulate vehicle flows and handle trouble spots in real time. This means that motorists spend less time in their cars, use less fuel and produce fewer CO₂ emissions;
- a reduction in power consumption on underground lines, allowing underground operators to address environmental protection concerns while lowering their operating costs;
- an increase in the capacity of the existing main line network and reduced travel time, while ensuring compatibility between the various European rail networks.

For example, the Green SelTrac[®] CBTC solution reduces a train's energy consumption by 15% by loading efficient speed profiles into the train's on-board system. Algorithms are used to limit energy-intensive stop/start cycles and to switch off power so that trains run on their accumulated power whenever possible. For a standard underground line, CO₂ emissions are reduced by around 14,000 tonnes per year, equivalent to taking 6,000 cars off the road. To date, Thales's solution Thales Green SelTrac[®] CBTC operates more than 85 lines in more than 40 cities.

The ATSoft Energy Saving solution takes advantage of interactions between trains to save energy by optimising real-time traffic management: use of slow speed profiles when the operating circumstances permit and optimisation of current recovery from train braking by synchronising the acceleration of some trains with the braking of others.

5.2.6.3.4 Smart Cities

Data analysis makes cities more efficient. Thales's solutions collect data on such parameters as water and energy consumption, subscriptions to various public and private services, and transport users, allowing city authorities to improve residents' quality of life and reduce their environmental footprint. Through its data analysis solutions, Thales helps city planners and managers:

- leverage the gigantic data reservoirs of the connected city - smartphones, street lighting, transport, billboards, access to public places, surveillance cameras, etc. - to better understand and anticipate the needs of residents and offer them services that make their lives easier;
- inform users via traffic information systems, giving motorists and train passengers information on traffic conditions in near-real time;
- manage day-to-day operations more effectively and facilitate the coordination of the various players, especially in the event of an emergency. These solutions also improve the environmental efficiency of cities with regard to water and energy consumption, transport use, etc.

For example, the PRESTO electronic system, designed and developed by Thales, allows residents of the Greater Toronto Area to travel using the various means of public transport (train, underground, bus) using a single ticket, in the form of an electronic contactless card that can be used across the entire network. Statistical analysis applied to the data collected gives an insight into mobility across this vast area, meaning that supply can be tailored to actual needs, new services can be created and the use of public transport can thereby be encouraged.

Thales contributes to the Hyderabad programme (India) to become a “green” city, in particular by supplying to the new metro system opened in 2017 CBTC (Communication Based Train Control) and ISC (Integrated Communications and Supervision) systems, for the very first time in the country. This environmentally friendly metro should reduce carbon emissions both through using zero emission electricity and by limiting high-emission road transport.

Going even further, Thales Research & Technology Quebec hosts and manages the Joint Research Unit in Urban Sciences (UMR-SU), which aims to identify needs and new technologies in the city of tomorrow.

5.2.7 Environmental indicators

The table below contains a number of items for assessing trends in Thales’s environmental performance on a comparable basis. In 2017, the scope comprised 28 countries and 155 sites. This scope represents 97% of sales and 98% of the Group’s workforce.

2015 is the base year for the 2016-2018 goals.

This chapter was subject to a fairness review by Mazars. In Section 5.4 “Independent third-party report on consolidated human resources, environmental and social information published in the management report,” the opinion provides moderate assurance concerning the indicators in the table below.

	Units	2008-2015 change (at constant 2008 scope)	2015	2016	2017	2015-2017 change
Energy						
Electricity consumption	Thousand toe	-12%	131 ^(b)	131	132	1%
Per sales electricity consumption	Toe/€k	-27%	9.57 ^(b)	9.1 ^(b)	8.65	-9%
Fossil energy consumption	Thousand toe	-38%	21	21.9	21.9	4%
Per sales fossil energy consumption	Toe/€k	-48%	1.54	1.52	1.44	-6%
Total energy consumption	Thousand toe	-17%	154 ^(b)	155 ^(b)	156	1%
Per sales total energy consumption	Toe/€k	-31%	11.2 ^(b)	10.7	10.2	-9%
Water						
Water consumption	Thousand cu. m	-26%	1,540 ^(b)	1,587 ^(b)	1,593	3%
Per sales water consumption	Cu. m/€m	-39%	112.3 ^(b)	110.3 ^(b)	104.4	-7%
Waste						
Total waste production ^(a)	Tonnes	-24%	15,045 ^(b)	14,967 ^(b)	16,080	6.9%
Per sales total waste production ^(a)	Kg/€m	-36%	1.10 ^(b)	1.04 ^(b)	1.05	-3.9%
Ratio of non-hazardous waste ^(a)	%		73	75.3 ^(b)	81	10.3%
Non-hazardous waste per person ^(a)	Kg/pers	-29%	161.2 ^(b)	159.7 ^(b)	179.5	11.3%
Non-hazardous waste recycling rate	%	45%	64	50 ^(b)	55	-14.6%
Hazardous waste recycling rate	%	-45%	19	24.8	32	68.8%
Industrial discharge						
Industrial wastewater discharge	Thousand cu. m	-1%	562 ^(b)	652	595	6%
Air emissions	Tonnes	-30%	917	993	923	1
CO₂						
CO ₂ emissions from energy use	Thousand tonnes CO ₂	-23%	187	187 ^(b)	188	1%
Per sales CO ₂ emissions from energy use	Kg CO ₂ /€m	-36%	14	13	12	-9%
CO ₂ emissions linked to Kyoto Protocol	Thousand tonnes CO ₂	-23%	35	27	30	-14% substances and R22
O/w CO ₂ emissions linked to SF ₆	Thousand tonnes CO ₂	-78%	6.7	1.6	3.4	-49%
CO ₂ emissions from transport (Group-wide)	Thousand tonnes CO ₂	-1%	79	81	77	-2%
Per sales CO ₂ emissions from transport	Kg CO ₂ /€m	-17%	5.8	5.6	5.07	-12%
CO₂ Scopes according to GHG Protocol						
Scope 1 (gas, fuel oil, coal, substances, mobile energy sources)	Thousand tonnes CO ₂	-35%	88	82	86	-2%
Scope 2 (electricity, steam)	Thousand	-13%	136	134	136	0%

