Environment Department

Contribution Determined at National Level
From MONACO

2020 update

To the United Nations Framework Convention on Climate Change
and the Paris Agreement

December 2020

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Pursuant to paragraphs 24 and 25 and Article 4 of Decision 1/CP.21, as well as Decision 4/CMA.1

Contribution Determined at National Level Direction of l'Environnement 2020 Review

CONTENTS

1 National context

The Principality of Monaco is a 208-hectare city-state with a diversified economy based mainly on services, construction, tourism and banking.

Since His accession to the throne in 2005, H.S.H. Prince Albert II has made environmental protection a top priority of His Government's national and international policies.

The Principality of Monaco ratified the United Nations Framework Convention on Climate Change (UNFCCC) on 20 November 1992 and the Kyoto Protocol on 27 February 2006.

Listed in Annex 1 of the Convention with a reduction commitment of 8% compared to 1990 under the first period of the Kyoto Protocol, the Principality has fulfilled its obligations by reducing its emissions by 13.18% compared to 19901.

Monaco continued its commitment by accepting the Doha Amendments on 27 December 2013. Monaco's target for the second period of the Kyoto Protocol is an average 22% reduction in emissions over the period 2013-2020.

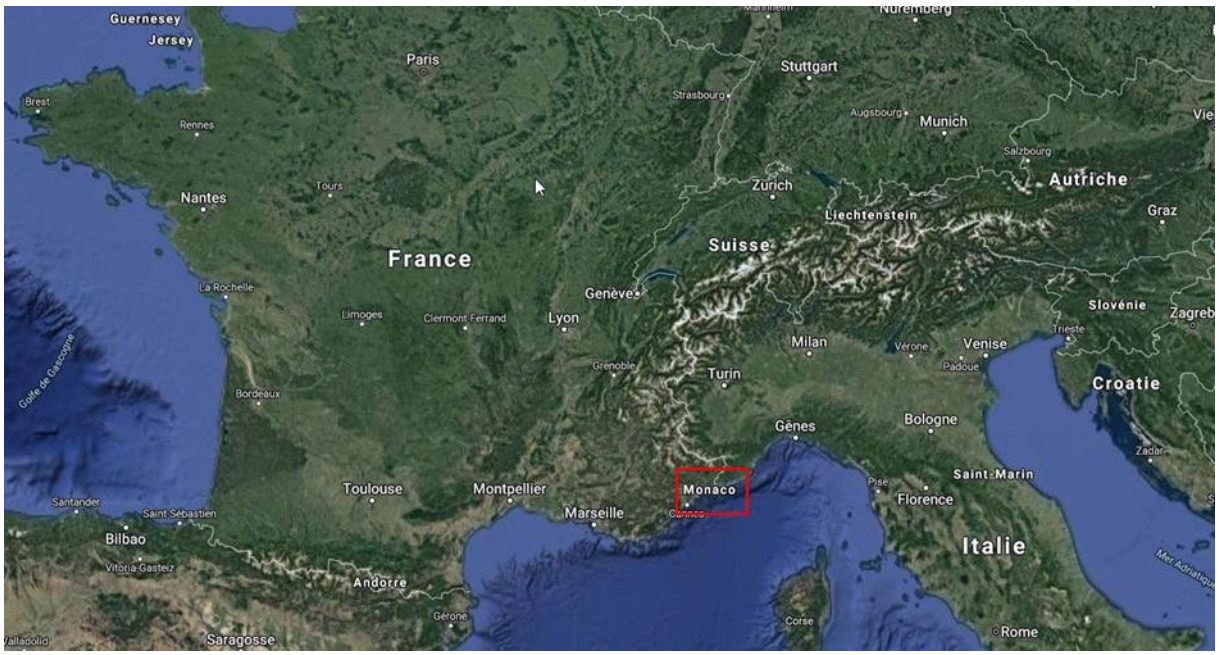
As part of its first Nationally Determined Contribution, the Principality of Monaco has set itself the target of reducing its greenhouse gas emissions by 50% by 2030.
H.S.H. the Sovereign Prince has also pledged that Monaco will be carbon neutral by 2050.

Aware of the eminently collective nature of the challenge of reducing emissions, the Principality of Monaco wishes to make its full contribution to the common effort. It hopes that the commitment of all Parties will enable the objective of containing the average rise in global temperatures to less than two degrees compared to pre-industrial levels, and as far as possible to less than 1.5°C, to be achieved.

[1] National Inventory Report for the Principality of Monaco, submitted on 3 September 2014:
http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/8108.php

1.1 Geography

The Principality of Monaco is a state bordering the Mediterranean Sea, landlocked in France along the Côte d'Azur, halfway between Nice and the Italian border. The Principality borders four French communes in the Alpes Maritimes department (Cap d'Ail, La Turbie, Beausoleil and Roquebrune-Cap-Martin) and has a coastline on the Mediterranean.



The Principality's geographical coordinates (at the Oceanographic Museum) are 43°43'49"N and 7°25'36"E.

The area is in the form of a narrow coastal strip at the foot of a 7km² watershed, surrounded by a cirque of high relief. It has a surface area of 208 hectares, nearly 40 of which have been reclaimed from the sea over the last 50 years.

Its territorial waters form a strip extending 12 nautical miles out to sea, the width of which corresponds to the Principality's coastal strip (approximately 3 km).

The surface area of territorial waters is approximately 71 km^2 , which is much larger than the country's land surface.

The Principality is the second smallest independent state in the world, after the Vatican.

The Principality of Monaco is built on a narrow coastal strip. As a result, all buildings are within a very short distance of the sea (less than 800 m). This situation, combined with the large depths of water available close to the coast, has contributed to the significant development of seawater heat pumps. The first installation was carried out in 1963, and this technology is now the leading source of local energy production.

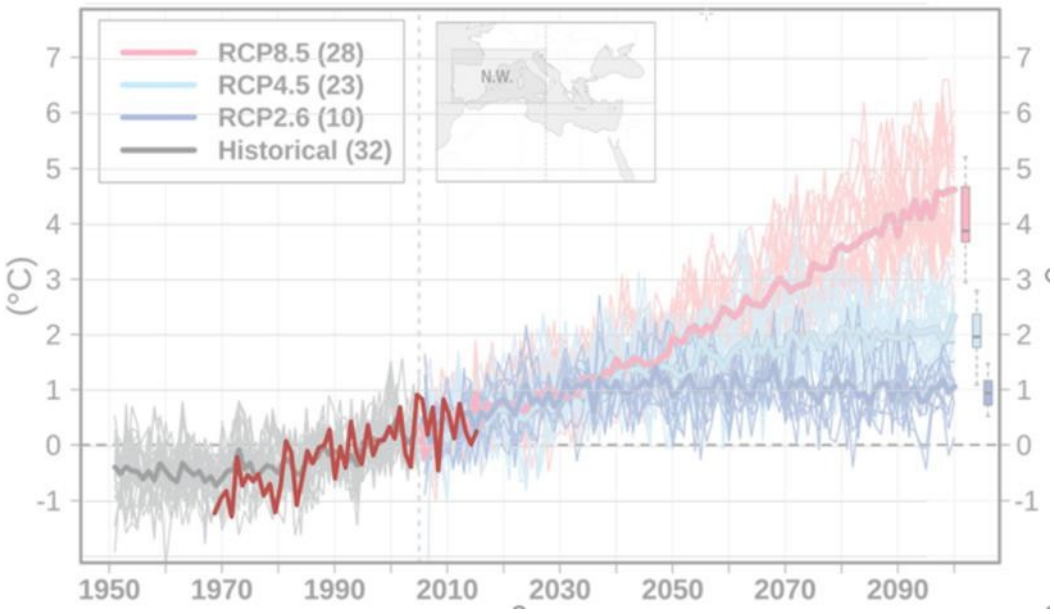
Aerial photograph of Monaco -Direction de la Prospective, de l'Urbanisme et de la Mobilité

1.2 Climate

Monaco lies to the north of the western Mediterranean and enjoys a temperate climate, with hot, dry summers and mild, wet winters.

The area lies at the interface of a vast adret washed by the sea and dominated by mountains facing south; temperatures are under the direct influence of the sea.
The average temperature is 16.5°C (1986-2005 normals), with a seasonal variation of less than 15°C. Annual rainfall averages 714.6 mm, with a distribution characteristic of the Mediterranean climate, with the heaviest rainfall in autumn and spring.

All the data collected on a Mediterranean scale points to warming during the 20th century and an acceleration in recent decades.
On a basin-wide scale, mean annual temperatures are now 1.5°C higher than they were at the end of the 19th century. Warming accelerated after the 1980s, and is increasing at a higher rate than the global average (Lelieveld et al. 2012; Lionello et al. 2012a; Zittis and Hadjinicolaou 2017; Cramer et al. 2018; Lionello and Scarascia 2018; Zittis et al. 2019).

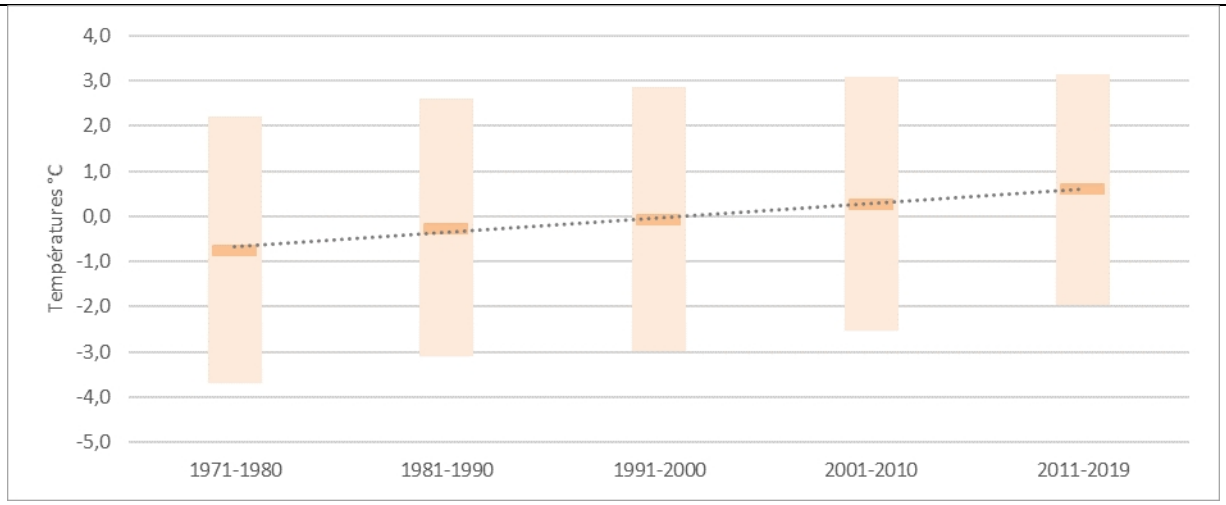


In red - change in annual temperatures in Monaco referenced to the 86-05 Normal) and in background - comparison with the RCP2.6 RCP4.5, RCP8.5 scenarios[2] from the IPCC AR5 report, derived from regional climate modelling for the North-West Mediterranean zone, (N.W. land only) according to: *A multi-model, multi-scenario, and multi-domain analysis of regional climate projections for the Mediterranean - George Zittis1 & Panos Hadjinicolaou1 & Marina Klangidou1 & Yiannis Proestos1 & Jos Lelieveld1,2* (Fig3)

Temperatures observed in Monaco since the early 1970s corroborate these observations and show a steady rise of 0.3°C per decade. This rise is more marked for minimum temperatures (+0.4°C) than for maximum temperatures. In addition, the warmest years were all observed after 2000.

