STATUS REPORT 2017-2018

Environment

Total E&P Danmark A/S

TOTAL

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Foreword

Total E&P Denmark

Since the acquisition of Maersk Oil in 2018, Total Exploration & Production Denmark (TEPDK) is now the largest oil and gas operator in Denmark. Working alongside our partners in the Danish Underground Consortium (DUC), we continue to safely maximize the recovery of oil and gas resources in the Danish North Sea with care for the environment.

Total is a global integrated energy producer and provider, a leading international Oil and Gas Company, and a major player in solar energy with SunPower and Total Solar. The Group discovers, produces, transforms, markets and distributes energy in a variety of forms to serve the end customer.

In 2018, the Total Group completed the acquisition of Maersk Oil. This was a significant acquisition for the Total Group as it provided entry into a country boasting a proud oil and gas industry extending back more than half a century. Oil was first discovered in the Danish sector of the North Sea in 1967, with commercial production beginning in 1972.

Today Denmark's upstream industry is gearing up for a new chapter with the full redevelopment of the Tyra field and its associated gas infrastructure, which will support energy security and the green transition in Denmark and Europe.

Halfdan Field.

Total E&P Denmark at a glance

Largest
Oil and gas operator in the Danish North Sea

1,000
Over 1,000 employees

2.2 billion
Barrels of oil produced (1972-2018)

1972
First oil

97%
Responsible for Denmark's gas production
Not applicable during Tyra Redevelopment

CO_2 35%
CO_2 emissions reduction from 2017 to 2018

85%
Responsible for 85% of the national oil production

30%
Decrease in oil in produced water concentration

16
Producing oil and gas fields
8 producing fields during Tyra Redevelopment

50
Offshore installations
30 installations during Tyra Redevelopment

Environmental Status Report introduction

Patrick Gilly
Managing Director,
Total E&P Danmark A/S

It is my pleasure to present to you the 2017-2018 Environmental Report for TEPDK. The last 24 months have seen a period of great change for the organization, but our commitment to the protection of the environment, the safety of our people, the integrity of our assets and the principles of sustainable development has remained unchanged.

When exploring, developing and producing hydrocarbons we have a responsibility to do so with the least possible impact on the environment and the marine life around our platforms. We will always seek to use the least harmful products in our operations and to minimize spills and discharges. We strive to reduce our emissions by decreasing flaring and becoming more energy efficient.

Another key element of our efforts to minimize our environmental footprint is our ambition to continuously improve the reliability of our operations, because this translates directly into safer, more efficient production with lower levels of emissions and discharges. Performance however in 2017 and 2018 was varied. So while we are happy to report performance improvements in many areas such as operational efficiency, which translates into less greenhouse gas emissions and lower oil in water and chemical discharges to sea, we do recognize that there is still work to be done in areas such as chemical rationalization and waste handling. Operating in a sustainable and responsible way remains a priority for TEPDK so we will continue to invest in projects that will allow us to preserve our environment.

In 2017 we self-reported three cases of administrative noncompliance of incorrect classification of production chemical to the authorities. As a consequence, we initiated an in-depth internal investigation of our quality and management systems to ensure no reoccurrence. Chemical management is a key priority for TEPDK. To minimize our impact on the environment, we have implemented several improvement initiatives to ensure a systematic approach to managing and using chemicals.

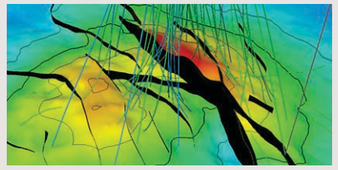
As I look at our performance in 2019 and into plans for 2020, I am encouraged about the level of investment TEPDK is making in key areas such as waste and chemical management. Our continued collaboration with the Danish Hydrocarbon Research and Technology Centre (DHRTC) and Aarhus University is seeing notable advances in how we treat produced water and how we evaluate risk to marine biodiversity. Partnerships with academia will assist our efforts to reduce our environmental footprint, so I am pleased that TEPDK continues to build on these relationships.

TEPDK strategy

BE RESPONSIBLE
- Health, safety and environment

BE SUSTAINABLE
- TYRA transition
- Business tranformation

BE PROFITABLE
- Operational excellence
- Lower cost



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The Total Group Ambition

The Total Group ambition

Total's ambition is to become the responsible energy major, providing reliable, clean and affordable energy to as many people as possible. Our focus on climate concerns is integral to our strategy. We have singled out five drivers to tackle climate issues: enhancing energy efficiency, growing in natural gas, stepping up our low-carbon electricity activities, promoting sustainable biofuels and investing in carbon storage.

Our objective is to be actively involved along the entire value chain, from primary energy production to final energy consumption, as a means of combating global warming.

IMPROVING OUR ENERGY EFFICIENCY

REDUCE 1%/YEAR VS 2010

Improving energy efficiency is essential to lower emissions. At Total, we are optimizing our operated facilities' energy consumption and encouraging customers to use our products responsibly.

GROWING IN NATURAL GAS

INCREASES TO 60% OF OUR PRODUCTION MIX BY 2035

Today, natural gas, the lowest-carbon fossil fuel, must be our first choice to meet energy demand while combating global warming. That is why it is a key component of our strategy.

DEVELOPING A PROFITABLE LOW-CARBON ELECTRICITY BUSINESS

PROVIDE ELECTRICITY AT BEST POSSIBLE PRICE IN LINE WITH IEA'S SUSTAINABLE DEVELOPMENT SCENARIO

To meet growing demand for power sustainability while reducing the emissions related to its generation, we are stepping up our low-carbon electricity activities. In other words, generating power from gas and renewable energies.

DEVELOPING SUSTAINABLE BIOFUELS

LOWER CARBON DIOXIDE EMISSIONS BY AT LEAST 50% COMPARED TO REGULAR FUELS

The transportation sector still relies overwhelmingly on liquid fuels. Our sustainable biofuels emit less carbon across their life cycle than fossil fuels do.

INVESTING IN CARBON SINK BUSINESSES

DEVOTE 10% OF OUR OVERALL R&D BUDGET TO RESEARCH INTO CCUS TECHNOLOGY

Storing carbon is a key factor in cutting carbon emissions. To that end, we are looking to expand the use of carbon capture utilization and storage (CCUS) technology and to preserve and restore ecosystems that absorb carbon naturally.

> Total's ambition is to reduce the carbon intensity of the energy products we make available to our customers by 15% between 2015 and 2030.

ENERGY EFFICIENCY
A key driver to lower emissions

NATURAL GAS
The strength of an integrated business model

LOW CARBON ELECTRICITY
An expanded presence

BIOFUELS
Sustainable biofuels emit less carbon

CARBON STORAGE
Through forests and carbon capture, utilization and storage (CCUS)

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Environmental performance summary

Halfdan Field.

