



# FIRST BIENNIAL TRANSPARENCY REPORT

Under the Paris Agreement

دولة قطر  
State of Qatar

## 2026

## **Minister's Foreword**

The State of Qatar recognizes the importance of effective climate action and international cooperation in addressing the challenges posed by climate change. Guided by Qatar National Vision 2030, the State continues to advance its efforts toward sustainable development, environmental protection, and enhanced climate resilience.

The submission of Qatar's First Biennial Transparency Report (BTR1) represents an important milestone in strengthening the State's climate transparency and fulfilling its commitments under the United Nations Framework Convention on Climate Change and the Paris Agreement. The report provides a comprehensive account of Qatar's national circumstances, greenhouse gas emissions and removals, progress toward its nationally determined contribution, climate change impacts and adaptation efforts, and the support required and received, in accordance with the Enhanced Transparency Framework.

The preparation of this report reflects the collective efforts of government entities, national institutions, technical experts, and relevant stakeholders. Their cooperation and contributions have been essential in strengthening national data, institutional arrangements, and reporting capacities.

Qatar remains committed to continuously enhancing the quality and transparency of its climate reporting, strengthening national capacities, and supporting the implementation of effective climate policies and measures. Through continued national collaboration and international cooperation, we look forward to contributing constructively to the collective efforts to achieve the objectives of the Paris Agreement while advancing Qatar's sustainable development priorities.

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***Minister of Environment and Climate Change***

***State of Qatar***

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## List of Abbreviations

| Abbreviation | Full Form                                              |
|--------------|--------------------------------------------------------|
| BAU          | Business-As-Usual                                      |
| BOD          | Biochemical Oxygen Demand                              |
| BTR          | Biennial Transparency Report                           |
| CBD          | Convention on Biological Diversity                     |
| CCS          | Carbon Capture and Storage                             |
| CNG          | Compressed Natural Gas                                 |
| CRT          | Common Reporting Tables                                |
| ETF          | Enhanced Transparency Framework                        |
| GDP          | Gross Domestic Product                                 |
| GHG          | Greenhouse Gas                                         |
| GSAS         | Global Sustainability Assessment System                |
| GTL          | Gas-to-Liquids                                         |
| IPCC         | Intergovernmental Panel on Climate Change              |
| KAHRAMAA     | Qatar General Electricity and Water Corporation        |
| LDAR         | Leak Detection and Repair                              |
| LNG          | Liquefied Natural Gas                                  |
| LULUCF       | Land Use, Land-Use Change, and Forestry                |
| MCM          | Million Cubic Meters                                   |
| MDO/MGO      | Marine Diesel Oil / Marine Gas Oil                     |
| MECC         | Ministry of Environment and Climate Change             |
| MEL          | Monitoring, Evaluation, and Learning                   |
| MMBTU        | Million British Thermal Units                          |
| MMSCFD       | Million Standard Cubic Feet per Day                    |
| MoPH         | Ministry of Public Health                              |
| MPGs         | Modalities, Procedures, and Guidelines                 |
| MRV          | Measurement, Reporting, and Verification               |
| MSW          | Municipal Solid Waste                                  |
| NCCC         | Qatar National Climate Change Committee                |
| NDC          | Nationally Determined Contribution                     |
| NDS          | National Development Strategy                          |
| NPC          | National Planning Council                              |
| QFFD         | Qatar Fund for Development                             |
| QNE          | Qatar National Environment and Climate Change Strategy |
| SNC          | Second National Communication                          |
| SWDS         | Solid Waste Disposal Sites                             |
| TJ           | Terajoule                                              |
| TSE          | Treated Sewage Effluent                                |
| UHI          | Urban Heat Island                                      |
| UNFCCC       | United Nations Framework Convention on Climate Change  |
| VLSHFO       | Very Low Sulphur Heavy Fuel Oil                        |

## Acknowledgments

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## Executive Summary

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The following document constitutes the First Biennial Transparency Report (BTR) submitted by the State of Qatar based on the guidelines adopted by the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement.

### Chapter 1: National Circumstances and Institutional Arrangements

The State of Qatar occupies a hyper arid peninsula characterized by extreme summer temperatures exceeding 43 degrees Celsius, negligible rainfall averaging 68 millimeters annually, and the absence of permanent freshwater resources. Spanning 11,637 square kilometers of karst limestone terrain with 80% desert cover and a 550-kilometer coastline, the nation maintains human settlement and economic activity through engineered water security systems including energy intensive desalination providing 61% of supply, strategic reservoir investments exceeding 20 billion Qatari riyals, and universal climate-controlled infrastructure.

The national economy leverages proven hydrocarbon reserves of 1,740 trillion cubic feet of natural gas to enable sustainable development in Qatar, while supporting comprehensive climate action and economic diversification toward nonhydrocarbon sector expansion. The growth in nonhydrocarbon sector currently contributes to 63% of Gross Domestic Product (GDP) and targeted to reach 70% by 2030.

Institutional governance operates through consolidated architecture established under Amiri Decision Number 41 of 2022, which positions the Ministry of Environment and Climate Change (MECC) as the national authority coordinating implementation across sector ministries through the National Committee on Climate Change. This framework integrates Qatar's Nationally Determined Contribution (NDC) with the Qatar National Environment and Climate Change Strategy establishing five quantified pillars covering GHG and air quality improvement, water security, circular economy transformation and waste, biodiversity protection and sustainable land use, alongside the Under progressed National Adaptation Plan (NAP).

At present, Qatar is in the process of developing an integrated national Measurement, Reporting and Verification (MRV) system to systematically track and manage greenhouse gas (GHG) emissions across all sectors of the economy. This system is intended to help strengthen our capacity to monitor and validate progress towards Qatar's Nationally Determined Contribution (NDC) targets, as outlined in its revised NDC submitted in August 2021. Once operational, it will provide a systematic, integrated, and robust framework for GHG data management system that will facilitate effective reporting, planning, financing, and the implementation and tracking of climate actions.

Qatar applies flexibility provisions under the Enhanced Transparency Framework consistent with its developing country status while progressively enhancing data granularity and sectoral coverage, engaging stakeholders across government, private sector, and academia to ensure continuous improvement in reporting accuracy and institutional readiness for BTR cycles.

### Chapter 2: National Inventory Report of Anthropogenic Emissions by Source and Sink of GHGs

The national greenhouse gas (GHG) inventory was developed using a combination of the 2006 IPCC Guidelines and the EU Monitoring and Reporting Regulation (EU MRR).

- Due to data limitations and confidentiality constraints, Tier 1 methodologies were applied for all the categories in the agriculture and waste sector, as well as lime production in the IPPU sector, and mobile combustion in the Energy sector. A Tier 2 approach was used for cement production where more detailed activity data were available.

- The EU MRR methodology was applied to estimate CO<sub>2</sub> emissions from the remaining energy and IPPU activities, while the IPCC Guidelines were used to estimate CH<sub>4</sub> and N<sub>2</sub>O emissions across these sectors.

The State of Qatar's total national greenhouse gas emissions (excluding CO<sub>2</sub> captured and stored) remained broadly stable over the period 2019-2023. Emissions reached a low of 113,193 ktCO<sub>2</sub>e in 2019 before increasing steadily to a peak of 118,830 ktCO<sub>2</sub>e in 2023.

The energy sector (including transport), given its significance to the national economy largely drives overall trends and leads to approximately 90% of the total national emissions. The IPPU sector was the second-largest contributor (around 7.4-8.8%), with emissions declining between 2019 and 2021 before implying to about 10,017 ktCO<sub>2</sub>e in 2023. The waste sector accounted for roughly 1–2% of emissions and showed a gradual increase, rising from about 1,621 ktCO<sub>2</sub>e in 2019 to 1,861 ktCO<sub>2</sub>e in 2023. Agriculture remained the smallest contributor (around 0.5%), with relatively stable emissions over the period.

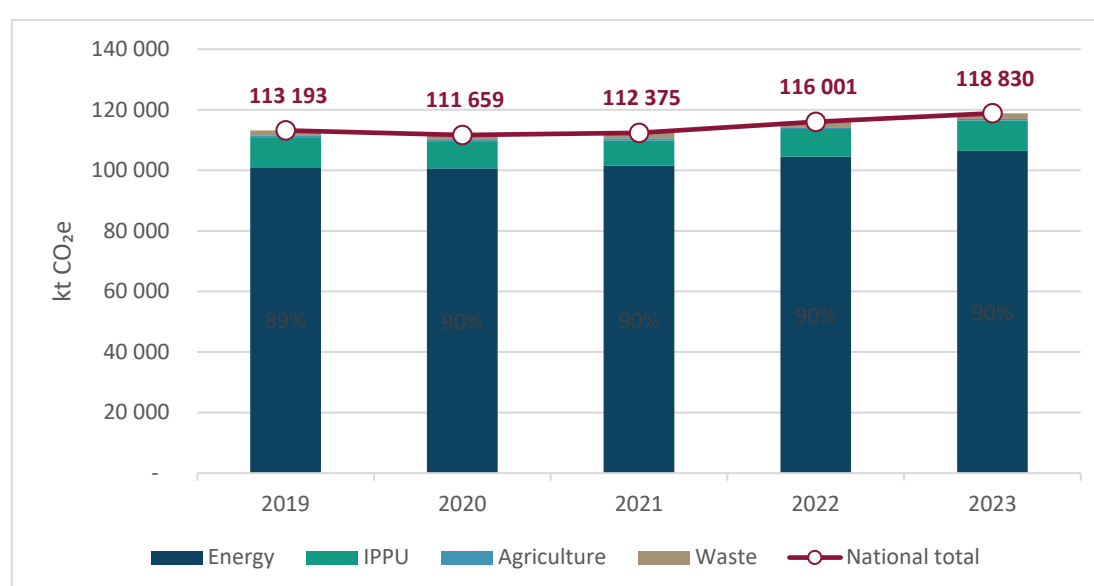


Figure 0-1: GHG emissions, 2019-2023 (in ktCO<sub>2</sub>e) and repartition by sector

### Chapter 3: Information Necessary to Track Progress Made in Implementing and Achieving Nationally Determined Contributions Under Article 4 of the Paris Agreement

Qatar's Nationally Determined Contribution (NDC), submitted in 2021 as an update to its 2015 Intended NDC, reflects an enhanced level of ambition under Article 4 of the Paris Agreement while maintaining a balanced approach between mitigation, adaptation, and economic development. Recognizing its national circumstances—particularly the significant role of the oil and gas sector in supporting socio-economic development — Qatar's NDC emissions reduction target was defined as a projected percentage reduction by 2030 below business-as-usual (BAU) levels (an emission reduction target below a projected baseline). All national actions and plans will be implemented in accordance with the principles and provisions of the UNFCCC, particularly Articles 4.7 and 12.4.

The BAU-based target is subject to periodic reviews and may be refined and updated. These reviews and updates will be in accordance with evolving national circumstances, the requirements of the Enhanced Transparency Framework (ETF), while maintaining coherence with Articles 4.3, 4.4, and 4.7 of the Paris Agreement, reflecting progression and the highest possible ambition, while acknowledging the role of international support in enabling implementation for developing country Parties.

In addition to mitigation, Qatar's NDC emphasizes adaptation actions with strong mitigation co-benefits, particularly in water management, sustainable infrastructure, food security, and public

awareness. The country also signals openness to voluntary cooperative approaches under Article 6, including carbon markets and technology cooperation, to support NDC achievement. Qatar is working to continuously improve its measurement, reporting, and verification (MRV) system, including potential future updates to emissions baselines and sectoral coverage. Overall, the NDC underscores Qatar's commitment to balancing climate action with economic resilience, while maintaining flexibility to enhance ambition over time in line with evolving national and international circumstances.

Qatar's mitigation policies and measures to achieve its NDC target are centered on a comprehensive, sector-wide approach that prioritizes emissions intensity reduction, energy efficiency, and lower-carbon technologies, particularly in the oil and gas and power sectors. In the oil and gas sector, which represents the largest mitigation potential, key actions include methane emissions reduction through LDAR programs and advanced monitoring technologies, elimination of routine flaring by 2030, deployment of carbon capture and storage (CCS) at scale, and energy efficiency improvements being implemented across the sector's operations. Complementary measures in the power and water sector focus on increasing renewable energy capacity to 30% of Qatar's total peak electricity demand by 2030, improving desalination and electricity efficiency, promoting demand-side management through initiatives such as Tarsheed, and expanding district cooling systems. Additional mitigation efforts are implemented across refining, petrochemicals, and fertilizers through process optimization, emissions intensity reduction targets, and lower-carbon product developments, while transport sector actions emphasize electrification, public transport expansion, and fuel efficiency standards.

Across other sectors, including buildings, waste, and industry, mitigation actions focus on sustainable infrastructure, waste-to-energy systems, green building standards, and resource efficiency, supported by research, innovation, and awareness programs. Many adaptation actions — particularly in water management, urban planning, and food security — also generate significant mitigation co-benefits by reducing energy demand and associated energy-related emissions. Overall, Qatar's mitigation strategy reflects a gradual but sustained transition toward a lower-carbon economy, with the largest contributions expected from oil and gas and power sector transformations, complemented by smaller yet important gains in transport, industry, and other sectors.

#### Chapter 4: Information Related to the Impacts of Climate Change and Adaptation Under Article 7 of the Paris Agreement

Qatar's national circumstances strongly shape its adaptation needs and priorities. As a low-lying peninsula in the Arabian Gulf, the country faces extreme heat, minimal and unpredictable rainfall, and high coastal exposure, with most of its population and infrastructure concentrated along vulnerable shorelines. Rising temperatures, increasing humidity, sea-level rise, and more intense climate extremes—such as heatwaves and flash floods—contribute to risks associated with water security, public health, infrastructure, and ecosystems. Heavy reliance on desalination, intensive utilization of groundwater, and high import dependence for food further increase vulnerability, while rapid urbanization intensifies exposure to climate hazards. Despite these risks, the country's strategic vision, particularly under Qatar National Vision 2030, provides a foundation for building national resilience through the allocation of its economic resources and capacity to climate action and adaptation measures.

Qatar has established institutional and policy frameworks integrating adaptation into national strategies such as the Qatar National Environment and Climate Change Strategy and the National Adaptation Plan. Key adaptation priorities include protecting coastal zones and infrastructure, ensuring water security, addressing heat-related health risks, strengthening food systems, and promoting climate-resilient urban development. Sectoral strategies focus on measures such as seawalls and nature-based coastal protection, expansion of water reuse, heat-health action plans, climate-smart agriculture, and resilient infrastructure design. However, challenges remain, including data gaps, coordination across sectors, reliance on imported technologies. To address these, Qatar

emphasizes monitoring, evaluation, and learning systems, as well as international cooperation and capacity building, to enhance long-term adaptive capacity and resilience.

#### Chapter 5: Information on Financial, Development, and Technology Transfer Support, and Capacity Building Needed and Received Under Articles 9 to 11 of the Paris Agreement

The State of Qatar's climate support architecture reflects a decisive shift from traditional donor-recipient frameworks toward self-financed, nationally led implementation supported by voluntary cooperation and solidarity with developed and developing nations, particularly in support of climate-vulnerable nations. Under Article 9 of the Paris Agreement, Qatar does not receive international financial support; climate action is financed exclusively through domestic sovereign resources and capital markets, including a USD 2.5 billion green bond issuance and over QAR 100 billion in public investments spanning renewable energy, water security, and sustainable mobility. Conversely, as a non-Annex I Party, Qatar voluntarily provides climate finance to least developed countries and small island developing states, fulfilling a pledge through the Adaptation Fund, the Green Climate Fund, and bilateral partnerships for green jobs and climate-resilient agriculture across Africa, the Caribbean, and the Pacific.

Under Article 10, Qatar does not receive international technology development and transfer support. Priority technology needs for mitigation focus on scaling carbon capture and sequestration for liquefied natural gas facilities, methane leak detection and repair systems, desert-optimized solar photovoltaic operations, and interoperable electric vehicle charging infrastructure. Adaptation priorities require advanced reverse osmosis optimization with brine mineral recovery, supervisory control and data acquisition systems for water networks, and controlled environment agriculture for arid conditions. Currently, all technology needs are delivered through domestic commercial contracting and engineering partnerships rather than grant-based mechanisms.

Under Article 11, Qatar does not receive international capacity-building support; institutional strengthening is self-financed and embedded within national programmes. Priority areas include strengthening operational capability for carbon capture and flare reduction systems, developing specialized skills in greenhouse gas inventory compilation and tier-upgraded methodologies, strengthening digital platforms for climate data governance, and enhancing workforce competency in smart water network management and ecosystem restoration monitoring.

Regarding Article 13, Qatar has received USD 1.102 million from the Global Environment Facility to strengthen institutional coordination and reporting workflows for the Enhanced Transparency Framework. However, additional support remains critical to establish enforceable legal mandates for cross-government GHG data sharing, complete the integrated national MRV Platform, and secure sustained resources for continuous Biennial Transparency Report cycles.

#### Chapter 6: Use of Flexibility Provisions

Qatar applied flexibility provisions available to developing country Parties under Article 13 of the Paris Agreement and Decision 18/CMA.1, reflecting existing capacity constraints in data availability, methodological development, monitoring systems, and institutional arrangements. Flexibility was applied across several reporting areas, including the national GHG inventory, tracking progress toward the NDC, adaptation reporting, and information on support needed and received. Qatar adopted a phased approach to adaptation reporting, focusing in BTR1 on infrastructure and coastal zones, water resources, and biodiversity and ecosystems, while additional sectors will be included in future reports.

#### Chapter 7: Improvement Over Time

Qatar has established a comprehensive improvement plan to strengthen future reporting under ETF and progressively address the capacity constraints identified in BTR1. Planned actions include developing a national QA/QC system, expanding quantitative uncertainty analysis, improving inventory completeness and time-series consistency, enhancing reporting on fluorinated gases and LULUCF, strengthening methodologies for quantifying mitigation actions and tracking NDC progress, and integrating adaptation monitoring and evaluation systems developed through the under progressed NAP.

# National Circumstances and Institutional Arrangements

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## 1.1 Introduction

Qatar's Biennial Transparency Report (BTR) builds upon the country's long-standing commitment to environmental sustainability and international climate cooperation. It serves as a key instrument for implementing the Paris Agreement and the United Nations Framework Convention on Climate Change (UNFCCC) consistent with the guidance of the Enhanced Transparency Framework (ETF). The report outlines Qatar's progress in advancing mitigation and adaptation measures, strengthening data systems, understanding capacity building and technological needs and integrating climate objectives within national development planning.

This first BTR reflects Qatar's integrated policy architecture that links climate action with national priorities. It builds upon the foundations of the Second National Communication and integrates key information and policy measures drawn from the Qatar National Vision 2030, the Third National Development Strategy for 2024 to 2030, Qatar's Nationally Determined Contribution (NDC), Qatar National Environment and Climate Change Strategy, and the Under progressed National Adaptation Plan (NAP). Together, these frameworks represent Qatar's coherent approach to achieving sustainable economic diversification, social development, and environmental stewardship while contributing to the global objectives of the 2030 Agenda for Sustainable Development and the Paris Agreement.

### 1.1.1 Purpose and Scope

Qatar's BTR provides comprehensive information on national greenhouse gas (GHG) emissions, mitigation and adaptation actions, progress toward the implementation of the NDC, and finance, technology and capacity building support received and required. The report draws on official data, policies, and measures. The report aims to strengthen transparency, comparability, and accountability in Qatar's climate actions. It consolidates updated national datasets and institutional developments that have advanced climate governance in recent years.

These institutional enhancements ensure that Qatar's reporting is comprehensive, science-based, and aligned with international good practices in data management, quality assurance, and continuous improvement. They reflect the principles set out in the NDC and reaffirm Qatar's commitment to transparent and credible reporting in line with the guidance of the UNFCCC and the Paris Agreement.

### 1.1.2 Alignment with the Enhanced Transparency Framework

This BTR follows the modalities, procedures, and guidelines of the ETF under Decision 18/CMA.1. Qatar's transparency system ensures continuous improvement in data collection, reporting, and verification, consistent with the principles of accuracy, consistency, and comparability.

The National Measurement, Reporting, and Verification (MRV) System, led by the MECC provides the institutional basis for compiling data from energy, transport, water, and industry using Intergovernmental Panel on Climate Change (IPCC) 2006 Guidelines.

## 1.2 National Circumstances

Qatar's national circumstances frame the conditions under which climate action is planned, implemented, and reported. They encompass the country's geographic realities, environmental constraints, demographic profile, and economic structure that collectively shape both its exposure to climate risks and its capacity to respond.

Understanding these underlying conditions is essential to interpreting national GHG trends, resilience needs, and the drivers that influence policy choices. These circumstances not only set the analytical basis for national reporting but also determine the strategic priorities for climate action. They guide where resilience investments yield the highest impact, where emission reduction opportunities are most feasible, and how institutional resources can be most effectively mobilized.

### 1.2.1 Physical, Environmental, and Resource Context

#### Geographic and Physical Characteristics

Qatar is a small peninsula located on the western coast of the Arabian Gulf, bordered to the south by the Kingdom of Saudi Arabia and surrounded on three sides by Gulf waters. It lies between latitudes 24°27'N and 26°10'N and longitudes 50°45'E and 51°40'E (Figure 1-1), covering about 11,637 square kilometers, including several offshore islands such as Halul, Shira'wa, and Alashat. The coastline extends roughly 550 kilometers along the western, northern, and eastern shores. At its longest point, the distance across the country is about 190 kilometers from north to south and about 90 kilometers from east to west.<sup>1</sup>

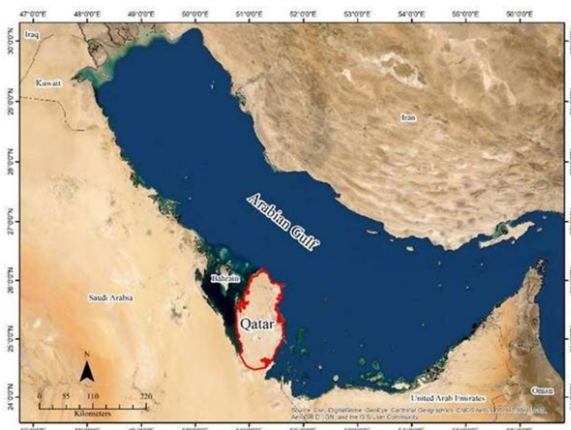


Figure 1-1: Qatar's Location (modified map)<sup>2</sup>

The terrain is flat and arid, with elevations ranging from sea level to approximately 107 meters.<sup>3</sup> It consists of low limestone plateaus, shallow depressions, and rocky plains, with isolated hill formations in the northwest and large sand dunes in the southeast. The highest elevation occurs near Dukhan in the west, while Jabal Fuwairit marks the northern coastal ridge.<sup>4</sup> Around 80% of the surface area is composed of limestone and dolomite underlain by gypsum in the south. This geology produces a karst system characterized by sinkholes, shallow drainage basins, and subsurface cavities.<sup>5</sup> Natural depressions known as Riyadh collect limited rainfall and allow sparse vegetation to grow briefly each year.

These physical factors shape national priorities in resilience and resource management. They require a development approach that integrates land stability, water security, and coastal protection into all planning processes. The spatial concentration of economic assets along the coast reinforces the need for targeted adaptation measures and forward-looking investment in coastal defenses, groundwater monitoring, and land restoration.

#### Climate Profile and Observed Trends

Qatar experiences a hyper-arid desert climate characterized by extremely high temperatures, limited and irregular rainfall, and high evaporation rates. Long-term meteorological records, maintained since 1972, indicate a stable but harsh climate system with two distinct seasons.<sup>6</sup> The hot season extends from June to mid-September, when daily temperatures range between 39 and 43°C, with night-time

<sup>1</sup> Baalousha et al., 2018; Duggan et al., 2014; Orndorff et al., 2018; SNC, 2025

<sup>2</sup> Duggan et al.; USGS, 2018; SNC, 2025

<sup>3</sup> Baalousha et al., 2018; Baalousha et al., 2022; SNC, 2025

<sup>4</sup> Ibid.

<sup>5</sup> Baalousha et al., 2018; Duggan et al., 2014; Orndorff et al., 2018; SNC, 2025

<sup>6</sup> Ajjur and Al-Ghamdi, 2022; SNC, 2025

lows averaging around 31.4 to 33.3°C.<sup>7</sup> The mild season spans from December to February, with daytime highs between 23.4 and 25.5°C and lows ranging from 16.3 to 19.4°C.<sup>8</sup> Relative humidity averages about 60% in summer and rises between 72% and 73.4% in winter. Transitional months such as March, April, May, October, and November are typically more temperate and less humid.<sup>9</sup>

Rainfall is scarce, brief, and spatially uneven. Between 2011 and 2022, annual precipitation averaged approximately 68.8 millimeters<sup>10</sup>, concentrated mainly between October and May. Intense, short-lived storms and occasional thunderstorms occur primarily during December, January, and February. Recorded totals over this period varied widely, from as little as 11 millimeters in 2021 to nearly 119.9 millimeters in 2018.<sup>11</sup> Only three of the twelve recorded years exceeded 100 millimeters of rainfall, while two years registered below 25 millimeters.<sup>12</sup> The year 2021 represented a particularly dry period, with precipitation equivalent to about one-fifth of the long-term average.

The combination of high temperature, low rainfall, and high evaporation results in water scarcity and limited natural recharge of aquifers. Seasonal temperature extremes place stress on energy systems, infrastructure, and public health. The concentration of rainfall in short, intense events complicates water harvesting and drainage management, increasing flash flood risks in urban areas. They underscore the need for integrated water resource management, improved early-warning systems, and heat-resilient infrastructure design.

## Terrestrial Ecosystems, Desertification, and Biodiversity Management

### *Land and Biodiversity*

Terrestrial ecosystem management in Qatar operates at the intersection of environmental security and sustainable land use. The limited ecological carrying capacity, combined with pressures from urban expansion and infrastructure development, requires a conservation approach that integrates biodiversity protection with spatial planning and land rehabilitation. Monitoring endangered species, restoring degraded areas, and enforcing habitat protection laws form the core of Qatar's strategy to sustain its terrestrial ecosystems under changing climatic conditions.

Qatar's terrestrial ecosystems are shaped by its arid climate, sparse vegetation, and highly specialized biodiversity. The country has committed to conserving 30% of its land and marine areas and restoring 30% of degraded habitats by 2030. These national targets reflect a strategic approach to halting land degradation, maintaining ecological integrity, and safeguarding native species under growing climatic and anthropogenic pressures.<sup>13</sup>

Qatar has expanded its terrestrial protected areas significantly over the past decade, now covering around 3,145 square kilometers, equivalent to roughly 7.4% of the national territory.<sup>14</sup> Eleven formally designated reserves and conservation zones protect ecologically sensitive desert and coastal habitats, mitigating the impacts of overhunting, overgrazing, and land degradation.

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<sup>7</sup> National Planning Council, 2023a; SNC, 2025

<sup>8</sup> Ibid

<sup>9</sup> Ibid

<sup>10</sup> Based on the 2011–2022 reference period

<sup>11</sup> National Planning Council, 2024a; SNC, 2025

<sup>12</sup> Ibid

<sup>13</sup> QNSECC, 2021

<sup>14</sup> National Planning Council, 2024a

The country's conservation framework is supported by a series of legislative instruments that date back to 1985 and address wildlife protection, sustainable resource use, and habitat preservation. These include laws regulating the hunting and trade of wild species, safeguarding natural reserves, and preventing damage to vegetation and ecosystems. Together, these instruments establish a legal foundation for biodiversity conservation and environmental enforcement.

The terrestrial environment is composed of diverse habitat types, including mangroves, sabkhas, sand dunes, rocky plateaus, and shallow wadis. Each ecosystem supports species uniquely adapted to arid conditions and high salinity levels. Qatar's terrestrial biodiversity includes approximately 1,152 documented species, consisting of eight mammals, 322 birds, 29 reptiles, one amphibian, and 228 invertebrates. Species such as the Arabian oryx, Greater spotted eagle, and Corn crane are classified as endangered and have been the focus of national monitoring programs implemented by the MECC. Population tracking of the Arabian oryx across protected areas demonstrates ongoing efforts to stabilize and strengthen vulnerable wildlife populations.

The MECC Vision 2030 aligns with paragraph 3 of Article 18 of the Convention on Biological Diversity (CBD), which encourages member states to establish a national biodiversity database. Such a database serves as an official mechanism for exchanging biodiversity information at national, regional, and international levels. It provides a reference point for tracking progress in implementing the CBD and acts as a hub to facilitate communication, coordination, and collaboration among the scientific community, government agencies, non-governmental organizations, and professional groups both nationally and internationally. In line with this vision, MECC established the Qatar Biodiversity Database and Information System. The system's primary objective is to support the conservation and sustainable use of biodiversity by providing reliable, centralized data to inform national reporting, monitoring, and decision-making processes.<sup>15</sup>

### *Desertification*

Qatar's land area spans about 11,586 square kilometers, almost entirely dryland. The 2022 United Nations Convention to Combat Desertification National Qatar Report indicates that land degradation increased from 8.9%, or 1,058 square kilometers, in the baseline period to 9.3%, or 1,074 square kilometers, in the latest assessment. Urban expansion, infrastructure development, and rising temperatures are the main causes. Land productivity declined by 2.6%, largely in areas converted to artificial surfaces, while soil organic carbon remained low but stable at around 17 tons per hectare. Artificial surfaces expanded from 370 to 462 square kilometers, mainly near Doha and Al Wakra, reducing vegetative cover by about 0.5% annually and exposing soil to wind erosion.<sup>16</sup>

The country is addressing land degradation and desertification through targeted mitigation and adaptation measures embedded in the Qatar National Strategy for Environment and Climate Change. The national strategy links land restoration to broader climate goals. A central initiative under this effort is the creation of a green belt surrounding Doha and its suburbs, as originally outlined in the Second National Development Strategy 2018–2022.<sup>17</sup> This initiative aims to mitigate urban heat, improve air quality, and stabilize topsoil around rapidly urbanizing areas.

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<sup>15</sup> <https://biodiversity.mecc.gov.qa/en>

<sup>16</sup> UNCCD, 2022

<sup>17</sup> <https://www.npc.qa/en/planning/Documents/nds2/NDS2Final.pdf>

The MECC is leading large-scale rehabilitation programs that directly target degraded rangelands and meadows. The Qatari Desert Rehabilitation Project focuses on restoring native vegetation and reducing soil erosion. In early 2024, the ministry launched a national plan to rehabilitate 100 meadows over five years. By mid-2024, 38 meadows across multiple regions had been fenced and rehabilitated, representing significant progress toward the project’s targets.<sup>18</sup>

### Marine Systems

Qatar’s marine environment encompasses coral reefs, mangrove forests, seagrass meadows, salt marshes, and sandy coastal habitats. These ecosystems sustain a range of endangered species, including the Hawksbill turtle (*Eretmochelys imbricata*), Leatherback turtle (*Dermochelys coriacea*), and Dugong (*Dugong dugon*). Scientific assessments and local observations confirm a gradual decline in dugong populations, largely attributed to habitat degradation, coastal development, and incidental bycatch.<sup>19</sup>

Coral ecosystems in Qatar show strong spatial differentiation. Umm Al Arshan has the highest coral species richness and remains the only site where *Acropora* corals are recorded. In contrast, Fuwayrit and Al Ashat exhibit reduced coral cover and lower diversity, indicating previous exposure to heat stress and sedimentation. Shallow coastal areas, generally between 3 and 8 meters deep, support highly productive seabed habitats covered by seagrass meadows.<sup>20</sup> Three main species are found—*Halodule uninervis*, *Halophila ovalis*, and *Halophila stipulacea*—which provide food and habitat for dugongs, turtles, and benthic organisms while acting as significant carbon sinks.<sup>21</sup>

Mangrove areas occur mainly along the eastern coast, notably at Al Dhakhira, Al Khor, Al Wakra, Umm Al Houli, Al Majfer, and Fuwayrit. These mangroves stabilize coastal sediments, buffer wave energy, and provide essential nursery and feeding grounds for marine species.

Two major marine protected areas anchor Qatar’s coastal conservation system. The Al Thakhira Marine Protected Area covers 179 square kilometers in the northeast, while the Khor Al Odaid Marine Protected Area spans 542 square kilometers in the southeast. Together with terrestrial reserves, these sites contribute to nearly 30% of Qatar’s total protected area, one of the highest proportions globally.

Qatar’s priorities include strengthening enforcement of coastal zoning and dredging regulations, restoring degraded coral and mangrove habitats, and expanding marine spatial planning to balance conservation with development.

### Water Resources and Management

Water availability in Qatar is limited by low natural recharge rates and high national demand. The hydrological system is structured around four main groundwater basins: Northern, Southern, Doha, and Allat basins. Across the country, about 850 depressions act as natural catchments that collect runoff from rare rainfall events, supporting temporary infiltration and shallow storage. Annual groundwater recharge from rainfall is estimated at 55.9 million cubic meters, with an additional 2.2 million cubic meters flowing from Saudi Arabia, bringing total renewable groundwater resources to approximately 58.1 million cubic meters per year.<sup>22</sup>

Qatar’s water supply relies on three sources: desalinated seawater, groundwater, and treated sewage effluent. By 2021, desalinated water accounted for about 61% of total supply, groundwater for 23%, and treated sewage effluent for 16%. Total water production rose from 914 million cubic meters in

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<sup>18</sup> MECC, 2024a; SNC, 2025

<sup>19</sup> Marshall et al. 2018

<sup>20</sup> INC, 2011; SNC, 2025

<sup>21</sup> Burt et al., 2016

<sup>22</sup> National Planning Council, 2024c

2016 to 1,104 million cubic meters in 2021, while overall consumption decreased from 987 to 898 million cubic meters due to conservation measures.<sup>23</sup>

Groundwater is stored mainly in the Umm er Rhaduma and Rus aquifers, composed of chalky limestone with limited freshwater lenses concentrated in the north.<sup>24</sup> The safe yield is about 54.2 million cubic meters annually, compared with total abstraction of around 250 million cubic meters, generating deficits of 57 to 184 million cubic meters each year between 2016 and 2021. This over-extraction has caused declining water tables, aquifer depletion, and increasing salinity from seawater intrusion, particularly in agricultural areas. Agriculture accounts for roughly 92% of total groundwater use, equivalent to 230 million cubic meters annually.<sup>25</sup>

Artificial recharge is now critical for maintaining aquifer stability. About 65% of recharge comes from treated sewage effluent and distilled water injection, 22% from recycled irrigation, and 13% from direct rainfall infiltration.<sup>26</sup> National programs continue to expand recharge wells and infiltration basins to offset depletion.

Desalination remains the foundation of municipal water supply. Since the first plant began operation in 1955, desalination capacity has expanded steadily to meet growing demand. Qatar national storage capacity is increasing, which reached 10.6 million cubic meters in 2021.<sup>27</sup> Under the Strategic Water Reserve Project, five mega-reservoirs are scheduled for completion by 2026, with another five planned by 2036.<sup>28</sup>

Treated wastewater reuse is a central element of Qatar's integrated water management approach. By 2022, 70% of treated wastewater was reused, and under the Third National Development Strategy (2024–2030), wastewater treatment reached 99.7%, enabling nearly all treated effluent to be reused for irrigation and landscaping.<sup>29</sup>

#### Agriculture and Food Security

Agriculture plays a strategic role in Qatar's economic diversification and food security agenda, but it continues to face structural and environmental constraints. The country's cultivable area of 65,000 hectares has remained constant since 2018, with 19 to 21% of this area under cultivation each year. In 2022, 12,156 hectares were cultivated, while 52,844 hectares remained unused. Green fodder accounted for 51% of cultivated land, vegetables for 23%, date palms for 22%, fruits for 3%, and cereals for 1%.<sup>30</sup>

Total agricultural production in 2022 reached 922,032 tons, slightly lower than in 2018, mainly due to fluctuations in fodder and cereal output. The livestock subsector performed strongly, with 39.7 thousand tons of meat production (72% from poultry) and 206.2 thousand tons of milk and dairy products. Fish output increased to 18.5 thousand tons, continuing a steady upward trend since 2018.<sup>31</sup>

Government interventions have focused on enhancing efficiency and productivity rather than expanding cultivated land. The Ministry of Municipality has distributed drip irrigation systems to 400

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<sup>23</sup> Ibid

<sup>24</sup> Alhaj et al., 2017, Baalousha et al., 2018

<sup>25</sup> National Planning Council, 2024c

<sup>26</sup> Ibid

<sup>27</sup> National Planning Council, 2024c

<sup>28</sup> Ibid

<sup>29</sup> TQNDS, 2024, QVNR, 2021; SNC, 2025

<sup>30</sup> National Planning Council, 2024g

<sup>31</sup> Ibid

farms, each covering ten dunums, to reduce water losses.<sup>32</sup> The promotion of greenhouse cultivation and modern irrigation technologies has become central to agricultural policy. These measures are aligned with the Third National Development Strategy (2024–2030).

Agricultural data indicate that the sector has reached a phase of relative stability, supported by steady production levels and targeted modernization efforts. The significant share of green fodder in cultivated areas suggests that agricultural patterns remain water intensive, underscoring the importance of improving resource efficiency. Expanding the cultivation of high-value, low-water-demand crops and promoting controlled-environment farming can strengthen productivity within existing land constraints.<sup>33</sup>

As for Qatar’s food security framework, it reflects significant institutional progress and policy coherence, yet sustainability indicators reveal ongoing structural challenges. The country’s high global ranking in food affordability and availability demonstrates the effectiveness of its import diversification and storage programs, while lower scores in sustainability and adaptation emphasize the need for greater resilience to climate and supply shocks. Strengthening domestic production through technology-based efficiency improvements, expanding storage capacity, and integrating renewable energy into food systems would reinforce long-term security.<sup>34</sup>

Building on the 2018–2023 Food Security Strategy, the upcoming 2024–2030 strategy aims to strengthen food reserves, increase self-sufficiency, and embed sustainability in the national food system.<sup>35</sup> In 2022, Qatar ranked second among Arab countries and 30th globally in the Global Food Security Index.<sup>36</sup> Its scores were 88.6 for affordability, 72.9 for availability, 71.7 for quality and safety, and 51 for sustainability and adaptation.<sup>37</sup>

### Waste Management and Circular Economy

Solid waste management in Qatar has advanced significantly as part of national efforts to strengthen environmental governance and urban infrastructure.<sup>38</sup> The system covers collection, treatment, recycling, and energy recovery, with municipalities overseeing operations supported by private contractors.<sup>39</sup> Waste is directed to three main facilities: Umm Al Afai for domestic and bulky waste, Rawda Rashed for construction and demolition materials, and Al Krana for sewage sludge.<sup>40</sup>

Organic waste makes up about 60% of total generation, recyclables account for the rest, and the national recycling rate remains below 15%.<sup>41</sup> Per capita waste generation averages 1.8 kilograms per day, with total production at roughly 2.5 million tons annually.<sup>42</sup> Construction and demolition waste represent about 70% of this amount, municipal solid waste 20%, and industrial waste 10%.<sup>43</sup>

The Domestic Solid Waste Management Center in Mesaieed is central to Qatar’s waste-to-resource system. It integrates sorting, composting, recycling, and energy recovery, producing in 2020 about

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<sup>32</sup> Ibid, MoM, 2024

<sup>33</sup> National Planning Council, 2024g

<sup>34</sup> GFSI, 2022; SNC, 2025

<sup>35</sup> MoM, 2024; SNC, 2025

<sup>36</sup> GFSI, 2022; SNC, 2025

<sup>37</sup> MECC, 2024a; MoM, 2024

<sup>38</sup> QVNR, 2021; SNC, 2025

<sup>39</sup> MoM, 2024; SNC, 2025

<sup>40</sup> Mariyam et al., 2022

<sup>41</sup> Zafar, 2018

<sup>42</sup> Mariyam et al., 2022

<sup>43</sup> Ibid

269,000 megawatt hours of electricity, 33 million cubic meters of biogas, and 30,000 tons of organic fertilizer, while recycling over 420,000 tons of construction waste and processing 30,000 tons of used tires.<sup>44</sup>

National policy applies to a waste hierarchy emphasizing prevention, reduction, reuse, and recycling before landfilling. Qatar aims to raise recycling rates up to 15% by 2022 through improved infrastructure, segregation programs, and industrial partnerships.<sup>45</sup> Priority areas include construction, food, plastic, and electronic waste.<sup>46</sup> Major operators have adopted circular economy measures, including thermal desorption and recovery systems for hazardous industrial waste.<sup>47</sup> In addition, entities in the energy sector continue to export Naturally Occurring Radioactive Material (NORM) waste from Halul Island and Ras Laffan for specialized treatment abroad.<sup>48</sup>

The country's system reflects a transition toward integrated resource recovery. The Mesaieed facility provides a strong base for scaling waste-to-energy and recycling initiatives. Key challenges remain in expanding waste segregation at the source and developing markets for recycled materials. Further progress depends on better data systems, stronger private sector participation, and linking waste targets to industrial and energy strategies. Incentives, enforcement, and public engagement will be essential to build a circular and resource-efficient waste economy.

### *1.2.2 Socioeconomic and Development Profile*

Qatar's national development model is shaped by the same environmental, and resource, dynamics outlined in the preceding sections. The country's efforts to manage water scarcity, reduce land degradation, and expand waste recovery systems are directly linked to its broader economic diversification and social development goals. These environmental and resource management measures form part of an integrated development framework that supports population growth, industrial expansion, and urban modernization under sustainable principles.

### *Demography and National Development vision*

Qatar's demographic transformation has been one of the most rapid in the region.<sup>49</sup> The population expanded from 369,079 in mid-1986 to 2,932,241 in mid-2022, reflecting an average annual growth rate of about 5.9%.<sup>50</sup> This sharp increase has been driven largely by labor migration linked to infrastructure expansion and industrial diversification.<sup>51</sup> Males constitute approximately three quarters of the total population, a result of the large number of expatriate workers who reside in Qatar without their families.<sup>52</sup> Among Qatari nationals, population growth has remained more moderate, averaging around 2.7% per year, with natural growth stabilizing in recent years as social and economic conditions mature.<sup>53</sup>

National development strategies have accompanied these demographic changes through sustained investment in health, education, and social services. Qatar ranks in the "Very High" Human

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<sup>44</sup> EcoMena, 2022; KAHRAMAA, 2024

<sup>45</sup> QVNR, 2021; Mariyam et al., 2022

<sup>46</sup> Mariyam et al., 2022

<sup>47</sup> QatarEnergy, 2022b; KAHRAMAA, 2024

<sup>48</sup> QatarEnergy, 2022b

<sup>49</sup> Al Marri, 2001; National Planning Council, 2023a

<sup>50</sup> National Planning Council, 2024i

<sup>51</sup> National Planning Council, 2023a

<sup>52</sup> Al Marri, 2001; National Planning Council, 2023a

<sup>53</sup> National Planning Council, 2023a

Development category, with a Human Development Index of 0.875 in 2022, placing it 40th globally<sup>54</sup>. This progress reflects long term implementation of the Qatar National Vision 2030 and successive National Development Strategies<sup>55</sup>. The third and current strategy, covering 2024–2030, focuses on balanced growth, institutional modernization, and environmental sustainability<sup>56</sup>.

Non-hydrocarbon sectors are targeted to reach 70% of gross domestic product (GDP) by 2030, up from 63% in 2022. Projected annual real GDP growth ranges between 3.5 and 4%, led by manufacturing, logistics, finance, tourism, and technology. Manufacturing's share of GDP is expected to double to 15%, while the private sector's investment share is anticipated to grow from 35 to 50%. Foreign direct investment is projected to reach 3% of GDP annually. Fiscal policy aims for a balanced budget by 2026 and public debt below 40% of GDP. Resource efficiency goals include reducing water losses by 15%, per capita water consumption by 20%, and energy intensity by 25% from 2015 levels<sup>57</sup>.

Labor and human capital targets include raising national workforce participation to 45%, female participation to 45%, and expanding vocational and technical education enrollment by 50%. Graduates in science, technology, engineering, and mathematics fields are expected to increase by 20%. Institutional modernization focuses on digital transformation, aiming for a 70% rise in fully digital public services and 90% of government transactions processed electronically. Artificial intelligence will be integrated across ministries with unified data governance frameworks.<sup>58</sup>

Social inclusion goals emphasize access to housing, healthcare, and transport. The strategy seeks to reduce traffic congestion by 25%, increase affordable housing by 15%, and expand urban green spaces by 40%. Quality of life indicators, including satisfaction with municipal services and public safety, will be tracked annually.<sup>59</sup>

### Economic Structure and Growth Patterns

Qatar's GDP at current prices reached 858.2 billion Qatari riyals, equivalent to approximately 274 billion United States dollars at the prevailing exchange rate of 3.65 Qatari riyals per dollar, in 2022. This represents an increase from 667.3 billion Qatari riyals in 2018, translating to an average annual growth rate of about 6.5%<sup>60</sup>. On a per capita basis, the country's GDP reached 185,503 Qatari Riyal in 2020, one of the highest globally at about 502% of the global average<sup>61</sup>.

The economy continues to be anchored by the oil and natural gas sectors, which account for about 36.9% of national output and remain the principal source of fiscal revenue and export earnings. At the same time, Qatar's economic structure reflects consistent diversification efforts, with non-hydrocarbon sectors increasingly contributing to total GDP. These sectors include tourism, financial services, technology, and logistics, all of which are being developed to support a more sustainable and balanced growth model.

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<sup>54</sup> UNDP, 2024; SNC, 2025

<sup>55</sup> National Planning Council, 2024b

<sup>56</sup> TQNDS, 2024; SNC, 2025

<sup>57</sup> Ibid

<sup>58</sup> Ibid

<sup>59</sup> Ibid

<sup>60</sup> Planning and Statistical Authority, 2023; Trading Economics, 2024; National Planning Council, 2024f; SNC, 2025

<sup>61</sup> Planning and Statistical Authority, 2023; Trading Economics, 2024; SNC, 2025

Qatar's economic trajectory illustrates a deliberate transition from a resource dependent model toward a more diversified and resilient economy. While the hydrocarbon sector continues to play an important role in national sustainable development, the steady expansion of non-hydrocarbon sectors demonstrates the effectiveness of national policies aimed at leveraging energy revenues to diversify the economy. The increasing contribution of sectors such as finance, logistics, and tourism indicates growing structural maturity. The development of free zones, logistics hubs, and the establishment of the Qatar Financial Centre have attracted investment and fostered private sector participation, supporting the shift toward knowledge-based growth.

### Education and Health Systems

Qatar's education system has undergone major reform over the past two decades, guided by the Qatar National Vision 2030 and aligned with Sustainable Development Goal 4.<sup>62</sup> The system aims to develop analytical, innovative, and socially responsible graduates while maintaining strong national identity.<sup>63</sup>

Between the 2018/2019 and 2022/2023 academic years, enrollment at all levels expanded steadily. Private school students increased from approximately 200,000 to over 230,000, and government universities recorded growth of 40.5%<sup>64</sup>. Secondary schools-maintained student to teacher ratios of 9 to 10 students per teacher, while universities averaged 16 to 17 students per faculty member between 2020 and 2022<sup>65</sup>. The higher education landscape has diversified, combining national universities with international branch campuses<sup>66</sup>. Reforms focus on modern teaching methods, digital learning, and stronger alignment between academic programs and labor market needs, particularly in science, technology, engineering, and mathematics fields<sup>67</sup>.

Gender equality remains a cornerstone of the system. Equal access for men and women is constitutionally guaranteed, and the education system provides equal opportunities for both sexes in line with Article 49 of the Constitution<sup>68</sup>. Colleges and universities in Qatar welcome both Qatari and non-Qatari students, supporting the objective of inclusive and equitable quality education<sup>69</sup>. Policies promoting lifelong learning and professional development strengthen education's role in advancing human capital and social inclusion<sup>70</sup>.

Qatar's health system reflects a unified approach to providing high quality, universal care. The Ministry of Public Health manages an integrated network that combines public health, primary care, and specialized hospital services<sup>71</sup>. Between 2019 and 2021, the number of hospitals increased from 19 to 21, hospital beds from 3,134 to 3,581, and physicians from 7,644 to 8,365, improving the population to physician ratio from 366 to 329. The number of nurses rose from 22,684 to 23,739 over the same

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<sup>62</sup> QVNRR, 2021; National Planning Council, 2024e; SNC, 2025

<sup>63</sup> National Planning Council, 2023a; SNC, 2025

<sup>64</sup> National Planning Council, 2024e; SNC, 2025

<sup>65</sup> National Planning Council, 2023a; SNC, 2025

<sup>66</sup> National Planning Council, 2024e

<sup>67</sup> QVNRR, 2021; National Planning Council, 2024e

<sup>68</sup> QVNRR, 2021; SNC, 2025

<sup>69</sup> National Planning Council, 2024e

<sup>70</sup> QVNRR, 2021; SNC, 2025

<sup>71</sup> MoPH, 2024; SNC, 2025

period, with population per nurse improving to 116 in 2021. Vaccination coverage in the first year of life remained high at 99% in 2019 and 2021<sup>72</sup>.

The system operates under several strategic frameworks, including the Mental Health and Wellbeing Strategic Framework, the Qatar National Dementia Plan, the Primary Health Care Strategy, the Health Facilities Master Plan, the e Health and Data Management Strategy, the Diabetes Strategy, the Continuing Care Design Strategy, and the National Cancer Framework<sup>73</sup>. These frameworks strengthen preventive care, digital health integration, and evidence-based decision making and support the shift from treatment to prevention, equitable access to services, and enhanced research and innovation<sup>74</sup>.

Non communicable diseases remain the country's main health challenge. A survey of 1,864 Qatari nationals found that 70.1% were overweight, approximately 17% of adults suffer from diabetes, and 44.9% of individuals aged 18 to 64 have three or more cardiovascular risk factors<sup>75</sup>. This has led to greater emphasis on prevention, lifestyle change, and integrated chronic disease management within national strategies.<sup>76</sup>

## Energy System and Efficiency

### *Oil and Gas*

Qatar is transitioning toward an energy model that combines high production capacity with low emissions intensity. This model enables the country to maintain its position as a leading global energy supplier, while leveraging the sector's contribution to Qatar's social and economic prosperity to facilitate economic diversification, technological advancement, and the growth of lower-carbon industries. Expansion projects are now structured to integrate more efficient and cleaner technologies, hence reducing the overall carbon footprint of exports.<sup>77</sup>

As of 31 December 2022, Qatar's proven hydrocarbon reserves totaled around 384 billion barrels of oil equivalent, including 1,740.7 trillion standard cubic feet of natural gas, 2.65 billion barrels of crude oil, and 71.40 billion barrels of condensate<sup>78</sup>. Domestic production fully covers national demand, with about 90% of oil products exported in 2022.<sup>79</sup> Natural gas dominates the national energy profile, accounting for 92.1% of total energy supply in 2022, while oil contributes 7.9%. Liquefied natural gas (LNG) production increased from 77.5 million tons in 2020 to more than 78 million tons in 2022, maintaining Qatar's global leadership in LNG exports<sup>80</sup>.

Qatar, through its state-owned enterprise, manages the entire hydrocarbon value chain from exploration to export. Ras Laffan Industrial City serves as the core center for LNG operations<sup>81</sup>. The North Field Expansion Project will significantly increase LNG capacity while incorporating advanced

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<sup>72</sup> National Planning Council, 2023a

<sup>73</sup> MoPH, 2024; SNC, 2025

<sup>74</sup> National Health Strategy, 2017; MoPH, 2024

<sup>75</sup> National Health Strategy, 2017

<sup>76</sup> MoPH, 2024; SNC, 2025

<sup>77</sup> QatarEnergy, 2022b; IEA, 2024; SNC, 2025

<sup>78</sup> QatarEnergy, 2022a; SNC, 2025

<sup>79</sup> QatarEnergy, 2022b; IEA, 2024; SNC, 2025

<sup>80</sup> QatarEnergy, 2022b; SNC, 2025

<sup>81</sup> QatarEnergy, 2022b; SNC, 2025

technologies to improve efficiency and environmental performance, as well as integrating production with carbon capture and storage technologies to mitigate production emissions<sup>82</sup>.

