سلطنة عمان
SULTANATE OF OMAN
هيئة البيئة
ENVIRONMENT AUTHORITY

First Biennial Transparency Report of the Sultanate of Oman to the United Nations Framework Convention on Climate Change

2025

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FOREWORDS

On behalf of the Sultanate of Oman, I am proud to present our First Biennial Transparency Report (BTR) to the United Nations Framework Convention on Climate Change (UNFCCC). This report emphasizes Oman's unwavering commitment to global climate action and our proactive steps to address climate change.

Since ratifying the UNFCCC in 1995, Oman has continually demonstrated its dedication to international climate agreements, including the Kyoto Protocol and the Paris Agreement. Our first BTR under the Enhanced Transparency Framework (ETF) provides a comprehensive overview of our efforts to reduce greenhouse gas (GHG) emissions, implement mitigation strategies, adapt to climate impacts, and mobilize necessary support.

Oman's diverse geography, from arid deserts to fertile plains and extensive coastlines, presents unique challenges and opportunities. Recent climatic shifts, including rising temperatures and changing precipitation patterns, highlight the urgent need for robust climate action. Adaptation to climate change is vital for Oman, given our vulnerability to extreme weather events and rising sea levels.

This first BTR shows that Oman is on track in implementing and achieving its Nationally Determined Contribution (NDC) under the Paris Agreement, emphasizing the nation's ambitious targets and comprehensive mitigation policies across various sectors.

Ultimately, Oman reaffirms its dedication to global climate action and looks forward to continued collaboration with the international community. Oman is on the right pathway to achieve our NDC goals and is laying the groundwork for achieving carbon neutrality by 2050. Our strategy includes transitioning to renewable energy, enhancing energy efficiency, adopting innovative technologies, and advancing green hydrogen initiatives. This ambitious goal reflects our commitment to creating a sustainable and resilient future for our nation and the global community.

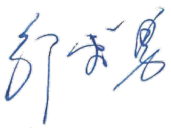
Abdullah bin Ali Al Amri
Chairman of the Environment Authority

It is with great satisfaction that we extend our sincere congratulations to the Sultanate of Oman on the successful completion of its First Biennial Transparency Report (BTR). This milestone demonstrates Oman's unwavering commitment to transparency, accountability and global climate governance, as outlined under the Paris Agreement. The first BTR constitutes a vital instrument for tracking progress in reducing greenhouse gas emissions and adapting to the adverse effects of climate change, in alignment with Oman's Nationally Determined Contributions (NDCs).

UNIDO is proud of its longstanding and fruitful partnership with the Sultanate of Oman, particularly through our collaboration with the Environment Authority under the Montreal Protocol. This cooperation has played a pivotal role in phasing out ozone-depleting substances while advancing sustainable industrial development and strengthening the country's environmental resilience. Moreover, our joint efforts in the area of climate finance continue to facilitate access to critical financial and technical resources—supporting Oman in meeting its national climate objectives and accelerating the implementation of transformative initiatives.

UNIDO remains fully committed to supporting Oman in its climate action endeavours. This first BTR represents a significant step forward, and we look forward to further strengthening our partnership with the Sultanate of Oman to build a sustainable, low-carbon and climate-resilient future. Together, we will continue to enhance national capacities, drive investments in climate-resilient infrastructure, and support the realization of Oman's NDC targets under the Paris Agreement.

As we celebrate this important milestone, we reaffirm our dedication to deepening the collaboration with Oman, to ensure the effective implementation of transformative climate action initiatives.



Ciyong Zou
Deputy to the Director General and Managing Director of the Directorate of Technical Cooperation and Sustainable Industrial Development, UNIDO

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ABBREVIATIONS AND ACRONYMS

- **BAU** Business as usual
- **BTR** Biennial Transparency Report
- **CCS** Carbon capture and storage
- **CCUS** Carbon capture, utilization, and storage
- **CH_4** Methane
- **CO_2** Carbon dioxide
- **CRT** Common Reporting Tables
- **dS/m** DeciSiemens per meter
- **EA** Environment Authority
- **ECw** Electrical conductivity of water
- **ETF** Enhanced Transparency Framework
- **EVs** Electric vehicles
- **GCF** Green Climate Fund
- **GDP** Gross domestic product
- **GHG** Greenhouse gas
- **GWP** Global warming potential
- **HDI** Human Development Index
- **HFCs** Hydrofluorocarbons
- **IPCC** Intergovernmental Panel on Climate Change
- **IPP** Independent power producer
- **IPPU** Industrial processes and product use
- **ITMOs** Internationally Transferred Mitigation Outcomes
- **LULUCF** Land use, land-use change, and forestry
- **MPGs** Modalities, procedures and guidelines
- **MRV** Monitoring, reporting and verification
- **$MtCO_2eq$** Million metric tons of carbon dioxide equivalent
- **MW** Megawatt
- **N_2O** Nitrous oxide
- **NAP** National Adaptation Plan
- **NDA** National Designated Authority
- **NCSI** National Centre for Statistics and Information
- **NDC** Nationally Determined Contributions
- **NF_3** Nitrogen trifluoride
- **NGOs** Non-governmental organizations
- **NMHEWC** National Multi-Hazards Early Warning Centre
- **ONZC** Oman Net Zero Centre
- **QA/QC** Quality assurance/quality control
- **PFCs** Perfluorocarbons
- **Ppm** Parts per million
- **PSU** Practical salinity units
- **PV** Photovoltaic
- **SF_6** Sulfur hexafluoride
- **SPP** Shared Socioeconomic Pathways
- **TJ** Terajoules
- **TNA** Technology needs assessment
- **UNFCCC** United Nations Framework Convention on Climate Change
- **UNIDO** United Nations Industrial Development Organization

EXECUTIVE SUMMARY

This document presents Oman's First Biennial Transparency Report (BTR) under Article 13 of the Paris Agreement and Decision 18/CMA.1. It provides a detailed overview of Oman's climate actions, including the national greenhouse gas (GHG) inventory, progress on its Nationally Determined Contribution (NDC) policies and measures, adaption efforts and support needed and received.

Building on Oman's previous National Communications, the BTR incorporates the latest GHG inventory data (2020-2022). It highlights Oman's national circumstances, GHG trends, climate policies, adaptation measures and capacity-building needs, reflecting Oman's commitment to transparency, international collaboration and sustainable development goals.

1. National circumstances and institutional arrangements

- **Background and contextual overview:** Oman has been actively engaged in global climate efforts, having signed the United Nations Framework on Climate Change (UNFCCC) in 1992, ratified it in 1995, acceded to the Kyoto Protocol in 2005, and ratified the Paris Agreement in 2019. The Enhanced Transparency Framework (ETF) under the Paris Agreement mandates BTRs that include details on GHG emissions, mitigation efforts, climate impacts, adaptation measures, and progress towards NDCs.

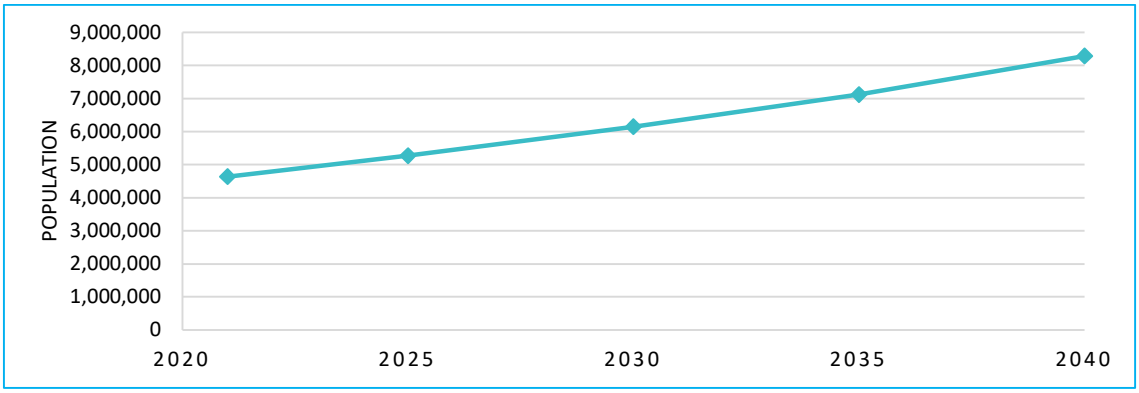
- **Geographic context:** Oman is located at the southeastern extremity of the Arabian Peninsula, covering approximately 309,500 km^3. It features diverse landscapes, including mountains, deserts, and fertile plains, and an extensive coastline of 3,165 km. The Hajar and Dhofar Mountains have elevations ranging from 1,000 to 3,075 meters above sea level. Oman is divided into 11 governorates with 61 wilayats, or provinces. Muscat, the capital, covers an area of 3,500 km^2.

- **Socioeconomic context:** In 2022, Oman's population was estimated at 4.93 million, accounting for approximately 0.06 per cent of the global population and ranking 123rd in population size among countries and territories. The total population of Oman is expected to reach 8.3 million by 2040.[1] The urban population grew by 2.06 per cent from 2021, reaching 4,015,701, with major cities including Muscat, Sohar, Sur and Salalah. Oman boasts a high per capita income and a low unemployment rate, which stood at 3.2 per cent in 2023. The country ranks 59th globally in the 2023/2024 Human Development Index (HDI). While Oman's economy remains heavily reliant on hydrocarbons, it has demonstrated resilience, with non-oil activities gaining greater importance. Post-pandemic

[1] National Centre for Statistics and Information (Population Projections 2021 – 2040), https://www.ncsi.gov.om/Elibrary/LibraryContentDoc/bar_Population%20Projections%202021%202040_80ac85b9-4c2e-48f9-9c32-d8e1b48a5738.pdf).

recovery was marked by economic growth of 3.1 per cent in 2021 and 4.3 per cent in 2022, with real GDP increasing from $82.73 billion in 2021 to $82.93 billion in 2022, whereas agriculture accounted for 1.84 per cent of Oman's GDP, industry contributed 56.98 per cent and services made up 44.48 per cent.

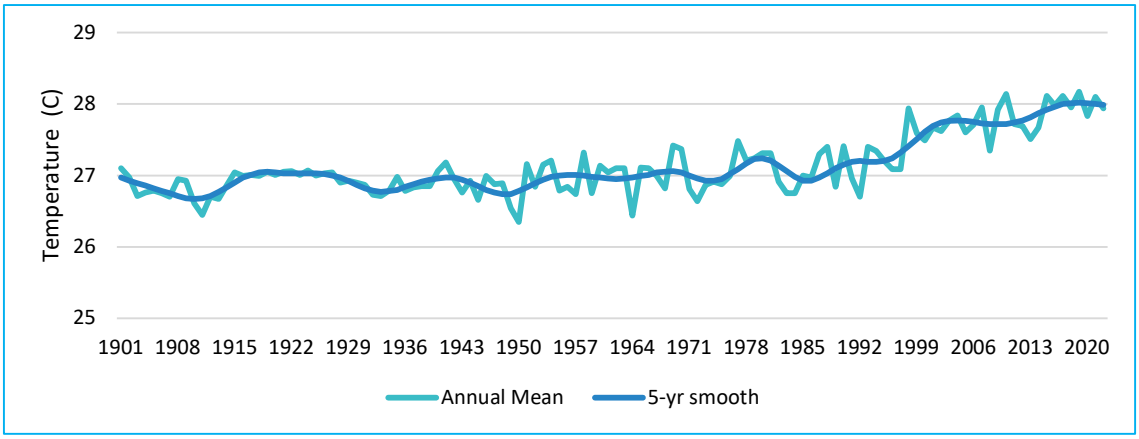
ES. Figure 1: Oman population projection (2021-2040)



- **Climatic context:** Oman, situated on the Tropic of Cancer, is an arid region with various microclimates influenced by major air masses, leading to significant seasonal temperature variations. Rainfall is scarce and erratic, with the summer monsoon affecting the Dhofar coast and winter rains in the north. Extreme weather events, including tropical cyclones, occasionally impact Oman.

- **Climate trend:** Analysis of average mean temperature data from 2011 (27.35°C)-2021(27.94°C) compared to 1901 (27.1°C)-1911 (26.45°C) shows a marked increase in annual temperatures across Oman, emphasizing the need for comprehensive climate action to address potential temperature changes (**ES Figure 2**).[2]

ES. Figure 2: Annual mean surface air temperature rise in Oman (1901-2022)



[2] Climate Knowledge Portal. https://climateknowledgeportal.worldbank.org/country/oman/climate-data-historical.

- **Energy:** In 2021, Oman's per capita energy consumption was approximately 5.3 tons of oil equivalent, nearly three times the global average, while per capita electricity consumption reached 6.8 megawatts per hour (MWh). The country's energy supply was predominantly derived from domestically produced natural gas (90.5 per cent), with oil products contributing 9.4 per cent and a growing share from renewables.[3]

- **Institutional arrangements and legal mechanisms:** Oman has established a framework to monitor GHG emissions and promote carbon reduction. In 2024, the Ministry of Energy and Minerals issued Ministerial Decree No. (35-2024) establishing the Oman Net Zero Centre (ONZC). The Centre's mandates include developing, updating and overseeing the implementation of the National Net Zero Implementation Plan and National Energy Efficiency Plan, providing technical support and strategic advice to government and private entities, and adopting, localizing and integrating the latest global practices and technologies.

  Additionally, the mandates aim to enhance scientific research, innovation, national capacities and awareness related to net zero and energy efficiency. They encompass managing certification processes for carbon, hydrogen and low-carbon products in coordination with the Ministry of Finance and the Environment Authority (EA), approving and registering local carbon credit trading applications in alignment with international coordination, and ensuring compliance with the carbon credit framework. Furthermore, managing and updating the carbon emissions inventory through a secure, accurate and confidential platform, and executing additional tasks assigned by the Supervisory Committee within its jurisdiction, are also key responsibilities.

  In 2019, Oman approved the National Strategy for Adaption and Mitigation to Climate Change for 2020-2040, which outlines strategic actions to mitigate negative impacts on vulnerable sections and facilitate the transition to a low-emissions economy. While the overarching Oman Vision 2040 focuses on achieving economic diversification and sustainable development.

- **Financial mechanisms:** Oman is committed to transitioning to renewable energy and fostering a low-carbon economy under Vision 2040, which serves as a strategic roadmap for sustainable socioeconomic development. To achieve this, the Sustainable Finance Framework was introduced to channel investments into climate-responsive projects that support economic growth and environmental resilience.

  The Ministry of Finance (MoF) established the framework to facilitate the issuance of green, social, and sustainability bonds, loans, and sukuk, adhering to

[3] IRENA Energy Profile Oman, International Renewable Energy Agency. https://www.irena.org/-/media/Files/IRENA/Agency/Statistics/Statistical_Profiles/Middle%20East/Oman_Middle%20East_RE_SP.pdf.

international standards such as the ICMA Green Bond Principles and Loan Market Association Green Loan Principles.

Key components of the Sustainable Finance Framework include:

- **Use of proceeds:** Funds will be allocated to eligible green and social projects, excluding fossil fuel-related and nuclear energy investments.
- **Project evaluation and selection:** A Sustainable Finance Working Group (SFWG) will oversee project selection and compliance with eligibility criteria.
- **Management of proceeds:** Unallocated funds will remain with MoF Oman and be tracked through a structured register to ensure compliance with environmental, social and governance (ESG) standards.
- **Reporting obligations:** An Annual Sustainable Financial Instrument Report will provide transparency on fund allocation and the impact of financed projects.

This framework strengthens Oman's ability to attract climate finance while ensuring alignment with global sustainability principles.

Oman launched the National Fund for Emergencies on 1 January 2024 to address the rising risks from climate-induced disasters. This fund is designed to provide rapid financial support for disaster response and recovery efforts, reinforcing national resilience against extreme weather events, earthquakes and other hazards.

The fund's financial resources include state budget allocations to ensure a steady flow of funding, gifts, donations, contributions approved by the Minister of Finance and returns from investments in fund assets.

The Minister of Finance oversees fund management, including investment strategies, financial reporting and post-emergency research coordination. The fund operates under a dedicated annual budget, with surpluses rolling over to ensure long-term sustainability. Legal exemptions enable swift decision-making during emergencies.

2. National inventory report of anthropogenic emissions by source and sink of GHGs

- **National circumstances, institutional arrangements, and cross-sectoral information:** The current inventory expands the temporal coverage, with a consistent time series presented from 2020 to 2022 employing 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines and their 2019 Refinement. The latest inventory used IPCC Inventory Software version 2.861 (June 2023) which populates the Common Reporting Tables (CRT) automatically. The Environment Authority facilitated data collection from various sources, including major industry players, ensuring comprehensive and accurate information for estimating national GHG emissions.

Through ONZC, Oman is developing a monitoring, reporting and verification (MRV) system and online activity data collection facility for future inventories.[4] The national platform is operational and consists of three main modules. The first module is the situational awareness module which represents the national GHG emission registry and has been built based on the IPCC Guidelines with Tier 1, Tier 2, and Tier 3 calculations available based on user requirements. The second module is built for forecasting future emissions based on time series regression and historical data available. The third module represents a carbon registry, which is currently under progress. The registry will act as a national record for all Omani-based carbon credits or Renewable Energy Certificates available for trading. The platform is fully modular for future updates to fit the Omani context in terms of county-specific emission factors or other aspects.

The Environment Authority facilitated data collection from various sources, including major industry players, ensuring comprehensive and accurate information for estimating national GHG emissions.

- **General description of scope and methodology:** Oman's GHG inventory for 2020-2022 was developed using the best available data, scientific knowledge, and appropriate tier approaches, following an eight-step process aligned with IPCC Guidelines. The inventory covers emissions and removals of carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorinated compounds and sulfur hexafluoride, using data from government ministries, entities, and additional sources to ensure comprehensive coverage.

- **Trends in emissions and absorptions:** The inventory provides a consistent time series from 2020 to 2022. Previous years (1995, 2000, 2015) were not reassessed. Oman plans to report a consistent time series from at least 2019 onwards in future BTR submissions. **ES. Table 1**[5] shows GHG emissions per sector for 1994, 2000, 2015, 2020, 2021, and 2022. From 1994 to 2015, total GHG emissions increased 4.6 times, primarily driven by the energy sector. Emissions increased by 12.8 per cent from 2020 to 2022. **ES. Figure 3** gives an overview of source and sink category emissions and trends. Oman will revisit emission calculation methodologies and assumptions used in previous inventories, and thus any future drastic changes in emissions will be highlighted as part of emission methodology updates rather than real emission changes.

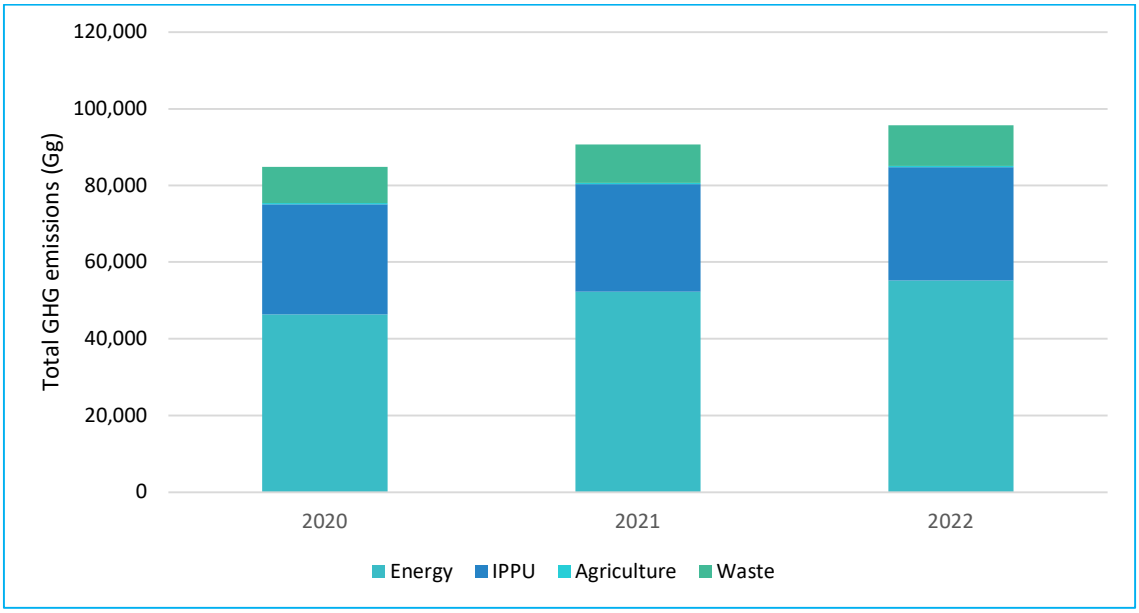
[4] *Oman Observer* (2023) "Oman to set up climate mitigation tracking system".
https://www.omanobserver.om/article/1146613/business/energy/oman-to-set-up-climate-mitigation-tracking-system.

[5] Initial National Communication under the UNFCCC. https://unfccc.int/resource/docs/natc/omnnc1.pdf.

ES. Table 1: Oman's GHG emissions for the years 1994, 2000, 2015, 2020, 2021 and 2022

GHG source/sink ($MtC0_2e$ Gg)	1994	2000	2015	2020	2021	2022
Energy	13,058	17,196	61,488	46,381	52,329	55,236
IPPU	0.594	2,865	29,181	28,703	28,039	29,518
Agriculture	6,571	0.799	1,466	0.296	0.333	0.363
LULUCF	NE	NE	NE	-0.591	-0.670	-0.794
Waste	0.497	0.806	3,938	9,459	10,033	10,589
Net emissions	20,720	21,666	96,072	84,248	90.064	94,912
Total emissions	**20,720**	**21,666**	**96,072**	**84,839**	**90,734**	**94,706**

ES. Figure 3: Overall trends and sectoral dynamics in GHG emissions, 2020-2022



- **Key category analysis and flexibility:** A key category in a national inventory system is prioritized due to its substantial influence on the country's total GHG inventory. This influence may relate to the absolute levels, trends, or uncertainties associated with the emissions and removals estimated. Recognizing the importance of these categories, they receive special attention in three critical aspects of inventory management:
    - **Efficient use of resources:** Prioritizing key categories ensures better allocation of resources to improve the quality of the most impactful categories on the inventory's magnitude, trend and uncertainty.
    - **Methodological selection:** Generally, inventory uncertainty is lower when emissions and removals are estimated using the most rigorous methods available, but this may not be feasible for all categories covered by the inventory. More detailed, higher-tier methods have therefore been selected for key categories.
    - **Verification procedures:** Key categories receive additional quality assurance and quality control (QA/QC) to ensure accuracy.

The 2006 IPCC Approach 1 was used for key category analysis for both level and trend, considering the base year 2021 and the latest inventory year 2022. Key categories were identified with and without including emissions and removals from the land use, land use change and forestry (LULUCF) sector. Approach 1 assesses the impact of various source categories on national emissions inventory levels and trends. Key categories are those that, when summed in descending order of magnitude, comprise over 95 per cent (or 85 per cent with flexibility) of total emissions or inventory trends. To improve the most significant categories and prioritize resources, Oman intends to use the 85 per cent threshold due to constraints during the preparation of its first BTR, in line with Article 13, paragraph 2, of the Paris Agreement. The threshold is expected to increase to 95 per cent for the third BTR as higher tier methods are applied. Fifteen key categories were identified: six in the energy sector, eight in industrial process and product use (IPPU) and one in the waste sector. No key categories were found in the agriculture and LULUCF sectors, reflecting their minimal GHG contributions.

3. Information to track progress in implementing and achieving NDCs under Article 4 of the Paris Agreement

- **Description of the latest NDC:** The business-as-usual (BAU) scenario reference baseline year is 2021, with GHG emissions estimated at 90.73 million tons of CO_2 equivalent ($MtCO_2eq$). Oman's NDC aims for a 21 per cent reduction in GHG emissions by 2030 compared to the BAU scenario, including a firm 7 per cent reduction and a conditional 14 per cent reduction. Oman aims to achieve significant reductions in GHG emissions in the key sectors of energy and IPPU, with agriculture, LULUCF and waste collectively contributing less than 5 per cent of total emissions.

- **Indicators to track progress towards the NDC:** Oman will track progress towards its NDC under Article 4 using "net GHG emissions and removals" as reported in its National Inventory Report (NIR). If there are recalculations due to new emission sources or methodology enhancements, updates to the BAU scenario will be included in the relevant BTR. There is a minor discrepancy between the GHG emissions reported in the NIR for 2021 and 2022 compared to the BAU scenario, but this variance is minimal, at approximately 1.1 per cent for 2022, and did not require a recalculation of the BAU scenario.

4. Mitigation policies and measures for achieving NDCs under Article 4 of the Paris Agreement

- **Key sectors and actions:**
    - **Power sector:** Oman aims to deploy large-scale renewable power (solar, wind), improve building insulation, and enhance energy efficiency. By 2030, the goal is a 42 per cent reduction from the BAU scenario.

- **Oil and gas sector:** Measures include electrifying processes, implementing efficiency improvements, and repurposing flared gas. By 2030, the goal is a 17 per cent reduction from the BAU scenario.
- **Industry sector:** Measures include electrifying heat processes and making feedstock changes in steel, cement, and petrochemicals. By 2030, the goal is a 7 per cent reduction from the BAU scenario.
- **Transport sector:** Measures include transitioning to electric vehicles (EVs) and hydrogen fuel cells and promoting biofuels. By 2030, the goal is a 19 per cent reduction from the BAU scenario.
- **Other sectors (agriculture, LULUCF, waste):** Targeting a 45 per cent reduction by 2030, measures include enhancing carbon sinks, improving waste management, and adopting sustainable agricultural practices.

5. Impacts of climate change and adaptation in Oman under Article 7 of the Paris Agreement

- **Impacts, risks and vulnerabilities:** Oman's agricultural sector relies heavily on groundwater for irrigation, facing increased salinity and reduced water availability due to overextraction and sea level rise. Date palms, a critical crop, and annual crops such as garlic, onion, maize, barley and oats, are threatened by temperature and water stress, impacting yield and quality. In fisheries and marine biodiversity, changes in sea temperature, salinity and oxygen levels are degrading marine ecosystems, reducing fish populations and primary production, necessitating adaptation strategies to sustain the fisheries sector.

- **Water management:** Groundwater is overexploited (beyond the safe yield), leading to significant water deficits. Climate change impacts such as higher temperatures, decreasing rainfall rates and rising sea levels exacerbate water scarcity and salinity, necessitating sustainable water management practices. Desalination plants face reduced efficiency due to increased sea temperatures and salinity, with disruptions from harmful algal blooms and jellyfish blooms.[6] Adaptation measures are needed to maintain desalination plant performance.

- **Public health:** Public health is significantly affected by climate change, with increased risks such as heatstroke, disease transmission and extreme weather impacts. Rising temperatures and extreme heat events pose severe risks,

[6] Regional Organization for the Protection of the Marine Environment (ROPME) (2020) *ROPME Marine Climate Change Impacts Evidence Report*, *(Lincoln, S., Buckley, P., Howes, E.L., Maltby, K.M., Pinnegar, J.K. and Le Quesne, W. eds.), Cefas, Lowestof.* https://ropme.org/wp-content/uploads/2021/09/ROPME-Marine-Climate-Change-Impacts-Evidence-Report.pdf.

particularly to vulnerable populations, necessitating adaptive measures to protect public health.

- **Natural hazards and urban planning:** The increased frequency and intensity of tropical cyclones highlight the need for effective adaptation measures, particularly in coastal and urban areas vulnerable to flooding and storm damage. Rapid coastal development increases vulnerability to sea level rise and flooding, with urban areas, especially in low-lying regions, facing significant risks from climate-induced hazards. Improved drainage systems and flood risk management are critical to address these vulnerabilities.

- **Strategic climate adaptation priorities:** In agriculture, Oman has integrated climate adaptation into planning processes, promoting sustainable practices and enhancing resilience to climate impacts. Key projects include improved irrigation systems, genetic crop research and alternative animal feed production. The fisheries and marine biodiversity sector focuses on sustainable management of resources, developing stakeholder management regimes, and incorporating climate adaptation strategies. Water management efforts aim to enhance conservation practices and construct dams for flood protection and groundwater recharge, supported by legislation to safeguard water resources. Public health initiatives under Health Vision 2050 integrate climate adaptation into planning, with wilayat health committees facilitating cross-sector collaboration. Urban planning and infrastructure strategies include improving urban water drainage and flood management and strengthening policies to integrate climate adaptation into development plans.

- **Progress in implementing adaptation:** Oman is actively progressing in its climate change adaptation efforts across key sectors, supported by the ongoing Green Climate Fund (GCF) National Adaptation Plan (NAP) for 2023-2026. Key activities include formulating long-term goals, aligning national strategies with international commitments, and developing sector-specific adaptation strategies. However, the integrating climate adaptation into a strategic vision remains partially completed, and further refinements are needed.