Environmental performance summary

Below is a summary of our environmental performance for 2017 – 2018. While we make every effort to explore, develop and produce hydrocarbons from the underground responsibility, our industry can be challenging. 2017 and 2018 saw varying results, but we continue our journey towards more stable production, zero HSE incidents, non-routine flaring, and eliminating the discharge of oil and chemicals into the sea.

OIL AND CHEMICAL SPILLS

Collectively 2017 and 2018 saw an increase in spills from 2016. Spilled oil decreased from 0.9 tons to 0.4 tons in 2017 but increased in 2018 due to two large diesel spills (approximately 13.5 tons). The amount of spilled chemicals increased from 1.0 ton to 3.7 tons and 2.4 tons in 2017 and 2018 respectively. This is not a satisfactory evolution and we are investigating all spills to avoid reoccurrence.

OPERATIONAL EFFICIENCY

Maintaining stability of our operations is a key focus area to ensure minimum CO_2 emissions from flaring. In 2017 and 2018, TEPDK focused on improving root cause analysis of unplanned events to avoid reoccurrence and reduction of the response time to recover after equipment breakdowns. This was possible through the implementation of the Oneshore Operations Centre (OOC) where daily monitoring of fuel and flare was a key focus area, improving from 72% in 2016 to 80% in 2017 and 2018.

MANAGING WASTE

We generated less waste than previous years, the total waste recycled by our facilities in the Danish North Sea during 2017 and 2018 increased by approximately 1%, compared to the year before. This was mainly due to a reduction in drilling activity using oil based muds. Cuttings and mud were sent onshore for treatment and disposal. Most of our waste is reused either through recycling, incineration or biotreatment, so less than 2% of the total waste ends in landfills.

ENERGY EFFICIENCY

In 2018, TEPDK's Environmental Management System, which houses its Energy Management System, was recertified by DNV to comply with ISO 14001:2015.

CO_2 emissions covered by the EU Emissions Trading Scheme (ETS) quota fell from 1.3 million tons in 2016 and 2017 to 1.21 million tons in 2018.

Furthermore, in 2018, a two-week planned summer shutdown was executed to perform preventive maintenance on safety critical systems. The natural decline in hydrocarbon production however, resulted in the highest GHG intensity (CO_2 eq. emissions per unit of hydrocarbons produced) in the past five years.

DISCHARGE TO SEA

The amount of oil discharged in produced water was reduced both in 2017 and again in 2018. Similarly the concentration of oil in produced water declined.

Our consistent focus in this area has reduced the amount of discharge to sea by 30% since 2016, and is now well below the limits set by the Danish Environmental Protection Agency and OSPAR.

The amount of chemicals discharged to sea has decreased in 2017 and 2018, primarily caused by a decrease in drilling activity. We drilled fewer wells which reduced the discharges and we use environmentally green chemicals whenever possible (see page 17 for chemical classification). In 2017 and 2018, the proportion of green discharged chemicals was maintained at a level of 65%. The amount of red chemicals discharged to sea were higher in 2017. This is because of the reclassification of hypochlorite and the discovery, that Benzalkonium Chloride (BAC50) had been added to one chemical without our knowledge. Very quickly after the discovery the benzalkonium chloride was removed from the product and the discharge ended in June 2017. In 2018 only one red chemical, sodium hypochlorite, was discharged.

See page 11 for our environmental data.

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Environmental data

Environmental data

The production of oil and gas has been in natural decline for a number of years as the fields in the Danish North Sea are maturing.

NATURAL GAS

Hydrocarbon production fell from 2016 to 2018 due to a decrease in oil production of 18% and natural gas production of 14% **(Figure 1)**. As well as the longterm natural decline in hydrocarbon production, TEPDK production was also affected by a two week planned shutdown in the summer of 2018 to allow for safety critical maintenance operations on several installations. Of the produced gas, about 87% was exported to shore for sale, 11% was used offshore as fuel gas to provide energy to the platforms, and around 2% was flared. Flaring is sometimes required for safety reasons during unstable production periods (Figure 2).

OIL

Initially, the production coming from the reservoir may be mostly hydrocarbons but over time, the proportion of produced water increases. Produced water (PW) is a normal by-product of oil and gas production. This is reflected in relatively high and increasing proportion of water in the total fluid produced (oil, natural gas and PW) from 74% in 2016 to 77% in 2018 (Figure 1).

PRODUCED WATER

Water exists naturally in the reservoir and is extracted along with the hydrocarbons, then separated and cleaned before it is discharged into the sea or reinjected into the reservoir, thus reducing the associated environmental impact. Water reinjection into the reservoir depends on factors including the volume and quality of produced water and the physical properties of the reservoir.

Produced water reinjection is currently only possible at Gorm and Skjold, where about 74% of the produced water from these two fields was reinjected in 2017 and 2018. Overall TEPDK reinjected about 16% of the water back into the reservoir in the last two years (Figure 3). This represents a unfortunate decrease compared to previous years due to technical issues with the produced water reinjection system at Gorm and Skjold.

OIL IN PRODUCED WATER

Our laboratory technicians take daily samples of the oil concentration discharged in the produced water. During times of unstable production, the monitoring frequency is increased to three times a day. Monitoring and treatment processes are subject to regular internal and external verifications and oil in water performance is reported monthly to the Danish Environmental Protection Agency.

The marine environment of the North East Atlantic is protected by the OSPAR Convention, which aims to limit the amount of oil discharged into the sea through produced water discharge. Both OSPAR and the Danish Environmental Protection Agency (DEPA) set requirements that regulate the maximum amount of oil discharge to sea by TEPDK.

DISCHARGES

The amount of oil discharged in produced water in 2017 and 2018 was markedly lower compared to previous years (Figure 4). In 2018, the amount of oil discharged to sea reached a historical low at 136 tons, well below the permitted 202 tons set by the Danish Environmental Protection Agency (DEPA) (Figure 4). This was achieved through efficient produced water treatment which resulted in low concentrations of oil in produced water discharged in 2017 and 2018 that remains below 7 mg/l, also well below the OSPAR limit of 30 mg/l (Figure 5). Oil in water continues to be a focus area for our daily operations.