[2] RCP: Representative Concentration Pathway.

Ten-year averages of temperatures in Monaco from 1971 to 2019 - Direction de l'Environnement

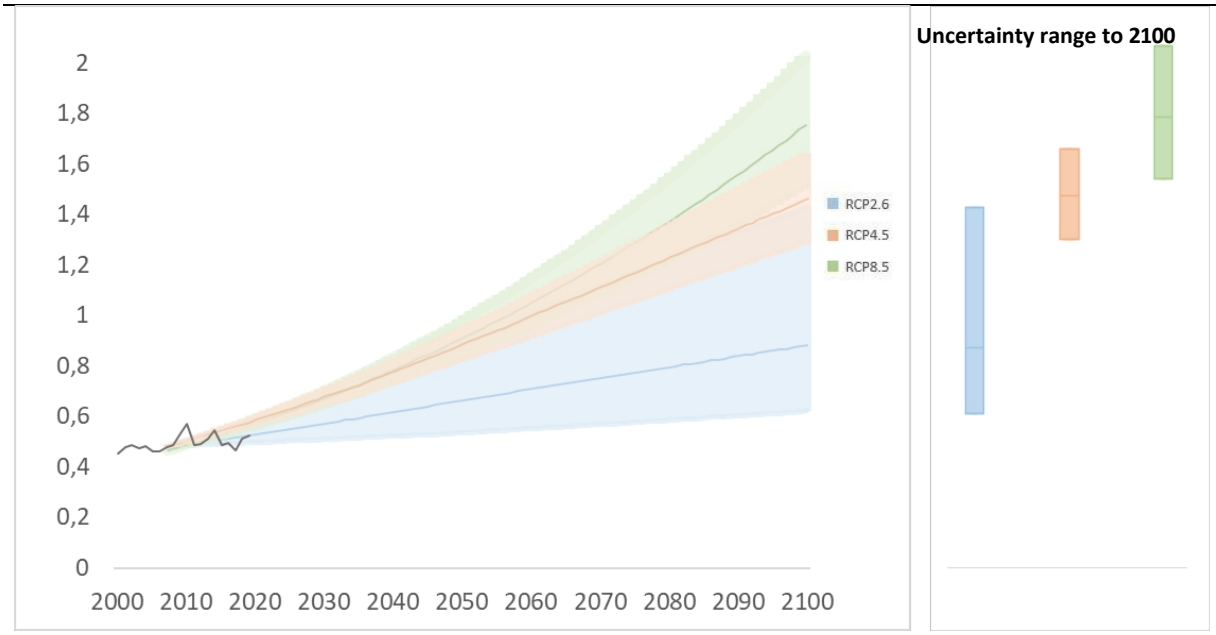


Increase in average ten-year temperatures observed in Monaco from 1971 to 2019. Relative to the normal value for 1986-2005.

1.3 Sea level rise

With its maritime character and coastline, the Principality of Monaco is directly exposed to a rise in the level of the Mediterranean Sea due to global warming. The height of the sea has been measured since 1999 by a coastal digital tide gauge operated by the Department of the Environment in collaboration with the French Navy's Hydrographic and Oceanographic Service (SHOM).

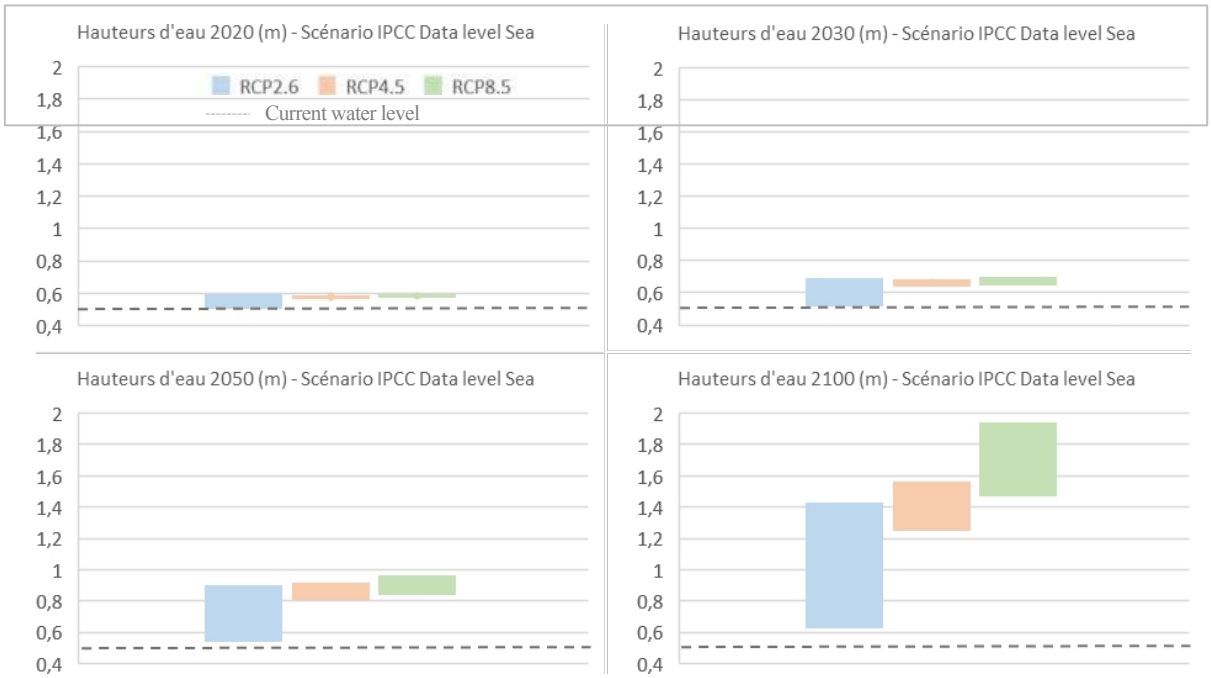
Projected sea level rise in Monaco (in metres) - Direction de l'Environnement



Projection of sea level rise in Monaco up to 2100 using the *IPPC SROCC* methodology - *Projected rise in global mean sea level*. Projections are made for three concentration pathways ([RCP3]).

[3] RCP: Representative Concentration Pathway.

On the northern coast of the western Mediterranean, a rise of 1 to 2 mm/year was observed between 1970 and 2004. The report by the Ocean and Climate Platform indicates that the rise in sea level accelerated to 3.6mm per year from the 1990s, compared with 1.4mm per year previously.
Recordings made in Monaco confirm this trend, with a measured rise of around
3.5mm per decade since 2000. Despite an increase that has slowed over the decade 2010-2020, current water levels are in line with the trend predicted by the IPCC increase scenarios.



Projection of sea level rise in Monaco up to 2100 using the *IPPC SROCC* methodology - *Projected rise in global mean sea level*. Projections are made for three concentration pathways (RCP) and compared with current levels.

According to projections, mean sea level in the Mediterranean at the end of the 21ème century will be between 20 and 110 cm higher than at the end of the 20ème century (Special Report on Ocean and Cryosphere - SROCC Oppenheimer et al. 2019, Le Cozannet et al. 2019; Thiéblemont et al. 2019) depending on the level of emissions, with local deviations of up to +10 cm (Carillo et Al. 2012; Adloff et al. 2015, 2018) compared with the basin average.

1.4 Population

The population of Monaco (resident and non-resident) is 9,486 (31 December 2019).

Monaco's resident population, as counted in June 2016, was 37,308. It was estimated at 38,100 on 31 December 2019. The population is cosmopolitan, with around 120 nationalities.
including 8,675 Monegasque nationals.
The largest community is the French, representing 24.8% of the population, followed by the Italians at just over 21.9% and the British at just over 7.5%.

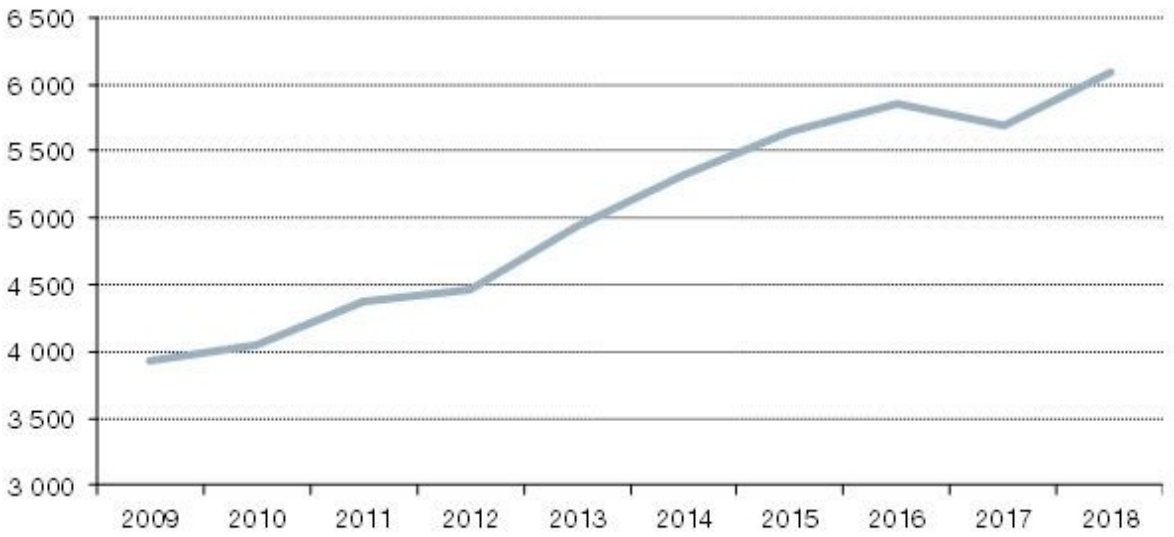
1.5 Economy

The Principality is a centre of economic expansion that has seen strong growth over the last ten years. It is a major source of employment for the French and Italian border regions.