### *Electricity*

Qatar's electricity sector is well developed and relies on natural gas for almost all power generation. Between 2017 and 2021, electricity production rose from 45.6 terawatt hours to 51.6 terawatt hours, which corresponds to average growth of about 3.1% per year<sup>83</sup>.

Most power plants are high efficiency combined cycle gas turbine plants, and many of them co-produce electricity and desalinated water<sup>84</sup>. RAF A, RAF B, and RAF B-1 are key desalination facilities that use membrane based reverse osmosis technology, which offers important environmental advantages compared to the traditional thermal desalination units installed in other co-producing plants.

Electricity access has been universal in Qatar since 1990<sup>85</sup>. Annual per capita electricity consumption is, reaching about 18.5 megawatt hours in 2021, which represents an 8.6% increase compared to the previous year. Over the period from 2000 to 2021, electricity consumption per capacity increased at an average rate of about 1.5% per year<sup>86</sup>.

### *Industrial Development and Diversification*

Qatar's industrial sector is concentrated in three industrial cities: Ras Laffan Industrial City in the northeast, Mesaieed Industrial City in the southeast, and Dukhan Industrial City in the western part of the country. Approximately 35 primary and secondary industrial plants operate within these cities<sup>87</sup>. Qatar's industrial activities include petrochemicals, fertilizers, and metals production, as well as minerals such as cement and lime, chemicals such as ammonia and methanol, and metals such as steel and aluminum, along with non-energy products generated from fuels and solvent use<sup>88</sup>. The sector plays an important role in economic diversification and technological progress.

Industries Qatar (IQ), established in 2003, is one of the most significant industrial groups. It operates in petrochemicals, fertilizers, and steel production through subsidiaries and partnerships with international firms that bring advanced technology and expertise. The group follows national and industry environment and safety standards and reports regularly on sustainability performance to align industrial growth with national environmental goals.

The present structure of the industrial economy reflects decades of planned development. Since 1971, Qatar has invested heavily in energy and manufacturing industries that use its hydrocarbon resources as a foundation for economic diversification. Companies such as Qatar Petroleum (Now QatarEnergy), Qatargas (now QatarEnergy LNG), and Qatar Steel played central roles in the development of this industrial base. By the mid-1990s, Ras Laffan Industrial City became operational, while the Qatar

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<sup>82</sup> QatarEnergy, 2022b; IEA, 2024; SNC, 2025

<sup>83</sup> National Planning Council, 2022b

<sup>84</sup> KAHRAMAA, 2024; SNC, 2025

<sup>85</sup> Ibid

<sup>86</sup> National Planning Council, 2022b; IEA, 2024

<sup>87</sup> SER, 2021; SNC, 2025

<sup>88</sup> Industries Qatar, 2021; SER, 2021; SNC, 2025

Industrial Development Bank expanded financing for industrial projects and small and medium enterprises.<sup>89</sup>

In the 2000s, growth accelerated with the creation of the Doha Industrial Estate for small and medium enterprises, the establishment of Qatalum for aluminum production, and the launch of Qatar Airways Cargo, which strengthened logistics capacity. Hosting the 2022 FIFA World Cup stimulated expansion in construction materials, energy services, and logistics. Between 2011 and 2017, major projects such as Barzan Gas, Qatargas 4, Pearl Gas to Liquids, and the North Field Expansion increased production capacity. During this period, the Qatar Development Bank introduced programs such as Tasdeer to promote exports, Jahez 1 and Jahez 2 to support small and medium enterprises, and the Qatar Business Incubation Center to strengthen innovation and local participation.<sup>90</sup>

Qatar's industrial development combines state investment, private sector participation, and international partnerships. This approach has created a diversified industrial base with strong links to the energy sector and growing manufacturing capacity. Future priorities – including improving energy efficiency, adopting cleaner technologies, promoting circular production systems that minimize waste, strengthening research and development capacity, and industrial cooperation within industrial cities – will align the sector with the Third National Development Strategy.

## Transport

Qatar's transportation sector continues to modernize through coordinated institutional efforts and strategic infrastructure development. Expansion of transport networks has been accompanied by initiatives that improve efficiency, apply smart technologies, and align system performance with national economic goals. Future progress will depend on better integration across transport modes, wider use of low-emission and electric vehicles, and stronger reliance on data analytics for managing traffic and logistics.

The total length of completed roads increased from 1,348 kilometers in 2017 to 3,253 kilometers in 2022, reflecting continuous investment in mobility, trade, and urban connectivity.<sup>91</sup> Between 2011 and 2023, its average contribution was 4,810.72 million rials, with a peak of 7,173 million in 2019.<sup>92</sup> Registered vehicles, including cars, heavy equipment, taxis, public transport, trailers, and motorcycles, rose from 1,522,733 in 2017 to 1,832,773 in 2022, an increase of 15.4%, driven by population growth, higher trade and construction activity, and continued reliance on private transport.<sup>93</sup>

The Ministry of Transport and Communications continues to promote integrated, technology-based solutions through the Smart Qatar Program known as TASMU. The TASMU Central Platform supports the development of smart city applications that improve traffic management, enable intelligent transport systems, and advance digital logistics, contributing to a more connected and resource-efficient economy.<sup>94</sup>

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<sup>89</sup> Ibid

<sup>90</sup> Ibid

<sup>91</sup> National Planning Council, 2024d; SNC, 2025

<sup>92</sup> Trading Economics, 2024; National Planning Council, 2024d

<sup>93</sup> National Planning Council, 2024d

<sup>94</sup> TASMU, 2021; United States Qatar Business Council (USQBC), 2021; SNC, 2025

Maritime transport remains a vital part of national logistics. The Ministry of Transport's maritime strategy emphasizes vessel safety, port efficiency, and compliance with international standards under the International Maritime Organization.<sup>95</sup>

Air transport remains essential for both passengers and cargo. Hamad International Airport serves as the primary hub. Passenger traffic remained stable between 2017 and 2022, except during the pandemic, while cargo volumes increased by 4.5% in 2021 before declining by 25% in 2022.<sup>96</sup>

### Urban Planning and Development

Qatar's urban planning and development policies aim to balance economic growth, environmental protection, and social well-being. Rapid population increase and infrastructure expansion have transformed the country's urban landscape, requiring coordinated planning to ensure efficient land use, air quality, buildings and sustainable mobility, and resilient infrastructure. The national approach integrates spatial development with environmental objectives to promote compact, well-connected cities that support both economic diversification and improved quality of life.

### Green Buildings and Areas

Qatar's construction sector has shifted toward sustainability by integrating environmental performance and resource efficiency into building design and infrastructure planning. The country ranks second in the Middle East for Leadership in Energy and Environmental Design certification, with 173 certified projects in 2021 compared with 17 in 2017, reflecting strong public and private commitment to sustainable construction.<sup>97</sup>

To complement international standards, Qatar introduced the Global Sustainability Assessment System, previously known as the Qatar Sustainability Assessment System. Developed from 40 international green building codes, it evaluates projects across eight categories: urban connectivity, site, energy, water, indoor environment, materials, management and operations, and cultural and economic values. Integration into the Qatar Construction Standards 2010 made certification mandatory for all new developments, embedding sustainability in national construction practices.<sup>98</sup>

The Qatar Green Building Council, established in 2009, promotes environmentally responsible and cost-efficient construction, supporting national environmental and social goals. Flagship projects demonstrate this progress.<sup>99</sup> Lusail City, a 38 square kilometer development valued at 45 billion United States dollars, integrates renewable energy, green infrastructure, and sustainable mobility. Msheireb Downtown Doha, valued at 5.5 billion United States dollars, is recognized as the world's first fully sustainable downtown regeneration project where all buildings target Leadership in Energy and Environmental Design Gold certification and connect to Doha's Metro network.<sup>100</sup>

District cooling represents another innovation, with 76 operational plants providing over one million tons of refrigeration capacity that meet about 20% of national air conditioning demand. The system

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<sup>95</sup> Ministry of Transport (MoT), 2024); SNC, 2025

<sup>96</sup> National Planning Council, 2024d; SNC, 2025

<sup>97</sup> USQPC, 2021; SNC, 2025

<sup>98</sup> USQBC, 2021; SNC, 2025

<sup>99</sup> EcoMENA, 2023; SNC, 2025

<sup>100</sup> USQBC, 2021; SNC, 2025

uses chilled water distributed through underground pipelines, reducing electricity consumption and reusing treated or seawater.<sup>101</sup>

The country also continues to expand green spaces to improve urban livability. Under the Second National Development Strategy, the number of public parks increased from 48 in 2010 to eighty-seven in 2016, and more than thirty-seven thousand native trees, including *Ziziphus* species, were planted across municipalities.<sup>102</sup>

By 2022, the number of public parks had reached, covering more than 43 million square meters, compared with only 2.5 million square meters in 2010. This expansion raised the per capita green area to 16 square meters, a sixteen-fold increase within just over a decade. The “The One Million Trees” initiative, launched in 2019, achieved its target in 2022 and continues to promote afforestation and landscape rehabilitation across the country.<sup>103</sup>

Green areas include a range of land uses such as public parks, nurseries, and agricultural and livestock farms, which together accounted for about 25% of total utilized land according to the 2015 Census. The proportion varies widely across zones, from nearly zero to about 85%, reflecting differences in population density, land use priorities, and ecological conditions.<sup>104</sup>

#### *Urban Ambient Air Quality*

Qatar has developed a structured national framework to monitor and manage air quality, led by the MECC in coordination with QatarEnergy, the Qatar Environment and Energy Research Institute, the Ministry of Public Health, and Hamad International Airport. About 25 fixed monitoring stations operate nationwide, including three main sites in Greater Doha: Al Corniche, Qatar University, and Aspire Zone. These stations measure key pollutants such as sulfur dioxide, nitrogen dioxide, ground-level ozone, carbon monoxide, and particulate matter (PM<sub>10</sub>).

Between 2016 and 2021, air quality in Doha generally met national standards, while monitoring activities indicated that Aspire Zone consistently achieved a “Clean” indicator (0-50) for all pollutants over three consecutive years, remaining below the annual limit of 51-100. The other two locations showed a similar trend, except for PM<sub>10</sub>, which had a “Normal” indicator, indicating it was still within average levels<sup>105</sup>.

From 2019 to 2021, Qatar recorded reductions of about 18.6 and 18.8% in ground-level ozone concentrations compared with 2019 levels, reflecting effective emission control and improved monitoring.<sup>106</sup>

Qatar’s coordinated monitoring network demonstrates the value of institutional collaboration and real-time data integration in improving air quality. The next step is to translate this information into stronger regulatory and planning measures. Expanding low-emission transport, strengthening industrial emission controls, and embedding air quality data into urban planning will be essential to maintain progress as economic activity and urbanization continue to grow.

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<sup>101</sup> Ibid

<sup>102</sup> SQNDS, 2018; SNC, 2025

<sup>103</sup> The Peninsula, 2022; SNC, 2025

<sup>104</sup> National Planning Council, 2024h; SNC, 2025

<sup>105</sup> Ibid

<sup>106</sup> National Planning Council, 2024a; SNC, 2025

## 1.3 Institutional Arrangements and Policy Framework for Climate Action

Qatar's institutional and policy framework for climate action is grounded in the principles of sustainable development set out in the Third National Development Strategy 2024–2030. This strategy establishes environmental sustainability as a strategic national outcome, with climate action being a key focus area under the outcome. Under the strategy, environmental sustainability and climate action are linked to economic diversification and social well-being. The strategy further emphasizes the integration of lower-carbon growth, efficient resource use, and environmental resilience into all development sectors.

### *1.3.1 Institutional arrangements and climate governance coordination*

Qatar's climate governance architecture functions as an integrated system where institutions operate with distinct mandates that complement one another across the full policy cycle: strategic planning, coordination, implementation, monitoring, and reporting. The institutional interlinkages are deliberate, ensuring that technical expertise, financial planning, and regulatory authority reinforce a unified national response to climate change.

At the strategic and policy formulation level, the Ministry of Environment and Climate Change (MECC) acts as the apex authority, setting the overall direction for climate policy including a currently being under progressed National Adaptation Plan (NAP) and ensuring coherence with Qatar National Vision 2030 and the Third National Development Strategy. The MECC defines national climate ambitions, oversees their integration into sectoral strategies, and manages compliance with international obligations. Within this architecture, the Qatar National Climate Change Committee (NCCC) provides the inter-ministerial coordination platform that brings together all relevant line ministries and state-owned enterprises. The NCCC ensures that policies proposed by the MECC are reviewed, harmonized, and translated into actionable plans across sectors such as energy, transport, water, waste, and urban development. It also resolves institutional overlaps and maintains coherence between national development goals and international commitments.

At the implementation level, specialized institutions translate national policy into concrete actions. The energy sector is driving lower-carbon operations through carbon capture and storage, flare and methane reduction, and energy efficiency improvements in hydrocarbon operations. The Tarsheed Program is implemented under the power and water sector, which aims to reduce energy and water consumption while promoting renewable integration in the electricity generation and water production. The Ministry of Municipality ensures that adaptation and environmental protection are embedded in land use planning, waste management, and green infrastructure. The Ministry of Transport advances low-carbon mobility solutions, electrification, and logistics efficiency. Together, these sectoral entities ensure that mitigation and adaptation measures are embedded in the country's core economic systems.

At the technical and scientific support level, the research institutions generate data, climate models, and technology assessments that feed directly into policy design. Their analytical work underpins the Measurement, Reporting, and Verification (MRV) System managed by the MECC. The MRV system depends on data supplied by implementing entities and ensures standardized reporting consistent with IPCC methodologies. This process creates a continuous feedback loop between science, policy, and implementation.

At the data and monitoring level, the National Planning Council (NPC) complement the MECC by ensuring that all climate and sustainability indicators are statistically validated and aligned with the Sustainable Development Goals and national targets. The NPC's role strengthens the evidence base for decision-making and enhances transparency in national reporting under the UNFCCC framework.

At the financing and international cooperation level, the Qatar Fund for Development (QFFD) supports the global dimension of Qatar's climate governance. It channels resources toward international climate and adaptation projects, reinforcing Qatar's contribution to global climate finance while also facilitating knowledge exchange and partnerships that inform domestic policy innovation.

These institutions collectively form a coherent governance ecosystem where the MECC provides leadership, the NCCC ensures inter-sectoral coordination, implementing agencies deliver measurable outcomes, research institutions supply technical expertise, and data and finance entities guarantee transparency and accountability. This integrated structure enables Qatar to transition from a policy-based to a performance-based model of climate governance, aligning national development with lower-emission and climate-resilient growth objectives.

### *1.3.2 International Climate Commitments and Cooperation*

Qatar ratified the UNFCCC in 1996, the Kyoto Protocol in 2005, and the Paris Agreement in 2017. Qatar's First NDC emissions mitigation ambition is specified as a projected percentage reduction by 2030 below business-as-usual (BAU) levels (an emission reduction target below a projected baseline).. Implementation occurs through Qatar National Environment and Climate Change Strategy, which align with global frameworks and emphasizes adaptation in water management, food security, coastal protection, health, and biodiversity.

Qatar participates in international negotiations through the Group of 77 and China, and the Arab Group, advocating for equity, technology transfer, and financial support for developing nations. The MECC leads this work, supported by technical teams responsible for data management, reporting, and coordination with the UNFCCC Secretariat.

Partnerships with international organizations that have strengthened Qatar's institutional capacity for climate action, including support for MRV systems and for integrating climate objectives into strategies such as Qatar National Environment and Climate Change Strategy. Qatar also draws on World Bank initiatives and data, for example through participation in the Global Gas Flaring Reduction partnership, which inform efforts to reduce emissions from the oil and gas sector, and on energy and emissions statistics and modeling frameworks developed under the International Energy Agency. The Qatar Environment and Energy Research Institute leads national work on energy system and climate modeling, including the Qatar TIMES model<sup>107</sup>, and conducts research on renewable energy, water management, and climate that supports national climate policy and reporting.

Through the Qatar Fund for Development<sup>108</sup>, the country contributes to global climate finance by supporting adaptation, resilience, and renewable energy projects in vulnerable countries, particularly in Africa, the Middle East, and Small Island Developing States.<sup>109</sup> These efforts align with Article 9 of

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<sup>107</sup> Qatar TIMES model is a national energy system model that simulates how Qatar's entire energy system could evolve under different policies and technologies over the coming decades. It is being developed by the Qatar Environment and Energy Research Institute (QEERI) in partnership with Imperial College London, Kahramaa and other national partners.

<sup>108</sup> <https://www.qatarfund.org.qa/>

<sup>109</sup> QFFD, 2021

the Paris Agreement and promote shared prosperity while addressing climate impacts on vulnerable regions.

Entities in the energy sector as well as other national institutions engage in international initiatives and research collaborations on carbon capture and storage, flaring reduction, and industrial efficiency, including participation in the Carbon Sequestration Leadership Forum and long-term partnerships with international companies and research centers.

Qatar is a signatory to the Global Methane Pledge<sup>110</sup> and, through QatarEnergy, contributes to the collective goal of reducing global methane emissions by at least 30% from 2020 levels by 2030.<sup>111</sup> QatarEnergy has joined the World Bank Global Gas Flaring Reduction Partnership<sup>112</sup> and endorsed the Zero Routine Flaring by 2030 initiative, and it is a signatory to the Methane Guiding Principles<sup>113</sup>, which frame its efforts to cut flaring and methane emissions in the oil and gas sector.

Hosting major international events has reinforced Qatar's leadership in climate diplomacy. The eighteenth Conference of the Parties held in Doha in 2012 marked a turning point for regional engagement and resulted in the Doha Amendment to the Kyoto Protocol. Since then, Qatar has maintained active diplomatic and financial support for the process under the Paris Agreement.

### *1.3.3 Measurement, Reporting, and Verification (MRV) System*

The MECC is developing the National Measurement, Reporting, and Verification (MRV) System to establish a continuous process for collecting, analyzing, and reporting climate-related data. The system supports the preparation of National Communications, BTR, and updates to the NDC. The system is composed of two main components.<sup>114</sup>

The system operates under the Climate Change Department within the MECC. The platform consolidates data from multiple sources into standardized formats for national inventory reporting. It applies automated data validation, quality assurance, and revision tracking to maintain reliability.<sup>115</sup> In addition to emissions monitoring, the system also records adaptation actions, climate finance, and technology transfer, ensuring comprehensive coverage of Qatar's reporting obligations under the Paris Agreement.

Qatar's NDC 2021 identifies three core pillars that guide the MRV process:

- Measurement involves deriving emission data using direct measurements and estimations consistent with IPCC methodologies.
- Reporting involves compiling and submitting results with full documentation of methods, assumptions, and datasets.
- Verification involves independent review by accredited third parties to ensure transparency, precision, and continuous improvement.

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<sup>110</sup> US Embassy Doha, 2022

<sup>111</sup> SNC, 2025

<sup>112</sup> OGI, 2022

<sup>113</sup> Methane Guiding Principles, 2022

<sup>114</sup> SNC, 2025

<sup>115</sup> Ibid

### 1.3.4 National Climate Policies, Strategies, and Action Plans

Qatar's climate policy architecture is anchored in the NDC, the Qatar National Strategy for Environment and Climate Change, and under progressed National Adaptation Plan (NAP). These interlinked instruments define the country's long-term direction for lower-emission and climate-resilient development.

#### Qatar's Nationally Determined Contribution

Qatar's NDC, submitted in August 2021, establishes a comprehensive framework for achieving low-emission and climate-resilient growth in line with its national circumstances and obligations under the Paris Agreement. The NDC presents both mitigation and adaptation commitments supported by an institutional framework for measurement, reporting, and verification.

Qatar's First NDC emissions mitigation ambition is specified as a projected percentage reduction by 2030 below business-as-usual (BAU) levels (an emission reduction target below a projected baseline)..<sup>116</sup> The target covers key sectors including energy, industry, buildings and construction, waste management, and transport, along with economic diversification and adaptation measures that provide mitigation co-benefits. The NDC applies the 2006 IPCC Guidelines for GHG inventory development and covers carbon dioxide, methane, and nitrous oxide.

The contribution highlights fairness and ambition by emphasizing Qatar's role as a global supplier of liquefied natural gas, which supports cleaner global energy systems by replacing more carbon-intensive fuels. Qatar considers its contribution consistent with the principles of equity and common but differentiated responsibilities under the UNFCCC.

#### Qatar National Environment and Climate Change Strategy (2021)

The strategy establishes a unified national framework to balance environmental protection, climate action, and sustainable economic and social growth. It aligns directly with the Qatar National Vision 2030<sup>117</sup> and the Third National Development Strategy (2024–2030)<sup>118</sup>. The strategy puts into action the national ambition to create a sustainable environment that supports human well-being and economic diversification while maintaining ecological integrity. It is structured around six main pillars:

- Climate change ambitions include reducing GHG emissions by 2030 compared with the business-as-usual scenario and strengthening adaptation and resilience in vital sectors such as water, energy, and infrastructure.
- Air quality will be improved through stricter national standards, expanded monitoring networks, and reductions in pollutants from transport, industry, and power generation.
- Water security will be enhanced through more efficient groundwater use, greater reuse of treated wastewater, and higher desalination efficiency to protect long-term water resources.
- Circular economy and waste management priorities focus on reducing waste generation, increasing recycling rates, and expanding waste-to-energy projects to support a circular economy model.
- Biodiversity and natural habitat protection efforts will expand protected areas to 30% of national territory, rehabilitate degraded land, and preserve coastal and desert ecosystems.

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<sup>116</sup> Ibid

<sup>117</sup> <https://www.gco.gov.qa/en/state-of-qatar/qatar-national-vision-2030/our-story/>

<sup>118</sup> <https://www.npc.qa/en/planning/nds3/Pages/default.aspx>

- Sustainable land use and environmental planning will integrate environmental considerations into urban planning, enhance green infrastructure, and promote sustainable building standards.

The strategy introduces quantifiable performance indicators for each pillar, ensuring that progress can be tracked transparently. These include:

- Achieving 100% reuse of treated wastewater by 2030.
- Expanding renewable energy capacity.
- Electrifying all public transport fleets by 2030.
- Increasing green cover and urban tree planting.
- Reducing air pollutants such as NO<sub>2</sub> and PM<sub>10</sub> to meet national standards.

Qatar's progressed National Adaptation Plan (NAP)

Qatar's Under progressed National Adaptation Plan (NAP) is the country's first comprehensive, science-based framework to manage and reduce climate risks while advancing long-term sustainable development. Developed through extensive national consultations involving more than 40 public and private institutions, the NAP identifies six priority sectors most vulnerable to climate change. These include water, agriculture and livestock, biodiversity, public health, energy, and infrastructure and coastal zones. The plan translates priorities for these sectors into adaptation measures, targeted actions, and projects. With a strategic roadmap extending to 2030 as a medium-term target and 2040 as a long-term target, the Plan is aligned with the pillars of Qatar National Vision 2030, aiming to protect vital resources, enhance institutional and community resilience, and position climate adaptation as a driver of innovation and green growth.

### *1.3.5 Stakeholder Engagement and Coordination Mechanisms*

The preparation of Qatar's BTR was led and coordinated by the MECC through its Climate Change Department. The process engaged ministries, agencies, the private sector, academia, and international partners to meet the requirements of the ETF.

The ministry guided the process through the National Committee on Climate Change, which ensured policy coordination, technical validation, and alignment with Qatar National Vision 2030 and the Third National Development Strategy. The committee facilitated data sharing, sectoral consultations, and verification to integrate climate actions with national sustainability goals.

Stakeholder engagement included 2 in person capacity building workshops and 3 Validation meetings

- Capacity Building Workshop on Preparation of National Inventory Report and Tracking progress towards NDC took place between 26-28 August 2025, in Qatar with 30-45 experts attending each day.
- Capacity Building Workshop on Loss and Damage and reporting on financial, technology, and capacity-building needs and support received took place between 5-6 October 2025, in Qatar with 30-45 experts attending each day.
- Consultation and Validation of National Inventory Report Chapter, 4 February 2026, online.

- Consultation and Validation of the Chapter on “Information on Financial, Technology Development and Transfer, and Capacity-Building Support Needed and Received (IFTC)”, 11 February 2026, online.
- Consultation and Validation of Tracking NDC Chapter. 26 February 2026

# National Inventory Report of Anthropogenic Emissions by Source and Sink of GHGs

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## 2.1 National circumstances, institutional arrangements, and cross-cutting information

### *2.1.1 Background information on GHG inventories and climate change (e.g. as it pertains to the national context, to provide information to the general public)*

Qatar reported its first national greenhouse gas inventory in 2011 as part of reporting requirements of the Initial National Communication submitted to UNFCCC, containing emissions estimates for the year 2007 across key sectors. In October 2025, Qatar submitted its Second National Communication, presenting the emissions for the years 2015 and 2022.

At present, Qatar is in the process of developing an integrated domestic Measurement, Reporting and Verification (MRV) system for tracking greenhouse gas emissions across all sectors of the economy. This system is designed to help Qatar measure and validate its progress towards its Nationally Determined Contribution (NDC) ambitions, as outlined in its revised NDC submitted in August 2021. The system, when operational, represents a systematic, integrated, and robust GHG data management system that will facilitate effective reporting, planning, financing, and implementation of climate actions.

### *2.1.2 A description of national circumstances and institutional arrangements*

To facilitate data collection, relevant government ministries and entities were engaged from the outset of the GHG inventory development process to identify national data availability and assess data quality. Standardized reporting templates were distributed to data providers from key sectors and sub-sectors based on the IPCC's 2006 inventory guidelines (IPCC, 2006) and the 2019 Refinement (IPCC, 2019). The required data was then collated in a systematic data collection process consistent with IPCC guidelines. The Ministry of Environment and Climate Change (MECC) facilitated the gathering of data from various sources across Qatar, including from major industry players in the private sector. In addition to government entities and the private sector, data was also collected from the National Planning Council (NPC) that annually publishes the country's statistical yearbook.

### *2.1.3 Brief general description of methodologies (including tiers used) and data sources used*

Two methodologies were used to develop the GHG emissions inventory, namely the Intergovernmental Panel on Climate Change (IPCC)'s 2006 GHG Inventory guidelines and the European Union's Monitoring and Reporting Regulation (EU MRR; EU, 2013).

- The EU MRR methodology was applied to develop the GHG inventory for emissions (CO<sub>2</sub>) associated with specific activities in energy and IPPU, while the IPCC's 2006 guidelines were used to account for CH<sub>4</sub> and N<sub>2</sub>O emissions from the same activities in energy and IPPU.
- As higher-tier data was unavailable, the Tier 1 approach from the 2006 IPCC Guidelines was applied for all reporting categories in the agriculture and waste sectors, as well as lime production in IPPU sector, and mobile combustion in the energy sector. Cement

production estimates were based on a Tier 2 approach, given that the corresponding activity data was available.

The use of Tier 1 methodologies, including 4 key categories, was driven by limited data availability and confidentiality constraints, limiting detailed information required for higher-tier reporting to be obtained.

Table 2-1 summarizes the specific emission types and source categories for which these two methodologies were applied.

*Table 2-1: Application of inventory methodology by emission type and source*

| Category    | Subcategory                                           | CO <sub>2</sub> |      | CH <sub>4</sub> & N <sub>2</sub> O |
|-------------|-------------------------------------------------------|-----------------|------|------------------------------------|
|             |                                                       | EU MRR          | IPCC | IPCC                               |
| Energy      | 1.A.1.a.ii - Combined Heat and Power Generation (CHP) | ✓               |      | ✓                                  |
|             | 1.A.1.b - Petroleum Refining                          | ✓               |      | ✓                                  |
|             | 1.A.1.c.ii - Other Energy Industries                  | ✓               |      | ✓                                  |
|             | 1.A.2.a - Iron and Steel                              | ✓               |      | ✓                                  |
|             | 1.A.2.b - Non-Ferrous Metals                          | ✓               |      | ✓                                  |
|             | 1.A.2.c – Chemicals                                   | ✓               |      | ✓                                  |
|             | 1.A.2.f - Non-Metallic Minerals                       |                 | ✓    | ✓                                  |
|             | 1.A.3.a.ii - Domestic Aviation                        |                 | ✓    | ✓                                  |
|             | 1.A.3.b.i.1 - Passenger cars with 3-way catalysts     |                 | ✓    | ✓                                  |
|             | 1.A.3.b.iii - Heavy-duty trucks and buses             |                 | ✓    | ✓                                  |
|             | 1.A.3.b.iv – Motorcycles                              |                 | ✓    | ✓                                  |
|             | 1.A.3.d.ii - Domestic Water-borne Navigation          |                 | ✓    | ✓                                  |
|             | 1.B.2.a.ii – Flaring                                  | ✓               |      | ✓                                  |
|             | 1.B.2.b.i – Venting                                   | ✓               |      | ✓                                  |
|             | 1.B.2.b.ii – Flaring                                  | ✓               |      | ✓                                  |
|             | 1.B.2.b.iii.6 – Other                                 | ✓               |      | ✓                                  |
|             | 1.C.2.a – Injection                                   | ✓               |      | ✓                                  |
|             | 1.C.2.b – Storage                                     | ✓               |      | ✓                                  |
| IPPU        | 2.B - Chemical Industry                               | ✓               |      | ✓                                  |
|             | 2.C.1 - Iron and Steel Production                     | ✓               |      | ✓                                  |
|             | 2.C.3 - Aluminum production                           | ✓               |      | ✓                                  |
|             | 2.A.1 - Cement production                             |                 | ✓    | ✓                                  |
|             | 2.A.2 - Lime production                               |                 | ✓    | ✓                                  |
| Agriculture | All subcategories                                     |                 | ✓    | ✓                                  |
| Waste       | All subcategories                                     |                 | ✓    | ✓                                  |

#### Emissions compilation:

- The IPCC's Inventory Software (Ver. 2.93) was used to compile emissions for the following categories:
  - Energy: fuel combustion of non-metallic minerals manufacturing industries (1.A.2.f), as well as mobile combustion (1.A.3),

- IPPU: mineral industry (2.A),
- Agriculture.
- The waste sector was estimated using an Excel-based tool complying with IPCC guidelines. Methane emissions from solid waste disposal sites were estimated using the IPCC Waste FOD Model<sup>119</sup>.
- Emissions from the remaining categories were directly provided by the relevant operating entities, as the corresponding activity data are subject to confidentiality restrictions. A sectoral approach was used to estimate GHG emissions from activities in each of these source categories. Site-specific activity data were assembled, and a mix of site-specific and default emission factors were used to build the sectoral GHG inventory for the Energy sector barring transportation and mineral industries of the IPPU sector.

### 2.1.3.1 Brief description of key categories

A key category analysis (KCA) was conducted based on the contribution of GHG emissions (expressed in CO<sub>2</sub>e) for each CRT category. The Approach 1 level assessment was applied; whereby key categories are identified as those that have a significant influence on the overall inventory in terms of the absolute level of emissions. In line with its national circumstances and capacity, the State of Qatar applied the flexibility provisions and used a cumulative threshold of no lower than 85% for identifying key categories.

Table 2-3 presents the key category analysis based on the level of emissions for 2023 (excluding LULUCF, as this sector was not estimated for this submission) and summarizes the key source categories for the latest inventory year. The categories are ranked according to their contribution to total emissions, with “Manufacture of Solid Fuels and Other Energy Industries: Other Energy Industries” identified as the largest contributor, followed by the remaining categories in descending order. Table 2- 4. presents the key category analysis but based on trend assessment between 2019 and 2023.

*Table 2-2: Key category analysis based on level of emissions for 2019 (excluding LULUCF)*

| CRT Category |                                                                                 | 2019   | Contribution | Cumulative Total of contribution | KCA rank T1 in level |
|--------------|---------------------------------------------------------------------------------|--------|--------------|----------------------------------|----------------------|
| 1.A.1.c      | Manufacture of Solid Fuels and Other Energy Industries: Other Energy Industries | 51 219 | 45.2%        | 45.2%                            | 1                    |
| 1.A.1.a      | Main Activity Electricity and Heat Production                                   | 21 407 | 18.9%        | 64.2%                            | 2                    |
| 1.A.3.b      | Road Transportation                                                             | 12 534 | 11.1%        | 75.2%                            | 3                    |
| 2.B          | Chemical Industry                                                               | 4 901  | 4.3%         | 79.6%                            | 4                    |
| 1.A.2.c      | Chemicals                                                                       | 4 049  | 3.6%         | 83.1%                            | 5                    |
| 1.A.2.b      | Non-Ferrous Metals                                                              | 3 847  | 3.4%         | 86.5%                            | 6                    |
| 2.A.1        | Cement production                                                               | 3 773  | 3.3%         | 89.9%                            | 7                    |
| 1.B.2.c      | Venting and Flaring                                                             | 3 139  | 2.8%         | 92.6%                            | 8                    |
| 1.A.2.f      | Non-Metallic Minerals                                                           | 1 727  | 1.5%         | 94.2%                            | 9                    |
| 1.A.1.b      | Petroleum Refining                                                              | 1 425  | 1.3%         | 95.4%                            | 10                   |

<sup>119</sup> Available at [Publications - IPCC-TFI](#)

|         |                                                            |         |        |        |    |
|---------|------------------------------------------------------------|---------|--------|--------|----|
| 1.A.2.a | Iron and Steel                                             | 1 320   | 1.2%   | 96.6%  | 11 |
| 2.C.3   | Aluminium Production                                       | 1 005   | 0.9%   | 97.5%  | 12 |
| 5.A.1   | Managed waste disposal sites                               | 783     | 0.7%   | 98.2%  | 13 |
| 5.A.3   | Uncategorized waste disposal sites                         | 546     | 0.5%   | 98.7%  | 14 |
| 3.A.1   | Enteric Fermentation                                       | 414     | 0.4%   | 99.0%  | 15 |
| 1.A.3.d | Domestic Water-borne Navigation                            | 322     | 0.3%   | 99.3%  | 16 |
| 2.C.1   | Iron and Steel Production                                  | 221     | 0.2%   | 99.5%  | 17 |
| 5.C     | Incineration                                               | 199     | 0.2%   | 99.7%  | 18 |
| 3.D.1   | Direct N <sub>2</sub> O Emissions from managed soils       | 142     | 0.1%   | 99.8%  | 19 |
| 5.D     | Wastewater treatment & discharge                           | 90      | 0.1%   | 99.9%  | 20 |
| 2.A.2   | Lime production                                            | 34      | 0.0%   | 99.9%  | 21 |
| 1.A.3.a | Domestic Aviation                                          | 25      | 0.0%   | 99.9%  | 22 |
| 3.D.2   | Indirect N <sub>2</sub> O Emissions from managed soils     | 24      | 0.0%   | 100.0% | 23 |
| 3.B.1   | Manure Management                                          | 20      | 0.0%   | 100.0% | 24 |
| 1.B.2.b | Natural Gas                                                | 20      | 0.0%   | 100.0% | 25 |
| 3.H     | Urea application                                           | 2       | 0.0%   | 100.0% | 26 |
| 5.B.1   | Composting                                                 | 2       | 0.0%   | 100.0% | 27 |
| 3.B.5   | Indirect N <sub>2</sub> O Emissions from manure management | 1       | 0.0%   | 100.0% | 28 |
| 5.B.2   | Anaerobic digestion                                        | 1       | 0.0%   | 100.0% | 29 |
| 1.C     | CO <sub>2</sub> Injection and Storage                      | -       | 0.0%   | 100.0% | 30 |
| 1.B.2.a | Oil                                                        | -       | 0.0%   | 100.0% | 31 |
|         | Total national                                             | 113 193 | 100.0% |        |    |

Table 2-3: Key category analysis based on level of emissions for 2023 (excluding LULUCF)

| CRT Category |                                                                                 | 2023   | Contribution | Cumulative Total of contribution | KCA rank T1 in level |
|--------------|---------------------------------------------------------------------------------|--------|--------------|----------------------------------|----------------------|
| 1.A.1.c      | Manufacture of Solid Fuels and Other Energy Industries: Other Energy Industries | 53 865 | 45.3%        | 45.3%                            | 1                    |
| 1.A.1.a      | Main Activity Electricity and Heat Production                                   | 24 777 | 20.9%        | 66.2%                            | 2                    |
| 1.A.3.b      | Road Transportation                                                             | 11 884 | 10.0%        | 76.2%                            | 3                    |
| 2.B          | Chemical Industry                                                               | 5 753  | 4.8%         | 81.0%                            | 4                    |
| 1.A.2.c      | Chemicals                                                                       | 4 660  | 3.9%         | 84.9%                            | 5                    |
| 1.A.2.b      | Non-Ferrous Metals                                                              | 3 657  | 3.1%         | 88.0%                            | 6                    |
| 1.B.2.c      | Venting and Flaring                                                             | 3 342  | 2.8%         | 90.8%                            | 7                    |
| 2.A.1        | Cement production                                                               | 3 016  | 2.5%         | 93.4%                            | 8                    |
| 1.A.1.b      | Petroleum Refining                                                              | 1 512  | 1.3%         | 94.6%                            | 9                    |
| 1.A.2.f      | Non-Metallic Minerals                                                           | 1 298  | 1.1%         | 95.7%                            | 10                   |
| 5.A.1        | Managed waste disposal sites                                                    | 1 168  | 1.0%         | 96.7%                            | 11                   |
| 2.C.3        | Aluminium Production                                                            | 1 057  | 0.9%         | 97.6%                            | 12                   |
| 1.A.2.a      | Iron and steel                                                                  | 905    | 0.8%         | 98.4%                            | 13                   |
| 1.A.3.d      | Domestic Water-borne Navigation                                                 | 412    | 0.3%         | 98.7%                            | 14                   |
| 5.A.3        | Uncategorized waste disposal sites                                              | 410    | 0.3%         | 99.1%                            | 15                   |
| 3.A.1        | Enteric Fermentation                                                            | 339    | 0.3%         | 99.3%                            | 16                   |
| 5.C          | Incineration                                                                    | 203    | 0.2%         | 99.5%                            | 17                   |

|         |                                                            |         |        |        |    |
|---------|------------------------------------------------------------|---------|--------|--------|----|
| 2.C.1   | Iron and Steel Production                                  | 152     | 0.1%   | 99.6%  | 18 |
| 3.D.1   | Direct N <sub>2</sub> O Emissions from managed soils       | 148     | 0.1%   | 99.8%  | 19 |
| 5.D     | Wastewater treatment & discharge                           | 77      | 0.1%   | 99.8%  | 20 |
| 1.A.3.a | Domestic Aviation                                          | 45      | 0.0%   | 99.9%  | 21 |
| 3.B.1   | Manure Management                                          | 40      | 0.0%   | 99.9%  | 22 |
| 2.A.2   | Lime production                                            | 38      | 0.0%   | 99.9%  | 23 |
| 3.D.2   | Indirect N <sub>2</sub> O Emissions from managed soils     | 25      | 0.0%   | 100.0% | 24 |
| 3.B.5   | Indirect N <sub>2</sub> O Emissions from manure management | 20      | 0.0%   | 100.0% | 25 |
| 1.B.2.b | Natural Gas                                                | 12      | 0.0%   | 100.0% | 26 |
| 1.B.2.a | Oil                                                        | 10      | 0.0%   | 100.0% | 27 |
| 5.B.1   | Composting                                                 | 4       | 0.0%   | 100.0% | 28 |
| 3.H     | Urea application                                           | 2       | 0.0%   | 100.0% | 29 |
| 5.B.2   | Anaerobic digestion                                        | 0       | 0.0%   | 100.0% | 30 |
| 1.C     | CO <sub>2</sub> Injection and Storage                      | -       | 0.0%   | 100.0% | 31 |
|         | Total national                                             | 118 830 | 100.0% |        |    |

Table 2-4: Key category analysis based on trend in emissions between 2019 and 2023 (excluding LULUCF)

| CRF code | CRF Category                                                                    | Base year emissions 1990 kt CO <sub>2</sub> e | Last year emissions 2023 kt CO <sub>2</sub> e | Trend Assessment (Txt) | % Contribution to Trend | Cumulative Total of Column G | KCA rank T1 in trend |
|----------|---------------------------------------------------------------------------------|-----------------------------------------------|-----------------------------------------------|------------------------|-------------------------|------------------------------|----------------------|
| 1.A.1.a  | Main Activity Electricity and Heat Production                                   | 21 407                                        | 24 777                                        | 0.020352               | 29.0%                   | 29.0%                        | 1                    |
| 1.A.3.b  | Road Transportation                                                             | 12 534                                        | 11 884                                        | 0.011256               | 16.0%                   | 45.1%                        | 2                    |
| 2.A.1    | Cement production                                                               | 3 773                                         | 3 016                                         | 0.008349               | 11.9%                   | 57.0%                        | 3                    |
| 2.B      | Chemical Industry                                                               | 4 901                                         | 5 753                                         | 0.005372               | 7.7%                    | 64.6%                        | 4                    |
| 1.A.2.f  | Non-Metallic Minerals                                                           | 1 727                                         | 1 298                                         | 0.004549               | 6.5%                    | 71.1%                        | 5                    |
| 1.A.2.a  | Iron and Steel                                                                  | 1 320                                         | 905                                           | 0.004252               | 6.1%                    | 77.2%                        | 6                    |
| 1.A.2.c  | Chemicals                                                                       | 4 049                                         | 4 660                                         | 0.003620               | 5.2%                    | 82.3%                        | 7                    |
| 1.A.2.b  | Non Ferrous Metals                                                              | 3 847                                         | 3 657                                         | 0.003367               | 4.8%                    | 87.1%                        | 8                    |
| 5.A.1    | Managed waste disposal sites                                                    | 783                                           | 1 168                                         | 0.003053               | 4.4%                    | 91.5%                        | 9                    |
| 1.A.1.c  | Manufacture of Solid Fuels and Other Energy Industries: Other Energy Industries | 51 219                                        | 53 865                                        | 0.000834               | 1.2%                    | 92.7%                        | 10                   |
| 5.A.3    | Uncategorised waste disposal sites                                              | 546                                           | 410                                           | 0.001448               | 2.1%                    | 94.7%                        | 11                   |
| 3.A.1    | Enteric Fermentation                                                            | 414                                           | 339                                           | 0.000850               | 1.2%                    | 95.9%                        | 12                   |
| 2.C.1    | Iron and Steel Production                                                       | 221                                           | 152                                           | 0.000701               | 1.0%                    | 96.9%                        | 13                   |
| 1.A.3.d  | Domestic Water-borne Navigation                                                 | 322                                           | 412                                           | 0.000649               | 0.9%                    | 97.9%                        | 14                   |
| 1.B.2.c  | Venting and Flaring                                                             | 3 139                                         | 3 342                                         | 0.000408               | 0.6%                    | 98.4%                        | 15                   |
| 1.A.3.a  | Domestic Aviation                                                               | 25                                            | 45                                            | 0.000174               | 0.2%                    | 98.7%                        | 16                   |

|              |                                               |                |                |                 |               |        |    |
|--------------|-----------------------------------------------|----------------|----------------|-----------------|---------------|--------|----|
| 3.B.5        | Indirect N2O Emissions from manure management | 1              | 20             | 0.000173        | 0.2%          | 98.9%  | 17 |
| 3.B.1        | Manure Management                             | 20             | 40             | 0.000163        | 0.2%          | 99.2%  | 18 |
| 1.A.1.b      | Petroleum Refining                            | 1 425          | 1 512          | 0.000135        | 0.2%          | 99.4%  | 19 |
| 5.D          | Wastewater treatment & discharge              | 90             | 77             | 0.000157        | 0.2%          | 99.6%  | 20 |
| 1.B.2.a      | Oil                                           | -              | 10             | 0.000089        | 0.1%          | 99.7%  | 21 |
| 1.B.2.b      | Natural Gas                                   | 20             | 12             | 0.000079        | 0.1%          | 99.8%  | 22 |
| 5.C          | Incineration                                  | 199            | 203            | 0.000060        | 0.1%          | 99.9%  | 23 |
| 2.C.3        | Aluminium Production                          | 1 005          | 1 057          | 0.000018        | 0.0%          | 99.9%  | 24 |
| 2.A.2        | Lime production                               | 34             | 38             | 0.000018        | 0.0%          | 100.0% | 25 |
| 5.B.1        | Composting                                    | 2              | 4              | 0.000019        | 0.0%          | 100.0% | 26 |
| 3.D.1        | Direct N2O Emissions from managed soils       | 142            | 148            | 0.000005        | 0.0%          | 100.0% | 27 |
| 5.B.2        | Anaerobic digestion                           | 1              | 0              | 0.000003        | 0.0%          | 100.0% | 28 |
| 3.H          | Urea application                              | 2              | 2              | 0.000001        | 0.0%          | 100.0% | 29 |
| 3.D.2        | Indirect N2O Emissions from managed soils     | 24             | 25             | 0.000000        | 0.0%          | 100.0% | 30 |
| 1.C          | CO2 Injection and Storage                     | -              | -              | 0.000000        | 0.0%          | 100.0% | 31 |
| <b>Total</b> |                                               | <b>113 193</b> | <b>118 830</b> | <b>0.070153</b> | <b>100.0%</b> |        |    |

A total of 31 categories were assessed under the key category analysis in level and in trend assessment.

Applying the cumulative threshold of 85%, under the KCA in level assessment in 2023, the first six categories were identified as key categories due to their significant contributions to total emissions. Together, these categories account for approximately 88% of national emissions. The largest contributor is “Manufacture of Solid Fuels and Other Energy Industries: Other Energy Industries” (45.3%), followed by “Main Activity Electricity and Heat Production” (20.9%) and “Road Transportation” (10%). Other key contributors include the “Chemical industry” (4.8%), associated “Chemicals” fuel consumption (3.9%) and “Non-Ferrous Metals” industry fuel consumption (3.1%). All remaining categories individually contribute less than 3% of total emissions and fall outside the 85 per cent cumulative threshold. When considering 2019, the same six emissions sources were key categories under the same order.

In terms of trend assessment between 2019 and 2023, there are eight key categories. Only one of the key categories from the level assessment (“Manufacture of Solid Fuels and Other Energy Industries: Other Energy Industries”) falls outside this group, while the remaining categories are included in the same general order. “Main Activity Electricity and Heat Production” ranks first, contributing 29% to the overall trend, followed by “Road Transportation” at 16%. Among the additional categories that emerge in the trend assessment compared to the level assessment “Cement Production” ranks third (11.9%), and “Non-Metallic Minerals” ranks fifth (6.5%).

#### 2.1.3.2 Brief general description of QA/QC plan and implementation

In light of its capacities, the State of Qatar has not yet developed a formal QA/QC plan and is thus applying the flexibility mechanism described in paras. 34 and 35 of the MPGs.

During the preparation of the inventory submission, quality control activities primarily focused on ensuring the completeness and consistency of emission estimates, as well as the correct application of notation keys in the CRT tables.

#### 2.1.3.3 General uncertainty assessment

The uncertainty in emissions estimates primarily stems from data sources and assumptions used in the inventory.

For the other categories, the following qualitative uncertainty analysis was carried on:

Within the energy sector (non-metallic minerals manufacturing industries (1.A.2.f) and mobile combustion (1. A.3) several sources of uncertainty have been identified. First, activity data are derived directly from stakeholder reporting, which may introduce uncertainty related to data completeness and consistency. Second, for the road transportation category. Finally, default IPCC emission factors were applied, which can introduce additional uncertainty compared to the use of country-specific factors.

Within the IPPU sector, activity data for the mineral industry (2.A) were collected directly from cement and lime producers. Default IPCC emission factors were applied, which introduces some uncertainty compared to country-specific factors. However, the availability of plant-level data for cement production allows for the application of a Tier 2 approach for estimating emissions from cement production, thereby reducing uncertainty for this category.

For the agriculture sector, activity data are primarily obtained from national sources supplemented where necessary by international databases (e.g., for inputs such as inorganic fertilizers). While these sources are considered broadly reliable, some uncertainty may arise from potential reporting inconsistencies, data aggregation practices, and the limited representation of national variability in international statistics. Emissions were estimated in accordance with the IPCC Guidelines using predominantly Tier 1 methodologies and default emission factors and parameters. Although these default values ensure methodological consistency, they may not fully capture country-specific conditions, which introduces an additional source of uncertainty.

For the waste sector, activity data were compiled from a combination of national sources and international datasets; however, gaps remain across several subcategories. In particular, assumptions were required regarding waste composition, as well as historical quantities of waste disposed. These data limitations required the use of assumptions and proxy information, which may not fully reflect actual waste management parameters during the reporting period. For wastewater treatment, activity data were primarily derived from international databases due to limited national data availability. In addition, default IPCC parameters were applied, which introduces further uncertainty compared to country-specific values.

#### 2.1.3.4 General assessment of completeness

##### 2.1.3.4.1 *Information on completeness*

**Temporal coverage:** The emission inventories presented in this document cover the years 2019-2023. Data was not available for all sectors for years prior to 2019 due to resources and time constraints.

**Geographical scope:** The present inventory relates to the State of Qatar.

#### *2.1.3.4.2 Categories not estimated*

In view of the difficulty to obtain activity data, and in view of the country's capacity, the following emissions sources remained not estimated (NE) for the State of Qatar:

- CRT 1.A.3.b.i to 1.A.3.b.iv – Emissions from road transport are reported in aggregate under category 1.A.3.b because national fuel sales are not differentiated by vehicle type. The notation key NE is used on subcategories 1.A.3.b.i to 1.A.3.b.iv, with the full estimate reported against 1.A.3.b.
- CRT 1.A.4.c – Agriculture, forestry and fishing
- CRT 2.F – Product uses as substitutes for ODS, where flexibility was applied
- CRT 3.I – Other carbon-containing fertilizers
- CRT 4 – LULUCF
- CRT 5 – all categories related to industrial waste treatment, as well as hazardous waste treatment. In particular, category CRT 5.D2. Industrial wastewater.

#### *2.1.3.4.3 Total aggregate emissions considered insignificant*

The total aggregate emissions considered insignificant are not estimated.

#### *2.1.3.5 Metrics*

Aggregate emissions and removals of all GHGs are expressed in CO<sub>2</sub> equivalents. The 100-year time-horizon global warming potential (GWP) values from the IPCC Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC) was used to report the aggregate emissions and removals of GHGs: 1 for CO<sub>2</sub>; 28 for CH<sub>4</sub>; and 265 for N<sub>2</sub>O.

#### *2.1.3.6 Summary of any flexibility applied*

As per paras. 4–6 of the MPGs, the State of Qatar used the flexibilities detailed in Table 2-5 in terms of GHG emission inventory estimation and reporting.

Table 2-5: Flexibilities in terms of GHG emission inventory estimation and reporting.

| MPG flexibility provision         | Year | Sector | Cat. | Gas | Description of the application of flexibility                                                                                                                                                                                                           | Clarification of capacity constraint                                                               |
|-----------------------------------|------|--------|------|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| Key categories (para. 25)         | All  | All    | All  | All | The 85% threshold was applied for the key category analysis.                                                                                                                                                                                            | Particularly related to data availability.                                                         |
| Uncertainty assessment (para. 28) | All  | All    | All  | All | A <u>qualitative</u> discussion of the latest inventory year/trend was provided.                                                                                                                                                                        | Insufficient resources.                                                                            |
| Completeness (para. 32)           | All  | All    | All  | All | Emissions were considered to be insignificant when the likely level of emissions was below 0.1% of total GHG emissions or 1000 ktCO <sub>2</sub> e.                                                                                                     | Insufficient resources to collect all data and estimate all categories.                            |
| QA/QC (paras. 34 and 35)          | All  | All    | All  | All | No QA/QC plan has been developed yet.                                                                                                                                                                                                                   | Insufficient resources.                                                                            |
| Gases (para. 48)                  | All  | All    | All  | All | Only the following three direct gases were reported: CO <sub>2</sub> , CH <sub>4</sub> and N <sub>2</sub> O. Consequently, other gases, such as F-gas, PFCs, SF <sub>6</sub> , nor CO, NO <sub>x</sub> , SO <sub>x</sub> and NMVOCs were not estimated. | Insufficient resources and data to estimate all gases and collect the corresponding activity data. |
| Time series (paras 57 and 58)     | 2024 | All    | All  | All | <ul style="list-style-type: none"> <li>The annual time series reported covers the period from 2019 onward.</li> <li>The most recent in this 2026 BTR submission is the year</li> </ul>                                                                  | Activity data was not available for all sectors for 2024 and for the years prior to 2019.          |

|  |  |  |  |  |                                                          |  |
|--|--|--|--|--|----------------------------------------------------------|--|
|  |  |  |  |  | 2023 (i.e. three years prior to the year of submission). |  |
|--|--|--|--|--|----------------------------------------------------------|--|

## 2.2 Trends in greenhouse gas emissions and removals

### 2.2.1 Description of emission and removal trends for aggregated GHG emissions and removals

Total national GHG emissions fluctuated over the period 2019-2023, decreasing from 113,193 ktCO<sub>2</sub>e in 2019 to 111,659 ktCO<sub>2</sub>e in 2020, before increasing to 118,830 ktCO<sub>2</sub>e in 2023. Overall, emissions remained relatively stable across the time series, with moderate interannual variation. Description of emission and removal trends by sector and GHG emissions.