  Foundational work is ongoing, focusing on assessing the current state of resources and vulnerabilities, particularly in critical sectors such as water, agriculture, and public health. The proposed GCF readiness project on climate adaptation technologies (2025-2027) will enhance these efforts by introducing advanced technologies and conducting sector-specific capacity assessments to strengthen resilience.

  Oman’s evaluation of climate risks is progressing, with continuous analysis of climate projections and vulnerability assessments. The proposed readiness

project will further refine climate models and improve localized impact assessments, ensuring that adaptation measures are well-targeted and effective.

Implementation of adaptation options is under way, with pilot projects and cost-benefit analyses being conducted. The upcoming GCF readiness project will accelerate these initiatives by focusing on the deployment of adaptation technologies and developing comprehensive risk management strategies tailored to Oman's needs.

Monitoring and evaluation systems are being developed, though they require further enhancement to integrate real-time data collection and advanced analysis technologies. The proposed readiness project will address these gaps, ensuring that Oman's adaptation efforts are effectively monitored and adjusted as necessary.

6. Financial, development, and technology transfer support, and capacity-building needed and received[7]

- **Financial support needed (Article 9):**
  - **Adaptation funding:** Financial support is needed for water resources management, sustainable agriculture, urban development, infrastructure, tourism, and ecosystem conservation. Specific needs include updating flood hazard maps, developing drought-resistant crops and enhancing climate-resilient infrastructure.
  - **Mitigation funding:** Investments are required in industry, oil and gas, power, transport, and buildings to achieve net zero emissions by 2050. Key areas include promoting carbon capture and storage, hydrogen-based steel production, electrifying industrial processes, developing renewable energy sources, and supporting electric mobility.

- **Financial support received (Article 9):**
  - Oman has received $5.19 million from GCF for four activities and $60 million from the Asian Infrastructure Investment Bank (AIIB) for a solar project. Despite these contributions, the pace of climate funding is insufficient to meet Oman's ambitious climate goals.

- **Support for development and technology transfer (Article 10):**
  - Oman has not received specific support for a technology needs assessment (TNA) for climate change adaptation or mitigation. However, the Sultanate recognizes the need for technology transfer in areas such as renewable energy, climate-resilient infrastructure, and agriculture. Key

[7] Modalities, procedures and guidelines (MPGs) – Facilitative Tool. https://unfccc.int/sites/default/files/resource/MPGs_Tool_BTRs_developing%20countries_FTC.pdf.

priorities include training programmes for climate-related skills, developing climate-resilient infrastructure, and transferring drought-resistant crop varieties.

- **Capacity-building support (Article 11):**
    - GCF readiness support has contributed to building Oman's capacity for climate action, but significant needs remain. Key priorities include:
        - **Institutional capacity:** Enhancing the ability to monitor and report climate indicators and improving coordination among relevant institutions.
        - **Technical capacity for climate-resilient infrastructure:** Developing climate-resilient and low-emission infrastructure in sectors such as renewable energy and transportation.
        - **Cooperation and financial resource mobilization:** Building expertise in climate-resilient agricultural practices and water management systems.

1. NATIONAL CIRCUMSTANCES AND INSTITUTIONAL ARRANGEMENTS

1.1. Background and contextual overview

On 11 June 1992, the Sultanate of Oman signed the United Nations Framework Convention on Climate Change (UNFCCC), officially ratifying it on 8 February 1995, and marking its entry into force on 9 May 1995, as a Non-Annex I party.[8] Further demonstrating its commitment to global climate initiatives, Oman acceded to the Kyoto Protocol on 19 January 2005, with the Protocol taking effect on 19 April 2005. These actions align Oman with the broader goals set forth during the Earth Summit in Rio de Janeiro in 1992, committing to the multifaceted approaches required under the UNFCCC umbrella for combating climate change.

As a party to the UNFCCC, the Sultanate of Oman is obligated to fulfill certain requirements. These include the submission of national communications, providing detailed inventories of anthropogenic emissions and outlining national strategies for mitigating climate change. Such inventories and national measures are essential for adhering to Article 4.1 and Article 12.1 of the UNFCCC, ensuring that all efforts are comparable, credible, and based on methodologies agreed upon by the Conference of the Parties (COP).

The adoption of the Paris Agreement during the COP21 negotiations in December 2015 marked a significant evolution in the global response to climate change. Signed by Oman on 22 April 2016, and ratified on 22 May 2019, this agreement introduced the Enhanced Transparency Framework (ETF) under Article 13. The ETF underscores the necessity of transparent reporting to track collective progress towards climate objectives. It mandates the submission of biennial transparency reports (BTRs), providing a comprehensive overview of greenhouse gas (GHG) emissions, mitigation efforts, the impacts of climate change, adaptation measures, and the progress towards Nationally Determined Contributions (NDCs) objectives by 31 December 2024.

The Sultanate of Oman has established comprehensive institutional arrangements for implementing the ETF and preparing the submission of its first BTR. These arrangements include setting up dedicated teams within key government departments to oversee data collection, analysis, and reporting in line with ETF requirements. This initial BTR report has been meticulously prepared, adopting recommended tabular formats to ensure clarity and consistency. However, Oman has faced technical challenges, including software incompatibility and the absence of automated data import tools for the ETF reporting mechanisms, which were still under test at the time of this report's preparation. However, these challenges are actively being addressed as part of ongoing efforts to redefine and test the reporting systems. Nonetheless, there is optimism that these

[8] https://unfccc.int/resource/docs/2005/cop11/eng/inf01.pdf.

issues will be addressed in time for the next reporting cycle, enhancing the efficiency and accuracy of future submissions.

1.2. Geographic context

The Sultanate of Oman is strategically situated at the southeastern extremity of the Arabian Peninsula. It is delineated by coordinates spanning from 16°40'N to 26°20'N in latitude and from 51°50'E to 59°50'E in longitude, encompassing a total area of approximately 309,500 square kilometers. This extensive territory is characterized by a remarkable diversity of topographical features, including mountainous terrains, arid deserts, and fertile plains, each contributing to the nation's unique geographic identity.

Oman boasts an extensive coastline of about 3,165 km, overseeing the Arabian Gulf, the Sea of Oman, and the Arabian Sea. This coastline extends from the Strait of Hormuz in the north, to the borders with the Republic of Yemen in the southwest. The coastal landscape exhibits significant variation, ranging from precipitous cliffs, as observed near Musandam at the northernmost point, to the shallow sandy beaches interspersed with inlets, lagoons, and mangroves prevalent in the Al Batinah governorates along the Sea of Oman. Central Oman's coastline is distinguished by its broad sandy beaches and areas of salt flats, notably Barr Al Hikman, which adjoins the Ash Sharqiyah Sands opposite Masirah Island. Furthermore, the Sultanate possesses a number of islands, with Masirah Island being the most sizable, located to the east of central Oman (**Figure 1**).

The topography of Oman is significantly influenced by its mountain ranges, which occupy approximately 15 per cent of the national territory. The Hajar mountains in the north form an extensive arc stretching 700 kilometers from Musandam Peninsula, curving eastward towards the coast up to Ras Al Hadd, the easternmost extremity of Oman. Among these, Jabal Shams, as part of the Jebel Akhdar range, stands as the acme, reaching 3,075 meters above mean sea level. Conversely, the Dhofar Mountains in the southwest exhibit elevations ranging from 1,000 to 2,000 meters above mean sea level, contributing to the region's distinctive climate and biodiversity.

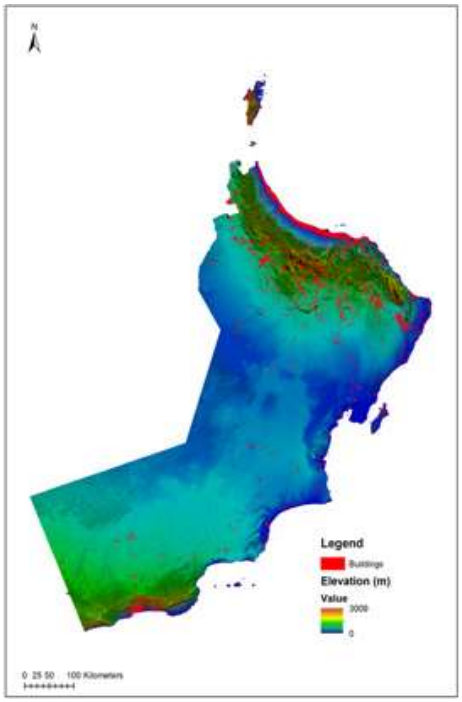


Figure 1: Topography and spatial distribution of built-up area

Coastal plains, which constitute approximately 3 per cent of Oman's land area, are pivotal for agricultural ventures. These plains extend from the Al Batinah Governorate along the Sea of Oman to the Salalah Plain in the southwest, adjacent to the Arabian Sea. The interior, covering the remaining 82 per cent of the territory, is predominantly composed of sandy

deserts and barren lands, with elevations reaching up to 500 meters above sea level. Administratively, Oman is divided into 11 governorates, which are further broken down into subdivisions called wilayats. There are a total of 61 provinces, or wilayats, across the Sultanate of Oman. Muscat, which became the capital of Oman in 1793, covers an area of 3,500 km^2 within the Muscat Governorate.

1.3. Climatic context

1.3.1. Climate

Oman, positioned on the Tropic of Cancer, is classified as an arid region under the Köppen and Geiger climate classification.[9] Despite this overarching aridity, Oman's extensive latitudinal range and varied topography give rise to several microclimates. These range from hyper-arid conditions in the Empty Quarter and coastal areas, with an average of 100 mm of annual rainfall, to semi-arid conditions in the Al Hajar Mountains, receiving 400 mm or less of rainfall annually.[10] The climate is significantly influenced by major air masses, leading to seasonal temperature variations. Winter (December to February) sees the influence of the Polar Continental air mass, bringing cooler temperatures and higher pressure, while summer (June to September) is dominated by the hot, dry Tropical Continental air mass. These patterns result in average annual temperatures varying widely from 10°C in mountain peaks to 26°C in most of the country (**Figure 2**). June, the hottest month, sees temperatures ranging from 23°C to above 42°C in interior plains. January, the coldest month, has temperatures ranging from -3°C to 20°C, with the coldest conditions in the highlands.

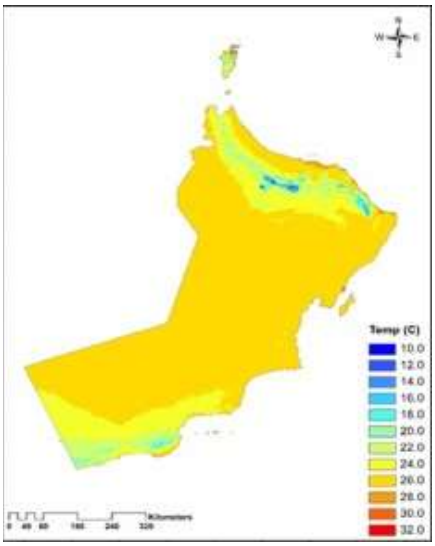


Figure 2: Annual mean temperature (1950-2020)

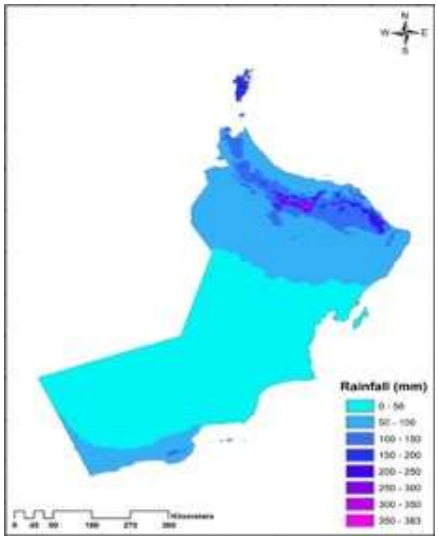


Figure 3: Annual average precipitation (1950-2020)

Rainfall in Oman is scarce and erratic. The summer monsoon (khareef) affects the Dhofar coast, bringing verdant vegetation through rains of 20 to 60 mm during June to September (**Figure 3)**. Winter months see rainfall of 20 to 60 mm in the north, with Muscat receiving about 75 mm and the Al Hajar Mountains up to 120 mm, due to cold frontal troughs. Extreme weather, including tropical cyclones from the north Indian Ocean and Arabian

[9] Köppen, W. and Geiger, R. (1928) *Klimakarte der Erde*. Gotha.
[10] MODIS Web – NASA. https://modis.gsfc.nasa.gov/gallery/individual.php?db_date=2024-10-15.

Sea, occasionally impacts Oman, especially during the pre-monsoonal (May-June) and post-monsoonal (October-November) periods.

1.3.2. Climate trend

Recent decades have seen Oman considerably affected by climate change. The climate trend analysis from 1980 to 2023 indicates significant changes in both temperature and precipitation patterns, highlighting a warming trend and a general decline in rainfall. The data reveal a statistically significant rise in temperatures across the country, with notable variations among different locations **(Table 1).** The highest warming trend is observed in Khasab, where temperatures have increased by +0.7°C per decade, followed by Sohar at +0.6°C per decade and Saiq at +0.4°C per decade. Other stations, such as Salalah, Masirah, Sur and Thumrait, exhibit warming trends between 0.2°C and 0.3°C per decade, while Muscat (Seeb) shows negligible change. On a national scale, the average temperature increase of 0.3°C per decade has led to an overall warming of 1.4°C since 1980. These findings align with prior research but also highlight differences, particularly the inclusion of Muscat (Seeb) in this study and the use of original raw datasets for Sur and Khasab, unlike the adjusted data in previous analyses.

Table 1: Mean annual temperature (1980-2023)

Station	Trend (per decade)	Total degree Celsius increase
Salalah	0.2	0.8
Masira	0.2	1.0
Muscat	0.0	0.1
Sur	0.2	1.0
Saiq	0.4	1.6
Sohar	0.6	2.5
Thumrait	0.2	0.8
Khasab	0.7	3.0
Overall Oman Temp	0.3	1.4

Precipitation trends **(Table 2)** indicate a significant decline in annual rainfall at most stations, with the steepest reductions recorded in Saiq (-19.0 mm per decade) and Khasab (-17.3 mm per decade), resulting in total rainfall losses of -81.7 mm and -74.3 mm, respectively, over the study period. Other stations, including Sohar and Salalah, also show declining trends, while Muscat (Seeb) and Thumrait exhibit minimal changes. In contrast, Sur and Masirah show slight increases in precipitation, with Sur experiencing a rise of +11.5 mm per decade. Compared to previous studies, these findings suggest a broader drying trend across Oman, extending beyond Saiq and Salalah, which were previously identified as the most affected areas. The continuation of this drying trend beyond the turning point of 1999 underscores its persistence, with significant

implications for water resource management, agriculture and climate adaptation strategies. Overall, Oman is experiencing a warming climate with decreasing precipitation in most regions, posing challenges for sustainable development and necessitating proactive adaptation measures.

Table 2: Total annual precipitation (1980-2023)

Station	Trend (mm per decade)	Total change (mm)
Salalah	-7.1	-30.5
Masira	1.5	8.6
Muscat	-1.2	-4.9
Sur	11.5	49.3
Saiq	-19.0	-81.7
Sohar	-10.0	-43.0
Thumrait	-0.1	-0.4
Khasab	-17.3	-74.3

1.3.3. Climate projection

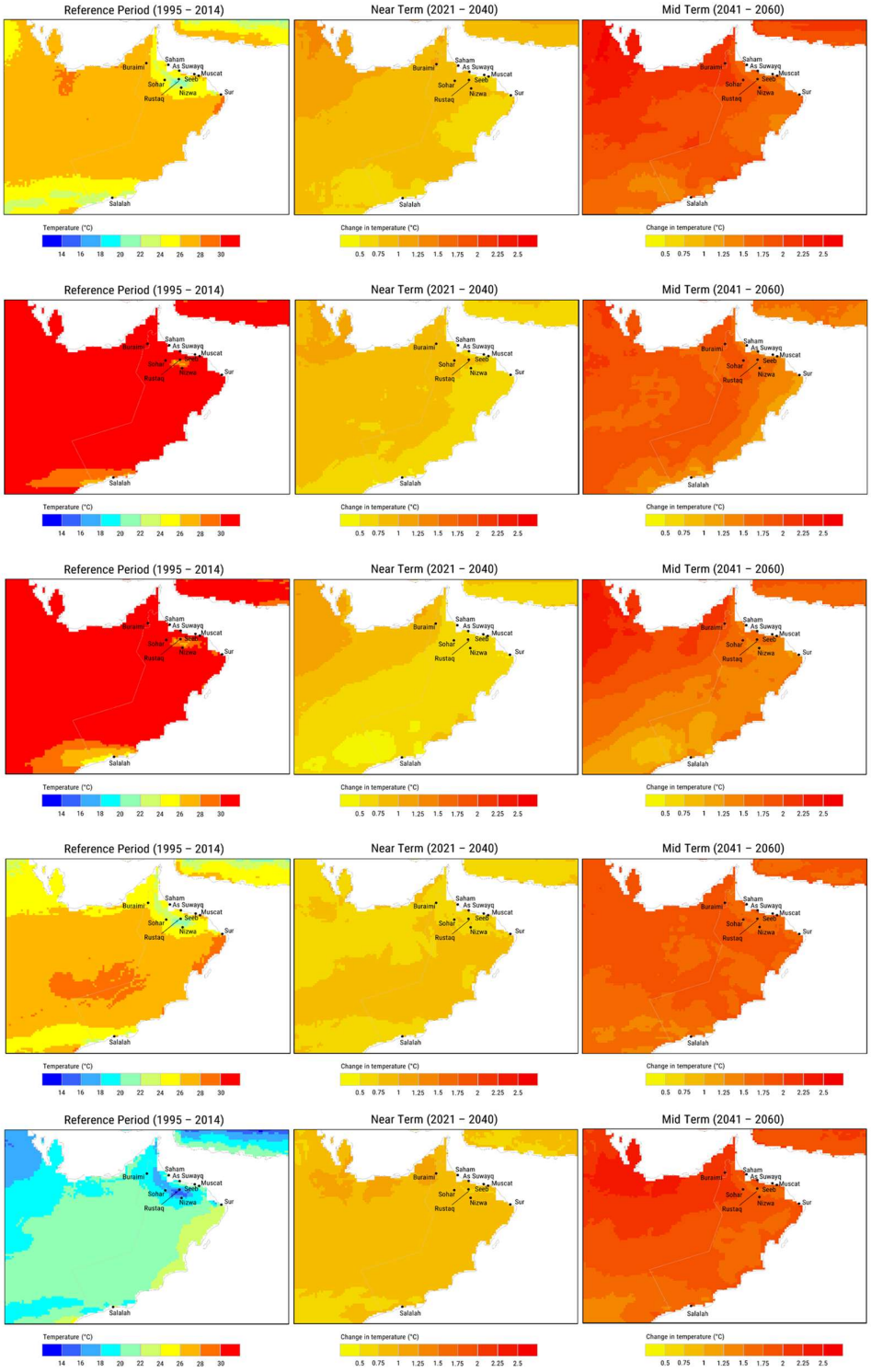
In the face of global climate change, the Sultanate of Oman is on the brink of experiencing significant shifts in its climate patterns across the upcoming decades.

Oman is experiencing a steady rise in temperatures across all seasons, with significant warming projected for the future **(Figure 4)**. During the reference period (1995–2014), autumn temperatures ranged from 18°C to 28°C, with cooler conditions in Salalah and higher temperatures in northern and inland areas like Muscat and Sohar. Near-term projections (2021–2040) indicate a rise of 0.5°C to 1.5°C, with stronger warming in the north and central regions, while the mid-term (2041–2060) suggests an increase of 1.5°C to 2.5°C, reducing the north-south temperature contrast.

Early summer trends show extreme heat, with temperatures exceeding 30°C in northern and inland areas. The near-term projects a 0.5°C to 1.5°C rise, while the mid-term anticipates further warming of up to 2.5°C, intensifying heat stress and increasing energy demand. Similarly, spring temperatures are rising gradually, affecting agriculture and water resources.

Winter follows the same warming trend, with near-term projections showing a 0.5°C to 1.5°C rise and mid-term projections exceeding 2.5°C in some areas. These changes may significantly impact agriculture, water availability, public health and energy consumption, emphasizing the urgent need for climate adaptation and mitigation strategies in Oman.

Figure 4: Mean change in seasonal temperature for ensemble of six SSP5-8.5 projections compared to the reference period - 10 km grid resolution

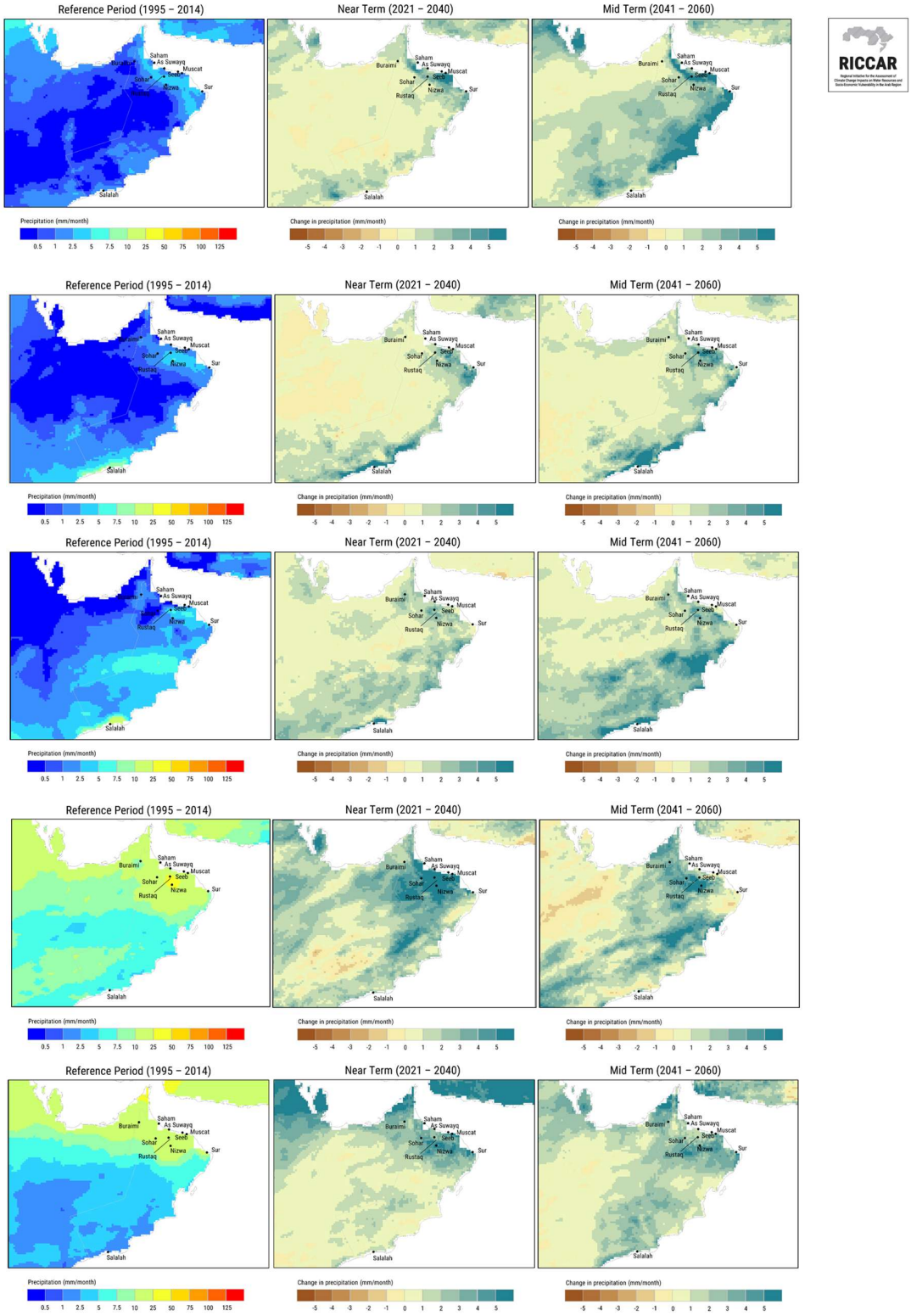


Oman's seasonal precipitation patterns are projected to change significantly, with an overall decline in rainfall across most regions **(Figure 5)**. Historically, autumn (September–November) experienced substantial precipitation, particularly in the south and central areas, including Salalah. However, near-term projections (2021–2040) indicate a reduction of up to 5 mm per month across much of the country, and by mid-term (2041–2060), precipitation levels remain low, with minor increases along the eastern and southern coasts, potentially affecting agriculture and groundwater recharge. Similarly, early summer (May–June) rainfall, which was once concentrated in the south and central regions, is expected to decline by up to 5 mm per month, persisting into the mid-term, except for slight increases along the southern coast. This trend may worsen water scarcity, emphasizing the need for sustainable water management.

During late summer (July–September), precipitation was historically highest in southern and central Oman, particularly in Salalah. Near-term projections suggest declines of up to 5 mm per month, with minor increases in some southern areas. By mid-term, mixed trends emerge, but overall reductions may negatively impact agriculture and water availability. Spring (March–April) rainfall was moderate in the northern and central regions, with lighter precipitation in the south. Near-term projections indicate varied trends, with slight increases in some areas but declines of up to 5 mm per month in others. By mid-term, rainfall decreases in most parts of the country, highlighting the necessity of adaptive water resource management.

Winter (December–February) previously experienced moderate to high precipitation in the south and central regions. Near-term projections show slight rainfall increases in some locations but declines in central and southern Oman. By mid-term, reductions become more pronounced, posing risks to agriculture and water resources. Overall, Oman is expected to experience declining precipitation across all seasons, with only localized increases in certain areas. These changes could heighten water scarcity risks, reduce agricultural productivity, and increase reliance on alternative water sources. Effective water conservation measures and adaptation strategies will be essential to mitigate the impacts of these shifts in precipitation patterns.

Figure 5: Mean change in seasonal precipitation for ensemble of six SSP5-8.5 projections compared to the reference period - 10 km grid resolution



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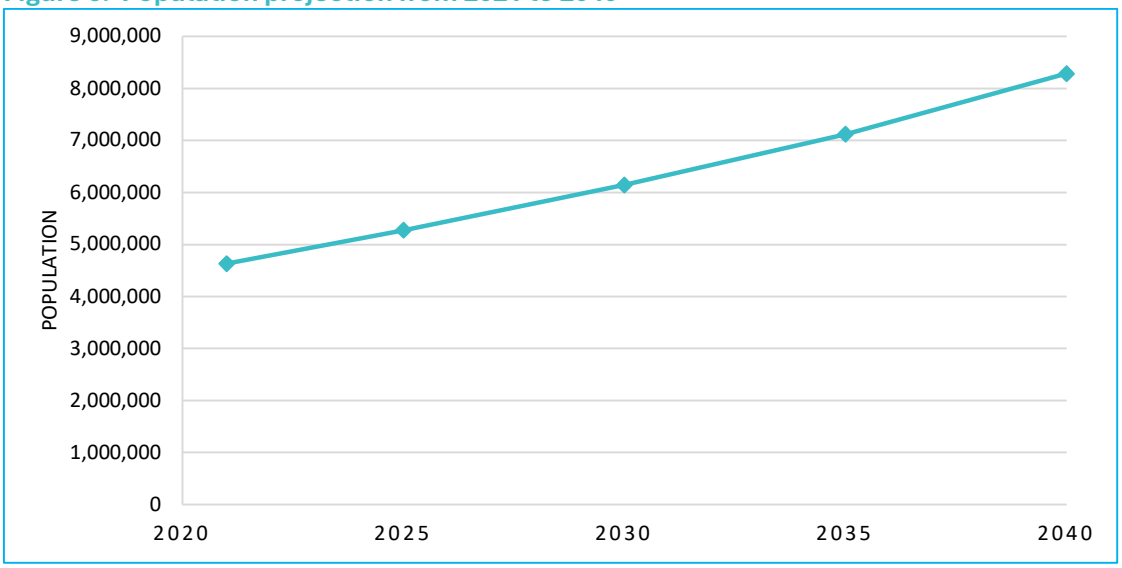
1.4. Socioeconomic context

1.4.1. Demography

Oman has achieved a notable demographic milestone, with its population exceeding 5 million people at the end of 2023, as reported by the National Centre for Statistics and Information (NCSI).[11] With a growth rate of 1.2 per cent compared to the previous year, the Sultanate's population has reached a total of 5,165,602, highlighting the nation's continuous economic progress and expansion. The population is projected to reach 6,143,027 by 2030, 7,120,364 by 2035, and 8,285,156 by 2040[12] **(Figure 6)**. This steady growth reflects significant demographic trends across genders and nationalities in the Sultanate. Over the previous decade, the bulk of Oman's population has consisted of individuals between the ages of 15 and 64.[13] The largest cities of Oman include Sohar, Muscat, Sur, and Salalah, all of which are situated on the coast. The Muscat Governorate remains Oman's most densely populated area, comprising 29.7 per cent of the country's total population, which amounts to 1,546,667 individuals. Following closely is the Ad Dakhiliyah Governorate, which represents 20.3 per cent of Oman's population, totalling 1,044,388 people.