Monaco's GDP for 2018 was €6.087 billion, an increase of 6.1% compared with 2017.

After the slowdown seen in 2009, GDP is continuing to grow, albeit at a slower pace in 2015.

Evolution du PIB en millions d'euros courants



Source : IMSEE
Unité : million d'euros

The Principality of Monaco's situation is atypical in terms of both its resident population and its employed population. For every 38,100 residents, there are almost 58,000 employees, 87.8% of whom live outside Monaco. This highly unusual situation makes comparisons difficult and the use of certain traditional international indicators inappropriate. This is particularly true of the traditional indicator of GDP per capita.
In order to situate the Principality in its environment and in its international context, two types of GDP per individual are calculated: firstly, a "per capita" GDP, calculated since 2005, and secondly, a GDP per employee, calculated since 2010.

GDP per capita is more specifically intended for international comparisons. The population used to calculate it is the sum of residents and non-resident employees of Monaco. It is 85,876 individuals in 2018. In 2015, GDP per capita amounted to 68,858 euros in current value.

This value can be compared with that of Northern European countries, reflecting a high standard of living among the population.

GDP per employee is an indicator for comparing productivity levels between countries. It stood at 108,112 euros in 2018.

More than half of Monaco's GDP (53.4%) is produced by 4 sectors:

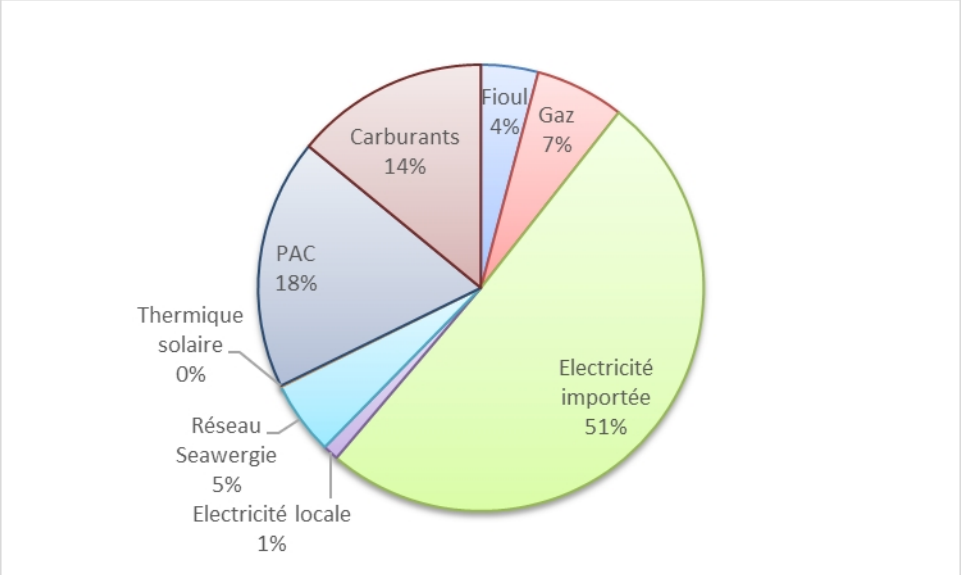
- Scientific and technical activities, administrative and support services (17.9%) ;
- Financial and insurance activities (15.9%) ;
- Real estate activities (10.0%) ;
- Construction (9.5%).

Activity in the Principality is relatively homogenous. The following eight sectors account for between 3.4% and 9.3%. They include wholesale trade, accommodation and catering, and retail trade.

1.6 Energy

The Principality of Monaco is a net importer of energy. None of its production is sold abroad.
Total final energy consumption in 2018 was around 1073 GWh.

Breakdown of total final energy consumption in 2018 - Direction de l'Environnement



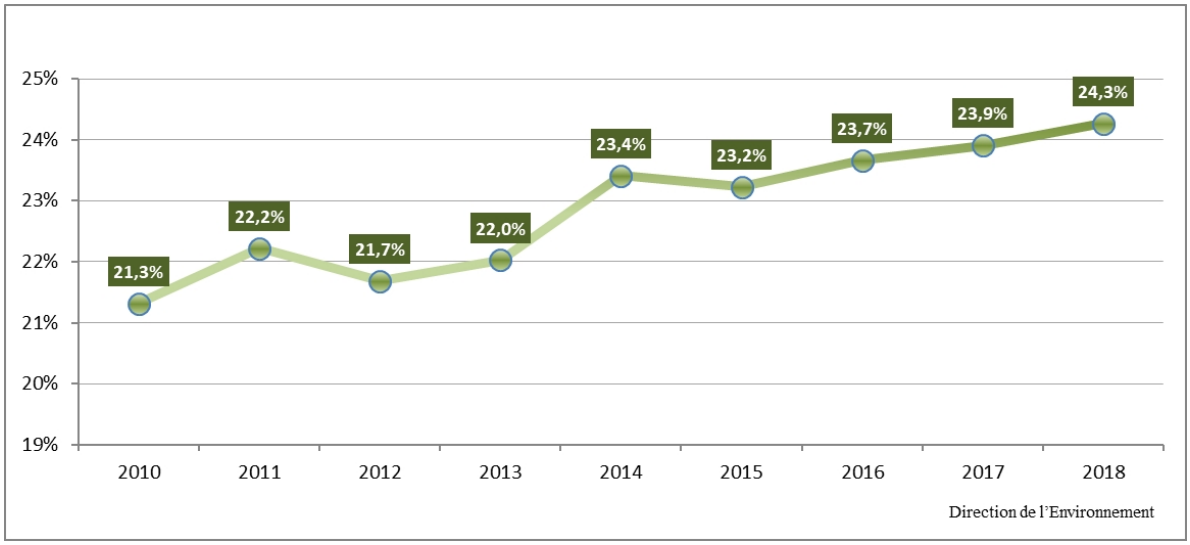
Half of the total energy consumed in Monaco is attributable to electricity used for private and public purposes, mainly homes, commercial and industrial facilities, public buildings and equipment (hospitals, schools, etc.) and street lighting.

Fuel consumption for transport is the second largest item of energy expenditure (14%). This includes the sale of petrol and diesel in the region.

Next come heating and cooling costs, with heat pumps, heating oil and natural gas consumption.

The energy produced in Monaco comes mainly from heat pumps and the waste-to-energy plant. Photovoltaic electricity production, although incidental, is increasing rapidly.
In 2018, 24.3% of Monaco's total final energy consumption was covered by local renewable production.

Local energy production as a proportion of total consumption - Direction de l'Environnement



In order to assess the effect of policies and measures in terms of reducing the Principality's energy consumption, two indicators are monitored: energy intensity and energy consumption per inhabitant.

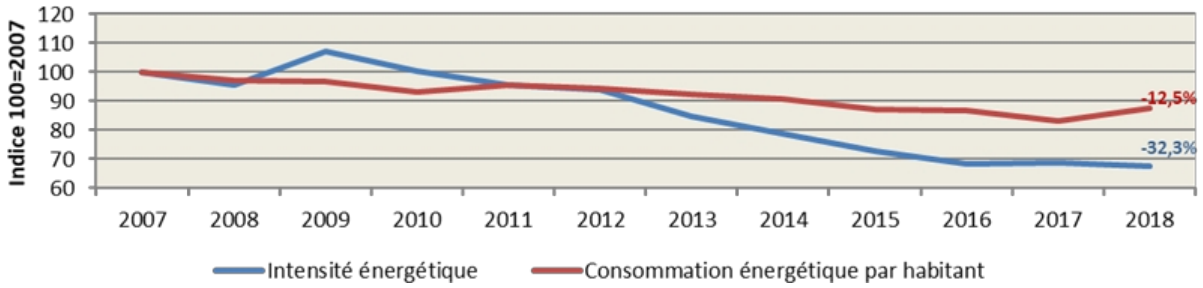
- Energy intensity is the ratio of final energy consumption to gross domestic product (GDP). A fall in energy intensity corresponds to greater energy efficiency and means that the country can produce more with the same amount of energy.

The Principality's energy intensity has been falling steadily since 2011, reaching a reduction of 32.3% in 2018 (compared with 2007).

- The second indicator, energy consumption per capita, is the ratio of final energy consumption to the resident population.

The amount of energy consumed by the resident population has been falling steadily since 2007, with a 12.5% reduction in 2018.

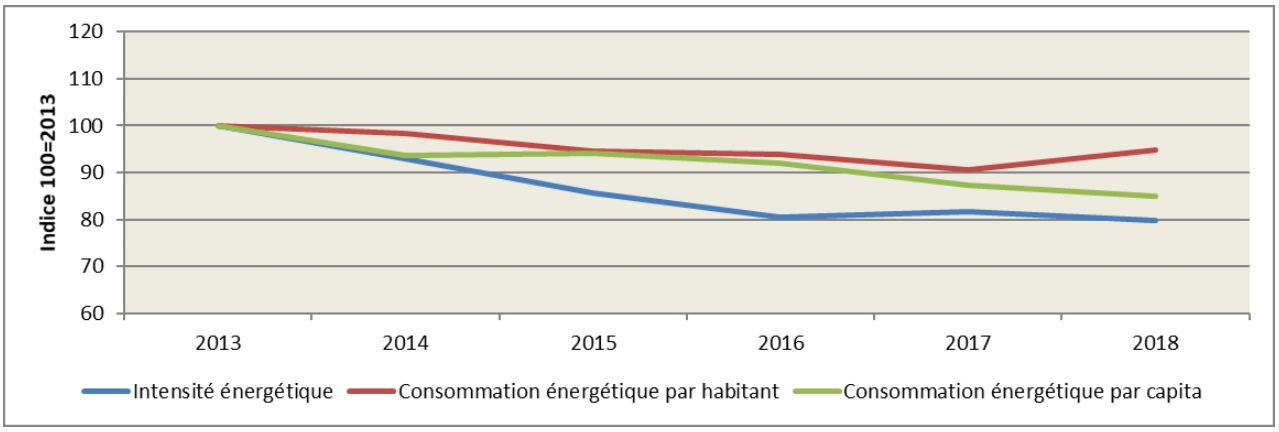
Energy indicators between 2007 and 2018 (base 100=2007) - Direction de l'Environnement



As explained in chapter 1.5 Economy, the proportion of commuters is extremely high. A reference population has therefore been calculated since 2013.