#### 2.2.1.1 By sector

Given the sector's significance to the national economy, the energy sector (CRT 1) was the main contributor throughout the period, accounting for approximately 90% of total national emissions. Emissions from this sector followed the overall national trend, declining in 2020 before increasing again and in 2023 (Table 2-6).

The IPPU sector (CRT 2) was the second-largest contributor, although at a much smaller scale, representing around 7.4-8.8% of national emissions. Emissions in this sector declined between 2019 and 2021, followed by a rebounding 2022 and a further increase in 2023, exceeding 2019 levels.

Emissions from the waste sector (CRT 5) contributed a relatively small share, generally around 1.5% of national emissions. Unlike IPPU, waste emissions showed a gradual increasing trend over the period, rising from 1,621 ktCO<sub>2</sub>e in 2019 to 1,861 ktCO<sub>2</sub>e in 2023.

The agriculture sector (CRT 3) was the smallest contributor, accounting for around 0.5% of national emissions. Emissions remained relatively stable overall, with minor fluctuations, including a temporary increase in 2021 followed by a decline in subsequent years.

Table 2-6: GHG emissions by sector, 2019-2023 (ktCO<sub>2</sub>e)

| CRT Category | Sector         | 2019    | 2020    | 2021    | 2022    | 2023    |
|--------------|----------------|---------|---------|---------|---------|---------|
| CRT 1        | Energy         | 101 035 | 100 668 | 101 512 | 104 525 | 106 379 |
| CRT 2        | IPPU           | 9 934   | 8 680   | 8 321   | 9 103   | 10 017  |
| CRT 3        | Agriculture    | 603     | 642     | 735     | 580     | 574     |
| CRT 5        | Waste          | 1 621   | 1 669   | 1 806   | 1 792   | 1 861   |
|              | National total | 113 193 | 111 659 | 112 375 | 116 001 | 118 830 |

Figure 2-1 presents sectoral emissions on a full scale, which highlights the emissions contribution from the energy sector. As the contribution of other sectors is comparatively small, Figure 2-2 provides a zoomed view to better illustrate emission trends in the remaining sectors.

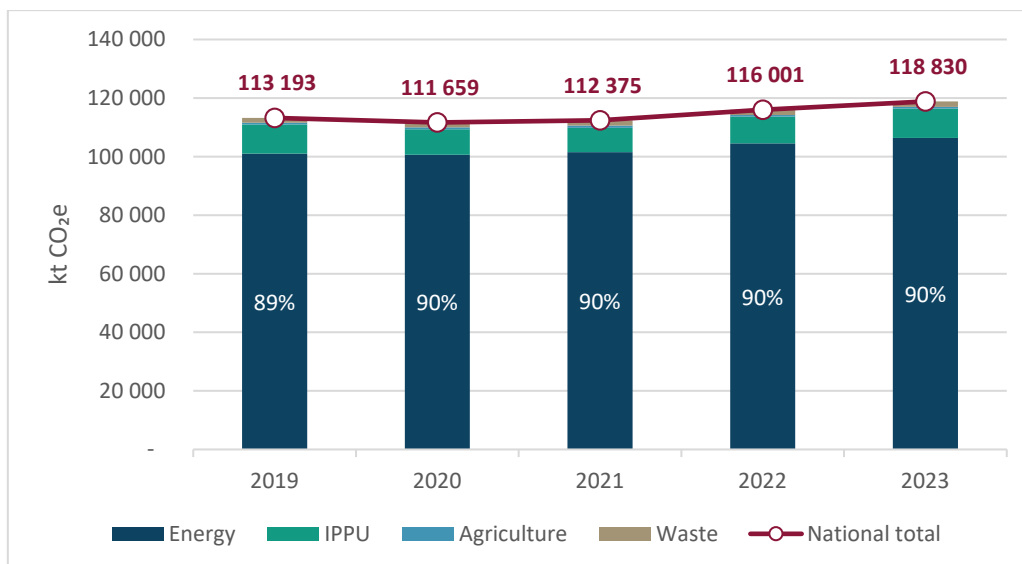


Figure 2-1: GHG emissions, 2019-2023 (in ktCO<sub>2</sub>e) and repartition by sector (%)

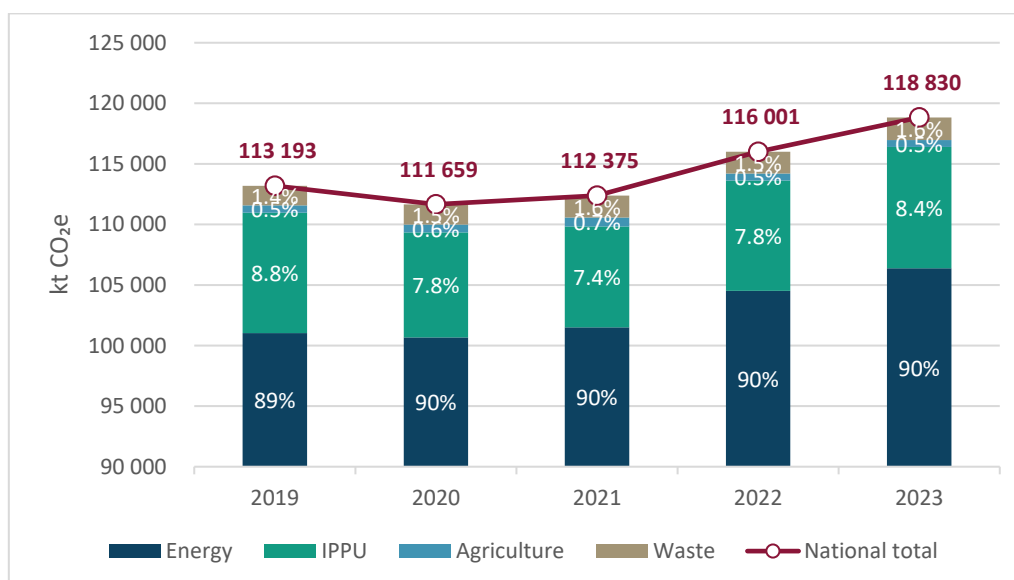


Figure 2-2: GHG emissions, 2019-2023 (in ktCO<sub>2</sub>e) and repartition by sector (%) (ZOOMED SCALE)

#### 2.2.1.2 By Greenhouse gas

Figure 2-3 shows the distribution of national emissions by greenhouse gas type for 2023. The relative contributions of CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O remain broadly consistent compared with earlier reporting years.

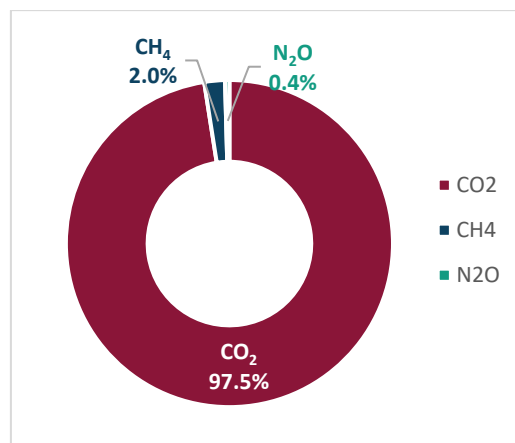


Figure 2-3: National emissions by type of gas, 2023

Carbon dioxide (CO<sub>2</sub>) (Figure 2-4) accounted for the vast majority of national greenhouse gas emissions throughout the period 2019-2023. In 2023, CO<sub>2</sub> emissions totalled 115,892 ktCO<sub>2</sub>e and were highest contribution from the energy sector, accounting for approximately 91.2% of total CO<sub>2</sub> emissions (Figure 2-4). The IPPU sector represented a smaller share, accounting for about 8.6%, while contributions from the waste and agriculture sectors were negligible. Over the time series, CO<sub>2</sub> emissions followed the overall national trend, declining in 2020 before increasing again in 2023. This pattern reflects the influence of energy-related activities within Qatar and hence, its contributions to national CO<sub>2</sub> emissions.

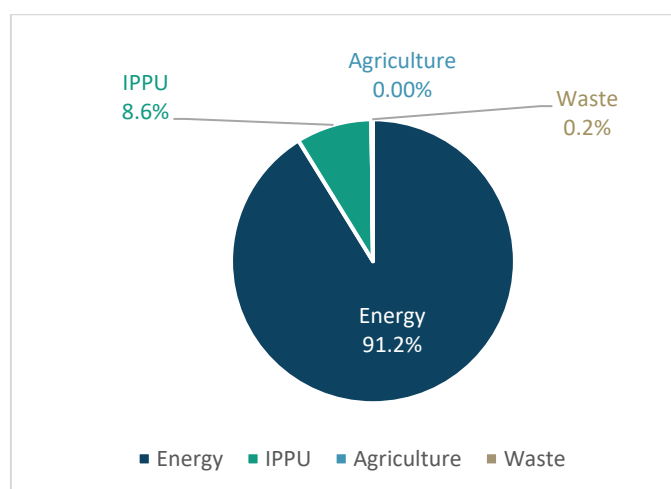


Figure 2-4: Repartition of CO<sub>2</sub> emissions by sector in 2023

Methane (CH<sub>4</sub>) emissions in 2023 (Figure 2-5) were primarily driven by the waste sector, which accounted for approximately 66.3% of total CH<sub>4</sub> emissions, followed by the energy sector (17.9%) and agriculture (15.6%), while the IPPU sector contributed only a negligible share. In the energy sector, methane emissions are distributed almost equally between combustion-related emissions and fugitive emissions from oil and gas systems. Over the period 2019-2023, total CH<sub>4</sub> emissions remained relatively stable, fluctuating between about 2,223 and 2,460 ktCO<sub>2</sub>e. Waste was consistently the largest source of CH<sub>4</sub> emissions, showing a gradual increase over time, rising from 1,373 ktCO<sub>2</sub>e in 2019 to 1,609 ktCO<sub>2</sub>e in 2023. CH<sub>4</sub> emissions from the energy sector varied moderately over the period, while emissions from agriculture showed a slight decline in the last two years after peaking in 2021.

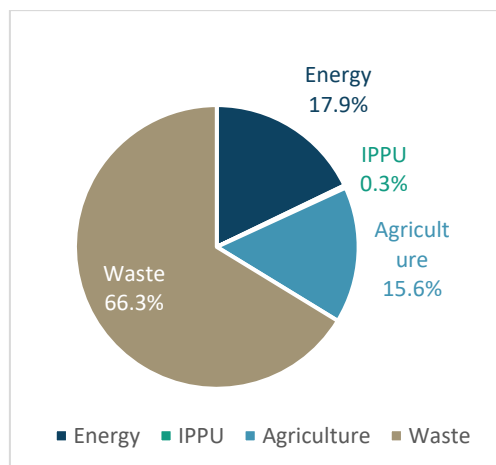


Figure 2-5: Repartition of CH<sub>4</sub> emissions by sector in 2023

Nitrous oxide (N<sub>2</sub>O) emissions in 2023 (Figure 2-6) were mainly driven by the energy sector, which accounted for approximately 50% of total N<sub>2</sub>O emissions. Agriculture was the second-largest contributor, representing about 38%, followed by the waste sector at around 11%, while emissions from the IPPU sector were negligible. Over the period 2019-2023, total N<sub>2</sub>O emissions showed a gradual decline, decreasing from 627 ktCO<sub>2</sub>e in 2019 to 499 ktCO<sub>2</sub>e in 2022, before slightly increasing to 511 ktCO<sub>2</sub>e in 2023. This decrease was primarily driven by reductions in N<sub>2</sub>O emissions from the energy sector, while emissions from agriculture fluctuated moderately. Emissions from the waste sector remained low and stable throughout the period.

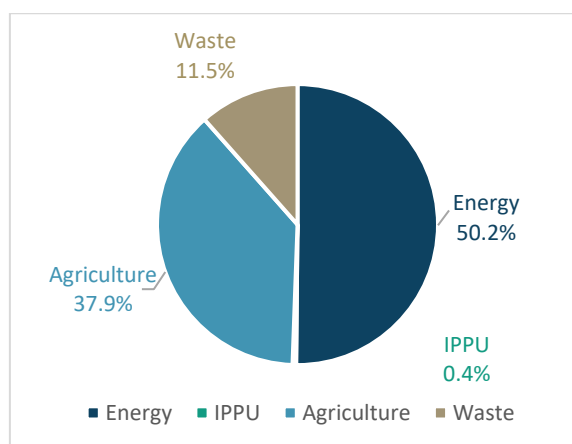


Figure 2-6: N<sub>2</sub>O emissions repartition by sector in 2023

## 2.3 Energy (CRT sector 1)

### 2.3.1 Overview of the sector and background information

The CRT 1 category covers the following sectors:

- Energy industries (1.A.1), including thermal power plants, oil refineries and production of solid and gaseous fuels,
- Manufacturing industry (1.A.2),
- Transport (1.A.3),
- Fugitive emissions from oil and natural gas (1.B.2),
- CO<sub>2</sub> transport and storage (1.C).

Other sectors (1.A.4) category is not relevant in the State of Qatar as electricity is mainly used in this sub-sector. Non-specified (1.A.5) and Fugitive emissions from solid fuels (1.B.1) are not occurring (NO).

#### Methodologies

For energy-related activities for which only emission data were available (i.e. where activity data were confidential), the EU MRR methodology was applied to estimate CO<sub>2</sub> emissions, while the IPCC 2006 Guidelines were used to estimate CH<sub>4</sub> and N<sub>2</sub>O emissions from the same activities.

Tier 1 methodologies from the 2006 IPCC Guidelines were applied to all other categories for which activity data were available, except for cement production (CRT 2A1). This approach was adopted due to limited data availability, which precluded reporting at higher tier levels. A Tier 2 approach was applied for the category 2A1 Cement production.

Fuel consumption data provided in tons were converted into energy units (TJ) using default IPCC net calorific values (NCVs) (Table 2-7).

Table 2-7: Default IPCC net calorific values

| Fuel                                                               | NCV value (TJ/Gg) | Source                                  |
|--------------------------------------------------------------------|-------------------|-----------------------------------------|
| Natural gas                                                        | 48.0              | Table 1.2, chap.2, Vol.2, 2006 IPCC GL. |
| Gasoline                                                           | 44.3              |                                         |
| Diesel                                                             | 43.0              |                                         |
| Jet kerosene                                                       | 44.1              |                                         |
| VLSHFO<br>(corresponding to residual fuel oil in the IPCC 2006 GL) | 40.4              |                                         |
| MDO/MGO<br>(corresponding to gas/diesel oil in the IPCC 2006 GL)   | 43.0              |                                         |
| LNG / CNG<br>(corresponding to natural gas in the IPCC 2006 GL)    | 48.0              |                                         |
|                                                                    |                   |                                         |

The emission factors (EF) used in the Qatar inventory are the IPCC default values, presented in Table 2-8 and Table 2-9.

Table 2-8: Emission factors for stationary combustion

| Fuel type   | CO <sub>2</sub> EF<br>(kg CO <sub>2</sub> /TJ) | CH <sub>4</sub> EF<br>(kg CH <sub>4</sub> /TJ) | N <sub>2</sub> O EF<br>(kg N <sub>2</sub> O/TJ) | Source                                 |
|-------------|------------------------------------------------|------------------------------------------------|-------------------------------------------------|----------------------------------------|
| Natural gas | 56100                                          | 1                                              | 0.1                                             | Table 2.2, chap.2, Vol.2, 2006 IPCC GL |

Table 2-9: Emission Factors for Mobile combustion

| Fuel type                    | CO <sub>2</sub> EF<br>(kg CO <sub>2</sub> /TJ) | CH <sub>4</sub> EF<br>(kg CH <sub>4</sub> /TJ) | N <sub>2</sub> O EF<br>(kg N <sub>2</sub> O/TJ) | Source                                                                                                                                                                                                    |
|------------------------------|------------------------------------------------|------------------------------------------------|-------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Road transport               |                                                |                                                |                                                 |                                                                                                                                                                                                           |
| Gas/Diesel oil               | 74 100                                         | 3.9                                            | 3.9                                             | Table 3.2.1 and 3.2.2, chap. 3, Vol. 2., 2006 IPCC GL<br>For gasoline, default EF of “Low Mileage Light Duty Vehicle Vintage 1995 or Later” is chosen as vehicles are characterized as “Euro II” in Qatar |
| Gasoline                     | 69 300                                         | 3.8                                            | 5.7                                             |                                                                                                                                                                                                           |
| Compressed Natural Gas (CNG) | 56 100                                         | 92                                             | 3                                               | As per the default value in the IPCC Software                                                                                                                                                             |
| Aviation                     |                                                |                                                |                                                 |                                                                                                                                                                                                           |
| Jet kerosene                 | 71 500                                         | 0.5                                            | 2                                               | Table 3.6.4 and 3.6.5, Chap. 3, Vol. 2, 2006 IPCC GL                                                                                                                                                      |
| Maritime                     |                                                |                                                |                                                 |                                                                                                                                                                                                           |
| HFO                          | 77 400                                         | 7                                              | 2                                               | Table 3.5.2 and 3.5.3; chap. 3, Vol. 2., 2006 IPCC GL.                                                                                                                                                    |
| MDO                          | 74 100                                         | 7                                              | 2                                               |                                                                                                                                                                                                           |
| LNG                          | 56 100                                         | 7                                              | 2                                               |                                                                                                                                                                                                           |

Total emissions from the energy sector remained relatively stable over the period 2019-2023, fluctuating between approximately 100,668 and 106,379 ktCO<sub>2</sub>e (Figure 2-7).

Energy industries (1.A.1) consistently represented the largest source, contributing around 73-75% of total sectoral emissions. Manufacturing industries and construction (1.A.2) accounted for 9-11% of emissions. Emissions (1.A.2) decreased by 11% in 2020 compared to the previous year and by a further 3% decrease in 2021, before recovering in subsequent years. Transport (1.A.3) contributed 12-13% of total sectoral emissions, with a noticeable decline in 2020 (6% compared to 2019), likely due to reduced mobility associated with the COVID-19 pandemic.

Fugitive emissions (1.B) remained a relatively small but stable component at around 3% of total sectoral emissions, with a slight increase observed in 2023. Overall, the sectoral distribution remained broadly consistent throughout the time series.

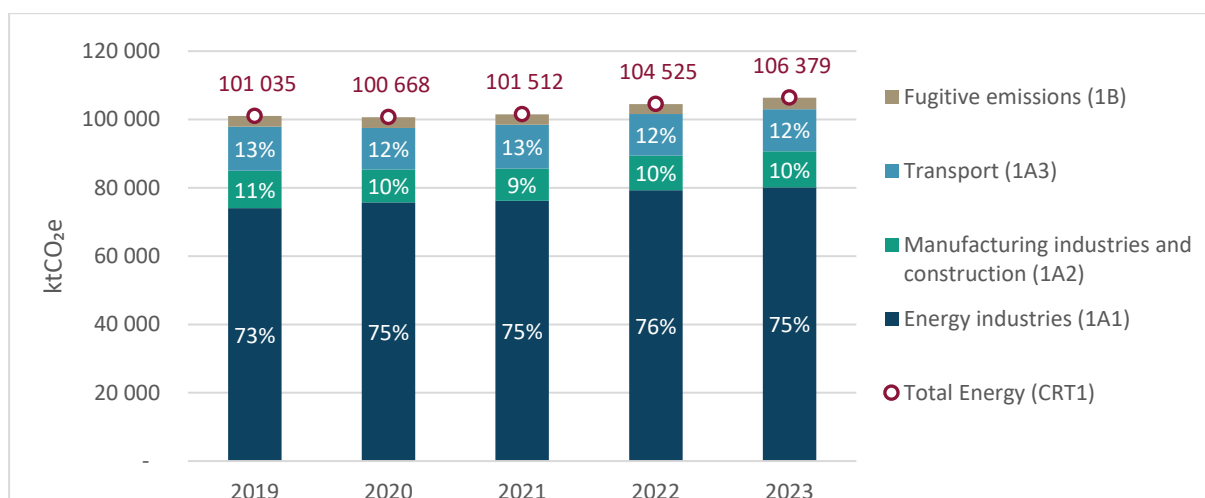


Figure 2-7: Emissions evolution of the Energy sector and its repartition between fuel combustion emissions (1A) and fugitive emissions (1B), 2019-2023 (in ktCO<sub>2</sub>e and %)

Overall, the energy sector remained the dominant source of national emissions throughout 2019-2023, contributing around 90% of total national emissions.

### 2.3.2 Fuel combustion (CRT 1.A)

#### 2.3.2.1 Comparison of the sectoral approach with the reference approach

The IPCC guidelines recommend using the reference approach, which involves comparing fuel consumption data for the Energy sector (CRT 1A) from energy balances – accounting for production, imports, exports, and stock changes (reference approach) – with fuel consumption data used in the emissions inventory (sectoral approach). Finally, CO<sub>2</sub> emissions calculated from both approaches are compared to ensure consistency.

#### 2.3.2.2 International bunker fuels

International aviation bunkers concern fuel consumptions of international flights refueling in Qatar. In addition, there is marine fuel consumption associated with international maritime traffic.

However, due to a lack of exhaustive data, emissions from international bunkers were not estimated and are reported as such (NE).

#### 2.3.2.3 Feedstocks and non-energy use of fuels

Fossil fuels are used both for energy through combustion and for non-energy purposes such as feedstock, intermediates, or reducing agents. Emissions may therefore arise from combustion and from industrial processes, though these cannot always be reported separately in practice. According to the 2006 IPCC Guidelines, combustion emissions from fuels derived from IPPU feedstocks are generally reported under the source category where the process occurs. If such fuels are transferred for combustion elsewhere, the emissions should instead be reported under the relevant Energy Sector categories (usually 1A1 or 1A2).

Thus, in Qatar's inventory this rule was applied to ammonia and petrochemicals production, where natural gas is used as feedstock. The associated CO<sub>2</sub> emissions are accounted for in the CRT category 2B1.

#### 2.3.2.4 Energy industries (CRT 1A1)

##### 2.3.2.4.1 Category description (e.g. characteristics of sources)

Energy industries were the largest contributor to national emissions over 2019-2023, accounting for approximately 65-68% of the national total and around 73-75% of the energy sector, with emissions remaining relatively stable and peaking in 2023 (Figure 2-8).

The distribution of emissions across energy industries subsectors remained broadly stable throughout the time series, with minor variations in relative contributions.

- Electricity generation and heat production (CRT 1A1.a): contributed between 29-32% of energy industries emissions across all years.
- Petroleum refining (CRT 1A1.b): accounted for a small and stable share of less than 2%.
- Fuel consumption in manufacture of solid fuels and other energy industries (CRT 1A1.c):
  - Oil and gas extraction activities: represented the largest share, accounting for 53-56% of energy industries' emissions.
  - Other energy industries – liquid fuels: accounted for a smaller share, contributing 12-13% depending on the year.

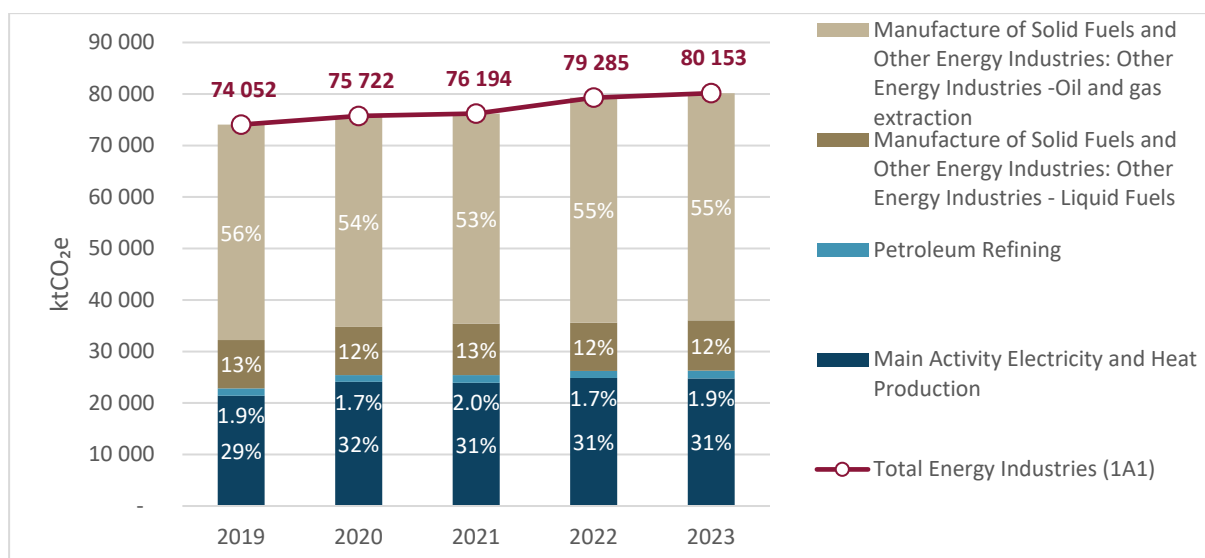


Figure 2-8: Energy industries emissions in ktCO<sub>2</sub>e

#### 2.3.2.4.2 Methodological issues

Only final emission estimates are provided as part of the data collection. Activity data for subcategories of the *Energy Industries* sector, i.e. *Electricity production*, *Petroleum refining* and “*other energy industries*”, are considered commercially sensitive and confidential.

However, an independent, accredited third-party assurance provider is appointed to conduct annual verification of emissions for assets in the *Energy Industries* sector.

#### 2.3.2.4.3 Uncertainty assessment and time-series consistency

General discussion on uncertainty in the Energy sector provided in earlier section.

#### 2.3.2.4.4 Category-specific recalculations

As this is Qatar’s first BTR, no recalculations are included. Recalculations will be undertaken and evaluated in the next reporting cycle.

#### 2.3.2.4.5 Category-specific planned improvements (Expected Plans)

The objectives for the next submissions are:

- Preparation of a national energy balance by the relevant government entities, using officially approved country data to apply the reference approach.
- Measurement of the carbon content of consumed natural gas to develop a country-specific emission factor and apply a Tier 2 approach for the CO<sub>2</sub> emissions of the electricity generation sector.

### 2.3.2.5 Manufacturing industries and construction (CRT 1A2)

#### 2.3.2.5.1 Category description (e.g. characteristics of sources)

In Qatar, Manufacturing Industries and Construction include emissions from fuel combustion in the following industries:

- Iron and steel (1A2a)

- Aluminium (1A2b)
- Petrochemicals, with among others: Methanol, Ethylene, Ethylene dichloride and vinyl chloride monomer (1A2c)
- Fertilizers: ammonia and urea (1A2c)
- Cement and lime (1A2f)

Over the period 2019-2023, the manufacturing industries combustion contributed around 8-10% of the total national GHG emissions, and around 10% of the Energy sector (CRT 1) in Qatar.

Within fuel combustion in manufacturing industries and construction (CRT 1A2), the relative contributions of subsectors remained broadly consistent over the period 2019-2023 (Figure 2-9), with highest proportion of emissions associated with the chemicals production sector:

- Chemicals (CRT 1A2.c): the main contributor throughout the period, accounting for approximately 37 to 50% of emissions. Emissions increased from about 4,049 ktCO<sub>2</sub>e in 2019 to a peak in 2021, followed by a slight decline but remaining the dominant source in 2023.
- Non-ferrous metals (aluminium production) (CRT 1A2.b): the second-largest contributor, representing around 35 to 39% of emissions, with a slight downward trend in absolute emissions over the period (5% decrease between 2019 and 2023).
- Non-metallic minerals (cement and lime production) (CRT 1A2.f) contributed a smaller but variable share, ranging from 6% to 16%. Emissions declined significantly after 2019, likely due to the COVID-19 pandemic but showed a partial recovery by 2023.
- Iron and steel (CRT 1A2.a) accounted for the smallest share overall, contributing between 5% and 12% of emissions. After a marked decline in 2020/2021, emissions increased again in the last two years of the period.

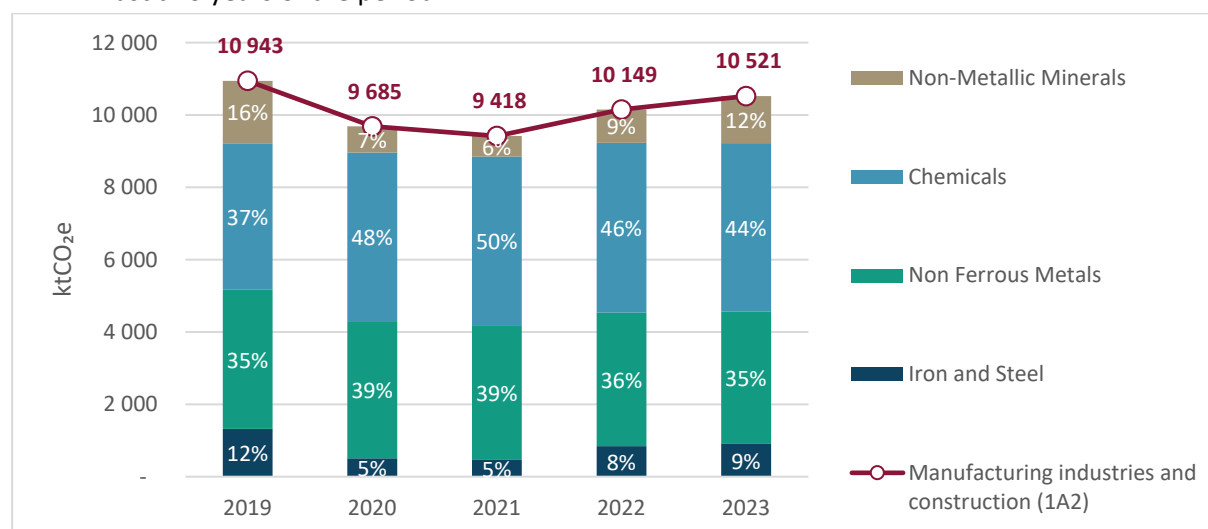


Figure 2-9: Manufacturing industries emissions in ktCO<sub>2</sub>e

#### 2.3.2.5.2 Methodological issues

##### Categories 1A2a, 1A2b, 1A2c:

Only final emission estimates are provided as part of the data collection for the categories 1A2a, 1A2b and 1A2c, as activity data is commercially sensitive and confidential.

However, an independent, accredited third-party assurance provider is engaged to conduct annual verification of emissions for assets in the categories 1A2a, 1A2b and 1A2c.

Non-energy fuel consumption is not reported under sector 1A2 but is instead included in CRT 2 – Industrial Processes.

#### Cement and lime production (1A2f):

GHG emissions from fuel combustion in cement and lime production are estimated using the Tier 1 methodology of the 2006 IPCC Guidelines, with default emission factors for CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O, as specified in those guidelines (see previous section for values).

The activity data was communicated in MMBTU by the two cement companies in Qatar: Al Khalij Cement Company and Qatar National Cement company (Table 2-10). MMBTU were converted to TJ using the conversion factor of 1.055056.

*Table 2-10: Fuel consumption of the Cement and lime production sector (CRT 1A2f), in MMBTU and TJ*

|                               | 2019       | 2020       | 2021      | 2022       | 2023       |
|-------------------------------|------------|------------|-----------|------------|------------|
| <b>In MMBTU</b>               |            |            |           |            |            |
| Al Khalij Cement Company      | 12 315 280 | 3 230 187  | 2 508 110 | 7 680 168  | 8 851 423  |
| Qatar National Cement Company | 16 838 421 | 9 011 092  | 7 078 929 | 7 820 352  | 13 063 257 |
| Total                         | 29 153 701 | 12 241 279 | 9 587 039 | 15 500 520 | 21 914 679 |
| <b>In TJ</b>                  |            |            |           |            |            |
| Al Khalij Cement Company      | 12 993     | 3 408      | 2 646     | 8 103      | 9 339      |
| Qatar National Cement Company | 17 765     | 9 507      | 7 469     | 8 251      | 13 782     |
| Total                         | 30 759     | 12 915     | 10 115    | 16 354     | 23 121     |

#### *2.3.2.5.3 Uncertainty assessment and time-series consistency*

General discussion on uncertainty in the Energy sector is provided in earlier section.

#### *2.3.2.5.4 Category-specific recalculations*

As this is Qatar's first BTR, no recalculations are included. Recalculations will be undertaken and evaluated in the next reporting cycle.

#### *2.3.2.5.5 Category-specific planned improvements*

Further improvements are required to assess whether additional categories should be included under the 1A2 reporting category, in order to ensure that emission estimates are complete and not underestimated.

### 2.3.2.6 Transport (CRT 1A3)

#### 2.3.2.6.1 Category description

This category covers the emission from combustion and evaporation of fuel for all transport activities. In Qatar, this sector includes the emission from:

- Air transport (CRT 1A3a),
- Road transport (CRT 1A3b),
- Marine transport (CRT 1A3d).

Over the period 2019–2023, the transport sector contributed 11% to the total national GHG emissions and accounted for around 12% of the emissions in the Energy category (CRT 1) in Qatar.

Emissions from this sector remained relatively stable, fluctuating between approximately 12,095 and 12,876 ktCO<sub>2</sub>e (Figure 2-10).

Road transportation was by far the dominant source, consistently accounting for 96 to 97% of transport emissions. A notable decline in total transport emissions occurred in 2020 (6% decrease), primarily driven by reduced road transport activity, likely reflecting mobility restrictions associated with the COVID-19 pandemic. Emissions rebounded in 2021, decreased again in 2022 (-5% compared to the previous year), before increasing slightly in 2023 (+1.5%). Domestic water-borne navigation represented a small share of emissions (around 3 to 4%), while domestic aviation contributed only a marginal fraction (0.1 to 0.4%), although it showed a significant increase in the latter years of the period, registering an 85% increase from 2019 to 2023.

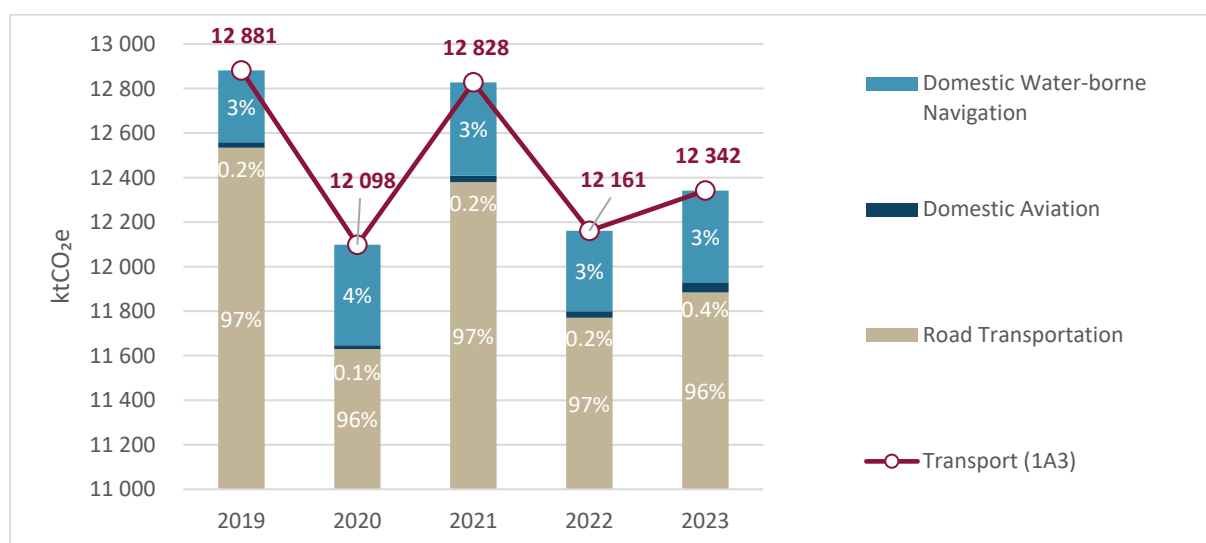


Figure 2-10: Transport emissions, 2019-2023, ktCO<sub>2</sub>e

#### 2.3.2.6.2 Methodological issues

The Tier 1 method, along with default emission factors for CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O from the 2006 IPCC Guidelines, is applied to calculate GHG emissions for the road transport, domestic aviation and domestic navigation:

Table 2-11: Emission Factors

| Fuel type | CO <sub>2</sub> EF<br>(kg CO <sub>2</sub> /TJ) | CH <sub>4</sub> EF<br>(kg CH <sub>4</sub> /TJ) | N <sub>2</sub> O EF<br>(kg N <sub>2</sub> O/TJ) | Source |
|-----------|------------------------------------------------|------------------------------------------------|-------------------------------------------------|--------|
|-----------|------------------------------------------------|------------------------------------------------|-------------------------------------------------|--------|

| Road transport |        |     |     |                                                                                                                                                                                                           |
|----------------|--------|-----|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Gas/Diesel oil | 74 100 | 3.9 | 3.9 | Table 3.2.1 and 3.2.2, chap. 3, Vol. 2., 2006 IPCC GL<br>For gasoline, default EF of "Low Mileage Light Duty Vehicle Vintage 1995 or Later" is chosen as vehicles are characterized as "Euro II" in Qatar |
| Gasoline       | 69 300 | 3.8 | 5.7 |                                                                                                                                                                                                           |
| CNG            | 56 100 | 92  | 3   | As per the default value in the IPCC Software                                                                                                                                                             |
| Aviation       |        |     |     |                                                                                                                                                                                                           |
| Jet kerosene   | 71500  | 0.5 | 2   | Table 3.6.4 and 3.6.5, Chap. 3, Vol. 2, 2006 IPCC GL                                                                                                                                                      |
| Maritime       |        |     |     |                                                                                                                                                                                                           |
| HFO            | 77 400 | 7   | 2   | Table 3.5.2 and 3.5.3; chap. 3, Vol. 2., 2006 IPCC GL.                                                                                                                                                    |
| MDO            | 74 100 | 7   | 2   |                                                                                                                                                                                                           |
| LNG            | 56 100 | 7   | 2   |                                                                                                                                                                                                           |

The activity data used consists in the following bottom-up data:

- Road transport:
  - collected from QatarEnergy;
  - Consumption of CNG was provided in MMBTU; data was converted to kt using a NCV value of 0.0523 MMBTU/kg
  - Consumption of gasoline and diesel was provided in kt (Table 2-12);

Data was then converted to TJ using default IPCC Net Calorific Value (NCV). It should be noted that fuel consumption is not differentiated by vehicle type but rather by fuel type (gasoline or gas/diesel oil), resulting in an aggregate figure that encompasses cars, buses, trucks, taxis, and two-wheeled vehicles.

Table 2-12: Fuel consumption in the road transport sector

|               | 2019   | 2020   | 2021   | 2022    | 2023   |
|---------------|--------|--------|--------|---------|--------|
| Total (kt)    |        |        |        |         |        |
| Gasoline      | 1,873  | 1,733  | 1,885  | 1,773   | 2,097  |
| Diesel        | 2,053  | 1,910  | 1,994  | 1,915   | 1,635  |
| Total (MMBTU) |        |        |        |         |        |
| CNG           | 99,108 | 54 207 | 78,649 | 123,880 | 82,167 |

- Domestic aviation: data provided by Gulf Helicopters, Qatar Airways and Qatar Executive. Only these three entities operate domestic trips within the country. Jet kerosene consumption is provided by aircraft type and in kg. Conversion to TJ was made using 2006 IPCC default NCV value of 44.1 TJ/Gg (Table 1.2, chap.2, Vol 2):

Table 2-13: Fuel consumption in the domestic aviation sector (in kg and TJ)

|                     | 2019      | 2020    | 2021      | 2022      | 2023      |
|---------------------|-----------|---------|-----------|-----------|-----------|
| Fuel consumed in kg |           |         |           |           |           |
| Qatar Airways       | 1 017 695 | 734 341 | 3 284 480 | 1 245 975 | 5 057 275 |
| Qatar Executive     | 176 314   | 271 708 | 160 461   | 83 624    | 62 828    |

|                     |           |           |           |           |           |
|---------------------|-----------|-----------|-----------|-----------|-----------|
| Gulf Helicopters    | 6 542 506 | 4 363 313 | 5 778 271 | 7 716 139 | 9 184 392 |
| Fuel consumed in TJ |           |           |           |           |           |
| Qatar Airways       | 45        | 32        | 145       | 55        | 223       |
| Qatar Executive     | 7.78      | 11.98     | 7.08      | 3.69      | 2.77      |
| Gulf Helicopters    | 289       | 192       | 255       | 340       | 405       |
| Total               | 341       | 237       | 407       | 399       | 631       |

- Water-borne navigation: fuel consumption of Very Low Sulphur Heavy Fuel Oil (VLSHFO), Marine Diesel Oil / Marine Gas Oil (MDO/MGO, and Liquefied Natural Gas (LNG) is provided by Nakilat, Qatar Gas Transport Company. Data reported in tons are converted to terajoules using default IPCC NCV values:

Table 2-14: Default NCV values of maritime fuels (in TJ/Gg)

| VLSHFO | MDO/MGO | LNG |
|--------|---------|-----|
| 40.4   | 43      | 48  |

Table 2-15: Fuel consumption in the domestic navigation sector (in tons and TJ)

|                       | 2019   | 2020    | 2021    | 2022   | 2023    |
|-----------------------|--------|---------|---------|--------|---------|
| Fuel consumed in tons |        |         |         |        |         |
| VLSHFO                | 88 199 | 127 114 | 118 646 | 96 380 | 107 290 |
| MDO/MGO               | 8 543  | 8 148   | 7 578   | 8 586  | 10 293  |
| LNG                   | 6 088  | 8 832   | 7 480   | 10 855 | 14 739  |
| Fuel consumed in TJ   |        |         |         |        |         |
| VLSHFO                | 3 563  | 5 135   | 4 793   | 3 894  | 4 335   |
| MDO/MGO               | 367    | 350     | 326     | 369    | 443     |
| LNG                   | 292    | 424     | 359     | 521    | 707     |
| Total                 | 4 223  | 5 910   | 5 478   | 4 784  | 5 485   |

#### 2.3.2.6.3 Uncertainty assessment and time-series consistency

A general discussion on uncertainty in the Energy sector is presented in previous section.

#### 2.3.2.6.4 Category-specific recalculations

As this is Qatar's first BTR, no recalculations are included. Recalculations will be undertaken and evaluated in the next reporting cycle.

#### 2.3.2.6.5 Category-specific planned improvements

##### Road transport:

- Specify the carbon content of the fuels to determine a country-specific CO<sub>2</sub> emission factor and apply Tier 2 methodology for CO<sub>2</sub> emissions estimation.
- For the reporting year, only total road transport fuel consumption and the distribution of vehicle types within the fleet were available; this information is insufficient to reliably estimate emissions by vehicle category. Future submissions would benefit from the collection of fuel

consumption or activity data disaggregated by vehicle type, enabling more accurate estimation and the application of higher-tier methodologies.

Domestic aviation:

- Apply Tier 2 methodology using Landing and Take-Off (LTO) data collected for Qatar Airways and Qatar Executive.

Domestic navigation:

- Specify the carbon content of the fuels to determine a country-specific CO<sub>2</sub> emission factor and apply T2 methodology for CO<sub>2</sub> emissions estimation.

#### 2.3.2.7 Other sectors (CRT 1A4)

##### *2.3.2.7.1 Category description (e.g. characteristics of sources)*

This category generally covers the emission from combustion of fuel for other activities, including:

- Commercial and institutional activities (CRT 1A4a),
- Residential (CRT 1A4b),
- Agriculture, forestry and fishing (CRT 1A4c).

However, in Qatar, the energy requirements of commercial and residential sectors only constitute electricity. Therefore, no direct emissions are occurring (NO) for these categories. For the agriculture and fishing sectors, fuel consumption data was not available and is estimated to be negligible, consequently the corresponding category 1A4c is reported as Not Estimated (NE).

##### *2.3.2.7.2 Methodological issues*

NA

##### *2.3.2.7.3 Uncertainty assessment and time-series consistency*

NA

##### *2.3.2.7.4 Category-specific recalculations*

NA

##### *2.3.2.7.5 Category-specific planned improvement*

Future BTRs may consider reviewing fuel consumption in the agriculture and fishing sectors. However, as this category is expected to not be significant, it could be addressed at a later stage.

#### *2.3.3 Fugitive emissions from solid fuels and oil and natural gas and other emissions from energy production (CRT 1.B)*

##### *2.3.3.1 Category description*

The intentional or unintentional release of greenhouse gases can occur during the extraction, processing, and delivery of fossil fuels to their point of final use. These releases are known as fugitive emissions.

In Qatar, fugitive emissions are associated with:

- Oil systems (CRT 1B2a): including oil production, upgrading, and transport

- Natural gas systems (CRT 1B2b): encompassing natural gas production, processing, transmission, storage, and distribution
- Venting and flaring of Oil and Gas systems (CRT 1B2c): including the emissions from venting and flaring of associated gas and waste gas/vapor streams at oil and gas facilities

Over the period 2019-2023, fugitive emissions contributed around a little less than 3% of the total national GHG emissions, and it contributed around 3% of the Energy category (CRT 1) in Qatar.

Emissions are almost entirely attributable to venting and flaring in the oil and gas sector, which accounts for more than 99% of total fugitive emissions. Leaks during natural gas production contribute around 0.5%, while leaks associated with oil production make up the remaining share (Figure 2-11).

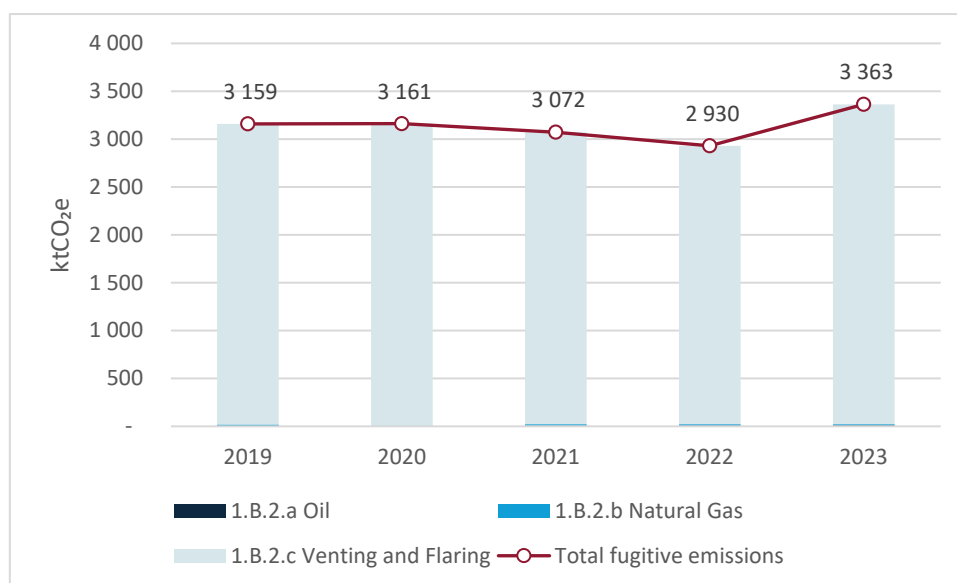


Figure 2-11: Emissions of fugitive emissions according to the source (in ktCO<sub>2</sub>e)

#### 2.3.3.2 Methodological issues

Activity data for this sector are considered commercially sensitive and confidential; therefore, only final emission estimates are provided.

However, an independent, accredited third-party assurance provider is appointed to conduct annual verification of emissions for assets in the Energy Industries sector.

#### 2.3.3.3 Uncertainty assessment and time-series consistency

A general discussion on uncertainty in the Energy sector is presented earlier.

#### 2.3.3.4 Category-specific recalculations

As this is Qatar's first BTR, no recalculations are included. Recalculations will be undertaken and evaluated in the next reporting cycle.

#### 2.3.3.5 Category-specific planned improvements

Future submissions will aim to improve the collection of supporting documentation, including underlying type of emission factors used and methodology applied, to enhance the transparency, reproducibility, and consistency of the inventory.

### 2.3.4 CO<sub>2</sub> Transport and Storage (CRT 1.C)

#### 2.3.4.1 Category description

Carbon dioxide capture and storage (CCS) is one of the mitigation measures available to reduce GHG emissions associated with the production and use of fossil fuels. According to the IPCC Guidelines, the CO<sub>2</sub> capture and geological storage chain consists of four main systems: capture and compression, transport, injection, and storage. The injection system includes surface and subsurface facilities at the injection site, such as distribution manifolds, pipelines to injection wells, compression, measurement and control systems, and the injection wells themselves. The storage system comprises the geological storage reservoir where CO<sub>2</sub> is permanently stored.

In Qatar, CCS activities are being undertaken to capture and permanently store a proportion of CO<sub>2</sub> emissions from Energy Industries sector.

#### 2.3.4.2 Methodological issues

The amount of CO<sub>2</sub> injected and subsequently stored is provided as part of data collection. CO<sub>2</sub> emissions from capture, transport, and storage activities are included under Category 1.A.1.

However, an independent, accredited third-party assurance provider is appointed to conduct annual verification of emissions for assets in the Energy Industries sector.

#### 2.3.4.3 Uncertainty assessment and time-series consistency

A general discussion on uncertainty in the Energy sector is presented earlier.

#### 2.3.4.4 Category-specific recalculations

As this is Qatar's first BTR, no recalculations are included. Recalculations will be undertaken and evaluated in the next reporting cycle.

#### 2.3.4.5 Category-specific planned improvements

Future submissions will aim to improve the collection of supporting documentation to enhance the transparency, reproducibility, and consistency of the inventory.

## 2.4 Industrial processes and product use (CRT sector 2)

### 2.4.1 Overview of the sector (e.g. quantitative overview and description, including trends and methodological tiers by category) and background information

This CRT 2 category covers all the industrial activities where the industrial process can imply GHG emissions which do not result from the combustion of fuels, as well as the use of industrial products such as lubricants, fluorinated gases and others.

In Qatar, the following sectors were estimated:

- Mineral industry (2A), including cement (2A1) and lime productions (2A2),
- Chemical industry (2B), including ammonia and urea production (2B1), as well as petrochemicals production (notably methanol, ethylene, ethylene dichloride and vinyl chloride monomer) (2B8),
- Metal industry (2C), including iron and steel (2C1) as well as aluminum (2C3) production.

Emissions in other industries are not occurring in the country; except for the use of:

- Non-energy products from fuels and solvent use, for which emissions were not estimated (NE)
- Product uses as substitutes for ODS (2F), where flexibility was applied (FX) and thus the emissions related to this category were not estimated.

### Methodologies

For industry-related activities for which emission estimates are used, the EU MRR methodology was applied to estimate CO<sub>2</sub> emissions, while the IPCC 2006 Guidelines were used to estimate CH<sub>4</sub> and N<sub>2</sub>O emissions from the same activities.

A mix of Tier 1/Tier 2 methodology from the 2006 IPCC Guidelines was applied to the cement and lime categories for which activity data were available.

### Trends

The CRT 2 IPPU sector contributed between 7.3% and 8.6% of total national GHG emissions over the period 2019-2023 period.