	tonnes CO ₂					
Scope 3 (business travel by air, rail, road)	Thousand tonnes CO ₂	-1%	79	81	77	-2%
TOTAL SCOPES 1, 2 AND 3	THOUSAND TONNES CO₂	-17%	303	297	299	-1%
TOTAL SCOPES 1, 2 AND 3 PER SALES	KG CO₂/€M	-31%	22	21	20	-12%
Other disclosures						
ISO 14001-certified entities			117	120	124	
Staff concerned as percentage of total workforce	%		90%	89%	89%	

(a) Excluding exceptional waste.

(b) Adjustment of 2015 scope following the resale of a site.

5.2.8 Environmental reporting rules

5.2.8.1 Scope

The consolidation scope of environmental data is based on the financial consolidation scope. However, due to restricted activity and/or workforce or the absence of operational control by Thales, certain establishments have not been included.

In connection with this report, the 2017 indicators are provided at constant scope with 2015.

5.2.8.1.1 Criteria

Only companies meeting the following criteria are included:

Equity interest and operational control

- Thales equity interest of 50% or more;
- Thales exercises operational control over the company.

Companies and joint ventures not meeting the above criteria are not included in Thales' environmental reporting.

Activity/workforce

- "Company/site" involved in an industrial activity (surface treatment, painting, pyrotechnics, shipbuilding, etc.) irrespective of the number of employees;
- "Company/site" involved in a semi-industrial activity only (testing, integration, R&D, etc.) with more than 50 employees;
- "Company/site" involved in a tertiary activity only (head office, service facility, sales office, etc.) with more than 100 employees.

Environmental Management System

All "companies/sites" that are ISO 14001 and/or EMAS-certified are included in the scope irrespective of the criteria related to activity.

5.2.8.1.2 Changes in scope

- Disposals/acquisitions: company to be included as soon as one full calendar year has been completed and if the company meets the scope selection criteria.
- New business: company to be included as soon as one full calendar year has been completed and if the company meets the scope selection criteria.
- Inter-site transfers: data taken into account in the reporting:
 - of the departure site from 1 January Y to the date of transfer,
 - of the arrival site from the date of transfer to 31 December Y.
- Intra-Group merger: integration of data for the absorbed entity for the period from 1 January Y to the date of absorption into the data of the absorbing entity.

5.2.8.2 Reporting procedure

The Group-wide reporting system includes an environmental reporting procedure with instructions for each successive stage of data entry, validation and consolidation. It also defines the roles of each person involved and includes the recording of data (traceability, archiving, etc.).

5.2.8.3 Indicators

Environmental concerns change over time. Environmental performance indicators therefore have to evolve to stay abreast of developments and reflect the Group's policy priorities. Different interpretations of certain indicators can lead to conflicting data from different countries. Thales is therefore adapting the indicators to make the environmental reporting system more efficient, building on lessons learned from previous years and refocusing the reporting effort on current and future environmental concerns. The indicators are described in the reporting tool. Information is also available on the calculation of the carbon footprint.

5.2.8.3.1 Reporting tool

An environmental reporting and management tool for the entire scope of consolidation of the Thales group is available on the corporate intranet. This tool consolidates the data from each entity, country and geographic area, and for the Group as a whole. It checks data consistency and suggests country-specific units of measurement, conversion factors, etc. The same tool provides access to the rules for data entry, validation and consolidation defined in the reporting procedure.

5.2.8.3.2 Analysis of performance

For easier analysis of environmental data, the Group reporting system incorporates the following principles:

- changes in scope specifically related to disposals and acquisitions. For each family of indicators, a gross figure is given (e.g. water consumption in cubic metres) and a ratio supplements the information to take account of changes in scope (e.g. water consumption per person);
- Group targets are set for a given period. During that period:
 - changes in performance are assessed on a like-for-like basis (i.e. at constant scope of consolidation),
 - coefficients such as emission factors for CO₂ emissions are constant;
- if emission factors are modified at the start of a new period, the performance data for the reference year are recalculated using the new coefficients;
- the principles and methods for reporting on data are described in the methodological guides to environmental reporting and calculation of CO₂ emissions, which are available in the Group reporting system.