If we compare the per capita and per capita energy consumption indicators, the decrease observed is greater for the latter. Economic activity has a constant trend towards electro-efficiency.

Energy indicators between 2013 and 2018 (base 100=2013) - Direction de l'Environnement



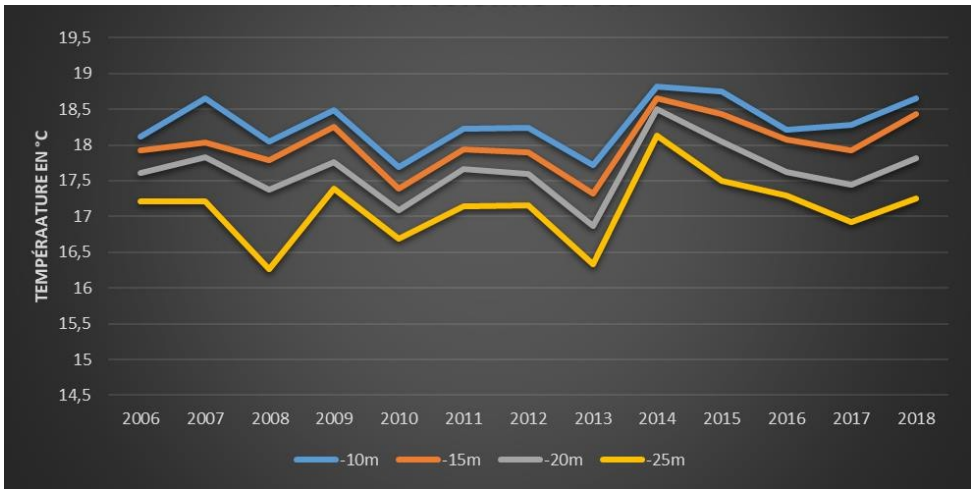
1.7 Biodiversity and habitats

1.7.1 Monitoring of fauna and flora

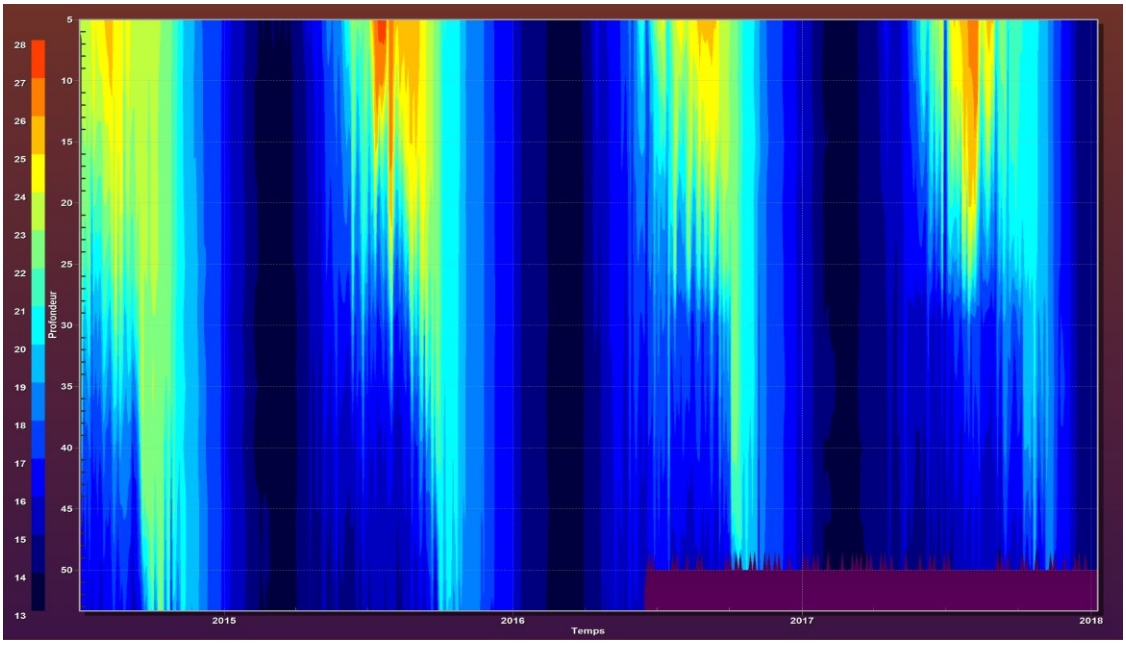
The late 90s and early 2000s were marked by a succession of positive thermal anomalies, which caused massive die-offs and local population extinctions, as well as blooms of harmful species (dinophytes and filamentous algae).

Since 2003, the Principality has been constantly monitoring the temperature of the water column, and is a forerunner in this field.

Average annual temperatures in the water column between 2006 and 2018 - Direction de l'Environnement



Daily temperature measurements in the water column between 2014 and 2018 - Direction de l'Environnement



The disappearance of heat-sensitive species has already been observed following abnormal thermal episodes. The gorgonians on the Spélugues drop-off (-9m to -37m) have been severely affected, with most of the purple gorgonians dying. The disappearance of these filter-feeding gorgonians has had a major impact on nearby species. Today, the species can be found below a depth of 45m.

Abnormal episodes in the temperature of water masses have also led to a significant quantitative reduction in Monegasque red coral. Laboratory studies carried out by the Monaco Scientific Centre show that this heat-sensitive species is also affected by ocean acidification. This thermal change has had other impacts, leading to changes in the physico-chemical parameters of bodies of water.

Thus, the modification of the environment induces either the disappearance of certain species, or the establishment and naturalisation of others, or migrations... Although the Mediterranean is not very productive in terms of plankton, the impact of these thermal changes on these living creatures is also poorly understood, and its effects need to be studied.

At the end of 2018, all the populations of great nacres on the Monegasque coast were affected by the epizootic raging on the Mediterranean coast, and none of the nacres present survived the massive die-off.
Faced with this situation, the Monegasque government decided to develop an experimental programme aimed at trying to restore the populations that had disappeared. The programme is based on the use of traps to capture great nacre larvae. Once these larvae have been captured, they will be taken from the natural environment and reared in an aquarium until they reach a stage at which they can be reintroduced into the environment. An initial attempt to capture these larvae has been scheduled for summer 2019 and will continue in 2020.

On land, the inventory of the vascular flora indigenous to the Principality of Monaco has enabled the identification of 347 taxa (species and subspecies) currently present, divided into 79 plant families. However, at least 49 taxa previously mentioned by botanists have not been found and can now be considered to have disappeared from the territory.

1.7.2 Invasive and new species

The presence of certain invasive species has increased in recent years, notably the mosquito *Aedes albopictus* and the algae *Ostreopsis ovata*.

The Principality of Monaco is highly vulnerable to the appearance of the *Aedes albopictus* mosquito. The exotic plants present in the Principality, such as the Balisier tree, are conducive to its development. These mosquitoes appear earlier in the year and disappear later. Their diapause is therefore shorter and shorter. At the same time, there has been a decline in the presence of Culex mosquitoes, in competition with "tiger" mosquitoes. In 2006, the European Centre for Disease Prevention and Control (ECDC) observed the presence of the *Aedes albopictus* mosquito in Monaco for the first time.

This mosquito is one of the 100 most invasive species in the world. Chikungunya is now considered to be a "re-emerging" disease. Climate projections for Monaco show an increase in the number of months when conditions are favourable for transmission of the virus, i.e. 4 to 5 months in the Principality.

Since 2007, a monitoring system and preventive management of the risk linked to the presence of the algae *Ostreopsis ovata* have been put in place. The appearance of the algae has been noted in the Mediterranean, but the risk thresholds for public health have never been reached in the Principality.

Observations of jellyfish on the coast, particularly *Pelagia noctiluca*, have increased since the 1990s. The apparent increase in their numbers, which has yet to be confirmed, is thought to be linked to a combination of factors that encourage their proliferation: an increase in water temperature, the strength and direction of currents, and overfishing by fish that predate on jellyfish and other planktonic species.

In the case of coastal jellyfish (*Aurelia aurita)*, the general rise in temperature would tend to encourage this proliferation by extending their reproduction period. Finally, plastic could serve as a food source for jellyfish. According to the Oceanological Observatory in Villefranche-sur-Mer (France), around one person in 200,000 develops hypersensitivity and an immediate allergic reaction that can lead to anaphylactic shock.

In addition, certain species of exotic fish are now found in Monegasque waters, such as the flutefish (*Fistularia commersonii*). Native to the Indian and Pacific oceans, this fish was first reported in the Mediterranean off the Israeli coast in 2000. The stonefish is a species associated with rocky reefs, of minor importance for commercial fishing. It is one of the species that has colonised the Mediterranean most rapidly. It was observed in Monegasque waters during 2010. However, although some individuals, most of them adults, have arrived, none of them have settled there permanently.

Although no exotic species of fish has yet taken up permanent residence in Monegasque waters, it is certain that the arrival of Lessepsian fish will continue and probably intensify in the western Mediterranean over the coming years.

2 Mitigation measures

2.1 Change in greenhouse gas emissions from 1990 to 2018

2.1.1 Change in overall emissions

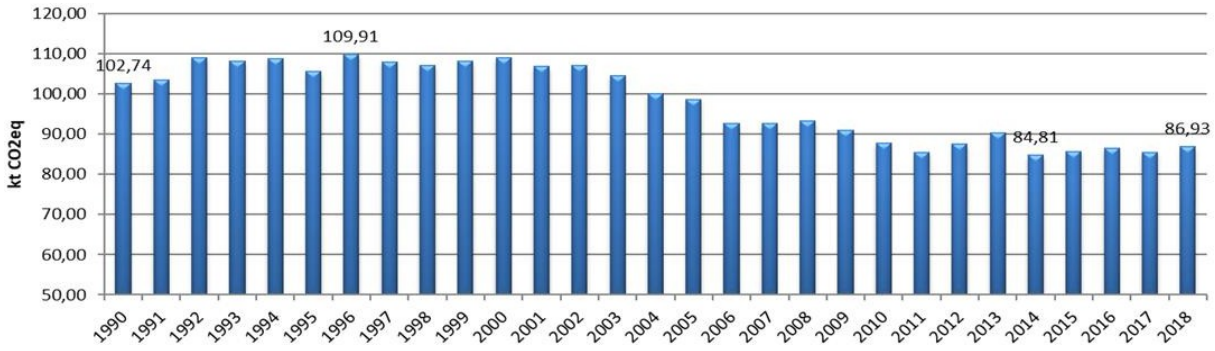
Monaco's overall greenhouse gas emissions[4] fell from 102.74 kt[5] $_{CO2eq}$ in 1990 (base year for $_{CO2}$, $_{CH4}$ and N2O and 1995 for fluorinated compounds, excluding LULUCF) to 86.93 kt CO2eq[6] in 2018.