Within the CRT 2 IPPU sector, the chemical industry (2.B) had the highest proportion of the sector's emissions over the period 2019-2023, contributing between 49% and 72% of total IPPU emissions. The mineral industry (2.A) was the second-largest contributor, accounting for approximately 14 to 38% of total IPPU emissions. Emissions from this category declined sharply from 3,808 ktCO<sub>2</sub>e in 2019 to 1,155 ktCO<sub>2</sub>e in 2021 (a 70% decrease), likely reflecting the impacts of the COVID-19 pandemic, before recovering to 3,054 ktCO<sub>2</sub>e in 2023. The metal industry (2.C) contributed a smaller share, ranging from 12% to 14%, with relatively stable emissions around 1,200 ktCO<sub>2</sub>e throughout the period. (Figure 2-12).

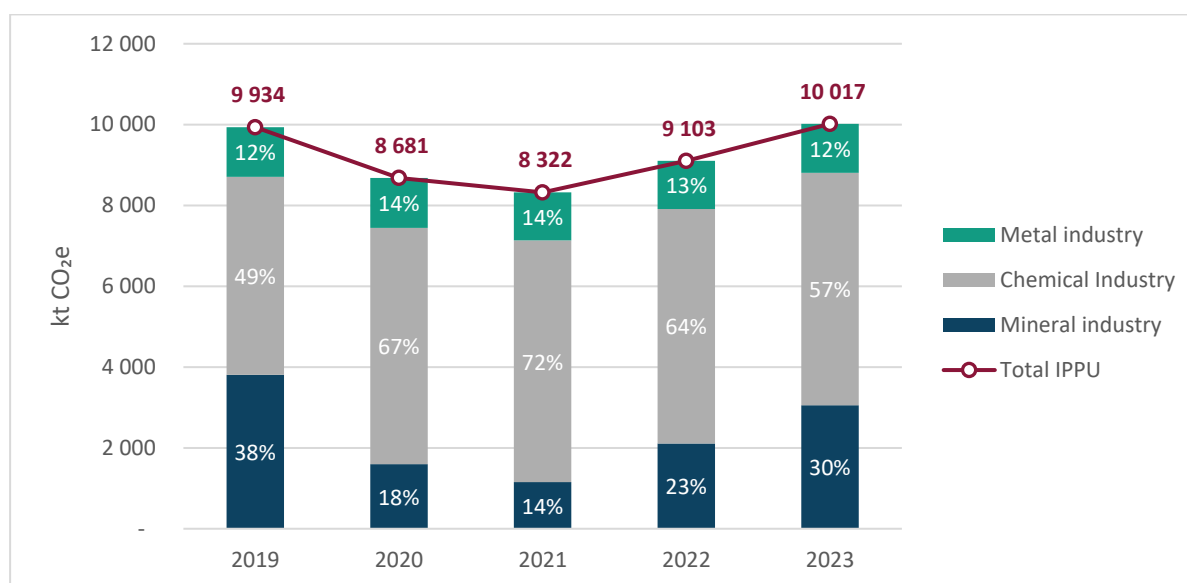


Figure 2-12: Emissions of the IPPU sector per sub-category (in ktCO<sub>2</sub>e)

## 2.4.2 Mineral industry (CRT 2A)

### 2.4.2.1 Category description

Mineral industry represented between 1 to 3.2% of national GHG emissions during the 2019-2023 period.

GHG emissions from the mineral industries (only CO<sub>2</sub>) are dominated by the cement industry, which contributes to around 98% of the sector's total during the 2019-2023 period (Figure 2-13). The remaining emissions come from the lime industry.

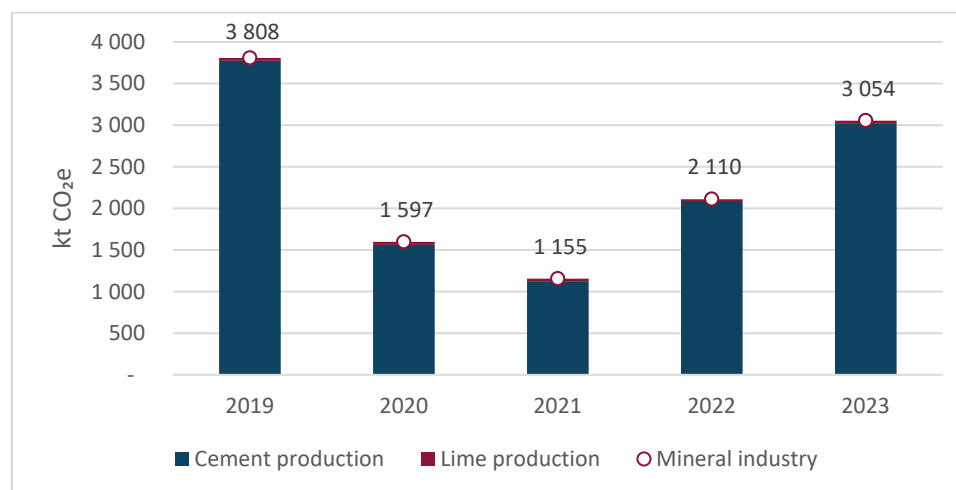


Figure 2-13: Mineral industry emissions, 2019-2023 (in ktCO<sub>2</sub>e)

#### 2.4.2.2 Methodological issues

**Cement production:** Emissions from cement and lime production were estimated using the Tier 2 methodology in accordance with the 2006 IPCC Guidelines. In the absence of country-specific parameters, the default CO<sub>2</sub> emission factor for clinker production provided in the Guidelines was applied (0.52 t CO<sub>2</sub> per ton of clinker).

Both Qatar National Cement Company and Al Khalij Cement company produce clinker, and activity data is available:

Table 2-16: Qatar clinker production, 2019-2023 (in tons)

|                               | 2019      | 2020      | 2021      | 2022      | 2023      |
|-------------------------------|-----------|-----------|-----------|-----------|-----------|
| Mass clinker in ton           |           |           |           |           |           |
| Al Khalij Cement Company      | 3 223 809 | 848 493   | 657 649   | 2 216 917 | 2 621 923 |
| Qatar National Cement Company | 4 032 728 | 2 153 028 | 1 491 038 | 1 775 336 | 3 178 655 |
| Total                         | 7 256 537 | 3 001 521 | 2 148 687 | 3 992 253 | 5 800 578 |

**Lime production:** The 2006 IPCC guidelines Tier 1 approach was used to estimate emissions from lime production, along with the CO<sub>2</sub> default emission factor for lime production of 0.75 t CO<sub>2</sub>/t lime produced (corresponding to “all lime production”).

Only Qatar National Cement Company produces lime. The corresponding activity data is presented in the Table 2-17.

Table 2-17: Qatar lime production, 2019-2023 (in tons)

|             | 2019 | 2020 | 2021 | 2022 | 2023 |
|-------------|------|------|------|------|------|
| Lime in ton |      |      |      |      |      |

|                               |        |        |        |        |        |
|-------------------------------|--------|--------|--------|--------|--------|
| Qatar National Cement Company | 45 602 | 48 307 | 49 896 | 45 897 | 50 654 |
|-------------------------------|--------|--------|--------|--------|--------|

#### 2.4.2.3 Uncertainty assessment and time-series consistency

A general discussion on uncertainty in the IPPU sector is presented within section 1 of this chapter.

#### 2.4.2.4 Category-specific recalculations

As this is Qatar's first BTR, no recalculations are included. Recalculations will be undertaken and evaluated in the next reporting cycle.

#### 2.4.2.5 Category-specific planned improvements

Improvements for future submissions include:

- Related to cement production: collect data regarding the CaO composition of the clinker to refine the emissions factor to be used.
- Related to lime production: collect information regarding the type of lime produced, in order to refine the emissions factor to be used and increase the accuracy of the estimates.

### 2.4.3 Chemical industry (CRT 2B)

#### 2.4.3.1 Category description

In Qatar, reported chemical activities include ammonia production, primarily used for urea fertilizer production, and petrochemical manufacturing including methanol, ethylene, and various other petrochemicals and derivatives.

Ammonia is produced through catalytic steam reforming of natural gas to produce hydrogen, which is combined with nitrogen to produce ammonia (NH<sub>3</sub>). CO<sub>2</sub> emissions are generated during this process and are either vented to the atmosphere or used as feedstock for downstream applications, such as urea production. The CO<sub>2</sub> emissions used for urea production are not included in this category but are allocated to the category in which the urea is ultimately consumed (Agriculture sector, CRT 3H).

Petrochemical production uses primary fossil fuels as feedstocks for non-energy purposes, which may result in CO<sub>2</sub> emissions from both process-related activities and the combustion of feedstock-derived fuels. In line with the IPCC Guidelines, emissions from fuels used within the petrochemical process are to be reported under the IPPU sector, while emissions from fuels transferred for combustion outside the process are to be allocated to the appropriate Energy Sector categories. Over the period, the chemical industry accounted for between 49 to 72% of GHG emissions from Industrial Processes and Product Use and around 5% of total national GHG emissions.

Emissions from the chemical industry increased by approximately 22% between 2019 and 2021.(Figure 2-14).

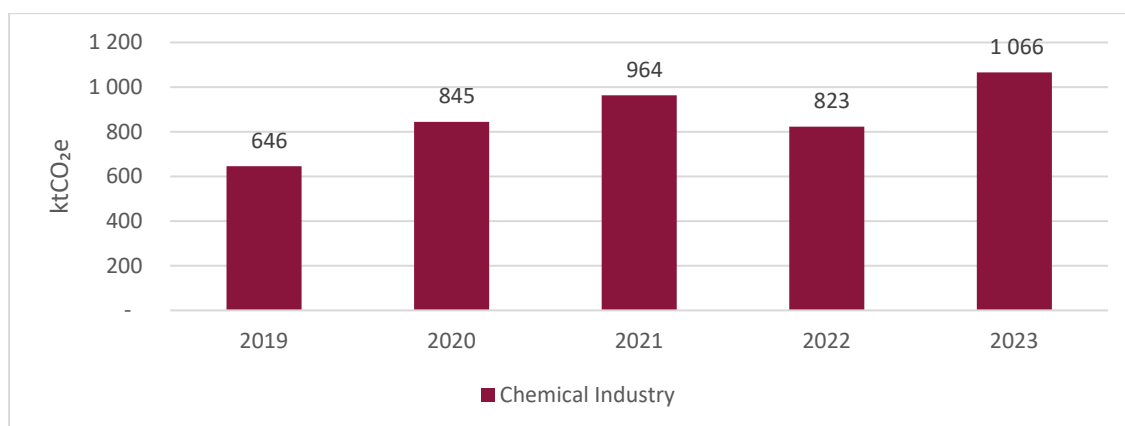


Figure 2-14: Chemical industry emissions, 2019-2023 (in ktCO<sub>2</sub>e)

#### 2.4.3.2 Methodological issues

Activity data for petrochemical production are considered commercially sensitive and confidential, while activity data for ammonia production and final emission estimates for these two sources are provided by QatarEnergy.

However, an independent, accredited third-party assurance provider is appointed to conduct annual verification of emissions for assets in the Energy Industries sector.

Table 2-18: Qatar ammonia production, 2019-2023 (in thousand tons)

|                         | 2019  | 2020  | 2021  | 2022  | 2023  |
|-------------------------|-------|-------|-------|-------|-------|
| Ammonia production (kt) | 3 771 | 3 786 | 3 769 | 3 786 | 3 720 |

#### 2.4.3.3 Uncertainty assessment and time-series consistency

A general discussion on uncertainty in the IPPU sector was presented earlier.

#### 2.4.3.4 Category-specific recalculations

As this is Qatar's first BTR, no recalculations are included. Recalculations will be undertaken and evaluated in the next reporting cycle.

#### 2.4.3.5 Category-specific planned improvements

Future submissions will aim to improve the collection of supporting documentation, including underlying type of emission factors used and methodology apply, to enhance the transparency, reproducibility, and consistency of the inventory.

### 2.4.4 Metal industry (CRT 2C)

#### 2.4.4.1 Category description

In Qatar, the metal industry category includes the production of iron and steel as well as aluminum.

This sector accounted for around 1% of national GHG emissions. Within the IPPU sector, the metal industry (2.C) was the third-largest contributor, representing approximately 12 to 14% of total IPPU emissions, with emissions remaining relatively stable at around 1,200 ktCO<sub>2</sub>e throughout the period.

GHG emissions from the Metal industries (including mainly CO<sub>2</sub>, and very few CH<sub>4</sub>) are dominated by the aluminum industry, which contributes to around 87% of the sector's total during the 2019-2023 period. The remaining emissions come from the iron and steel industry (Figure 2-15).

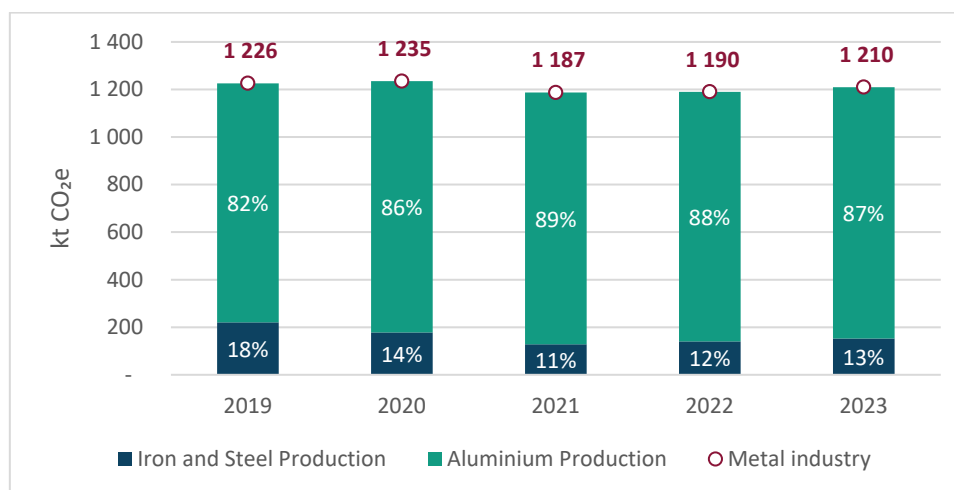


Figure 2-15: Metal industry emissions, 2019-2023 (in ktCO<sub>2</sub>e)

#### 2.4.4.2 Methodological issues

Activity data for iron and steel production is considered commercially sensitive and confidential, while activity data for aluminum production and final emission estimates for both categories.

However, an independent, accredited third-party assurance provider is appointed to conduct annual verification of emissions for assets in the Energy Industries sector.

|                           | 2019 | 2020 | 2021 | 2022 | 2023 |
|---------------------------|------|------|------|------|------|
| Aluminium production (kt) | 653  | 655  | 662  | 666  | 677  |

#### 2.4.4.3 Uncertainty assessment and time-series consistency

A general discussion on uncertainty in the IPPU sector is presented in previous section.

#### 2.4.4.4 Category-specific recalculations

As this is Qatar's first BTR, no recalculations are included. Recalculations will be undertaken and evaluated in the next reporting cycle.

#### 2.4.4.5 Category-specific planned improvements

Future submissions will aim to improve the collection of supporting documentation, including underlying type of emission factors used and methodology apply, to enhance the transparency, reproducibility, and consistency of the inventory.

## 2.5 Agriculture (CRT sector 3)

### 2.5.1 Overview of the sector and background information

The Agriculture sector gathers all emissions related to agricultural activities other than the fuel combustion for the mobile engines, the heating of the buildings, the heating of greenhouses, etc.,

which are included in the CRT category 1A4c. In addition, CO<sub>2</sub> emissions related to the carbon from soils and biomass related to agricultural activities are included in the LULUCF sector (CRT 4) but no emissions are currently reported for this sector.

Agriculture - CRT 3 covers the following sectors:

- 3.A. Enteric fermentation
- 3.B. Manure management
- 3.C. Rice cultivation
- 3.D. Agricultural soils
- 3.E. Prescribed burning of savannahs
- 3.F. Field burning of agricultural residues
- 3.G. Liming
- 3.H. Urea application
- 3.I. Other carbon-containing fertilizers
- 3.J. Other

The activities of Rice cultivation (3.C), Prescribed burning of savannas (3.E), Field burning of agricultural residues (3.F) and Liming (3.G) do not occur in Qatar. The emissions of other carbon-containing fertilizers (3.I) are not estimated (NE), due to a lack of available activity data.

Tier 1 methodologies were applied to all categories in the agriculture sector. This decision was driven by the limited availability of data and the short time frame, which made it difficult to collect sufficient data for reporting at a higher tier level.

In 2023, the CRT 3 category accounted for 0.5% of the national total GHG emissions.

The agriculture sector is an important emission source of methane and nitrous oxide. However, it is almost negligible in terms of carbon dioxide, with only the application of urea (CRT 3.H) being an emission source of this GHG.

Figure 2-16 presents the overall GHG emission trend for the agriculture sector in Qatar, from 2019 to 2023, detailed by subsector. Emissions are dominated by the enteric fermentation and N<sub>2</sub>O from agricultural soils.

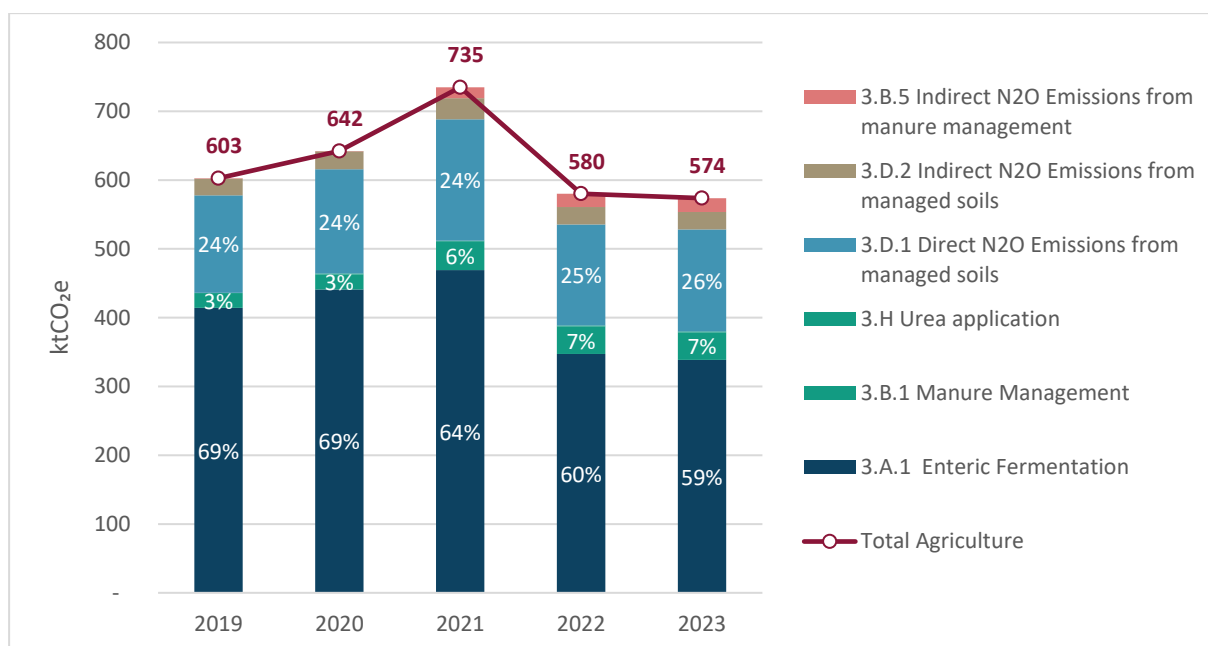


Figure 2-16: Emissions of the Agriculture sector (in ktCO<sub>2</sub>e)

## 2.5.2 Enteric fermentation (CRT 3A)

### 2.5.2.1 Category description

The enteric fermentation category covers the emissions of methane (CH<sub>4</sub>) from the different animal species – cattle, sheep, goats, camels and horses. There is no enteric fermentation accounted for in the IPCC Guidelines for poultry.

Among the enteric fermentation, the camel category is the main source of emissions, representing around 40% of the sector emissions between 2019 and 2023, followed by the sheep category representing around 34% of the category. Goats account for 15% of enteric fermentation, while cattle represent 10% of the sector. Here, the cattle category is constituted only by the “other cattle” category (i.e. non-dairy cows). The trend and distribution among categories is presented in Figure 2-17.

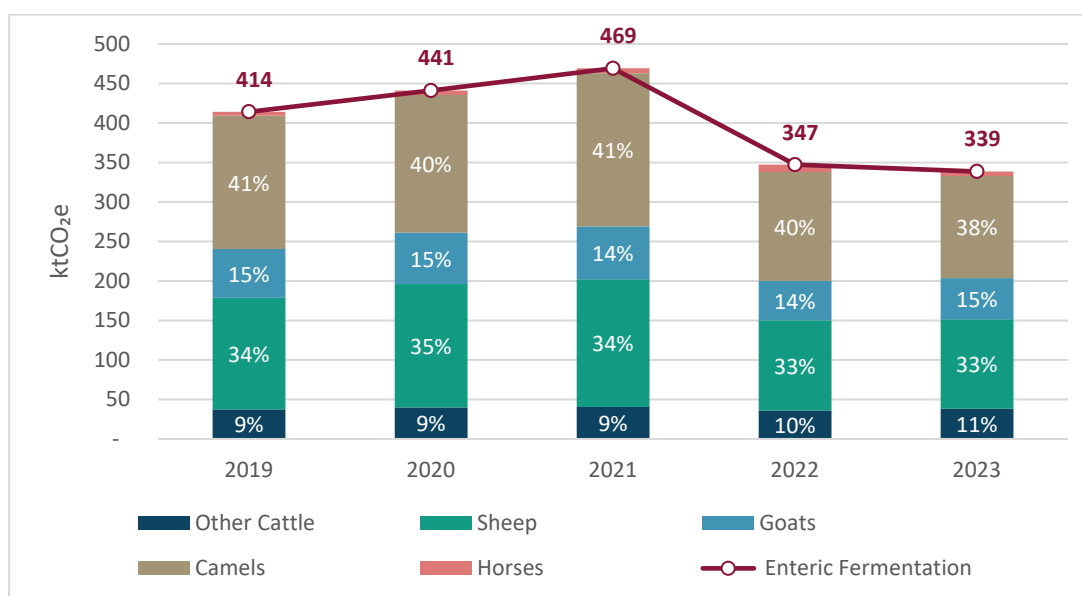


Figure 2-17: CO<sub>2</sub>e emissions from enteric fermentation (in ktCO<sub>2</sub>e)

The main decrease observed is encountered for camels, explained by the decreasing livestock population over time.

Enteric fermentation (CRT 3A) has decreased its contribution to the total and sectoral GHG emissions. This category accounts for less than 0.5% of the total national GHG emissions between 2019 and 2023. Concerning its share in the agriculture sector (CRT 3), in Qatar, it is of 69% in 2019, and 61% in 2023.

2.5.2.2 Methodological issues

Emissions of CH<sub>4</sub> from enteric fermentation are calculated with a Tier 1 approach which is in line with the 2006 IPCC Guidelines.

Activity data used are the annual livestock (average population in heads), for each subcategory. These activity data for the entire time series are provided by the Economic Statistics System of the State of Qatar (Figure 2-18 and Figure 2-19).

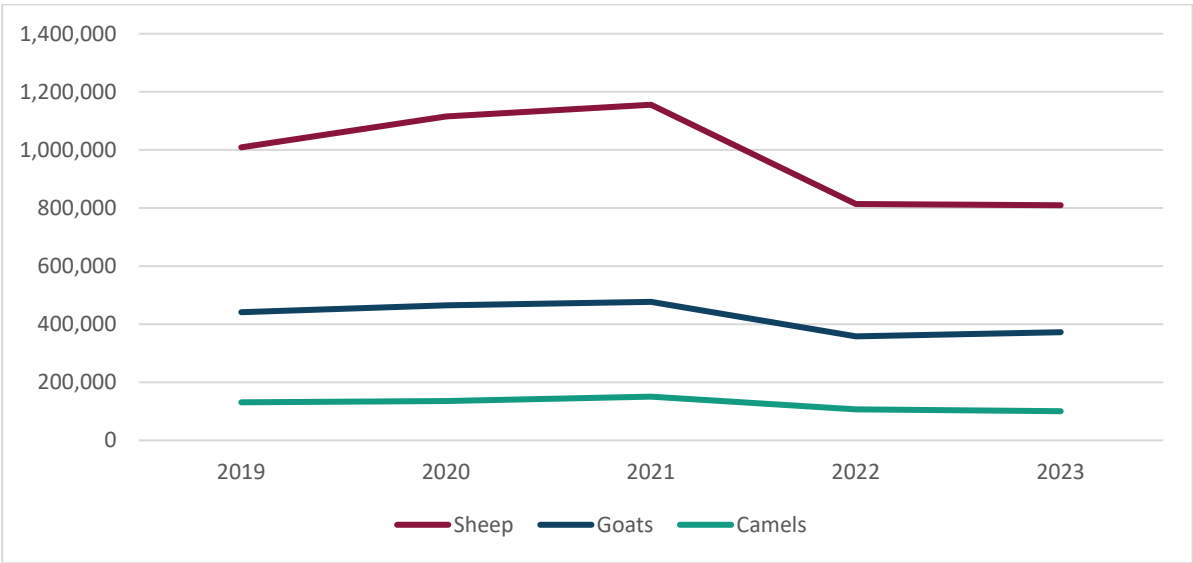


Figure 2-18: Annual average population (heads) – Sheep, Goat, Camels

Sheep population is strongly decreasing between 2021 and 2022 (-30%).

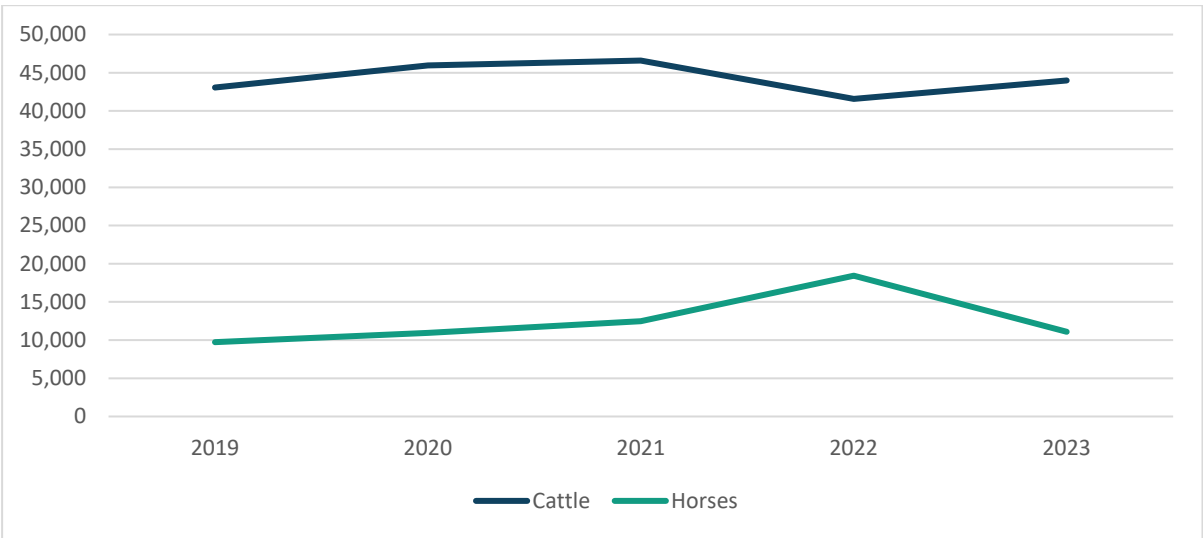


Figure 2-19 : Annual average population (heads) – Cattle and Horses

Emission factors used for calculating CH<sub>4</sub> emissions from enteric fermentation are taken from the 2006 IPCC guidelines. They are of:

- 31 kg CH<sub>4</sub>/head/year for other cattle (Africa and Middle East)
- 5 kg CH<sub>4</sub>/head/year for sheep and goats (Developing countries)
- 46 kg CH<sub>4</sub>/head/year for camels (Developing countries)
- 18 kg CH<sub>4</sub>/head/year for horses (Developing countries)

#### 2.5.2.3 Uncertainty assessment and time-series consistency

A general discussion on uncertainty in the agriculture sector was presented earlier.

#### 2.5.2.4 Category-specific recalculations

As this is Qatar's first BTR, no recalculations are included. Recalculations will be undertaken and evaluated in the next reporting cycle.

#### 2.5.2.5 Category-specific planned improvements

To improve the estimates from enteric fermentation, efforts could be made starting with the most emitting categories in the current estimates (camels and sheep). The improvement suggested consists in moving to an upper Tier method, which would be a Tier 2 method for sheep (no Tier 2 method available for camels). The implementation of a Tier 2 method requires the collection of numerous data complementary to those necessary for the Tier 1 method (weight, feeding situation, milk production, wool growth, ...).

### 2.5.3 Manure management (CRT 3B)

#### 2.5.3.1 Category description

The manure management category covers the emissions of CH<sub>4</sub> (CRT 3B1) and N<sub>2</sub>O (CRT 3B2) from the different livestock – cattle, sheep, goats, camels, horses and poultry. Cattle are considered non-dairy cattle. For poultry, they are considered broilers.

Figure 2-20 describes the evolution of the emissions of GHG in equivalent CO<sub>2</sub>, with details given by animal categories for all the emissions, except for indirect N<sub>2</sub>O emissions that are reported with all the animal categories aggregated.

Poultry has become the largest contributor from 2021, due to a very strong increase in livestock population (multiplied by 40 between 2020 and 2021). The following main contributors are camels and sheep, both presenting a decreasing trend as the livestock population is decreasing.

Manure management (CRT 3B) contributed to 3% of the agriculture sector in 2019 and 7% in 2023. This increasing trend is mainly due to the poultry contribution.

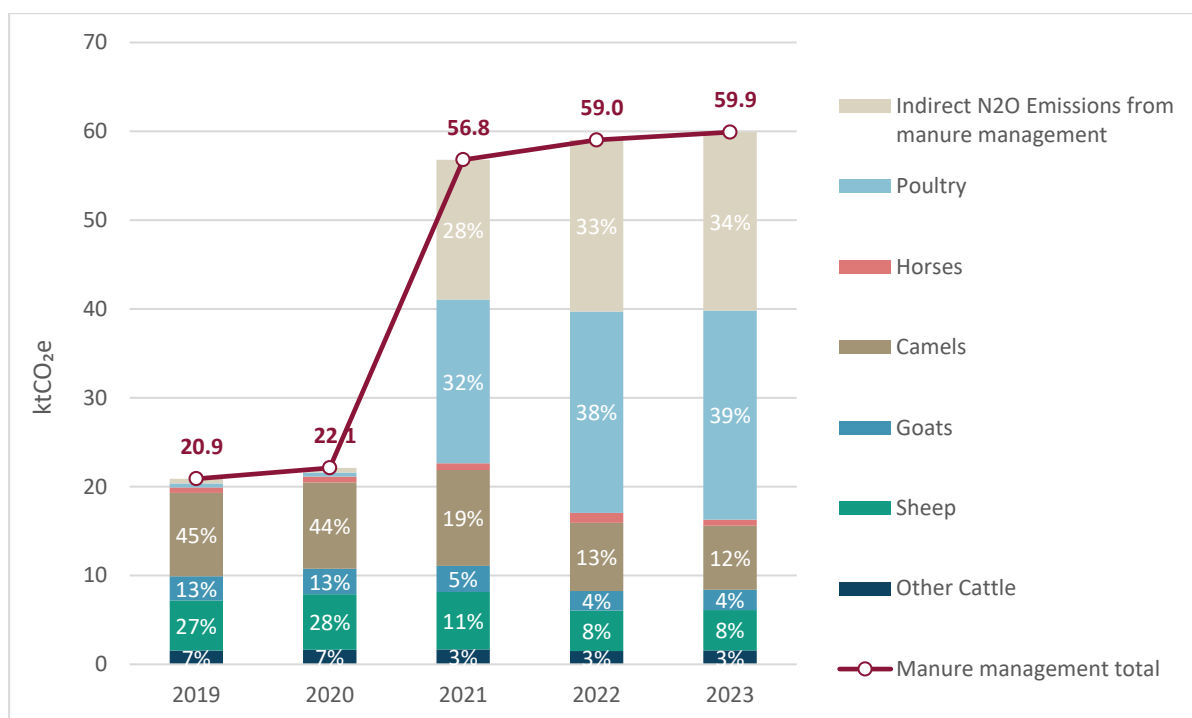


Figure 2-20: CO<sub>2</sub>e emissions from manure management (in ktCO<sub>2</sub>e)

### 2.5.3.2 Methodological issues

#### CH<sub>4</sub> emissions:

Emissions of CH<sub>4</sub> from manure management are calculated with a Tier 1 approach which is in line with the 2006 IPCC Guidelines.

Activity data used are the annual livestock (average population in heads), for each subcategory. These activity data for the entire time series are provided by the Economic Statistics System of the State of Qatar and are presented in the previous section (enteric fermentation), except for poultry population presented below (Figure 2-21)

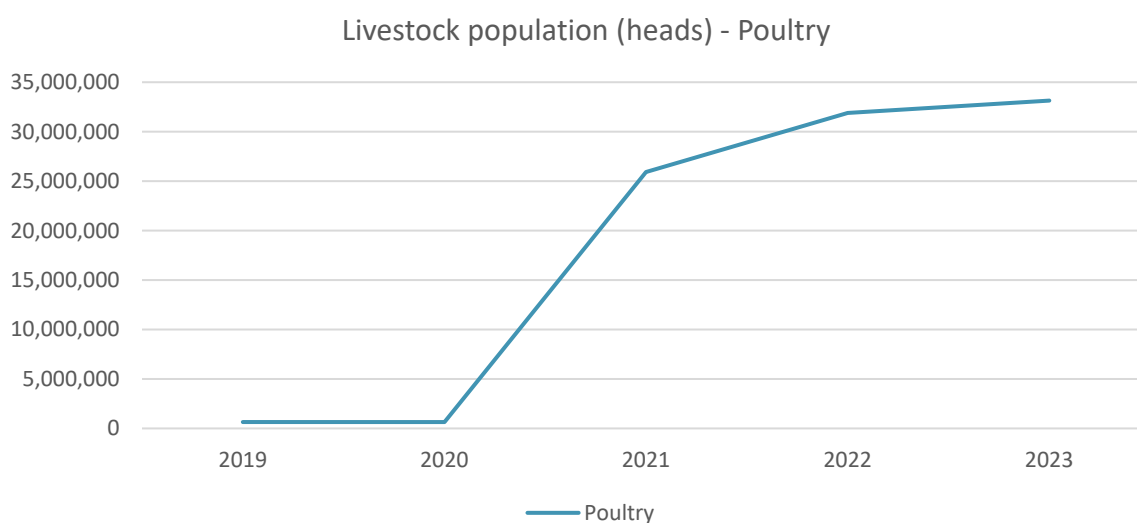


Figure 2-21: Annual average population (heads) – Poultry

The emission factors used are provided by the 2006 IPCC Guidelines. Depending on the category, the values retained are the ones for Middle East (warm climate) or developing countries (warm climate):

Table 2-19: Emission Factor (CH<sub>4</sub>/head)

| Category     | Emission factor (CH <sub>4</sub> /head) | Regional characteristics |
|--------------|-----------------------------------------|--------------------------|
| Other cattle | 1                                       | Middle East              |
| Sheep        | 0.20                                    | Developing countries     |
| Goats        | 0.22                                    | Developing countries     |
| Camels       | 2.56                                    | Developing countries     |
| Horses       | 2.19                                    | Developing countries     |
| Poultry      | 0.02                                    | Developing countries     |

#### N<sub>2</sub>O emissions:

Direct nitrous oxide emissions from manure management are subdivided by type of livestock (cattle, sheep, goats, camels, horses and poultry). There is an additional CRT category (3B2.5) in which indirect N<sub>2</sub>O emissions from volatilization and leaching are reported, aggregating all the animal categories. The Tier 1 methodology is implemented. According to the Tier 1 methodology, indirect N<sub>2</sub>O emissions from leaching and runoff from manure management are not estimated, in accordance with IPCC guidelines. Only indirect N<sub>2</sub>O emissions from volatilization are accounted for.

To calculate N<sub>2</sub>O emissions, the first step is to estimate the N excreted per animal category. To do so, the calculation suggested in the 2006 IPCC Guidelines is applied, based on a default N rate (provided in the 2006 IPCC Guidelines – values taken from Middle East) and the average weight per animal (provided in the 2006 IPCC Guidelines).

The following weights have been considered:

Table 2-20: Average weight (kg/head)

| Category     | Average weight (kg/head) | Regional characteristics          |
|--------------|--------------------------|-----------------------------------|
| Other cattle | 325                      | Asia / Mature females / Stall fed |
| Sheep        | 28                       | Developing countries              |
| Goats        | 30                       | Developing countries              |
| Camels       | 217                      | Developing countries              |
| Horses       | 238                      | Developing countries              |
| Poultry      | 0.9                      | Developed countries - Broilers    |

The following N rates have been considered:

Table 2-21: N rate (kg N/1000 kg animal mass/day)

| Category     | N rate (kg N/1000 kg animal mass/day) | Regional characteristics |
|--------------|---------------------------------------|--------------------------|
| Other cattle | 0.79                                  | Middle East              |
| Sheep        | 1.17                                  | Middle East              |
| Goats        | 1.37                                  | Middle East              |
| Camels       | 0.46                                  | Middle East              |
| Horses       | 0.46                                  | Middle East              |

|         |     |                        |
|---------|-----|------------------------|
| Poultry | 1.1 | Middle East - Broilers |
|---------|-----|------------------------|

Direct N<sub>2</sub>O emissions from manure management are estimated using a Tier 1 methodology. N<sub>2</sub>O emission factors from the 2006 IPCC Guidelines are provided by manure management system. The following distribution has been considered for Qatar, based on default values from the IPCC Guidelines (Other Cattle - Middle East) and assumptions. Some adjustments have been suggested and indicated in Table 2-22.

Table 2-22 : Animal distribution per manure management system

| Livestock    | Dry lot | Pasture range | Daily spread | Digester | Poultry manure with litter | Comments                                                                  |
|--------------|---------|---------------|--------------|----------|----------------------------|---------------------------------------------------------------------------|
| Other cattle | 1.0%    | 96.0%         | 2.0%         | 1%       | 0%                         | "Other" attributed to Digester<br>"Burned for fuel" attributed to pasture |
| Sheep        |         | 100%          |              |          |                            | hypothesis 100% pasture                                                   |
| Goats        |         | 100%          |              |          |                            | hypothesis 100% pasture                                                   |
| Camels       |         | 100%          |              |          |                            | hypothesis 100% pasture                                                   |
| Horses       |         | 100%          |              |          |                            | hypothesis 100% pasture                                                   |
| Poultry      |         |               |              |          | 100%                       | hypothesis 100% poultry with litter                                       |

The direct N<sub>2</sub>O emissions factors provided by the 2006 IPCC are as follow:

- Dry lot: 0.02 kg N<sub>2</sub>O/kg N
- Pasture range: accounted for in 3D
- Daily spread: 0 kg N<sub>2</sub>O/kg N
- Anaerobic digester: 0 kg N<sub>2</sub>O/kg N
- Poultry manure with litter: 0.001 kg N<sub>2</sub>O/kg N.

Manure management distribution and associated emissions factors being stable though time, emissions for the different animal categories are directly proportional to livestock numbers and vary according to their trends.

Indirect N<sub>2</sub>O emissions from manure management are estimated using a Tier 1 methodology. Values for the parameters are taken from the 2006 IPCC Guidelines and are as follow:

- Dry lot: 20%
- Pasture range: accounted for in 3D
- Daily spread: 7%
- Anaerobic digester: 40% (*assumption based on liquid manure from dairy cows*)
- Poultry manure with litter: 40%

The emission factor used is taken from the 2006 IPCC Guidelines (EF4 = 0.01 kg N-N<sub>2</sub>O/kg N volatilized).

#### 2.5.3.3 Uncertainty assessment and time-series consistency

A general discussion on uncertainty in the agriculture sector was presented earlier.

#### 2.5.3.4 Category-specific recalculations

As this is Qatar's first BTR, no recalculations are included. Recalculations will be undertaken and evaluated in the next reporting cycle.

#### 2.5.3.5 Category-specific planned improvements

To improve the estimates from manure management, efforts could be made starting with the animal distribution per manure management system. The improvement would consist in collecting national data to be more representative of the Qatari situation.

Another improvement that could be further explored consists in moving to an upper Tier method starting with the most emitting category (here, camels).

### 2.5.4 Rice cultivation (CRT 3C)

There is no rice cultivation in Qatar.

### 2.5.5 Agricultural soils (CRT 3D)

#### 2.5.5.1 Category description

The agricultural soils category covers the direct (3D1) and indirect (3D2) emissions of N<sub>2</sub>O. For direct emissions, the following emission sources are covered in the Qatari inventory (Figure 2-22):

- Application of inorganic N fertilizers (3.D.1.1),
- Application of animal manure (3.D.1.2.a),
- Urine and dung deposited by grazing animals (3.D.1.3),
- Crop residues (3.D.1.4).

Emissions related to the application of sewage sludge (3.D.1.b.ii), other organic fertilizers (3.D.1.b.iii), mineralization/ immobilization associated with loss/gain of soil organic matter (3.D.1.e) and Cultivation of organic soils (3.D.1.f) are all considered as "not occurring" (NO).

For indirect emissions, the emissions are distinguished between the atmospheric deposition (3.D.2.1) and the nitrogen leaching and run-off (3.D.2.2).

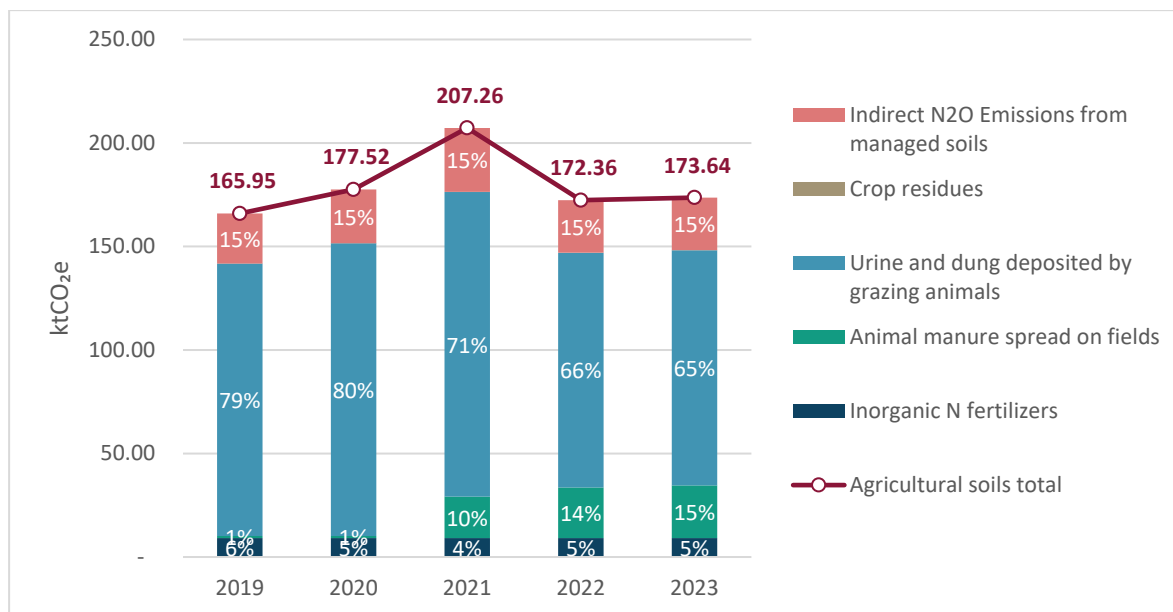


Figure 2-22: CO<sub>2</sub>e emissions from agricultural soils (in ktCO<sub>2</sub>e)

The agricultural soils (CRT 3D) contribute to less than 0.2% of the total GHG emissions over the 2019-2023 period. Concerning its share in the Agriculture sector (CRT 3), in Qatar, it is of 27% in 2019, and 31% in 2023.

#### 2.5.5.2 Methodological issues

##### Direct N<sub>2</sub>O emissions:

The methodology is based on the 2006 IPCC Tier 1 approach, meaning that the emission factors (EF) applied to the activity data remain constant throughout the time series. Consequently, the direct N<sub>2</sub>O emissions from agricultural soils are directly proportional to the activity data presented below (Table 2-23).

Activity data used are the following:

- Amount of inorganic fertilizer: data are taken from the IFASTAT database<sup>120</sup>.
- Amount of animal manure applied to soils: estimated according to the 2006 IPCC Guidelines
- Urine and dung deposited by animals: estimated according to the 2006 IPCC Guidelines
- Amounts of N from crop residues: estimated according to the 2006 IPCC Guidelines.

Amount of animal manure applied to soils:

The amount of animal manure applied to soils is estimated based on the 2006 IPCC Guidelines method, using the values provided per manure management system for the parameters:

- Dry lot: 30%
- Pasture range: accounted for in 3D
- Daily spread: 22%
- Anaerobic digester: 40% (assumption based on liquid manure from dairy cows)

<sup>120</sup> <https://www.ifastat.org/databases>

- Poultry manure with litter: 50%

Urine and dung deposited by animals:

The amount of nitrogen from urine and dung deposited by animals is estimated based on the nitrogen excreted per animal (see section 3B), multiplied by the share of animals in pasture (see section 3B).

Crop residues:

The following crops have been considered for the crop residues calculations: wheat, barley, maize, other cereals and green fodder. To apply the 2006 IPCC Guidelines method, developed area and associated productions provided by the Economic Statistics System of the State of Qatar have been used. All the other parameters used for the calculation have been taken from the 2006 IPCC Guidelines.

The main N input is provided by grazing animals, the total amount globally following livestock population trends as described before.

*Table 2-23: Activity data for direct N<sub>2</sub>O emissions from agricultural soils (3D1), 2019-2023*

|                                                         | 2019   | 2020   | 2021   | 2022   | 2023   |
|---------------------------------------------------------|--------|--------|--------|--------|--------|
| Inorganic fertilisers (tons of N)                       | 2 200  | 2 200  | 2 200  | 2 200  | 2 200  |
| Animal manure applied to soils (tons of N)              | 234    | 240    | 4 809  | 5 873  | 6 106  |
| Urine and dung deposited by grazing animals (tons of N) | 27 724 | 29 816 | 31 148 | 23 479 | 23 323 |
| Crop residues (tons of N)                               | 8.0    | 9.0    | 9.0    | 6.0    | 6.0    |

Emissions factors used for calculating N<sub>2</sub>O emissions are taken from the 2006 IPCC Guidelines and are as follow:

- For inorganic fertilizers, animal manure applied to soils and crop residues: 0.01 kg N-N<sub>2</sub>O/kg N,
- For cattle, swine and poultry grazing: 0.02 kg N-N<sub>2</sub>O/kg N,
- For other animals grazing: 0.01 kg N-N<sub>2</sub>O/kg N.

#### Indirect N<sub>2</sub>O emissions:

The indirect emissions of N<sub>2</sub>O from managed soils are separated between two subcategories: atmospheric deposition and leaching and run-off. The emission estimation methodology used is based on Tier 1 from the 2006 IPCC guidelines.

Activity data used are the same as the one for direct N<sub>2</sub>O emissions, with some additional calculations to estimate the amounts of volatilized N and N lost through leaching and run-off, according to the 2006 IPCC guidelines.

Those parameters – taken from the 2006 IPCC Guidelines - are as follow:

- Fraction of synthetic fertilizer N that volatilizes as NH<sub>3</sub> and NO<sub>x</sub>: FGASF = 0.1 kg N volatilized/kg N applied;
- Fraction of organic fertilizer N (including urine and dung deposited by grazing animals) that volatilizes as NH<sub>3</sub> and NO<sub>x</sub>: FGASM = 0.2 kg N volatilized/kg N applied or deposited;

- The emission factor for indirect N<sub>2</sub>O from volatilization is taken from the 2006 IPCC Guidelines (0.01 kg N-N<sub>2</sub>O/kg N volatilized).

No leaching is considered in Qatar as the 2019 IPCC Guidelines maps of climate shows that the whole area is considered as dry.

### 2.5.5.3 Uncertainty assessment and time-series consistency

See section 1.6 for a general discussion on uncertainty in the Agriculture sector.

### 2.5.5.4 Category-specific recalculations

As this is Qatar's first BTR, no recalculations are included. Recalculations will be undertaken and evaluated in the next reporting cycle.

### 2.5.5.5 Category-specific planned improvements

Further improvement could be made:

- by collecting national data on mineral fertilizers,
- by implementing the 2019 IPCC Guidelines that provides disaggregated values for emission factors, based on climate
- by improving the current method applied for crop residues, refining some of the parameters used
- by completing the types of crops considered for crop residues

## 2.5.6 Field burning of agricultural residues (CRT 3F)

No field burning of agricultural residues is currently considered in Qatar

## 2.5.7 Urea application (CRT 3H)

### 2.5.7.1 Category description

For this category, emissions of CO<sub>2</sub> related to the application of urea on agricultural fields are estimated. This sector represents the only emissions of CO<sub>2</sub> from the Agriculture sector (which are considered in the emission inventory scope, hence different from CO<sub>2</sub> related to biomass).

Emissions are calculated using a Tier 1 methodology with a constant emission factor (EF) applied; therefore, emissions are directly proportional to changes in the activity data.

The urea application (CRT 3H) represents only 0.3% of the Agriculture sector and remained stable over time.

### 2.5.7.2 Methodological issues

CO<sub>2</sub> emissions from urea application are calculated with a Tier 1 approach which is in line with the 2006 IPCC Guidelines.

Activity data used are the annual quantities of urea applied to agricultural soils, which are taken from the IFASTAT database (Table 2-24)

Table 2-24: Activity data for urea application (3H)

|             | 2019 | 2020 | 2021 | 2022 | 2023 |
|-------------|------|------|------|------|------|
| Urea (tons) | 2174 | 2174 | 2174 | 2174 | 2174 |

The emission factor used for calculating CO<sub>2</sub> emissions is provided by the 2006 IPCC guidelines and the value is of 0.2 t C/t urea.

#### 2.5.7.3 Uncertainty assessment and time-series consistency

A general discussion of uncertainty in the Agriculture sector was presented earlier.

#### 2.5.7.4 Category-specific recalculations

As this is Qatar's first BTR, no recalculations are included. Recalculations will be undertaken and evaluated in the next reporting cycle.

#### 2.5.7.5 Category-specific planned improvements

No specific improvement planned.

## 2.6 Land use, land-use change and forestry (CRT sector 4)

### Overview of the sector

This category includes all GHG emissions and absorptions (or "removals", or "negative emissions") due to land use, land use change and forestry (LULUCF).

In Qatar, based on the 2015, 25% of the total land under use in the country fell into the "Green areas" category, varying from 0% to about 85% depending on the zone's location (National Planning Council, 2024h). Green areas encompass farms, nursery plant farms, poultry farms, and animal farms (camel, sheep, goats, cows).

By 2022, the number of public parks in Qatar had increased to 148, up from 56 in 2010, marking a growth of 164%. The total area of green spaces also expanded to over 43 million square meters in 2022, compared to about 2.5 million square meters in 2010. The per capita share of the green area rose significantly to 16 square meters, up from less than one square meter in 2010, reflecting a sixteen-fold increase. The millionth tree was recently planted as part of the Plant Million Trees initiative launched in 2019 (The Peninsula, 2022).

### LULUCF Emissions and Data Availability

Currently, no emissions or removals are estimated for this sector.

More time is needed to collect relevant data to better reflect land use and land use changes in Qatar and associated evolutions through time. Providing first estimates for LULUCF sector is a global action included in the improvement plan.

## 2.7 Waste (CRT sector 5)

### *2.7.1 Overview of the sector and background information*

In Qatar, the Waste sector (CRT 5) includes the emissions from the following activities:

- Solid waste disposal (5A) – managed Solid Waste Disposal Sites (5A1).
- Biological treatment of solid waste (5B) – Composting (5B1) and anaerobic digestion (5B2)
- Incineration (5C1).
- Wastewater treatment and discharge (5D), including only domestic wastewater (5D1).

Open-burning is not occurring in the country (NO), while industrial wastewater treatment is not estimated (NE) due to lack of data.