Figure 1

Production of gas, oil and water

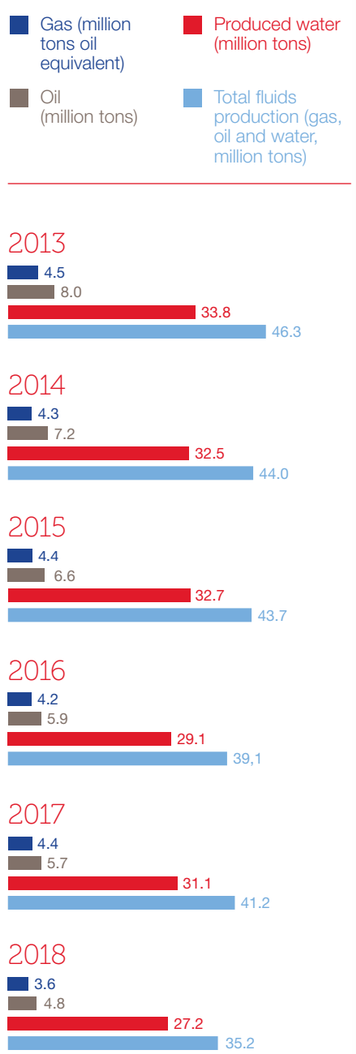


Figure 2

Use of natural gas produced

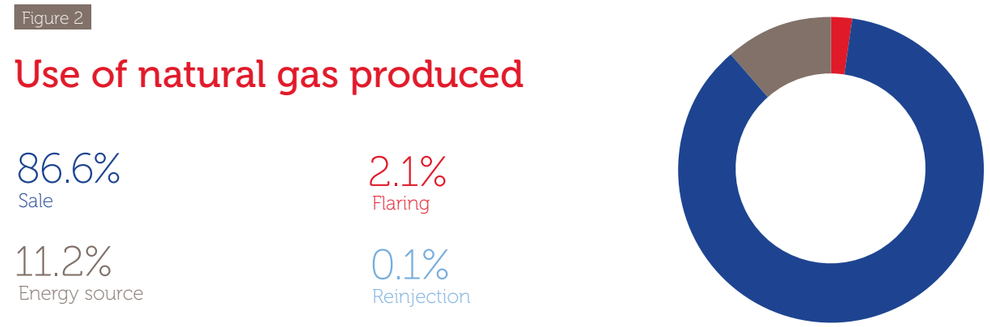


Figure 3

Produced water is reinjected or discharged to sea

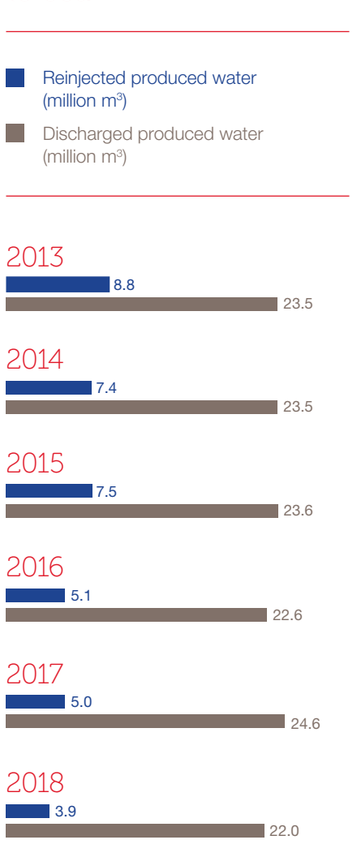


Figure 4

Oil in produced water discharged to sea

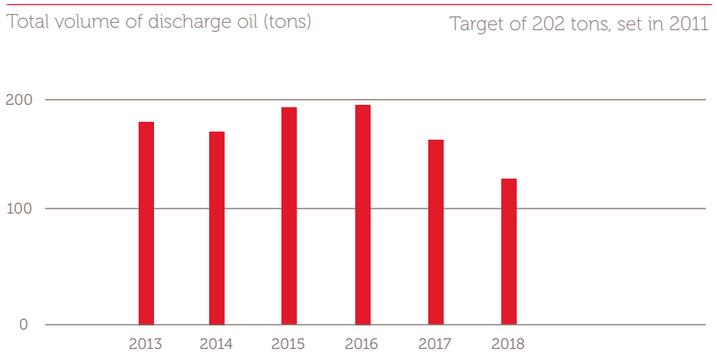
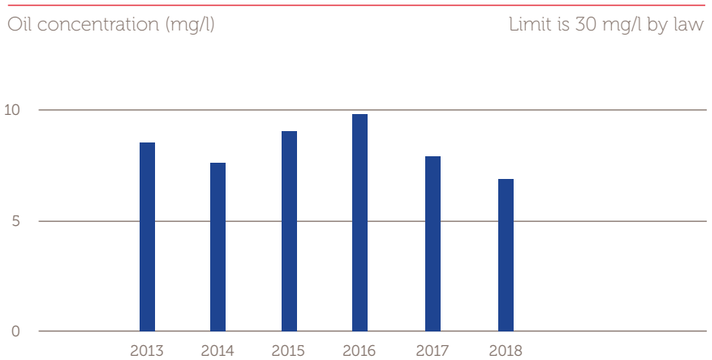


Figure 5

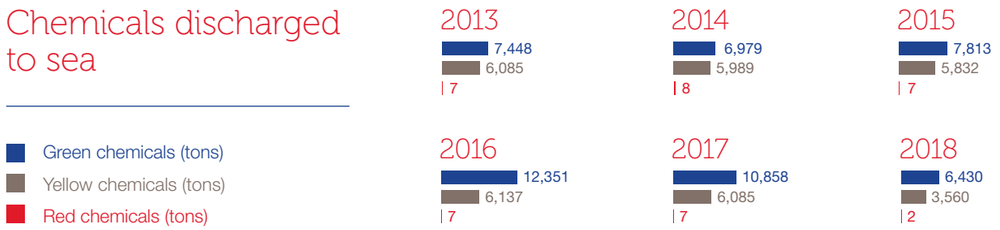
Average concentration of oil in produced water discharged to sea



TEPDK measures daily the oil concentration in produced water in accordance with the discharge permit terms.

Figure 6

Chemicals discharged to sea



Chemicals

Chemicals are used in our production, maintenance and drilling activities for technical, safety and environmental reasons. Hydrogen sulphide (H_2S) scavenger chemicals are used to reduce the otherwise potentially dangerous levels of H_2S in the gas coming from the reservoir. Corrosion control chemicals are used to reduce corrosion on pipelines, facilities and wells, thus reducing the potential risk of oil spill or gas leakage. Biocides are also used to remove bacterial growth that affects the efficiency of the produced water system. Chemicals use and discharge are regulated by the DEPA through a permitting process (Box 1).

Prior to use, our production and drilling chemicals are tested by a third-party laboratory to determine whether their components could bio-accumulate, are toxic or slow to degrade. A certificate, called a Harmonized Offshore Chemical Notification Format (HOCNF), is issued by the chemical vendor and the results are used by our Environmental Advisors to assess the OSPAR chemical classification and environmental risks associated with their use (Box 1). Together with an estimate of expected use and discharge, TEPDK files a permit application to the Danish Environmental Protection Agency which evaluates the products and decides whether the chemical can be used under the terms described in the application. Applications for red chemicals that can be discharged to the environment require a thorough assessment looking at all technical, health, safety and environmental considerations.