This represents a 15.4% reduction in emissions.

Over this period, emissions rose from 1990 to 2000. The peak was reached in 1996, with emissions of 109.91 kt $_{CO2eq}$. Then, from 2000 onwards, the trend was generally downwards until 2018, despite a few upturns.

The agricultural sector is non-existent in Monaco. There is no farming or livestock rearing.

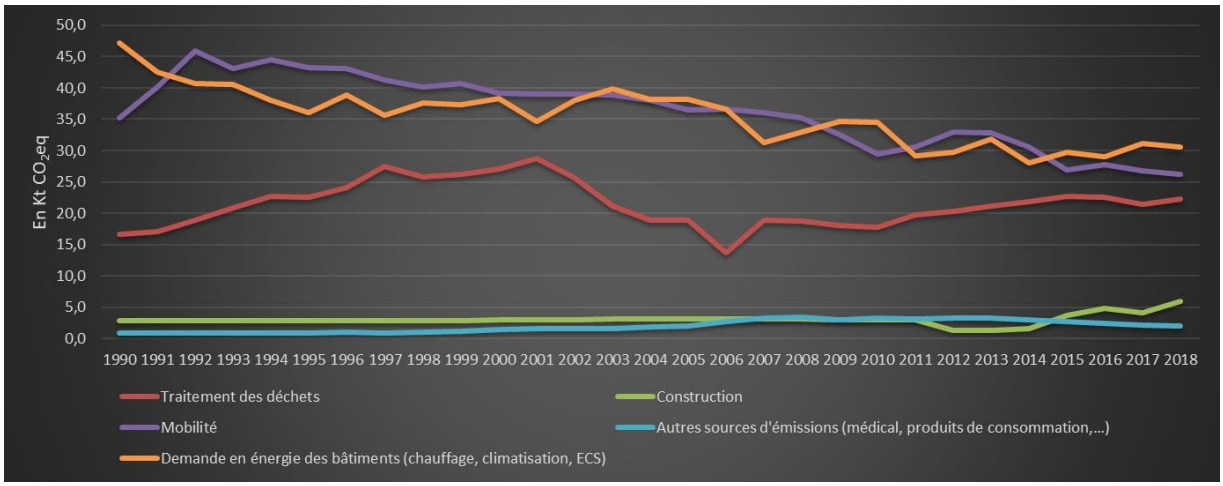
Trends in global GHG emissions from 1990 to 2018 - Direction de l'Environnement



[4] National Inventory Report 2020 - Department of the Environment - Monaco
[5] kt: kilotonne
[6] kt CO2eq: kilotonnes of carbon dioxide equivalent

2.1.2 Emissions trends by major sector of activity

2.1. 2Evolution of emissions by main sectors of activity between 1990 and 2018 - Direction de l'Environnement



This graph shows changes in greenhouse gas emissions by major sector of activity, as detailed below:

Energy demand in buildings: includes emissions linked to the combustion of domestic fuel oil and natural gas for heating and domestic hot water, heavy fuel oil and natural gas by the SeaWergie network, gases from stationary air conditioning, gases from electrical transformers and losses from the natural gas network.

Emissions from this sector fell by 35% between 1990 and 2018.

Waste treatment: includes emissions linked to waste incineration at the UIRUI.

Emissions from this sector increased by 34% between 1990 and 2018.

Mobility: includes emissions from road fuels, domestic shipping and aviation fuels, automotive air conditioning gases and automotive lubricants and additives.
Emissions from this sector fell by 26% between 1990 and 2018.

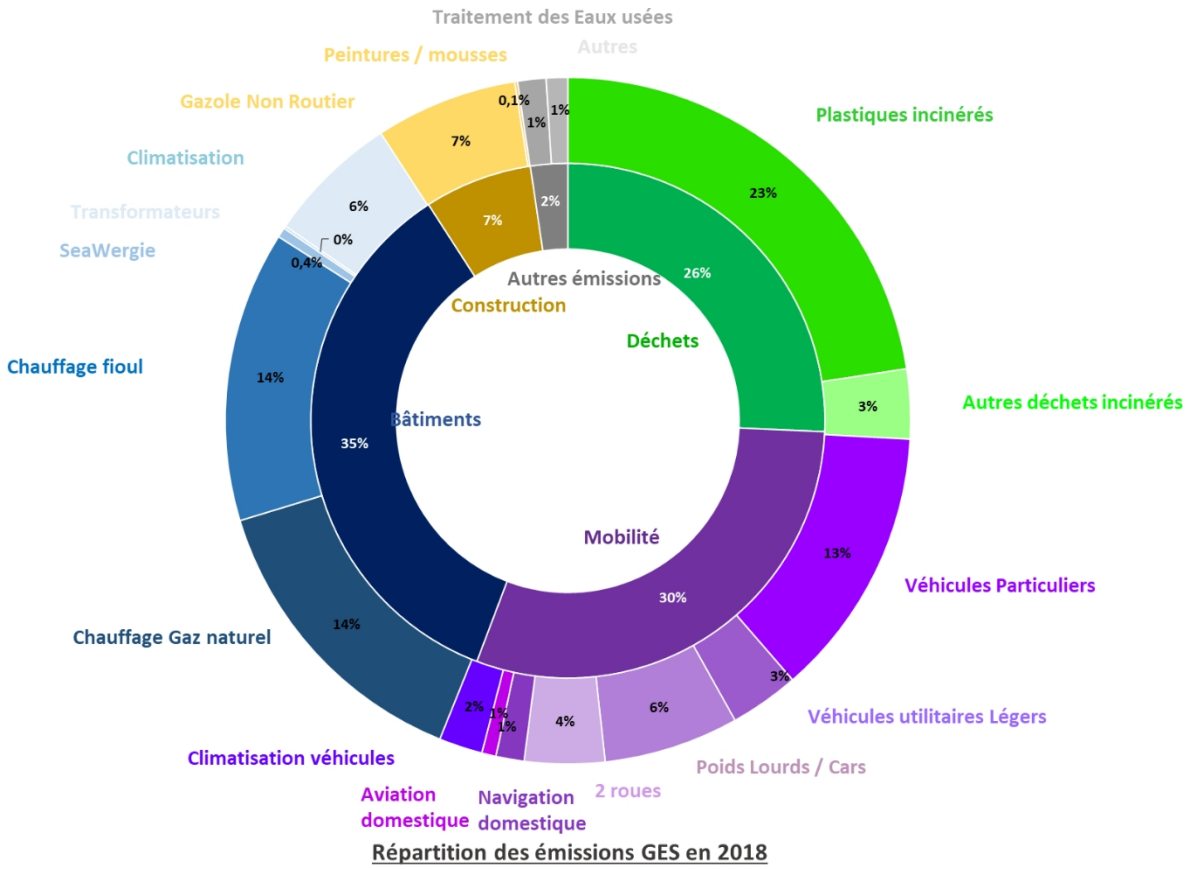
Construction: includes emissions from non-road diesel, paints, foams, bitumen and wood treatments.

Emissions from this sector rose by 107% between 1990 and 2018.

Other: includes emissions linked to refrigerator gases, gases from medical inhalers and particle accelerators, pressings, pressurised containers such as whipped cream, glues, paraffin and printing inks.

Emissions from this sector rose by 115% between 1990 and 2018.

2.1.3 Breakdown of greenhouse gas emissions by major business sector in 2018



Répartition des émissions GES en 2018

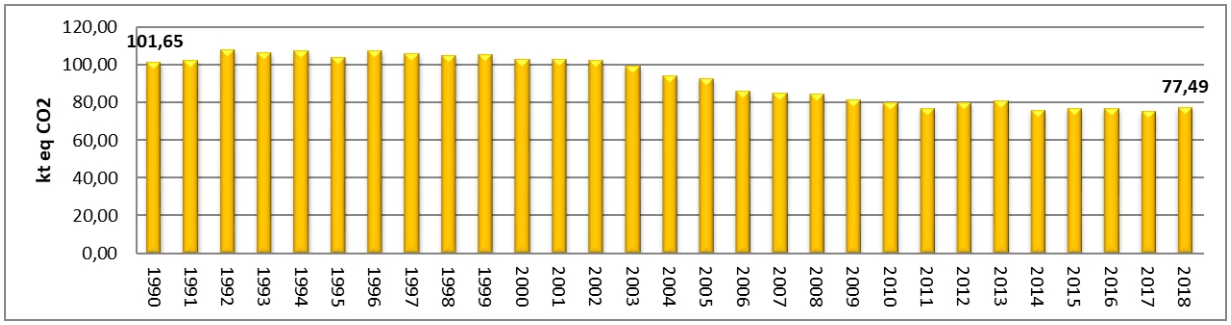
Source: Rapport National d'Inventaire 2020 - CCNUCC- Direction de l'Environnement

The graph above shows the breakdown of greenhouse gas emissions in 2018 by major sector of activity (inside) and by sub-category (outside).

2.1.4 Emissions trends in the Energy sector

Emissions from the Energy sector fell from 101.65 kt CO2eq in 1990 to 77.49 kt CO2eq in 2018, a change of -23.76%.