Emissions of CH<sub>4</sub>, N<sub>2</sub>O, and CO<sub>2</sub> are estimated for the Waste sector. Tier 1 methodologies are applied to all waste categories, due to limitations in data availability that prevented the application of higher-tier approaches.

In accordance with the IPCC Guidelines, the estimation of emissions from solid waste disposal sites (SWDS) requires a historical assessment extending back at least 50 years. While a substantial amount of data was provided by the Ministry of Municipality, several assumptions were necessary to complete the time series, particularly with respect to activity data, waste composition, and the distribution of waste treatment methods. For the purposes of the present NID, however, results are presented for the period 2019-2023.

The allocation of waste treatment types is based on data provided by the Ministry of Municipality for waste disposal sites, biological treatment, and incineration, together with estimates of total municipal solid waste generation derived from population data and per capita waste generation rates.

The waste treatment distribution for the period 2019–2023 is illustrated in the Figure 2-23.

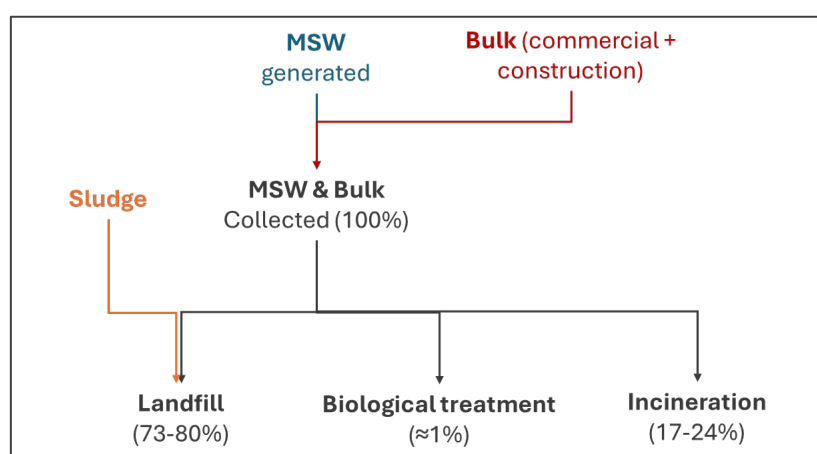


*Figure 2-23: Summary of waste treatment distribution in Qatar, 2019-2023*

Over the period 2019-2023, total emissions from the waste sector increased moderately from 1,621 to 1,861 ktCO<sub>2</sub>e, representing a growth of about 15% (Figure 2-24). In 2023, the CRT 5 contributed to around 66% of the national CH<sub>4</sub> emissions, 10% of the national totals of N<sub>2</sub>O, and less than 2% of the national total emissions (including all gases). Within this sector, the methane emissions are predominant and represent around 87% of the emissions, while CO<sub>2</sub> emissions represent around 10% and N<sub>2</sub>O emissions around 3%.

Solid waste disposal (5.A) was the dominant source throughout the period, accounting for approximately 82 to 85% of total waste emissions and increasing by around 19%, from 1,330 ktCO<sub>2</sub>e in 2019 to 1,578 ktCO<sub>2</sub>e in 2023. Incineration (5.C) was the second-largest contributor, representing about 11 to 14% of emissions, with relatively stable levels over the time series and a slight overall increase. Emissions from wastewater treatment and discharge (5.D) showed a declining trend, decreasing by about 15% over the period and contributing a smaller share (4 to 6%) of total waste emissions. Biological treatment of solid waste (5.B) remained a negligible contributor despite relative growth, with emissions remaining very low in absolute terms across the period.

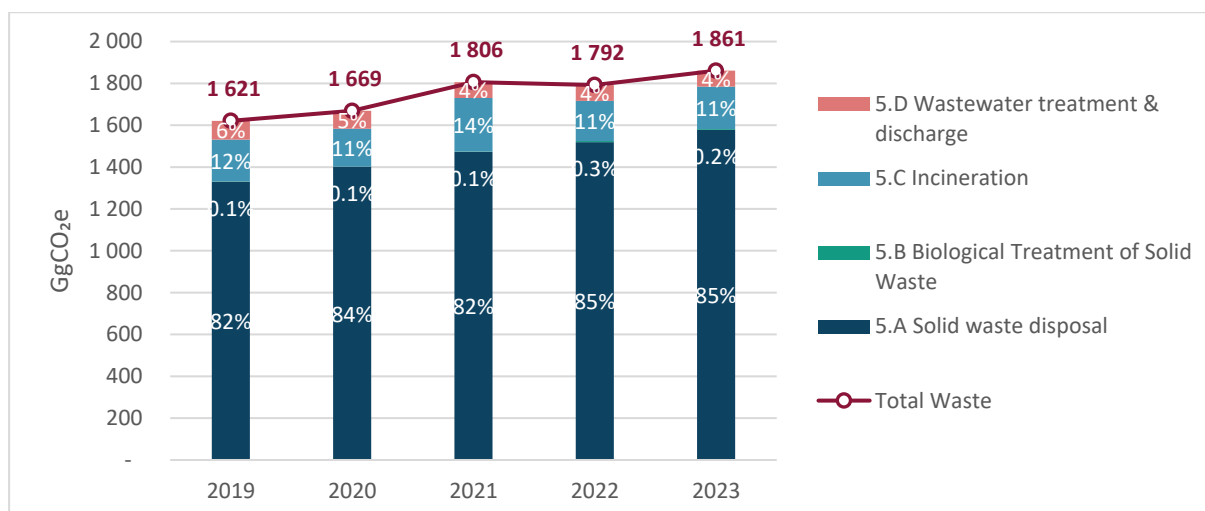


Figure 2-24: Waste sector emissions by sub-sector, 2019-2023 (in ktCO<sub>2</sub>e)

## 2.7.2 Solid waste disposal sites (CRT 5A)

### 2.7.2.1 Category description

The category of the disposal of solid waste (5A1) is responsible of emissions of methane (CH<sub>4</sub>), and of biogenic CO<sub>2</sub>, which is not reported in the national totals.

Estimated emissions pertain to municipal solid waste and sludge. No information was available on industrial solid waste.

Within solid waste disposal (5.A), emissions increased from 1,330 ktCO<sub>2</sub>e in 2019 to 1,578 ktCO<sub>2</sub>e in 2023, representing a 19% rise over the period (Figure 2-25). This increase was driven by emissions from managed waste disposal sites, which grew by approximately 35%, rising from 783 to 1,168 ktCO<sub>2</sub>e. As a result, the share of emissions from managed sites increased steadily from 59% in 2019 to 74% in 2023. In contrast, emissions from uncategorized disposal sites declined by about 25%, falling from 546 to 410 ktCO<sub>2</sub>e, with their relative contribution decreasing from 41% to 26% over the same period. These trends reflect the gradual commissioning of managed solid waste disposal sites, with the first facility opening in 2011 and additional sites becoming operational in 2016.

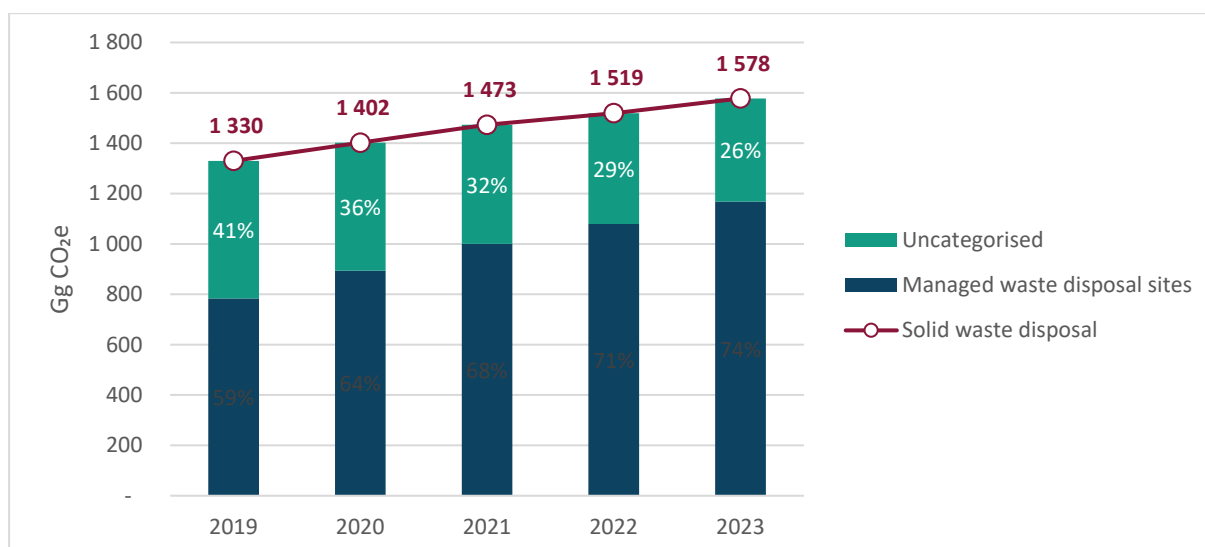


Figure 2-25: Solid waste disposal sites emissions, 2019-2023 (in ktCO<sub>2</sub>e)

### 2.7.2.2 Methodological issues

The Tier 1 methodology recommended by the 2006 IPCC Guidelines was applied. The IPCC Waste Model was used, specifically the “waste by composition” approach.

As far as possible, country-specific parameters were used as input data.

- Amount of municipal solid waste generated and collected:

Total amount of waste generated in Qatar for the 2013-2023 period was based on the amount of waste treated by the different treatment types and provided by the Ministry of Municipality. A 100% collection rate was considered.

The total amount of waste generated between 1970 and 2012 has been estimated based on the population and an estimated generation rate of solid waste per inhabitant.

- Population

National data on population used in the Qatari inventory are from local records for 1970 and the 1986-2023 period. Linear increase was applied for the period 1971-1985.

- Municipal Solid Waste (MSW) generation rate:

Generation rates for the period 2013 – 2023 are calculated using population data and the total amount of waste generated, as provided by the Ministry of Municipality.

The per capita solid waste generation rate for the period 1970–2012 was estimated using the average rate from 2013 to 2017 and was assumed to remain constant over time.

- Quantity of sludge generated

The quantity of sludge generated for the period 2013-2023 is based on data provided by the Ministry of Municipality. For the period 1970-2012, the quantity was estimated using a per capita sludge generation rate – calculated as the average rate for 2013-2017 and assumed to be constant – together with population data. The totality of the sludge is landfilled.

- Fraction of generated MSW going to landfills (% to SWDS)

The quantity of municipal solid waste disposed of in landfills is estimated using different approaches depending on the time period considered and based on the following assumptions:

- 2015 - 2023: Estimates are based on data on municipal waste sent to landfills provided by the Ministry of Municipality, assuming that sludge is included in the reported waste.
- 2014: The estimate is based on the value of 93% reported by the World Bank in the *What a waste global database*.<sup>121</sup>
- 1970 - 2013: The proportion of MSW disposed of in landfills is assumed to be constant and equal to the 2014 value.

- Repartition between management practices

For years prior to 2011, SWDS are assumed to be uncategorized due to limited historical information. For the period 2011-2015, one third of solid waste disposal sites are assumed to be managed semi-aerobically (Table 2-25). This assumption is informed by data from the Ministry of Municipality and the establishment in 2011 of the first large-scale integrated municipal waste management facility in Mesaieed, which includes modern landfill operations. In 2016, the share of managed (semi-aerobic) solid waste disposal sites increased to 100%, following the opening of two additional large-scale modern facilities that year.

Table 2-25: *Repartition between management practices*

| Year        | Unmanaged, shallow (%) | Unmanaged, deep (%) | Managed (%) | Managed, semi-aerobic (%) | Uncategorized (%) |
|-------------|------------------------|---------------------|-------------|---------------------------|-------------------|
| 1970 - 2010 | 0%                     | 0%                  | 0%          | 0%                        | 100%              |
| 2011 - 2015 | 0%                     | 0%                  | 0%          | 33%                       | 67%               |
| 2016 - 2023 | 0%                     | 0%                  | 0%          | 100%                      | 0%                |

- Waste composition

According to data provided by the Ministry of Municipality, “bulk waste” represents the largest share of total waste generated, accounting for approximately 56 to 67% over the period 2013-2023. However, the composition of this waste stream is not specified, and certain waste fractions (e.g. plastics, glass) are not identified in the available waste categorization.

Due to the lack of detailed composition data, waste composition estimates from the World Bank *What a Waste global database*<sup>122</sup> were applied (Table 2-26). This composition is assumed to remain constant throughout the entire series.

Table 2-26: *Municipal solid waste composition used for landfill estimation, per waste category (in%)*

| Waste stream        | Share (%) |
|---------------------|-----------|
| Food/organic waste  | 57%       |
| glass               | 4%        |
| Metal               | 9%        |
| Paper and cardboard | 11%       |

<sup>121</sup> Available at: [What a Waste Global Database - World Bank Data Catalog](#)

<sup>122</sup> Available at: [What a Waste Global Database - World Bank Data Catalog](#)

|         |     |
|---------|-----|
| plastic | 14% |
| Other   | 5%  |

- Methane recovery

There is no methane recovery occurring in the Qatari SWDS.

- Other parameters

Default values recommended by the 2006 IPCC Tool have been applied for the other parameters:

- Degradable organic carbon (DOC) content of each category of waste
- Fraction of the degradable organic carbon that decomposes under anaerobic conditions (DOCf)
- Methane generation rate constant (k), corresponding to dry tropical climate
- Methane Correction Factor (MCF): 0.7 for managed semi-aerobic SWDS (not well managed) and 0.6 for uncategorised SWDS
- An oxidation factor of 0 was assumed

### 2.7.2.3 Uncertainty assessment and time-series consistency

See section 1.6 for a general discussion of uncertainty in the Waste sector.

### 2.7.2.4 Category-specific recalculations

As this is Qatar's first BTR, no recalculations are included. Recalculations will be undertaken and evaluated in the next reporting cycle.

### 2.7.2.5 Category-specific planned improvements

The following improvements are proposed to enhance the accuracy and relevance of data used in this category.

- Conduct a comprehensive characterization study of bulk municipal solid waste to identify and quantify the waste streams contained within this dominant fraction.
- Improve inventory completeness by including industrial waste disposed of in landfills, which is currently excluded due to data limitations.

## 2.7.3 Biological treatment of waste: composting and anaerobic digestion

### 2.7.3.1 Category description

Biological treatment of solid waste in the State of Qatar includes both composting and anaerobic digestion of organic waste.

Composting is an aerobic process in which a large share of the degradable organic carbon is converted to CO<sub>2</sub>. Methane may form in localized anaerobic zones within the compost, but much of it is oxidized as it passes through aerobic layers. Composting can also result in nitrous oxide (N<sub>2</sub>O) emissions. Anaerobic digestion of organic waste produces CH<sub>4</sub>. In Qatar, a portion of the generated methane is recovered and flared. N<sub>2</sub>O emissions from this process are assumed to be negligible.

Emissions from biological treatment of solid waste (5.B) remained very low in absolute terms but showed variability over the period, increasing from 2.0 ktCO<sub>2</sub>e in 2019 to 4.0 ktCO<sub>2</sub>e in 2023, with a

peak in 2022 (Figure 2-26). Overall, this category represented only a negligible share of total national emissions, ranging from about 0.001% to 0.004% over the period.

The trend was largely driven by composting (5.B.1), which accounted for the majority of emissions in most years and increased significantly after 2021, rising to around 3.8 ktCO<sub>2</sub>e in 2023. This increase reflects a substantial rise in the quantity of waste treated through composting, which grew sharply between 2021 and 2022 (approximately +643%). As a result, the share of composting within biological treatment increased markedly, representing about 94% of emissions in 2022 and 2023.

In contrast, emissions from anaerobic digestion (5.B.2) remained small and declined over time, falling from around 0.51 ktCO<sub>2</sub>e in 2019 to 0.23 ktCO<sub>2</sub>e in 2023, with its relative contribution dropping to about 6% in the last two years of the period.

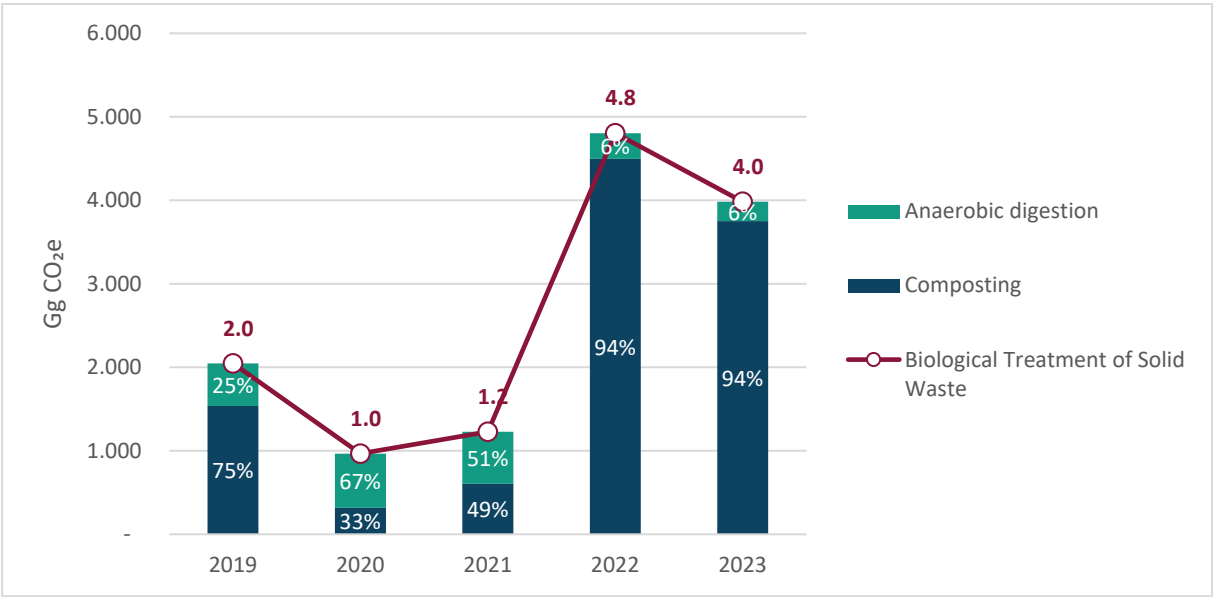


Figure 2-26: Biological treatment emissions, 2019-2023 (in ktCO<sub>2</sub>e)

### 2.7.3.2 Methodological issues

The Tier 1 methodology from the 2006 IPCC Guidelines was applied to estimate CH<sub>4</sub> and N<sub>2</sub>O emissions from biological treatment, using the corresponding default emission factors (Table 2-27).

Table 2-27: Default emission factor for biological treatment

| Process             | CH <sub>4</sub> EF<br>(g CH <sub>4</sub> /kg waste treated) | N <sub>2</sub> O EF<br>(g N <sub>2</sub> O/kg waste treated) | Source                                                                   |
|---------------------|-------------------------------------------------------------|--------------------------------------------------------------|--------------------------------------------------------------------------|
| Composting          | 4                                                           | 0.24                                                         | Table 4.1, Chap. 4, Vol. 5, 2006 IPCC GL<br>Values on a wet weight basis |
| Anaerobic digestion | 0.8                                                         | Assumed negligible                                           |                                                                          |

The amount of organic waste sent to composting and anaerobic digestion was collected by the Ministry of Municipality and is as follows:

Table 2-28: Activity data for biological treatment, 2019-2023

| Waste stream        | 2019          | 2020          | 2021          | 2022          | 2023          |
|---------------------|---------------|---------------|---------------|---------------|---------------|
| Composting process  |               |               |               |               |               |
| Garden waste (t)    | 8 752         | 1 809         | 3 444         | 25 605        | 21 359        |
| Anaerobic digestion |               |               |               |               |               |
| Food (t)            | 14 600        | 14 600        | 14 600        | 14 600        | 14 600        |
| Slaughterhouse (t)  | 8 169         | 8 169         | 8 169         | 8 169         | 8 169         |
| <i>Total</i>        | <i>22 769</i> | <i>22 769</i> | <i>22 769</i> | <i>22 769</i> | <i>22 769</i> |

### 2.7.3.3 Uncertainty assessment and time-series consistency

A general discussion of uncertainty in the Waste sector was presented earlier

### 2.7.3.4 Category-specific recalculations

As this is Qatar's first BTR, no recalculations are included. Recalculations will be undertaken and evaluated in the next reporting cycle.

### 2.7.3.5 Category-specific planned improvements

Planned improvements include obtaining reliable data on methane recovery rates from anaerobic digestion in order to enhance estimate accuracy and reduce the risk of over- or underestimation of emissions for this category.

## 2.7.4 Open burning and incineration (CRT 5C1 and 5C2)

### 2.7.4.1 Category description

The categories of open-burning and incineration (5C1 and 5C2) are responsible of emissions of CO<sub>2</sub>, CH<sub>4</sub> and to a lesser extent of N<sub>2</sub>O.

In Qatar, incineration is the second most common treatment for municipal solid waste, after landfilling and there is no open-burning occurring.

Emissions from waste incineration (5.C) remained relatively stable over the period 2019–2023, fluctuating between 181 and 256 ktCO<sub>2</sub>e, with a peak observed in 2021 (Figure 2-27). In terms of overall significance, incineration represented a very small share of total national emissions, ranging from approximately 0.16% to 0.22% over the period. Within the waste sector, however, incineration was the second-largest source of emissions, accounting for roughly 11-14% of total waste emissions throughout the time series.

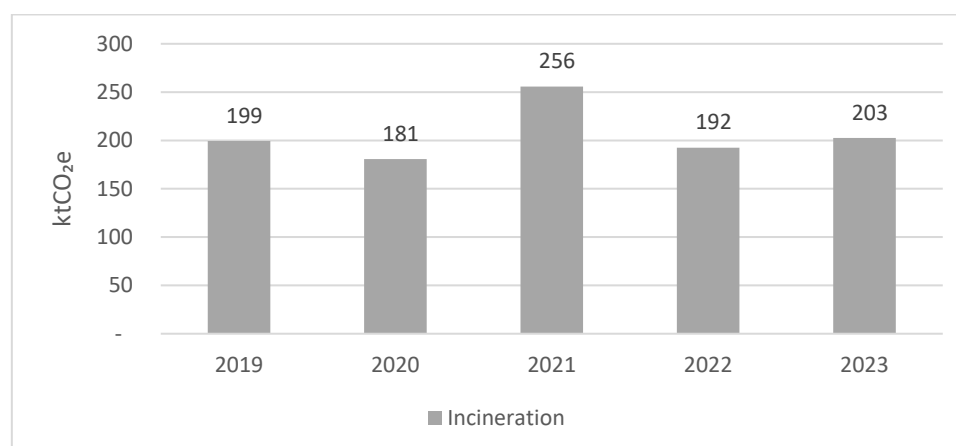


Figure 2-27: Incineration emissions (in ktCO<sub>2</sub>e)

#### 2.7.4.2 Methodological issues

The Tier 1 methodology recommended by the 2006 IPCC Guidelines was applied.

As far as possible country-specific parameters have been used as input data to estimate emissions from the incineration of domestic waste.

- *Amount of domestic waste generated:* the quantity of waste incinerated was provided by the Ministry of Municipality for the period 2019-2023.
- *MSW composition:* the same composition as described in the previous section on SWDS was used, i.e. using the estimates corresponding to the State of Qatar from the World Bank *What a Waste* global database<sup>123</sup> (Table 2-29). This composition is assumed to remain constant over the years.

Table 2-29: Municipal solid waste composition used for the incineration estimation, per waste category (in%)

| Waste stream        | Share (%) |
|---------------------|-----------|
| Food/organic waste  | 57%       |
| Glass               | 4%        |
| Metal               | 9%        |
| Paper and cardboard | 11%       |
| Plastic             | 14%       |
| Other               | 5%        |

- *CO<sub>2</sub> emission factor:* default values of dry matter content, Total carbon content, Fossil carbon fraction, and Oxidation Factor from the 2006 IPCC guidelines were used to calculate the CO<sub>2</sub> emission factor.
- *CH<sub>4</sub> and N<sub>2</sub>O emissions factors:* default values from the 2006 IPCC guidelines were used: 0.2 kg/t waste (wet weight) for CH<sub>4</sub> (table 5.3) and 50 g/t waste (wet weight) for N<sub>2</sub>O (table 5.6), corresponding to a continuous (stocker) incinerator.

#### 2.7.4.3 Uncertainty assessment and time-series consistency

A general discussion of uncertainty in the Waste sector was presented earlier

#### 2.7.4.4 Category-specific recalculations

As this is Qatar's first BTR, no recalculations are included. Recalculations will be undertaken and evaluated in the next reporting cycle.

#### 2.7.4.5 Category-specific planned improvements

To improve the accuracy of the data and assumptions, the following improvements are proposed:

- Conduct a comprehensive characterization study of incinerated domestic waste to identify and quantify the waste streams contained in it.

<sup>123</sup> Available at: [What a Waste Global Database - World Bank Data Catalog](#)

- Collect national data on the quantity of industrial or hazardous waste that is potentially sent to incineration.

## 2.7.5 Wastewater treatment (CRT 5D)

### 2.7.5.1 Category description

Under this category, the following sources must be considered:

- Wastewater treatment: only domestic wastewater is considered as data was not available to estimate industrial wastewater.
- Water discharge in water bodies.

CH<sub>4</sub> emissions primarily occur during the wastewater treatment phase, while N<sub>2</sub>O emissions occur during water discharge. However, GHG emissions from wastewater treatment are almost entirely methane.

On-site biogas production in WWTP does not occur over the territory.

Emissions from wastewater treatment and discharge (5.D) showed a declining trend over the period 2019-2023, decreasing from 90 to 77 ktCO<sub>2</sub>e. This category represented a very small share of total national emissions, consistently accounting for less than 0.1%. The decrease is primarily explained by changes in the treatment profile, with a transition towards fully centralized aerobic treatment systems. By 2023, almost all wastewater was treated in centralized, well-managed aerobic facilities, whereas in 2019 a small share (around 5%) was still managed through septic systems, which typically generate higher emissions.

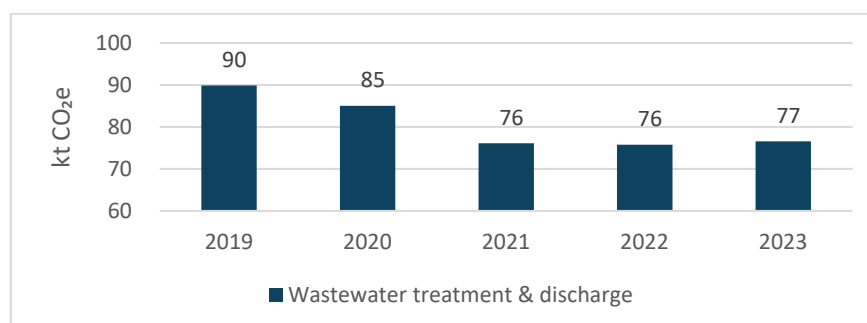


Figure 2-28: Wastewater treatment emissions (in ktCO<sub>2</sub>e)

### 2.7.5.2 Methodological issues

Tier 1 methodology of the 2006 IPCC Guidelines was applied to estimate CH<sub>4</sub> and N<sub>2</sub>O emissions from domestic wastewater treatment and discharge.

#### CH<sub>4</sub> emissions:

- TOW in domestic wastewater is estimated using the equation 6.3 of the 2006 IPCC Guidelines.*

As far as possible, country-specific parameters have been used as input data in the calculation:

- *Population* comes from local database

- *Degree of utilisation of treatment/discharge pathway or system ( $T_{i,j}$ )* - The treatment systems and discharge pathways repartition used is from UN water database<sup>124</sup>. No rural/urban distinction is made. The repartition is similar from 2020 to 2021 (Table 2-30).

Table 2-30: Degree of utilization of treatment/discharge pathway or system ( $T_{i,j}$ ) in urban and rural areas, 2019-2023

| Type of treatment                                   | 2019 | 2020 | 2021 | 2022 | 2023 |
|-----------------------------------------------------|------|------|------|------|------|
| Septic system                                       | 5%   | 3%   | 2%   | 0%   | 0%   |
| Centralized, aerobic treatment plant - well managed | 95%  | 97%  | 98%  | 100% | 100% |

- *Correction factor for additional Industrial Biochemical Oxygen Demand BOD (I)* - The default I values proposed in the 2006 IPCC Guidelines were used for the relevant treatment and discharge system, i.e. 1 for septic system and 1.25 for centralized, aerobic treatment plant.
  - *Organic component removed as sludge (S)* - Only the quantity of sludge removed is available, without further details on the BOD content. Consequently, the default value recommended in the 2006 IPCC Guidelines (zero) is applied.
- b) *Emission factors for each discharge or treatment system of domestic wastewater are estimated using Equation 6.2 of the 2006 IPCC Guidelines.*
- *Methane Correction factor (MCF)* - Default values recommended by the 2019 Refinement IPCC Guidelines are applied to each treatment system and discharge pathway (Table 2-31).

Table 2-31: Methane correction factor per treatment systems and discharge pathways (MCF)

| Type of treatment and discharge pathway or system considered | MCF applied | Source                                  |
|--------------------------------------------------------------|-------------|-----------------------------------------|
| Septic tank                                                  | 0.5         | Table 6.3, Chap.6, Vol. 5, IPCC 2019 RE |
| Centralized, aerobic treatment plant - well managed          | 0.03        |                                         |

- *Maximum  $CH_4$  producing capacity ( $B_0$ )* - the default value recommended in the 2006 IPCC Guidelines (0.6 kg  $CH_4$ /kg BOD) is applied.
- c) Since the main treatment is aerobic, no  $CH_4$  is recovered (R).

#### N<sub>2</sub>O emissions:

To estimate N<sub>2</sub>O emissions from domestic wastewater discharged, the equation 6.7 of the 2006 IPCC Guidelines is applied.

- *Total nitrogen in effluent (N-effluent)* - estimated using the equation 6.8 of the 2006 IPCC Guidelines.

<sup>124</sup> Degree of use of the treatment system or discharge pathway for each income class ( $T_{i,j}$ ) – State of Qatar  
United Nation - Water treatment - countries.xlsx  
United Nation – Water

- *Population (P)* - The population data used for the category 5D are consistent with the data used for the category 5A and population data used for CH<sub>4</sub> emissions from 5D.
- *Annual per capita protein consumption (Protein)* - National data on the annual amount of protein consumed per capita used are from FAO Statistics (Dietary Protein Consumption: g/person/day); average data in kg/year are considered in calculations (Table 2-32).

Table 2-32: Annual per capita protein consumption

| Year | Value (g/cap/d) | Value (kg/cap/y) |
|------|-----------------|------------------|
| 2019 | 114.21          | 41.69            |
| 2020 | 113.36          | 41.38            |
| 2021 | 111.09          | 40.55            |
| 2022 | 110.65          | 40.39            |
| 2023 | 105.09          | 38.36            |

- *Fraction of Nitrogen in protein (Fnpr), Factor for non-consumed protein (Fnon-con) and factor for industrial and commercial co-discharged (Find-com)*. In the absence of country-specific information, the default values recommended in the 2006 IPCC Guidelines are applied for the fraction of nitrogen in protein, the factor for non-consumed protein added to wastewater, and the factor for industrial and commercial co-discharged protein into the sewer system (Table 2-33).

Table 2-26: Fraction of Nitrogen in protein (Fnpr), Factor for non-consumed protein (Fnon-con) and factor for industrial and commercial co-discharged (Find-com)

| Parameters                                                                 | Applied                                                  |
|----------------------------------------------------------------------------|----------------------------------------------------------|
| Fraction of Nitrogen in protein (kg N/kg protein)                          | 0.16                                                     |
| Factor for non-consumed protein (F <sub>non-con</sub> )                    | 1.1                                                      |
| Factor for industrial and commercial co-discharged (F <sub>ind-com</sub> ) | 1.25 for centralized aerobic plant ; 1 for septic system |

- *Nitrogen removed with sludge (N-sludge)* - In absence of country specific information, the default value recommended in the 2006 IPCC Guidelines (zero) is applied.
- *Emission factor (EF)*

The default emission factor recommended in the 2006 IPCC Guidelines (0.005 kg N<sub>2</sub>O-N/kg N) is applied.

**Note:** N<sub>2</sub>O emissions from advanced wastewater treatment plants (WWTPs) are not estimated, as there are no advanced WWTPs with controlled nitrification and denitrification processes in the State of Qatar. Consequently, such emissions are assumed not to occur.

### 2.7.5.3 Uncertainty assessment and time-series consistency

A general discussion of uncertainty in the Waste sector was presented in earlier sections.

#### 2.7.5.4 Category-specific recalculations

As this is Qatar's first BTR, no recalculations are included. Recalculations will be undertaken and evaluated in the next reporting cycle.

#### 2.7.5.5 Category-specific planned improvements

Planned future improvements include:

- Estimation of emissions from industrial wastewater.
- Estimation of the BOD content in removed sludge

# Information Necessary to Track Progress Made in Implementing and Achieving Nationally Determined Contributions Under Article 4 of the Paris Agreement

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## 3.1 National circumstances and institutional arrangements

### 3.1.1 Background

Climate change governance is led by the Ministry of Environment and Climate Change (MECC), which serves as the national focal point for the UNFCCC and the Paris Agreement. The MECC coordinates climate-related policies and reporting in collaboration with sectoral entities. Inter-ministerial coordination is facilitated through the National Climate Change Committee (NCCC), which supports policy coherence and implementation across sectors.

Qatar has experienced rapid demographic growth over recent decades, driven primarily by economic expansion and labor migration. The population increased from approximately 369,000 in 1986 to 2.93 million in 2022, representing one of the fastest growth rates in the region. The population is concentrated in urban areas, particularly within the Greater Doha metropolitan region. The country is characterized by flat and arid terrain consisting of limestone plateaus, rocky plains, shallow depressions, coastal habitats, and sand dunes. Qatar possesses a coastline of approximately 550 km and includes several offshore islands. Its strategic location and concentration of population and economic assets along the coast increase exposure to climate-related risks, including sea-level rise, coastal erosion, and extreme weather events. The country hosts diverse terrestrial and marine ecosystems, including mangroves, coral reefs, seagrass meadows, sabkhas, and desert habitats, which provide important ecological and climate adaptation functions.

Qatar is pursuing economic diversification under Qatar National Vision 2030 and the Third National Development Strategy (2024–2030), with increasing investments in manufacturing, logistics, finance, tourism, technology, and knowledge-based industries. The country is one of the world's leading producers and exporters of liquefied natural gas (LNG), supported by substantial hydrocarbon reserves and major industrial complexes in Ras Laffan, Mesaieed, and Dukhan. Continued economic growth, industrial development, and urban expansion influence national emissions trends, while diversification efforts are expected to support a gradual transition toward a more resource-efficient and low-carbon economy.

Qatar's emissions profile and climate vulnerability are influenced by several key sectors:

**Energy:** The energy sector is dominated by natural gas production, processing, and export activities, with natural gas accounting for over 90% of the national energy supply. Electricity generation relies primarily on natural gas-fired power plants, and energy demand is driven largely by cooling requirements.

**Industry:** Industrial activities are concentrated in petrochemicals, fertilizers, steel, aluminum, and associated manufacturing sectors. Major industrial facilities are located in Ras Laffan, Mesaieed, and Dukhan Industrial Cities.

**Transport:** Rapid urbanization and economic growth have contributed to increased vehicle ownership and transport demand. Investments in public transport, including the Doha Metro and electric mobility initiatives, support efforts to mitigate transport-related emissions.

**Buildings and Urban Development:** Urban expansion and high cooling demand make buildings a significant source of energy consumption. Green building standards, district cooling systems, and sustainable urban planning are increasingly incorporated into national development strategies.

**Water Resources:** Qatar relies heavily on desalination, groundwater abstraction, and treated wastewater reuse. Water scarcity and high energy requirements for water production create strong interlinkages between water management and climate mitigation.

**Agriculture and Food Security:** Agricultural production is constrained by limited arable land, water scarcity, and harsh climatic conditions. Government policies focus on improving water-use efficiency, greenhouse cultivation, and food system resilience.

**Waste Management:** Qatar has invested in integrated waste management systems, including recycling, waste-to-energy, and resource recovery facilities, to support circular economy objectives and reduce emissions from waste disposal.

**Biodiversity and Ecosystems:** Marine and terrestrial ecosystems, including coral reefs, mangroves, seagrass meadows, and protected desert habitats, contribute to climate resilience, biodiversity conservation, and ecosystem services.

### *3.1.2 National Circumstances Affecting GHG Emissions*

Qatar's GHG emissions profile is shaped by its hydrocarbon-based economy, rapid population growth, industrial expansion, urbanization, and climatic conditions. The energy sector, including oil and natural gas production and processing, remains the primary source of emissions. High temperatures and widespread use of air conditioning contribute to elevated electricity consumption, while desalination requirements increase energy demand further.

### *3.1.3 National Circumstances and Implementation Challenges*

Current geopolitical realities present external constraints that are expected to cause delays in the deployment of specific projects. As a result, the trajectory for reaching established targets and implementation timelines may require adjustment. While these exogenous factors pose temporary logistical challenges and financial constraints—particularly since the State finances its own climate initiatives, they do not alter the strategic direction; our overarching policy framework and long-term project objectives remain steadfast.

### *3.1.4 Institutional Arrangements for Tracking Progress Towards the NDC*

Qatar has established an institutional framework to monitor, report, and track progress toward implementing and achieving its NDC. The MECC serves as the lead institution responsible for coordinating climate policy, monitoring implementation, and fulfilling reporting obligations under the Paris Agreement.

The National Climate Change Committee provides the primary mechanism for inter-ministerial coordination and supports the integration of climate objectives across sectoral policies and plans. Sectoral ministries and entities, including QatarEnergy, KAHRAMAA, the Ministry of Municipality, the

Ministry of Transport, and the Ministry of Public Health, are responsible for implementing mitigation and adaptation actions and supplying relevant data for monitoring purposes.

The National MRV System, managed by the MECC, forms the backbone of Qatar's transparency framework. The system includes a facility-level GHG emissions reporting component and a Climate Action MRV Platform that tracks mitigation measures, adaptation actions, climate finance, technology transfer, and capacity-building activities. Data are collected from implementing entities, verified through quality assurance and quality control procedures, and compiled using methodologies consistent with the 2006 IPCC Guidelines.

## 3.2. Description of a Party's NDC under Article 4 of the Paris Agreement, including updates (para. 64 of the MPGs)

### 3.2.1. Background

The NDC of the State of Qatar was submitted to the UNFCCC in August 2021, in accordance with Decisions 1/CP.19 and 1/CP.20, and in line with Decision 24/CP.18, as well as the provisions and principles of the Convention.

Qatar's Intended Nationally Determined Contribution (INDC), communicated in 2015, reflected a balanced approach considering adaptation, economic diversification, and mitigations, consistent with Article 4.7 and Article 7 of the Paris Agreement. This balanced approach reflects Qatar's national circumstances, in which economic prosperity and national sustainable development is closely linked to the oil and gas sector, a key contributor to national GDP as well as the primary source of domestic GHG emissions. Accordingly, the sector is at the forefront of Qatar's climate mitigation efforts.

As a result, achieving long-term climate change mitigation requires carefully balancing economic stability with environmental sustainability. Transitioning toward a more sustainable and diversified economy is therefore essential, while ensuring that mitigation actions do not jeopardize the nation's economic prosperity.

Qatar's First NDC emissions mitigation ambition is specified as a projected percentage reduction by 2030 below business-as-usual (BAU) levels (an emission reduction target below a projected baseline).

Over the past several decades, Qatar has contributed to international efforts to address climate change and promote sustainable development through the export of natural gas and its derivatives to global energy markets. Compared to conventional fuels, these energy sources are relatively cleaner and more efficient, contributing to reductions in CO<sub>2</sub> emissions and improvements in air quality.

In accordance with Article 4.8 of the Paris Agreement and Decisions 1/CP.21 and 4/CMA.1, Qatar continues to implement its NDC in pursuit of climate adaptation and mitigation objectives, taking into account national circumstances and capabilities.

The BAU-based target is subject to periodic reviews and may be refined and updated. These reviews and updates will be in accordance with evolving national circumstances, the requirements of the Enhanced Transparency Framework (ETF), while maintaining coherence with Articles 4.3, 4.4, and 4.7 of the Paris Agreement, reflecting progression and the highest possible ambition, while acknowledging the role of international support in enabling implementation for developing country Parties.

Although Qatar submitted its third NDC (NDC3.0) in November 2025, reflecting progression in its climate ambition. However, as the reporting period for the first BTR covers 2019–2023, progress is

assessed in relation to 2021 NDC. Progress in relation to the implementation of NDC 3.0 will be reported in the second BTR.

### 3.2.2. Description of the latest NDC

#### (a) Target and description

Qatar's First NDC emissions mitigation ambition is specified as a projected percentage reduction by 2030 below business-as-usual (BAU) levels (an emission reduction target below a projected baseline).

The target is consistent with Articles 4.3, 4.4, and 4.7 of the Paris Agreement, reflecting progression and the highest possible ambition, while acknowledging the role of international support in enabling implementation for developing country Parties. All national actions and plans described will be implemented in accordance with the principles and provisions of the UNFCCC, particularly Articles 4.7 and 12.4.

- Article 4.3 requires each country's NDC to represent a progression over time and reflect its highest possible ambition, taking national circumstances into account.
- Article 4.4 recognizes that developing countries may implement economy-wide emissions reduction targets in a flexible manner.
- Article 4.7 emphasizes that the extent of implementation by developing countries depends on the provision of finance, technology transfer, and capacity-building. Qatar's NDC acknowledges the role of international support in achieving its objectives.
- Article 6 allows countries to cooperate voluntarily in implementing their NDCs, including through international carbon markets and non-market approaches. By stating that Article 6 is considered in implementation, Qatar indicates that it may use cooperative approaches to support achievement of its NDC, where appropriate.

Table 3-1: Description of the NDC

| Information                             | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Target and description                  | Qatar's NDC emissions reduction target was previously defined as a projected percentage reduction by 2030 below business-as-usual (BAU) levels (an emission reduction target below a projected baseline). The target is consistent with Articles 4.3, 4.4, and 4.7 of the Paris Agreement, reflecting progression and the highest possible ambition, while acknowledging the role of international support in enabling implementation for developing country Parties. All national actions and plans described will be implemented in accordance with the principles and provisions of the UNFCCC, particularly Articles 4.7 and 12.4. |
| Target type                             | Qatar's First NDC emissions mitigation ambition is specified as a projected percentage reduction by 2030 below business-as-usual (BAU) levels (an emission reduction target below a projected baseline).                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Target year                             | 2030 (single-year target)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Base year                               | 2019                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Implementation period                   | 2021-2030                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Sectors                                 | Energy (Oil and Gas, Power and Water), Construction and Industry, Transport, Waste and AFOLU                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Gases                                   | Carbon dioxide (CO <sub>2</sub> ), methane (CH <sub>4</sub> ), nitrous oxide (N <sub>2</sub> O)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Intention to use cooperative approaches | The State of Qatar supports the operationalization of Article 6 of the Paris Agreement to facilitate voluntary cooperative approaches and promote sustainable development. Cross-sectoral cooperation, including in clean energy, hydrogen, energy efficiency, waste management, and enabling policies, is considered important for effective NDC implementation.                                                                                                                                                                                                                                                                      |

|                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Any updates or clarifications of previously reported information, as applicable | The BAU-based target is subject to periodic reviews and may be refined and updated. These reviews and updates will be in accordance with evolving national circumstances, the requirements of the Enhanced Transparency Framework (ETF), while maintaining coherence with Articles 4.3, 4.4, and 4.7 of the Paris Agreement, reflecting progression and the highest possible ambition, while acknowledging the role of international support in enabling implementation for developing country Parties. |
|---------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

(b) Target year

The NDC target of Qatar is a single-year target. The target year is 2030.

(c) Base Year and Baseline

Qatar's First NDC emissions mitigation ambition is specified as a projected percentage reduction by 2030 below business-as-usual (BAU) levels (an emission reduction target below a projected baseline).

(d) Time Frame for Implementation

The implementation period for Qatar's NDC spans from 2021 to 2030 in line with Qatar's National Vision (QNV 2030), with the emissions reduction target focused on the end of this timeframe.

(e) Scope and Coverage

The Nationally Determined Contribution (NDC) of the State of Qatar covers the following sectors:

- Energy (Oil and Gas, Power and Water),
- Construction and Industry,
- Transport,
- Waste and
- AFOLU

(f) Intention to use cooperative approaches that involve the use of internationally transferred mitigation outcomes under Article 6 towards NDCs under Article 4 of the Paris Agreement

Qatar is already experiencing the impacts of climate change, including extreme climate conditions and events, which underscore the importance of adaptation alongside mitigation. In this context, Qatar welcomes technical assistance and capacity-building support available to developing country Parties under the Convention. International cooperation, including the transfer and deployment of advanced technologies, is considered essential to support emissions reduction efforts and enhance adaptive capacity.

Qatar supports the development and operationalization of Article 6 of the Paris Agreement as a mechanism to promote sustainable development and facilitate international cooperation. Cooperation across sectors—including renewable energy systems, lower-carbon fuels and technologies, energy efficiency, waste management, sustainable agriculture, downstream specialty chemicals, and enabling national policies and measures—is considered important for effective NDC implementation.

(g) Any updates or clarifications of previously reported information (e.g. recalculation of previously reported inventory data, or greater detail on methodologies or use of cooperative approaches)

The BAU-based target is subject to periodic reviews and may be refined and updated. These reviews and updates will be in accordance with evolving national circumstances, the requirements of the Enhanced Transparency Framework (ETF), while maintaining coherence with Articles 4.3, 4.4, and 4.7 of the Paris Agreement, reflecting progression and the highest possible ambition, while acknowledging the role of international support in enabling implementation for developing country Parties.

### 3.2.3. Adaptation Actions with Mitigation Co-benefits

Consistent with Article 4.7 of the Paris Agreement, Qatar underscores that many adaptation and economic diversification measures yield mitigation co-benefits—strengthening resilience while

reducing emissions. To capture these synergies, the NAP monitoring framework will align with the NDC, Biennial Transparency Reports (BTR), and the national MRV system. This integration maximizes efficiency, avoids duplication, and ensures coherence with Qatar's global commitments. A central challenge lies in developing robust methodologies and algorithms to quantify and monitor mitigation co-benefits from adaptation.

The NAP has identified adaptation measures with mitigation co-benefits (5 actions). This improves climate resilience while cutting emissions through smart energy actions, such as installing peaking power units, weather-responsive cooling systems, and smart meters, to optimize utility use and reduce stress on infrastructure. Adaptation Measures with Mitigation Co-Benefits:

- Install peaking power units to ensure grid stability during extreme weather
- Implement smart meters to monitor utility consumption.
- Establish control mechanisms for weather-responsive cooling systems.
- Implement an intelligent street lighting control management system.
- Design of Domestic Water pumping system with Variable Speed Drives (VSD).

## Water Management

Efficient water management constitutes a cornerstone of Qatar's climate change adaptation strategy and delivers significant mitigation co-benefits. Given the country's heavy reliance on energy-intensive seawater desalination for urban water supply, reducing per capita water and energy consumption is essential to enhance resilience to water scarcity while simultaneously lowering associated production and generation GHG emissions. Qatar has implemented a range of water-conservation measures since 2015, resulting in substantial and sustained efficiency gains across the water sector. These measures include strengthened regulatory frameworks, targeted awareness campaigns for high-consumption households, retrofitting of water-saving devices in government facilities, and expanded use of treated sewage effluent (TSE) for irrigation and other non-potable purposes.

The increasing utilization of TSE in agriculture, green landscapes, district cooling systems, construction activities, and aquifer recharge significantly reduces the demand for desalinated water, thereby lowering energy consumption and associated emissions. Investments in wastewater treatment infrastructure have resulted in the treatment of over 98% of total wastewater, with beneficial reuse across multiple sectors. In parallel, Qatar has advanced institutional and legal reforms through the development of a National Water Policy, draft National Water Law, and groundwater regulation frameworks.

## Infrastructure and Urban Development

Qatar's adaptation efforts in infrastructure development are closely aligned with mitigation objectives through the promotion of sustainable urbanization and climate-resilient design. Guided by the National Vision 2030, Qatar has committed to a comprehensive urban development framework that integrates population distribution, infrastructure services, and efficient resource use. Climate risk assessments focusing on coastal zones are underway, examining both historical climate trends and long-term projections of sea level rise and related stressors. These studies identify key vulnerabilities across socio-economic systems and natural ecosystems, supporting targeted adaptation planning for flooding, erosion, infrastructure integrity, port operations, and coral ecosystems.

By embedding climate resilience into infrastructure planning—particularly transport networks, drainage systems, sanitation services, and sustainable urban developments—Qatar enhances long-term adaptive capacity while generating mitigation co-benefits through reduced energy demand, improved transport efficiency, and lower lifecycle emissions. Major initiatives, including integrated rail systems, expressway and drainage programs, and sustainable urban developments such as Lusail City and Msheireb Downtown, exemplify this approach. These projects contribute to emissions reductions through modal shifts, energy-efficient design, and optimized land use, while strengthening resilience to climate-related risks.

#### Awareness and Behavioral Change

Raising awareness and fostering behavioral change play a critical role in enhancing adaptive capacity and unlocking mitigation co-benefits across society. Public engagement initiatives, educational campaigns, and institutional leadership contribute to a shared understanding of climate risks and sustainable practices. Awareness-raising activities led by governmental and non-governmental institutions promote resource efficiency, energy conservation, and waste reduction, which in turn support emissions mitigation.

Programs targeting sustainable workplace practices—such as paper reduction, energy-saving behaviors, and digitalization—help reduce indirect emissions while cultivating long-term societal resilience. Community-focused initiatives, including school-level education, public awareness parks, and conservation campaigns, embed sustainability principles among younger generations. These efforts reinforce adaptive capacity by encouraging responsible consumption patterns and strengthening societal readiness to respond to climate impacts.

#### Food Security

Qatar’s national food security strategy represents a key adaptation measure with notable mitigation co-benefits. Designed to safeguard domestic food supply against climate-related and external shocks, the strategy optimizes land and water use while reducing vulnerability to global supply disruptions. Increased domestic production of selected agricultural products—particularly vegetables, red meat, and fisheries—enhances resilience while reducing emissions associated with long-distance food transportation.

The expansion of hydroponic greenhouse agriculture improves water efficiency, reduces reliance on groundwater resources, and enables more controlled and climate-resilient production systems. These practices also support mitigation objectives through optimized use of inputs, reduced agrochemical demand, and lower transport-related emissions. Complementary measures, including strategic food reserves, market efficiency programs, and food waste reduction initiatives, further enhance adaptive capacity while contributing to emissions reductions across the food system.

#### *3.2.4. Response measures*

Qatar’s sustainable social and economic development is highly dependent on oil and gas export revenues and may therefore be adversely affected by climate change response measures implemented by developed countries, particularly where such measures impact international trade. In this regard, Article 4.10 of the Convention calls for due consideration of the needs of developing country Parties with vulnerable economies, including those dependent on the production, processing, and export of fossil fuels. Qatar underscores the importance of international cooperation to address the potential

impacts of response measures and to support sustainable development, in accordance with Articles 4.8 (e) and (h) and Article 4.10 of the Convention.

### *3.2.5. Fairness and Ambition*

This NDC is grounded in the principles and provisions of the Convention, in particular Articles 3.2, 4.1, 4.8 (e) and (h), and 4.10. Qatar's national actions and plans are voluntary, and their implementation is subject to the availability of means of implementation and support, consistent with Articles 4.7 and 12.4 of the Convention. Qatar's commitments align with Articles 4.3 and 4.4 of the Paris Agreement, Decision 1/CP.21, and relevant guidance under Decision 4/CMA.1. In accordance with Article 2 of the Convention and Article 4.1 of the Paris Agreement, Qatar will continue to explore pathways to enhance its mitigation ambition, taking into account climate science, global efforts, and its national circumstances, while reserving the right to update this NDC to avoid adverse economic and social impacts and associated national sustainable development arising from response measures.