Figure 6: Population projection from 2021 to 2040



The Sultanate of Oman is a country with a high income. The unemployment rate stood at 3.2 per cent in 2023. However, while the rate remains low for the population as a whole, unemployment among young people in Oman (labour force ages 18-24) is higher, reaching 15.79 per cent in 2022.[14] The Sultanate has demonstrated remarkable progress in the 2023/2024 Human Development Index (HDI) released by the United Nations Development Programme (UNDP).[15] Oman is now categorized among the countries with

[11] NCSI (2024). https://www.ncsi.gov.om/AboutUs/Pages/PopulationClock.aspx.
[12] Population Projection 2021-2040 (2023).
[13] NCSI (2024). https://www.ncsi.gov.om/Pages/AllIndicators.aspx.
[14] Ibid.
[15] United Nations Development Programme (UNDP) *Human Development Report 2023/2024.* https://hdr.undp.org/system/files/documents/global-report-document/hdr2023-24overviewen.pdf).

"very high human development," securing 59th position globally out of 191 nations and ranking fifth among Arab and Gulf countries. This achievement solidifies Oman's status as one of the world's top performers in human development.

With an HDI value of 0.819, Oman boasts impressive indicators across various aspects of human well-being. The average life expectancy at birth in the Sultanate stood at 73.94 years in 2022. The expected number of years of schooling is 13, while the mean is 11.9 years. Additionally, the gross national income per capita in Oman is $32,967, reflecting a high standard of living for its citizens.

1.4.2. Economy

Oman, with an economy heavily reliant on hydrocarbons, has shown great determination in its pursuit of diversification and has displayed remarkable resilience amid global challenges. The economic data presented in **Table 3** offer a detailed breakdown of Oman's economic structure from 2018 to 2022, categorizing the economy into petroleum and non-petroleum activities, and unveils several significant trends and insights into the Sultanate's economic journey.

Table 3: Percentage share of GDP at current market prices in Oman[16-17]

	2018	2019	2020	2021	2022[18]
1. Petroleum activities	**32.5**	**31**	**26.5**	**30.3**	**37.7**
1.1 Crude petroleum	27.9	26.3	21.4	25.8	32.9
1.2 Natural gas	4.6	4.7	5.1	4.5	4.8
2. Non-petroleum activities	**70.7**	**73.1**	**78.2**	**72.9**	**65.6**
2.1 Agriculture, forestry & fishing	1.8	2	2.5	2.1	1.8
2.2 Industry	21.4	20.4	20.7	20.3	19.3
2.3 Services activities	47.5	50.7	55	50.5	44.5

Petroleum activities, consisting of crude petroleum and natural gas, have been declining as a share in the economy, with a noticeable drop between 2018 and 2020. This downward trajectory can be largely attributed to global oil price volatility and the decreased demand for oil during the COVID-19 pandemic. However, the sector showed signs of recovery in 2021 and 2022, suggesting a potential rebound in the global oil market.

On the other hand, non-petroleum activities have demonstrated a growing prominence in Oman's economy, with their share reaching a peak of 78.2 per cent in 2020. This shift towards non-oil sectors is an encouraging indication of the Sultanate's efforts to diversify its economy and decrease its dependence on the unpredictable oil market. Services activities, in particular, have surfaced as a notable contributor to the non-oil sector, accounting for more than 50 per cent of the economy in 2020.

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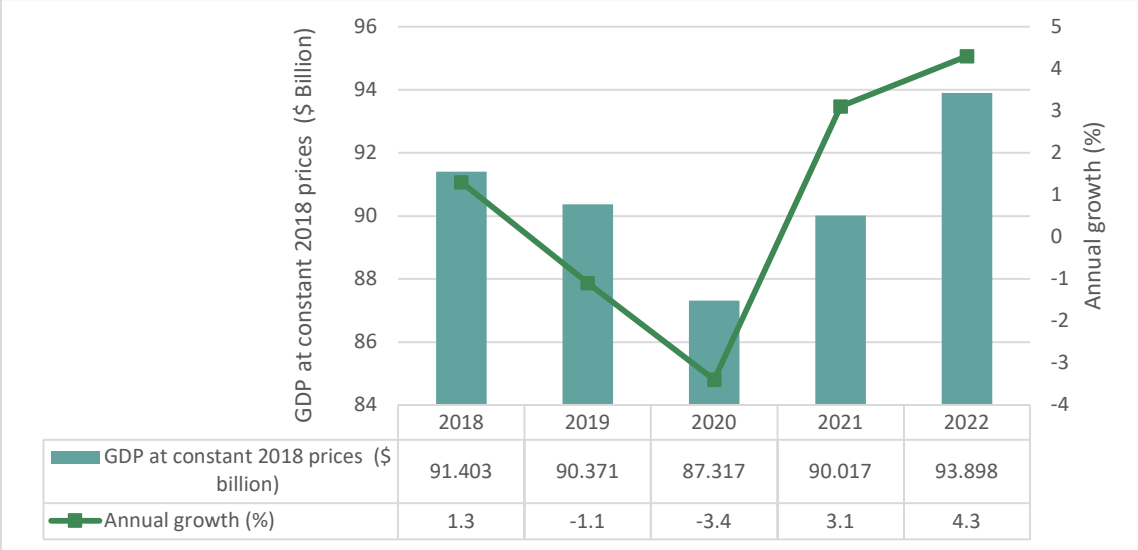
[16] Shares may not add up to 100 because two items are not considered here, i.e. net import taxes and financial intermediation services indirectly measured.

[17] Central Bank of Oman, *Annual Report 2022*. (https://cbo.gov.om/sites/assets/Documents/English/Publications/AnnualReports/Annual%20Report%202022%20ENG.pdf).

[18] Provisional.

It is noteworthy that Oman has fully recovered from the COVID-19 pandemic, which is a testament to the government's effective strategies and the economy's resilience. The recovery is apparent in the resurgence of petroleum activities and the stabilization of non-petroleum activities in 2021 and 2022. However, it is essential to acknowledge that non-petroleum activities experienced a decline in 2021 and 2022, while petroleum activities witnessed a resurgence. This development indicates that Oman's economy is still significantly influenced by the performance of the oil sector, despite the government's diversification efforts. The information in Figure 3 delineates Oman's economic performance from 2018 to 2022, emphasizing GDP at constant 2018 prices and yearly growth rates. The Omani economy slightly contracted in 2019 by 1.1 per cent and more significantly in 2020 by 3.4 per cent due to the pandemic. However, the nation showed resilience, bouncing back with growth rates of 3.1 per cent in 2021 and 4.3 per cent in 2022, exceeding pre-pandemic GDP levels **(Figure 7)**.[19]

Figure 7: Oman's GDP and annual growth rates from 2018 to 2022, adjusted to 2018 prices



	2018	2019	2020	2021	2022
GDP at constant 2018 prices ($ billion)	91.403	90.371	87.317	90.017	93.898
Annual growth (%)	1.3	-1.1	-3.4	3.1	4.3

To further strengthen economic resilience and foster sustainable growth, Oman is continuing to develop non-oil sectors such as agriculture, forestry, fishing, industry and services through a raft of measures, including targeted investments, policy reforms, and initiatives that encourage innovation, attract foreign direct investment and create a conducive environment for private-sector growth. Furthermore, the government is prioritizing human capital development, ensuring that the workforce is equipped with the necessary skills to support the growth of non-oil sectors through education and training programmes that align with the demands of the evolving economic landscape.

Oman is actively pursuing economic diversification as outlined in its ambitious Oman Vision 2040 plan, while simultaneously working towards decarbonizing its economy in line with the 2050 carbon neutrality pathway. By focusing on innovation, technology adoption and human capital development, Oman aims to create a vibrant, diversified,

[19] Central Bank of Oman, *Annual Report 2022*.

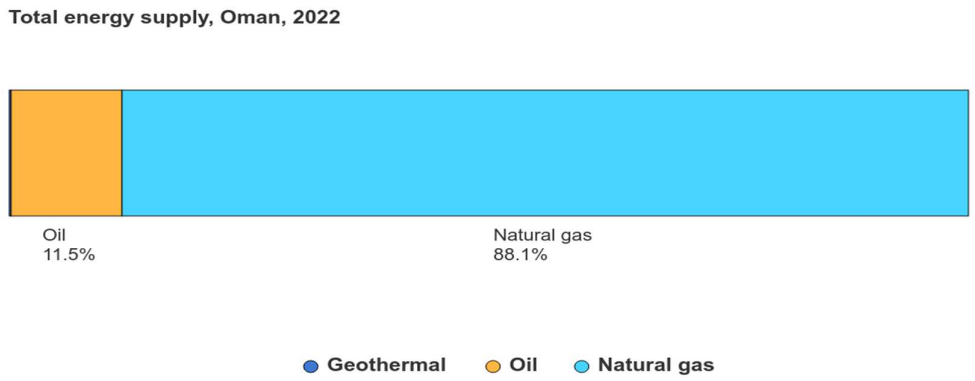
and competitive economy, reducing its reliance on hydrocarbons. In parallel, the country is committed to decarbonizing its economy by embracing clean energy technologies, energy efficiency measures and sustainable practices across all sectors. The successful implementation of these transformative strategies will be crucial in shaping Oman's future, positioning it as a leader in the transition to a low-carbon economy while ensuring long-term prosperity and social well-being for its citizens.

1.4.3. Energy

Energy supply

In 2022, the majority of Oman's energy was derived from domestically sourced natural gas, accounting for 88.1 per cent of its supply, alongside oil products at 11.5 per cent, and a minimal contribution from renewable sources like wind and solar energy at 0.4 per cent **(Figure 8)**.[20] By the end of 2024, generation will be proved by renewable energy sources at 4 per cent.[21] As a significant exporter of oil and gas, Oman is also taking steps towards sustainable energy usage. The government has initiated the "Residential PV Initiative" to encourage private adoption of solar PV systems, complemented by the 500-MW Ibri II Solar project and the Dhofar 50-MW Wind Power Project to boost renewable energy production.

Figure 8: Oman's total energy supply in 2022

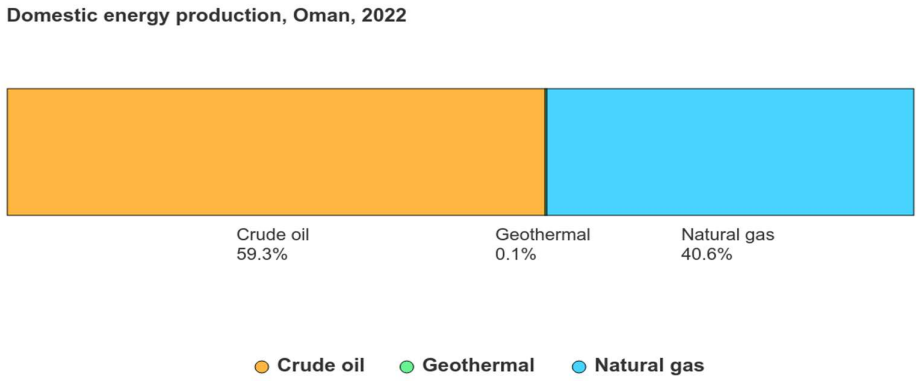


Domestic energy production, exports and transformation

In 2022, Oman's energy production was primarily comprised of crude oil, which accounted for 59.3 per cent of the nation's domestic energy output, while natural gas contributed 40.6 per cent **(Figure 9)**.[22] Net energy exports made up 66 per cent of its total energy production for the year. Between 2000 and 2022, energy exports jumped by 16 per cent, illustrating shifts in global energy dynamics.[23]

[20] International Energy Agency (IEA). Licence: CC BY 4.0.
[21] Nama PWP's 7-Year Statement (2023 – 2029). https://omanpwp.om/PDF/7%20Year%20Statement%20Issue%2017%202023%20-%202029.pdf.
[22] https://www.iea.org/countries/oman.
[23] Oman energy mix: https://www.iea.org/countries/oman/energy-mix.

Figure 9: Oman's total energy production in 2022



On the global stage, Oman ranked 26th in energy exports for 2022, with a total of 2,554,064 terajoules (TJ).[24] Regionally, within the Middle East, Oman held 7th position in terms of energy exports. Refining crude oil into oil products, such as fuels for vehicles, ships and aircraft, represents a critical transformation within the energy system. The refining capacity has been increased with OQ8. In 2022, the share of domestic refining in Oman's consumption was significant, at 207 per cent of the total final consumption of oil products. This highlights Oman's capacity not just to meet its domestic needs but also to supply international markets. In terms of total oil products refined, Oman produced 684, 803 TJ in 2022, placing it 7th in the Middle East and 39th globally. The sector has seen substantial growth, with a 304 per cent change from 2000 to 2022, underscoring Oman's expanding role in the global refining landscape.[25]

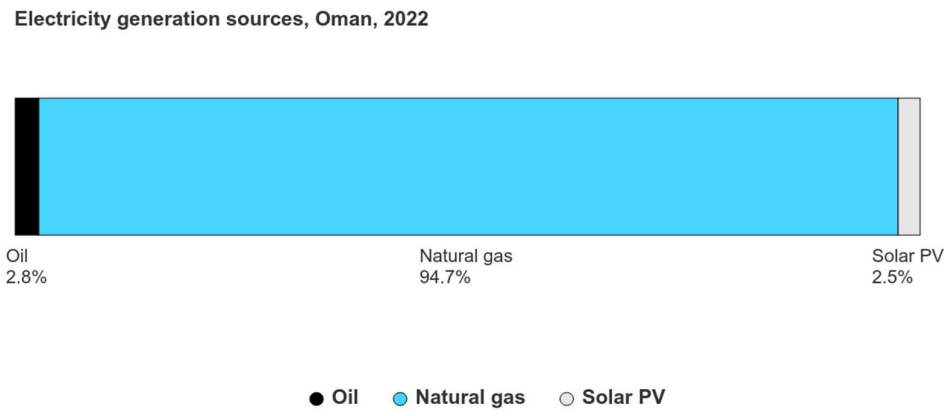
Electricity generation

In Oman's electricity generation mix for 2022, the country relied predominantly on natural gas, which accounted for 94.7 per cent of its total electricity production. Oil contributed to 2.8 per cent of the electricity generation, while solar PV systems were responsible for a smaller, yet significant, share of 2.5 per cent **(Figure** 10: Oman's electricity generation mix in 2022

10).[26] This distribution highlights Oman's heavy reliance on natural gas for electricity production, with renewable energy sources like solar PV beginning to make a notable albeit modest contribution.

[24] Ibid.
[25] Ibid.
[26] IEA. Licence: CC BY 4.0.

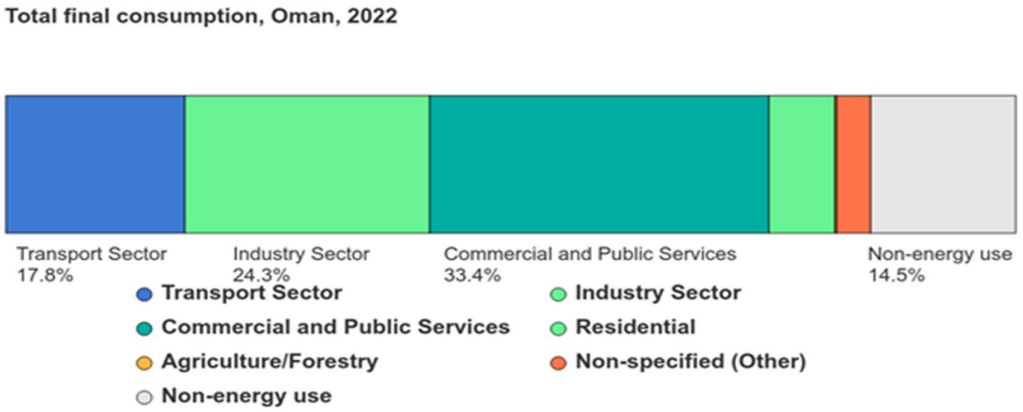
Figure 10: Oman's electricity generation mix in 2022



Energy consumption by sector

In 2021, the final energy consumption in Oman was dominated by the commercial and public services sector, which accounted for 33.4 per cent of total consumption, translating to 354,974 TJ. In second place was the industry sector, with a 24.3 per cent share equivalent to 258,056 TJ. Transport made up 17.8 per cent of consumption, amounting to 188,386 TJ. The residential sector was responsible for 6.4 per cent of consumption, at 68,375 TJ **(Figure 11)**.[27]

Figure 11: Oman's total final energy consumption in 2022



1.4.4. Oil & gas sector

The oil and gas sector is a cornerstone of Oman's economy and a significant driver of its economic development. Historically, the sector contributed about 54 per cent of GDP in 1972, and despite efforts at diversification, its importance has remained substantial over the decades. The contribution of oil activities to GDP averaged 68 per cent in 1970, declined to 48 per cent in 2000, and rose again to 53 per cent in 2014. By the third quarter

[27] IEA. Licence: CC BY 4.0.

of 2023, the sector's contribution stood at 33.64 per cent, reflecting the ongoing efforts to diversify the economy.

The oil and gas sector's influence extends beyond GDP contributions, as it plays a critical role in driving other economic sectors, generating employment opportunities and significantly bolstering government revenues. Oil revenues are strategically invested in infrastructure, education, health services and other essential projects. The private sector, particularly companies involved in oil and gas operations, is a vital partner in Oman's economic development. These companies contribute to local growth, national economic programmes, and the development of skilled national workforces.

1.4.5. Industry sector

The industrial sector in Oman is a cornerstone of the nation's economic development and diversification strategy, contributing significantly to GDP and employment. According to the NCSI, the manufacturing sector alone contributed over 10 per cent of GDP in recent years, with a growth rate of 7.2 per cent in 2021. Key industries include cement, aluminum, iron and steel, methanol, urea and ammonia production, supported by Oman's strategic location and robust infrastructure:

- **Cement industry**: Oman produces approximately 6.5 million tons of cement annually, addressing domestic construction needs and exporting to regional markets. The industry is also focusing on reducing its carbon footprint through alternative fuels and clinker substitution.
- **Aluminum industry:** Sohar Aluminium, a key player, has an annual production capacity of around 390,000 tons of aluminum. This sector supports downstream industries such as aluminum extrusion and fabrication, significantly contributing to export revenues.
- **Iron and steel:** Oman's iron and steel industry, anchored by Jindal Shadeed and other producers, has a capacity exceeding 2 million tons per year. It caters to domestic demand and exports to markets in the Middle East and beyond.
- **Chemical manufacturing:** Oman's methanol production capacity is approximately 3 million tons per year, while ammonia and urea production are bolstered by facilities like the Oman India Fertilizer Company (OMIFCO), producing 1.65 million tons of urea annually for export markets.
- **Industrial hubs:** Key industrial zones, such as Sohar Port and Freezone, Salalah Free Zone and the Duqm Special Economic Zone, provide integrated facilities for industrial growth. These zones collectively attract billions in foreign direct investment, including $15 billion in Sohar Freezone projects alone.
- **Environmental and technological advancements:** Oman is integrating sustainability into its industrial operations. Initiatives include transitioning to cleaner energy sources, implementing energy efficiency programmes, and adopting advanced technologies to lower GHG emissions.

1.4.6. Agriculture and fisheries

The agriculture sector in Oman plays a critical role in the nation's sustainable development efforts, contributing significantly to food security, biodiversity conservation and climate change mitigation:

- **Agriculture development:** Oman focuses on enhancing crop productivity through modern irrigation techniques, soil conservation measures and pest management programmes. Date farming remains a central part of agricultural output, accounting for over 80 per cent of total fruit production, with an estimated annual yield exceeding 370,000 tons.
- **Livestock management:** The country has implemented initiatives to boost livestock health and production. Livestock contributes significantly to rural livelihoods, and Oman supports this through veterinary services and the distribution of quality animal feed. In 2023, approximately 3 million heads of livestock were recorded, with sheep and goats being predominant.
- **Forestry and land use:** Efforts to combat desertification and promote afforestation have been intensified. Programmes under the Ministry of Agriculture, Fisheries and Water Resources (MAFWR) target the restoration of degraded lands and the establishment of green belts, which are vital for carbon sequestration.
- **Fisheries as a complementary sector:** The fisheries sector, part of the broader resource management strategy, recorded fish landings of over 580,000 tons in 2023, reflecting the nation's commitment to sustainable marine resource management.

1.4.7. Waste

The waste sector in Oman plays a pivotal role in the country's environmental management and climate action strategies, covering municipal solid waste, industrial waste, hazardous waste and wastewater management. Oman Environmental Services Holding Company (be'ah), the government entity responsible for regulating and overseeing waste management, is at the forefront of driving sustainable practices and infrastructure development.

A notable achievement in the sector is the planned development of a waste-to-energy plant, a transformative project aimed at reducing carbon emissions from landfills by 50 million tons. Once operational, the plant will process 4,500 tons of municipal solid waste daily, generating 130-150 MWh of electricity. This initiative is projected to divert 80 per cent of municipal solid waste from landfills, aligning with waste reduction and clean energy goals.

The waste-to-energy project offers significant environmental benefits, with the environmental impact assessment indicating significantly lower GHG emissions compared to traditional landfill practices. Economically, the project involves a capital expenditure of $700–$900 million and is designed for a 35-year operational lifespan, presenting long-term opportunities for green investment.

Additionally, the project supports circular economy integration, where byproducts such as bottom ash will be repurposed for construction and landfill cover, while fly ash will undergo safe processing at be'ah's Industrial Waste Treatment Facility.

1.5. Legal mechanisms and stakeholder engagement

1.5.1. National strategic mechanisms

Oman has established a comprehensive framework of national strategic mechanisms to monitor GHG emissions and promote carbon reduction, aligning with its NDCs goals. The process involves gathering and scrutinizing transparent and verified climate action data, which is crucial for informed decision-making. Understanding historical and projected trends in GHG emissions not only aids in strategy formulation but also builds trust and broadens stakeholder engagement through evidence-based approaches. For effective communication and provision of reliable, comprehensive, and transparent GHG emissions data, Oman has undergone an extensive development process in its institutional, legal, strategic, and financial mechanisms concerning climate change. This ensures consistent quality and continual enhancement of the reporting process as part of the international environmental agreements.

Oman's historical journey in environmental governance began with the establishment of the Office of the Environmental Protection Adviser in 1974. This was followed by the creation of a public agency for environmental protection and pollution control under Royal Decree No. 14/79, and subsequently, the establishment of the Environmental Protection and Pollution Control Council in 1979 by Royal Decree No. 68/79. The Ministry of Environment came into existence in 1984 under Royal Decree No. 45/84, leading to a series of decrees culminating in the announcement of the Ministry of Environment and Climate Affairs as an autonomous entity in 2007 by Royal Decree No. 90/2007. Further enhancing this framework, 2008 saw the issuance of Royal Decree No. 18/2008, which delineated the mandate of the Ministry of Environment and Climate Affairs and approved its organizational structure, including the establishment of a new Directorate General of Climate Affairs. The Environment Authority (EA) was established in August 2020 as per Royal Decree No. 106/2020, taking over climate-related responsibilities from the Civil Aviation Authority according to Royal Decree No. 2022/60. The responsibilities of the Environment Authority in addressing climate change encompass:

- monitoring and assessing climate change to ensure the protection of environmental, social and economic systems;
- supporting the advancement of scientific research in climate-related fields, facilitating the exchange of knowledge, and accumulating and utilizing scientific data;
- educating and fostering an understanding among all societal segments about adapting to severe climate conditions;
- drafting proposed laws and royal decrees concerning climate affairs, and issuing regulations and directives under these laws and decrees;

- strengthening and expanding cooperation in climate-related areas with relevant entities, other countries, and regional and international organizations and institutions; and
- executing the mandates of international climate agreements to which the Sultanate is a signatory.

In April 2019, the National Strategy for Adaptation and Mitigation to Climate Change 2020-2040 was unveiled, further solidifying Oman's stance on environmental responsibility.[28] This strategy outlines proactive measures for climate change adaptation and mitigation, showcasing Oman's proactive commitment to global climate agreements.

Simultaneously, Oman Vision 2040, launched in 2019, offers an extensive blueprint for economic diversification, building upon the former Vision 2020. This vision underscores the need to develop an economic framework that significantly reduces hydrocarbon dependence, ensuring Oman's sustainable development for the next two decades.[29]

In November 2022, Oman pledged to achieve carbon neutrality by 2050, charting a novel trajectory for the nation's energy policy and economic progression.[30] The Sultanate of Oman's National Strategy for an Orderly Transition to Net Zero delineates a course for catalyzing investment in alternative energy sources, including renewables and hydrogen. It encompasses initiatives for decarbonizing conventional hydrocarbon resources through technologies like carbon capture and storage (CCS) and negative emission techniques. The implementation of this progressive energy policy signifies Oman's gradual transition from a hydrocarbon-reliant, rentier economy to one that is diversified with reduced government control, expenditure, and public-sector ownership. In 2025, through the Oman Net Zero Centre (ONZC), the country started a net zero strategy refresh study including updated sectoral decarbonization pathways that will feed into the upcoming NDC and BTR.

1.5.2. Financial mechanisms

Oman's Sustainable Finance Framework: A pathway to Vision 2040

Oman is transitioning to renewable energy to reduce fossil fuel dependence and support economic growth in a low-carbon future through the following pathways:

- Vision 2040: A Strategic Roadmap for the Future: Oman's Vision 2040 serves as the nation's guiding framework for socioeconomic transformation. It aims to tackle climate change challenges and ensure equitable development for all. One of its main objectives is to achieve the SDGs, fostering inclusive economic growth while addressing environmental concerns.

[28] National Strategy for Adaptation and Mitigation to Climate Change 2020-2040 (https://www.ea.gov.om).
[29] https://www.oman2040.om/Oman2040Report?lang=en.
[30] https://www.ea.gov.om/media/xdvpdu1w/oman-net-zero-report-2022_screen.pdf.

- Sustainable Finance Framework:[31]A Financial Strategy for Vision 2040: To bring Vision 2040's objectives to life, a well-structured and dependable financing mechanism was essential. The Sustainable Finance Framework was introduced to channel funds into projects that address climate change, foster socioeconomic growth and support the transition to a low-carbon economy.
- The Ministry of Finance (MoF) of Oman established the Framework to facilitate the issuance of green, social, and sustainability bonds, loans, or sukuk (collectively referred to as Sustainable Financial Instruments). These instruments comply with internationally recognized standards, including:
    - International Capital Market Association Green Bond Principles (2021, updated June 2022) – Guidelines for project evaluation, transparency and fund allocation.
    - International Capital Market Association Social Bond Principles (2023) – Ensuring that socially beneficial projects align with global best practices.
    - International Capital Market Association Sustainability Bond Guidelines (2021) – Merging environmental and social finance considerations.
    - Loan Market Association Green Loan Principles (2023) – Defining standards for green loan financing.
    - Loan Market Association Social Loan Principles – Ensuring transparency and accountability in social finance.

- The key components of the Sustainable Finance Framework are as follows:

    - **Use of proceeds:** Funds raised through Sustainable Financial Instruments will be used for new projects or refinancing existing eligible green and social expenditures. Key conditions include:
        - Expenditures should be no older than three years before issuance or no later than two years after.
        - Only state agencies, local authorities and government entities are eligible for funding.
        - Co-financed projects must include only the MoF's proportional share of financing.

      Certain sectors, such as fossil fuel-related projects, nuclear power generation and infrastructure dedicated to fossil fuel transportation, are explicitly excluded.

    - **Project evaluation and selection:** A Sustainable Finance Working Group (SFWG), along with the MoF and other relevant ministries, will evaluate and select projects under the Framework. Once a project is approved, the SFWG ensures ongoing compliance with Eligible Expenditure criteria throughout the financing period.

[31] Oman Sustainable Finance Framework. (https://www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=https://www.mof.gov.om/download.aspx%3Fid%3DL1VwbG9hZHNBbGwvUHJvamVjdHNTZWN0aW9uc1RhYnMvMTcyNDMyNDA5NDA3MzE3MDQ4ODExNzU5NTdTdXN0YWluYWJsZSBGaW5hbmNlIEZyYW1ld29ya2NvbXByZXNzZWQucGRm&ved=2ahUKEwif7Iewm_yKAxXMVKQEHWgPLHoQFnoECAsQAQ&usg=AOvVaw132V6jrra3EUOlk5hlumEs).