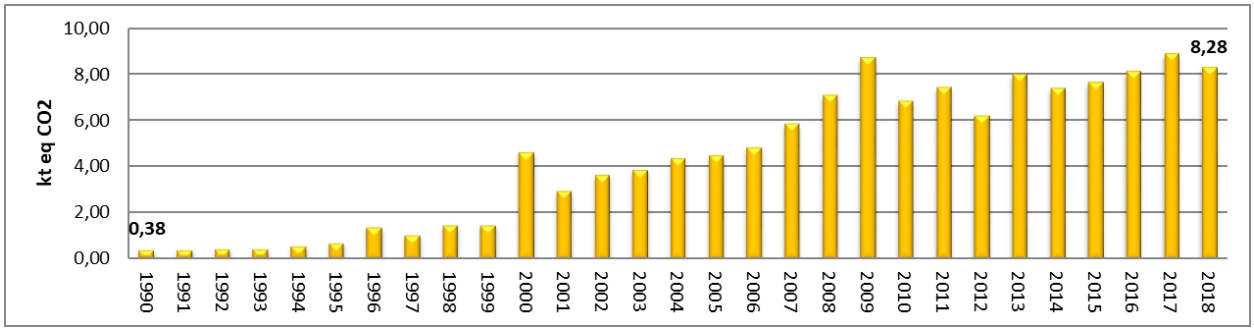
GHG emissions trends in the energy sector from 1990 to 2018



2.1.5 Emissions trends in the Industry sector

Emissions from the Industry sector (excluding transport) rose from 0.38 kt CO2eq in 1990 to 8.289 kt $_{CO2eq}$ in 2018, an increase of 2060%.

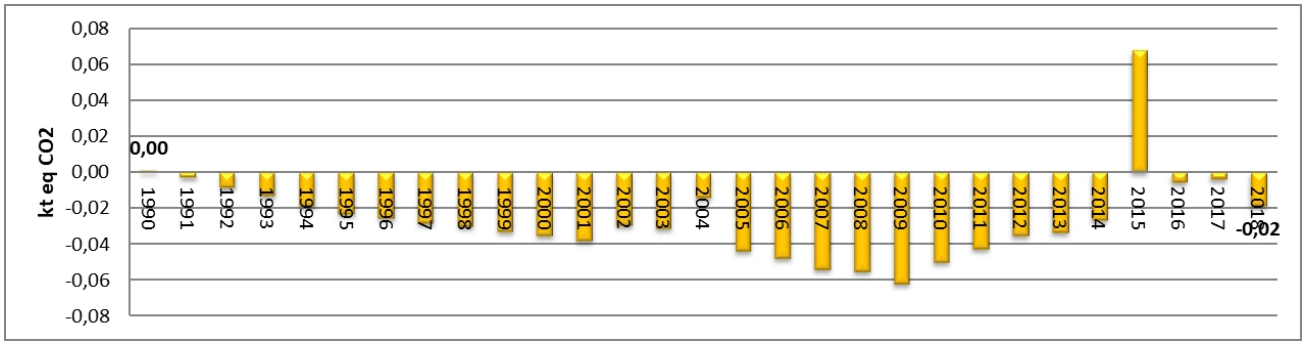
GHG emissions trends in the Industry sector from 1990 to 2018



2.1.6 Emission trends in the [LULUCF7] sector

Emissions from the Land Use, Land-Use Change and Forestry sector fell from 0.00 kt CO2eq in 1990 to -0.02 kt CO2eq in 2018, a change of -1286%.

GHG emissions trends in the LULUCF sector from 1990 to 2018

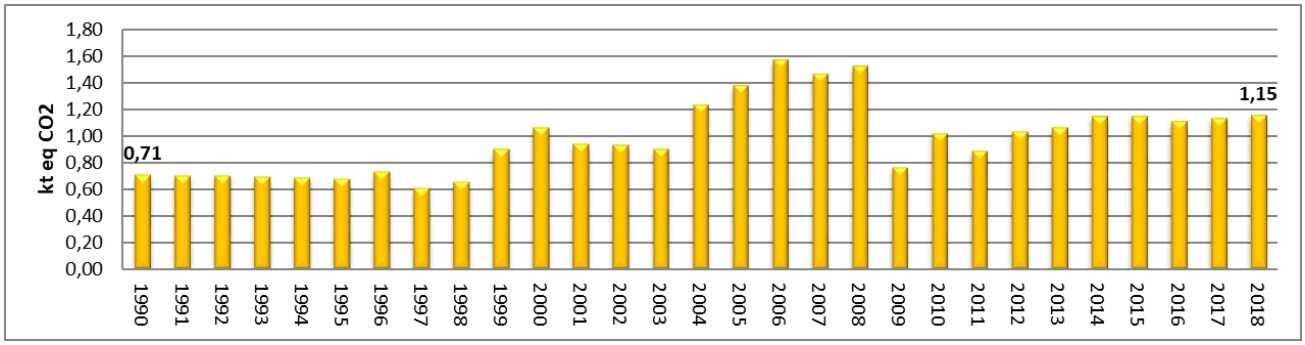


[7] LULUCF: Land Use, Land Use Change and Forestry.

2.1.7 Emissions trends in the Waste sector

Emissions from the waste sector rose from 0.71 kt CO2eq in 1990 to 1.15 kt CO2eq in 2018, an increase of 63%.

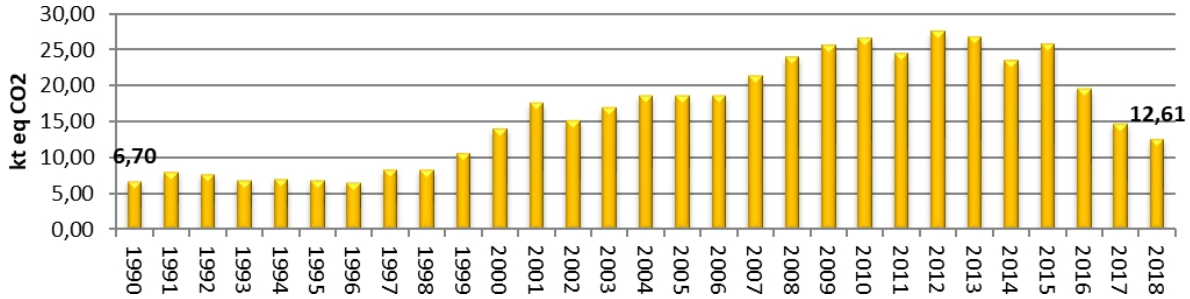
GHG emissions in the waste sector from 1990 to 2018



2.1.8 Emissions trends in the International Soultes sector

Emissions from the International Soultes sector rose from 6.70 kt CO2eq in 1990 to 12.61 kt $_{CO2eq}$ in 2018, an increase of 88%.

Change in GHG emissions from the International Soultes sector from 1990 to 2018



2.1.9 Greenhouse gas emissions by gas

Carbon dioxide is the main greenhouse gas emitted in the Principality. In 2011, the values and percentages of emissions of the various greenhouse gases were as follows (LULUCF excluded):

Carbon dioxide CO_2 - The main gas emitted in 2018 remains CO_2, which accounts for 86% of global emissions. Between 1990 and 2018, CO_2 emissions fell from 98.23 kt to 74.76kt.

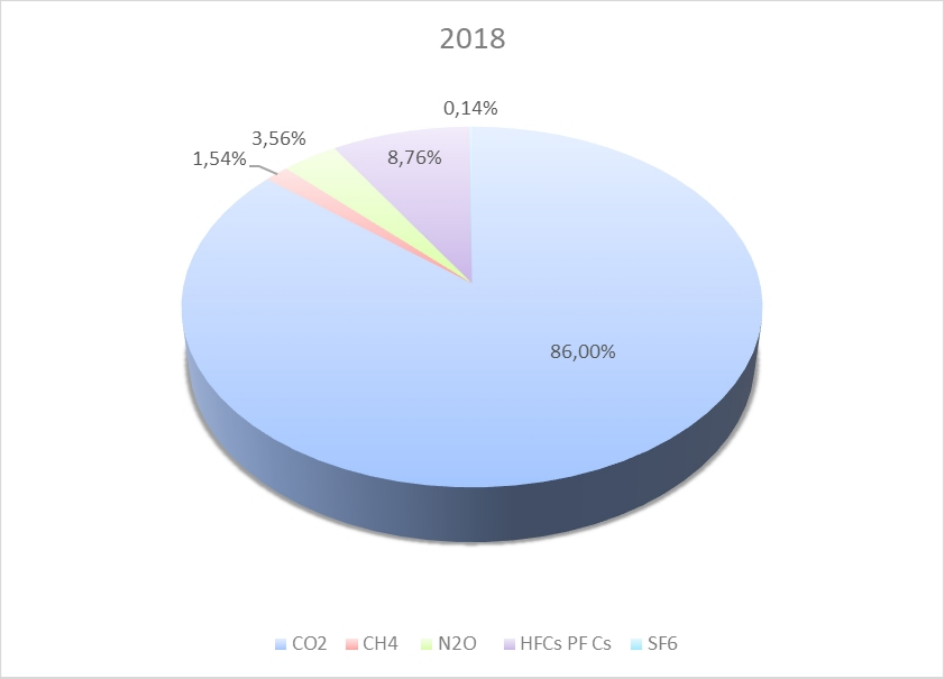
Methane CH_4 - CH_4 emissions fell from 0.09 kt in 1990 to 0.05 kt in 2018.

Nitrous oxide N2O - N2O emissions fell from 0.007 kt in 1990 to 0.01 kt in 2018.

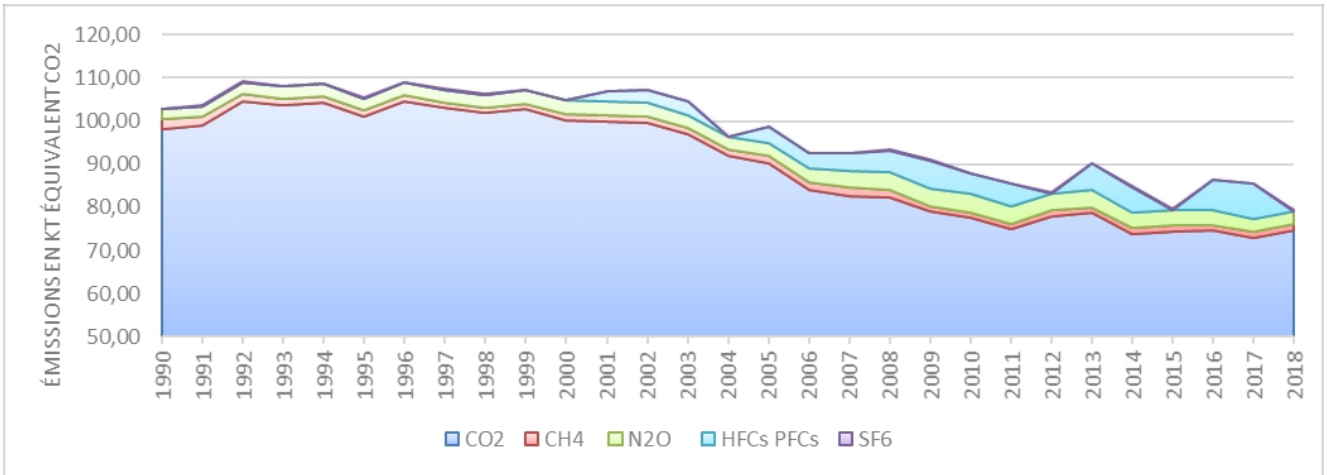
HFCs and PFCs - HFC-PFC emissions have risen from 0.0 kt CO2eq in 1990 (0.29 kt CO2eq in 1995) to 7.61 kt CO_{2eq} in 2018.