## 3.3. Information necessary to track progress made in implementing and achieving NDCs under Article 4 of the Paris Agreement (paras. 65–79 of the MPGs)

To track progress toward the implementation and achievement of its nationally determined contribution (NDC) under Article 4, Qatar will track the implementation progress of its targets on a project-based basis, allowing for precise monitoring and quantification of emission reductions across all national initiatives.

## 3.4 Mitigation policies and measures, actions and plans, including those with mitigation co-benefits resulting from adaptation actions and economic diversification plans, related to implementing and achieving a nationally determined contribution under Article 4 of the Paris Agreement

### 3.4.1. Oil & Gas

The State of Qatar benefits from abundant hydrocarbon resources, which are vital to its sustainable economic and social development. At current production levels, Qatar exports around three-quarters of the natural gas it produces, hence, these natural gas resources are also critical to supporting other countries in their sustainable development and energy security objectives, as well as efforts to transition away from more carbon-intensive fossil fuels, such as coal and oil.

#### Sectoral Mitigation Efforts

The Oil & Gas sector in the State of Qatar is at the forefront of national mitigation efforts. The sector's initiatives are diverse and include deploying cleaner fossil fuel technologies, developing engineered sinks to store emissions, diversifying the energy mix, and driving operational excellence across existing facilities and infrastructure.

**Carbon Capture and Storage.** In line with the Paris Agreement objectives of balancing anthropogenic emissions with removal sinks of greenhouse gases, the Oil & Gas sector is prioritizing the adoption of technology levers that are grounded in the best available science, have reached sufficient levels of technology maturity, and are currently available to be commercially deployed. Accordingly, Qatar is taking a leading role in deploying carbon capture and storage (CCS) technology at scale across the Oil

& Gas sector. The sector's significant investments and capacity additions position Qatar among global leaders in deploying CCS and cleaner fossil technologies. In 2019, the largest CO<sub>2</sub> capture and sequestration facility at the time in the Middle East and North Africa (MENA) region commenced sequestration operations at Ras Laffan in Qatar. This facility has a design capacity of 2.2 million tons of CO<sub>2</sub> capture and storage. Additionally, several greenfield and brownfield projects are being developed, leading to an expected fivefold increase in CCS capacity within Qatar.

**Renewable Energy.** Leveraging its abundant sunshine, the State of Qatar is advancing solar energy as a key pillar of its renewables strategy to diversify the local energy mix. Currently, three solar power plants with a combined capacity of approximately 1.7 gigawatts are operational in the country. Additional projects are underway to double this capacity. These projects complement existing gas-based electricity generation, ensuring that growing power demand is met while reducing the emissions intensity of the sector. In addition, various end-use applications across the industry, buildings, and transport sectors in Qatar are progressively undergoing electrification and implementing small-scale renewable energy systems. To further strengthen the role of renewables in the national energy mix, several initiatives are also being implemented to advance the transition toward a smart grid. These initiatives focus on infrastructure upgrades to enable greater integration of renewable energy.

**Energy Efficiency.** A multitude of operational emissions reduction efforts are being targeted across the entire value chain, encompassing LNG, upstream, midstream, and downstream operations producing energy and associated products. All assets in the sector are actively implementing energy efficiency improvement projects. These interventions focus on performance monitoring, as well as the identification and implementation of energy-saving initiatives. The primary objective of these efforts is to reduce natural gas consumption by optimizing its utilization as feedstock and fuel, as well as minimizing power demand to achieve indirect savings in gas use. In addition, activities to phase out and replace older equipment and processes with modern technologies will deliver improved efficiency and support further mitigation of emissions.

**Flaring.** Eliminating routine flaring and undertaking projects to minimize other sources of flaring to the lowest technically feasible levels is a key target across the sector. Flaring mitigation projects are being implemented across all assets. The sector has already implemented several world-class flaring reduction projects, including the Al Shaheen Oil Field Gas Recovery and Utilization Project, as well as the Jetty Boil-Off Gas Recovery Project at the LNG loading facilities.

**Methane Emissions.** Another key priority for the sector is methane emissions mitigation and abatement. The sector is aiming for near-zero methane emissions across all assets in Qatar. To support this ambition, all upstream and midstream assets are required to execute methane emissions implementation plans to fulfill the Oil and Gas Methane Partnership (OGMP 2.0) reporting requirements. Additionally, all assets have implementing Leak Detection and Repair (LDAR) programs. LDAR activities are being supported with the use of advanced monitoring technologies, including satellites, drones, advanced cameras, and sensors.

**Local Mitigations with a Global Impact.** The combination of these initiatives supports not only the mitigation of emissions within the State of Qatar but also Qatar's international commitments to supply energy and associated products at a lower carbon intensity.

### 3.4.2. Power & Water

The Power & Water sector accounts for the second largest share of GHG emissions in Qatar. With demand for both water and electricity projected to rise due to population and GDP growth, the State of Qatar continues to invest heavily in power and water infrastructure to ensure reliability and reduce the sector's carbon intensity. Currently, gas-fired thermal power plants account for the majority of Qatar's total capacity, while most power plants are cogeneration plants that have thermal water desalination. Qatar aims to reduce the carbon intensity of power and water generation while managing demand through efficiency and conservation measures. Qatar aims to expand its renewable energy capacity by promoting small-scale solar photovoltaic (PV) uptake, and to increase the efficiency of its gas-fired power plants by replacing aging units with new, high-efficiency power plants. Qatar also aims to reduce the carbon intensity of water desalination by increasing the share of reverse osmosis. Lastly, Qatar is introducing energy efficiency measures, such as the deployment of district cooling, and energy and water conservation measures aimed at buildings and agriculture.

#### Sectoral Mitigation Efforts

**Replacement of Retiring OCGT with CCGT.** Qatar plans to retire Open-Cycle Gas Turbines (OCGT) and replace them with more efficient Combined-Cycle Gas Turbines (CCGT).

**Adoption of Reverse Osmosis in Desalination Plants.** Desalinated seawater constitutes the main source of Qatar's municipal water supply. To reduce carbon emissions from seawater desalination, Qatar aims to accelerate the adoption of electricity-driven reverse osmosis technology. Reverse osmosis is anticipated to be more efficient than the thermal processes currently used, thereby reducing energy requirements and subsequently GHG emissions associated with desalinated water production.

**Adoption of District Cooling.** District cooling plays an important role in Qatar's climate change mitigation efforts, offering energy efficiency gains compared to conventional air conditioning systems. With 39 district cooling plants operational, Qatar's district cooling capacity has reached approximately 1.2 million tons of refrigeration (TR).

**Adoption of TSE for Agriculture, Landscaping, District Cooling, & Industry.** Enhancing sustainable water management through circularity and efficiency is also a key element of Qatar's mitigation strategy. Qatar increasingly relies on Treated Sewage Effluent (TSE) water for landscaping, agriculture, district cooling, and industry. As national water demand grows, the reuse of TSE is anticipated to offset additional demand for seawater desalination, which is more energy intensive in comparison to wastewater treatment, and therefore contributes to GHG mitigation.

**Demand-Side Management Measures.** Qatar has intensified efforts to improve energy and water efficiency in the building sector, through a combination of regulatory measures, public awareness programs, and technology deployment. New regulations, including mandatory star-rating standards for air conditioners, were introduced in 2020 to promote the adoption of high-efficiency household equipment. In addition, conservation codes now regulate the use of efficient plumbing fixtures and provide guidelines for water use in buildings. Qatar aims to introduce a comprehensive framework for training and certifying facility management companies. This framework will establish standardized criteria to assess and enhance the capabilities of facility management companies, with a particular focus on conserving energy and water. These policies are especially critical given that buildings

represent a significant share of national electricity consumption and cooling demand, positioning efficiency improvements in this sector as a key contributor to Qatar’s climate-mitigation efforts.

### 3.4.3. Industry & Construction

The Industry & Construction sector accounts for the third-largest share of GHG emissions in Qatar. Identified as a growth cluster under the NDS-3, the industrial sector is a key pillar of Qatar’s economic growth. Efforts to localize supply chains and enhance in-country value creation will support the provision of specialty chemicals, manufacturing, engineering, and maintenance services. Innovation, technology development, and transfer in relation to clean technologies, renewable energy, and process efficiency are considered important factors in reducing industrial emissions while maintaining industrial growth.

#### Sectoral Mitigation Efforts

##### a. Industry

The industry sector plays an important role in providing essential products for daily use, as well as for various transition and adaptation-related applications. Mitigations undertaken by the sector primarily focus on improving energy efficiency, while incorporating circular practices.

**Renewable Energy & Energy Efficiency Measures.** The sector is deploying measures focused on optimizing energy consumption, increasing production efficiency and adopting advanced technologies, including small-scale renewables, to lower the emission intensity of production.

**Flaring & other NOx Reduction Projects.** Facilities in the sector are undertaking flaring reduction projects. New projects are also focused on use of best available technologies and practices, such as ultra-low NOx burners, near-zero liquid discharge, and selective catalytic reduction for boilers and furnaces to regulate post-combustion emissions, as well as waste and off-spec material recycling.

**Adoption of Circular Economy Practices.** Circular economy practices are gaining prominence in Qatar’s manufacturing sector, with these practices aimed at reducing environmental impacts through the reuse of materials, recycling of industrial by-products, and the treatment and reuse of wastewater.

The adoption of circular economy practices is supported by the Qatar National Manufacturing Strategy 2024–2030, notably by creating investment opportunities in the recycling sector, analyzing waste data to support industrial planning, and launching incentive programs to facilitate their adoption. More specifically, two key initiatives are outlined:

- The first initiative involves investing in innovative technologies and creating value chains for transformational technologies, through (1) investment in targeted, mature, and relevant technologies and enabling their access within Qatar's supply chains, and (2) developing and promoting green finance solutions to encourage investment in sustainable projects and eco-innovation.
- The second initiative involves promoting the development of a sustainable economy market by (1) developing channels to identify and incentivize demand for recyclable materials, (2) promoting local demand for recycled aggregates through guidelines and quality assurance, (3) working toward the at-source separation of construction and demolition waste, through waste screening, waste management plans, and incentive mechanisms, (4) establishing public

procurement guidelines and enforcing compliance, (5) considering an Extended Producer Responsibility scheme to encourage producers to produce and package more sustainable products and invest in recycling, and (6) creating incentive mechanisms to encourage individuals, as well as private and public entities, to purchase recycled products to promote the growth of a thriving circular economy market.

#### b. Construction

To mitigate construction-related emissions, the sector is gradually adopting circular economy measures and energy-efficient technologies.

Recycling in Construction. Key initiatives include the establishment of recycling yards to process construction waste, and the mandate requiring increasing the use of recycled materials in public infrastructure and construction projects. Additionally, projects related to sustainable road construction are incorporating recycled asphalt materials, such as crumb rubber modified binders and reclaimed asphalt pavement.

### 3.4.4. Transport

The Transport sector accounts for the fourth-largest share of GHG emissions in Qatar. As a significant portion of transport-related GHG emissions is associated with land-based mobility, the sector's priorities are to accelerate the development of public mobility infrastructure, promote a shift to public and non-motorized modes of transport, and enable the uptake of low-emission vehicles for both private and public mobility.

#### Sectoral Mitigation Efforts

GHG emission reduction efforts in the transport sector are guided by the Transportation Master Plan for Qatar 2040, a comprehensive framework launched in 2022 that provides the blueprint for the development of the country's land transportation systems in a staged, chronological, and coherent manner through 2025, 2030, 2035 and 2040. The plan aims to create an integrated, efficient, and sustainable transportation network that not only meets the mobility needs of Qatar's population but also contributes to the nation's broader goals of sustainability, economic diversification, and enhanced quality of life.

Qatar's mitigation strategy for road transport encompasses four key pillars: the development of public transport infrastructure, the electrification of the public transport vehicle fleet, the renewable energy generation for electric transit buses, and the deployment of public electric vehicle (EV) charging infrastructure.

Development of Public Transport Infrastructure. The shift to public transport and non-motorized modes of transport is a key component of reducing GHG emissions from land transport. The provision of high-quality, affordable public transport options is key to incentivizing a shift in transport mode choices. Public transport in Qatar continues to provide passengers with multiple options and is facilitating multi-modal connections.

- The current Doha Metro network is expected to see extensions to existing metro lines, as well as a new Light Rail scheme connecting within and to Lusail New Town.

- Rail transport in Doha is complemented by an integrated, extensive Bus Rapid Transit (BRT) system. The BRT network will be further expanded with additional bus routes, providing alternative, lower-cost options for key corridors, improving local accessibility to workplaces, and incentivizing the use of public transport buses over private vehicles.
- In terms of waterborne transport modes, Qatar aims to develop a continuous passenger ferry service between Hamad Port and Doha Port, with several intermediate stations.
- At the regional level, Qatar's future public transport development plans are expected to include the implementation of a Long-Distance & Regional Rail Network by 2030.

Electrification of Public Transport & Taxis. Qatar aims to maximize the use of electric urban transit buses and plans to transition its traditional taxi fleet to hybrid, plug-in hybrid, and electric vehicles to reduce emissions.

Renewable Energy Generation for Public Buses. In 2022, the Lusail Bus terminal – the world's largest electric bus depot with a capacity of 478 buses - was equipped with 11,000 PV solar panels that generate 4 MWh of electricity per day.

Deployment of EV charging infrastructure. To address one of the main barriers to the adoption of electric vehicles (EVs) by private car buyers, Qatar is significantly expanding its network of public EV chargers. To improve EV charging convenience, a user-friendly smartphone app has been developed, enabling users to locate charging stations, check availability, initiate charging sessions, and track energy usage.

Improving Standards. Qatar aims to establish various standards and requirements for road transportation, addressing all new light-duty vehicles and heavy-duty vehicles

LNG Vessel Program. The LNG Vessel Program to increase LNG export capabilities is focused on modernizing existing fleets with advanced vessels designed for higher operational efficiency. The vessels are equipped with dual-fuel systems that will utilize LNG as the primary fuel; hence, lowering emissions compared to the use of conventional bunker fuels. Efforts to optimize fuel consumption further include deploying advanced hull designs, air lubrication systems, and underwater coatings.

### 3.4.5. Waste

Waste-related GHG emissions mostly emanate from organic waste decomposition and wastewater treatment and discharge activities. The growth of population, urbanization, and industry, as well as the development of new economic sectors, pose challenges related to sustainable waste management. The wastewater infrastructure in Qatar - including the wastewater network - is being expanded to accommodate growing populations in urban and industrial areas. In addition, national efforts across multiple stakeholders are underway to integrate wastewater management with water reuse, notably in landscaping, agriculture, district cooling, and industry.

#### Sectoral Mitigation Efforts

Qatar National Environmental and Climate Change Strategy (QNE) identifies the enhancement of circular economy and waste management practices as one of its five key pillars. The QNE sets ambitious 2030 objectives, notably enhancing its waste accounting capacity, closing and rehabilitating unsanitary landfills, increasing the material recycling rate of municipal waste, reducing per capita food

waste, and encouraging the reduction of food losses along production and supply chains. An integrated national solid waste program was launched in 2022 to operationalize these ambitions.

Closure and Rehabilitation of Mesaieed and Um Al Afaiee Old Landfills. This includes capping and covering closed landfills with engineered layers, and transforming former dump sites into safe, usable land.

Waste-to-Energy Generation. A proportion of non-recyclable waste in Qatar is used to generate electricity, which is fed into the national grid. Qatar plans to double its waste-to-energy capacity by 2030.

Looking ahead, Qatar aims to enhance the role and participation of the private sector in waste treatment and recycling, which is expected to improve efficiency through the deployment of advanced technologies for smart waste management, vehicle tracking, and container monitoring systems.

### 3.5 Projections of greenhouse gas emissions and removals, as applicable (paras. 92–102 of the MPGs)

In accordance with paragraph 92 of the Modalities, Procedures and Guidelines (MPGs) for the ETF under Article 13 of the Paris Agreement, the country provides projections of GHG emissions and removals based on the best available national data, methodologies, and institutional capacities.

Recognizing national circumstances and existing technical and institutional constraints, the country intends to apply the flexibility provisions available to developing country Parties that need it in the light of their capacities, as provided under the MPGs. In particular, flexibility is applied with respect to the scope, coverage, level of detail, and methodological approaches used for emissions projections, including sectoral disaggregation, the inclusion of removals, and the number and type of projection scenarios presented.

Consistent with paragraph 98 of the MPGs, projections are provided for key sectors and gases where sufficient data and methodological capacity are available. However, in accordance with the flexibility provisions for developing country Parties (paragraph 102), projections may not cover all categories of anthropogenic emissions and removals included in the national inventory. Where relevant categories are not yet covered, this reflects current data limitations and modelling constraints.

In line with paragraphs 93–97 of the MPGs, the projections are developed using available national statistics, historical emissions trends, and simplified modelling approaches, supported where necessary by international datasets and default parameters consistent with the 2006 IPCC Guidelines for National GHG Inventories. Due to capacity constraints, the country applies flexibility regarding the level of methodological sophistication and the documentation of underlying modelling assumptions.

Qatar is committed to progressively improving the completeness, methodological robustness, and sectoral coverage of its emissions projections over time, including strengthening national modelling capacity, enhancing data systems, and expanding the range of scenarios presented in future BTRs.

# Information Related to Climate Change Impacts and Adaptation (Article 7 of the Paris Agreement)

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## 4.1 National Circumstances Relevant to Adaptation

Qatar is a peninsula in the Arabian Gulf with a distinctive geographic, climatic, socioeconomic, and cultural profile that shapes its vulnerability and response to climate change. Qatar has an extremely arid climate, characterized by very low, unpredictable annual rainfall of 68.8 mm, and summer temperatures often surpassing 45°C. Coastal humidity further worsens heat stress. Covering 11,636.8 km<sup>2</sup> with a 550 km coastline, the region has most residents, economic activities, and infrastructure concentrated along the low-lying coast, which is highly susceptible to sea-level rise and saline intrusion.

Geography and topography influence Qatar's risks related to climate change impacts. The land is mostly flat and low, which heightens the threat of coastal flooding and storm surges in urban areas, ports, and industrial zones. Inland desert plains and shallow depressions are prone to flash flooding during rare heavy rains. Limited natural barriers and surface water systems decrease resilience to heat and floods, increasing climate risks across various sectors.

Qatar's economy relies heavily on natural gas and oil exports, making it one of the wealthiest countries in the world per capita. A hydrocarbon-based economy continues to support infrastructure and urban growth as well as economic diversification, while balancing continuing social and economic development with environmental protection. Under Qatar National Vision 2030, the country continues to pursue environmental protection, economic diversification, and sustainable development. While adapting to climate change is crucial to balance growth and resilience.

## 4.2 Institutional Arrangements, Legal Frameworks, and Governance

Qatar has established a comprehensive legal and institutional framework for climate change adaptation, led by the Ministry of Environment and Climate Change (MECC), which oversees climate policy development, planning, and cross-sectoral coordination. The Climate Change Department manages international climate negotiations, reporting obligations, and the integration of adaptation strategies into national development plans. A key component of this framework is Qatar's Under progressed National Adaptation Plan (NAP), currently under development, which will provide a roadmap for managing climate risks through 2030 and 2040. The NAP is being developed through multisectoral consultation and will be finalized in due course. Based on multisectoral scientific assessments, the NAP will promote climate resilience through adaptation measures, targeted actions, and projects that address vulnerabilities in six priority sectors: water resources, agriculture and livestock, biodiversity, public health, energy and industry, and infrastructure and coastal zones.

Qatar's adaptation efforts align with Qatar National Vision 2030 (QNV 2030), the Third National Development Strategy (NDS-3), and the 2021 Qatar National Environment and Climate Change Strategy, which set measurable adaptation and sustainability targets. This alignment integrates climate adaptation into national budgets, urban planning, and sectoral development policies while addressing major risks, including water scarcity, extreme heat, and coastal vulnerability. The framework is supported by legal instruments, including the Environmental Protection Law (Law No. 30 of 2002) and sector-specific legislation, which increasingly incorporate adaptation measures in line with the Paris Agreement, the Sustainable Development Goals (SDGs), and Gulf Cooperation Council (GCC) environmental frameworks.

Supporting institutions contribute to climate risk monitoring, research, and early warning systems, while inter-ministerial committees facilitate coordination across government sectors. Although

governance remains largely top-down, participation by academia, civil society, and the private sector is increasing. The NAP also serves as Qatar’s primary mechanism for fulfilling its commitments under the Paris Agreement, providing a structured pathway to strengthen climate resilience and sustainable development. Nevertheless, challenges remain in improving institutional coordination, mainstreaming adaptation across sectors, and ensuring the effective implementation of adaptation measures at the local level

## 4.3 Impacts, Risks and Vulnerabilities

### 4.3.1 Projected Climate Change for Qatar

Climate projections utilize CMIP6 models, which are downscaled for Qatar using regional models such as HCLIM-ALADIN, under the SSP2-4.5 and SSP5-8.5 scenarios, focusing on mean changes and extremes, including maximum temperatures and precipitation events. Regional analysis follows the RICCAR methodology.<sup>125</sup> Coastal–marine data include NOAA SST (1981–present) and AVISO+/CMEMS sea level. Water scenarios from 2021 to 2040/2040 are modeled with WEAP, considering demographic and climate stressors.<sup>126</sup> The policy context is based on NDC, and other relevant policies (QNV 2030)<sup>127</sup>, MECC (2021)<sup>128</sup>, and government sources. Uncertainty is addressed through ensemble spread and confidence levels per IPCC guidelines.

Mean temperatures are projected to keep rising across all scenarios. By the 2040s, the average temperature increase ( $\Delta T$ ) is expected to be +1.16 °C (range: 1.03–1.40) under SSP2-4.5 and +1.30 °C (range: 1.13–1.46) under SSP5-8.5. The number of hot days, the duration of heatwaves, and the frequency of warm nights all tend to increase.<sup>129</sup>

Observed SST trends indicate that Qatar’s waters have warmed by approximately 0.039 to 0.066 °C per year since the 1980s, with marine heatwaves becoming more frequent and prolonged.<sup>130</sup> Projections suggest that SST could increase by approximately 0.40°C by 2030 and about 0.89°C by 2040 under SSP2-4.5, with a potential rise of over 2°C by 2100 under high-emissions scenarios compared to 1995–2014 levels.<sup>131</sup>

Observed sea level rise (SLR) data indicate a multi-millimeter increase per year, with notable interannual variability, as determined by local altimetry measurements.<sup>132</sup> The outlook suggests continued SLR through 2100, with projections aligning with AR6 findings: an increase of approximately

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<sup>125</sup> United Nations Economic and Social Commission for Western Asia (UNESCWA). (2017). Arab Climate Change Assessment Report: Main report (RICCAR); and Intergovernmental Panel on Climate Change (IPCC). (2021). *Summary for policymakers*. In V. Masson-Delmotte et al. (Eds.), *Climate Change 2021: The Physical Science Basis* (Working Group I contribution to the Sixth Assessment Report). Cambridge University Press.

<sup>126</sup> Planning and Statistics Authority, 2022; MECC, 2021a

<sup>127</sup> Government Communications Office. (n.d.). Qatar National Vision 2030

<sup>128</sup> Ministry of Municipality and Environment (MME). (2021). *Qatar National Environment and Climate Change Strategy*. Ministry of Municipality and Environment, State of Qatar.

<sup>129</sup> Intergovernmental Panel on Climate Change (IPCC). (2021). Chapter 9: Ocean, cryosphere, and sea level change. In *Climate Change 2021: The Physical Science Basis*. Cambridge University Press. and UNESCWA, 2017

<sup>130</sup> Oliver, E. C. J., Donat, M. G., Burrows, M. T., Moore, P. J., Smale, D. A., Alexander, L. V., ... Wernberg, T. (2018). Longer and more frequent marine heatwaves over the past century. *Nature Communications*, 9, 1324; and NOAA National Centers for Environmental Information (NCEI). (2020). Optimum Interpolation Sea Surface Temperature (OISST), version 2.1 [Dataset].

<sup>131</sup> IPCC, 2021.

<sup>132</sup> CLS. (2022). SSALTO/DUACS user handbook: Climatologies products (SALP MU P EA 23570 CLS).

0.44–0.76 meters under SSP2-4.5, and approximately 0.63–1.01 meters under SSP5-8.5, relative to 1995–2014 periods. Regional deviations are also expected.<sup>133</sup>

#### 4.3.2 Sectoral Vulnerabilities

##### Water security (desalination, groundwater, reuse)

The system profile indicates that the municipal water supply primarily relies on seawater desalination, whereas agriculture relies on over-extracted aquifers and treated sewage effluent (TSE).<sup>134</sup> Stressors such as higher intake temperatures and salinity, along with risks of biofouling and power–water coupling during heatwaves, increase operational challenges; flash floods further strain drainage systems and impact water quality.<sup>135</sup> According to WEAP projections from 2021 to 2040, under high growth and heat scenarios, domestic unmet demand is expected to range from approximately 300 to 1,900 million cubic meters (MCM), while agricultural unmet demand could reach roughly 800 to 6,500 MCM. These estimates suggest a need to expand the use of TSE, adopt demand management strategies, and modify crop types and technologies.<sup>136</sup> Moreover, groundwater extraction totals approximately 230 MCM annually, far exceeding the sustainable yield of roughly 55 MCM, indicating ongoing depletion.<sup>137</sup>

##### Public health

Qatar experiences summer temperatures over 45°C. By mid-century, the number of intense heat days could double, with a 1.2–1.3°C increase under high-emissions scenarios. Humidity exacerbates risks, particularly in coastal areas where heat index limits are frequently exceeded. Prolonged hot nights above 30°C hinder recovery and strain health systems.<sup>138</sup> Heat-related illness and mortality risk increase; humid heat can exacerbate this risk in some episodes. Dust and air quality exacerbate cardiopulmonary stress, especially for vulnerable groups and outdoor workers.<sup>139</sup>

##### Coastal zones & critical infrastructure

Inundation and erosion risks rise with SLR; flood recurrence intervals shrink. Exposed locations include West Bay, Lusail, Al Khor, Hamad Port, and industrial hubs (Mesaieed, Ras Laffan)<sup>140</sup>. Low-lying road/utility corridors are expected to face more frequent disruptions by mid- to late-century.<sup>141</sup>

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<sup>133</sup> IPCC, 2021, Ch. 9.

<sup>134</sup> MECC, 2021a; NPC, 2022

<sup>135</sup> Intergovernmental Panel on Climate Change (IPCC). (2022). Chapter 10: Asia. In *Climate Change 2022: Impacts, Adaptation and Vulnerability* (Working Group II contribution to AR6). Cambridge University Press. And MECC, 2021a.

<sup>136</sup> NPC, 2022

<sup>137</sup> NPC, 2022; and Al Khoury, I., Haddad, M., & Sherif, M. (2023). Synergetic water demand and sustainable supply strategies in GCC countries: Data-driven recommendations. *Water Resources Management*, 37, 4299–4320.

<sup>138</sup> *Second National Communication Report (SNC)* (2025). State of Qatar SNC Submitted to the United Nations Framework Convention on Climate Change. State of Qatar; Ministry of Municipality and Environment. (2021). *Qatar National Environment and Climate Change Strategy (QNE)*. Ministry of Municipality and Environment.

<sup>139</sup> Pal, J. S., & Eltahir, E. A. B. (2016). Future temperature in Southwest Asia projected to exceed a threshold for human adaptability. *Nature Climate Change*, 6(2), 197–200; and IPCC, 2022.

<sup>140</sup> MECC, 2021; and IPCC, 2021, Ch. 9

<sup>141</sup> MECC, 2021.

### Marine & coastal ecosystems

Recurrent thermal stress and more frequent marine heatwaves threaten coral cover, dugong habitat, and fisheries; potential declines in coastal protection/ecosystem services.<sup>142</sup>

### Food systems

High import dependence exposes Qatar to climate-amplified supply and price shocks abroad; domestic horticulture remains heat- and water-constrained despite advances in controlled environments.<sup>143</sup>

### Built environment & urban systems

Higher night-time temperatures and UHI intensify cooling demand and indoor heat risk for vulnerable groups.<sup>144</sup> Intensifying cloudbursts can exceed drainage design capacities in densely populated districts; local upgrades and temporary storage are necessary.<sup>145</sup>

## 4.3.3 Key Uncertainties and Limitations

Precipitation changes show model differences, with internal variability dominating through mid-century.<sup>146</sup> Dust projections remain uncertain due to land-surface and aerosol–dynamic feedback.<sup>147</sup> Local sea level rise and extreme sea level events depend on Gulf hydrodynamics, bathymetry, and coastal structures, necessitating site-specific studies.<sup>148</sup> Additionally, socioeconomic factors such as population and asset sitting influence risks as much as physical changes.<sup>149</sup>

## 4.4 Adaptation Priorities and Barriers

### 4.4.1 Sector Strategies and Priority Actions

According to SNC 2025 and MECC, 2021, below section describes sector strategies and priority actions.

#### Coastal Zones and Marine Ecosystems

Most people and assets are located along the coast. Vulnerable areas include low-elevation regions and industrial hubs, such as the Doha waterfront, Ras Laffan, and Mesaieed, which face risks from sea-level rise and storm surges. Key strategies to manage these risks are: (i) implementing risk-aware spatial planning with coastal setback zones; (ii) adopting design standards that consider sea-level rise for ports, desalination plants, transportation, and energy infrastructure; (iii) installing engineered defenses such as seawalls and revetments at critical points; (iv) using ecosystem-based solutions like mangrove protection and restoration; and (v) establishing early-warning systems and evacuation plans for coastal hazards.

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<sup>142</sup> Oliver et al., 2018; and Ministry of Environment and Climate Change (MECC). (2021b). Qatar National Environment and Climate Change Strategy (QNE).

<sup>143</sup> IPCC, 2022; MECC, 2021

<sup>144</sup> IPCC, 2022.

<sup>145</sup> IPCC, 2021, 2022; MECC, 2021a.

<sup>146</sup> IPCC, 2021

<sup>147</sup> UNESCWA, 2017

<sup>148</sup> IPCC, 2021, ch. 9; and CLS, 2022

<sup>149</sup> IPCC, 2022; MECC, 2021

## Water Resources

Climate vulnerability increases due to factors like structural aridity, groundwater salinity, and dependence on desalination. Important strategies to tackle these problems include boosting water reuse (TSE) for farming, landscaping, and industry; strengthening water supply resilience through storage and diversification; improving the efficiency and durability of desalination methods; monitoring and managing aquifers; and lowering demand through conservation efforts and leak control.

## Public Health

Rising temperatures, humidity, dust storms, and heavy rainfall periodically increase health risks, particularly for outdoor workers, seniors, and children. Key strategies include: (i) deploying heat-health action plans and early warning systems; (ii) providing occupational protection and restricting summer working hours; (iii) establishing climate-resilient healthcare facilities; and (iv) implementing integrated surveillance for heat, air quality, and vector-related threats.

## Food Security and Agriculture

The rationale emphasizes the importance of climate-smart domestic production for Qatar, given its significant dependence on imports and limited arable land, both of which are essential for strategic resilience. The main strategies include: (i) implementing controlled-environment farming such as greenhouses and hydroponics; (ii) growing salt-tolerant and drought-resistant crops; (iii) enhancing irrigation systems by using treated sewage effluent (TSE); and (iv) supporting sustainable fisheries and aquaculture practices.

## Infrastructure and Urban Development

Rapid urban development increases vulnerability to climate-related hazards such as heatwaves, flash floods, and coastal threats. To manage these risks, key strategies include: (i) developing flood-resistant drainage systems and retention zones; (ii) strategically positioning and elevating infrastructure with climate considerations; (iii) adopting GSAS and green building standards along with district cooling solutions; (iv) creating shaded, walkable public spaces and boosting urban greenery to lessen heat island effects; and (v) incorporating climate risk assessments into Environmental Impact Assessments (EIAs) and building codes.

## Biodiversity and Ecosystems

Mangroves, seagrasses, and coral reefs act as natural defenses for coastlines, support fisheries, and offer cultural benefits. However, they are increasingly vulnerable to warming temperatures and rising sea levels. Key strategies to protect these ecosystems include: (i) expanding and managing protected areas; (ii) restoring mangroves and monitoring coral health; (iii) enforcing coastal setback regulations and habitat protections; and (iv) integrating nature-based solutions into coastal planning.

### 4.4.2 Barriers

Despite strong national frameworks, Qatar faces significant challenges that hinder effective adaptation. These include a lack of high-resolution climate data specific to Qatar's arid environment and coordination gaps on sectoral initiatives involving multiple government and private entities, potentially impacting project implementation and timeframes. Although adaptation is incorporated into the QNE, its mainstreaming across sectors remains inconsistent. The country also relies heavily on imported technologies, highlighting the need for effective technology transfer. Additionally, knowledge gaps exist due to limited research and monitoring of ecosystems such as mangroves and desert biodiversity. Private sector involvement in adaptation is minimal, with most investment coming from public funds. Capacity for monitoring, evaluation, and learning (MEL) is limited, complicating systematic assessment of adaptation outcomes.

## 4.5 Adaptation strategies, policies, plans, goals and actions to integrate adaptation into national policies and strategies

Qatar's adaptation strategy is shaped by the Under progressed National Adaptation Plan (NAP), currently under development, which will serve as the main framework for addressing climate risks and building resilience through 2030 and 2040. The NAP embeds adaptation into national development plans and outlines a comprehensive set of sectoral and cross-sectoral actions. These cover areas such as water resources, public health, agriculture and livestock, biodiversity, energy and industry, and infrastructure and coastal zones. Cross-sectoral initiatives aim to enhance climate governance, develop climate information systems, promote research and innovation, build capacity, improve risk assessments, establish financing mechanisms, and foster institutional coordination to facilitate adaptation efforts across all sectors. Qatar's NAP cross sectoral Adaptation measures include:

- Integrated Water-Energy Nexus Adaptation Measures
- Environmental Health and Ecosystem-Linked Adaptation
- Early Warning Systems and Disaster Risk Management
- Circular Economy, Water Recycling and Circular Resource Use, Waste Management and Resource Efficiency
- Climate Data, Monitoring, and AI Integration
- Green Finance for Climate Adaptation and Environmental, Social, and Governance (ESG) Goals

Qatar has adopted occupational heat protection measures to address rising temperatures and associated risks. These measures include Wet Bulb Globe Temperature (WBGT)-based work-rest schedules, heat-health action plans, awareness campaigns, and climate-resilient healthcare services. Early Warning Systems (EWS) play a crucial role in this adaptation strategy by improving monitoring, forecasting, and risk communication, helping to prepare for and respond to extreme heat, dust storms, coastal flooding, and other climate hazards.

In the energy sector, adaptation efforts focus on strengthening the resilience of electricity generation and distribution. These efforts include adopting energy-efficiency standards, implementing district cooling, deploying thermal energy storage, advancing demand-side management, and building climate-resilient power infrastructure. Water security remains a key national priority, supported by durable desalination systems, increased reuse of treated sewage effluent (TSE), leakage-reduction programs, groundwater conservation measures, water-saving initiatives, and improvements in storage and supply reliability.

To reduce coastal vulnerability, Qatar adopts integrated coastal zone management that incorporates sea-level rise forecasts into planning, asset-level risk assessments, setback and elevation standards, ecosystem-based adaptation strategies, engineered coastal defenses, and emergency preparedness plans. Urban resilience efforts include climate-responsive land-use planning, sustainable drainage solutions, upgraded stormwater systems, permeable surfaces, detention and retention facilities, and flood risk management protocols.

Ecosystem-based adaptation efforts emphasize conserving and restoring biodiversity and coastal habitats, including mangroves, seagrass beds, and coral reefs. These actions strengthen resilience and deliver environmental and socioeconomic benefits. In the agriculture and food sectors, Qatar supports

climate-smart farming, sustainable fisheries, efficient irrigation, and drought- and salinity-resistant production systems to enhance food security.

Aligned with the NAP, adaptation implementation is supported by a social inclusivity framework that aims to strengthen the resilience of vulnerable groups, safeguard public health and livelihoods, ensure equitable access to adaptation benefits, and increase community awareness and participation in climate resilience initiatives. Several initiatives reflect efforts to ensure that stakeholders from diverse backgrounds are meaningfully engaged in climate adaptation planning and action:

- Social Inclusivity in Academia: Women in Academia Committee (WiAC)
- Accessible Infrastructure Development – Msheireb Downtown Doha
- Youth and Community Climate Awareness – Earthna Centre for a Sustainable Future
- Support for Women in Agriculture – Qatar Development Bank (QDB) Initiatives

Furthermore, Qatar NAP has recognized Early Warning Systems (EWS) as pivotal for building resilience across sectors – public safety, environmental protection, and health. Integrating EWS into the NAP ensures that adaptation measures are not only forward-looking but also directly address the growing challenge of loss and damage in line with global frameworks under the UNFCCC, the Sendai Framework for Disaster Risk Reduction, and the Santiago Network. Some of the ongoing efforts to advance early warning and climate risk management in Qatar:

- Smartphone-Based Public Warning System for Public Safety.
- Enhancing Rapid Response in High-Risk Settings.
- Satellite-Based Early Warning System to Monitor Marine Oil Pollution.
- Ambient Air Quality Monitoring and Alerting.
- Radiation Early Warning Network

## 4.6 Monitoring, Evaluation, and Learning (MEL)

### 4.6.1 Purpose and Principles

The MEL framework is crucial to Qatar’s adaptation governance, ensuring that climate actions are implemented, monitored, and continually improved over time. Key documents emphasize that MEL provides critical evidence to:

- Track progress toward national adaptation goals and sector strategies.
- Ensure accountability to stakeholders and the global community through the ETF.
- Incorporate practical lessons into future policies, enhancing learning.
- Build public trust and attract investment in Qatar’s adaptation initiatives.

The 2021 QNE describes it as a cross-sector accountability system that links national strategies to international reporting requirements. The Monitoring and Evaluation (M&E) framework established under the NAP provides a complementary mechanism for tracking adaptation progress, assessing outcomes, and identifying lessons learned. The framework will also support the development of adaptation indicators, strengthen evidence-based decision-making, and facilitate more comprehensive adaptation reporting in future BTRs. Moving forward, the implementation of the monitoring framework will focus on:

- **Defined Methodologies:** Establishing clear data collection protocols, assigning responsibilities, and setting evaluation processes to assess effectiveness.
- **System Harmonization:** Integrating MECC's centralized M&E Tool with monitoring systems of other ministries to enable efficient data sharing and avoid duplication.
- **Strengthening Monitoring, Evaluation and Learning (MEL):** Conducting a comprehensive review of existing mechanisms across ministries and agencies, followed by the harmonization of MECC's MEL system with sectoral goals
- **Global Alignment:** Ensuring coherence with global reporting obligations under the UNFCCC, SDGs, and the Sendai Framework, allowing Qatar to meet its international commitments while advancing national adaptation priorities.

#### *4.6.2 Institutional Arrangements*

The responsibilities related to MEL are designated but collaboratively managed among various organizations. The MECC provides methodological guidance on climate indicators, oversees reporting duties under the UNFCCC and ETF, and hosts the Climate Change Department, which serves as the main contact for MEL matters. The National Planning Council (NPC) ensures that MEL indicators are aligned with Qatar National Vision 2030 and the National Development Strategy (NDS-3), incorporating adaptation tracking into the country's development indicators. Sector agencies play vital roles: KAHRAMAA focuses on water and energy efficiency, the Ministry of Public Health (MoPH) gathers health data related to climate change, Ashghal manages drainage and flood resilience infrastructure, and QatarEnergy, along with industry partners, concentrates on asset resilience and adaptation investments. Research and academic institutions, including Qatar University and entities within Qatar Foundation, contribute through climate modeling, vulnerability research, and the development of evaluation tools.

#### *4.6.3 Data Collection, QA/QC, and Reporting*

Data collection involves sectoral agencies gathering raw data, such as KAHRAMAA on TSE and MoPH on health outcomes. The MECC conducts quality control checks, aligning methods with IPCC guidance and national statistical standards. Results are then consolidated into national reports, such as the BTR, NDC progress reviews, and the State of the Environment reports. The NPC ensures these results are comparable with other national development indicators and oversees efforts to minimize duplication.

#### *4.6.4 Learning and Adaptive Management*

Qatar's MEL system is carefully designed to promote continuous learning and improvement. It includes feedback tools, such as annual reports, that support mid-term reviews of key frameworks like QNE and NAP. The system also encourages cross-sector collaboration through regular workshops with MECC, government ministries, academia, and the private sector, creating a platform to share best practices. Additionally, scenario-based learning is incorporated into planning by using innovative models for sea level rise and heatwaves, boosting preparedness. Capacity building remains a priority, with MEL serving as a vital resource to train officials in MRV methods, climate data analysis, and resilience strategies.

#### *4.6.5 Contribution to the ETF*

MEL systems improve Qatar's compliance with Article 13 of the Paris Agreement by providing quantitative evidence of adaptation results, linking NDC progress tracking with adaptation reporting, and strengthening the credibility of Qatar's reports through consistent indicators and transparent data flows.

## 4.7 Cooperation, good practices, experience and lessons learned

Qatar recognizes that, despite substantial domestic investment in adaptation, ongoing support is essential for achieving the necessary resilience at the right scale and pace. The SNC (2025) identified institutional, technological, and data gaps as obstacles, while the QNE (2021) emphasized that Qatar's adaptation goals need continuous financial, technical, and capacity-building support, especially in technology-heavy sectors such as water, health, and coastal protection.

Qatar funds its climate adaptation mainly through government budgets and sovereign wealth funds. However, many projects—like coastal defenses, urban drainage, flood management, and mangrove restoration need substantial and ongoing funding. Water security efforts, including wastewater reuse, desalination, and aquifer replenishment, require public and private investments. Public health initiatives, such as climate-resilient hospitals and heat-warning systems, also need continuous support. Strategies to improve agricultural resilience, like controlled-environment farming and saline-tolerant crops, involve high initial and ongoing costs. The QNE (2021) suggests exploring innovative financing, including public-private partnerships, green bonds, and insurance, to supplement government funding.

Adaptation efforts in Qatar rely on advanced technologies, such as high-resolution climate models, early warning systems for extreme weather, and water management solutions like desalination and water recycling. Healthcare systems incorporate heat stress monitoring, while food security strategies include hydroponics and saline-tolerant seeds. Ecosystem monitoring utilizes remote sensing and drones. Both SNC (2025) and QNE (2021) emphasize the significance of technology transfer, international research and development collaboration.

Although Qatar has strong institutional frameworks, continued efforts are required in improving capacities by training officials in climate data, monitoring, and reporting according to IPCC standards, and equipping professionals with climate resilience knowledge. Community awareness programs should target outdoor workers, vulnerable groups, and residents about heat and flood risks. A key focus area is alignment on integrated adaptation strategies and improvements in cross-sectoral coordination and cooperation among agencies such as MECC, NPC, KAHRAMAA, Ashghal, MoPH, MoM, and QatarEnergy.

The main gaps are insufficient data on sea-level rise, heat extremes, and ecosystem health, along with heavy reliance on imported technology and limited local innovation. The absence of a unified MEL system, as well as any limitations in cross-sectoral and institutional coordination also pose challenges. Additionally, knowledge gaps exist regarding socio-economic and health impacts, and there is a need for diverse financing tools to engage the private sector better.

Qatar has strong internal skills; however, it still relies on international cooperation to access knowledge and technology. QNE (2021) recommends focusing on collaboration with GCC nations on resilience, engaging with UNFCCC mechanisms for support, forming academic and R&D partnerships, and participating in global initiatives related to climate, health, and water.

Qatar's adaptation efforts are bolstered through cooperation at multiple levels—national, regional, and international. These collaborations are crucial for sharing data on climate projections, sea-level rise, and heatwave modeling, which enhances understanding and response capabilities. Additionally, strengthening institutional capacities by aligning adaptation strategies with sustainable development is vital. Lastly, integrating adaptation and mitigation strategies and exploiting cross-sectoral benefits can further strengthen overall resilience.

At the domestic level, Qatar fosters whole-of-government and multi-sectoral coordination through:

- National Committee on Climate Change, chaired by MECC, ensuring policy coherence across ministries and agencies.
- Integration with national development plans such as the Qatar National Vision 2030 and the National Development Strategy (NPC, 2018–2022, 2024–2030).
- Cross-sectoral task forces that align adaptation actions with energy, water, health, transport, and municipal planning priorities (QNE, 2021).
- Investments in climate-resilient infrastructure and resource efficiency through QatarEnergy, KAHRAMAA, and industry actors including private sector partnerships.

Qatar’s SNC (2025) and QNE (2021) emphasize the importance of regional cooperation, given the shared vulnerabilities of Gulf states to extreme heat, water scarcity, and sea-level rise. Areas of collaboration include:

- GCC: Joint initiatives on water security, desalination efficiency, and integrated power grids.
- Regional meteorological cooperation: Data exchange and early warning system collaboration via the Gulf Cooperation Council Interconnection Authority and WMO partnerships.
- Shared marine and coastal ecosystems: Cooperative mangrove and coral reef management across the Arabian Gulf to safeguard biodiversity and fisheries.

Qatar is actively engaged in global efforts under the UNFCCC and beyond:

- UNFCCC engagement: Reporting through NCs, BURs, and now BTRs; participation in the Santiago Network on Loss and Damage for technical support.
- Technology cooperation: Partnerships with international research centers for hydroponics, saline-tolerant crops, and water-use efficiency.
- Capacity building: Training exchanges with global institutions to strengthen MEL, MRV systems, and adaptation planning.
- South–South cooperation: Sharing adaptation knowledge and innovations with other arid and semi-arid countries, particularly in water and energy nexus management.

# Financial, Technology Development and Transfer, and Capacity Building Under Articles 9 to 11 and Article 13 of the Paris Agreement

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## 5.1 National Circumstances

The Ministry of Environment and Climate Change (MECC) leads compilation of information on finance, technology development and transfer, and capacity building reported under Articles 9 to 11 and Article 13 of the Paris Agreement. Cross government coordination is provided through the National Committee on Climate Change, which supports timely data requests, consolidation of inputs, and resolution of reporting issues across entities that hold relevant information.

Prior to the Measurement, Reporting and Verification platform (MRV) platform, information collection relied on a traditional coordination approach led by the MECC through formal data requests to relevant entities. The approach relied on standard questionnaires and templates, targeted technical meetings and workshops, and structured follow up with data owners to clarify definitions, resolve gaps, and confirm figures. These arrangements have been strengthened through the Climate Action MRV platform, launched in July 2025. The platform provides a structured channel for submission, review, and consolidation of information across mitigation, adaptation, and support. It applies to standard templates, maintains a clear record of revisions, and supports validation and consistency checks before final compilation. The platform strengthens traceability of inputs and improves readiness for future BTR by supporting a more continuous and institutionalized reporting workflow across responsible entities.

### *5.1.1 Institutional arrangements for tracking and reporting support information in the Biennial Transparency Report*

Support information is compiled through an institutional arrangement that combines policy level coordination, entity level data ownership, and an integrated digital platform that supports structured data capture and quality control. The arrangement covers three support information groups for this chapter.

1. Financial information, including voluntary reporting on domestic climate related finance and private finance mobilization, and any international finance received during the reporting period, where applicable
2. Technology development and transfer support needed and received, where applicable.
3. Capacity building support needed and received, where applicable, including transparency related capacity building.

#### 5.1.1.1 Responsible entities, mandates, and coordination

Institutional arrangements for tracking and reporting support information follow a national coordination model led by the MECC. The Climate Change Department coordinates cross sector data collection and consolidates inputs for the BTR. This mandate reflects institutional reforms under Amiri Decision No. 41 of 2022, which defined the Ministry's organizational structure and consolidated climate change governance functions within the Ministry.

The National Committee on Climate Change reinforces coordination by providing an interministerial platform to align inputs, address overlaps, and support technical validation. Data collection starts with formal requests coordinated by the Climate Change Department within the MECC. Each relevant entity compiles its inputs from internal records, programme documentation, administrative datasets, and partner reporting, in line with agreed templates and reporting parameters for the BTR.

Entities designate focal points to coordinate internal consolidation across departments, apply initial checks for completeness and internal consistency, and submit an endorsed dataset for sector level review. After entities complete this compilation and internal clearance, the information is uploaded to the Climate Action MRV Platform for structured review, consolidation, and final validation.

Support information is distributed across multiple data owners. Financial information draws on public finance and implementing programme entities, and on financial sector regulators and institutions for private mobilization and enabling measures, with the Ministry of Finance playing a key role in advancing a sustainable finance system. Technology development and transfer and capacity building information is held by implementing entities and partners, including line ministries, public agencies, and research and higher education institutions, reflecting the NDC emphasis on international cooperation and technology deployment. Where reporting requires consistency with national indicators, the National Planning Council supports statistical alignment and coherence.

The Climate Action MRV platform serves as the core system for tracking progress towards NDC targets and related mitigation, adaptation, and support measures. The Climate Change Department operates the platform as a web-based system that enables structured data entry, exchange, and verification among stakeholders. It is organized into three modules covering mitigation, adaptation, and support, including finance, technology development and transfer, and capacity building. The platform also supports automated validation, quality assurance, and revision tracking, strengthening consistency and a clear link between data owners and reported outputs. Table 5-1 below provides information on responsible entities, mandates, and coordination.

*Table 5-1: Responsible entities, mandates, and coordination*

| Entity                                                                                                                                                                           | Mandate relevant to support reporting                                                                                             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Ministry of Environment and Climate Change                                                                                                                                       | National climate governance and reporting under the United Nations Framework Convention on Climate Change and the Paris Agreement |
| Climate Change Department within the Ministry of Environment and Climate Change                                                                                                  | Technical coordination of climate change information and reporting                                                                |
| National Committee on Climate Change                                                                                                                                             | Cross government coordination on climate policy and implementation alignment                                                      |
| National Planning Council                                                                                                                                                        | National statistics and indicator coherence                                                                                       |
| Qatar Fund for Development                                                                                                                                                       | International cooperation and development support channels                                                                        |
| Sector implementing entities and regulators, such as QatarEnergy, KAHRAMAA, Qatar General Electricity and Water Corporation, Ministry of Transport, and Ministry of Municipality | Implementation of sector actions and associated cooperation arrangements                                                          |

#### 5.1.1.2 Data sources, and collection workflow

Support information relies on administrative records and programme documentation held by the entities that implement or host each activity. Typical evidence includes signed cooperation documents, project documents, training agendas, participation lists, progress reports, completion reports, and official correspondence with partners. For transparency related support, evidence also includes technical assistance records related to reporting system development, including MRV system development and reporting readiness workshops. Table 5-2 below provides information on data sources, and collection workflow.

*Table 5-2: Data sources, and collection workflow*

| Information item                                             | Primary data sources                                                                                                           |
|--------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| Climate finance received                                     | Grant agreements, cooperation agreements, project documents, disbursement records, implementation reports                      |
| Domestic public climate related finance                      | Programme and project budgets, public investment plans, expenditure execution records, programme monitoring reports            |
| Private finance mobilization and enabling measures           | Sustainable finance policies, supervisory guidance, financial sector reporting, green or sustainability linked product records |
| Capacity building support received                           | Training programmes, technical assistance activities, workshops, institutional strengthening programmes                        |
| Technology development and transfer support received         | Technology cooperation projects, pilots, research partnerships, operational support programmes                                 |
| Technology development and transfer support needed           | Sector plans, national strategies, project pipelines, identified gaps                                                          |
| Capacity building support needed                             | Institutional gap assessments, reporting improvement plans, sector implementation requirements                                 |
| Support for transparency related activities under Article 13 | Reporting readiness support, system development support, technical expert support                                              |

#### 5.1.1.3 Validation, approval, and data quality procedures

The BTR applies a layered validation and quality control process led by the MECC, with coordination support from the National Committee on Climate Change. Each reporting entity validates its reported information against internal records and supports documentation, confirming the entity responsible, time frame, implementation status, classification, and reported outputs and results. The MECC undertakes a technical review to check completeness, consistent classification, currency and reporting period consistency for finance entries, and documentary traceability for each reported item, with reconciliation to underlying records where available. Consolidation checks screen for coherence between narrative and tables and avoid double counting, including duplicates where one activity includes multiple support elements and potential overlap between transparency related support under Article 13 and broader capacity building.