- **Management of proceeds:** The Framework has strict rules governing the management of funds. Key points include:

- **Reporting obligations:** The Ministry of Finance will publish an Annual Sustainable Financial Instrument Report as long as any Sustainable Financial Instruments remain outstanding. This report, which may be integrated with broader ESG reporting, will include:

    - Unallocated funds remain with the MoF until designated for eligible expenditures.
    - Unused net proceeds may be invested in approved avenues under the Framework.
    - ESG compliance: If an expenditure no longer qualifies or is subject to ESG controversies, it must be replaced with a compliant expenditure within a year.
    - Internal tracking: The SFWG maintains a register for fund monitoring and reporting.
    - Summary of outstanding instruments, including transaction details, will be provided.
    - Allocation reporting will detail expenditures, investment tracking, and unallocated funds.
    - Impact reporting will demonstrate environmental and social benefits generated from financed projects.

National Fund for Emergencies

As the intensity and frequency of tropical cyclones along Oman's coast increase due to climate change, the government took the proactive decision to establish a National Fund for Emergencies, which came into operation on 1 January 2024. This initiative aims to address urgent situations and natural disasters—ranging from climatic events and floods to earthquakes and other hazards—that cause damage to public facilities and infrastructure. It underscores the critical importance of a swift and effective response to emergencies that significantly impact the nation. The fund is designed to support the implementation of public policy related to emergency management procedures, enhancing Oman's readiness and resilience against natural disasters. It also provides necessary funding as required to facilitate a swift recovery and return to normalcy following emergencies.

The resources of the fund include: allocations from the state budget, ensuring a steady flow of financial support; gifts, donations and contributions accepted by the Minister of Finance, which broaden the fund’s financial base; and returns on the investment of the fund's resources further increase its capacity. Other approved resources by the Cabinet allow flexibility to adapt to emerging needs.

The Minister of Finance is empowered to make necessary decisions to effectively manage and regulate the fund. This includes managing the fund's assets and adopting investment strategies that align with established financial policies, establishing committees to achieve the fund’s objectives, setting project tendering rules, and

endorsing financial reports to maintain transparency and accountability. Additionally, the Minister is responsible for coordinating with relevant entities to prepare post-emergency reports for research purposes and to develop strategies to mitigate future risks. The role also includes regulating the reception and allocation of cash donations during and after emergencies to ensure proper management of resources.

The fund maintains a separate annual budget with surpluses rolling over each year, ensuring a sustained flow of funding. Its assets are considered public funds and are thus subject to the rigorous standards of the penal code and financial and administrative control laws. Importantly, decisions and contracts made by the Minister of Finance in direct and immediate response to emergencies are granted exemptions from general and specific legal stipulations, enabling rapid action. By establishing the National Fund for Emergencies, Oman strengthens its capacity to manage and respond to the increasing challenges posed by climate change, ensuring the safety and stability of its infrastructure and communities.

1.5.3. Stakeholder engagement

Stakeholder engagement has been vital for the advancement of Oman's Vision 2040, its Net Zero 2050 strategy, and successful implementation of its NDC. Recognizing the importance of broad stakeholder involvement, Oman has ensured comprehensive development and execution of its climate and sustainability goals. Key stakeholders involved include:

- **Government departments:** All government departments and public-sector companies have coordinated efforts for Oman Vision 2040 and Net Zero 2050, promoting interagency cooperation and the integration of climate and sustainability considerations.
- **Ministries:** Various ministries, including the Environment Authority, the Ministry of Energy and Minerals, the Ministry of Commerce, Industry and Investment Promotion, the Ministry of Agriculture and Fisheries Wealth, the Ministry of Economy, the Ministry of Finance, and the Ministry of Transport and Communications and Information Technology, play pivotal roles in achieving sector-specific climate and sustainability targets.
- **Banks and private sector:** Public financial institutions like the Ministry of Finance, Oman Investment Authority and the Central Bank, along with private-sector entities, are essential for financing and implementing climate projects.
- **Academic institutes:** Institutions such as Sultan Qaboos University contribute significantly to research and innovation in climate science, ensuring strategies are well-informed.
- **NGOs:** NGOs, environmental organizations, and civil society groups provide valuable perspectives, raise awareness, mobilize communities, and contribute to the success of climate-related projects.

2. NATIONAL INVENTORY REPORT OF ANTHROPOGENIC EMISSIONS BY SOURCE AND SINK OF GHGs

2.1. National circumstances, institutional arrangements and cross-sectoral information

2.1.1. Background

The Sultanate of Oman is highly vulnerable to climate change impacts, including rising temperatures, extreme weather events, droughts and coastal erosion risks directly threatening communities and economic assets. However, the country has made significant progress on multiple climate adaptation and resilience priorities that also deliver a series of essential co-benefits. In pursuing a target to achieve carbon neutrality by 2050, Oman is demonstrating its clear commitment to advance these priorities despite climate change constraints.[32]

Oman published its first national greenhouse gas inventory in 2013 as part of reporting requirements within the Initial National Communication submitted to UNFCCC, containing emissions estimates for the year 1994 across key sectors.[33] This was followed by the second inventory in the framework of the Second Communication of Oman to UNFCCC submitted in 2019, containing estimates for the reference year 2000.[34] Additionally, the inventory for 2015 was published under the First Biennial Update Report to the Convention in 2019.[35]

The Sultanate has steadily improved its inventory processes over the years, focusing on enhancing data accuracy and adopting higher-tier methodologies. The use of the 2006 IPCC Guidelines for National GHG Inventories, combined with the application of Tier 2 and Tier 3 methods where appropriate, has allowed Oman to produce more accurate and sector-specific emissions estimates. These improvements reflect Oman's commitment to continuously strengthening the transparency and reliability of its GHG reporting under the ETF of the Paris Agreement.

Oman's recent efforts to enhance its GHG inventory culminated in the development of a comprehensive plan to conduct annual assessments of GHG emissions. Starting with the year 2020, Oman now produces a continuous time series of inventories, covering the years 2020 to 2022. These assessments are conducted with a one-year time lag, allowing for thorough data collection, processing and quality assurance. This approach

[32] https://www.ea.gov.om/media/aaslyc3l/oman-net-zero-report-2022_screen.pdf.
[33] https://unfccc.int/sites/default/files/resource/Sultanate_of_Oman-INC-UNFCCC-9-10-2013.pdf.
[34] https://unfccc.int/sites/default/files/resource/Oman%202nd%20National%20Communication%20%2817%20November%202019%29%20-%20Final.pdf.
[35] https://unfccc.int/documents/204848.

represents a significant advancement from earlier inventories, as it allows for real-time tracking of emissions trends and more responsive policy adjustments.

For the development of the 2020–2022 GHG inventory, Oman utilized the most recent IPCC Inventory Software, version 2.861, which was released in June 2023. This software integrates the 2006 IPCC Guidelines and their 2019 Refinement, allowing Oman to incorporate the latest methodological advancements in its GHG accounting.

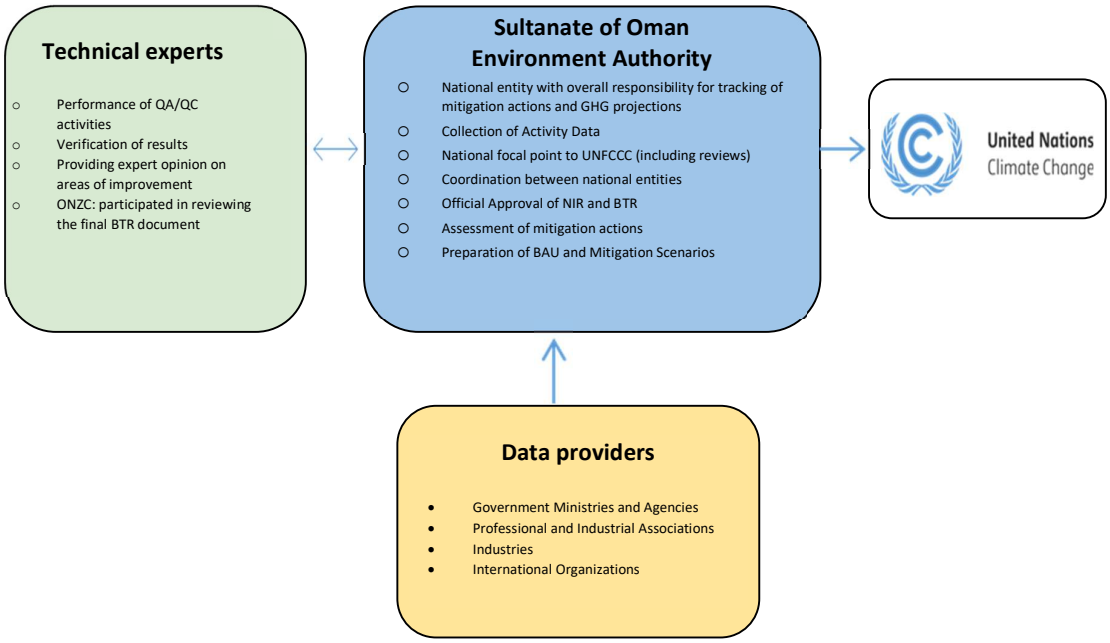
2.1.2. National circumstances and institutional arrangements

Oman has developed a robust and transparent process for preparing its GHG inventory reported in the supporting National Inventory Report (NIR) and through this BTR, adhering to IPCC Guidelines and the reporting requirements under the Paris Agreement. The Environment Authority, represented by Maha Al-Balushi as the national focal point, coordinates and oversees the entire process, ensuring all relevant data, methodologies and supporting documentation are accurately archived for the reported time series. This systematic approach includes clear institutional arrangements, standardized data collection, and rigorous quality control measures to produce high-quality, standards-compliant inventories **(Figure 12)**.

The GHG inventory process was a collaborative effort coordinated by the Environment Authority, involving multiple stakeholders. Key contributors include government ministries such as the Ministry of Energy and Minerals and the Ministry of Transport and Communications, along with industry representatives from sectors like cement production, oil refining and waste management, who provided critical activity and emissions data. To ensure consistent and comprehensive data collection across sectors, structured reporting templates aligned with the 2006 IPCC Guidelines were shared with data providers. This collaborative approach facilitated clear role definitions, effective communication and high-quality data for accurate emissions estimation.

For energy emissions, a top-down approach was adopted due to the availability of aggregated country-level fuel consumption data. Expanding access to detailed activity data across all sub-sectors and fuel types remains a priority for enabling a bottom-up emissions estimation approach in the future. Until late 2024, there was no formalized process for archiving the reported time series data. This is a gap that is addressed through–the implementation of the national inventory platform established by ONZC, which will cover all sectors in the country once all targeted stakeholders partake in a bottom-up inventory approach using the platform on an annual basis.

Figure 12: Oman's institutional arrangement for Oman's first BTR and NIR development



A significant improvement in data collection was the introduction of a robust system for tracking hydrofluorocarbon (HFC) use, which was implemented by the Environment Authority in 2016. This system has reduced uncertainties in HFC emissions assessments observed in earlier inventories, such as the 2015 inventory prepared for Oman's First Biennial Update Report (BUR), thereby enhancing the reliability and completeness of emissions data.

The inventory employs IPCC-approved methodologies, using 100-year time-horizon global warming potential (GWP) values from the IPCC Fifth Assessment Report to calculate emissions and removals in CO_2-equivalent terms. Where applicable, sector-specific emission factors were developed in consultation with international experts, including the United Nations Industrial Development Organization (UNIDO), to ensure alignment with global best practices.

The data validation and approval process are integral to maintaining the inventory's integrity. A workshop conducted from 8 September to 13 September 2024, brought together representatives from all contributing departments to review their respective data and monitoring procedures. This interactive forum allowed for clarification of methodologies and alignment of practices, ensuring consistency and transparency.

UNIDO experts participated in the validation process, providing independent oversight to ensure the data met international standards. Following this review, the Environment Authority conducted the final approval of the inventory, ensuring adherence to quality assurance and quality control measures before submission to UNFCCC, whereas all necessary information including emissions data from the energy, industrial process and product use (IPPU), agriculture, forestry and other land use (AFOLU) and waste sectors, along with sectoral trends. Additionally, details on the methodologies and accounting

approaches, projections of GHG emissions and absorptions, and mitigation policies, measures, and plans. Indicators for tracking progress towards the NDC have also been provided, sourced from the National GHG Inventory.

As part of the evolving institutional framework, from 2025 onwards ONZC will provide strategic support and guidance to relevant authorities and institutions in achieving carbon neutrality goals. Its primary focus is on reducing carbon emissions and enhancing energy efficiency. ONZC is responsible for developing and updating the national energy efficiency plan, monitoring its implementation across various sectors, assessing energy consumption levels in approved projects, and proposing necessary improvements in coordination with relevant entities. Additionally, ONZC oversees the processes for tracking and updating carbon emissions from different sources, maintaining a dedicated platform for storing emissions data, and facilitating access to this information for Environment Authority personnel and other stakeholders based on their areas of expertise.

2.1.3. General description of scope and methodology

The Sultanate of Oman has developed a GHG inventory for the years 2020 and 2021 as part of its national plan for timely reporting of emissions using best available granular data, latest scientific knowledge, appropriate tier approaches and following an eight-step process aligned with 2006 IPCC Guidelines. The inventory covers anthropogenic emissions and removals of CO_2, methane (CH_4), nitrous oxide (N_2O), HFCs, perfluorinated compounds (PFCs) and sulfur hexafluoride (SF_6). nitrogen trifluoride (NF_3) emissions do not occur in Oman.

The inventory was developed using data collected from relevant government ministries and entities as the primary data source, along with additional data from the 2023 statistical yearbook. This publication, published annually by the NCSI, encompasses 21 crucial sectors integral to Oman's economy and development planning, including: geography, climate, population, housing, employment, agriculture, fisheries, energy, mining, electricity, water, enterprises, foreign trade, transport, communications, national accounts, public finance, financial institutions, price indexes, health, education, social services and tourism.

The inventory was developed using a systematic eight-step process to ensure transparency and compliance with international standards. This included reviewing IPCC Guidelines, coordinating with data providers, collecting and analyzing data, applying IPCC emission factors, calculating emissions and removals, validating methods and data, preparing the NIR and finalizing the inventory. The tiered methodology prioritized higher-tier methods (Tier 2 and 3) when detailed data was available. For instance, Tier 2 methodologies were used for cement production based on company-level data, while Tier 1 methods relying on default IPCC factors were applied for sectors with limited data, such as chemical and petrochemical production. In the energy sector, aggregated fuel consumption data were combined with direct, source-specific information to improve accuracy. The 2006 IPCC Guidelines were the primary reference for calculations, supplemented by the 2019 Refinement, which provided updated methodologies, default factors and clarifications to enhance inventory robustness,

particularly for new emission sources. Additionally, methodological guidance from the 2013 IPCC Wetlands Supplement was utilized for emissions calculations from mangrove areas. The supplement provides expanded guidance on wetlands including mangrove ecosystems beyond 2006 IPCC Guidelines.

Oman's GHG inventory upholds the quality principles set forth in the IPCC Guidelines—transparency, completeness, consistency, comparability, and accuracy. By adhering to international standards, Oman underscores its dedication to enhancing inventory methodologies, fulfilling climate reporting commitments and advancing mitigation efforts. The nation remains focused on continuous improvement by broadening data availability, adopting higher-tier methods and refining data collection processes. Key future goals include minimizing uncertainties and increasing the precision and detail of estimates. Collaboration with data providers and expert reviews ensures the reliability and credibility of the inventory.

2.2. Trends in emissions and absorptions

The current inventory provides a consistent time series from 2020 to 2022 employing 2006 IPCC Guidelines and their 2019 Refinement. The previously reported years 1995, 2000 and 2015 were not assessed and/or recalculated to ensure their consistency with the reported years 2020-2022. However, in the description of the trends, a qualitative evaluation of emissions relative to the years reported in previous inventories will be reported.

Due to capacity and time constraints encountered during the preparation of its first BTR, Oman did not prepare a consistent time series starting from 1990. However, the country intends to develop and report a consistent time series from 2019 onwards in the next BTR submissions, in addition to the ongoing development of the monitoring, reporting and verification (MRV) framework. This improvement in the time-series consistency is aimed at the second or third BTR. Consequently, and in line with Article 13, paragraph 2, of the Paris Agreement, Oman is leveraging the flexibility provision outlined in paragraph 57 of the modalities, procedures, and guidelines (MPGs), as annexed to Decision 18/CMA.1, to report a consistent annual time series from at least 2020 onwards, which includes the reference period for the NDC.

It is important to note that ONZC will revisit all methodologies used in calculating emissions reported in this BTR to ensure that the Sultanate is using the most suitable methodologies for its sectors. This review may result in drastic changes in emissions, however these changes will be clearly explained and highlighted in future in communications.

The GHG emissions per sector and the national total are presented in **Table 4**. **Table 5** presents a detailed breakdown of Oman’s emissions by sector and GHG type for the year 2022, highlighting the contributions of various sectors to total GHG emissions. The detailed breakdown of emission sources and sinks is further demonstrated in the accompanying NIR, which provides comprehensive documentation of data sources, methodologies and recalculations applied in the GHG inventory process. It is important to note that the BTR and the NIR are usually evaluated together to ensure consistency,

transparency and alignment with international reporting requirements under the UNFCCC.

Table 4: Oman's GHG emissions/removals for the years 1994, 2000, 2015, 2020, 2021 and 2022

GHG source/sink ($MtCO_2e$ Gg)	1994	2000	2015	2020	2021	2022
Energy	13,058	17,196	61,488	46,381	52,329	55,236
IPPU	0.594	2,865	29,181	28,006	28,039	29,518
Agriculture	6,571	0.799	1,466	0.279	0.333	0.363
LULUCF	NE	NE	NE	-0.574	-0.670	-0.794
Waste	0.497	0.806	3,938	9,459	10,033	10,589
Net emissions (incl. LULUCF)	20,720	21,666	96,072	84,248	90,064	94,912
Total emissions (not incl. LULUCF)	**20,720**	**21,666**	**96,072**	**84,839**	**90,734**	**95,706**

Table 5: Oman emissions by sector and GHG type, 2022

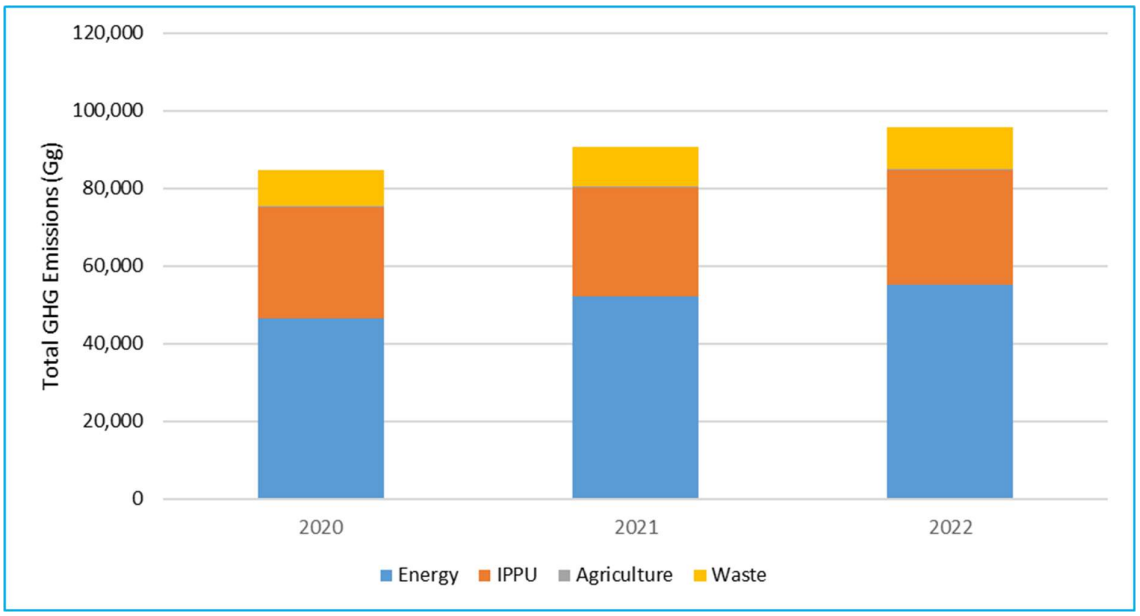
GHG source/sink	Million tons				Million tons CO_2e		
	CO_2e	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6
Energy	55.236	51.541	0.130	0.000	NA	NA	NA
IPPU	29.518	15.909	0	0.022	0.177	4.190	3.455
Agriculture	0.363	0.017	12	0.000	NA	NA	NA
LULUCF	-0.794	-0.794	0	0.000	NA	NA	NA
Waste	10.589	0.000	372	0.001	NA	NA	NA
Net emissions	94.912	66.674	514	0.023	0.177	4.190	3.455
Total emissions	**95.706**	**67.467**	**514**	**0.023**	**0.177**	**4.190**	**3.455**

From 1994 to 2015, total GHG emissions increased by over four and a half times, from 20.720 million tons of CO_2 equivalent ($MtCO_2eq$) in 1994 to approximately 96.072 $MtCO_2eq$ in 2015, representing an average annual growth rate of about 8 per cent. During the same period, CH_4 emissions grew at a slightly higher rate of approximately 9 per cent per year. Notably, HFC emissions, which were non-reported in 1994 and 2000, accounted for 13.4 per cent of all CO_2eq emissions by 2015.

The energy sector has been the primary driver of this overall increase in GHG emissions. From 1994 to 2015, CO_2 equivalent emissions from energy usage more than quadrupled, increasing at an average rate of 8 per cent per year. This rise is largely attributed to heightened demands for electricity generation, desalinated water production, and process heat in manufacturing sectors. Additionally, CO_2eq emissions from IPPU, although constituting less than 31 per cent of the total emissions in 2015, surged by nearly 50 times, growing at about 20 per cent per year.

The total national emissions of GHG in Oman have shown an increasing trend from 2020 to 2022. The emissions have risen from 84.839 $MtCO_2eq$ in 2020 to 90.734 $MtCO_2eq$ in 2021, and further to 95.706 $MtCO_2eq$ in 2022. This reflects an overall increase of 10.87 million tons, or 12.81 per cent over the three-year period **(Figure 13)**. These figures suggest a recovering trajectory as the country moves away from the economic contraction caused by the pandemic and previous years of austerity.

Figure 13: Overall trends and sectoral dynamics in GHG emissions, 2020-2022



2.3. Overview of source and sink category emission estimates and trends

- **Energy:** Emissions from the energy sector rose 19.1 per cent between 2020-2022, accounting for the largest share of GHG increases. As lockdown measures eased, expanded industrial activity and electricity demand likely contributed to more fossil fuel combustion. Government efforts to stimulate the economy and accelerate growth in transportation, manufacturing, and other sectors are also plausible factors driving the surge.
- **IPPU:** Emissions increased slightly by 2.8 per cent during 2020-2022, notably less than in the energy sector. As industrial operations gradually resumed under government plans to restore economic stability post-pandemic, emissions from major industries saw a moderate rise.
- **Agriculture:** The sector saw a small but steady increase in emissions of 22.6 per cent from 2020-2022. This rise is potentially fuelled by expanded dairy and livestock activities to boost domestic milk and meat production, in alignment with agricultural diversification and food security initiatives. Government policy to

accelerate growth in the agriculture sector, particularly in dairy production, which is more emissions intensive, is likely driving the higher agricultural GHGs.

- **LULUCF:** Improved net CO_2 removal of 34.35 per cent over 2020-2022 suggests targeted efforts to expand mangrove cover and accelerate afforestation programmes, aligning with wider reforestation goals.
- **Waste:** The waste sector posted emissions increases of 11.95 per cent from 2020-2022. Expanded industrial activity and urban growth resulting from government plans to revive economic growth have contributed rising volumes of waste, driving up methane emissions despite targets to improve recycling and landfill management.

2.4. Key category analysis and flexibility

A key category in a national inventory system is prioritized due to its substantial influence on the country's total greenhouse gas inventory. This influence may relate to the absolute levels, trends, or uncertainties associated with the emissions and removals estimated. Recognizing the importance of these categories, they should receive special attention in three critical aspects of inventory management:

- **Efficient use of resources:** The identification of key categories enables the limited resources available for preparing inventories to be prioritized towards improving the quality of those categories that have the greatest contribution to the inventory magnitude, trend and uncertainty.
- **Methodological selection:** Generally, inventory uncertainty is lower when emissions and removals are estimated using the most rigorous methods available, but this may not be feasible for all categories covered by the inventory. More detailed, higher-tier methods should therefore be selected for key categories.
- **Verification procedures:** It is good practice to give additional attention to key categories with respect to quality assurance and quality control.

The 2006 IPCC Approach 1 has been used to conduct the key category analysis for both the level and the trend, considering the base year of 2021 and the latest inventory year of 2022. Furthermore, key categories were identified both including and excluding emissions and removals from the LULUCF sector. Approach 1 methodology for the identification of key categories assesses the impacts of various source categories on the level and the trend of the national emissions inventory. Key categories are those which, when summed together in descending order of magnitude, add up to over 95 per cent or 85 per cent if the flexibility of paragraph 25 of the MPGs is applied to total emissions (level assessment) or the trend of the inventory in absolute terms (trend assessment).

With the intention to focus on improving the most significant categories and prioritizing resources, and due to capacity and time constraints encountered during the preparation of its first BTR, the Sultanate of Oman intends to identify key categories using the threshold of 85 per cent. Consequently, and in line with Article 13, paragraph 2, of the

Paris Agreement, Oman is leveraging the flexibility provision outlined in paragraph 25 of the MPGs, as annexed to Decision 18/CMA.1. The increase of the threshold to 95 per cent is foreseen for the third BTR and is dependent on the progress of applying higher-tier methods for the currently identified key categories.

The conducted assessment adhered as closely as possible to the aggregation level recommended for Approach 1 in the 2006 IPCC Guidelines. Fifteen key categories have been identified through this process. Of these, six fall within the energy sector, eight within IPPU, and one within the waste sector. Notably, no key categories were identified for the agriculture and LULUCF sectors, which reflects their minimal contributions to national GHG emissions.

Table 6: Summary of key categories identified by the key category analysis

R5	Name	Gas	With LULUCF			Without LULUCF		
			L2022	L2020	Trend	L2022	L2020	Trend
1.A.1	**Energy industries - gaseous fuels**	CO_2	√	√	√	√	√	√
1.A.2	**Manufacturing industries and construction - gaseous fuels**	CO_2	√	√	√	√	√	√
1.A.3.b	**Road transportation - liquid fuels**	CO_2	√	√	√	√	√	√
5.A	**Solid waste disposal**	CH_4	√	√		√	√	
2.A.2	**Lime production**	CO_2	√	√	√	√	√	√
2.A.1	**Cement production**	CO_2	√	√	√	√	√	√
2.C.3	**Aluminum production**	PFCs	√	√	√	√	√	√
2.B.8	**Petrochemical and carbon black production**	CO_2	√	√		√	√	
2.C.4	**Magnesium production**	SF_6	√	√	√	√	√	√
1.B.2.b	**Natural gas**	CO_2	√	√		√	√	
1.B.2.b	**Natural gas**	CH_4	√	√		√	√	
2.B.2	**Nitric acid production**	N_2O	√	√	√	√	√	√
2.B.3	**Adipic acid production**	N_2O			√			√
2.B.1	**Ammonia production**	CO_2			√			√
1.A.3.e	**Other transportation - gaseous fuels**	CO_2			√			√

Table 6 presents an overview of all the key categories identified under the level and trend assessments for the base year 2020 and the latest inventory year 2022, both including and excluding LULUCF.

2.5. Uncertainty assessment

Oman's GHG inventory for the reporting years 2020-2022, due to the application of Tier 1 methodologies and the reliance on aggregated data for certain sectors, is subject to inherent uncertainties. The utilization of IPCC default factors for multiple sectors and the absence of plant-specific data for some industries limit the potential for transitioning to higher tier methods, which necessitate installation-level emissions data. The impact of COVID-19 related economic disruptions during 2020 and 2021 further influences the robustness of the inventory for those specific years.

Recognizing these limitations, Oman estimates the overall uncertainty of its national inventory for 2020-2021 to be +/-10 per cent, based on expert judgment, acknowledging the limitations of the current approach. While a quantitative uncertainty analysis was not conducted for the first BTR due to capacity constraints, Oman intends to develop a comprehensive quantitative uncertainty analysis for the second BTR through ONZC, leveraging the flexibility provision outlined in paragraph 29 of the MPGs, as annexed to Decision 18/CMA.1, to provide a qualitative discussion of uncertainty for the national inventory, including key categories, in the first BTR. As higher-tier methodologies are progressively implemented, the reduction of uncertainty is a key objective, ultimately leading to more robust inventory assessments.

2.6. Improvements introduced

The Sultanate of Oman, recognizing the continuous need for improvement in its national GHG inventory, has identified several areas where further enhancements could be made in accordance with the ETF guidelines, as outlined in paragraph 7 of the MPGs. A summary table is provided in **Annex 1**.