SF_6 - SF6 emissions rose from 3.6 E-6 kt in 1990 (4.1 E-6 kt in 1995) to 5.4 E-6 kt in 2018.

Breakdown of GHG emissions by gas in 2018

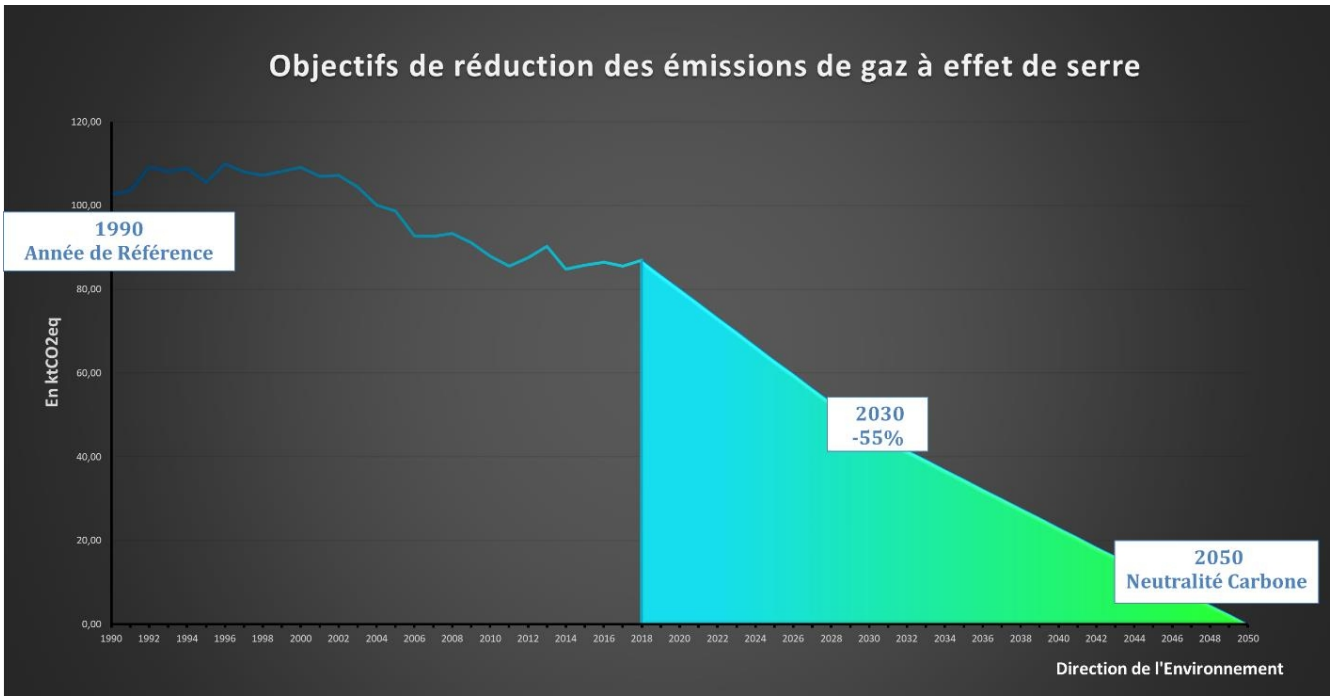


GHG emissions by gas between 1990 and 2018



2.2 Targets for reducing greenhouse gas emissions in 2030

As part of this Nationally Determined Contribution, the Principality of Monaco has set itself the target of reducing its greenhouse gas emissions by 55% by 2030.



2.3 Main policies and measures

To achieve its 2030 objectives, the Principality of Monaco has already implemented major policies and measures. These policies also aim to put the Principality on a path towards reducing greenhouse gas emissions and achieving carbon neutrality by 2050.

The Principality is therefore implementing policies and measures covering the three main sectors of energy, transport and waste, as detailed in the Climate Air Energy Plan 2030. These policies and measures are of an organisational, technical, regulatory or incentive nature.

The main actions are detailed below:

2.3.1 Energy

The consumption of fossil fuels in buildings is one of the main sources of greenhouse gas emissions.

The priorities developed by the Principality in this sector aim to decarbonise the energy consumed by buildings and improve their energy efficiency.

Decarbonising fossil fuels means increasing the proportion of renewable or recovered energy consumed, in particular through the creation of thalassothermal networks, the recovery of waste energy, and an increase in solar thermal and photovoltaic production in the region and abroad (in proportion to the electricity consumed in the region).

In addition, it will result in an increase in the biogenic content of fossil fuels, or even the replacement of these fuels by new 100% biogenic fuels.

Improving the energy and environmental performance of all existing and future buildings is also essential. The best energy is the energy we don't consume.

The policies and measures simultaneously target the renovation of existing buildings (envelopes and energy systems), changes in usage and behaviour, and sustainable construction methods for new buildings (adapted to the Mediterranean climate and Monaco's specific characteristics), with the aim of optimising the energy efficiency of all buildings.

This optimisation requires a gradual tightening of the regulatory thermal requirements for new buildings and renovations, as well as a prioritisation and increase in the annual renovation rate, supported by financial measures.

In addition, the Government is supporting the adaptation of building methods to local climatic conditions through Monaco's Sustainable Mediterranean Building initiative and the training of construction professionals in new techniques and technologies.

It should be noted that the Principality of Monaco is very interested in "blue energy" and in particular in thalassothermal energy as a substitute for fossil fuels. With its coastline and high bathymetry close to the coast, this technology is particularly well suited to the Principality. The studies carried out have also demonstrated that the discharge of water will have no environmental impact on biodiversity.

2.3.2 Transport

Transport policies and measures mainly concern road transport. Monaco also has a heliport and two marinas. Monaco is a major centre of activity adjacent to the French department of Alpes-Maritimes. This economic dynamism generates significant exchanges of working people (commuting with France and Italy), as well as traffic generated by economic activity (outside companies, deliveries, etc.).

Monaco's range of services (hotels, sports facilities, education, etc.) attracts a large number of day visitors (local visitors).

The Principality is therefore pursuing two lines of action to reduce greenhouse gas emissions from road transport, namely traffic reduction and decarbonisation of means of transport.

The priority for action is an absolute reduction in the number of kilometres travelled by motorised individual transport, in favour of active modes of transport and public transport.
The key initiatives will include the creation of park-and-ride facilities at border crossings and the development of a wide range of alternative mobility solutions (cable cars, support for walking and cycling by improving facilities and e-services).

Public transport will be gradually replaced to achieve 0 CO_2 emissions by 2030.

In addition, the Government is supporting the replacement of internal combustion vehicles with electric vehicles. While this would improve the situation in terms of direct CO_2 emissions and atmospheric pollutants, it would not solve the problems of congestion on transport routes (which primarily determine the scope for developing alternative modes) and would be difficult to generalise (very high electricity consumption and power, risk of fire in public car parks, etc.).

In the air transport sector, efforts are being made to limit aircraft fuel consumption. The Monaco heliport is pursuing an Airport Carbon Accreditation certification process. Electric helicopters could be in service by 2030 on regular routes between Monaco and Nice (France).

Finally, with regard to shipping, the Principality has banned the use of heavy fuel oil in its territorial waters and is deploying systems to power ships in ports.
Consideration is being given to the use of hydrogen on ships.

These policies will be supported by a gradual decarbonisation of fuels in line with European policies in this area.

2.3.3 Waste

Since 2016, the Principality has been deploying an ambitious strategy to limit the amount of waste produced and prioritise the recycling of waste materials.

This strategy has been supplemented by a "zero single-use plastic waste by 2030" policy.

In terms of reducing greenhouse gas emissions, Monaco's priority in this area is to reduce plastic waste, incineration of which is responsible for the majority of emissions in this sector.

However, this must be part of a comprehensive, long-term policy aimed at both reducing all types of waste at source and improving their recovery - primarily of materials and secondarily of energy - with a view to reducing their energy, climate and environmental impact.

These policies and measures take the form of regulatory measures aimed at banning the marketing or distribution of certain products, measures aimed at simplifying sorting and increasing the quantities collected.

2.3.4 Industry

There is no heavy industry in the Principality and the industrial sector is very small. The greenhouse gas emissions reported in the Industry sector mainly concern small-scale activities.

The policies and measures focus on general measures relating to energy, pollutant emissions and fluorinated gases.

With regard to fluorinated gases, the Principality intends to significantly limit the global warming potential of the fluorinated gases used on its territory.

It should be noted that the Principality of Monaco benefits from changes in European Union regulations on products, due to the customs union between the two territories.

2.3.5 Cross-functional actions

Although the Principality is committed to ambitious energy and climate objectives, the Prince's Government cannot achieve them alone. It must be shared with the residents and the public and private players who live, work and visit the Principality.

The drive towards carbon neutrality in 2050 will require far-reaching changes, particularly in the energy, buildings and transport sectors, but above all in our individual habits and choices.

These transformations are a source of many positive impacts (living environment, jobs, innovation, etc.) but they must be shared and require a commitment from everyone.

The cross-functional policies and measures involve both actions to mobilise local players and raise their awareness, and support actions.

In this respect, Framework Law No. 1.456 of 12 December 2017 on the Environment Code provides the legal basis for implementing regulatory actions and financial support.

The Government intends to continue and step up its support efforts in order to encourage more people to take action. But this package of measures offered by the Government will only have an impact if there is a collective awareness of the issues, a clear understanding of the objectives and solutions, and above all a federative dynamic based on the desire to contribute and succeed together.

Various means have been developed to achieve this, through sector-specific initiatives such as "Commerce Engagé" or "Restaurant Engagé", or more global initiatives that bring together all the players involved, such as the "Pacte National pour la Transition Énergétique Energie" (National Pact for Energy Transition).