The National Committee on Climate Change supports cross government validation by addressing overlaps, confirming consistency with national priorities, and verifying that reported activities reflect established cooperation and support arrangements. The Ministry completes consolidation and secures internal sign off for submission. Where items relate to international cooperation instruments, an additional clearance step may be applied to ensure consistency with official cooperation records and aligned public reporting.

## 5.2 Country Priorities, Strategies and Regulations

Qatar's climate priorities and the enabling policy and regulatory environment are anchored in Qatar National Vision 2030 and operationalized through a set of strategies and plans that define national targets, sector measures, and implementation arrangements. These instruments provide the policy basis for identifying, classifying, and reporting support related information in this chapter across finance, technology development and transfer, and capacity building, including transparency related capacity building under Article 13 of the Paris Agreement. Qatar has also strengthened institutional governance for climate action through the establishment of the MECC, which consolidated climate change functions under a dedicated mandate.

### 5.2.1 National climate policy framework and implementation priorities

Qatar's national climate policy framework is anchored in its Qatar National Vision 2030 and operationalized through a suite of strategies and commitments, including the Qatar National Environment and Climate Change Strategy (QNE) launched in 2021, the NDC under the Paris Agreement (2021), and the Third National Development Strategy 2024–2030 (NDS-3). These plans collectively outline Qatar's climate goals, notably an economy-wide of greenhouse gas emission mitigate by 2030 and identify priority sectors for mitigation and adaptation action. Qatar's efforts focus on the oil and gas, power and water, transportation, and building, construction and industry sectors, in line with national development objectives and the NDC targets.

Each sectoral strategy is closely aligned with Qatar's economic diversification agenda and is designed to maximize co-benefits such as resource efficiency, air quality improvements, and climate resilience. Importantly, Qatar's climate strategies emphasize creating an enabling environment for implementation, including regulatory measures, institutional coordination, and integrated tracking systems for emissions and support. This framework provides the basis for identifying implementation priorities and corresponding needs for financial resources, technology transfer, and capacity building to achieve Qatar's climate goals.

The NDS-3 2024 to 2030 reinforces this implementation direction through defined pathways that are directly relevant to technology transfer and capacity building, including carbon capture and storage, renewable energy, lower-carbon fuels, electrification, energy efficiency, and strengthening regulations and standards.

While regulatory instruments provide the compliance and enforcement backbone that often shapes capacity building needs for institutions and implementing entities. Qatar's environmental legal framework includes Law No. 30 of 2002 on environmental protection and Executive by Law No. 4 of 1983. Sector implementation also relies on applied standards such as the Global Sustainability Assessment System for buildings, which supports consistent requirements for lower-carbon and resource efficient design and creates practical demand for technical training and deployment support.

Table 5-3 below provides information on national climate policy framework and implementation priorities, while Table 5-4 provides information on priority sectors and subsectors for climate action implementation.

*Table 5-3: National climate policy framework and implementation priorities*

| Instrument                                             | Purpose and scope                                                                         | Implementation priorities most relevant to finance, technology development and transfer, and capacity building                                                                               |
|--------------------------------------------------------|-------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Qatar National Vision 2030                             | Long term national direction, including environmental development as a core pillar        | Integrate environmental sustainability into national planning and cross government prioritization                                                                                            |
| Qatar National Environment and Climate Change Strategy | National environment and climate strategy with priority pillars and measurable indicators | Air quality, water security, circular economy and waste management, biodiversity and natural habitat protection, sustainable land use and environmental planning, with measurable indicators |
| Third Qatar National Development                       | National development plan embedding environmental                                         | Lower carbon growth pathways, including renewable energy, carbon capture and storage,                                                                                                        |

|                                                           |                                                                                                       |                                                                                                                                            |
|-----------------------------------------------------------|-------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Strategy 2024 to 2030                                     | sustainability targets and sector pathways                                                            | monitoring technologies, electrification, energy efficiency, strengthened standards and enforcement, and biodiversity and water priorities |
| Environmental legal framework                             | Environmental protection law and executive regulations, and legal instruments supporting conservation | Establishes environmental compliance requirements, permitting, enforcement responsibilities, and biodiversity protection                   |
| Global Sustainability Assessment System for buildings     | Building sustainability rating system referenced in national planning                                 | Mainstreaming sustainability requirements in buildings and construction, resource efficiency, and performance-based design                 |
| Qatar Central Bank sustainable finance policy instruments | Financial sector strategy and sustainable lending guidance                                            | Strengthens sustainable finance governance and market readiness in the financial sector, supporting private finance mobilization           |

*Table 5-4: Priority sectors and subsectors for climate action implementation*

| Priority Sector            | Priority Subsector(s)                                                                                                                                                               |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Oil and Gas                | - Carbon capture and storage (CCS) - Utility-scale solar energy - Methane emissions reduction - Flaring elimination - Energy efficiency in extraction and processing                |
| Power and Water            | - Small-scale solar energy - Grid integration and storage - Reverse osmosis desalination - Water reuse and recycling - District cooling systems - Energy-efficient power generation |
| Transport                  | - Public transport infrastructure (metro, bus, rail) - Electric vehicle transition - Charging infrastructure - Fuel economy and emissions standards - Alternative fuels (CNG, GTL)  |
| Buildings and Construction | - Green building design (GSAS) - Energy efficient retrofits - Building code enforcement - Efficient appliances and systems                                                          |
| Industry                   | - Industrial energy optimization - Cleaner production processes - Carbon abatement technologies - Resource recovery and reuse                                                       |
| Waste and Circular Economy | - Solid waste recycling - Construction and demolition waste reuse - Waste-to-resource infrastructure                                                                                |
| Land and Natural Systems   | - Biodiversity protection - Sustainable land use planning - Urban greening and heat island reduction                                                                                |
| Research and Innovation    | - Climate-related R&D - Technology localization - Academic partnerships for applied innovation                                                                                      |

### *5.2.2 Nationally Determined Contribution priorities and enabling environment*

Qatar's First NDC emissions mitigation ambition is specified as a projected percentage reduction by 2030 below business-as-usual (BAU) levels (an emission reduction target below a projected baseline), using 2019 as the base year. The target covers carbon dioxide, methane, and nitrous oxide.

The approach prioritizes sectors based on proportion of national emissions and measurable abatement potential—oil and gas, power and water, transport, and buildings and industry.

Achieving these goals depends on an enabling environment supported by international cooperation. The NDC and national strategies highlight the importance of access to finance, technology transfer, and capacity building. Qatar explicitly welcomes global partnerships and knowledge exchange to

support the deployment of lower-carbon technologies and to strengthen institutional and technical capabilities. This support framework is essential to closing the gap between ambition and implementation.

Table 5-5 summarizes the priority sectors and relevant subsectors identified under Qatar’s NDC and national climate strategies.

*Table 5-5: Nationally Determined Contribution priorities and enabling environment*

| Sector               | Relevant Subsector(s)                                                                                                                                                                                                                                                                    |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Oil and Gas          | Carbon capture and storage (CCS); methane emissions reduction; energy efficiency.                                                                                                                                                                                                        |
| Power and Water      | Renewable energy (small-scale solar); energy-efficient desalination and district cooling; demand-side management.                                                                                                                                                                        |
| Transport            | Public transit (e.g. metro, light rail); electric vehicles (EVs) and charging infrastructure; aviation (airport sustainability initiatives).                                                                                                                                             |
| Buildings & Industry | Resource and energy efficiency; sustainable construction practices; lower-carbon manufacturing processes.                                                                                                                                                                                |
| Waste                | Recycling programmes; landfill emissions reduction; waste-to-energy solutions.                                                                                                                                                                                                           |
| Health               | Heat stress management (protecting workers and communities from extreme heat); climate-related disease surveillance and research (e.g. monitoring vector-borne illnesses); climate-resilient healthcare systems (strengthening hospitals and services to withstand climate impacts).     |
| Water                | Water conservation and efficiency measures (e.g. regulations to curb per-capita use, efficient fixtures); water recycling and reuse (expanded use of treated sewage effluent for irrigation, cooling, etc.); groundwater management (new water policy and groundwater well regulations). |
| Biodiversity         | Marine habitat restoration (mangrove planting); afforestation/urban greening (planting indigenous trees); ecosystem conservation initiatives.                                                                                                                                            |

## 5.3 Underlying Assumptions, Definitions, and Methodologies

This section describes the assumptions and methods used to identify, classify, compile, and quality check information reported in this chapter.

### 5.3.1 Reporting scope and time boundary

This BTR applies to a defined reporting scope for supporting information to ensure consistency across reported tables and narrative. The reporting period for support information in this chapter covers calendar years 2023 to 2025. Activities are included where at least one of the following occurs during the reporting period. This time range especially applies to quantitative data of initiatives and projects where applicable. Qualitative data on the other hand may include reference to older initiatives and projects as case studies or additional information.

- A commitment or decision is made to provide or receive support
- Delivery occurs, such as training delivered, a technical assistance mission completed, or equipment installed
- Disbursement occurs for financial support
- Implementation continues for a multi-year activity with measurable progress during the reporting period

### 5.3.2 Definitions and classifications for financial support, technology development and transfer support, and capacity building support

Support information is compiled using a consistent classification approach. The chapter applies harmonized fields and categories to ensure comparability across activities, enable clear linkage to

national priorities and measures, and support transparent aggregation and quality review. Definitions applied in this chapter are presented in Table 5-6.

*Table 5-6: Definitions and classifications for financial support, technology development and transfer support, and capacity building support*

| Support pillar                      | Working definition for this chapter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Financial support                   | Monetary resources linked to climate action activities, programmes, policies, or systems covered by this Biennial Transparency Report                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Technology development and transfer | Technology development and transfer refer to support that enables access to, development of, deployment of, or improved use of climate relevant technologies and related know-how. Information is classified by:<br>First, technology area and stage, covering for example renewable energy, energy efficiency, hydrogen, carbon management, water efficiency, waste management, and climate information systems, and stages from design and pilots to deployment and operations.<br>Second, cooperation form, covering deployment support, research and development cooperation, knowledge and know-how transfer, and institutional support for technology uptake such as standards, testing capacity, and system readiness. |
| Capacity building                   | Support that strengthens human, institutional, and system capacity to plan, implement, monitor, and report climate action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

### *5.3.3 Treatment of transparency related capacity building*

Transparency related capacity building under Article 13 is treated as a distinct subcategory within capacity building. Where an activity supports both general climate implementation capacity and transparency capacity, the primary objective determines the classification, and cross references are used to avoid double counting.

### *5.3.4 Currency conversion assumptions, if any voluntary financial information is included*

Where financial values are reported in Qatari Riyals and converted to United States Dollars, this BTR applies the Qatar Central Bank official fixed rate framework. The Qatari Riyal is pegged to the United States Dollar at 3.64 Qatari Riyals per Dollar.

For conversion to United States Dollars, the applied reference is the Qatar Central Bank sell rate of 3.6415 Qatari Riyals per United States Dollar, as of February 5, 2026, which is the official rate applied by the Qatar Central Bank for selling United States Dollars to banks operating in the State of Qatar.

### *5.3.5 Approach to avoid double counting and ensure consistency*

This BTR applies a practical approach to avoiding double counting across support pillars:

- Each reported activity is assigned a single primary classification, finance, technology development and transfer, or capacity building.
- Cross references are used where a single cooperation programme delivers multiple support elements.
- Financial values are reported once only.

## **5.4 Financial Support received and needed under Article 9 of the Paris Agreement**

Climate action is financed primarily through domestic resources, including national budgets, domestic capital markets, and financial sector mobilization. International financial support received and or needed is therefore not a prerequisite for implementing mitigation and adaptation priorities. Where

international support is received, it is typically linked to transparency and reporting deliverables and is reported for completeness and transparency.

This domestic financing model provides funding for multi-year programmes and supports stable sequencing of climate-related expenditure. It enables faster delivery by reducing reliance on external financing cycles and related administrative requirements. It supports capital efficiency and market depth through domestic sustainable finance instruments with clear use of proceeds structures. It also strengthens the integrity of climate finance tracking through national systems that support consistent classification, evidence retention, and quality control.

Article 9 addresses the provision of financial resources by developed country Parties. During the reporting period, Qatar did not identify a need for international financial support to implement national climate priorities. Qatar also did not report receiving international financial support for implementation during the reporting period, given the domestic financing approach and alignment with national programming cycles and public financial management controls.

Domestic capital market instruments strengthen traceability between raised capital and eligible climate expenditure. The sovereign green bond issuance of United States dollars 2.5 billion in May 2024 applies a defined framework to support use of proceeds tracking and reinforce investor confidence in labelled climate finance. Financial sector policy instruments further support domestic mobilization through guidance on sustainable products, strengthened governance and risk management, and improved disclosure and data infrastructure. These measures support scaling up domestic lending and capital markets aligned with climate objectives, complementing public finance and limiting reliance on international financial inflows.

Domestic climate related financing is emphasized given that finance received and needed is not applicable. Reporting covers domestic finance where information is available, verifiable, and cleared for reporting, including public expenditure linked to climate measures and programmes and capital market instruments with defined use of proceeds that enable tracking of eligible climate expenditure.

#### *5.4.1 Domestic climate related public finance*

Domestic climate related public finance provides the principal source of funding for climate action. Public authorities allocate resources through national budgets and public investment programmes, and they mobilize capital through sovereign market instruments. Public utilities and state-owned entities complement this effort through capital expenditure and operational programmes that deliver measurable mitigation and adaptation outcomes.

This domestic model prioritizes scale, continuity, and execution. It supports long term capital commitments for infrastructure, energy, and services. It also enables rapid procurement and delivery through established national systems, and it strengthens accountability through national budgeting, audit, and performance management processes. Table 5-7 provides information on domestic climate related public investments with stated amounts.

Mitigation related public investment includes sovereign mobilization and sector investments that reduce emissions at scale. In May 2024, the Ministry of Finance issued sovereign green bonds totaling 2.5 billion United States dollars. This instrument supports eligible green expenditure through a structured use of proceeds approach and strengthens transparency on the allocation of finance to climate relevant categories. Public investment also supports renewable energy deployment. Publicly reported figures include an estimated cost of 1.7 billion Qatari riyals for the Al Kharsaah solar

photovoltaic power plant, which contributes to a lower-carbon electricity supply. Public investment in sustainable mobility also provides a long-term mitigation lever.

Adaptation related public investment focuses on resilience of essential services and protection against climate risks. Water security investments provide a central adaptation priority. Publicly reported contract values include 17 billion Qatari riyals for the Water Security Mega Reservoirs Project and 3.224 billion Qatari riyals for additional reservoirs and pumping station works. Stormwater and drainage investments support resilience to extreme rainfall and flooding. Publicly reported figures include a five-year infrastructure plan valued at more than 81 billion Qatari riyals for the period 2025 to 2029, and contract awards of around 12 billion Qatari riyals linked to drainage, roads, and public buildings. Wastewater and sanitation infrastructure also contribute to resilience and environmental protection. Publicly reported figures include 691.2 million Qatari riyals for the Doha South Sewage Treatment Plant expansion and associated outfall works. Table 5-7 provides information on domestic climate related public initiatives and projects.

Qatar's Under progressed National Adaptation Plan (NAP), currently being finalized, identifies adaptation finance as a strategic priority through Chapter 11, which outlines the use of adaptation bonds and an ESG strategy to mobilize capital for climate resilience. In parallel, Cross-Sectoral Measure 6 on Green Finance/ESG is being structured around three targeted actions to channel financing into sectoral adaptation priorities. The Green Finance for Adaptation and ESG Goals (3 actions) mobilizes climate finance through Qatar's Sovereign Green Financing Framework, sustainable finance data platforms, and ESG-aligned investment criteria that drive funding toward climate-resilient development.

The adaptation actions as well as the Outputs for 2030-2040 Timeline include:

- Integrate environmental and social risks into finance decisions to support sustainable, climate-resilient investments: Financial institutions are directing investments using Environmental and Social Risk Management Policy and Sustainable Finance and Product Framework. These frameworks exclude activities that harm biodiversity, water resources, or human rights, aligning with the UN Sustainable Development Goals (SDGs), IFC Performance Standards, and Qatar National Vision 2030.
- Sustainable finance data platform: Develop a data repository to collect and aggregate relevant data for climate, environmental and social risks assessments
- Establish a Sovereign Green Financing Framework to mobilize funding for climate adaptation and resilience projects: The Framework enables Qatar to issue green bonds and sukuk to finance environmentally sustainable projects, aligning with the nation's climate objectives and the Qatar National Vision 2030.

*Table 5-7: Domestic climate related public initiatives and projects*

| No. | Initiative or project                                                                   | Climate linkage                         | Lead public entity or delivery channel                                                                               |
|-----|-----------------------------------------------------------------------------------------|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| 1   | Tarsheed Programme for conservation and efficiency                                      | Mitigation, energy and water efficiency | Qatar General Electricity and Water Corporation (Kahramaa)                                                           |
| 2   | District cooling regulation and market development                                      | Mitigation, cooling efficiency          | Qatar General Electricity and Water Corporation (Kahramaa)                                                           |
| 3   | Electric bus deployment for public transport, 741 buses                                 | Mitigation, fleet electrification       | Ministry of Transport and Mowasalat (Karwa)                                                                          |
| 4   | Electric vehicle charging enablement through national platforms and rolling out targets | Mitigation, transport electrification   | Ministry of Communications and Information Technology and Qatar General Electricity and Water Corporation (Kahramaa) |

|    |                                                                                      |                                                              |                                             |
|----|--------------------------------------------------------------------------------------|--------------------------------------------------------------|---------------------------------------------|
| 5  | Domestic Solid Waste Management Centre and waste to energy and recycling development | Mitigation, methane reduction and circular economy           | Relevant national authorities and operators |
| 6  | Dukhan solar project                                                                 | Mitigation, renewable electricity generation                 | QatarEnergy                                 |
| 7  | Carbon capture and storage expansion at Ras Laffan                                   | Mitigation, industrial and energy sector emissions reduction | QatarEnergy                                 |
| 8  | Qatar Development Bank green finance support for small and medium enterprises        | Mitigation and cross cutting, access to green finance        | Qatar Development Bank                      |
| 9  | Sustainable finance taxonomy and sustainable finance framework                       | Cross cutting, mobilization and classification               | Qatar Central Bank                          |
| 10 | Sustainable finance data platform and disclosure related infrastructure              | Cross cutting, transparency and mobilization                 | Qatar Central Bank                          |

#### 5.4.1.1 State owned entities and national programmes contributing to climate action financing

State owned entities and national programmes provide a core channel for climate action financing through public capital, operational budgets, and programme delivery, including utilities, transport entities, infrastructure agencies, and state-owned energy and industrial entities.

The Ministry of Finance supports sovereign mobilization and strengthens the domestic climate finance architecture through market instruments, including the sovereign green bond issuance, which supports climate relevant expenditure and strengthens governance, allocation discipline, and reporting structures for finance tracking.

The Public Works Authority finances and delivers resilience infrastructure, including drainage networks, strategic outfalls, and wastewater systems. Publicly reported values indicate the scale of this role, including a five-year infrastructure plan valued at more than 81 billion Qatari riyals, contract awards of around 12 billion Qatari riyals, and investments such as the Doha South Sewage Treatment Plant expansion.

The Qatar General Electricity and Water Corporation finances water security infrastructure and supports demand side management and efficiency measures. Publicly reported contract values for water storage and pumping infrastructure, including 17 billion Qatari riyals and 3.224 billion Qatari riyals, illustrate its role in resilience finance. Utility-led efficiency programmes also provide recurring domestic financing through programme budgets, with relevance to energy and water savings and associated emissions reductions where data is available.

State owned energy and industrial entities also contribute through capital and operational investments that reduce emissions, which can be reported as domestic climate related finance where public disclosures provide clear scope and status and evidence is held by the relevant entity.

#### 5.4.2 Private finance mobilization and enabling measures

Private finance mobilization for climate action is advancing through a combination of financial sector policy direction, market disclosure infrastructure, and bank led product innovation. Mobilization covers two complementary channels. The first channel strengthens the enabling environment so that financial institutions can identify, price, and report sustainable finance consistently. The second channel deploys labelled instruments and sustainability linked facilities that channel private capital

toward mitigation and adaptation related investments. Private sector activity reported in this section is presented through two groupings.

1. Enabling measures that shape the sustainable finance market and improve the quality of disclosures used by lenders and investors.
2. Financial products and transactions that mobilize private capital through bonds, facilities, deposits, and retail and corporate lending offers.

Table 5-9 provides information on sustainable finance policies, incentives, disclosure related measures, and other enabling measures.

#### 5.4.2.1 Key initiatives that mobilize private investment for mitigation and adaptation

Mobilization is observed through labelled debt issuances, sustainability linked facilities and liquidity transactions, deposit products that earmark funds toward sustainable uses, and targeted retail and corporate lending products. Issuances and facilities disclosed with amounts demonstrate market depth. Frameworks and products without disclosed amounts remain relevant as they expand the addressable pipeline and support future tracking of mobilized volumes. Table 5-10 provides information on labelled, and sustainability themed debt instruments issued by Qatar based private sector entities and Table 5-11 provides information on sustainability linked facilities and sustainability linked liquidity transactions, Table 5-12 below provides information on green and sustainable deposit products,

Table 5-13 provides information on retail and corporate green lending products and offers and finally

Table 5-14 provides information on bank and market frameworks that structure private climate finance.

#### 5.4.3 Key finance tracking gaps and planned improvements

Tracking of private climate finance is improving, but important gaps remain in coverage, comparability, and the ability to aggregate across institutions and instruments. Planned improvements focus on consistent classification, stronger disclosure, and better data infrastructure for aggregation and quality control. Table 5-8 provides information on key finance tracking gaps and planned improvements.

*Table 5-8: Key finance tracking gaps and planned improvements*

| Tracking gap                                                                                                                                             | Planned improvement direction                                                                                                                        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| No single national definition and classification for climate related finance that is applied consistently across regulators and financial institutions   | Establish a national classification and eligibility framework, with common minimum data fields and evidence requirements for inclusion               |
| Reporting templates and data fields differ across reporting channels, limiting comparability across institutions and products                            | Harmonize reporting templates across regulators and reporting channels, with standard fields for instrument type, tenor, sector, and climate purpose |
| Limited ability to distinguish climate finance from broader Environmental, Social, and Governance finance, and to separate green from transition finance | Introduce clear national tagging rules for climate mitigation, adaptation, and transition categories and require consistent use in reporting         |
| Aggregation remains constrained by fragmented data systems and limited                                                                                   | Develop an integrated national data architecture or reporting hub to enable aggregation,                                                             |

|                                                                                                                                          |                                                                                                                                                                         |
|------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| interoperability across institutions and regulators                                                                                      | validation, and version control across data sources                                                                                                                     |
| Limited time series and portfolio level reporting of private climate finance volumes, reducing the ability to assess trends and progress | Introduce routine annual aggregation and publication of climate finance volumes by product, sector, and climate objective, supported by consistent time series tracking |
| Incomplete capture of private transactions outside regulated reporting perimeter or not covered by current voluntary fields              | Expand coverage through phased reporting requirements and targeted voluntary fields, prioritizing high impact institutions and products                                 |

## 5.5 Voluntary Information on Support Provided by Qatar (Article 9, paragraph 2)

As a developing country Party, the State of Qatar is not obligated to provide climate finance under the UNFCCC. However, Qatar has voluntarily extended support to international climate efforts in line with its capabilities and solidarity with vulnerable nations. Qatar’s leadership has affirmed its readiness to “extend a helping hand” to global partners on climate change, exemplified by HH the Amir Sheikh Tamim bin Hamad Al-Thani’s pledge at the 2019 UN Climate Action Summit to assist least developed countries (LDCs) and small island developing states (SIDS) in adapting to climate change and building resilience.

### 5.5.1 Overview of International Climate Support Provided by Qatar

Qatar is recognized as a donor to LDCs and SIDS, rapidly mobilizing funding to address crises exacerbated by climate change, including droughts and severe floods in these countries. The following sub-sections outline the climate-related support Qatar has provided on a voluntary basis, the approach and sources for reporting this information, and examples of specific initiatives and their impacts.

Qatar’s international support focuses on financial contributions, technology transfer, and capacity-building initiatives that aid other developing countries in tackling climate change. A cornerstone of Qatar’s voluntary climate finance is its engagement with multilateral climate funds. Notably, Qatar announced commitment to assist vulnerable countries, which is being channeled through the UNFCCC’s dedicated funds for adaptation. Qatar became the first non-Annex I Party and the first Middle Eastern developing country – to contribute to the Adaptation Fund, with an initial disbursement in January 2021 to help meet the urgent adaptation needs of climate-vulnerable communities.

### 5.5.2 Reporting Approach, Scope and Data Sources for Qatar’s Support Information

All monetary values are reported in US dollars (USD), consistent with international practice and Qatar’s own reporting of pledges. Given the voluntary nature of this reporting, Qatar has not applied a formal MRV system to quantify support provided; instead, it presents a qualitative account of major contributions and programmes based on documented evidence. This approach aligns with the flexibility afforded to non-Annex I Parties, aiming to increase transparency without prejudicing Qatar’s developing country status. Qatar will continue to improve the scope and detail of such reporting in future BTRs as more data become available and methodologies evolve.

Scope and boundaries: Qatar’s voluntary reporting on support provided covers climate specific support and relevant cross-cutting aid extended to other countries. This encompasses: (a) Financial contributions to multilateral climate funds (e.g. GCF, Adaptation Fund, LDCF) and initiatives; (b) Bilateral support for climate adaptation, mitigation, or resilience-building projects (often delivered via QFFD); and (c) Technology and knowledge transfer initiatives that Qatar has led or funded

internationally. The emphasis is on support that directly targets climate change objectives or has clear climate co-benefits, in line with UNFCCC guidance that support should be “climate-specific” for transparency reporting. General development assistance without a discernible climate link is excluded. Geographically, the focus is on aid directed to developing countries, particularly LDCs, SIDS, and other vulnerable states. The timeframe of reported activities centers on recent years (primarily 2018–2025), which corresponds to Qatar’s ramped-up engagement in climate finance and the period after its first NDC submission.

Institutional arrangements were put in place to gather data from relevant agencies, chiefly the MECC, the Ministry of Foreign Affairs, and QFFD, who maintain records of international cooperation activities. Qatar’s reporting approach involved reviewing official government documents and statements (e.g. national communications, climate change strategies, press releases of high-level announcements) to identify support initiatives with climate co-benefits.

The information in this section has been compiled voluntarily by Qatar to enhance transparency regarding its climate-related support, consistent with Article 13 of the Paris Agreement. In its updated NDC, Qatar acknowledged that any provision of support would be undertaken in accordance with the UNFCCC’s principles and provisions (notably Articles 4.7 and 12.4), which recognize that developing countries may communicate such information on a voluntary basis.

#### *5.5.3 Examples of climate related support provided*

As the host of the first carbon-neutral FIFA World Cup in 2022, Qatar has committed to share lessons and infrastructure (such as modular stadium components) with other countries, showcasing a form of knowledge transfer in sustainable technologies and design. Through these efforts in sharing knowledge, expertise, and sustainable practices, Qatar contributes to building global capacity for climate action.

Moreover, Qatar has placed emphasis on capacity-building and technology transfer to address climate challenges. A key initiative is the establishment of the Global Drylands Alliance (GDA), spearheaded and financed by Qatar as an international coalition to combat desertification and strengthen agricultural resilience in arid regions. GDA enables member states across Africa, the Middle East, and Asia to pool research and adopt innovative technologies for drought-resistant agriculture and food security, thereby building adaptive capacity to climate change in dryland countries. Qatar also supports innovation platforms that intersect with climate action, for instance, it has funded the UNDP Accelerator Labs to explore new solutions at the nexus of climate change, development, and fragility.

In addition to multilateral climate finance, Qatar provides bilateral and regional support with climate co-benefits, often delivered through Qatar Fund for Development (QFFD) (the government’s international development aid arm). Qatar’s assistance emphasizes building resilience and sustainable development in climate-vulnerable regions. For example, QFFD has collaborated with relevant institutions to launch programmes that create green jobs and foster lower-carbon growth in SIDS and LDCs. This partnership supports climate-resilient development across 12 island nations in the Caribbean and Pacific, as well as climate-smart agriculture projects in countries like Kiribati and Senegal, boosting local entrepreneurship and food security under changing climate conditions. Qatar is also supporting climate adaptation at the community level in drought-prone areas: a recent QFFD agreement with the UN Food and Agriculture Organization (FAO) provided USD 1.7 million to assist Somalia in achieving food security and enhancing the resilience of vulnerable communities (including women and youth) against climate shocks. Such targeted initiatives demonstrate Qatar’s use of its foreign aid to deliver climate change adaptation and mitigation benefits on the ground in developing countries.

In parallel, Qatar has pledged support to the Least Developed Countries Fund (LDCF), which finances climate adaptation in LDCs, as part of fulfilling the pledge. Qatar has also joined other nations in backing the Green Climate Fund (GCF), through the Qatar Fund for Development (QFFD), a USD 3 million contribution was announced in 2020. In partnership with the GCF, Qatar has worked to mobilize institutional investors for climate projects, leveraging its influence as a global investor to scale up climate finance. These multilateral engagements underscore Qatar's role in supporting global mitigation and adaptation efforts beyond its own borders.

## 5.6 Information on Technology Development and Transfer Support Needed by Qatar under Article 10 of the Paris Agreement

### 5.6.1 Overview of Qatar's technology development and transfer plans

Qatar's technology development and transfer needs align with the implementation of mitigation and adaptation actions in sectors that already show active delivery and clear technology pathways. The national approach focuses on deploying proven technologies at scale, strengthening system integration and performance management, and expanding applied research that targets solutions suited to national operating conditions.

Mitigation oriented plans concentrate on achieving lower emissions across the liquefied natural gas value chain, expanding renewable electricity supply, reducing electricity demand for cooling and desalination, and enabling transport electrification through digital infrastructure. Delivery signals include a carbon capture and sequestration project at Ras Laffan designed to capture and sequester up to 4.1 million tons of carbon dioxide per year. Renewable electricity deployment also provides a clear pathway through the 800-megawatt peak Al Kharsaah solar photovoltaic project, which uses bifacial modules on single axis trackers, string inverters, and a module cleaning system designed for desert conditions. Demand reduction through efficient cooling and digital optimization forms a second mitigation pillar. Law No. 19 of 2024 establishes a regulatory basis for district cooling services, while large asset operators deploy digital optimization tools such as Siemens Demand Flow technology at Hamad International Airport to reduce electricity use for cooling and mitigate emissions. Transport technology priorities focus on scaling charging infrastructure and enabling interoperability through a unified digital platform. The Tarsheed Smart Electric Vehicle Charging Platform connects charging points through a central management portal, includes a service provider portal, and provides real time status monitoring and usage analytics. Public reporting indicates more than 135 charging points connected since December 2023, with a pipeline towards 1,000 stations by 2030.

Adaptation oriented plans prioritize water security and system reliability, climate smart agriculture and food security, ecosystem resilience, and climate resilient infrastructure. The Water Security Mega Reservoirs Project indicates reliance on advanced operational technologies, including tendering a Supervisory Control and Data Acquisition control system for operations and management. Research and innovation programmes also target desalination efficiency and brine management, including seawater reverse osmosis optimization, scale and fouling mitigation, and brine treatment with mineral recovery to reduce environmental impacts and improve circularity. Technology transfer occurs through structured cooperation that combines international expertise with local implementation. A protected farming and climate smart agriculture programme led by the Ministry of Municipality involves cooperation with the Korea Trade Investment Promotion Agency, the Hyundai Research Institute, and Plant Farm company to identify technologies appropriate for Qatar and develop realistic recommendations for sustainable production under arid conditions. Ecosystem resilience efforts also show technology localization through a mangrove restoration initiative led by Qatar Foundation Earthna, which includes nursery systems designed for mangrove cultivation and operational practices that replicate coastal salinity conditions to improve seedling survival, with partners including the Ministry of Environment and Climate Change and Qatar University.

Cross cutting priorities focus on national climate data infrastructure through a national Measurement, Reporting and Verification platform. Recent workshops focused on building institutional capacity for annual data flows, data collection, and reporting responsibilities across entities. The same approach appears in other thematic areas, including industrial emissions management platforms, life cycle assessment tools, lower-carbon cement technologies such as alternative fuels use and materials substitution systems, and applied research on cooling innovation, air quality monitoring, coastal hydrodynamics, marine monitoring, desalination impacts, and water intrusion management.

### *5.6.2 Primary needs and priorities for technology development and transfer*

Primary needs reflect two structural drivers. Mitigation requires considerable reductions in energy systems and emissions intensive industrial operations. Adaptation requires resilient water and food systems under extreme heat and aridity, alongside strengthened protection of coastal and urban assets.

The priorities below translate the technology plans in section 5.6.1 into concrete areas where technology development and transfer support has the highest delivery value. These priorities focus on deployment enabling inputs, including system integration, operational readiness, monitoring capability, and local capacity to operate, maintain, and continuously improve performance.

Mitigation priorities emphasize scaling carbon capture and sequestration with robust MRV across capture, transport, injection, and permanent storage. They also emphasize advanced methane detection and repair, flare reduction optimization, and digital energy management that enables measurable performance improvement across complex oil and gas assets.

In power and water, priorities include grid integration tools for variable renewables, forecasting and dispatch optimization, and efficiency improvements for desalination and co production systems, including operational measures that sustain performance in high heat and high salinity conditions. In buildings and urban systems, priorities include digital optimization for district cooling plants, measurement systems that verify savings, and technology packages that improve end use efficiency through verified equipment performance, testing, and compliance. In transport, priorities include interoperable charging systems, fleet management and analytics, and technical standards and testing systems that support both electrification and vehicle efficiency regulation. In waste and circular economy systems, priorities include advanced treatment technologies with strong environmental monitoring and safe operations capacity.

Adaptation priorities emphasize smart water systems that strengthen reliability and operational control, including supervisory control and data acquisition, leakage management, and asset management linked to climate risk. They also emphasize sustainable desalination and brine management technologies, including scale and fouling mitigation, brine treatment optimization, and mineral recovery solutions supported by pilots and real time monitoring. Food security priorities include controlled environment agriculture and precision irrigation supported by local trials and technology localization. Coastal resilience priorities include risk based coastal engineering, resilient retrofit technologies, and ecosystem restoration and monitoring tools that support mangrove survival tracking and blue carbon measurement. Table 5-9 provides information on mitigation priorities and technology requirements and

Table 5-10 provides information on adaptation priorities and technology requirements. Qatar's in process of finalizing a new national adaptation plan that also prioritizes the same sectors and issue in addition to NAP identifies similar priorities, plus hydroponics, salt-tolerant crops, AI monitoring, brine recovery, and green building.

*Table 5-9: Mitigation priorities and technology requirements*

| Mitigation priority                                                                              | Technology types required                                                                                                                                                                                                                                                                                                                                                        |
|--------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Carbon capture and sequestration for liquefied natural gas and industrial facilities             | Carbon capture, compression, and transport systems. Storage injection infrastructure. measurement, reporting, and verification systems for long term storage assurance.                                                                                                                                                                                                          |
| Methane emissions reduction and flare reduction in upstream and liquefied natural gas operations | Methane detection, measurement, and data systems. Leak Detection and Repair tools and protocols. Flare gas recovery and flare control systems.                                                                                                                                                                                                                                   |
| Utility scale renewable electricity and grid integration in desert conditions                    | Solar photovoltaic generation technologies suited to desert conditions. Operations and maintenance technologies for soiling and heat. Grid integration tools for variable renewables, including forecasting and dispatch support.                                                                                                                                                |
| District Cooling system efficiency and digital optimization                                      | Digital optimization and control systems for cooling plants. High efficiency drives, pumps, and sensors for performance monitoring. Demand management tools that reduce peak electricity loads.                                                                                                                                                                                  |
| Transport electrification through interoperable charging and digital management                  | Electric vehicle charging infrastructure. Smart charging and load management. Centralized digital platforms for interoperability, monitoring, and analytics.                                                                                                                                                                                                                     |
| Industrial emissions management and performance platforms                                        | Digital emissions and resource management platforms. Carbon footprint assessment and scenario modelling. Circular economy and life cycle assessment tools. Environmental, Social, and Governance data and reporting systems.                                                                                                                                                     |
| Circular economy systems and low carbon industrial operations                                    | Alternative fuels and materials substitution systems. Waste to energy and waste to product technologies. Energy efficiency packages for industrial production. Product transparency tools such as environmental product declarations and life cycle assessment. Greenhouse gas reporting and forecasting tools. Renewable energy integration planning for industrial operations. |
| Transport energy reduction and cooling load management research                                  | Building physics and energy modelling tools. Advanced glazing and envelope solutions. Cooling load reduction technologies and controls. Measurement systems to validate energy and emissions impacts for major transport assets.                                                                                                                                                 |

Table 5-7: Adaptation priorities and technology requirements

| Adaptation priority                                                | Technology types required                                                                                                                                                                                                                                      |
|--------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Water security infrastructure operations and resilience            | Operational control and monitoring systems for reservoirs and pumping networks. Smart network management tools for leakage and pressure control. Asset management systems linked to climate risk. Energy efficiency optimization for pumping and distribution. |
| Desalination efficiency and environmentally sound brine management | Reverse osmosis optimization tools for high salinity conditions. Brine treatment and mineral recovery technologies. Planning tools such as life cycle assessment. Pilot and monitoring systems for adaptive operations.                                        |
| Climate smart agriculture and protected farming for food security  | Controlled environment agriculture systems. Precision irrigation and sensor-based water management. Climate resilient crop systems. Monitoring tools for productivity, water efficiency, and heat stress.                                                      |

|                                                                                |                                                                                                                                                                                                                                        |
|--------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ecosystem resilience and coastal protection through restoration and monitoring | Mangrove restoration and nursery technologies. Restoration design and site selection tools. Remote sensing and field monitoring protocols. Blue carbon measurement methods for climate benefit quantification.                         |
| National climate data infrastructure and transparency systems                  | National Measurement, Reporting and Verification platform capabilities. Data exchange interfaces with sectoral systems. Automated quality checks and audit trails. Analytics dashboards for tracking progress and reporting readiness. |
| Climate health preparedness and early warning systems                          | Integrated platforms linking air quality, heat, and health surveillance. Forecasting and risk modelling tools. Operational alerting and response workflows.                                                                            |
| Coastal and marine monitoring and water intrusion management                   | Hydrodynamic and intrusion modelling tools. Marine monitoring platforms and sensors. Decision support analytics for coastal and groundwater protection.                                                                                |
| Water and desalination innovation                                              | Solar powered desalination approaches. Environmental impact monitoring for desalination and marine biodiversity. Integrated brine management and mineralization concepts.                                                              |

### 5.6.3 Needs for enhancing endogenous capacities

Endogenous capacity needs to link directly to technology development and transfer priorities. They define the institutional and technical capabilities required to select, procure, integrate, operate, and maintain transferred technologies under Qatar's operating conditions, and to sustain performance through measurement, reporting, and verification. These needs cover system commissioning and handover readiness, operations and maintenance procedures, calibration and inspection functions, data management and analytics, and quality assurance and quality control practices. Strengthening these capacities ensures that technology transfer delivers durable outcomes, reduces dependence on external technical services over time, and supports credible performance verification for national tracking and reporting. Table 5-11 provides information on needs for enhancing endogenous capacities.

Table 5-8: Needs for enhancing endogenous capacities

| Capacity need area                           | Priority capacity requirements                                                                                                                                                                                                                                 |
|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mitigation monitoring and verification       | Monitoring tools and specialist skills to track energy efficiency, methane, and flaring outcomes. Monitoring, reporting, and verification competence for carbon capture and storage integrity and performance.                                                 |
| Carbon management engineering and operations | Engineering capability to manage capture, dehydration, compression, and injection systems at scale. Long term operations and maintenance capacity for compressors, pipelines, and injection wells.                                                             |
| Methane management and flare reduction       | Specialist teams for Leak Detection and Repair programme design and execution. Data analytics to prioritize repairs based on quantified emissions. Calibration and maintenance capability for Optical Gas Imaging equipment and continuous monitoring sensors. |
| Digital platforms operations                 | Platform governance, cybersecurity, and operational support for national systems. Integration capability across service providers and interoperability management. Capability to translate analytics into operational decisions and targeted investments.      |
| Water data and analytics                     | Water data systems, data governance, and analytics capability to support allocation and conservation decisions.                                                                                                                                                |
| Utility operations for smart water systems   | Supervisory Control and Data Acquisition integration and control room capability. Network operations capability for leakage detection and                                                                                                                      |

|                                                           |                                                                                                                                                                                                                                        |
|-----------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                           | pressure management. Resilience focused on operating procedures for disruption scenarios.                                                                                                                                              |
| Resilience standards and implementation                   | Technical capacity to update and apply resilience codes and standards, supported by compliance assurance and lifecycle maintenance planning capability for transport infrastructure.                                                   |
| Agriculture technology deployment                         | Operations and maintenance skills for greenhouse and indoor farming systems. Capacity to evaluate and localize technologies and crop systems under heat and aridity. Monitoring capability for water use efficiency and productivity.  |
| Ecosystem monitoring and research use                     | Nursery operations and transplantation planning skills. Field monitoring and remote sensing capacity to track survival and health. Capability to quantify climate and coastal protection co benefits and apply findings in management. |
| National Measurement, Reporting and Verification capacity | Training and onboarding of data owners and reviewers. Data quality assurance and quality control procedures. Annual reporting workflows and institutional coordination.                                                                |

#### 5.6.4 Needs for enhancing endogenous technologies

Endogenous technology enhancement links directly to technology development and transfer priorities by strengthening Qatar’s ability to adapt, localize, and improve imported technologies so they perform reliably under national operating conditions. It focuses on applied optimization and local solution development for heat, dust, salinity, and high cooling loads, covering design adaptation, testing and certification, digital control and monitoring, and performance diagnostics. This pathway complements technology transfer by converting initial deployment into sustained national capability, enabling continuous performance improvement, building local service and integration capacity, and reducing long term reliance on external technical support. Table 5-12 provides information on needs for enhancing endogenous technologies.

Table 5-9: Needs for enhancing endogenous technologies

| Endogenous technology area                                                                      | Priority technology enhancement requirements                                                                                                                                                                                                                |
|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Green building assessment and implementation systems                                            | Building performance modelling capability. Materials and systems optimization for hot climate conditions. Digital compliance and certification workflows across public and private projects.                                                                |
| Smart and resource efficient urban solutions                                                    | Localized smart city applications that reduce energy and water demand and improve congestion outcomes. Interoperable platforms supported by open application programming interfaces. Stronger local solution provider ecosystem and integration capability. |
| Water and energy efficiency solutions adapted to national conditions                            | Local testing and certification capacity. Performance based procurement tools and specifications. Operational optimization solutions for district cooling, desalination, and building energy systems aligned with demand reduction objectives.              |
| Desert optimized solar operations and maintenance technologies                                  | Desert adapted operations and maintenance solutions, including soiling management. Performance monitoring and fault diagnostics for large solar fleets. Forecasting and dispatch optimization for variable renewable integration.                           |
| Advanced desalination and brine management technologies tailored to Qatar’s seawater conditions | Reverse osmosis performance enhancement for high salinity conditions, including scale and fouling mitigation. Brine management, valorization, and mineral recovery options. Best                                                                            |

|                                                                                          |                                                                                                                                                                                                                             |
|------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                          | available techniques guidance supported by life cycle assessment.                                                                                                                                                           |
| Digital optimization technologies for cooling systems                                    | Local configuration of digital optimization models to match load profiles. Integration of optimization tools across district cooling assets. Measurement systems to verify electricity savings and emissions outcomes.      |
| Climate smart agriculture technology packages adapted to arid and heat stress conditions | Localized controlled environment agriculture designs for heat and humidity extremes. Sensor calibration and monitoring for water efficiency and productivity. Applied research linking crop selection to climate stressors. |
| Coastal restoration technologies and monitoring protocols                                | Nursery design and restoration methods suited local salinity conditions. Monitoring protocols combining field surveys and remote sensing. Blue carbon measurement approaches that support national reporting needs.         |
| National data platform technologies for climate action tracking                          | Data exchange interfaces with sectoral systems. Automated validation rules and audit trails aligned with workflows. Dashboards for decision support, progress tracking, and reporting readiness.                            |

## 5.7 Information on Technology Development and Transfer Support Received by Qatar under Article 10 of the Paris Agreement

### 5.7.1 Case studies and results

#### *Case study 1. Ras Laffan carbon capture and storage for existing LNG facilities*

The Ras Laffan carbon compression and transport facility demonstrates technology transfer embedded in Engineering, Procurement and Construction delivery for a high complexity low-emission system. The project is operated by QatarEnergy and is designed to process and transport up to 4.1 million tons of carbon dioxide each year from existing liquefied natural gas liquefaction plants for permanent geological storage.

The technology transfer dimension sits in three technical layers. First, process integration and control. The facility captures carbon dioxide from existing liquefaction plants, compresses it, removes moisture, and manages pressure and temperature control for safe movement of dense phase carbon dioxide. This requires specialized design methods, safety engineering, and operational control logic that are typically transferred through design packages, commissioning plans, and operator training during handover.

Second, transport and integrity management. The project includes around 20 kilometers of underground pipelines that transport compressed carbon dioxide to a depleted gas reservoir for permanent storage. This introduces technology transfer needs in pipeline design, materials selection, integrity management, leak prevention, and operational monitoring. These elements are typically embedded in contractor specifications, testing procedures, and long-term maintenance arrangements that build domestic capability over time.

Third, storage assurance. Permanent geological storage requires monitoring and verification practices that sustain confidence in containment performance over the operational life of the system. Technology transfer therefore extends beyond equipment to include measurement methods, monitoring system design, data handling procedures, and governance arrangements for storage integrity assurance.

## *Case study 2. Tarsheed Smart Electric Vehicle Charging Platform, second release*

The Tarsheed Smart Electric Vehicle Charging Platform demonstrates technology transfer through national digital system development and integration of multiple service providers. The Ministry of Communications and Information Technology and the Qatar General Electricity and Water Corporation launched the second release in March 2025, expanding the platform's operational and service management functions.

The technology transfer dimension sits in digital interoperability and system operations. The second release includes a service provider portal that supports station management, and an updated Central Management Portal that strengthens notification management and real-time status monitoring. These features require shared technical rules for onboarding service providers, standardized data exchange, and operational workflows that connect charging infrastructure to a unified national platform.

The platform also demonstrates early scale and data driven operations. Public reporting indicates more than 135 charging points connected since December 2023, with more than 3,561 charging transactions recorded. This creates a practical base for transferring know-how in network monitoring, usage analytics, service optimization, and operational decision making based on real usage data.

This case also illustrates that technology transfer is not limited to hardware deployment. It includes platform governance, cybersecurity management, data quality controls, service provider enablement, and the operational capabilities needed to run a national scale digital mobility system reliably.

## **5.8 Information on Capacity Building Support Needed by Qatar under Article 11 of the Paris Agreement**

### *5.8.1 Qatar's approach to enhancing capacity building*

National entities strengthen capabilities to manage annual data flows, apply consistent methods, and maintain quality assurance and quality control across reporting. This track supports operation of the national MRV platform and readiness for BTR and National Communications. It also supports stronger facility level GHG data management.

Capacity building priorities align with technologies being scaled through commercial delivery and national programmes, including carbon capture and sequestration systems, methane detection and repair and flare optimization programmes, utility scale solar photovoltaic operations under desert conditions, district cooling optimization, interoperable electric vehicle charging platforms, smart water operations systems, and desalination and brine management solutions. This track prioritizes engineering and operator capability, operations and maintenance readiness, calibration and inspection skills, and the ability to convert monitoring data into operational decisions that deliver verified outcomes.

Capacity building strengthens the skills needed across planning, operations, maintenance, and verification functions to ensure that advanced systems perform reliably over time. Priority areas include operator and technician readiness for commissioning and routine operations, calibration and maintenance competence for specialized monitoring equipment, data management and analytics skills to translate operational data into decisions, and applied skills for inspection and compliance where standards and performance requirements apply.

### *5.8.2 Qatar's specific capacity building needs*

Qatar's capacity building needs reflect the practical requirements of sustaining high performance delivery of climate actions across mitigation and adaptation systems, while ensuring credible transparency reporting and robust decision support. It is also aligned to its climate policy framework including the NAP which emphasizes the need for capacity building with emphasis on regulatory frameworks, research/innovation, data infrastructure, and social inclusivity. Qatar is strengthening environmental awareness and sustainability through partnerships among government entities, civil society organizations, and community groups. Efforts include promoting sustainable building practices through industry outreach and capacity development, integrating environmental education into schools and extracurricular programs, and enhancing environmental knowledge among students and families. Community initiatives provide practical learning opportunities in regenerative agriculture, while youth-focused programs support environmental leadership, advocacy, and climate education. These actions are complemented by national campaigns on water and energy conservation that encourage sustainable lifestyles and foster a stronger culture of environmental stewardship across the country.

### *5.8.3 Constraints and gaps in communicating capacity building needs*

Capacity building needs in Qatar are clear across transparency systems, technical delivery, and workforce competence. Communicating these needs in a structured and prioritized manner can be constrained by the way information is held across entities and by differences in how capacity building is defined, recorded, and validated. Capacity building is often embedded in projects and operational systems rather than captured as a discrete activity, which can reduce visibility and comparability. In addition, confidentiality constraints in high emitting sectors can limit the level of detail that can be shared publicly, even when operational needs are well understood. Strengthening common definitions, documentation practices, and cross entity workflows can improve the clarity and completeness of communicated capacity building needs over time.

### *5.8.4 Processes for enhancing public awareness, public participation, and access to information*

Qatar applies a structured mix of awareness programmes, targeted training, and open information measures that support behavior change, workplace protection, and public participation in national priorities.

- National conservation awareness and skills programmes led by Qatar General Electricity and Water Corporation through the Conservation and Energy Efficiency Department. Recent delivery includes youth programmes with practical workshops on solar energy and water desalination, and technical awareness workshops for facilities management on energy and water efficiency in buildings.
- Targeted worker protection awareness campaigns led by the Ministry of Labour in cooperation with health and worker support entities. Recent campaigns focus on heat stress risk recognition, prevention practices, multilingual guidance materials, and annual training expectations for employers.
- Public access to information and open data measures under the Third Qatar National Development Strategy 2024 to 2030. National priorities include addressing limited access to up-to-date information and ensuring easy access to government reports, policy changes, and open public data, supported by strengthened data governance and interoperability across government.
- Structured stakeholder engagement for climate reporting and planning. The Ministry of Environment and Climate Change uses stakeholder questionnaires and workshops to collect climate related information and support alignment across entities, and the national platform approach further formalizes participation through defined data owner roles.

These processes provide a practical foundation for scaling public participation and access to information, while reducing the reporting constraints identified for future transparency cycles.

## 5.9 Information on Capacity Building Support Received by Qatar under Article 11 of the Paris Agreement

Qatar's capacity building is primarily financed and delivered through domestic institutions, national programmes, and project level delivery arrangements. Qatar does not rely on international capacity building support as a recipient country for implementation. Where external inputs appear, they typically take the form of targeted technical cooperation for national planning or commercial partnerships that include commissioning support, operational training, and knowledge transfer as part of project delivery. This approach strengthens durable operational capability and institutional readiness across priority mitigation and adaptation areas.

### 5.9.1 Key case studies of capacity building support received, where applicable

#### *Case study 1. National Adaptation Plan development and institutional readiness for implementation*

Qatar strengthened national capacity for adaptation planning through development of the National Adaptation Plan led by the Ministry of Environment and Climate Change, supported through technical cooperation with relevant institutions. Public reporting confirms the National Adaptation Plan launch in December 2025 and indicates a structured pipeline that translates priority sectors into adaptation measures, targeted actions, and projects. This cooperation strengthened practical skills in vulnerability assessment, prioritization, inter entity coordination, and translation of risks into implementable measures with defined delivery pathways.