The use of permitted chemicals are monitored daily by our Production Chemists to ensure that we adhere to the specifications. Annual reports on the use and discharge of chemicals are submitted to the DEPA.

OSPAR APPROACH

Since 2017, we have assessed the use and discharge of our production chemicals through the OSPAR 'Risk Based Approach' tool. Based on estimate of chemical discharges, environmental risk associated with production water discharge is evaluated by combining laboratory toxicity data and 3D hydrodynamic modelling to calculate environmental risk. The data is used by our Environmental Advisors to recommend additional focus on specific chemicals that contribute most to the environmental risks. Concretely, this means that such chemicals are thoroughly evaluated for substitution or a reduction leading towards an acceptable risk level.

Compared to 2016, the amount of chemicals discharged to sea declined by 8% in 2017 and by 46% in 2018, marking a historical low. (Figure 6).

However in 2017, Total (then Maersk Oil) self-reported administrative non-compliance of chemical classification of two production chemicals to The Danish Environmental Protection Agency after discovering administrative errors. The case was unfortunate and resulted in a legal closure. Maersk Oil also self-reported a third chemical, Scavtreat, after discovering that the product composition had been changed by the supplier without notification. This mistake led to an unintentional discharge of Scavtreat with the 'red chemical' component BAC50 from 2005-2017. The Scavtreat matter was initially legally dismissed, but the case was later reopened for further investigation. Total is working with the authorities to provide full transparency as well as sharing learnings and initiatives implemented to avoid reoccurrence.

The majority of chemicals (65%) that were discharged in 2017 and in 2018 pose little or no risk to the environment

CHEMICAL DISCHARGES
TEPDK discharges have reached their lowest since 2013 i.e. 9,992 tons. The significant decrease in chemical discharge was due to a reduction of drilling activity in the past few years and a refinement of the methods applied to estimate discharge of production chemicals in 2018.

The majority of chemicals (65%) that were discharged in 2017 and in 2018 pose little or no risk to the environment (OSPAR, green classification), and 35% for yellow chemicals both in 2017 and 2018. Red chemical discharges represented approximately 0.04% of the total discharges in 2017 and 0.02% of the total discharges in 2018.

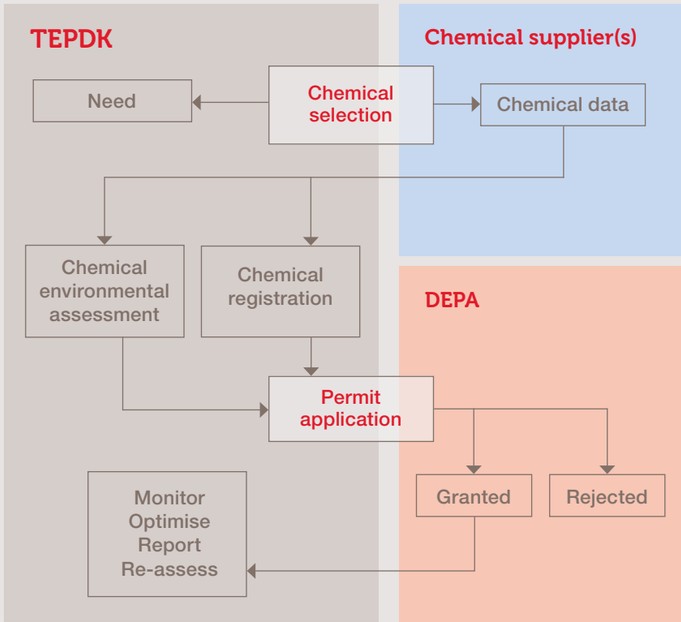
Sodium hypochlorite is classified as red due to toxicity even at low concentration. This chemical was used in 2017 and 2018 as a disinfectant to treat seawater before injection and used in the cooling systems on Dan and Gorm platforms.

After a thorough review of the health, safety and environmental risks associated with existing alternatives, DEPA authorized the continued use and discharge of sodium hypochlorite. The advantage of sodium hypochlorite compared to currently available alternative is that when introduced into seawater sodium hypochlorite is readily transformed into salt, a naturally present component in seawater.

BOX 1

Chemical permitting

Total complies with OSPAR guidelines on the use and discharge of chemicals, which are classified as black, red, yellow or green.



TEPDK 2018 chemical permitting process

BLACK CHEMICALS
Chemicals containing one or more components registered in OSPAR's 'List of Chemicals for Priority Action', and their use is prohibited except in special circumstances.

RED CHEMICALS
Chemicals containing one or more components that, for example, accumulate in living organisms, are toxic, or slow to naturally degrade in the marine environment.

YELLOW CHEMICALS
Chemicals that can normally be discharged without specific conditions, although their use is monitored by the DEPA.

GREEN CHEMICALS
Chemical components that pose little or no risk to the environment according to OSPAR's PLONOR classification.

2018 distribution of black, red, yellow and green chemicals discharged to sea, following the discharge permit process (Figure 7).

Figure 7

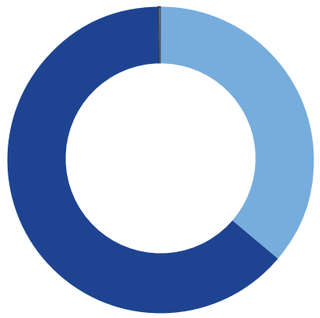
2018 distribution of black, red, yellow and green chemicals discharged to sea, following the discharge permit process.

0%
Black chemicals

0.02%
Red chemicals

35.6%
Yellow chemicals

64.4%
Green chemicals



Drilling

When it is technically viable, TEPDK uses water-based drilling mud. Following strict environmental guidelines from authorities, water-based drilling mud and drill cuttings, which are made of rock drilled from the well, are discharged into the sea after use. The amount of drill cuttings generated also depends on the length and condition of the wells drilled, as well as the technical difficulties encountered while drilling through the reservoir.

When it is necessary to use an oil-based drilling mud, cuttings and used mud are shipped ashore for treatment and are not discharged into the sea. These figures are reported in the section on waste (See page 24).

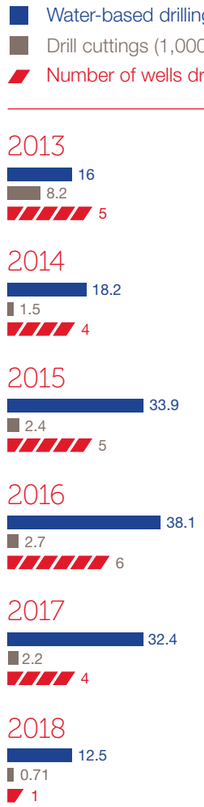
The volume of water-based drilling mud discharged decreased from 38,100 m^3 in 2016 to 32,500 m^3 in 2017 and 12,500 m^3 in 2018, a significant decrease directly associated with the number of wells drilled in those years. Accordingly, the volume of drill cuttings decreased from 2,700 m^3 to 2,200 m^3 in 2017 and 710 m^3 in 2018 (Figure 8).