Key areas for enhancement:

- **Time series consistency:** While the national inventory provided a consistent time series from 2020 onwards, the next BTR will cover at least the years 2019 onwards in the time series, with a possibility of including further years before 2019 should reliable data be available.
- **Data granularity:** Although progress has been made in data collection, obtaining more detailed activity data for specific processes and technologies across various sectors remains a priority. Transitioning towards a bottom-up approach for emissions estimation, using detailed activity data rather than aggregated data, is considered essential for improving accuracy and reliability. This shift is also expected to facilitate the adoption of higher-tier methods in the future, further enhancing the inventory's comprehensiveness. The establishment of ONZC is

expected to contribute significantly to data granularity in Oman through its mandate to develop a national MRV and implement comprehensive data collection mechanisms.

- **Methodology refinement:** As a developing country, Oman had the flexibility to choose suitable methods for calculating emissions. At the time, Oman utilized a Tier 1 top-down approach for its inventory, based on the data and resources available. However, future plans included improving methods and transitioning to higher-tier approaches, such as Tier 2 and Tier 3, as better data and tools became available. The IPCC Inventory Software v2.861 was expected to support this transition, particularly for key categories, with assistance from related industrial units.
- **Uncertainty assessment:** Oman required flexibility in addressing capacity constraints related to this provision. At the time of preparing this BTR, a qualitative approach was adopted to discuss uncertainties due to limited capacity, resource constraints, and time limitations. However, for the next BTR, Oman plans to conduct a quantitative uncertainty assessment. Some category-specific qualitative and limited quantitative uncertainty information has been provided in the detailed sections below.

3. INFORMATION NECESSARY TO TRACK PROGRESS MADE IN IMPLEMENTING AND ACHIEVING NDCs UNDER ARTICLE 4 OF THE PARIS AGREEMENT (PARAS. 59–103 OF THE MPGs)

3.1. National circumstances and institutional arrangements

3.1.1. National circumstances and context relevant to the NDC process

Oman's commitment to achieving carbon neutrality by 2050, as declared by His Majesty Sultan Haitham bin Tariq in November 2022, marks a significant shift toward sustainable development. The strategy is anchored in key national objectives, such as environmental sustainability, energy system cost optimization, economic growth, social equity and energy security. This ambitious target aligns with Oman's broader vision of a green, knowledge-based economy and demonstrates the country's dedication to addressing global climate challenges.

Progress has been made through the deployment of key decarbonization technologies, including large-scale renewable energy projects like the Ibri Solar Plant and Dhofar wind farms, energy efficiency programmes across multiple sectors and the electrification of transport. Additionally, Oman is investing in green hydrogen and piloting carbon capture and storage technologies, particularly in the oil and gas sector. These initiatives are vital for reducing the country's reliance on fossil fuels and meeting its NDC targets.

Oman's climate strategy also includes natural climate solutions, such as afforestation, to enhance carbon sequestration and strengthen resilience to climate change. To ensure transparent and accountable progress, the government, through ONZC, has established a national MRV system to track emissions and NDC implementation. While financing the energy transition and ensuring equitable social impacts remain challenges, Oman's renewable energy potential and strategic positioning provide a strong foundation for achieving its climate goals.

3.1.2. Impact on GHG emissions and removals

Oman, despite its relatively small contribution to global greenhouse gas emissions (approximately 0.2 per cent),[36] as well as its use of natural gas versus other more potent fuels to power its energy and industry sectors, has proven itself as a pioneering developing country at the forefront of ambitious climate action and sustainable development.

[36] https://www.iea.org/countries/oman/emissions.

Oman's GHG emissions trajectory is deeply influenced by its unique national circumstances, primarily driven by its reliance on the oil and gas sector. As one of the key pillars of the economy, this sector has historically contributed to a high percentage of carbon emissions, particularly from energy production and heavy industries. Furthermore, the high demand for oil and gas exports, coupled with rapid urbanization and population growth, has placed additional reliance on the energy infrastructure, further driving up emissions. Despite these challenges, Oman is undergoing a transformative yet calculated shift towards clean energy and carbon neutrality, which aims to restructure the economy while aligning with the present realities of the importance of the oil and gas sector for national economic growth and stability. This transition, though ambitious, is essential for reshaping the emissions profile over the coming decades.

Geographically, Oman's arid landscape and limited agricultural zones offer both challenges and opportunities for GHG removals. With scarce natural forests and vegetation, Oman faces constraints in terms of natural carbon sequestration, as its land cover does not provide the same level of CO_2 absorption as regions with dense forests or wetlands. However, the country has begun implementing large-scale afforestation and land rehabilitation projects to address this gap. These efforts, which include reforestation of degraded lands and the introduction of drought-resistant plant species, are critical to enhancing the country's carbon removal capacity. Although these programmes are in the early stages, they hold significant potential for long-term CO_2 removal, particularly as part of Oman's climate adaptation strategy. Additionally, these actions not only increase removals but also contribute to protecting biodiversity and improving the resilience of ecosystems to climate change impacts.

Oman's evolving policy framework is also playing a critical role in reshaping its GHG emissions and removals. The country's commitment to renewable energy projects, such as the Ibri Solar Plant and Dhofar Wind Farm, reflects a national effort to diversify energy sources and shift away from high-emission fossil fuels. By integrating renewables into the national grid and promoting energy efficiency across key sectors, Oman is expected to see a steady reduction in emissions in the energy and industrial sectors over time.

Furthermore, Oman is investing in carbon capture and storage technology to mitigate emissions from hard-to-abate sectors like oil and gas, ensuring that industrial activities can continue with reduced environmental impact. These technologies, combined with ONZC's strengthened national MRV systems, are designed to provide more precise tracking of both emissions and removals, ensuring a data-driven approach to achieving Oman's long-term climate targets.

3.1.3. Institutional arrangements for tracking progress in implementing and achieving Oman's NDC

Oman has established and continues to refine a robust institutional framework to monitor, report, and track progress in implementing its NDC under the Paris Agreement. Central to this effort is ONZC, which, moving forward, shall serve as the coordinating entity for GHG emissions inventories and related climate action reporting. Through a network of working groups and committees, ONZC will collaborate with various

government departments, stakeholders and experts to collect activity data, prepare inventory reports and oversee the assessment of mitigation actions.

To enhance NDC implementation, Oman has integrated climate action monitoring into its broader national development strategy, particularly through Vision 2040, which embeds sustainability and emissions reduction targets into sectoral planning and investment decisions. ONZC, from 2025 will play a central role in tracking and coordinating mitigation efforts. ONZC will collect emissions data, oversee the implementation of emission reduction projects and ensure that sectoral mitigation actions align with Oman's NDC targets and long-term climate strategies.

Since 2022, the Environment Authority has coordinated a sectoral workshop for top-down data collection to track the progress made under the NDC and the Net Zero 2050 Strategy through a week-long workshop called "Carbon Lab", in which sectoral data are collected from ministries and official institutions to discuss advancements to adopted initiatives. In 2025, ONZC started a Net Zero Strategy refresh including refreshing the decarbonization pathways for all sectors.

By integrating climate monitoring with national development objectives and leveraging dedicated institutions like ONZC, Oman ensures that NDC implementation is embedded within long-term sustainability planning. These measures reinforce transparency, accountability and the effectiveness of climate action, positioning Oman to meet its 2030 emissions reduction target and advance its long-term net-zero commitment.

Moving forward, the Environment Authority will be tasked with validating the data collected by ONZC, as well as projecting it to track the progress made towards the NDC targets. Finally, the insights and results of these projections will be transparently reported in the next reporting cycle (BTR).

Furthermore, Oman is advancing institutional mechanisms to track and manage Internationally Transferred Mitigation Outcomes (ITMOs) under Article 6 of the Paris Agreement. The development of an Article 6 policy framework is under way to facilitate international carbon market participation while ensuring environmental integrity, preventing double counting, and maintaining alignment with national climate strategies.

To track the implementation of mitigation actions, information must be obtained from the relevant implementing agencies. The main sources of information for tracking mitigation actions by sector are detailed in **Table 7**.

Table 7: Implementing ministries and agencies of mitigation actions

Sector	Implementing ministries and agencies
Energy	Ministry of Energy and Minerals Nama Power & Water Procurement Authority for Public Services Regulation Environment Authority Ministry of Housing and Urban Planning Ministry of Transport, Communications and Information Technology Authority for Public Services Regulation Civil Aviation Authority Oman Vision 2040 Implementation Follow-up Unit
IPPU	Ministry of Energy and Minerals Ministry of Commerce, Industry and Investment Promotion Public Authority for Special Economic Zones and Free Zones
AFOLU	Ministry of Agriculture, Fisheries and Water Resource Environment Authority
Waste	Be'ah (Oman Environmental Services Holding Company)

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

On 29 November 2023, the Sultanate of Oman formally presented its first update of the second NDC to the UNFCCC Secretariat. This revision outlines Oman's ambitious goal to achieve net zero greenhouse gas emissions by 2050, transitioning towards a sustainable low-carbon economy. It highlights a significant commitment to reduce emissions by 21 per cent from projected business-as-usual levels by 2030, marking a crucial step in addressing the global climate crisis.

This update not only showcases Oman's latest national strategies and programmes aimed at combating climate change but also highlights the introduction of new baseline data and BAU projections that underscore its journey towards net zero emissions. This effort emphasizes transparency and accuracy in the data used, enhancing the credibility of Oman's environmental commitments.

Additionally, the document provides a detailed overview of Oman's historical, current and planned actions in both adaptation and mitigation across various sectors. These actions are integrated with the nation's strategies for economic diversification and the active involvement of its youth. Oman's earnest dedication to meaningful global climate action is evident in the comprehensive and holistic approach of its updated NDC, illustrating its role as a proactive participant in global environmental governance.

3.2.2. Description of the latest NDC

(a) Target and description

The Sultanate of Oman's NDC to climate action specifies a target for reducing GHG emissions by 21 per cent by 2030 compared to a projected BAU scenario. This target includes a firm commitment to reduce emissions by 7 per cent and a conditional additional reduction of 14 per cent. The attainment of the conditional portion depends on several factors: receipt of international climate finance, technology transfers, the implementation of Article 6 of the Paris Agreement, and support for capacity-building programmes. The type of NDC of the Sultanate of Oman falls under the category "emission reduction target below a projected timeline".

The baseline year for the BAU scenario is 2021, as reported in the 2023 NDC report of the Sultanate of Oman. Although a slight deviation exists between this estimate and the GHG inventory reported in the National Inventory Report of the first BTR, the variance is minimal, falling below 0.1 per cent range. Consequently, this minor deviation did not necessitate a recalculation of the BAU scenario as outlined in the NDC report.

By 2030, the Sultanate of Oman targets a 21 per cent reduction in GHG emissions compared to the BAU scenario. This reduction will be achieved primarily in four key sectors. Other sectors, including agriculture, LULUCF, and waste, collectively account for less than 5 per cent of total emissions **(Table 8).**

Table 8: Mitigation targets by 2030 per sector (percentage from BAU)

Category	Mitigation target by 2030 (% reduction from BAU)
Power	42%
Oil & gas	17%
Industry	7%
Transport	19%

(b) Target year

The NDC target of the Sultanate of Oman is a single-year target. The target year is 2030.

(c) Base year and baseline

The base year for Oman's BAU scenario is established as 2021, with the scenario projecting GHG emissions from 2021 through 2030 (baseline years).

(d) Time frame for implementation

The time frame for implementation of the NDC is from 2021 to the end of 2030.

(e) Scope and coverage

The NDC encompasses all domestic sectors, i.e. it covers all domestic sectors including LULUCF. However, sectors with specific quantitative targets encompass:

- Power
- Oil & gas
- Industry
- Transport

Regarding aviation and shipping, Oman's NDC includes domestic activities but excludes international operations.

The GHG covered under the NDC includes CO_2, CH_4, and N_2O. Additionally, fluorinated gases (F-gases) are currently included only within the industrial sector (i.e. aluminum industry, and magnesium industry), as their impact in other sectors is still under investigation. Oman intends to expand the coverage of F-gases to all sectors in its future climate commitments, ensuring alignment with international standards. To support this expansion, the country is actively revising its regulations to reflect global best practices for managing F-gas emissions.

Regarding the sectors and their mitigation targets, as Oman intends to recalculate its BAU scenario and subsequently the reduction pathways, the sectoral targets shall be revised to be more aligned with the IPCC categorization of key sectors.

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

The conditional 14 per cent of the target is contingent upon several factors, including international climate financing, technology transfers, the activation of Article 6 of the Paris Agreement, and support for capacity-building programmes.

(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)

In the event of recalculations to the base year of the BAU scenario, or due to factors like the inclusion of new emission sources or enhancements in the methodologies used for estimating emissions in the national inventory, updates to the BAU scenario will be incorporated into subsequent BTRs. This ensures that the reporting remains accurate and up-to-date with the latest data and techniques.

Due to limitations in the traceability of the methodologies and assumptions used to develop the BAU of Oman as reported in the last update of the NDC, the Sultanate is considering recalculating the BAU projections for years beyond 2030 to further clarify the underlying assumptions and methodologies. This update shall be reflected in the next NDC planned for the year 2025.

3.2.3. Cooperative approaches

In its latest NDC report, the Sultanate of Oman has articulated an ambitious objective to achieve a 21 per cent reduction in GHG emissions by 2030. This target comprises a committed reduction of 7 per cent, with the remaining 14 per cent contingent upon the provision of international support and collaboration. Oman acknowledges the critical importance of ITMOs under Article 6 of the Paris Agreement as a vital mechanism to facilitate such cooperation. By effectively harnessing ITMOs, Oman is poised to strengthen its capacity to meet its NDC targets while promoting sustainable development.

In pursuit of this commitment, Oman is in the process of formulating a comprehensive Article 6 policy that aligns with the overarching objectives of the Paris Agreement. This policy framework will delineate the guidelines for implementing cooperative approaches, ensuring that engagements with developed countries significantly contribute to Oman's climate objectives. The government is actively exploring a range of collaborative avenues, emphasizing projects that deliver substantial emissions reductions and co-benefits for sustainable development. By cultivating strategic partnerships with developed nations, Oman aims to leverage their technological advancements and financial resources, thereby enhancing the efficacy of its mitigation strategies.

As part of its preparatory efforts for Article 6 implementation, Oman is also developing a positive and negative list of potential projects and initiatives for cooperative approaches. This list will be informed by a comprehensive assessment of abatement costs. By identifying projects that are both economically viable and environmentally beneficial, Oman seeks to maximize the impact of its cooperative endeavours while ensuring transparency and accountability in the execution of its NDC commitments.

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

3.3.1. Indicators to track progress towards the NDC

To track progress towards the implementation and achievement of its NDC under Article 4, Oman will use the "net GHG emissions and removals," as reported in its NIR. These emissions will be further verified by ONZC and subsequently reported in the next BTR. **Table 9** presents key indicators to track progress towards achieving the NDC targets. As indicated to the previous section, in the event of recalculation of the GHG emission inventory due to the inclusion of new emission sources or enhancements in the methodologies used for estimating emissions in the national inventory, an update of the BAU scenario will be incorporated in the relevant biennial transparency report.

Table 9: Indicators to track progress towards the NDC

Indicator	Description
Indicator(s) selected to track progress towards the implementation of the NDC	Annual net GHG emissions and removals
Definition of selected Indicator	Total net GHG emissions represent the annual total of emissions and removals, expressed in CO_2 equivalents, as reported in Oman's most recent GHG inventory. It includes all sectors and gases outlined in the reporting format for NDC under Article 4 of the Paris Agreement.
Reference year(s), base year(s), reference period(s) or other starting point(s);	Base year: 2021 Reference period: 2021-2030 BAU projection year: 2030
Quantifiable information on the reference indicators, their values in the reference year(s), base year(s)	The Sultanate of Oman's GHG emissions in 2021 (base year) were 90.73 MtCO2e.
Relation to the NDC	The indicator is consistent with the unit and metric used in Oman's NDC, ensuring its applicability for monitoring progress toward achieving the NDC target.
Most recent information	Oman's 2022 total GHG stand at 95.706 $MtCO_2eq$
Progress towards the implementation and achievement of its NDC under Article 4.	Oman is actively monitoring its **NDC targets** and making steady progress toward its **2030 climate goals**. The **achieved net emissions** are aligned with the projected **reduction pathway**, with emissions **reduction by 21 per cent** in line with the country's commitments.

The GHG emissions for the base year of the BAU scenario (2021) are 90 $MtCO_2eq$, as reported in the 2023 NDC report. There is a slight discrepancy between this estimate and the figures reported in the National Inventory Report of the first BTR; however, the variance is minimal. Given this minor deviation, a recalculation of the BAU scenario as presented in the NDC report was not deemed necessary.

3.3.2. Methodology and accounting approach used for target and construction of the baseline

In line with the Net Zero 2050 Strategy, Oman has revised its NDC baseline year from 2015 to 2021 following an assessment of various factors. This revision considered reported emissions data, activity levels, and energy consumption statistics to improve the accuracy of emissions estimates and better reflect current conditions. **Table 10** provides an overview of the methodologies and accounting approaches used, ensuring alignment with Article 4, paragraphs 13 and 14, of the Paris Agreement, and decision 4/CMA.1.

Table 10: Structured summary for methodologies and accounting approaches – consistency with Article 4, paragraphs 13 and 14, of the Paris Agreement and with decision 4/CMA.1

Indicator	Description
For the first NDC under Article 4	
For the first NDC under Article 4, each Party shall clearly indicate and report its accounting approach, including how it is consistent with Article 4, paragraphs 13 and 14 of the Paris Agreement.	The Sultanate of Oman uses IPCC 2006 Guidelines and methodology as guided by 1/CP.21 Article 4, paragraph 13 of the Paris Agreement for the inventory of their GHG emissions and removals.
For the second and subsequent NDC under Article 4	
Consistency of reporting information referred to in chapter III.B and C of Annex to decision 18/CMA.1 with decision 4/CMA.1	Oman has consistently reported its NDC, with the second NDC submitted in 2021and First Update of Second NDC is submitted to UNFCCC in 2023.
Methodological approaches used for accounting for anthropogenic greenhouse gas emissions and removals	The Sultanate of Oman has employed the IPCC methodology and 2006 Guidelines for the inventory of their GHG emissions and removals. Additionally, Oman used the same methodology and guidelines for projecting GHG emissions up to 2030 under the BAU scenario. The methodology contains more than 200 technologies and shift levers across all sectors of the economy that allowed Oman to build tailored abatement scenarios. Thanks to the bottom-up modeling of energy consumption, capital expenditures, operating expenditures, and emission factors, the methodology granularly quantifies the greenhouse gas abatement, investments, savings and energy system implications of each scenario.
Each Party shall provide any definitions needed to understand its NDC under Article 4, including those related to each indicator identified in paragraph 65 above, those related to any sectors or categories defined differently than in the national inventory report, or the mitigation co-benefits of adaptation actions and/or economic diversification plans.	No additional definitions are required. Oman's NDC under Article 4 is based on NIR data and is comprehensively detailed in Section 3 of this BTR. Definitions for identified indicators are provided in section 3.3.1.
Methodologies and accounting approaches - target(s), construction of baseline(s) and indicator(s)	
Target(s)	Oman utilizes the 2006 IPCC Guidelines for National Greenhouse Gas Inventories and supplements them with the 2019 Refinement to the 2006 IPCC Guidelines to ensure robust estimation and reporting of GHG emissions and removals.
The construction of baselines	Oman's baseline is constructed using 2021 as the reference year, based on historical emissions data and national circumstances. Emissions are calculated

	following the 2006 IPCC Guidelines, using Tier 2 and Tier 3 approaches where detailed data is available.
Each indicator identified	Identified indicator is annual net GHG emissions and removals.
Key parameters, assumptions, definitions, data sources and models used	Oman's NDC baseline and target-setting rely on key parameters such as activity data (e.g., energy consumption, industrial production), country-specific emission factors, and socio-economic indicators like GDP and population growth. Assumptions include trends in economic growth, energy demand, and technology uptake. The data sources for Oman's GHG inventory include reports from the Ministry of Energy and Minerals (MEM), Oman National Centre for Statistics and Information, and sector-specific databases. Key sectors such as oil and gas, industry, transport, buildings, and power are covered. Oil and gas data include production, flaring, venting, and LNG use, with details from MEM reports and company filings. Industry data, including cement, aluminum, and petrochemicals, rely on MEM and permit reports. Transport emissions use registered vehicle data, fuel consumption trends, and national transport models. Building sector estimates are based on APSR electrical consumption data and assumptions about insulation and electrification levels. Power sector data incorporate MEM reports, excluding minor contributions like UAE electricity imports and industrial grid-fed electricity.
IPCC Guidelines used	Oman employs the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, supported by the 2013 Wetlands Supplement for relevant sectors.
Metrics used	Oman's NDC metrics cover CO_2, CH_4, and N_2O, with emissions calculated in CO_2 equivalents (CO_2eq) using GWPs from the IPCC Fifth Assessment Report (AR5) with a 100-year time horizon. F-gases are included for the industrial sector, specifically in aluminum and magnesium industries.
Where applicable to its NDC, any sector-, category- or activity-specific assumptions, methodologies and approaches consistent with IPCC guidance, taking into account any relevant decision under the Convention, including as applicable:	
The approach used to address emissions and subsequent removals from natural disturbances on managed lands;	As of now, Oman does not account for GHG emissions and removals from natural disturbances on managed lands. In the future, such emissions and removals will be addressed if any, in alignment with the 2006 IPCC Guidelines.
The approach used to account for emissions and removals from harvested wood products;	As of now, Oman does not account for GHG emissions and removals from harvested wood products. In the future, such emissions and removals will be addressed if any, in alignment with the 2006 IPCC Guidelines.

The approach used to address the effects of age-class structure in forests;	As of now, Oman does not account for the effects of age-class structure in forests. In the future, this aspect will be considered if any, following the 2006 IPCC Guidelines, with the integration of field inventory measurements where applicable.
Double counting approach	As of 2024, Oman is not participating in cooperative approaches involving the use of ITMOs under Article 6. Oman is in the process of developing its own Article 6 policy and aims to implement it in the coming years. Once the Article 6 policy is implemented, Oman will ensure the avoidance of double counting in accordance with international guidelines.

The energy sector, encompassing power, energy use in industry, and oil and gas, is expected to remain a primary driver of emissions, fuelled by increasing energy demand as economies grow. Similarly, the transport sector is likely to experience rising emissions due to the growing number of vehicles coupled with the slow adoption of cleaner transportation technologies.

The buildings sector has no direct emissions as it is fully electrified. However, the sector consumes 80 per cent of power demand (2021). Therefore, the indirect GHG emissions from the buildings sector are anticipated to increase as urbanization progresses, driving higher demand for infrastructure and housing, which in turn leads to greater energy consumption.

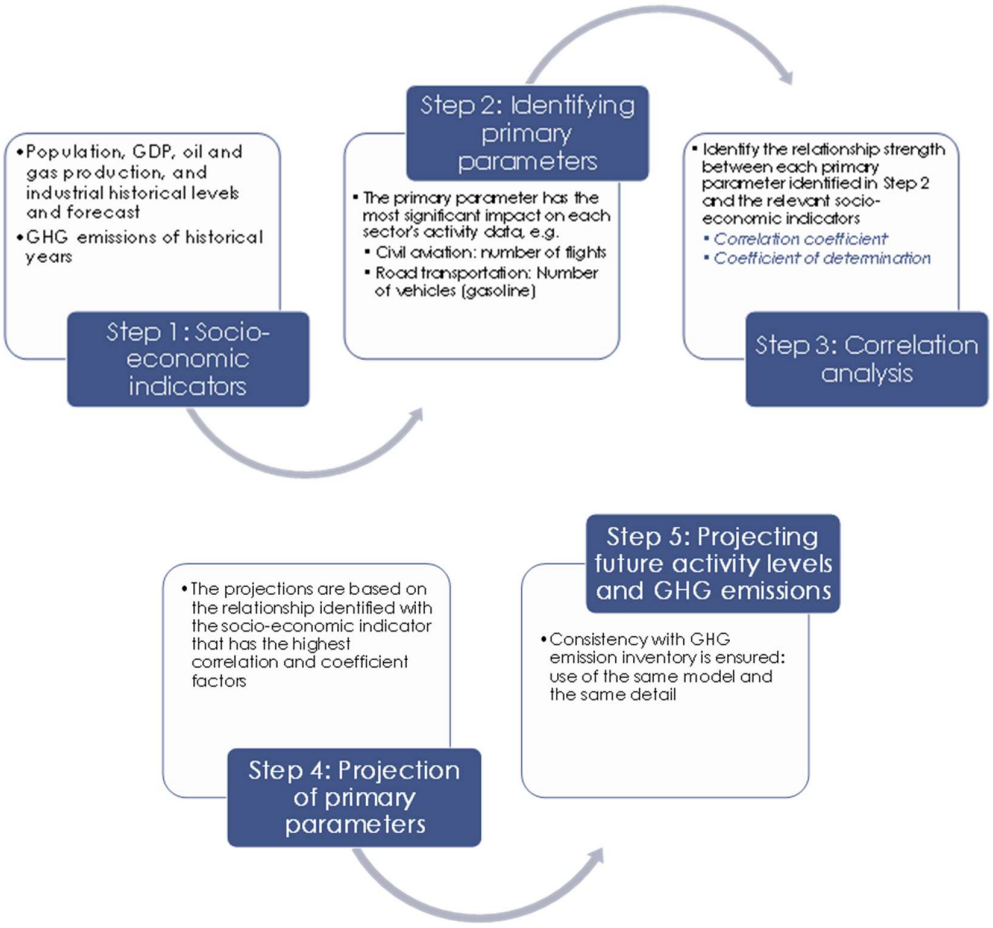
The remaining sectors (agriculture, waste and LULUCF) have minor contributions to GHG emissions. Agriculture, though subject to yield improvements, could still contribute to emissions due to conventional farming practices and livestock production. These projections underscore the importance of transitioning to more sustainable agricultural methods.

Within this BAU framework, economic growth may elevate living standards, but it might also be accompanied by a commensurate increase in resource consumption and waste generation. The construction of the baseline (BAU scenario) depended on forecasting four main areas:

1. **Population forecast:** Derived from official government statistics and the latest UN World Population Prospects, specifically focusing on the high fertility scenario.
2. **GDP forecast:** Grounded in the projections outlined in the Oman 2040 Vision document.
3. **Oil & gas production forecast:** Based on data from the Ministry of Energy and Minerals and supplemented by external global energy forecasts, which estimate production levels for countries based on global demand and supply cost curves.
4. **Industrial forecast:** Based on data from the Annual Industrial Statistics Report of Oman (2019).

A five-step methodology was applied to develop the BAU scenario of the GHG emissions, as illustrated in **Figure 14**.

Figure 14: Methodology applied for the construction of the baseline (BAU scenario)



- ***Step 1: Socioeconomic indicators***
  - The first step in developing the BAU scenario involves collecting socioeconomic indicators, such as data about population, GDP, oil and gas production and industrial production, as well as analyzing their historical values, along with official projections for the years up to 2050.

- ***Step 2: Identifying primary parameters for GHG emission projections in each sector***
  - In the second step, the primary parameter that has the most significant impact on each sector's activity data, and therefore on its GHG emissions, is identified. These parameters are selected based on their potential to predict future GHG emissions in each sector.
  - The parameters identified for each sector are then correlated with the socioeconomic indicators in the next step of the methodology.

- ***Step 3: Correlation analysis between primary parameters and socioeconomic indicators***
    - The purpose of the third step is to identify the relationship strength between each primary parameter identified in Step 2 and the relevant socioeconomic indicators. The indicator with the strongest correlation is selected to project the parameter, activity data, and subsequently, the GHG emissions.
    - The relationship strength between the primary parameters and socioeconomic indicators is evaluated using two measures: the correlation coefficient and the coefficient of determination. These measures provide a quantitative assessment of the relationship between the primary parameters and the socioeconomic indicators, helping to identify the most relevant indicator for each sector.
    - A brief definition of correlation coefficient and coefficient of determination follows:
        - **Correlation coefficient:** A correlation coefficient is a statistical measure that quantifies the strength and direction of the relationship between two variables. It ranges from -1 to 1, where values close to -1 indicate a strong negative correlation, values close to 1 indicate a strong positive correlation, and values close to 0 indicate no correlation.
        - **Coefficient of determination:** The coefficient of determination, also known as R-squared, is a statistical measure that indicates how well a regression model fits the observed data. It represents the proportion of the total variation in the dependent variable that is explained by the independent variables. It ranges from 0 to 1, with higher values indicating a better fit of the model to the data.

- ***Step 4: Projecting primary parameters for each sector***
    - In the fourth step of the methodology, the primary parameters for each sector are projected. The projections are based on the relationship identified with the socioeconomic indicator that has the highest correlation and coefficient factors.
    - By projecting the primary parameters, it is possible to estimate the future activity levels and GHG emissions for each sector in the following step.