These initiatives provide forums for sharing and learning about each other's actions, as well as a space for raising awareness and mobilising people.

3 Adaptation measures

Monaco's vulnerability to climate change must be assessed in terms of the direct effects of climate change: an increase in hot spells, changes in bioclimatic characteristics, energy stress and rising sea levels.

The urban climate is generally characterised by higher temperatures than in the surrounding rural areas (especially at the end of the day and at night), specific winds and the presence of urban pollution.

3.1 Adapting to urban heat islands

The temperature difference observed in urban heat islands (UHI) is linked to the heat stored during the day in the mineral city and released at night, thus preventing the cooling of the air in the city at night. This difference, which is more marked at night, is characterised by specific air temperatures (at different heights) and surface temperatures (temperatures of urban materials), and is therefore strongly correlated with variations in urban density, particularly building materials.

A study launched in 2020 identified urban heat and cold islands (ICU) in order to assess the region's vulnerability and the areas at greatest risk.

The aim will then be to take account of summer comfort in the construction, renovation and operation of buildings, as well as in land-use planning. Once completed, this study will serve as a management tool for the tree species present in the Principality, with the aim of favouring species that play a role in thermal regulation, but also in capturing various atmospheric pollutants in correlation with air quality data.

This issue can be felt at two levels: at the scale of the building (indoor thermal discomfort) and at the scale of the neighbourhood (urban heat islands). In the Principality, the issue of thermal discomfort in buildings is not predominant. Conversely, rising temperatures are likely to have a major impact on the phenomenon of UHIs.

3.2 Nature in the city

Strengthening the role of nature is a priority for the Principality in order to improve the quality of life and adapt the region to climate change.
In the context of a dense urban environment, environments that are favourable to biodiversity are rare and must therefore be both preserved and developed. The aim today is to propose a new urban model for Monaco, in which nature is deployed wherever possible, both in public spaces and on buildings.

Through the National Biodiversity Strategy 2030, the Government of Monaco aims to place biodiversity at the service of the Principality's living environment and climate policy.

As Monaco is the most densely populated coastal city in the world, climate change will exert additional pressure on the local population and biodiversity. It is therefore necessary to prepare the resilient city of tomorrow by integrating the services provided by nature.
These services relate to attractiveness, improving the living environment and quality of life for residents, the social need to connect with nature, reducing vulnerability to natural hazards and adapting the Monegasque territory to climate change.

With the aim of making biodiversity a key component of Monaco's quality of life, a plan to "renaturate" the city has been initiated. Road surfaces account for around 30% of Monaco's surface area. These areas provide opportunities for the integration and development of biodiversity. A target of renaturating at least 20% of these areas has been set for 2030, representing a gain of more than 13 ha of space favourable to biodiversity.

Lastly, this renaturation of the area will improve connectivity between natural areas, which will benefit the development of biodiversity and contribute to improving the well-being of the Principality's inhabitants and reducing temperatures.

The role of trees in the city is to be strengthened with a major planting programme. An increase of at least 20% in the number of trees, representing the planting of 2,400 additional trees in the area, is planned between now and 2030, in addition to the 12,000 trees already present in the area. In addition, the development of green infrastructure on buildings, such as intensive roofs and modular green walls, will be encouraged to 'ensauvagise' the city, with the aim of allowing a large number of plant species to coexist (seeded, planted, but also spontaneous), with different strata (shrubby, herbaceous, muscular) adapted to local climatic and microclimatic conditions (temperature, humidity, light, wind).

3.3 Adapting coastal areas

In the medium term, climate change will lead to changes in wind patterns, which are the source of waves, and a rise in mean sea level. Monaco's coastline will be subject to these changes.

A study has been carried out in the Principality to define the coastal areas most exposed to the risk of flooding, as well as a map identifying the risks of flooding along the entire Monegasque coastline for the current situation and by 2100.

As the Principality is largely built on the sea, the risk of flooding is high. As a result, developments and works will have to be carried out in the future, including :
- In the short term, based on localised raising solutions (embankments, fixed or removable landscape walls depending on location, capping beams where possible, etc.) and regulating activities behind structures in exposed areas.
- In the medium term, through the construction of new works acting as an anti-submergence belt that could eventually serve as an urban extension to the Principality of Monaco if these works are built at sea and not on the coastline.

4 Climate finance

True to its tradition of solidarity, the Principality of Monaco fully intends to shoulder its share of responsibility in the collective fight against climate change. To this end, Monaco will maintain its support for developing countries and their efforts to mitigate and adapt to climate change.

The Government of Monaco's strategy for growth in international climate financing provides for a two-yearly increase of 100,000 euros from 2020 to 2030.

A cross-functional approach, linking several sustainable development objectives, will continue to be favoured, particularly activities with climate/biodiversity/ocean co-benefits, as these issues cannot be tackled separately.

As in the past, the Principality will continue to focus its efforts on the Least Developed Countries and Small Island Developing States, which are among the first victims of climate change.

The majority of the Principality's international climate funding is channelled bilaterally, in particular through the Green Climate Fund, which Monaco has supported since it began operations in 2015.

At the Fund's first rebuilding in 2019, the Government of Monaco pledged to contribute €3.75 million over the period 2020-2023, thereby strengthening the Principality's position as a major per capita donor. Through this contribution, Monaco guarantees the equitable allocation of its climate finance resources between adaptation and mitigation, while ensuring that they actually reach the developing countries Parties.

Monaco also pays particular attention to the way in which climate change affects human health and threatens the fundamental right of individuals to live in a healthy, clean and sustainable environment. In order to remedy this, the Government of Monaco channels part of its international funding to organisations working to combat the harmful effects of climate change, including the W.H.O., through its strategic priority B3, and the Climate and Clean Air Coalition.

Lastly, in addition to its traditional climate funding, the Prince's Government runs a number of international cooperation programmes which, although not dedicated to it, have "climate co-benefits" for the Principality's partner countries in terms of both adaptation and mitigation. For the year 2021, these projects represented a total of almost €4.8 million, an increase of around 87% compared to 2018.

In the future, Monaco plans to further integrate climate considerations at the heart of its development cooperation policy, in order to make all its funding more consistent with low-carbon and resilient development in its partner countries. The medium-term objective is to be able to boast of cooperation that is totally "climate compatible".

The Principality has provided all of its funding in the form of donations and intends to continue to do so. Multilateral, regional and bilateral channels will continue to be used according to their capacity to produce concrete results on the ground.

5 Market mechanisms

Reducing greenhouse gas emissions in the region is primarily the result of national measures.

In the event that these reductions do not make it possible to achieve the targets set, the Principality may have recourse to the market mechanisms referred to in Article 6 of the Paris Agreement.

6 Information to be provided to improve the clarity, transparency and understanding of nationally determined contributions

6.1 Quantifiable information on the reference point

Monaco takes 1990 as the reference year for its commitments.

6.2 Implementation periods

The Principality of Monaco is committed to reducing its emissions by 55% by 2030.
The implementation period runs from 1er January 2021 to 31 December 2030.

6.3 Scope and application

Monaco's commitment covers all territorial emissions, as reported in the National Inventory Reports.

It covers all sectors: Energy, Industrial Processes and Product Use, Agriculture, Forestry and Land Use and Waste.

Finally, it covers all gases: carbon dioxide ($_{CO2}$), methane ($_{CH4}$), nitrous oxide ($_{N2O}$), the fluorinated gases hydrofluorocarbons (HFCs) and perclofluorocarbons (PFCs), sulphur hexafluoride ($_{SF6}$) and nitrogen trifluoride ($_{NF3}$).

Greenhouse gas emissions for all sectors are estimated in accordance with the 2006 guidelines (GL 2006) of the Intergovernmental Panel on Climate Change (IPCC). The global warming powers used are those published in the IPCC's 4th Assessment Report on Climate Change (IPCC - AR 4 - 2007). The values may be modified as a result of methodological improvements in estimating greenhouse gas emissions.

6.4 Planning process

The preparation of the Nationally Determined Contribution is part of the review of the Principality of Monaco's energy and climate planning for 2030. As part of this process, public and private stakeholders were consulted through various bodies.

The projections, policies and measures have been determined in order to achieve the 2030 objectives and to put the Principality on the path to carbon neutrality by 2050.

6.5 Assumptions and methodological approaches, including those for estimating and accounting for anthropogenic greenhouse gas emissions and, where appropriate, anthropogenic removals

The methodological assumptions and approaches, including those for estimating and accounting for anthropogenic greenhouse gas emissions, are those used in the national inventory reports in accordance with the IPCC guidelines.

The implementation of policies and measures will be monitored as part of the governance of the Climate Air Energy Plan.
Changes in greenhouse gas emissions, energy indicators and the impact of policies and measures will be monitored through the preparation of national inventory reports and other reports required under the Convention and the Paris Agreement.

6.6 How the Party considers that its nationally determined contribution is fair and ambitious given its national circumstances

Monaco's commitment to reducing its greenhouse gas emissions has been reviewed and increased as part of this Nationally Determined Contribution.

As a result, the quantified commitment to reduce GHG emissions by 2030 has been increased from -50% to -55%.

Monaco considers its commitment to be particularly ambitious given its national situation and, in particular, its 2km² territory, which corresponds to a dense urban environment.

The policies and measures implemented cover all the sectors responsible for greenhouse gas emissions. Support policies are being implemented to help people make the necessary transitions to meet their commitments.

6.7 The way in which the contribution determined at national level contributes to achieving the objective of the Convention as set out in its Article 2

The IPCC[8] has determined the trajectory for limiting global warming to 1.5°C: "*Under trajectories that limit global warming to 1.5°C with no or minimal overshoot, net global anthropogenic CO2 emissions decline by about 45% from 2010 levels to 2030 (interquartile range: 40-60%), reaching zero by 2050*".

[8] IPCC Special Report on the consequences of global warming of 1.5°C above pre-industrial levels and associated global greenhouse gas emission trajectories, in the context of strengthening global action on climate change, sustainable development and poverty reduction - Summary for Policymakers - paragraph C.1

By deciding to reduce its greenhouse gas emissions by 55% by 2030 compared to 1990 levels, the Principality of Monaco has decided to align its commitment for 2030 with this trajectory.

The Principality of Monaco therefore intends to assume its responsibility to enable ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and that economic development can continue in a sustainable manner by setting its greenhouse gas emission reduction target on the long-term objective as set out in Article 2 of the Convention and specified by Decision 10/CP.21.