In 2018 water-based drilling mud discharge to sea was 61% lower compared to 2017.

Reduction in water-based drilling mud and drill cuttings discharged to sea is highly dependent on the number of rigs operating in the area; consequently, an increase is expected when the number of activities is higher.

Figure 8

Water-based drilling mud and drill cuttings discharged to sea



Water-based drilling mud and drill cuttings may contain traces of oil from the reservoir. The oil content is monitored to ensure it does not exceed an average of 2% of the oil concentration in water-based drilling mud and drill cuttings. If it does, the mud and cuttings are transported to shore for treatment and disposal.

Discharges

We operate a policy of zero tolerance towards spills, which demands that all discharges of oil and chemicals, regardless of volume, must be reported. We continue to improve our performance in this area by reducing the volume and number of spills further.

Figure 9A

Oil and diesel spills

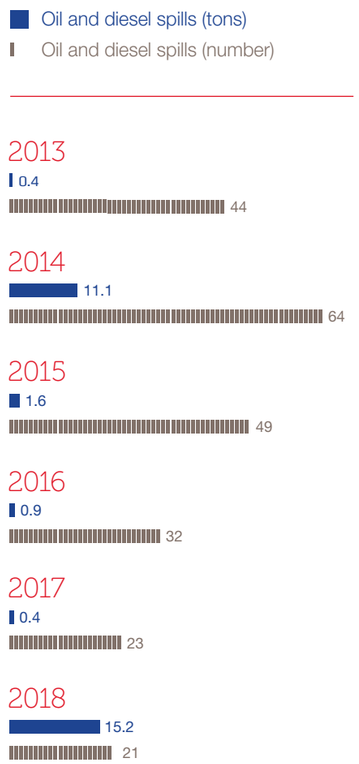
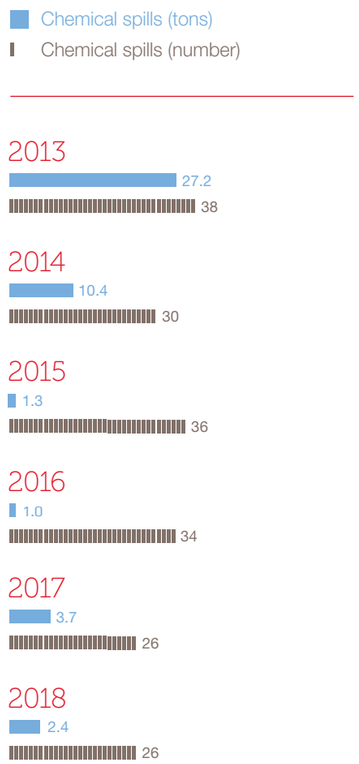


Figure 9B

Chemical spills



OIL CHEMICAL SPILLS

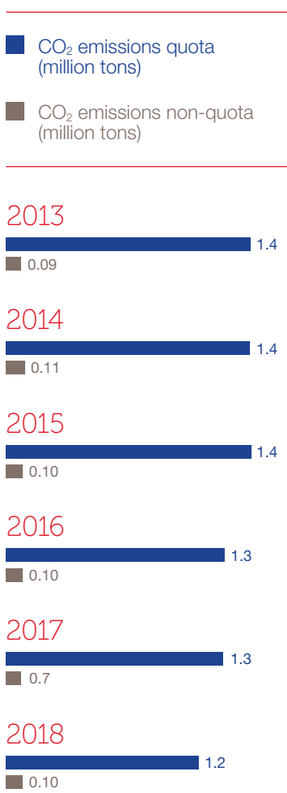
The amount of oil and chemicals discharged into the sea in 2017 and 2018 was the lowest in the past five years (Figures 9A, 9B).

This is the results of an increased level of awareness from our offshore workforce.

The number of spills is also at an historical low, though we would like to see a further reduction and to eliminate large (diesel) spills that increase the total tonnage of spills.

Figure 10

CO_2 emissions



Greenhouse gas emissions (GHG)

Air emissions carbon dioxide (CO_2), Nitrogen oxide (NO_x), Sulphur oxide (SO_x), methane (CH_4) and non-methane volatile organic compounds (nmVOC) are classified as greenhouse gasses. We monitor our emissions to air with the aim of managing and reducing the emission levels.

CO_2 EMISSIONS

Gas and diesel combustion in turbines/engines to produce energy on our production platforms, as well as safety flaring are the main sources of CO_2 emissions from our operations. They are subject to the European Union Emissions Trading Scheme's CO_2 quota system (except CO_2 emissions from small engines on a few satellite platforms). Non-quota emissions are caused by the use of diesel fuel on mobile rigs and supply ships, as well as helifuel for helicopter transport. More than 90% of CO_2 emissions are covered by the quota system.

Over the last five years, CO_2 emissions have consistently decreased and are now 15% lower than in 2013 (Figure 10). Figures reached their lowest levels in 2018, as most of CO_2 emissions released were from combustion of fuel gas (82%), and 16% of these emissions were due to safety flaring during production shutdowns, and 2.0% were from diesel combustion (Figure 11). Overall, the decline in CO_2 emissions is due to a decrease in the use of fuel gas.

Greenhouse gas emissions

Emissions are released into the atmosphere from the production facilities

CO_2
Carbon dioxide

NO_x
Nitrogen oxide

CH_4
Methane

nmVOC
Other volatile organic compounds

SO_x

Figure 11

CO_2 emissions (production platforms)

82.0% Gas fuel

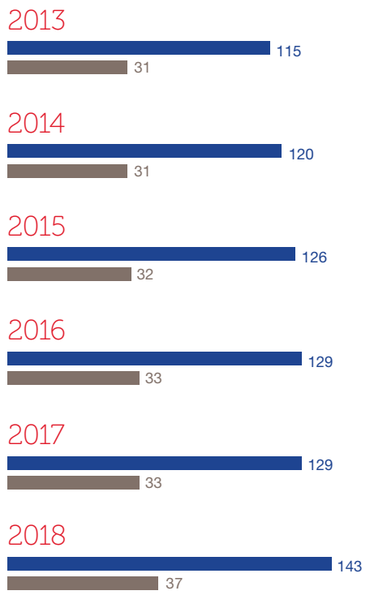
16.0% Gas used

2.0% Diesel

Greenhouse gas (GHG) emissions reduction since 2015.