- ***Step 5: Projecting future activity levels and GHG emissions for each sector***
    - In the fifth and final step of the methodology, the future activity levels and GHG emissions for each sector are projected. This is done by using the detailed model developed for the estimation of the GHG inventory.
    - The model takes into account the projected activity levels for each sector, along with the primary parameters and their relationship with the socioeconomic indicators. Based on these inputs, the model can compute

the future GHG emissions for each subsector. The results of this step provide the final GHG emissions projections for the BAU scenario.

The accounting of GHG emissions for the NDC target and baseline adheres to the 2006 IPCC Guidelines and the 100-year time-horizon GWP values from the IPCC Fifth Assessment Report, aligning with the established GHG inventory practices. Currently, there is no specific approach implemented to address emissions and subsequent removals resulting from natural disturbances on managed lands, nor to account for emissions and removals from harvested wood products. This is due to the relatively low contribution of the LULUCF sector.

3.3.3. Economic diversification and co-benefits

Economic diversification

In 2022, Oman's GDP grew by 4.3 per cent, outperforming the 2007-2017 average growth rate of 4.1 per cent, thanks to contributions from both the oil and gas sector (3.1 per cent) and non-oil sectors (5.5 per cent). Remarkably, this economic expansion occurred despite the challenges posed by COVID-19.

Oman’s commitment to mitigating GHG emissions while fostering sustainable economic growth is prominently outlined in its NDC report. The country is focused on transforming its economy through innovation, adoption of new technologies, and capacity-building. These efforts aim for a comprehensive integration of economic sectors to diversify trade, invest in high-value sectors, and increase the GDP share. Essential to this strategy are, fostering local innovation, empowering entrepreneurship, and creating a supportive legislative environment, which will enhance Oman's competitiveness globally and regionally, ensuring sustainable and stable growth.

The economic diversification policy, known as "Tanwea’a," anchors Oman's NDC strategy. Additionally, the National Program for Investment and Exports Development "Nazdaher" has been launched to further economic diversification. Oman is promoting sectors such as tourism, technology, and green innovations—including green hydrogen, carbon capture, utilization and storage (CCUS) and solar investments. This approach targets emissions reduction and aims to improve the living standards of its citizens.

While the Oman Economic Development Index showed slight improvement in 2021, further efforts are required to achieve a top 20 global ranking. Investments in renewable energy and eco-tourism are generating diverse job opportunities, enhancing skills, empowering communities, and fostering green employment, particularly for the youth. This strategic direction aligns with Sustainable Development Goals 8 (Decent Work and Economic Growth) and 9 (Industry, Innovation, and Infrastructure), positioning Oman as a leader in the global green economy.

Oman is actively pursuing economic diversification across various sectors, including advancements in the Salalah Methanol Company, Salalah Ammonia Plant, Asyad Dry Dock, Karwa Motors, and Intaj Sohar in Advanced Manufacturing. Efforts also include developments in polymers, the Sustainable City Yiti, Omani abalone farming, Ras Markaz

crude oil storage, Sohar Aluminum, expansion of Oman Chromite Company, Duqm Dry Dock, and the Special Economic Zone at Duqm. The government supports these initiatives through the National Program for Fiscal Sustainability and Financial Sector Development, emphasizing high-impact projects to foster a robust, diversified economy.

Co-benefits

Oman's strategy acknowledges the integral link between climate action and socioeconomic development, emphasizing co-benefits that harmonize environmental and socioeconomic goals. Firstly, transitioning from fossil fuels to cleaner technologies not only reduces GHG emissions but also improves air quality, which has a positive impact on public health and overall quality of life. Additionally, this strategic pivot towards renewable energy enhances Oman's energy security, protecting the nation from global energy price volatility and promoting energy independence.

Moreover, Oman's rich cultural heritage, stunning landscapes and pristine coastlines serve as a foundation for sustainable tourism. Investments in eco-tourism, cultural preservation, and responsible hospitality not only boost Oman's economy but also underscore the nation's commitment to environmental conservation.

Furthermore, economic diversification through innovation and the adoption of advanced technologies spurs economic growth and positions Oman as a leader in sustainable development. Initiatives such as promoting renewable energy and reducing methane emissions in the oil and gas sector generate new business opportunities and foster the creation of green jobs in Oman.

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 NDC under Article 4 of the Paris Agreement (paras. 80–90 of the MPGs)

The mitigation measures encompass a range of sectors, primarily targeting industry, oil and gas, power generation, and transportation. Other sectors such as agriculture, LULUCF, and waste contribute less than 5 per cent to total emissions in the structured transition toward a net zero pathway by 2050. Consequently, they are not detailed extensively in this section. **Table 11** summarizes the key priority levers for mitigation action in the Sultanate of Oman.

Table 11: Key priority levels of mitigation action (not exhaustive)

Sector	Mitigation action
Power (CRT sector: energy)	Deploy renewable power generation at large scale, mainly driven by solar PV and onshore wind. In the buildings subsector, improve insulation standards for new builds, improve energy efficiency of air conditioning units and other electrical equipment. Wide transition to electric vehicles (EVs) and hydrogen fuel cells for long-distance trucks and buses. Promote behavioral changes to reduce car usage and implement biofuels blending for lower emissions from internal combustion engine vehicles.
IPPU (CRT sector: energy)	Electrify low/medium-temperature heat across industries. Implement feedstock changes in steel, cement, petrochemicals, and establish selective grid connections. Apply leak detection and repair for fugitives and repurpose/export flared gas.
AFOLU	Focus on sustainable practices in agriculture and LULUCF to enhance carbon sequestration and reduce emissions.
Waste	Implement waste management strategies to reduce methane emissions, promote recycling, and enhance composting initiatives to minimize waste sent to landfills.

3.4.1. Mitigation measures in the power sector (CRT sector: energy)

Oman targets net zero emissions in 2050 for the power sector with 60 per cent renewables (solar, wind) and decarbonization (gas, CCUS, potential nuclear) for the remaining 40 per cent. The mitigation target by 2030 is 42 per cent reduction from the BAU scenario.

Annex 2 provides a detailed table about current and planned mitigation measures in the energy sector. These measures include a range of initiatives and policy actions for power and buildings sectors. The GHG primarily affected by these measures is CO_2, as the policies and measures focus on reducing or transitioning away from the use of fossil fuels in combustion processes.

Enhancing energy efficiency in power sector

The National Energy Strategy has significantly boosted the overall energy efficiency of gas-fired plants, working in tandem with the clean energy initiatives. The period between 2004 and 2015 saw a commendable 13 per cent increase in efficiency, climbing from 26 per cent to 39 per cent. The momentum of improvement gained even greater pace from 2015 to 2020, with an impressive 15.63 per cent surge in efficiency, reaching 55 per cent. This remarkable rise in energy efficiency can be attributed to the decommissioning of older, less efficient plants, coupled with technological enhancements in gas-fired plants and a strategic shift towards more efficient combined-cycle plants. The trend of increasing efficiency is projected to continue in the forthcoming years, with an anticipated improvement of approximately 11 per cent from 2021 to 2025, aiming to achieve 63 per cent efficiency by 2027.[37] These advancements have led to substantial reductions in GHG emissions from the power sector. Specifically, the GHG emissions

[37] The Second Nationally Determined Contribution (NDC) of Oman, (https://unfccc.int/sites/default/files/NDC/2022-06/Second%20NDC%20Report%20Oman.pdf).

were reduced by about 5,778 metric tons of CO_2 equivalent in 2020, around 6,485 metric tons in 2021, and approximately 6,644 metric tons in 2022[38] **(Figure 15)**.

Figure 15: Gas required per unit of electricity generation in the main interconnected system

Implemented and planned renewable energy projects

Oman has set ambitious plans in motion to expand its renewable energy portfolio, with over 3,000 MW of solar and wind power capacity under way. If realized as per the timelines, these projects can potentially reduce GHG emissions by over 7.24 million tons of CO_2 annually[39] **(Table 12)**.

[38] Namaa's Power and Water Procurement (PWP) 7-Year Statement (2023-2029), available at https://omanpwp.om/PDF/7%20Year%20Statement%20Issue%2017%202023%20-%202029.pdf.

[39] Estimated based on the GHG mitigation benchmark of the operational 500-MW solar PV project in Ibri and Dhofar 50-MW wind project.

Table 12: Implemented and planned renewable energy projects

Project name[40]	Date of implementation	Avg annual emission offset (MtCO2eq)
Ibri II Solar IPP 500 MW	2021	545,221
Manah I Solar IPP 500 MW	2025	850,668
Manah II Solar IPP 500 MW	2025	850,668
Ibri III Solar IPP 500 MW	2026	853,372
Jaalan Bani Bu Ali Wind IPP 100 MW	2026	170,674
Duqm Wind IPP 200 MW	2026	259,457
Dhofar II Wind IPP 120 MW	2026	155,674
Solar 27 IPP 500 MW	2027	650,719
Solar 29 IPP 1000 MW	2029	1,309,795
Al Wusta Wind IPP 200-300 MW	2027	390,431
Sadah Wind IPP 100 MW	2028	130,560
Wind 29 IPP 100-200 MW	2029	346,020
NWS Solar Power 10-15 MW	2025	25,520
Ground Mounted - 1 MW	2021	1,706
KW Roof Top	2021	682
North Solar IPP	2026	213,368
Wind Energy IPP 1	2026	245,085
Wind Energy IPP 2	2026	245,085
Total		7,244,705

Mitigation actions in the buildings sector (CRT sector: energy)

The buildings sector in the Sultanate of Oman is fully electrified. Measures both implemented and planned are aimed at reducing energy consumption, specifically through electricity savings. To avoid double counting, the mitigation impact of these measures has been included within the power sector. The GHG primarily affected by

[40] The listed mitigation measures and initiatives have been collected from sectoral stakeholders in a validation workshop in September 2024. The average annual emission reduction data has been validated in limited assurance by means of sampling projects per sector and validating the underlying methodology used to calculate the estimated emission reductions.

these measures is CO_2, as the policies and measures focus on reducing or transitioning away from the use of fossil fuels in combustion processes. Policies and measures have the status of either implemented (current policy levers) or planned (future initiatives).

Oman is advancing multiple energy efficiency and infrastructure projects to meet its sustainability goals. **Table 13** provides details on both implemented and upcoming projects.

Table 13: Implemented and planned projects under building initiatives

Project	Details	Completion date
Replacement of old cooler with more energy-efficient technology	This project involves upgrading Line 3's cooler with a state-of-the-art IKN cooler (3000 TPD) to enhance energy efficiency in industrial operations.	Q1 2022
Interconnection of rural areas (Connection of Masirah Island to the Main Transmission Network)	A significant project aimed at connecting rural areas, like Masirah Island, to the national power grid, improving electricity access in remote regions.	Q4 2026
North – South Interconnector Project (Phase 1)	Phase 1 of the interconnection project aims to enhance energy distribution between the northern and southern parts of Oman for greater grid stability.	Q4 2023
North – South Interconnector Project (Phase 2)	The second phase will continue expanding the national grid's capacity, reinforcing power transmission across the country.	Q4 2026
Energy efficiency at AlAnsab Wastewater Treatment Plant (WWTP)	Focused on improving energy efficiency at the AlAnsab WWTP, this project seeks to optimize the energy use in water treatment processes.	2023
Demand response study	A study to evaluate and implement demand response mechanisms to manage energy consumption more efficiently across various sectors.	2025

Mitigation actions in the transport sector (CRT sector: energy)

Oman targets net zero emissions in 2050 for the transport sector through policy changes and infrastructure investments to support the adoption of electric and fuel cell electric vehicles (FCEVs).

Mitigation actions in the oil and gas sector (CRT sector: energy)

The mitigation target by 2030 is a 17 per cent reduction from the BAU scenario. The BAU GHG emissions by 2030 are expected to follow a defined trajectory.

Table 14 lists the implemented mitigation projects under the oil and gas sector aimed at reducing flaring and improving energy efficiency. These projects are part of Oman's broader efforts to mitigate GHG emissions and enhance operational efficiencies across its oil and gas fields.

Table 14: Oil and gas sector ongoing and planned mitigation actions

Project name[41]	Segment	Date of implementation	Avg annual emission offset/capture (MtCO2eq)
Wadi Umairi gas recovery	Flaring	2021	53,393
Khazzan - Improve reliability of Flash Gas Compressors (FGC)	Flaring	2021	80,000
Khazzan - Improve transportation efficiency	Power	2021	550
Khazzan - Eliminate fuel gas flare purge and blanketing	Flaring	2021	57,000
Rima water treatment plant	Power - surface	2021	48,000
Yibal and ALH rejuvenation project- LP & AP gas recovery	Flaring	2021	74,331
Vibal to Lekhwair PL via Daleel	Flaring	2021	15,592
MMA AP gas recovery - liquid ring gas compressor	Flaring	2021	7,796
SNGP hydrocarbon conservation	Flaring	2021	3,898
Khazzan - Phase I - Use advanced process control to optimize and increase the discharge pressure from the re-compressor	Power	2022	19,350
Khazzan - Green completion- retesting production wells	Flaring	2022	4,200
Total			**364,110**

3.4.2. Mitigation measures in the industry sector (CRT sector: IPPU)

Oman targets net zero emissions for industry[42] by switching to alternative production methods and an energy mix between hydrocarbon and renewable sources. The mitigation target by 2030 is 7 per cent reduction from the BAU scenario. The BAU GHG emissions by 2030 are expected to follow a defined trajectory.

[41] The listed mitigation measures and initiatives have been validated by Oman's Ministry of Energy and Minerals.

[42] The term industry or industrial sector is used as it is referred to in the NDC document. It encompasses manufacturing industry and construction and petroleum refining (including petrochemical industry).

Table 15 outlines the various energy efficiency and sustainability initiatives undertaken by key industrial players. These initiatives encompass a range of technologies, including LED lighting, solar energy solutions, and sustainable plantation practices. Each entry specifies the type of initiative, its implementation segment, the relevant technology employed, and the expected dates for implementation.

Table 15: Industry sector ongoing and planned mitigation actions

Project name[43]	Segment	Date of implementation	Avg annual emission offset/capture (MtCO2eq)
Transforming from tube lights to LED lamps across the industry	Urea manufacturing	2021-2029	507
Urea plant energy saving: conversion of demineralized water injection to process condensate injection at ammonia preheater inlet.	Urea manufacturing	2023	117
Phase I of decarbonization plan: green power usage / stopping gas turbines / steam turbine to motor drive conversion	Urea manufacturing	2030	169,150
Total			**169,774**

3.4.3. Mitigation measures in AFOLU (CRT sectors: agriculture and LULUCF)

Agriculture and LULUCF collectively account for less than 5 per cent of total emissions in the orderly transition to the net zero pathway. Consequently, they are not discussed in detail in this section. The mitigation target for these sectors by 2030 is a 45 per cent reduction from the BAU scenario. The BAU GHG emissions by 2030 are expected to follow a defined trajectory. **(Table 16)**.

The agriculture sector in Oman is significantly impacted by drought conditions, prompting a focus on adaptation policies and measures to bolster food security and enhance the resilience of its food production systems. To improve water availability and management, Oman is investing substantially in surface water harvesting infrastructure, which includes the construction of dams, reservoirs, and other water storage facilities designed to capture and store rainwater during the rainy season for utilization in drier periods.

[43] The listed mitigation measures and initiatives have been collected from sectoral stakeholders in a validation workshop in September 2024. The average annual emission reduction data has been validated in limited assurance by means of sampling projects per sector and validating the underlying methodology used to calculate the estimated emission reductions.

Table 16: AFOLU sector's current policies and measures and adopted future initiatives

Name	Description	Objective	Type of instrument	Gases affected	Implementing entity or entities	Non-GHG mitigation benefits
Initiatives to enhance natural carbon sinks	Ongoing efforts in Hayma city, including tree planting, green buffer zones, and the EA's "Plant a Tree" initiative in Special Economic Zones. Aims to protect and restore coastal habitats. Aims to plant 10 million trees.	Mitigate environmental impact and enhance carbon sequestration.	Information and Research	CO_2	EA (OPA)	Enhanced biodiversity, improved air quality, and coastal resilience.

3.4.4. Mitigation measures in waste (CRT sectors: waste)

The waste sector is actively engaged in implementing strategies to reduce emissions, particularly focusing on methane (CH_4) **(Table 17)**.

Table 17: Waste sector's current policies and measures and adopted future initiatives

Project name[44]	Segment	Date of implementation	Avg annual emission offset/capture (MtCO2eq)
Methane recovery - landfill gas recovery for direct use (only Al-Multaqa LF)	Municipal waste	2025	113,864
Methane recovery - landfill gas recovery for electricity self-generation (Barka and Al-Multaqa LF)	Municipal waste	2025	303,542
Methane recovery - landfill gas recovery for electricity exportation	Municipal waste	2025	303,542
Waste-to-energy at Barka LF	Municipal waste	2028	3,873,074
Fish waste treatment	Municipal waste	2025	27,256
Biogas and compost facility	Municipal waste	2025	65,250
Blue bins project	Municipal waste	2025	160
Paper and cardboard collection and recycling	Municipal waste	2027	463,687
Reuse centre	Municipal waste	2025	52,799
Food waste project	Municipal waste	2025	146
LF Cell closure-Al-Multaqa Cell 1	Municipal waste	2025	377,364
LF Cell closure-Al-Multaqa Cell 2	Municipal waste	2025	589,632

[44] The listed mitigation measures and initiatives have been collected from sectoral stakeholders in a validation workshop in September 2024. The average annual emission reduction data has been validated in limited assurance by means of sampling projects per sector and validating the underlying methodology used to calculate the estimated emission reductions.

LF Cell closure-Barka Cell 1	Municipal waste	2025	754,729
LF Cell closure-Barka Cell 2	Municipal waste	2025	731,615
LF Cell closure-Tahwa Cell 1	Municipal waste	2025	28,302
LF Cell closure-Tahwa Cell 2	Municipal waste	2025	28,302
Total			**7,713,264**

3.4.5. Flexibility applied in reporting of mitigation policies and measures, actions and plans (i.e. by developing country Parties that need it in the light of their capacities as per paras. 4–6 of the MPGs)

In alignment with Article 13, paragraph 2, of the Paris Agreement, the Sultanate of Oman is leveraging the flexibility provision outlined in paragraph 85 of the MPGs, as annexed to Decision 18/CMA.1. Due to capacity and time constraints encountered during the preparation of its first BTR, the Sultanate of Oman did not estimate and report the expected and achieved GHG emission reduction for its actions, policies and measures.

3.4.6. Improvement plan for reporting of mitigation policies and measures, actions and plans

Depending on the availability of capacity and resources, Oman aims to assess the mitigation impacts of its policies and measures with plans to integrate this evaluation into the recently developed national MRV system. This system will track progress in key areas such as renewable energy deployment and energy efficiency enhancements.

Currently, mitigation measures have been identified through a bottom-up approach, with inputs from both public and private sector stakeholders. The implementation of these measures, along with the corresponding emission reductions, will be systematically reported through the national MRV system and relevant institutional frameworks, as outlined in section 3.1.3 of this report.

To enhance the accuracy and consistency of its GHG inventory, Oman is actively addressing data gaps related to activity data, emission factors, and other key parameters. In alignment with the 2006 IPCC Guidelines, the country is in the process of incorporating surrogate data, extrapolation, interpolation, and splicing techniques to estimate missing emission values and ensure a continuous and reliable time series. These methodological advancements will improve the credibility of national emissions reporting and support compliance with the ETF. Additionally, efforts are underway to strengthen institutional capacity and optimize data collection processes, ensuring that future inventories adhere to international standards and best practices.

3.5. Projections of GHG emissions and absorptions

3.5.1. Definition of projection scenarios

Oman has two projected pathways, namely, a BAU scenario (without measures) and an orderly emissions reduction scenario (with measures) to reach climate neutrality by 2050[45].

The "orderly transition" scenario meets key decline targets - emissions fall 21 per cent below BAU levels by 2030. The BAU and "orderly transition" scenarios were prepared as a part of the preparation of the Third Update of the Second NDC of the Sultanate of Oman in 2023. At that time, the most recent GHG inventory data available were for 2021. Therefore, this year was selected as the base year for both scenarios. Furthermore, the NDC report disaggregates emissions in sectors that are different compared to the IPCC and/or UNFCCC CRT sectors. For that reason, the projection scenarios were reported only as total national GHG emissions with LULUCF, and they are reported neither on a sectoral basis (IPCC or CRT sectors) nor by gas. The mapping between the sectors reported in the NDC report and CRT categories is provided in **Table 18**.

Table 18: Mapping between sectoral basis reported in NDC report and IPCC / CRT sectors

NDC sector	CRT sectors
Power sector	1A1ai
Oil & gas	1A1aii and 1B2
Industry	1A1b, 1A2 and 2 except 2F
Transport	1A3
Other	Agriculture, LULUCF and waste

The BAU scenario is the baseline scenario of the NDC and the climate neutrality target for 2050, as described in section 3.2.2. The definition and the methodology for the preparation of the BAU scenario is described in section 3.3.2. The BAU scenario resembles a 'without measures' projection scenario that excludes all policies and measures implemented, adopted and planned after the year 2021, which is the base year of the BAU scenario. Therefore, the BAU scenario depicts the projected evolution of emissions, resource consumption, and other critical indicators over this period, influenced by existing demographic shifts, economic growth patterns, technological advancements, and policy dynamics.

The "orderly reduction" scenario encompasses all mitigation policies, measures and actions described in section 3.4. Therefore, it reflects both implemented/adopted and planned policies and measures. It was estimated by subtracting the aggregated effect of mitigation policies and measures from the BAU GHG emission levels. The "orderly reduction" scenario resembles a 'with measures' projection scenario. This strategic trajectory leaves Oman with a "last mile" challenge, constituting approximately 8 per cent of emissions, which needs to be addressed to attain net zero emissions by 2050.

[45] The Sultanate of Oman's National Strategy for an Orderly Transition to Net Zero, November 2022. https://www.ea.gov.om/media/aaslyc3l/oman-net-zero-report-2022_screen.pdf.

To address the remaining emissions gap, Oman has outlined several strategic initiatives. Firstly, the country plans to adopt cutting-edge decarbonization technologies that have the potential to substantially lower emissions. Additionally, Oman is considering the use of both engineered and natural negative emissions techniques. These include direct air capture (DAC) of carbon followed by storage in depleted geological reservoirs, and the enhancement of natural carbon sinks such as expanding mangrove forests which absorb significant amounts of carbon.

3.5.2. Description of emission projections up to 2030

Looking ahead to 2030, the BAU scenario projects a 13 per cent increase in emissions in the industrial sector[46] compared to the levels recorded in 2021. This uptick is primarily driven by the expansion of industrial activities, particularly in sectors like petroleum refining, petrochemicals, cement production, aluminum manufacturing, as well as iron and steel production. Addressing this growth in emissions is pivotal, as Oman strives to meet its sustainability goals and create a more environmentally responsible future through an anticipated emission reduction of 7 per cent from the 2030 BAU scenario.

The oil and gas sector,[47] renowned for its proactive stance on emissions reduction, charts a course to achieve 17 per cent emissions cut by 2030. Anchored in cost-effective decarbonization strategies, this journey hinges on energy efficiency enhancements, the repurposing of captured natural gas and the electrification of upstream production processes, all aiming to wield substantial influence.

Anticipating a transformation in the landscape of transportation, the sector casts its aspirations towards a 19 per cent reduction in GHG emissions by 2030. This forward-looking trajectory envisions the integration of diverse solutions such as the proliferation of EVs, the utilization of hydrogen fuel cells for heavy-duty vehicles and the widespread adoption of biofuels. Collectively, these efforts form a comprehensive strategy to reduce emissions.

In the power sector, fossil fuels (mainly natural gas) account for approximately 92 per cent of power generation, which prompts for innovative, transformative interventions. A notable 80 per cent of electricity consumption is attributed to the buildings and residential sector, which anticipates surges due to population growth. As the population grows, the expansion of housing is expected to lead to a 90 per cent increase in energy consumption by 2050. In this context, the introduction of green hydrogen, harmonized with wind and solar energy, is a critical step in addressing these challenges, as it aligns with the sector's targeted 42 per cent reduction in emissions by 2030.

[46] The term industry or industrial sector is used as it is referred to in the NDC document. It encompasses manufacturing industry and construction, and petroleum refining (including petrochemical industry).
[47] It encompasses the following sectors: upstream production, fugitives, flaring/venting, and LNG terminals.

3.5.3. Flexibility applied in reporting of mitigation policies and measures, actions and plans (i.e. by developing country Parties that need it in the light of their capacities as per paras. 4–6 of the MPGs)

In accordance with paragraphs 4–6 of the MPGs and recognizing the national circumstances and capacity constraints encountered in the preparation of this BTR, flexibility has been applied in the reporting of mitigation policies, measures and planned actions. This flexibility is reflected in both the depth of data verification and the approach to ensuring the robustness of the reported information.

The listed mitigation measures and initiatives reported in this BTR have been initially identified through a series of consultations with sectoral stakeholders, culminating in a dedicated validation workshop held in September 2024. During this workshop, representatives from government agencies, the private sector, industry associations and civil society organizations engaged in an iterative review process to refine the list of prioritized mitigation actions. The Ministry of Energy and Minerals provided final confirmation of the measures, ensuring that all proposed initiatives align with current national priorities and policy frameworks.

Given the constraints in technical capacity, financial resources, and time, a limited assurance approach was adopted to validate the estimated emission reductions associated with the reported mitigation measures. Rather than employing full-scale, third-party verification for each individual project, a targeted sampling methodology was used. Sectoral stakeholders and technical experts jointly selected representative projects from each major sector—such as energy, transport, and industrial processes—and subjected these sample projects to a more detailed examination of their underlying assumptions, input data, emission factors, and calculation methodologies.

During the validation workshop, technical specialists and stakeholders worked collaboratively to review the methods employed in quantifying projected emission reductions. By focusing on specific samples, the process aimed to ensure that the core methodologies and baseline assumptions were consistently applied and technically sound. Although limited assurance does not reach the rigor of full accreditation, this approach was deemed appropriate in light of existing resource constraints. The information gleaned from these sampled verifications can be reasonably extrapolated to other projects of a similar nature, thereby reinforcing the overall credibility of the reported data.

Stakeholders and decision-makers have been encouraged to adopt a conservative approach in selecting and proposing mitigation initiatives. Projects included in the pipeline have been screened to ensure a high likelihood of implementation and sustained operation. Furthermore, conservative buffer periods have been applied to project commissioning timelines. By not overly relying on early commissioning dates or overly optimistic performance assumptions, this practice helps to reduce the risk of overestimating future mitigation impacts and avoids presenting a misleading picture of the country's mitigation trajectory.

This conservative stance is consistent with the principle of environmental integrity and the precautionary approach, ensuring that reported emission reductions are both credible and realistic. Through this careful calibration of ambition and timelines, the national reporting framework aims to maintain the trust of both domestic and international audiences while acknowledging that conditions and capacities may evolve over time.

In sum, the flexibility applied in this BTR's reporting framework balances the need for robust and credible data with the practical realities of capacity constraints, resource limitations, and timeline pressures faced by a developing country Party. By employing a limited assurance approach to data validation, engaging stakeholders through a structured consultation process, and encouraging conservative project selection and timing, this BTR maintains both transparency and integrity while adhering to the principles and guidance provided by the MPGs.

3.5.4. Improvement plans for the projections of GHG emissions and absorptions

As Oman further expands its national capacities and climate action institutional arrangements, it has taken a crucial decision to recalculate its projections for both its "without measures" and "with measures" scenarios. The recalculation aims to clarify the methodologies, assumptions, and data sources, and to align the projections with more accurate Oman socioeconomic growth projections.

ONZC has taken on this task as part of its official mandate. The revision of projections calculations is expected to enhance the transparency and traceability of Oman's climate action, and shall inform the next NDC target setting, which will be studied and committed by the Environment Authority, solidifying Oman's position as a pioneer in the region.

4. INFORMATION RELATED TO THE IMPACTS OF CLIMATE CHANGE AND ADAPTATION UNDER ARTICLE 7 OF THE PARIS AGREEMENT

4.1. National circumstances, institutional arrangements and legal framework

4.1.1. National circumstances

Oman, located on the southeast corner of the Arabian Peninsula, spans an area of 310,000 km^2, featuring a diverse topography that includes mountain ranges, deserts and coastal plains. Most of the country is classified as arid or semi-arid, with many regions receiving less than 100 mm of rainfall annually. The coastal areas are highly vulnerable to rising sea levels and storm surges, especially in low-lying zones. Oman's varied climate, shaped by its complex geography, leads to extreme temperature fluctuations and susceptibility to tropical cyclones, droughts and flash floods.

Oman's economy is heavily reliant on the oil and gas sector. However, the country has been making efforts to diversify into other sectors, including agriculture, fisheries, tourism and infrastructure development. Despite these diversification efforts, Oman remains vulnerable to climate-induced disruptions, particularly in agriculture and fisheries, which depend heavily on groundwater and coastal resources that are increasingly under threat due to changing climate patterns.