#### *Case study 2. Hamad International Airport district cooling optimization with Siemens*

Qatar strengthened technical and operational capacity for cooling efficiency through the partnership between Hamad International Airport and Siemens to optimize district cooling infrastructure using Siemens Demand Flow technology. Public reporting indicates the project completed in November 2023 and focuses on optimizing cooling plant performance to reduce energy consumption. This type of delivery arrangement typically includes configuration support, operator enablement, and operational procedures that strengthen local capability to run digital optimization systems and sustain performance improvements over time.

These examples show capacity building embedded in delivery. They strengthen (1) institutional readiness to plan and coordinate adaptation, and (2) technical and operational capability to operate advanced systems that reduce energy demand in high cooling load contexts. This approach supports continuous improvement through better operational procedures, clearer ownership, and stronger performance management in priority sectors.

## 5.10 Information on Support Needed and Received for Implementation of Article 13 of the Paris Agreement and Transparency Related Activities

Qatar is enhancing its transparency framework under Article 13 of the Paris Agreement. This involves identifying where additional support is needed to fulfill reporting requirements and leveraging support already received through UNFCCC-related projects. The following sections outline Qatar's needs for support in preparing climate reports, the support received to date (particularly via UNFCCC mechanisms), and considerations for addressing future recommendations from technical expert reviews.

### *5.10.1 Support Needed for Preparing Reports Pursuant to Article 13 of the Paris Agreement*

Support needs focus on strengthening completeness, consistency, and repeatability of national reporting across future reporting cycles, alongside continued operationalization of an integrated GHG data management and MRV system that supports the ETF. NAP's M&E framework will be complementary to the MRV platform as it will enable systematic monitoring of adaptation actions across sectors, assess progress against defined indicators, and support evidence-based reporting to national and international stakeholders. By consolidating data from relevant entities, the system will enhance transparency, strengthen accountability, and facilitate timely identification of implementation gaps and emerging risks. The NAP monitoring framework will align with the NDC, BTR, and the national MRV system. This integration maximizes efficiency, avoids duplication, and ensures coherence with Qatar's global commitments.

A central challenge lies in developing robust methodologies and algorithms to quantify and monitor mitigation co-benefits from adaptation. MECC, with technical partners, will continue to refine these methodologies to ensure both international compatibility and scientific rigor.

Key support needs include the following:

- Integrated national reporting system completion and sustained operation  
Support is needed to complete and operationalize an integrated GHG data management and Measurement, Reporting and Verification system that enables routine tracking of emissions, mitigation and adaptation actions, and support information through standardized workflows.
- Legal and procedural basis for data provision  
Establish enforceable routes for collecting greenhouse gas and mitigation related data across entities. This includes improved data sharing between ministries, formalized roles and mandates for climate data management, designated focal points, minimum evidence requirements, and agreed confidentiality handling for sensitive datasets.
- Human and technical capacity for inventory compilation and tracking  
Strengthen technical expertise of national greenhouse gas inventory teams to apply the 2006 IPCC guidelines consistently and improve accuracy of estimates. Expand capability to use advanced software and tools for inventory compilation and tracking of mitigation actions.
- Data validation, quality assurance, and evidence retention  
Strengthen validation steps for data received from stakeholders. Build capacity within sector entities to perform quality assurance and quality control and apply consistent checklists, audit trails, and evidence retention rules that support traceability and review readiness.
- Inventory compilation tooling and dataset structure improvements  
Address dataset structure constraints that limit consistent national compilation. Improve the organization and mapping of sector and facility datasets to support systematic use of national compilation tools and reproducible calculations across reporting years.
- Improved time series completeness and methodological strengthening  
Strengthen activity data systems, develop country specific emission factors and models where feasible, and improve uncertainty information across time series and sub sectors to support tier improvement and reduce gaps in coverage.
- Integration of facility level data into national processes  
Strengthen practical mechanisms to integrate facility level activity data and emission factors into national compilation workflows, including standard templates, documentation routines, and reproducible calculation processes.
- Phased expansion of coverage  
Build capability to quantify and report additional greenhouse gases over time, including fluorinated gases, supported by phased methods development and data collection.

- Financial and resource support for sustained reporting cycles  
Secure resources to procure and maintain data platforms, run stakeholder workshops, and retain or train technical experts needed for regular preparation of BTR and National Communications, ensuring continuity across reporting cycle

## Use of Flexibility Provisions

In accordance with Article 13 of the Paris Agreement and Decision 18/CMA.1, the State of Qatar applies flexibility provisions available to developing country Parties that need them in light of their capacities. Consistent with paragraph 6 of the Modalities, Procedures and Guidelines (MPGs), Qatar identifies in this chapter the areas where flexibility has been applied in the preparation of its first BTR1, the associated capacity constraints, and the planned improvements for future reporting cycles.

Qatar's application of flexibility reflects the ongoing development of its national MRV system, institutional arrangements, sectoral data collection mechanisms, and analytical capacities. While significant progress has been made in establishing data-sharing arrangements among key institutions and compiling information required under the ETF, further work is needed to strengthen data availability, methodological consistency, and reporting systems across all sectors.

*Table 6-1: Summary of Flexibility Provisions Applied in BTR1*

| Reporting Area                    | Flexibility Applied                                                                                                                                                                                                                                                                          | Capacity Constraint                                                                                                                                                               | Planned Improvement                                                                                                                                                                     |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| National Greenhouse Gas Inventory | Flexibilities related to key category analysis, uncertainty assessment, completeness, QA/QC procedures, gas coverage, and time-series reporting were applied in accordance with relevant MPG provisions. Detailed information is provided in the (NIR table 2-5).                            | Limited availability of activity data, emission factors, historical datasets, and institutional resources required for comprehensive inventory development and quality assurance. | Continued strengthening of national inventory systems, institutional coordination, data management arrangements, and technical capacities before BTR2 and subsequent submissions.       |
| Tracking Progress Towards the NDC | Quantitative assessment of the impacts of individual mitigation policies and measures remains limited. In addition, methodological approaches for estimating the contribution of individual measures toward NDC achievement are still under development.                                     | Limited availability of sector-specific monitoring data, policy impact assessment methodologies, and integrated modelling tools.                                                  | Development of enhanced monitoring systems for mitigation actions, improved policy tracking mechanisms, and strengthened analytical capacity for estimating mitigation impacts by BTR2. |
| Adaptation Reporting              | Qatar adopted a phased approach to adaptation reporting in BTR1. Reporting focuses on infrastructure and coastal zones, water resources, and biodiversity and ecosystems, while agriculture and livestock, public health, and energy and industry sectors will be covered in future reports. | Sector-specific vulnerability assessments, adaptation indicators, monitoring systems, and institutional reporting arrangements are still being developed in several sectors.      | Expansion of adaptation reporting to additional sectors in BTR2, supported by improved sectoral data collection, monitoring frameworks, and institutional coordination.                 |

|                                            |                                                                                                      |                                                                                                                                              |                                                                                                                                       |
|--------------------------------------------|------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Information on Support Needed and Received | Reporting on support needs has focused on priority sectors where information is currently available, | Limited institutional mechanisms for tracking climate finance needs, technology requirements, and capacity-building gaps across all sectors. | Development of more comprehensive systems for identifying, tracking, and reporting support needs and received support in future BTRs. |
|--------------------------------------------|------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|

Qatar continues to invest in institutional strengthening, capacity building, and inter-agency coordination to reduce reliance on flexibility over time, with the aim to improve compliance with the reporting requirements of the Enhanced Transparency Framework in future BTRs.

## 7. Improvement in Reporting Over Time

Qatar intends to progressively improve its reporting under the ETF in line with Article 13 of the Paris Agreement and Decision 18/CMA.1. While currently applying flexibility provisions available to developing country Parties with capacity constraints, the country is working toward strengthening its MRV system to enable more comprehensive, consistent, and transparent reporting over time.

Current efforts focus on enhancing institutional arrangements, improving sectoral data flows, and expanding the scope and completeness of greenhouse gas inventories, particularly beyond the energy sector where some gaps remain. Qatar also aims to develop more consistent time-series data and increase the frequency and accuracy of reporting as technical capacity grows.

Through ongoing investments in capacity building, inter-agency coordination, and international technical partnerships Qatar seeks to gradually reduce its reliance on flexibility provisions and move toward full compliance with the ETF requirements in future BTR.

*Table 7-1: Planned Improvements Related to Flexibility Provisions Applied in BTR1*

| Reporting Area / Flexibility Applied          | Improvement Action                                                                                                                                                                     | Responsible Entity(ies)                           |
|-----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
| Reference Approach for Energy Sector          | Strengthen national energy data collection and compilation systems and develop the information required to apply the IPCC Reference Approach alongside the Sectoral Approach.          | MECC in coordination with sectoral data providers |
| Reference Approach for Energy Sector          | Strengthen national energy data collection and compilation systems and develop the information required to apply the IPCC Reference Approach alongside the Sectoral Approach.          | MECC in coordination with sectoral data providers |
| QA/QC Plan                                    | Develop and institutionalize a national GHG inventory QA/QC plan, including sector-specific verification procedures, documentation protocols, and responsibilities for data providers. | MECC in coordination with sectoral data providers |
| Uncertainty Analysis                          | Expand uncertainty assessment from qualitative analysis to more comprehensive quantitative uncertainty estimation across key source categories and gases.                              | MECC and sectoral inventory experts               |
| Time-Series Consistency and Data Completeness | Improve historical activity-data collection and archiving systems to enhance completeness and consistency of inventory time series.                                                    | MECC                                              |
| Fluorinated Gases (F-gases)                   | Establish data collection arrangements for fluorinated gases and strengthen estimation methodologies for product-use sectors to improve inventory coverage.                            | MECC, and relevant ministries                     |
| LULUCF Reporting                              | Improve data availability on LULUCF activities, strengthen institutional arrangements for land-sector data collection, and including mangroves/blue carbon                             | MECC, Ministry of Municipality and relevant land- |

|                                                    |                                                                                                                                                                                                                                               |                                                                           |
|----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
|                                                    |                                                                                                                                                                                                                                               | management authorities                                                    |
| Quantification of Mitigation Policies and Measures | Develop methodologies and monitoring systems to estimate the GHG impact of key mitigation measures and improve tracking of progress toward NDC implementation.                                                                                | MECC and sectoral ministries responsible for mitigation actions           |
| NDC Progress Tracking                              | Align NDC tracking with NDC 3.0                                                                                                                                                                                                               | MECC and implementing sectoral entities                                   |
| Adaptation Monitoring and Evaluation (M&E)         | Integrate adaptation indicators and reporting mechanisms being developed under the Under progressed National Adaptation Plan (NAP) process into the national transparency framework.                                                          | MECC and sectoral adaptation focal points                                 |
| Adaptation Sector Coverage                         | Expand adaptation reporting from the three sectors covered in BTR1 (infrastructure and coastal zones, water resources, and biodiversity and ecosystems) to include agriculture and livestock, public health, and energy and industry sectors. | MECC in coordination with relevant sector ministries and agencies         |
| Institutional Coordination and Data Sharing        | Strengthen formal data-sharing arrangements and reporting procedures among national institutions contributing to ETF reporting.                                                                                                               | MECC, and all reporting entities                                          |
| Capacity Building and Technical Expertise          | Implement targeted capacity-building programmes on inventory preparation, uncertainty assessment, adaptation reporting, NDC tracking, and ETF reporting requirements.                                                                         | MECC with support from international partners and technical organizations |

## Annexes

### Annex 1: Key categories

Level of disaggregation: category level, gas are not disaggregated.

Tables 4.2 of chapter 4, volume 1 of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (excluding LULUCF):

|          | A/B                                                                             | C                                                    | D                                              | E                           | F    | G                            | H                    |
|----------|---------------------------------------------------------------------------------|------------------------------------------------------|------------------------------------------------|-----------------------------|------|------------------------------|----------------------|
| CRT Code | CRT Category                                                                    | Gas                                                  | Last year emissions ktCO <sub>2</sub> e (2023) | Ex,t  (GgCO <sub>2</sub> e) | Lx,t | Cumulative Total of Column F | KCA rank T1 in level |
| 1.A.1.c  | Manufacture of Solid Fuels and Other Energy Industries: Other Energy Industries | CO <sub>2</sub> (CH <sub>4</sub> , N <sub>2</sub> O) | 53 865                                         | 53 865                      | 45%  | 45.3%                        | 1                    |
| 1.A.1.a  | Main Activity Electricity and Heat Production                                   | CO <sub>2</sub> (CH <sub>4</sub> , N <sub>2</sub> O) | 24 777                                         | 24 777                      | 21%  | 66.2%                        | 2                    |
| 1.A.3.b  | Road Transportation                                                             | CO <sub>2</sub> (CH <sub>4</sub> , N <sub>2</sub> O) | 11 884                                         | 11 884                      | 10%  | 76.2%                        | 3                    |
| 2.B      | Chemical Industry                                                               | CO <sub>2</sub> (CH <sub>4</sub> , N <sub>2</sub> O) | 5 753                                          | 5 753                       | 5%   | 81.0%                        | 4                    |
| 1.A.2.c  | Chemicals                                                                       | CO <sub>2</sub> (CH <sub>4</sub> , N <sub>2</sub> O) | 4 660                                          | 4 660                       | 4%   | 84.9%                        | 5                    |
| 1.A.2.b  | Non-Ferrous Metals                                                              | CO <sub>2</sub> (CH <sub>4</sub> , N <sub>2</sub> O) | 3 657                                          | 3 657                       | 3%   | 88.0%                        | 6                    |
| 1.B.2.c  | Venting and Flaring                                                             | CO <sub>2</sub>                                      | 3 342                                          | 3 342                       | 3%   | 90.8%                        | 7                    |
| 2.A.1    | Cement production                                                               | CO <sub>2</sub> (CH <sub>4</sub> , N <sub>2</sub> O) | 3 016                                          | 3 016                       | 3%   | 93.4%                        | 8                    |
| 1.A.1.b  | Petroleum Refining                                                              | CO <sub>2</sub> (CH <sub>4</sub> , N <sub>2</sub> O) | 1 512                                          | 1 512                       | 1%   | 94.6%                        | 9                    |
| 1.A.2.f  | Non-Metallic Minerals                                                           | CH <sub>4</sub>                                      | 1 298                                          | 1 298                       | 1%   | 95.7%                        | 10                   |
| 5.A.1    | Managed waste disposal sites                                                    | CO <sub>2</sub> (CH <sub>4</sub> , N <sub>2</sub> O) | 1 168                                          | 1 168                       | 1%   | 96.7%                        | 11                   |
| 2.C.3    | Aluminium Production                                                            | CO <sub>2</sub> (CH <sub>4</sub> )                   | 1 057                                          | 1 057                       | 1%   | 97.6%                        | 12                   |
| 1.A.2.a  | Iron and Steel                                                                  | CO <sub>2</sub> (CH <sub>4</sub> , N <sub>2</sub> O) | 905                                            | 905                         | 1%   | 98.4%                        | 13                   |
| 1.A.3.d  | Domestic Water-borne Navigation                                                 | CO <sub>2</sub> (CH <sub>4</sub> , N <sub>2</sub> O) | 412                                            | 412                         | 0%   | 98.7%                        | 14                   |
| 5.A.3    | Uncategorised waste disposal sites                                              | CH <sub>4</sub>                                      | 410                                            | 410                         | 0%   | 99.1%                        | 15                   |

|                |                                                            |                                                      |         |         |      |        |    |
|----------------|------------------------------------------------------------|------------------------------------------------------|---------|---------|------|--------|----|
| 3.A.1          | Enteric Fermentation                                       | CH <sub>4</sub>                                      | 339     | 339     | 0%   | 99.3%  | 16 |
| 2.C.1          | Iron and Steel Production                                  | CO <sub>2</sub> (CH <sub>4</sub> , N <sub>2</sub> O) | 152     | 152     | 0%   | 99.6%  | 17 |
| 3.D.1          | Direct N <sub>2</sub> O Emissions from managed soils       | CO <sub>2</sub> (CH <sub>4</sub> )                   | 148     | 148     | 0%   | 99.8%  | 18 |
| 5.D            | Wastewater treatment & discharge                           | N <sub>2</sub> O                                     | 77      | 77      | 0%   | 99.8%  | 19 |
| 1.A.3.a        | Domestic Aviation                                          | CH <sub>4</sub> (N <sub>2</sub> O)                   | 45      | 45      | 0%   | 99.9%  | 20 |
| 3.B.1          | Manure Management                                          | CO <sub>2</sub> (CH <sub>4</sub> , N <sub>2</sub> O) | 40      | 40      | 0%   | 99.9%  | 21 |
| 2.A.2          | Lime production                                            | CH <sub>4</sub> (N <sub>2</sub> O)                   | 38      | 38      | 0%   | 99.9%  | 22 |
| 3.D.2          | Indirect N <sub>2</sub> O Emissions from managed soils     | CO <sub>2</sub>                                      | 25      | 25      | 0%   | 100.0% | 23 |
| 3.B.5          | Indirect N <sub>2</sub> O Emissions from manure management | N <sub>2</sub> O                                     | 20      | 20      | 0%   | 100.0% | 24 |
| 1.B.2.b        | Natural Gas                                                | N <sub>2</sub> O                                     | 12      | 12      | 0%   | 100.0% | 25 |
| 1.B.2.a        | Oil                                                        | CH <sub>4</sub>                                      | 10      | 10      | 0%   | 100.0% | 26 |
| 5.B.1          | Composting                                                 | CH <sub>4</sub>                                      | 4       | 4       | 0%   | 100.0% | 27 |
| 3.H            | Urea application                                           | CH <sub>4</sub> (N <sub>2</sub> O)                   | 2       | 2       | 0%   | 100.0% | 28 |
| 5.B.2          | Anaerobic digestion                                        | CO <sub>2</sub>                                      | 0       | 0       | 0%   | 100.0% | 29 |
| 1.C            | CO <sub>2</sub> Injection and Storage                      | CO <sub>2</sub>                                      | -       | -       | 0%   | 100.0% | 30 |
| Total national |                                                            |                                                      | 118 830 | 118 830 | 100% |        |    |

## Annex 2: Common reporting tables (Attached Excel Files)

Annex 3: Common Tabular Formats (Attached Excel Files)

## Annex 4: Adaptation Projects in Water Sectors

### Water Management

#### Water measures (4):

1. National Strategy for Water Use, Reuse Efficiency, and Monitoring (5 actions):  
Improves water security by regulating usage, expanding greywater and treated sewage reuse in Heating, Ventilation, and Air Conditioning (HVAC) and agriculture, reducing non-revenue water losses, and enabling real-time monitoring through a national water database.
2. Development and Modernization of Water Infrastructure (2 actions):  
Strengthens system reliability through green infrastructure, smart reservoir systems, aquifer storage projects, and upgraded wastewater facilities that increase recycling and resilience during peak demand or drought conditions.
3. Water Resource Management and Ecosystem Restoration Measures (3 actions):  
Restores natural systems by reactivating wadis<sup>150</sup>, assessing groundwater resources, and designing wetlands to improve water retention, biodiversity, and flood control under climate stress.
4. Enhancing Awareness and Outreach including National-Scale Studies (3 actions):  
Builds public and institutional adaptive capacity through conservation campaigns, water footprint education, and comprehensive studies on sustainability and desalination impacts to inform national policy.

#### Water actions (13):

Table 1 Annex 4: Adaptation Measure 1. National Strategy for Water Reuse, Resue Efficiency and Monitoring

| No. | Adaptation Actions                                                                                              | Outputs for 2030-2040 Timeline                                                                                                                                     | Type of Adaptation Actions                   |
|-----|-----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
| 1   | Implement comprehensive measures to regulate and reduce water usage across all sectors, focusing on efficiency. | • Establish a centralized data management system for real-time water monitoring and data sharing to support improved decision-making and stakeholder coordination. | Improvement of existing adaptation measures. |
|     |                                                                                                                 | • Develop and operationalize an Integrated Water Resource Database for Qatar, integrating research and studies in alignment                                        | Planned adaptation measure.                  |

<sup>150</sup> Wadis are valleys, ravines, or channels that are dry except in the rainy season

| No. | Adaptation Actions                                                                                                                                                       | Outputs for 2030-2040 Timeline                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Type of Adaptation Actions                                                            |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
|     |                                                                                                                                                                          | <p>with Qatar National Vision 2030, under the guidance of the Permanent Water Resources Committee.</p> <ul style="list-style-type: none"> <li>• Design greywater systems to collect, treat, and reuse water from showers and washbasins for irrigation, car washing, and toilet flushing.</li> <li>• Strengthen and expand Tarsheed Program and Building Efficiency Code to promote water conservation, enhance demand management, and integrate behavioural change initiatives across residential, commercial, and industrial sectors.</li> <li>• Enhance coordination between Tarsheed initiatives and national water efficiency programs to ensure integrated management of water and energy resources.</li> </ul>                                            |                                                                                       |
| 2   | Reduction of Non-Revenue Water losses and improvement of water network efficiency.                                                                                       | <ul style="list-style-type: none"> <li>• Conduct a Pipe Turbidity Study to assess the durability and defects of pipe materials and evaluate water losses, as a basis for developing a strategy and action plan to reduce Non-Revenue Water.</li> <li>• Identify and address sources of water loss, especially from shallow groundwater and distribution systems, to ensure adequate water supply and strengthen resilience during droughts or periods of water scarcity.</li> <li>• Complete Zero Pressure Testing in District Metered Areas, carry out water balance assessments and leak detection, use in-line acoustic leak detection for medium and large diameter mains, and implement a three-year leak detection program for large pipelines.</li> </ul> | Improvement of existing adaptation measure.                                           |
| 3   | Store surplus treated sewage effluent (TSE) in winter and expand the treated water distribution network to ensure reliable water availability during peak summer demand. | <ul style="list-style-type: none"> <li>• Store excess TSE during periods of low demand in winter for reuse during summer peak demand.</li> <li>• Develop a supply network for treated water reuse in landscaping, cooling plants, agriculture, and industries.</li> <li>• Design and specify the use of TSE in water-cooled chilled systems to reduce reliance on freshwater and enhance water efficiency.</li> </ul>                                                                                                                                                                                                                                                                                                                                            | <p>Improvement of existing adaptation measure.</p> <p>Planned adaptation measure.</p> |

| No. | Adaptation Actions                                                                                                                                 | Outputs for 2030-2040 Timeline                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Type of Adaptation Actions                  |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
|     |                                                                                                                                                    | <ul style="list-style-type: none"> <li>Assess existing foul and treated effluent water infrastructure within natural catchments to identify opportunities for safe and efficient water reuse.</li> </ul>                                                                                                                                                                                                                                                                                                    |                                             |
| 4   | Utilize treated wastewater in Heating, Ventilation, and Air Conditioning (HVAC) systems instead of potable water to conserve freshwater resources. | <ul style="list-style-type: none"> <li>Implement agreements with local authorities to shift HVAC systems from potable water to treated sewage effluent (TSE), eliminating potable water use and enhancing water resource sustainability.</li> <li>Qatar Cool has pioneered the use of treated sewage effluent (TSE) in district cooling systems, replacing potable water with non-potable sources to enhance water resource sustainability and reduce reliance on energy-intensive desalination.</li> </ul> | Improvement of existing adaptation measure. |
| 5   | Implement the Water Law (issued in October 2025; Law No. 23/2025) and its regulations.                                                             | <ul style="list-style-type: none"> <li>Enforce the Water Law to regulate water use, management, and conservation, ensuring clear enforcement mechanisms, institutional coordination, and compliance measures are established.</li> </ul>                                                                                                                                                                                                                                                                    | Planned adaptation measure.                 |

Table 2 Annex 4. Adaptation Measure 2. Development and Modernization of Water Infrastructure

| No. | Adaptation Actions                                                                                                                                     | Outputs for 2030-2040 Timeline                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Type of Adaptation Actions                  |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| 6   | Develop green and smart infrastructure for efficient water management, including rainwater harvesting, flood control, and improved irrigation methods. | <ul style="list-style-type: none"> <li>Expand rainwater harvesting infrastructure to reduce reliance on desalinated water for supply.</li> <li>Design and operate large-scale water reservoirs using advanced technologies and best practices to enhance structural integrity, flexibility, and resilience to climate change, integrating smart water management systems (e.g., SCADA) for demand management, optimized operations, leak detection, and water quality monitoring.</li> </ul> | Improvement of existing adaptation measure. |

| No. | Adaptation Actions                                                                                                                                   | Outputs for 2030-2040 Timeline                                                                                                                                                                                                                                                                                                                                                                            | Type of Adaptation Actions                  |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| 7   | Develop and upgrade infrastructure to promote water reuse and recycling through the safe and efficient use of treated wastewater across all sectors. | <ul style="list-style-type: none"> <li>Establish permanent industrial wastewater treatment facilities to enable the reuse of treated effluent in light to medium industries.</li> <li>Rehabilitation of sewage treatment plant facilities by enhancing wastewater treatment capacity and efficiency and implementing advanced technologies - to recycle and use treated sewage effluent (TSE).</li> </ul> | Improvement of existing adaptation measure. |
|     |                                                                                                                                                      | <ul style="list-style-type: none"> <li>Construct and Implement the ASR (Aquifer Storage and Recovery) project to ensure that domestic demand for water is met.</li> <li>Enhance coordination through the Tarsheed Program to improve water–energy efficiency.</li> <li>Implement Strategic Project INWARD to integrate water data from all sector stakeholders for coordinated management.</li> </ul>     | Planned adaptation measure.                 |

Table 3. Annex 4 . Adaptation Measure 3. Water Resources Management and Ecosystem Restoration Measures

| No. | Adaptation Actions                                                                         | Outputs for 2030-2040 Timeline                                                                                                                                                                                                                                                                                                                                                                                                           | Type of Adaptation Actions                  |
|-----|--------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| 8   | Reactivation of natural wadis (streams) to harness and manage water resources efficiently. | <ul style="list-style-type: none"> <li>Restore vegetation and ecosystems, manage water quality, and apply seasonal water management strategies to reduce flood risks and support natural water systems.</li> <li>Strengthen coordination and promote the integration of energy and water efficient cooling technologies that complement natural water resource management and reduce demand on freshwater and energy systems.</li> </ul> | Planned adaptation measure.                 |
| 9   | Ground water assessment and surficial ground water collection.                             | <ul style="list-style-type: none"> <li>Evaluate groundwater levels, recharge areas, and water quality, as well as surface–groundwater interactions within catchment areas,</li> </ul>                                                                                                                                                                                                                                                    | Improvement of existing adaptation measure. |

|    |                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                         |                                             |
|----|------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
|    |                                                      | <p>and incorporate surficial groundwater collection and purification techniques for dry-weather periods.</p> <ul style="list-style-type: none"> <li>Promote energy and water efficiency upgrades in groundwater extraction, treatment, and distribution systems through Tarsheed initiative acting as a national Super ESCO, facilitating performance contracting and investment in efficiency improvements.</li> </ul> |                                             |
| 10 | Wetland design, restoration and storage assessments. | <ul style="list-style-type: none"> <li>Conduct field surveys and apply ecological modelling to identify potential wetland sites, assess their environmental characteristics, and evaluate their impact on biodiversity and water treatment within the watershed.</li> </ul>                                                                                                                                             | Improvement of existing adaptation measure. |

Table 4. Annex 4: Adaptation Measure 4. Enhancing Awareness and Outreach including National Scale Studies

| No. | Adaptation Actions                                                                                  | Outputs for 2030-2040 Timeline                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Type of Adaptation Actions                  |
|-----|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| 11  | Community Awareness Programmes for Water Conservation in Residential Sectors.                       | <ul style="list-style-type: none"> <li>Encourage sustainable water conservation behaviour and mindset in society to optimize household water usage.</li> <li>Strengthen Tarsheed Program as the national driver of water-conservation awareness and behavioural change.</li> </ul>                                                                                                                                                                                                                                                 | Improvement of existing adaptation measure. |
| 12  | Improve water footprint through awareness raising and educational campaigns on reducing consumption | <ul style="list-style-type: none"> <li>Increase the adaptive capacity of the water sector by reducing water consumption among the public, as well as public and private establishments.</li> </ul>                                                                                                                                                                                                                                                                                                                                 | Improvement of existing adaptation measure  |
| 13  | Enhanced policies that support water sustainability                                                 | <ul style="list-style-type: none"> <li>A comprehensive study on water management in Qatar to support sustainability policies, covering four components on water resources, management practices, and the environmental impact of desalination across the country.</li> <li>Integrate water-efficiency and conservation standards into national policies supporting long-term water sustainability.</li> <li>Implement the new Qatar Water Law to strengthen regulation, coordination, and sustainable water management.</li> </ul> | Improvement of existing adaptation measure. |

## Annex 5: Adaptation Projects in the Infrastructure and Coastal Sector

### Infrastructure Coastal Resilience

#### Infrastructure and Coastal Resilience measures (3):

1. Urban Planning, Green Infrastructure, and Drainage Management (9 actions):  
Improves resilience to floods and heat by integrating stormwater systems, green-certified buildings, shaded walkways, underground utilities and tree planting.
2. Coastal and Flood Resilience (3 actions):  
Protects vulnerable coastlines and infrastructure through sea wall upgrades, storm surge modelling, shoreline monitoring, and flood prevention plans using nature-based drainage solutions, such as environmental focal areas.
3. Sustainable Transport and Mobility (3 actions):  
Supports climate-resilient mobility by piloting autonomous vehicles, transitioning taxi fleets to low-emission vehicles, and studying climate risks to transport infrastructure, such as metro networks.

#### Infrastructure and Coastal Resilience actions (15):

*Table 1 Annex 5: Adaptation Measure 1. Urban Planning, Green Infrastructure and Drainage Management*

| No. | Adaptation Actions                                                                     | Outputs for 2030-2040 Timeline                                                                                                                                                                                                                                                                                                                                                     | Type of Adaptation Actions                  |
|-----|----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| 1   | Integrating sustainable urban drainage and sponge city principles into urban planning. | <ul style="list-style-type: none"> <li>• Increase resilience to extreme rainfall and flooding by enhancing drainage infrastructure and reducing urban waterlogging and flood risks.</li> <li>• Reduce the exposure of urban areas to climate-related disasters by integrating nature-based solutions and resilient urban planning, supporting long-term sustainability.</li> </ul> | Improvement of existing adaptation measure. |

|   |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                             |
|---|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
|   |                                                                                     | <ul style="list-style-type: none"> <li>• Conduct stormwater drainage studies informed by flood risk assessments to enhance urban flood resilience and adaptive water management.</li> <li>• Integrate wetlands into the Sustainable Urban Drainage Master Plan to support stormwater management, enhance biodiversity, and promote community well-being.</li> </ul>                                                                                                                                                                                                      | Planned adaptation measure.                 |
| 2 | Development of green spaces, public parks, and landscaped areas across the country. | <ul style="list-style-type: none"> <li>• Implement urban tree planting initiatives to improve air quality, reduce the urban heat island effect, expand green spaces, lower surface runoff, and contribute to carbon emission reduction.</li> </ul>                                                                                                                                                                                                                                                                                                                       | Improvement of existing adaptation measure. |
| 3 | Subterranean utilities in urban areas.                                              | <ul style="list-style-type: none"> <li>• Install sanitation, water, gas, electricity, and telecommunication networks underground in urban areas to safeguard infrastructure from extreme weather events.</li> </ul>                                                                                                                                                                                                                                                                                                                                                      | Improvement of existing adaptation measure. |
|   |                                                                                     | <ul style="list-style-type: none"> <li>• Implement underground infrastructure in newly developed areas to reduce surface clutter, enhance visual appeal, and protect natural landscapes.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                      | Planned adaptation measure.                 |
| 4 | Promote sustainable building through green-certified design and construction.       | <ul style="list-style-type: none"> <li>• Apply the assessment standards across design and construction phases to ensure sustainability throughout the building lifecycle, incorporating local environmental conditions and regional needs.</li> <li>• Promote green building practices to minimize ecological impact, reduce resource consumption, and support a sustainable built environment.</li> <li>• Adopt Building Information Modelling (BIM) to integrate sustainability in design and construction, reduce material waste, and optimize energy use.</li> </ul> | Improvement of existing adaptation measure. |
| 5 | Implement climate-responsive architectural design to reduce urban                   | <ul style="list-style-type: none"> <li>• Implement the Qatar Utility Management Manual to ensure unified, sustainable standards for services in public spaces, rail protection zones, and utility corridors.</li> </ul>                                                                                                                                                                                                                                                                                                                                                  | Planned adaptation measure.                 |

|   |                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                             |
|---|--------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
|   | heat island effect through shading, greening, and material selection.                                              | <ul style="list-style-type: none"> <li>• Provide shaded walkways and design station entrances with a main air-conditioned area and open-air remote shelters to enhance comfort and reduce cooling demand.</li> <li>• Improve energy efficiency by integrating shading systems, special surface coatings, and high-performance glass on station facades.</li> </ul>                                                                                                                                                                                                                                                                                                                                   | Improvement of existing adaptation measure. |
| 6 | Implement landscape integration measures in environmentally protected areas, new roads and utility infrastructure. | <ul style="list-style-type: none"> <li>• Tree-planting initiatives aligned with national targets, with plans to expand into mangrove restoration to enhance biodiversity and coastal resilience.</li> <li>• Enhance Right-of-Way with tree planting and green landscaping to support the 10 million Tree Program, reduce emissions, and boost urban resilience.</li> </ul>                                                                                                                                                                                                                                                                                                                           | Planned adaptation measure.                 |
| 7 | Improving drainage systems to manage heavy rainfall and flooding.                                                  | <ul style="list-style-type: none"> <li>• Enhance flood management by conducting hydrological assessments, modelling, and designing Wadi channels, along with estimating water storage and recharge capacities.</li> <li>• Expand and upgrade surface and groundwater drainage systems to reduce flooding risks in vulnerable and low-lying areas, enhancing stormwater management and flood prevention.</li> <li>• Promote the multi-use of Ecologically Functional Areas (EFAs) as flood management zones and recreational spaces by integrating them as final discharge points and surface runoff collection areas within natural catchments to enhance urban resilience and usability.</li> </ul> | Planned adaptation measure.                 |
| 8 | Storm water drainage studies and design.                                                                           | <ul style="list-style-type: none"> <li>• Establish pre- and post-development scenarios for stormwater conveyance and apply advanced industry modelling techniques to design sustainable urban drainage systems.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Planned adaptation measure.                 |
| 9 | Airport Carbon Accreditation (ACA)                                                                                 | <ul style="list-style-type: none"> <li>• Strengthen climate-resilient infrastructure by maintaining and advancing MATAR's carbon-accredited airport, targeting higher ACA levels to enhance adaptive capacity and reduce emissions.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Improvement of existing adaptation measure. |

Table 2. Annex 5: Adaptation Measure 2. Coastal and Flood Resilience

| No. | Adaptation Actions                                                                                                                                                     | Outputs for 2030-2040 Timeline                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Type of Adaptation Actions                  |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| 10  | Enhance sea and coastal defences.                                                                                                                                      | <ul style="list-style-type: none"> <li>Protect coastal infrastructure and communities from sea level rise, storm surges, and coastal erosion to reduce climate-related damage.</li> <li>Assess historical coastal changes using satellite data to better understand long-term shoreline dynamics.</li> </ul>                                                                                                                                                                                                                                     | Planned adaptation measure.                 |
| 11  | Develop infrastructure resilience strategies based on assessments of coastal dynamics and storm surge risks to protect vulnerable areas and enhance adaptive capacity. | <ul style="list-style-type: none"> <li>Model storm surge scenarios using available tidal data to inform adaptation strategies for extreme climatic events.</li> <li>Develop engineering solutions to enhance the resilience of critical infrastructure—such as roads, bridges, culverts, and utilities—within watersheds and coastal zones, accounting for shoreline changes from sedimentation, tidal shifts, and storm surges.</li> </ul>                                                                                                      | Planned adaptation measure.                 |
| 12  | Prepare a flood prevention plan, considering potential future impact of climate change.                                                                                | <ul style="list-style-type: none"> <li>Complete a risk assessment for each station/location to identify climate-related vulnerabilities.</li> <li>Develop adaptation measures incorporating defect resolution and lessons learned.</li> <li>Review and update the flood prevention plan annually based on findings from the Rainy Season Preparedness exercise.</li> <li>Integrate Environmental Focal Areas (EFAs) as final discharge points and surface runoff collection zones within catchment areas to enhance urban resilience.</li> </ul> | Improvement of existing adaptation measure. |

Table 3. Annex 5: Adaptation Measure 3. Sustainable Transport and Mobility

| No. | Adaptation Actions                                       | Outputs for 2030-2040 Timeline                                                                                                                                                                                                                                                                                           | Type of Adaptation Actions  |
|-----|----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| 13  | Automated vehicles with upskilling of drivers/workforce. | <ul style="list-style-type: none"> <li>Launch a pilot program for driverless vehicles within the public fleet on select routes to assess feasibility and public acceptance.</li> <li>Roll out upskilling programs to help employees transition into technical roles supporting autonomous vehicle operations.</li> </ul> | Planned adaptation measure. |

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|----|------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
|    |                                                                                                                        | <ul style="list-style-type: none"> <li>• Develop a long-term plan for full integration of autonomous fleets and smart transit infrastructure backed by ongoing training and capacity building.</li> </ul>                                                                                                     |                                             |
| 14 | Transition taxi fleets to low-emission vehicles tailored to the local climate.                                         | <ul style="list-style-type: none"> <li>• Traditional taxi fleet transitioned to climate-resilient fleet (plug-in hybrid, hybrid, and electric vehicles) operating alongside the existing eco-fleet.</li> </ul>                                                                                                | Planned adaptation measure.                 |
| 15 | Perform a study on extreme weather and climate change impacts, as well as overall readiness of Qatar's railway system. | <ul style="list-style-type: none"> <li>• Study conducted on extreme weather and climate change impacts, including assessment of Qatar's railway system overall readiness.</li> <li>• Climate risk vulnerabilities identified and addressed through incorporation of targeted remediation measures.</li> </ul> | Improvement of existing adaptation measure. |

## Annex 6: Adaptation Projects in the Biodiversity Sector

### Biodiversity conservation measures

#### Biodiversity measures (4):

1. Regulatory, Policy Instruments, and Educational Campaigns for Biodiversity Protection (4 actions):  
Strengthens Qatar's resilience to biodiversity loss by enacting net-positive biodiversity legislation, considering offset programs and building public awareness through education and stakeholder capacity-building initiatives.
2. Protected Areas, Natural Habitat Conservation, and Ecological Connectivity (4 actions):  
Enhances ecosystem resilience to climate change by expanding protected areas, creating wildlife corridors, restoring wetlands, such as Al Thakira, and safeguarding terrestrial, coastal, and aquifer habitats.
3. Species and Genetic Conservation (In Situ and Ex Situ) (4 actions):  
Safeguards biodiversity under climate stress through genomics research on Qatari flora, in vitro propagation of endangered plants, and species conservation plans that protect genetic diversity and control invasive species.
4. Monitoring, Research, and Early Warning Systems for Biodiversity Conservation (4 actions):  
Improves adaptive management by tracking ecosystem changes through biodiversity assessments of temporary desert meadows (known as "Rawdat"), digitized herbarium records, AI-based threat detection, and expanded research and early warning systems.

#### Biodiversity actions (16):

*Table 1. Annex 6: Adaptation Measure 1. Regulatory, Policy Instruments, and Educational Campaigns for Biodiversity Protection*

| No. | Adaptation Actions                                                                                                                            | Outputs for 2030-2040 Timeline                                                                                                                                                                                                                                                                                                                                | Type of Adaptation Actions  |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| 1   | Introduce a legislative obligation for all projects to demonstrate net-positive design measures for biodiversity protection and conservation. | <ul style="list-style-type: none"> <li>Enact legislation mandating net-positive biodiversity measures, requiring all development projects to contribute to biodiversity conservation.</li> <li>Establish a compliance framework with clear guidelines, assessment criteria, and approval processes to ensure biodiversity-positive project design.</li> </ul> | Planned adaptation measure. |

| No. | Adaptation Actions                                                             | Outputs for 2030-2040 Timeline                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Type of Adaptation Actions                                                                                          |
|-----|--------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
|     |                                                                                | <ul style="list-style-type: none"> <li>Implement monitoring and enforcement mechanisms, including audits, field inspections, and penalties for non-compliance.</li> <li>Strengthening legal and institutional frameworks for species protection by enhancing enforcement, promoting stakeholder collaboration, and raising public awareness.</li> <li>Using treated wastewater (TSE) instead of potable water for cooling, the system significantly reduces pressure on natural water resources and minimizes impacts on coastal, wetland, and mangrove ecosystems. The project integrates environmental impact assessments in site selection and operational practices, supporting NAP priorities for sustainable resource use and biodiversity protection while demonstrating the application of net-positive design principles in urban infrastructure.</li> </ul> | Improvement of existing adaptation measure.<br><br>Planned adaptation measure. Biodiversity-Positive Infrastructure |
| 2   | Expand the use of marine spatial planning (MSP) for biodiversity conservation. | <ul style="list-style-type: none"> <li>Develop an integrated Marine Spatial Planning (MSP) framework to regulate marine resource use with a strong focus on biodiversity conservation.</li> <li>Identify and designate key biodiversity areas within Qatar's Exclusive Economic Zone (EEZ) to guide protection and sustainable use.</li> <li>Establish marine protection zones aligned with international best practices for sustainable ocean governance.</li> <li>Implement stakeholder engagement initiatives to ensure inclusive planning involving fisheries, energy, and conservation sectors.</li> </ul>                                                                                                                                                                                                                                                       | Improvement of existing adaptation measure.                                                                         |
| 3   | Establish a biodiversity offset program to promote sustainable development.    | <ul style="list-style-type: none"> <li>Create a regulatory framework mandating developers to offset biodiversity loss through targeted conservation investments.</li> <li>Establish a national biodiversity fund, financed by biodiversity impact fees collected from development projects.</li> <li>Implement ecological restoration projects using offset funds, with a focus on rehabilitating degraded coastal and terrestrial habitats.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                               | Planned adaptation measure.                                                                                         |

| No. | Adaptation Actions                                                                                                          | Outputs for 2030-2040 Timeline                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Type of Adaptation Actions                  |
|-----|-----------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| 4   | Build capacity and promote educational campaigns on the value of natural capital, biodiversity protection and conservation. | <ul style="list-style-type: none"> <li>Promote biodiversity awareness through social media, TV, public events, and outreach materials; integrate biodiversity into school curricula and community initiatives; support citizen science and community-led conservation projects.</li> <li>Train educators, tour operators, and community leaders to effectively promote biodiversity awareness and stewardship.</li> <li>Equip research institutions, government bodies, and the private sector with tools, infrastructure, and best practices for biodiversity conservation, offset implementation, and plant biotechnology.</li> <li>Conduct capacity-building programs for regulatory authorities, policymakers, and stakeholders to enhance implementation of biodiversity-positive practices and long-term sustainability.</li> </ul> | Improvement of existing adaptation measure. |

Table 2. Annex 6: Biodiversity Conservation Adaptation Measure 2. Protected Areas, Natural Habitat Conservation and Ecological Connectivity

| No. | Adaptation Actions                                                                              | Outputs for 2030-2040 Timeline                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Type of Adaptation Actions                  |
|-----|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| 5   | Establish new and enhanced protected areas, ensuring connectivity through ecological corridors. | <ul style="list-style-type: none"> <li>Designate new protected areas and upgrade existing ones to conserve Qatar's terrestrial and marine biodiversity effectively.</li> <li>Create ecological corridors to connect fragmented habitats, enabling species migration, genetic flow, and increased ecosystem resilience to climate change and habitat loss.</li> <li>Develop habitat maps and conduct ecological baseline studies to inform strategic conservation planning, trend monitoring, and adaptive management.</li> <li>Strengthen surveillance and enforcement mechanisms using ranger deployment, remote sensing, and compliance systems to protect conservation zones from illegal activities and degradation.</li> </ul> | Improvement of existing adaptation measure. |

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|---|---------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| 6 | Protect and enhance natural spaces, including terrestrial ones, coastal, and aquifers.                                    | <ul style="list-style-type: none"> <li>• Designate and expand protected natural areas to ensure legal protection and effective management of critical terrestrial, coastal, and aquifer ecosystems.</li> <li>• Restore and conserve ecosystems through reforestation, habitat rehabilitation, and resilience-building measures.</li> <li>• Implement habitat enhancement projects, including native vegetation planting, erosion control, and sustainable water resource management to support biodiversity.</li> <li>• Develop long-term management strategies that integrate ecological monitoring, community engagement, and adaptive conservation planning.</li> </ul> | Improvement of existing adaptation measure. |
| 7 | Improving Qatar's biodiversity and ecosystem sustainability to enhance the management and conservation of protected areas | <ul style="list-style-type: none"> <li>• Strengthening management plans for protected areas by incorporating adaptive strategies, stakeholder input, and sustainable resource use practices.</li> <li>• Implement ecosystem restoration initiatives, including habitat rehabilitation, native species reintroduction, and improving ecological connectivity.</li> <li>• Enhance biodiversity monitoring and reporting systems through remote sensing, field surveys, and data analytics to assess ecosystem health and track conservation progress.</li> </ul>                                                                                                             | Improvement of existing adaptation measure. |
| 8 | Strengthen the sustainable management of Qatar's wetlands.                                                                | <ul style="list-style-type: none"> <li>• Implement a wetland restoration program targeting critical ecosystems such as Al Thakira Mangroves and inland sabkhas.</li> <li>• Develop policies for regenerative tourism and promote eco-friendly recreational activities in wetland areas to support conservation and sustainable use.</li> <li>• Establish water management strategies to maintain optimal salinity levels and support the ecological health of wetland habitats.</li> </ul>                                                                                                                                                                                 | Improvement of existing adaptation measure. |

Table 3 Annex 6: . Biodiversity Conservation Adaptation Measure 3. Species and Genetic Conservation (In Situ and Ex Situ)

| No. | Adaptation Actions | Outputs for 2030-2040 Timeline | Type of Adaptation Actions |
|-----|--------------------|--------------------------------|----------------------------|
|-----|--------------------|--------------------------------|----------------------------|

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|----|--------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| 9  | Multi-omics analysis to provide key genomic adaptation of Qatari flora to climate change                           | <ul style="list-style-type: none"> <li>• Develop a genomic database of Qatari flora to document adaptations to climate change, aiding researchers and conservationists in understanding genetic resilience.</li> <li>• Identify climate-resilient plant species and traits to guide targeted conservation and restoration of native vegetation.</li> <li>• Produce scientific publications and policy recommendations to ensure research findings inform national biodiversity policies and climate adaptation strategies.</li> <li>• Apply genomic insights in habitat restoration and agriculture to support the selection and propagation of climate-adapted species for long-term ecosystem sustainability.</li> </ul>                           | Improvement of existing adaptation measure. |
| 10 | Developing in vitro regeneration protocols to maintain biodiversity in endangered native Qatari plant species      | <ul style="list-style-type: none"> <li>• Establish in vitro regeneration protocols for endangered native plant species to enable large-scale propagation and conservation.</li> <li>• Conserve genetic material through seed banks and tissue culture to ensure long-term viability and availability for future restoration efforts.</li> <li>• Integrate in vitro propagation into habitat restoration projects, supporting the reintroduction of endangered species to enhance biodiversity resilience.</li> </ul>                                                                                                                                                                                                                                 | Improvement of existing adaptation measure. |
| 11 | Exploring the genetic diversity of Qatari native plants to identify the key genetic factors for their conservation | <ul style="list-style-type: none"> <li>• Develop a comprehensive genetic diversity database of Qatari native plants, documenting species variations, genetic markers, and population dynamics to inform conservation planning.</li> <li>• Identify key genetic traits for adaptation and resilience, enabling targeted protection of robust plant species and ecosystems.</li> <li>• Produce scientific reports and policy recommendations to ensure genetic research supports national biodiversity protection strategies and environmental policymaking.</li> <li>• Apply genetic insights in habitat restoration and species management by selecting and propagating climate-adapted native plants to strengthen ecosystem resilience.</li> </ul> | Improvement of existing adaptation measure. |

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|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| 12 | Species conservation and management, including protection of threatened species and preservation of genetic diversity as well as controlling the spread of invasive species | <ul style="list-style-type: none"> <li>• Develop conservation action plans for threatened species, outlining targeted measures for habitat protection, population recovery, and long-term sustainability.</li> <li>• Preserve genetic diversity through seed banks and breeding programs to ensure the survival of native plant and animal species facing environmental and climate threats.</li> <li>• Implement invasive species control programs with robust monitoring systems, early detection, rapid response, and long-term management to safeguard biodiversity.</li> </ul> | Improvement of existing adaptation measure. |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|

Table 4. Biodiversity Conservation Adaptation Measure 4. Monitoring, Research and Early Warning Systems for Biodiversity Conservation

| No. | Adaptation Actions                                                                                                                             | Outputs for 2030-2040 Timeline                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Type of Adaptation Actions                  |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| 13  | Assessment of habitat biodiversity in Qatar's Rawdat to understand the influence of the current and future climate change scenarios            | <ul style="list-style-type: none"> <li>• Produce a comprehensive biodiversity assessment report for Qatar's Rawdat habitats, documenting species diversity, ecosystem health, and conservation priorities.</li> <li>• Conduct climate change impact analysis on terrestrial ecosystems to assess current and future effects on biodiversity, habitat stability, and ecosystem functionality.</li> <li>• Establish a centralized database of species distribution and habitat conditions to support biodiversity monitoring and inform policy and research.</li> <li>• Develop adaptive management strategies with science-based recommendations to mitigate climate risks and strengthen ecosystem resilience.</li> </ul> | Improvement of existing adaptation measure. |
| 14  | Digitisation of herbarium collection specimens to track changes in desert ecosystems over time, providing insights into climate change impacts | <ul style="list-style-type: none"> <li>• Develop a digitized herbarium database with high-resolution specimen images and metadata to support accessible research and conservation efforts.</li> <li>• Conduct comparative analyses of historical and current plant distributions to track species presence, abundance, and habitat range shifts over time.</li> </ul>                                                                                                                                                                                                                                                                                                                                                     | Improvement of existing adaptation measure. |

| No. | Adaptation Actions                                                                                 | Outputs for 2030-2040 Timeline                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Type of Adaptation Actions                  |
|-----|----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
|     |                                                                                                    | <ul style="list-style-type: none"> <li>• Generate insights into long-term climate change impacts on desert ecosystems to inform predictions and conservation planning.</li> <li>• Integrate digital herbarium data into biodiversity monitoring programs, enabling real-time tracking of vegetation trends and ecosystem health in Qatar.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                             |
| 15  | Strengthen monitoring and research frameworks to support biodiversity conservation and adaptation. | <ul style="list-style-type: none"> <li>• Enhance biodiversity monitoring systems using standardized protocols for consistent data collection, analysis, and reporting to effectively track ecosystem changes.</li> <li>• Expand conservation and climate adaptation research programs to advance scientific understanding of species resilience, habitat restoration, and adaptive management.</li> <li>• Establish centralized biodiversity databases, advanced monitoring tools, and regional cooperation in data sharing and research. Integration of regional risk scoring and predictive modelling would enhance Qatar's capacity to assess species vulnerability, ecosystem productivity, and climate-driven stressors, improving the effectiveness of adaptation actions.</li> <li>• Develop data-driven decision-making tools for policymakers by integrating real-time biodiversity and climate data into legislative and conservation planning.</li> </ul> | Improvement of existing adaptation measure. |
| 16  | Develop an early warning and response system for biodiversity threats.                             | <ul style="list-style-type: none"> <li>• Implement an AI-based monitoring network to detect and respond to biodiversity threats such as habitat destruction and illegal poaching in real time.</li> <li>• Enhance the national biodiversity emergency response framework to effectively manage and mitigate ecosystem degradation events.</li> <li>• Conduct training programs for enforcement agencies and conservationists on rapid response and intervention techniques.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Improvement of existing adaptation measure. |

| No. | Adaptation Actions | Outputs for 2030-2040 Timeline                                                                                                                                                       | Type of Adaptation Actions |
|-----|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
|     |                    | <ul style="list-style-type: none"> <li>Create a centralized biodiversity threat database to improve stakeholder coordination, data sharing, and informed decision-making.</li> </ul> |                            |