Figure 12

CO_2 emissions per produced hydro-carbons and fluids



We are constantly looking for ways to reduce flaring but periods of unstable production can lead to an increase in safety flaring. Our average flare rate in 2018 was 0,23 MSm3/d, the main flare sources were the Gorm asset (50% of gas flared) followed by Tyra, and then Dan. We are initiating activities to reduce flaring on Gorm.

We used less fuel gas on our installations in 2018, both in absolute and percentage terms and succeeded in fulfilling our internal target of less than 1.5 MSm3/d. Platform specific KPIs were also successfully met on all platforms except Tyra West, where it was exceeded by 0.023 MSm3/d.

NO_X AND SO_X EMISSIONS

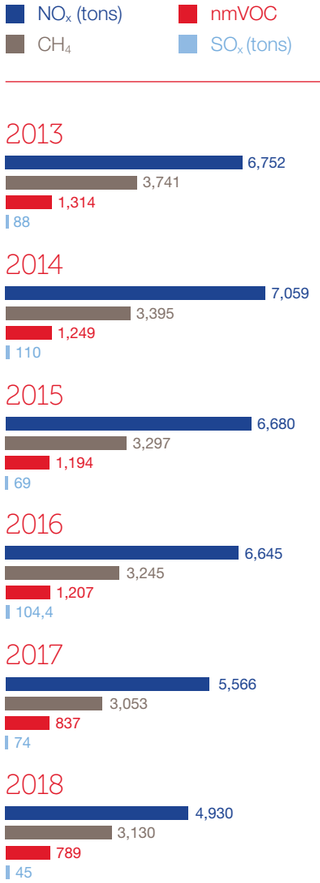
Typically, these types of emissions are released from the use of fossil fuels to produce energy, such as fuel gas, diesel fuel, or gas flaring for safety purposes.

NO_X emissions have decreased over the past four years and reached their lowest level in 2018 (Figure 13), with diesel fuel accounting for 38% of NO_x emissions, helifuel about 1%, and fuel gas contributing the rest of the NO_x emissions.

We use the Predictive Emissions Monitoring System (PEMS), which offers more accurate emissions data, to calculate NO_x emissions. The PEMS uses a variety of information, including gas consumption and speed, to calculate emissions, compared to the Continuous Emissions Monitoring System (CEMS), which measures emissions directly in the fuel gas. The PEMS is controlled in a similar way to CEMS by comparing calculated emissions with parallel measurements. An accredited third party carries out measurements using high-quality reference equipment.

Figure 13

Greenhouse Gas Emissions: NO_x, CH_4, nmVOC and SO_x



SO_x emissions decreased by more than 50% in 2018 compared to 2016 primarily due to lower sulphur content of diesel fuel used by our vessels and some offshore equipment. The average sulphur content of our diesel in 2018 was 0.04%, compared to a concentration of 0.09% in 2016 and this is mostly due to market availability. It is important to note that in our purchase of fuel we ensure that we comply with the requirement of less than 0.1% sulfur in marine fuels (Figure 14). Required by the International Maritime Organization's MARPOL Convention for the EU SECAs region (North Sea & Baltic Sea).

VOC EMISSIONS

Venting gas for safety purposes causes around two thirds of the release of volatile organic compounds (VOCs). In some areas, natural gas is used for maintaining pressure and oxygen-free conditions at production facilities. Some of the gas is emitted directly to the atmosphere through the venting system without being flared. This is called cold venting.

We no longer use hydrochlorofluorocarbon (HCFC) gases, which are greenhouse gases that also deplete the stratospheric ozone layer.

VOCs are split into two fractions as methane (CH_4) representing about in weight and non-methane VOC's (nmVOC) about 20%. Methane emissions in 2017 and 2018 have been relatively low compared to 3,100 tons the previous year, whereas nmVOC has decreased by a 1/3 in 2017 and 2018 compared to previous years (Figure 13).

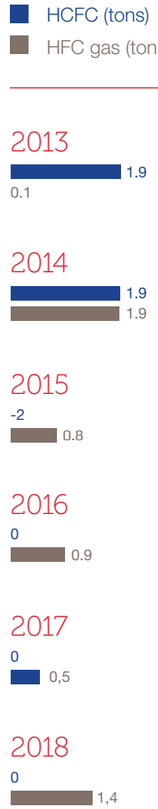
REFRIGERANTS

We no longer use hydrochlorofluorocarbon (HCFC) gases, which are greenhouse gases that also deplete the stratospheric ozone layer, including Freon 22. Freon 22 was phased out as a cooling agent in the treatment of gas from wells on the Gorm and Tyra platforms in 2014 (Figure 14).

In 2015, the total consumption of hydrofluorocarbon (HFC) gases, which are greenhouse gases used in gas-based cooling systems such as air conditioning, was 0.54 tons in 2017 and 1.4 tons in 2018 (Figure 14).
There was a sharp decline in 2016 when Heating Ventilation Air-Conditioning (HVAC) systems were renewed offshore and more stable systems fitted that are less prone to leakage.

Figure 14

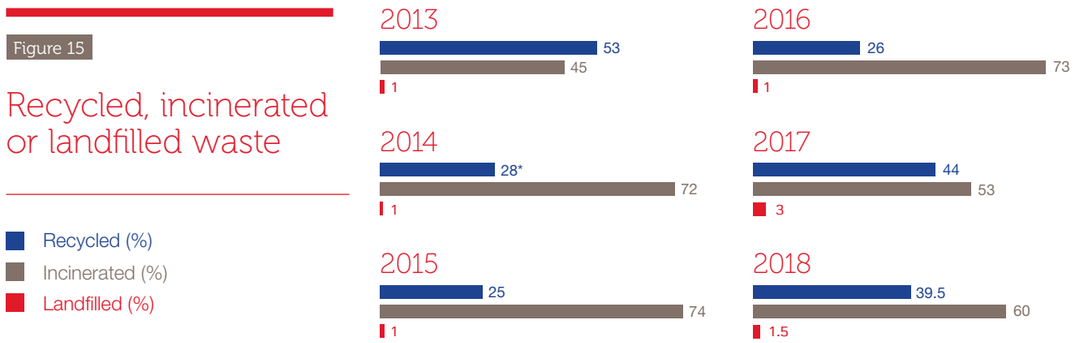
Consumption of hydrochlorofluorocarbons (HCFC gas) and hydrofluorocarbons (HFC gas)



Tyra East.

Figure 15

Recycled, incinerated or landfilled waste



Waste management

At TEPDK, we consider waste to be a potential resource and put in considerable effort to reuse waste. We consistently have a high recovery of more than 95% of all our waste either though recycling or incineration for energy recovery. All waste from our facilities in the Danish North Sea is transported to shore where it is recycled, incinerated or landfilled in accordance with current legislation.