The nation's infrastructure is concentrated along the coast, but urban planning has historically not accounted for the growing risks associated with climate change. This has left cities vulnerable to flooding, storm surges, and coastal erosion. In response, the government is increasingly focusing on developing infrastructure that is resilient to climate change, incorporating climate risks into national building and design codes to protect urban areas from future impacts.

Oman's adaptive capacity is shaped by government initiatives such as the National Strategy for Adaptation and Mitigation to Climate Change (2020-2040). This strategy seeks to address vulnerabilities across key sectors, including (i) water resources (ii) fisheries and marine resources (iii) agriculture and allied sectors (iv) urban areas, tourism, and infrastructure (v) public health. However, there are still gaps in sectoral planning, particularly regarding the inclusion of gender-disaggregated data, societal awareness and engagement with the private sector. These gaps highlight the need for a more comprehensive approach to climate adaptation and resilience in the years ahead.

4.1.2. institutional arrangements and governance on adaptation

The National Strategy for Adaptation and Mitigation to Climate Change in Oman 2020-2040, approved in 2019, lays the foundational framework for climate adaptation

activities in the country. To enhance the execution of its adaptation measures, the Government of Oman initiated the NAP in December 2022. This project is supported by funding from the Green Climate Fund (GCF) and is implemented by the UNIDO and the EA of Oman.

Oman's NAP, currently being prepared with GCF support, will define the country's medium- to long-term climate adaptation requirements and the strategies and programmes to address them. The plan will aim to drive systemic change that tackles climate impacts and vulnerabilities by catalyzing action and financing. It will be tailored to Oman's priorities, including its NDC and National Adaptation Program of Action. Key indicators for the project will include humidity, mean annual temperature, sea level rise and extreme weather events like floods and cyclones. The NAP's implementation will address the following barriers:

- Inadequate legal framework for climate change adaptation
- Limited progress in mainstreaming sectoral risks
- Insufficient sector-specific decision support
- Poor understanding of social and gender-specific impacts
- Low public and private sector engagement.

4.2. Effects, risks and vulnerabilities

4.2.1. Risk analysis of climate change effects

Climate trends and climate change scenarios

The section titled "Climatic context" provides an in-depth examination of Oman's climate, climate trends and climate projection based on the scenarios.

Identification of risks towards climate change effects and vulnerabilities

Oman, like many other regions across the globe, is facing significant climate risks due to rising temperatures, extreme weather events, shifting precipitation patterns, and rising sea levels. Each of these factors presents unique challenges that could affect the country's economy, society, and environment in profound ways:

- **Rising temperatures:** Oman has already experienced a notable rise in temperatures, especially during the summer months, when extreme temperatures between 48-50 °C are becoming increasingly common. These searing heat waves are expected to intensify, with projections indicating an additional rise of 2-3 °C by 2079, particularly in summer.[48] Such high temperatures pose serious risks to human health, as heat stress can lead to increased mortality and reduced productivity. Vulnerable populations, such as the elderly, children, and outdoor workers, are at a greater risk. Furthermore, agriculture will be severely impacted by the heat, leading to decreased crop yields and increased water demand for irrigation. Ecosystems, already stressed by arid

[48] https://climateknowledgeportal.worldbank.org/country/oman.

conditions, will struggle to cope, potentially leading to the loss of biodiversity and shifts in species distributions.

- **Extreme weather events:** Oman is bracing for an increase in the frequency and intensity of extreme weather events, including droughts, sandstorms, and possibly cyclones. Droughts can lead to severe water shortages, reduced agricultural output, and strain on food security. Sandstorms, which can disrupt daily life and damage infrastructure, are likely to become more common and intense, threatening transportation and public health. Infrastructural resilience will be put to the test as these extreme events may damage roads, power lines, and buildings, requiring substantial investment in mitigation and adaptation measures. Moreover, the escalation of these events could have social and economic consequences, as livelihoods—particularly in agriculture and tourism—are disrupted.
- **Precipitation patterns:** Although Oman is expected to experience episodes of more intense rainfall, the overall average annual rainfall remains uncertain. The unpredictability of rainfall patterns is coupled with the likelihood of more prolonged dry spells, further exacerbating water scarcity issues. Water resources are already a concern in Oman, and prolonged droughts could lead to desertification and degradation of arable land, threatening food security and increasing reliance on water desalination and imports. The combination of sporadic heavy rainfall and longer dry periods could also increase the risk of flash floods, which could damage infrastructure, agricultural land and settlements, particularly in low-lying areas.
- **Sea-level rise:** Oman's coastline has experienced a gradual sea-level rise, measured at 0.18-0.23 cm per year in recent decades. While this may seem small, the cumulative effect over time could lead to significant changes in coastal areas. The rising sea levels will likely result in higher tides and increased coastal flooding, putting low-lying coastal communities, critical infrastructure, and urban areas at risk. Coastal erosion is another concern, as it could lead to the loss of valuable land and damage to infrastructure like ports, roads, and buildings near the shore. Moreover, saltwater intrusion into freshwater aquifers could exacerbate water scarcity and affect agriculture in coastal regions.

4.2.2. Effects and problems associated with climate change

Water management

Oman heavily relies on several key aquifers, such as Masarrat in Al-Dhahirah with a capacity of 19,500 million cubic meters (Mm^3), Al-Sharquiya Sands in Al-Sharquiya with 12,000 Mm^3, Najd in Dhofar with 5,000 Mm^3, and West Wusta in Dhofar with 1,000 Mm^3.[49] The Batinah plain further contains critical aquifers within both alluvium and the underlying Upper Fars formation, extending to the South Al-Batinah coastal area, which hosts an alluvial aquifer stretching from the Sea of Oman to the Hajar Mountains. These

[49] McDonnell, R (2016) *Groundwater use and policies in Oman*. IWMI Project Report No. 14. *Groundwater governance in the Arab world,* International Water Management Institute.

aquifers, particularly along the densely populated Batinah plain, are vital for agriculture but are under pressure due to overexploitation and the impacts of climate change.

Oman's water resources are categorized into "renewable" sources, replenished by rainfall and stored in underground aquifers, and "non-renewable" fossil water reserves, which experience minimal replenishment after extraction. The total annual replenishment of renewable water resources is approximately 1,300 Mm^3, with a current recovery rate of about 70 per cent. However, much of the groundwater in other areas is brackish or saline. In 2017, rainfall contributed 19,190 Mm^3 of water to Oman, of which 79 per cent evaporated, leaving only 3,288 Mm^3 as effective rainfall. This effective rainfall contributes to surface runoff and direct groundwater recharge. A water balance analysis indicates a national water deficit of roughly 316 Mm^3 annually, with significant regional variations in water demand and recharge. The northern coastal plain of Al Batinah has the highest demand for agricultural water.[50]

The impact of climate change poses three critical challenges: increasing temperatures, decreasing rainfalls, and rising sea levels.[51] Higher temperatures are expected to increase evaporation rates, reduce groundwater recharge and escalate water demands for agriculture, affecting the sustainability of aflaj systems and other water resources. Reduced rainfall will lower water collection in dams and increase reliance on groundwater, potentially depleting aquifer levels. Exceptional weather events may lead to flooding, increased sediment transport and damage to infrastructure. Meanwhile, rising sea levels are likely to exacerbate seawater intrusion into coastal aquifers, significantly increasing salinity and rendering these water sources unsuitable for agricultural use, ultimately affecting the livelihoods of local farmers. These pressing issues highlight the urgency of implementing sustainable water management practices to mitigate the adverse impacts on Oman's water resources and agricultural sectors in the face of climate change.

Fisheries and marine biodiversity

Managed by the Ministry of Agriculture, Fisheries, and Water Resources, this sector contributed 2 per cent to Oman's GDP in 2022. The marine ecosystems of the Arabian Peninsula are confronting serious environmental degradation, due to the impact of the climate change.[52] Over the past 50 years, the Western Arabian Sea surrounding Oman has undergone significant changes in its physical and chemical properties. These changes include:[53]

- An increase in average sea temperatures by over 2°C at the surface and about 1°C at a depth of 300 meters since 1960.

[50] MRMWR (2013) Water Balance Computations for Sultanate of Oman, June 2013. A report prepared by Mott MacDonald for the Ministry of Regional Municipalities and Water Resources, Sultanate of Oman.
[51] Al-Maktoumi, A., Zekri, S., El-Rawy, M. et al. (2018) "Assessment of the impact of climate change on coastal aquifers in Oman." Arab J Geosci 11, 501, https://doi.org/10.1007/s12517-018-3858-y.
[52] World Bank Knowledge Portal. (2023) Climate Projections for Oman. Retrieved from https://climateknowledgeportal.worldbank.org/country/oman/climate-data-projections.
[53] Piontkovski, S.A., Queste, B.Y. (2016) "Decadal changes of the Western Arabian sea ecosystem." Int Aquat Res 8, 49–64, https://doi.org/10.1007/s40071-016-0124-3.

- An increase in average salinity at lower depths, rising at a rate of about 0.1 parts per thousand per decade since 1950.
- A notable shift in chemical properties such as acidity, with pH levels dropping by 0.1 units at the surface and 0.2 units at a depth of 350 meters.
- Nitrate concentrations have also decreased by about 30 per cent over the past 30 years, and there has been a significant decline in dissolved oxygen levels. For instance, oxygen concentration levels of 1 milligram per liter are now found at a depth of about 75 meters, compared to 120 meters in the 1960s. The situation is alarming in the Arabian Sea, where increasing sea surface temperatures are accompanied by a significant intensification of the oxygen minimum zone (OMZ), already recognized as one of the largest globally. This expanding OMZ contributes to hypoxic conditions unfavorable for many marine species, leading to ecosystem stress and altering marine food chains[54].
- A decline in chlorophyll-a concentration by about 40 per cent from the 1950s to 2010.

These environmental changes are adversely affecting marine biodiversity and impacting the productivity and sustainability of the fisheries sector. The decline in nitrates in the upper layer has likely limited primary production, critical for sustaining fish populations. Changes in temperature and salinity are altering the patterns of marine biodiversity, affecting ecosystem dynamics, and compressing habitats of both large and small pelagic fishes over the Omani shelf. These factors, combined with increased fish kill incidents, highlight the urgent need for adaptive strategies within the fisheries sector to mitigate these impacts and promote long-term sustainability.

Agriculture

Agriculture in Oman relies entirely on irrigation. The primary crops include dates, fruits, alfalfa, vegetables and various forage crops, all of which require irrigation. Agricultural production and productivity are greatly impacted by groundwater salinity and aquifer depletion, caused in part by seawater intrusion in the country's main agricultural region in the north.[55] In this region, about 40 per cent of the agricultural land is irrigated with water that has a salinity level (ECw) higher than 5 deciSiemens per meter (dS/m), or 3,500 parts per million (ppm).[56] Salinity levels are highest near the coast, severely limiting plant growth and leading to the abandonment of excessively salinized lands. The increasing salinity of groundwater is primarily due to reduced annual recharge, alongside unauthorized and indiscriminate well drilling and over extraction of water. Sea level rise is anticipated to exacerbate saltwater intrusion into aquifers, further jeopardizing agricultural output. Consequently, the annual income of smallholder farmers, who rely on agriculture for their livelihoods, is expected to decline as sea level rise inundates coastal areas, rendering some lands unfit for cultivation. Additionally, the topography of

[54] Lachkar, Z., Lévy, M., and Smith, S. (2018) 'Intensification and deepening of the Arabian Sea oxygen minimum zone in response to increase in Indian monsoon wind intensity," Biogeosciences, 15, pp. 159–186, https://doi.org/10.5194/bg-15-159-2018.

[55] Oman AQUASTAT https://openknowledge.fao.org/server/api/core/bitstreams/45adcf5d-03c7-4372-881c-644686feeb99/content.

[56] Oman Salinity Strategy (2011). https://maqsurah.com/uploads/items/74078/files/FULL/2021-06-16_11_28_121974225.pdf.

the Sultanate limits the expansion of agriculture beyond the coastal zones to a profitable scale.

In Oman, the date palm is the predominant and most crucial crop, occupying 50 per cent of the total farming area and comprising 80 per cent of all fruit crops grown in the country. Climate change poses significant threats to date palm cultivation, a crop vital for its economic and cultural value and well-suited to the arid conditions of the region. The implications of climate change for date palm cultivation are severe, particularly due to the crop's susceptibility to temperature and water stress:[57]

- **Temperature stress:** Date palms can typically endure high temperatures up to 45°C. However, when air temperatures rise above this limit, it can reduce physiological activities, impair pollen viability, disrupt flower and fruit development, and increase fruit drop rates. Higher temperatures might also trigger earlier flowering and fruiting phases, which could misalign with optimal pollination periods, negatively impacting both the quality and quantity of yields.
- **Water stress and salinity:** The challenges are compounded by higher temperatures and extended droughts, which increase evapotranspiration rates and, consequently, the irrigation demands of date palms. Oman's already limited water resources are put under further strain. Additionally, sea level rise leads to saltwater intrusion into coastal aquifers, endangering the essential freshwater supplies needed for irrigation. Increased salinity restricts nutrient absorption, inhibits growth, and decreases yields, often necessitating costly soil leaching measures to preserve soil health.
- **Extreme weather events:** Date palm plantations are vulnerable to physical damage from cyclones and flooding, which can erode soil and deposit salts, exacerbating salinity issues and potentially destroying entire harvests. Drought conditions further stress this scenario by depleting groundwater levels, thereby reducing available irrigation water and increasing dependency on potentially salinized coastal aquifers.

The vulnerability of the agricultural sector to climate change impacts extends beyond environmental damage, significantly affecting the socioeconomic landscape of Oman. Agriculture is a critical source of income for many rural communities, and disruptions can lead to economic instability and increased poverty among farmers. A decline in agricultural productivity could result in higher food prices, compromising national food security and increasing dependence on imported goods.

Urban planning and Infrastructure

The Ministry of Housing and Urban Development in Oman oversees urban regions and infrastructure. Over the past five decades, the use of the coast in Oman has dramatically increased, a trend that is expected to continue throughout the 21st century. Coastal population growth has led to the widespread transformation of natural coastal landscapes into industrial and residential areas. According to the 2020 census, Oman has more than 5 million residents, with about 80 per cent living in low-lying areas such

[57] Allbed, A., Kumar, L. & Shabani F. (2017) "Climate change impacts on date palm cultivation in Saudi Arabia." *The Journal of Agricultural Science*, 155(8), pp. 1,203-1,218. doi:10.1017/S0021859617000260.

as coastal plains.[58] Additionally, the census reveals that 65 per cent of Oman's population is concentrated in Muscat and the Al-Bathina coastal plain. This plain, which serves as one of Oman's primary agricultural areas, features elevations ranging from 0 to 500 meters with its width at the center around 50 km. The Muscat-Al-Batinah coastal plain has seen rapid development over the past five decades, and its attractiveness for heavy industrial activities is likely to continue into the future. Oman boasts a 3,165 km-long coastline, encompassing seven coastal governorates: Musandam, North Al-Bathina, South Al-Bathina, Muscat, Al-Wusta, and Dhofar.

Data shows that the shoreline of these coastal governorates is extensively and increasingly used for urban settlement. About 47.7 per cent of the total built-up areas of these governorates are situated within 500m of the shoreline, with urban coastal settlements reaching 100 per cent in Musandam, South Al-Sharquiya, and North Al-Bathina, and fluctuating between 28 per cent and 34 per cent in the governorates of South Al-Bathina, Muscat, Al-Wusta and Dhofar.

Sea level rise poses a significant threat to Oman, given its long coastline and densely populated low-lying urban areas. The IPCC in its 6th Assessment Report projects that global sea levels will continue to rise throughout the 21st century. Under the best-case scenario, sea levels are projected to rise between 0.26 and 0.55 meters by 2100, and under the worst-case scenario, they could rise by between 0.52 and 0.98 meters. These projections highlight the potential impact of sea level rise on Oman's coastal areas and infrastructure. The risks are exacerbated by the fact that a large portion of the population resides in low-lying areas considered high-risk for flooding.

In terms of urban flooding, Oman, located in an arid zone, is prone to flash flooding, with major events recorded in numerous years. Records show that major flash floods occurred in Oman in 1989, 1997, 2002, 2003, 2005, 2007, 2010, 2011, 2013, 2014. 2018 and 2021. The settlement of Omani villages has been determined by the availability of water and therefore, many settlements exist mainly along the wadis. Based on this principle, the urban areas are located very close to, if not directly on the wadis. Muscat, the capital of Oman is the fastest growing city in Oman. Due to the geographic location of the capital, which is surrounded by mountains, and the horizontal expansion of the urban areas, most of the wadis (Wadi Aday, Wadi Kabir, and Wadi Samail) and the main channels have been occupied by urban development. Also, steep terrains surrounding Muscat and limited vegetation also play a role in the surge of flash floods during intense rainfall.

Overall urban expansion in Omani cities has not properly taken account of historical risks of flooding, much less the greater flooding risks that will accompany climate change. This puts Oman's urban areas and infrastructure, such as government and private properties, transportation systems and power and water supplies at serious risk of damage from floods. With climate change, these risks are projected to increase still further, especially if current patterns of development in high-risk flood-prone zones continue.

[58] National Strategy for Adaptation and Mitigation to Climate Change 2020-2040. https://www.ea.gov.om.

Public Health

Managed by Oman's Ministry of Health, the public health sector is significantly affected by climate change. The severe impacts of extreme weather events on urban populations and economies highlight the sector's susceptibility. Issues such as flooding, heatstroke, disease vector transmission, and other extreme events pose substantial risks to public health. Additionally, under high climate emission scenarios, climate change is expected to increase the prevalence of diseases like malaria, affecting a larger segment of the population in the coming decades. Under the high emission SSP5-8.5 scenario, climate projections for Oman indicate a concerning rise in temperatures by 2100, potentially surpassing human survivability thresholds. The daily maximum temperature anomaly could increase by +6.5°C, reaching peaks of 52.06°C in Al Dhahira Governorate **(Figure 17)**. This scenario also forecasts a sharp increase in extremely hot days (Tmax > 45°C) across all governorates, with Al Dhahira expecting an additional 110.65 hot days annually **(Figure 16)**. Similar increases are anticipated in Adkhilia, Asharquia, and Dhofar. The severity of these projections underscores the urgent need for adaptive measures to protect vulnerable groups such as the elderly, children, and those with pre-existing health conditions from the impacts of climate change.

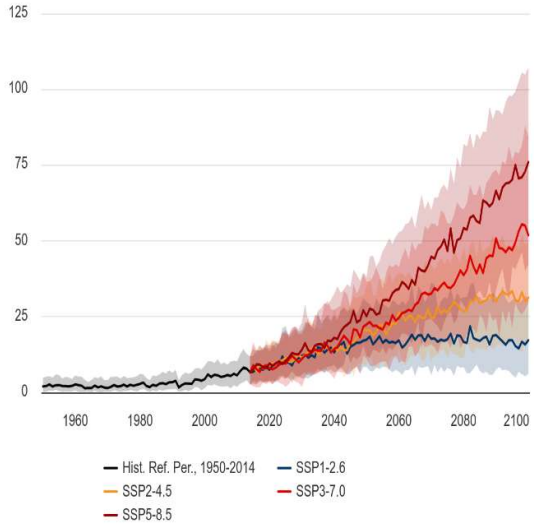


Figure 16: Projected number of hot days (Tmax >45 C) for the Governorate of Al Dhahira from 2014 to 2100, based on the IPCC's future climate scenarios (SSP1-1.9; SSP1-2.6; SSP2-4.5; SSP3-7.0 and SSP5-8.5).

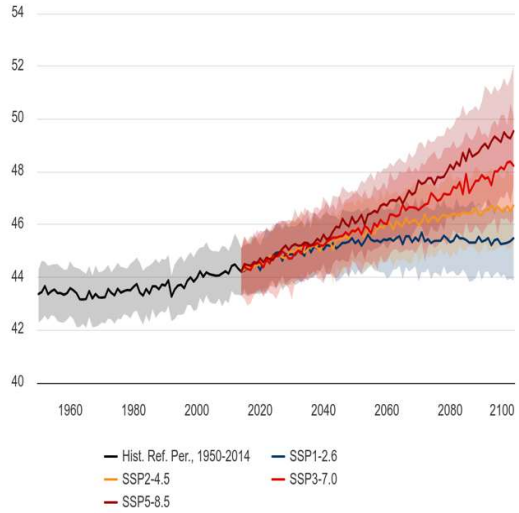


Figure 17: Projected maximum of daily max-temperature (Tc) for the Governorate of Al Dhahira from 2014 to 2100, based on the IPCC's future climate scenarios (SSP1-1.9; SSP1-2.6; SSP2-4.5; SSP3-7.0 and SSP5-8.5).

Desalination

Climate change poses significant risks to the operation and efficiency of desalination plants stations in Oman. By the 2040s, sea surface temperatures in Oman's coastal waters are projected to increase by an average of 1.76°C, with a maximum increase of 4.23°C in extreme cases.[59] Salinity levels are also expected to rise by an average of 0.17 PSU and a maximum of 0.66 PSU. These changes in water temperature and salinity can reduce the efficiency of desalination processes, particularly in the increasingly common reverse osmosis plants. Furthermore, climate change may lead to more frequent and intense harmful algal blooms and jellyfish blooms.[60] harmful algal blooms can clog and damage filtration systems and membranes, causing significant disruption to desalination operations.

While the link between climate change and harmful algal blooms is not conclusive, their occurrence is expected to increase. Jellyfish blooms, although more sporadic in Oman compared to other parts of the region, can also block intake screens and may become more common as waters warm. Additionally, sea level rise, coastal erosion and flooding pose physical risks to the infrastructure of desalination plants, although Oman's rocky coastlines are less vulnerable compared to low-lying sedimentary coasts elsewhere in the region. To maintain the performance of these critical facilities, adaptation measures will be necessary to address the challenges posed by climate change in the coming decades.

Natural hazards

The last two decades have seen several tropical cyclones hit Oman, causing significant damage and loss of life, including Cyclone Gonu in 2007, the strongest cyclone over the Arabian Sea, which particularly impacted Muscat. Other notable cyclones include Cyclone Phet in 2010, Cyclone Chapala in 2015, Cyclone Mekunu in 2018, Cyclone Luban in 2018, and Cyclone Shaheen in 2021. These events have underscored the region's vulnerability to extreme weather, potentially influenced by climate change. The increase in both the frequency and intensity of such events has highlighted the urgent need for effective measures to mitigate their impact.

4.3. Priorities and challenges in relation to adaptation

4.3.1 National priorities: Oman Vision 2040

The Sultanate of Oman recognizes the urgency and complexity of the climate crisis and is deeply committed to addressing its multifaceted challenges. Oman has embraced a comprehensive development approach placing the nation on a climate-resilient

[59] ROPME (2022) Policy Brief: Adapting desalination plants and industrial cooling water systems to climate change. ROPME (Capuzzo E., Fernand, L., Haverson, D., Harrod, O., Buckley, P., Bradley, K., Le Quesne, WJF. eds.), Cefas, Lowestoft. https://ropme.org/wp-content/uploads/2022/11/Adapting-Desalination-Plants-and-Industrial-Cooling-Water-Systems-to-Climate-Change-ROPME-Policy-Brief-2022.pdf.

[60] Middle East Desalination Research Center, https://www.medrc.org/combating-habs-threat-to-desalination-plants-in-oman-an-operational-model/.

development trajectory. The Vision 2040 highlights Oman's key performance indicators for accelerating developmental and climate actions to confront the future impacts of climate change. It underscores the imperative of global alignment, collaboration, and a shared vision to create a world where communities can thrive in the face of climate change's impacts:

- **Health**: Oman aims to establish a leading healthcare system that meets international standards. The focus will be on both preventive and clinical care, supported by strong research and sustainable funding mechanisms. A decentralized healthcare system will be promoted to ensure fairness, transparency, and accessibility across all regions.
- **Education, learning, scientific research and national capabilities:** Building a knowledge-based society is central to Oman's vision for the future. The nation will enhance high-quality education, research, and innovation, equipping Omanis with competitive skills for both local and global markets. Educational systems will be developed to nurture creativity while preserving and promoting Omani national identity.
- **Citizenship, identity and national heritage and culture:** Oman seeks to foster pride in its national identity and culture, encouraging a strong sense of citizenship among its people. Efforts will be made to preserve and promote Oman's cultural and historical heritage on a global scale. Education and media will play key roles in reinforcing cultural identity and promoting responsible citizenship.
- **Well-being and social protection:** Social justice and cohesion are critical to Oman's vision. The country will ensure the provision of sustainable social safety nets and services that support all citizens. Special emphasis will be placed on empowering vulnerable groups, including women, youth, and people with disabilities. Civic engagement and sports will also be promoted as integral parts of social development.
- **Economic leadership and management:** Oman will focus on strengthening its economic governance to ensure stability and innovation. Enhancing regulatory frameworks will support economic growth and sustainability. Effective leadership will be essential in aligning policies across sectors to foster resilience and promote long-term development.
- **Economic diversification and fiscal sustainability:** The Omani economy will diversify beyond oil, with a focus on technology, knowledge and innovation. Competitive sectors, particularly non-oil industries, will be developed to ensure long-term economic growth. Fiscal sustainability will be promoted through sound policies and optimal resource management.
- **Labour market and employment:** Oman will create a dynamic labour market that attracts talent and fosters a positive work culture. Education and employment policies will be aligned to ensure that the workforce possesses the skills needed for future markets. Regulations will be designed to enhance productivity and innovation, making the workforce more competitive.
- **Private sector, investment and international cooperation:** The private sector will be empowered as a key driver of economic growth. Oman will work to enhance its global competitiveness by investing in strategic sectors and fostering public-private partnerships. International cooperation and trade will be promoted to integrate Oman into the global economy.
- **Development of governorates and sustainable cities:** Balanced regional development will be promoted to enhance the competitiveness of Oman's governorates. Smart,

sustainable cities will be developed with world-class infrastructure. Local communities will be empowered to set their own development priorities and manage resources effectively through decentralized decision-making.

- **Environment and natural resources:** Sustainable use of natural resources will be a priority for Oman, with a strong emphasis on promoting renewable energy. Environmental, economic, and social needs will be balanced to protect ecosystems. Green policies and environmental awareness will be enhanced to ensure long-term sustainability.
- **Legislative, judicial and oversight system:** Oman will strengthen its legislative and judicial systems to promote transparency, accountability, and efficiency. The rule of law and swift justice will be ensured by using advanced technologies. Oversight systems will be implemented to combat corruption and protect the nation's resources.
- **Governance of state's administrative bodies, resources and projects:** The country aims to build high-performing, transparent government institutions. Effective management of state resources and projects will be ensured through good governance practices. Partnerships between the government, private sector and civil society will be fostered to promote sustainable development across all sectors.

4.3.2 Challenges to adaptation

Oman's climate change adaptation strategy identifies critical barriers that hinder effective planning and implementation, including a moderate legal framework that does not fully integrate climate adaptation into development policies. Additionally, there's limited progress in mainstreaming climate risks into sector-specific policies and significant gaps in decision support for financing optimal adaptation strategies. Furthermore, there's a poor understanding of the social and gender-specific impacts of climate change, potentially leading to the unintentional exclusion of vulnerable groups in adaptation processes. Engagement from both the public and private sectors remains low, with ineffective communication and educational strategies to raise awareness about climate adaptation efforts.

A particularly crucial issue is the significant gap in accessing international climate finance. This shortfall hampers Oman's ability to secure necessary funding for implementing effective climate adaptation measures. Enhancing access to these funds is vital for supporting Oman's climate resilience initiatives and ensuring the successful execution of its adaptation strategy. Addressing this financial barrier is essential for leveraging international resources to mitigate climate impacts comprehensively.

4.4. Adaptation strategies, policies, plans and goals and actions to integrate adaptation into national policies and strategies

4.4.1. Adaptation measures

Oman acknowledges the vital need for adaptation to tackle the adverse effects of climate change and strengthen climate resilience, in line with Article 7 of the Paris Agreement and the Global Goal on Adaptation.[61] Given its arid environment and heightened

[61] Oman Vision 2040. https://www.oman2040.om/VisionDocument?lang=en.

vulnerability to climate impacts, Oman is dedicated to bolstering its adaptive capacity to safeguard its population and infrastructure.

Currently, the country is actively developing a comprehensive NAP with support from GCF. The EA is collaborating with the UNIDO on this NAP project, which aims to enhance the nation's resilience against climate change impacts. This strategic framework is crucial for guiding Oman's adaptation efforts, addressing the social, economic, and environmental repercussions of climate change.

The project entails a thorough three-year assessment of vulnerabilities and adaptation options across various sectors, including agriculture, water resources, coastal regions, and infrastructure. These assessments will enable Oman to effectively prioritize and implement necessary adaptation measures.