In 2017 and 2018, the proportion of recycled waste was high at approximately 42% compared to previous years. Approximately 56% of the waste was used for heat and electricity recovery and less than 2% was disposed in landfill (Figure 15).

In 2018, 11,907 tons of waste was generated, compared to 13,961 tons in 2015, a decrease of 15%. This was caused by a decline in waste from vessel cleaning and oil based mud and cuttings sent onshore for treatment and disposal.

Naturally Occurring Radioactive Material (NORM)

NORM is a routine part of the production of oil and gas, especially in aging oil and gas fields. NORM handled by Total is low level radioactive, and our handling and storage procedures for NORM ensure that it does not pose a risk to the surrounding environment, our employees or the public.

Small amounts of radioactive substances are found in the subsoil of the North Sea. NORM is primarily found in the Gorm Field (80%) and in much lower quantities across our other installations. This material is produced with the mixture of gas, oil and water and eventually is concentrated e.g. in separators. When staying close to equipment covered with NORM deposits, one can therefore be exposed to external radiation.

Since 1989 a regular assessment of NORM on Total's installations has occurred to ensure areas of exposure are classified accurately and only staff with the relevant training are permitted to work in areas where there is a NORM risk. These persons are certified according to Danish legislation, where the yearly dose limit in offshore connection is 15 mSv. This dose is similar to the exposure someone would get when receiving a computed tomography (CT) scan of the abdomen (12.2 mSv).

As a responsible operator Total applies high quality standards, procedures and personal protective equipment to carry out NORM related work and monitoring. These routines have been established in all Total's oil and gas fields.

NORM STORAGE

Onshore NORM is packaged in a way that ensures it is securely contained onshore. It is handled by specialized service companies that handle, treat and pack NORM for storage onshore. This involves packing NORM in several layers and in multiple drums to ensure the waste cannot leak.

Total's NORM waste is stored in an approved, inspected and fenced off area with proper signage. Radiation from Total's NORM storage is far below the authority's set limit for radiation outside the site fence.

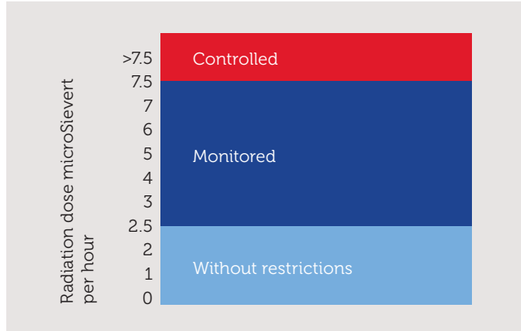
Denmark currently has no permanent disposal solution for NORM. TEPDK is currently investigating technical opportunities for disposal and through Oil and Gas Denmark the industry is in dialogue with the authorities to find a safe future solution for final disposal of NORM waste.

Classification of areas

Areas where exposure to radioactive radiation can take place are classified as follows:

- Controlled
- Monitored
- Without restrictions

The areas are classified by measurement before the work begins.



Halfdan Field.


Halfdan Field.

Biodiversity

Total is aware of the important role biodiversity plays and the consequence of loss of biodiversity on a global scale. Therefore, we take biodiversity into account in our development and our operations. In Denmark, this means that we evaluate the risk of our activities on marine biodiversity through environmental impact assessment or advanced modelling. Additionally, we regularly collect marine biodiversity data and publish the results of our studies in collaboration with academics and environmental specialists.

In 2017, an inventory of species that are present on the platform legs was done using our underwater videos taken by a remotely operated vehicle. This knowledge was used to assess the risk of spreading invasive species or endangering protected species when removing platforms for the Tyra Redevelopment project. The data is used to manage our activities but also supports advances in scientific studies. The Tyra study was part of a North Sea global study[1] carried out by Wageningem University to understand the role of oil and gas platforms as artificial reefs.

In 2018, we conducted a seabed survey by collecting more than 500 sediment samples for biological, chemical and physical analysis and characterized the potential impact from platform discharges. We published a summary based on a large data set of 25 years of seabed data and our environmental status is generally good. Changes in sediment composition and a reduction in the number of species were detected locally, within 1500 meters of the installation after drilling operations. We also show that environmental status returns to previous levels after a period of maximum five years.

In 2013, Total initiated a marine mammal sighting reporting program in which offshore volunteers can report wildlife observations to a central database. The data collected provides us with a picture of marine mammals in our activity area and supports the development of protective measures that are appropriate for the operated area. The voluntary reporting scheme has now extended to other oil and gas operators and their contractors. In 2018, the program had collected 225 reports of more than 450 individuals of porpoise, whales, dolphins and seals, but also include several species of sharks and fish. In 2018, we published a scientific article summarizing the results of this program and we continue to collect the data for future scientific studies.[2]

In the future, we will support researchers to develop and test new technology such as environmental DNA. The method is based on collection and analysis of the DNA shed by marine organisms to establish a list of species from bacteria to whale in an area. We see this method as an opportunity to improve our monitoring of the environment in which we operate and further reduce our environmental footprint.

1 Oil and gas platforms as artificial substrates for epibenthic North Sea fauna: Effects of location and depth
https://doi.org/10.1016/j.seares.2019.101782

2 Marine mammal sightings around oil and gas installations in the central North Sea
https://doi.org/10.1017/S0025315417000406


Minke whale Harald Field.
Photo: Peter Hasselby


Minke whale Dan Field.
Photo: Daniel Nordenbaek

5

2019 focus areas

Tyra East.

2019 focus areas

Now into our fifth decade producing oil and gas from the Danish North Sea, TEPDK remains committed to minimizing our impact on the environment in which we operate.

During the early years of hydrocarbon production, higher pressures that naturally exist in reservoirs meant that extraction was relatively easy. As a field matures, it takes more technology and resources to recover oil and gas, and to maintain aging facilities. Therefore, the impact on the environment typically increases. That is why high operational efficiency and energy efficiency continue to be focus areas.

Unstable production, which is often caused by a stoppage of older equipment, can cause higher flaring and increase the likelihood of discharges and higher concentrations of oil in produced water.

In 2019, we continue to focus on stabilizing production through operational and maintenance excellence programs that meet the specific demands of operating in mature fields. We are also working to create a single unified plan for all activities, which aims to reduce the number of unplanned shutdowns, consequently minimizing our environmental impact. For example, in 2019 we will focus on reducing flaring, following up daily against our KPIs.

CO_2 emissions decreased in 2018, however the intensity of CO_2 emissions continues to increase. As a field matures, more energy is needed to produce hydrocarbons, which is why we have plans in place to improve our energy efficiency in 2019.

In 2017, an investment decision was made to redevelop the Tyra field due to subsidence within the field. Subsidence is a natural consequence of the continuous extraction of oil and gas over decades causing the hydrocarbon pockets to collapse and the seabed to sink. The Tyra Redevelopment Project Team is designing new facilities that excel in areas of operational and energy efficiency. The production from existing facilities will be closed in September 2019 and restart in 2022, reducing 30% of our CO_2 emissions.

TEPDK managed its exploration and production activities in line with the principles of the ISO 14001:2015 standard on Environmental Management Systems and Total's environmental commitments and industry best practices.

This means that we adopt the principle of continual improvement according to ISO 140001:2015, by setting measurable objectives and monitoring on key parameters such as oil in water, chemical use and discharges, spills, emissions and waste. In addition, we monitor seabed and marine mammals to protect the marine environment, and perform chemical and waste management, where we continuously look for greener solutions.

We review our performance and effectiveness through independent audits. An analysis of these audit results allows us to manage our activities and plan how to further reduce our environmental footprint.

Our Environmental focus areas

OPERATIONAL & ENERGY EFFICIENCY

- Focus on decreasing flaring
- Greenhouse gas emissions reduction

BIODIVERSITY

- Assessment of good environmental status
- Monitoring of seabed, marine mammals
- New monitoring technology

WASTE MANAGEMENT

- Ensure waste disposal compliance
- Implement waste handling identified improvements

CHEMICAL MANAGEMENT

- Transition to green chemicals
- Chemical optimization

Glossary

Units of measurement

- **b** barrel
- **B or G** billion
- **boe** barrel of oil equivalent
- **Btu** British thermal unit
- **CO_2 eq** CO_2 equivalent
- **eq** equivalent
- **Gt** billion tons
- **GW** gigawatt
- **k** thousand
- **M** million
- **Mboe/d** million barrels of oil equivalent per day
- **m^3** cubic meters
- **mg/l** milligram per liter
- **MMSCFD** million standard cubic feet per day
- **MWh** megawatt-hour
- **t** metric ton
- **toe** ton of oil equivalent

Acronyms

- **DUC** Danish Underground Consortium
- **CCUS** Carbon Capture, Utilization and Storage
- **DEPA** Environmental Protection Agency
- **EU-ETS** EU Emissions Trading Scheme
- **EU SECAs** EU Sulfur Emissions Control Areas
- **HCFC** Hydrochlorofluorocarbon
- **HOCNF** Harmonized Offshore Chemical Notification Format
- **HVAC** Heating Ventilation Air-Conditioning
- **IEA** International Energy Agency
- **MARPOL** International Convention for the Prevention of Pollution from Ships
- **NO_x** Nitrogen oxide
- **OSPAR** Oslo and Paris Convention
- **PEMS** Predictive Emissions Monitoring System
- **CEMS** Continues Emissions Monitoring System
- **PW** Produced water
- **SO_x** Sulphur oxide
- **VOC** Volatile organic compounds

Definitions

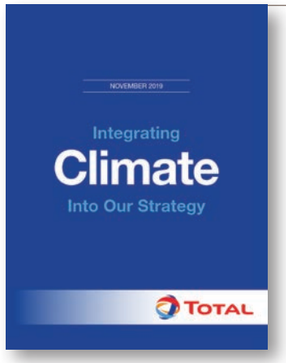
- **Bioaccumulation:** The accumulation of a chemical in an organism relative to its level in the ambient medium
- **Greenhouse gases (GHG):** The six gases named in the Kyoto Protocol: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N2O), Sulphur oxide (SO_x), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF6), with their respective Global Warming Potential (GWP), as described in the 2007 IPCC report.
- **Non-routine flaring:** Flaring other than routine flaring or safety flaring associated with oil production and occurring primarily during occasional or intermittent events.
- **Operated facilities:** Offshore Facilities operated in Total's Exploration & Production in Denmark.
- **PLONOR:** OSPAR list of substances used and discharged Offshore which are considered to Pose Little or No Risk to the Environment
- **Routine flaring:** Flaring during normal production operations in the absence of sufficient facilities or adequate geological conditions permitting the reinjection, onsite utilization or commercialization of produced gas (as defined by the working group Global Gas Flaring Reduction program as part of the World Bank's Zero Routine Flaring Initiative). Routine flaring does not include safety flaring.
- **Safety flaring:** Flaring to ensure safe performance of operations conducted at the production sites (emergency shutdown, safety-related operations, etc.).

Total's environmental publications

Total offers a sustainability reporting and information process outlining Total's corporate social responsibility (CSR). In addition to the publications below, you can find additional information on our Sustainable Performance website, sustainable-performance.total.com. All other publications and the latest news and reports can still be found at Total's corporate website, total.com.

TOTAL publications

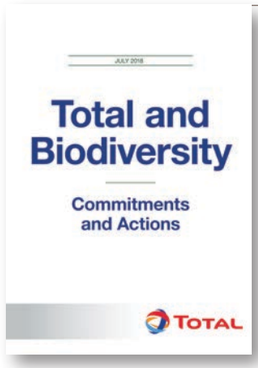
Integrating climate 2018



Integrating Climate into our strategy, discover our four Climate-Oriented strategic focuses: natural gas, stepping up our low-carbon electricity activities, promoting sustainable biofuels and investing in carbon storage.

www.total.com/en/media/media

Total and Biodivesity



Through the act4nature initiative, Total has reaffirmed and broadened its commitment to biodiversity. We adhere to the initiative's 10 under takings, and have added six specific commitments of our own.

www.sustainable-performance.total.com

Sustainable performance

In May 2016, Total launched a dedicated website to provide transparent information on our CSR challenges. The website, regularly updated, introduces the company's policies, commitments and performance on all sustainability issues relevant to Total, particularly safety, climate, environmental stewardship, business ethics, human rights and community engagement, environmental, social and governance (ESG) reporting standards and indexes.

https://www.sustainable-performance.total.com

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Total is encouraging paper recycling. Sort your trash, protect the environment.
www.citeo.com

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This document refer to a carbon intensity indicator for Total energy sales that measures the weighted average greenhouse gas emissions of energy products sold by Total, from their production in Total facilities to their end use by Total customers. This indicator covers, besides direct GHG emissions of Total (scope 1),indirect GHG emissions (scopes 2 and 3) that Total does not control (for the definitions of scopes 1, 2 and 3, refer to Total's Registration Document).

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total.com

Total is a global integrated energy producer and provider, a leading international oil and gas company, and a major player in solar energy with SunPower and Total Solar. Our 98,000 employees are committed to better energy that is safer, cleaner, more efficient, more innovative and accessible to as many people as possible. As a responsible corporate citizen, we focus on ensuring that our operations in more than 130 countries worldwide consistently deliver economic, social and environmental benefits.

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