Water resources

Oman, a water-stressed country with limited annual rainfall, has been actively pursuing adaptation strategies and economic diversification plans to address water scarcity and climate change. The country has focused on improving water management practices and enhancing groundwater recharge. Initiatives such as the Water and Sanitation for Health program, launched in 1991, have led to the development of recharge augmentation methods and the installation of monitoring wells across wadis to evaluate the effectiveness of recharge dams. By 2018, Oman had constructed 155 dams, including 64 recharge dams to replenish groundwater aquifers. However, challenges like sedimentation and siltation affect their efficiency. The Ministry of Agriculture, Fisheries and Water Resources is also maintaining and rehabilitating traditional irrigation systems, such as the aflaj, to ensure sustainable water usage and reduce reliance on groundwater.

To conserve water, Oman has enacted various Royal Decrees, such as No. 82/1988, No. 29/2000, and No. 114/2001, which regulate water extraction, prevent pollution, and protect groundwater recharge areas. The country is expanding wastewater treatment facilities using advanced technologies like membrane bioreactors in locations such as Madinat Al Sultan Qaboos and Shattie Al Qurm. Treated wastewater is reused in agriculture and other applications, promoting water efficiency and reducing the strain on natural resources. Oman's National Water Sector Master Plan (2015–2040) emphasizes initiatives like promoting water-efficient appliances, developing rainwater harvesting systems, and integrating climate change adaptation into development policies to improve resilience to extreme weather events.

Efforts are also directed at expanding the hydrometric monitoring network, upgrading flood hazard maps, and strengthening early warning systems. Projects like the Al Batinah Coastal Aquifer Recharge initiative, which injects treated wastewater into coastal aquifers, contribute to sustainable groundwater management. Multi-level stakeholder engagement plays a crucial role in addressing these challenges. MAFWR collaborates with academic institutions, government agencies, and the private sector to tackle issues like dam sedimentation and improve water management practices. Local communities are actively involved in preserving traditional systems like aflaj, ensuring sustainability and cultural heritage conservation.

Fisheries and marine resources

Oman has launched various initiatives to advance the fisheries sector sustainably while integrating climate resilience. The "Sustainable Management of the Fisheries Sector in Oman - A Vision for Shared Prosperity," developed with the World Bank, focuses on enhancing the sector's economic viability and ecological sustainability through accurate resource assessments, stakeholder-inclusive management, and the development of a sustainable value chain. Measures to address overfishing include monitoring climate change impacts on fish stocks, adjusting catch limits, implementing seasonal fishing bans, and enforcing sustainable practices like restrictions on juvenile catches and specific net sizes.

Aquaculture projects, such as Al Jazeera Shrimp Farm and Al Bustan Fish Farm, reduce pressure on coastal fisheries, while resilience-building measures enhance fishing infrastructure, including harbors, markets, and processing units, to withstand climate impacts. The establishment of Marine Protected Areas (MPAs), such as the Dimaniyat Islands and Masirah Island MPAs, supports biodiversity conservation, carbon sequestration, and ecosystem resilience. Coastal protection strategies aim to mitigate erosion and rising sea levels, complemented by mangrove conservation initiatives that restore critical ecosystems and build climate resilience.

Policies like the two-month kingfish fishing ban (15 August 2024 to 15 October 2024) ensure sustainable practices and protect vulnerable species. The Marine Science and Fisheries Centre monitors fish breeding and migration patterns to guide adaptive management in response to warming waters, while Early Warning Systems (EWS) for extreme weather events and harmful algal blooms enhance preparedness. Initiatives such as the Coastal Zone Management Programme and the development of mangrove conservation acts underscore Oman’s commitment to integrating ecosystem-based approaches into national strategies.

Collaboration among stakeholders is integral to these efforts. MAFWR works with the World Bank, local communities, private sector players and researchers to promote sustainable fisheries and aquaculture. Organizations like Fisheries Development Oman (FDO) and Oman Aquaculture Development Corporation (OADC) support local entrepreneurs in adopting climate-resilient practices. Community engagement through capacity-building activities and education on sustainable practices ensures local participation and long-term success. Subnational efforts, such as mangrove conservation and aquaculture promotion, further highlight the importance of localized actions in achieving national sustainability goals.

Agriculture and allied sectors

Oman is actively integrating climate resilience into its agricultural sector through initiatives like the 2040 Sustainable Agriculture and Rural Development Strategy (SARDS 2040), aligned with Oman’s Vision 2040. This strategy promotes sustainable agricultural practices, adoption of modern technologies, enhanced farmer professionalism, and increased productivity while minimizing environmental impacts such as water and energy usage. Key projects include genetic engineering for crop improvement,

hydroponic vegetable and feed production, integrated pest and disease management for date palms, and the introduction of modern irrigation systems. Large-scale initiatives, such as the Million Date Palm Plantation Project and the nationwide planting of 10 million native trees, aim to combat desertification, enhance biodiversity, and improve air quality, contributing to carbon sequestration and climate mitigation. Additionally, the Building Resilient Environment and Sustainable Agriculture and Water project, funded by GCF, addresses saltwater intrusion and promotes climate-resilient crops, supporting both adaptation and mitigation goals.

Efforts to reduce agriculture's environmental footprint include replacing water-intensive crops like Rhodes grass with alternatives such as wheat, improving energy efficiency, utilizing treated wastewater to combat salinity, and adopting renewable energy sources. Oman is also building long sea defense dams, such as those at Khor Al Rustaq, to prevent saline intrusion and enhance groundwater recharge. Rangeland management, invasive species control, and sustainable livestock systems are being implemented to ensure resilience and long-term sustainability in agricultural practices.

Climate change adaptation is embedded in the sectoral planning framework through initiatives like the National Strategy for Agriculture and Rural Development (2013–2017) and its successor, SARDS 2040, which integrate natural disaster risk management and climate-resilient practices into agricultural policies and programs. Investments are focused on knowledge management of coastal aquifers, evaluating irrigation vulnerabilities, and developing adaptive strategies for crops and livestock. Sustainable practices, such as tissue propagation of improved fruit varieties and the use of treated water in agriculture, align with efforts to build resilience. Food security initiatives, led by the Oman Food Investment Company (OFIC) and Tanfeedh, prioritize agriculture as a key sector for economic diversification, with strategies for import substitution and export enhancement further reinforcing climate adaptation and mitigation co-benefits.

MAFWR collaborates with national organizations like OFIC and international partners, such as, to advance sustainable agricultural practices. Private sector firms, like OQ, support treated water use for fodder cultivation, while subnational and community-level efforts, led by the Omani Agriculture Association, promote smart technologies to reduce farming costs and improve efficiency. Local farmers are engaged through capacity-building activities, ensuring adaptability to climate challenges. Large-scale initiatives, including tree-planting campaigns and rangeland interventions, exemplify collective efforts to achieve sustainability goals while fostering resilience at the community level.

Urban areas, tourism and infrastructure

Oman is advancing climate adaptation and economic diversification through the Oman Spatial Strategy 2040,[62] which aims to enhance urban water drainage systems, mitigate flood risks and manage scarce water resources effectively, in alignment with Oman's Vision 2040. Key strategies include modernizing drainage networks with retention basins, adopting Sustainable Urban Drainage Systems (SUDS) such as permeable pavements and green roofs to reduce runoff and increase groundwater recharge, and conducting

[62] Oman National Spatial Strategy 2040. https://andp.unescwa.org/plans/1459.

comprehensive flood mapping and risk assessments to guide infrastructure improvements. Enhanced wadi management focuses on reinforcing wadi beds and constructing dams to control sudden floods while enabling sustainable urban development. Investments in large-scale storage and protection dams, desalination facilities, and water distribution networks further support climate adaptation and water security.

Urban sustainability initiatives include the Sultan Haitham Smart City project, designed for 100,000 residents near Muscat, integrating energy-efficient infrastructure and green urbanization. In alignment with the Net Zero 2050 Agenda, Oman is promoting electric vehicle (EV) adoption, incentivized by the Ministry of Energy and Minerals, and expanding EV networks, including self-driving vehicles and charging infrastructure, aiming to reduce per capita carbon emissions to 0.85 tons annually. Solid waste management is a critical focus, with be'ah planning to launch a biogas facility by 2026 to convert organic waste into sustainable energy. Oman is promoting the use of recycled materials through a global secondary market exchange and implementing extended producer responsibility initiatives to encourage eco-friendly product design and recycling.

Climate resilience is central to Oman's National Urban Development Strategy, which spans 20 years and emphasizes sustainability while meeting development objectives. This includes the development of national building and design codes to ensure structures can withstand climate challenges such as heatwaves, storms, and floods while maintaining a low carbon footprint. The Ministry of Housing and Urban Planning has introduced urban greenery guidelines to reduce urban heat islands and expand green cover. Disaster management studies by the Civil Aviation Authority, using tools like ATLAS and Storm Search, identify flood-prone areas, while the Coastal Vulnerability Index (CVI) prioritizes urban zones at risk from extreme weather and tsunamis.

These initiatives involve collaboration across stakeholders, including government entities, the private sector and local communities. Subnational efforts focus on community-level resilience through capacity-building programs and sustainable urban planning. Be'ah drives waste management innovations, while companies like OQ contribute to renewable energy integration and EV infrastructure development. Local actions, such as expanding urban greenery and promoting sustainable drainage systems, highlight community engagement in achieving climate adaptation and mitigation goals. Private sector contributions, including eco-friendly building designs and waste recycling solutions, complement national efforts, creating a comprehensive framework for resilient and sustainable urban development.

Public health

Oman's Health Vision 2050[63] provides the strategic framework for the public health sector, focusing on improving the overall health system. This vision is supported by initiatives such as the establishment of wilayat health committees, which enhance collaboration across sectors like environment, water, education, and agriculture. These committees, led by local leaders, identify community health issues and devise solutions

[63] Ministry of Health 2014, Health Vision 2050. https://faolex.fao.org/docs/pdf/oma169441.pdf.

while ensuring effective communication between the health sector, other related sectors, and NGOs. However, while climate change adaptation within the public health sector is yet to be specifically planned, Oman is accelerating its One-Health System, which seeks to achieve a sustainable balance by improving human, animal, plant and ecosystem health.

In line with this, Oman launched a central public health laboratory in February 2023, under the directives of His Majesty Sultan Haitham bin Tarik, to promote health, prevent diseases and support public health and environmental conservation efforts. Additionally, Oman has established Ambient Air Quality (AAQ) standards and operates monitoring stations in key locations like Rusail, Raisout Harbor, and Sohar Industrial areas, along with initiatives on chemical safety, food safety, and occupational health and safety. Integrated health systems, including primary, secondary, and tertiary treatment facilities, are also being developed to improve healthcare delivery and enhance resilience to health challenges.

In terms of disaster preparedness and resilience, Oman is strengthening its National Emergency Management System, which coordinates multiple agencies during emergencies and provides real-time information on disasters. The National Committee for Civil Defense (NCCD) oversees disaster preparedness and response, while the Civil Aviation Authority uses advanced weather forecasting tools to predict extreme events. Oman has invested in early warning systems, leveraging satellite data to provide timely alerts to vulnerable communities. Shelters equipped with essential amenities are strategically established in disaster-prone areas to protect citizens during cyclones and floods. Efforts to design infrastructure that can withstand extreme weather events, including flooding and cyclonic winds, further enhance climate resilience.

Oman collaborates with international organizations such as the United Nations and the World Health Organization to adopt best practices in disaster preparedness and response. Stakeholder involvement spans government agencies, the private sector, and local communities, ensuring that resilience-building efforts are comprehensive and include subnational actions. Community-level engagement and capacity-building initiatives are critical for integrating health and climate adaptation strategies, while private sector participation plays a pivotal role in developing infrastructure and technologies that support climate resilience and sustainable health outcomes.

4.4.2. Science, gender perspectives and traditional knowledge related to adaptation

Gender perspectives

Oman has made progress in gender equality, particularly in education, land ownership, and workforce participation. However, gender perspectives are not yet fully integrated into climate change policies, despite the country's active participation in global conventions like the Convention on the Elimination of All Forms of Discrimination against Women (CEDAW). Gender disparities remain in political engagement and leadership roles, and Oman lacks a comprehensive gender analysis or data on how men and women are differently affected by climate change. This gap limits inclusive adaptation strategies.

While initiatives like the Oman Women's Association and the Sidab Women's Group empower women socially and economically, research on how climate change affects them remains scarce. The absence of gender-disaggregated data in adaptation efforts further challenges the development of gender-sensitive policies. Women, particularly in agriculture and domestic roles, may face unique climate-related vulnerabilities, such as heat stress and water scarcity.

Oman plans to address these gaps by developing guidelines for integrating gender equality into climate programs, producing a gender-responsive National Climate Change Adaptation Policy (NCCAP), and conducting assessments on gendered climate impacts. A gender-sensitive National Adaptation Monitoring Framework and a stakeholder engagement strategy focused on vulnerable groups, including women, are also in progress.

Traditional knowledge related to adaptation

Oman's rich heritage of traditional agricultural practices, particularly in the mountain oases, exemplifies sustainable land-use strategies that have been honed over centuries. These practices are vital for managing water resources in arid conditions and can inform modern agricultural techniques. For instance, the ancient irrigation methods used in Jabal Akhdar have maintained soil health and prevented salinization, providing valuable lessons for sustainable agriculture under climate stress.

The integration of traditional knowledge with scientific approaches enhances biodiversity conservation efforts. Traditional ecological knowledge is increasingly recognized for its role in managing local ecosystems sustainably. However, there is a noted gap in linking this knowledge with formal biodiversity conservation policies. Efforts are under way to document and assess traditional knowledge related to biodiversity to ensure its incorporation into national strategies.

4.4.3. Priorities

These priorities are aligned with Oman's national strategies and commitments, including its National Strategy for Adaptation and Mitigation to Climate Change (2020-2040), and its NDC under the Paris Agreement:

1. **Strengthening governance and institutional coordination**: Improving the adaptation planning framework and building mechanisms for monitoring and evaluation of climate adaptation measures. This involves strengthening governance, enhancing coordination between institutions and integrating adaptation strategies across various sectors.

2. **Developing evidence-based adaptation solutions**: Reinforcing the foundation for adaptation through scientific assessments and cost-benefit evaluations. This includes analyzing vulnerabilities in critical sectors such as water, agriculture, fisheries, and infrastructure, and using this evidence to formulate Oman's NCCAP.

3. **Increasing adaptation financing**: Enhancing knowledge among stakeholders regarding climate finance and external funding options for adaptation projects. The plan includes developing high-quality project proposals and concept notes to attract international funding, such as through GCF.

4.4.4. Nature-based solutions involved in climate change adaptation

Oman has implemented several initiatives that leverage nature-based solutions to address climate change adaptation, sustainable development, and ecosystem restoration:

- **A sustainable agriculture and rural development strategy:**[64] MAFRW requested support from the Food and Agriculture Organization of the United Nations (FAO) to develop a national strategy for agriculture and rural development, aligned with the National Vision 2040 then under formulation. The project produced a number of studies to provide background information to facilitate the formulation of the Sustainable Agriculture and Rural Development Strategy (SARDS) of the Sultanate of Oman and its Five-Year Plan. The objective of the project was thus to support the government in analyzing the existing situation and formulating a sustainable agricultural development and rural development strategy to address the efficient and sustainable use of the scarce natural resources for the improved livelihoods of the Omani people.
- **National initiative to plant 10 million trees:**[65] This initiative was conceived as a continuation of the Environment Authority's efforts to raise awareness and educate the public about preserving wild plants, combating desertification, and contributing to the expansion of green spaces in Oman. It was officially launched on 8 January 2020, in collaboration with Petroleum Development Oman and in partnership with various sectors, including government, private entities, and civil society.
- **Mangrove restoration:**[66] The Oman Blue Carbon project, a pioneering initiative by the Environment Authority in collaboration with MSA Green Projects Company, seeks to plant 10 million mangrove trees throughout the Sultanate. This large-scale effort will greatly improve the natural environment, with the potential to

[64] A sustainable agriculture and rural development strategy for Oman, https://www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=https://andp.unescwa.org/sites/default/files/2020-10/Sustainable%2520Agriculture%2520and%2520Rural%2520Development%2520Strategy%2520towards%25202040%2520-%2520SARDS%25202040.pdf&ved=2ahUKEwj3v8v58feMAxWEhf0HHXisDioQFnoECBwQAQ&usg=AOvVaw1Ya_77dNRC8ZbH4WYtQ5Ua.

[65] National Initiative to plant 10 million trees. https://ashjar.ea.gov.om/Default.aspx#:~:text=About%20the%20national%20initiative%20to,in%20the%20Sultanate%20of%20Oman.

[66] FAO (2024) "Leading the way: Gulf countries' efforts in mangrove restoration," https://www.fao.org/neareast/news/blog/blog-details/greening-agriculture--water-scarcity-and-climate-action/2024/07/25/leading-the-way--gulf-countries'-efforts-in-mangrove-restoration/en#:~:text=In%20Oman%2C%20the%20Oman%20Blue,significantly%20enhancing%20the%20natural%20environment.

reduce carbon dioxide emissions by 1.4 million tons. FAO is also set to launch a comprehensive mangrove restoration programme in Oman to protect and enhance the country's coastal mangrove ecosystems, addressing the various threats they face. This partnership will harness the significant carbon sequestration potential of mangroves, aligning with Oman's national goal of reaching net-zero carbon emissions by 2050. The collaboration will also support the implementation of the UN Decade on Ecosystem Restoration in Oman, empower fishing communities to take an active role in mangrove restoration for the benefit of their livelihoods, and utilize advanced monitoring systems, such as FAO's SEPAL platform, to improve restoration tracking techniques.

- **Million Date Palm Plantation Project:**[67] The Million Date Palm Plantation Project is one of the biggest leading projects in the Sultanate. This is due to the offshoots that shall enhance the country's economic growth, social development and environmental awareness. Most importantly, enhancing the role of date palm in the agriculture sector to keep pace with the future requirements and the social needs. The Million Date Palm Plantation Project has 11 farms so far that are spread in different regions of the Sultanate, such as Ibri, Nizwa, Al Safa, Rahab and much more. Each of these farms are homes to between 10 to 100 thousand palm trees.

4.5. Progress on implementation of adaptation

Oman has embarked on a comprehensive journey toward climate adaptation, guided by a strategic vision that aligns with both national priorities and international commitments. The approach is characterized by systematic planning, implementation of targeted initiatives, and continuous refinement of strategies to address emerging climate risks.

Table 19 provides an overview of Oman's progress in climate change adaptation across various key sectors, highlighting the strategic vision, foundational adaptation efforts, risk evaluation, adaptation implementation, monitoring and evaluation, and climate finance. This overview reflects the achievements and ongoing challenges in Oman's climate adaptation journey, as guided by the National Strategy for Adaptation and Mitigation to Climate Change 2020-2040 and supported by the GCF NAP (2023-2026).

A detailed assessment of progress in specific sectors—water, agriculture, fisheries, infrastructure (including urban areas and tourism), and public health—is provided in **Annex 3**. This assessment offers an in-depth analysis of how adaptation measures are being implemented and the results achieved in these critical areas, providing a clearer understanding of the challenges and successes in Oman's climate adaptation efforts.

[67] Million Date Palm Plantation Project (2024), http://nakheel.om/?page_id=841#:~:text=Ibri%20farm%20is%20located%20in,male%20date%20trees%20of%20464.

Table 19: Overview of Oman's progress in climate change adaptation across key sectors

Category	Key activities	Degree of implementation	Current status and future direction
Strategic vision	- Formulation of long-term goals across sectors - Alignment with national and international climate commitments	Partially completed	Long-term goals are defined, but further integration of climate adaptation is needed. The National Strategy for Adaptation and Mitigation to Climate Change 2020-2040 provides a strategic vision based on climate science, vulnerability assessment, and sustainable development. The GCF NAP (2023-2026) and the proposed GCF readiness project on climate adaptation technologies (2025-2027) will refine these goals, integrating advanced technologies and strategic frameworks for increased resilience.
Foundation for adaptation	- Assessment of current state of resources and vulnerabilities - Development of adaptation strategies aligned with climate goals	Ongoing and continuous	Progress has been made in assessing resources and developing adaptation strategies. The Climate Change Strategy 2020-2040 offers a knowledge base through climate projections and sectoral vulnerability assessments. The GCF NAP (2023-2026) and the proposed GCF readiness project on climate adaptation technologies (2025-2027) will focus on identifying and deploying suitable adaptation technologies, conducting sector-specific adaptive capacity assessments, and developing cost-effective strategies to strengthen national resilience.
Evaluating climate change risks	- Analysis of climate projections and impacts - Identification of vulnerabilities and impact evaluations in key sectors	Ongoing and continuous	Ongoing analysis of climate projections and sector-specific vulnerability assessments are being conducted, supported by the GCF NAP (2023-2026) and the Climate Change Strategy 2020-2040. The proposed GCF readiness project on climate adaptation technologies (2025-2027) will enhance these efforts by refining climate models, improving localized impact assessments, and assessing technological needs across critical sectors, particularly in water, agriculture, and public health.
Adaptation options and implementation	- Exploration of adaptation methodologies - Implementation of	Ongoing and continuous	Adaptation options are under exploration, with several pilot projects in development. The Climate Change Strategy 2020-2040

	pilot projects - Execution of cost-benefit analyses and development of risk management strategies		and the GCF NAP (2023-2026) emphasize sector-specific adaptation strategies. The proposed GCF readiness project on climate adaptation technologies (2025-2027) will accelerate the implementation of these projects by focusing on adaptation technologies, conducting detailed cost-benefit analyses, and developing comprehensive risk management strategies tailored to Oman's needs.
Monitoring and evaluation	- Establishment of monitoring systems - Setting of evaluation criteria	Partially completed	Monitoring and evaluation systems are being developed but need enhancement. The Climate Change Strategy 2020-2040 supports the establishment of comprehensive monitoring frameworks. The GCF NAP (2023-2026) and the proposed GCF readiness project on climate adaptation technologies (2025-2027) will strengthen these efforts by integrating real-time data collection, applying advanced technologies for improved analysis, and ensuring that evaluation criteria are responsive to evolving climate conditions and technological advancements.
Climate finance	- Identification of climate finance sources - Development of strategies for accessing climate finance	Ongoing and continuous	The GCF NAP (2023-2026) is developing three concept notes for funding to GCF to support ongoing and future adaptation initiatives. Additionally, the proposed GCF readiness project on climate adaptation technologies (2025-2027) will develop further concept notes for GCF funding, focusing on securing resources for the implementation of advanced adaptation technologies. These efforts are aimed at securing diversified, sustainable funding and improving private-sector engagement in climate adaptation initiatives.

4.6. Information related to averting, minimizing and addressing loss and damage associated with climate change impacts

Oman is increasingly at risk from extreme weather events, such as cyclones, floods and heatwaves, which are becoming more frequent and severe due to climate change. Over the past two decades, these events have caused significant damage, particularly to infrastructure, agriculture, and public health. From 2002 to 2021, Oman suffered economic losses totalling approximately $7.30 billion, primarily due to severe cyclones

like Cyclone Gonu in 2007 and Cyclone Mekunu in 2018, which caused billions in damages and significant loss of life.

Observed and potential climate change impacts

The best available science shows that Oman is facing growing climate-related risks, including cyclones, floods, heatwaves and droughts. These extreme weather events have increased in frequency and severity, causing significant economic and social damage. By 2040, projected economic losses due to these events could reach $13.14 billion, with infrastructure damage potentially accumulating to $9 billion. Agriculture, a vital sector in Oman, particularly date palm exports, is also highly vulnerable, with projected losses of $540 million due to extreme heat and drought. Public health costs, mainly from heat-related illnesses, are expected to rise to $1.17 billion. The energy grid could incur an additional $150 million in costs due to increased demand during heatwaves, while water scarcity could lead to further losses of $360 million. If no action is taken, the cumulative GDP loss due to reduced productivity and other factors could reach $72 billion by 2040.

Activities to avert, minimize and address loss and damage

Oman recognizes the need to enhance its early warning systems and build climate resilience to avert and minimize future loss and damage. The National Multi-Hazard Early Warning Centre (NMHEWC), managed by the Directorate General of Meteorology, is a critical component of the country's disaster risk reduction strategy. Established in 2015 with support from the Intergovernmental Oceanographic Commission of UNESCO (IOC-UNESCO), NMHEWC aligns with the Sendai Framework for Disaster Risk Reduction. While the system effectively monitors water-related hazards such as cyclones, floods and tsunamis, it faces significant challenges, including outdated technology and gaps in coverage for emerging climate risks like heatwaves, droughts and dust storms.

To address these vulnerabilities, Oman plans to upgrade NMHEWC by integrating cutting-edge technologies, expanding its coverage to include a wider range of climate-related risks and strengthening human and technical capacities. This upgrade would improve the accuracy of weather predictions and broaden hazard monitoring, enabling better preparedness and response to future climate risks. Oman also seeks support from GCF to finance these upgrades, which would include developing robust data integration platforms, enhancing forecasting tools and implementing comprehensive training programmes.

Institutional arrangements for implementation

NMHEWC, aligned with global disaster frameworks, is central to Oman’s climate adaptation strategy. However, gaps in its technological infrastructure and hazard coverage limit its full potential. Enhancing the system will require coordinated efforts between government agencies, international partners and technical experts. Support from GCF is essential for realizing these ambitious improvements. Through financial and technical backing, Oman aims to implement the necessary upgrades to NMHEWC, ensuring it can handle future climate risks and provide timely, accurate early warnings.

Investing in these improvements will align Oman's climate resilience efforts with its national priorities, protecting infrastructure, reducing economic losses, and safeguarding public health. Additionally, by bolstering early warning systems, Oman can better meet its international climate commitments and potentially secure $500 million in climate funding, further supporting its sustainable development goals.

4.7. Cooperation, good practices, experience and lessons learned

4.7.1. Efforts to share information, good practices, experience and lessons learned

Oman, under the leadership of the EA, has been actively sharing information, good practices, experiences and lessons learned in climate adaptation. The Sultanate has developed comprehensive national strategies, such as the National Climate Change Adaptation Framework, which integrates the latest scientific research to ensure informed decision-making. Oman participates in regional platforms like the Gulf Cooperation Council (GCC) and international forums such as the UNFCCC, sharing its approach to incorporating science into adaptation planning.

Oman is spearheading innovative pilot projects in partnership with national and international stakeholders, focusing on critical sectors such as water management, coastal protection, and sustainable agriculture. The insights and outcomes from these initiatives are shared through government reports, workshops and international conferences, contributing to global knowledge on climate adaptation and sustainability.

As part of its efforts to enhance food security and economic sustainability, the Ministry of Housing and Urban Planning, in collaboration with MAFWR, is advancing the Agricultural Cities project. This initiative aligns with national and regional urban strategies, aiming to promote agricultural sustainability by integrating advanced technologies like hydroponics, aeroponics, and fish farming. It also focuses on developing sustainable agricultural infrastructure and increasing local production to meet future demands.

Adaptation measures are integrated at national, regional and local levels. The Ministry of Environment and Climate Affairs (MECA), along with MAFWR and the Supreme Council for Planning, tailors these actions to meet the unique needs of various regions, ensuring their effectiveness and sustainability. Oman also shares its experience with GCC countries, offering valuable insights for regional adaptation planning.

Through partnerships with international organizations, research institutions, and academic bodies, including the World Meteorological Organization (WMO) and the International Centre for Integrated Mountain Development (ICIMOD), Oman strengthens its scientific and institutional capacities in climate adaptation.

Oman's commitment to sustainable development is evident through its cross-sectoral efforts in water management, agriculture, coastal protection, and disaster risk reduction, demonstrating best practices for building resilience in vulnerable communities and ecosystems. Notable initiatives include the Nimr Water Treatment Plant (NWTP), the world's largest treatment wetland spanning 5 million m^2. It treats oil-

contaminated wastewater with 99 per cent less energy than conventional methods, repurposing the water for crop irrigation while enhancing biodiversity.

Additionally, Oman has launched the Building Resilient Environment and Sustainable Agriculture and Water Project in collaboration with FAO, funded by GCF and Oman's government. This $949,388 project addresses challenges such as seawater intrusion, water scarcity and sustainable resource management through studies on the aflaj system and groundwater quality.

MAFWR is also advancing a 20-hectare onion cultivation project in Dhank to boost local production, reduce imports and strengthen food security, providing technical and financial support to local agricultural firms. These efforts highlight Oman's integrated approach to sustainability and resilience.

Oman has emphasized the importance of international cooperation to advance sustainable development, as demonstrated during the second regular session of the UNICEF Executive Board. Highlighting its commitment to Africa's development agenda, Oman signed an agreement with UNESCO on 22 January 2021, amounting to €583,566. This initiative supports a three-year capacity-building programme to enhance sustainable development through heritage conservation in five Eastern African countries: Comoros, Kenya, Madagascar, Somalia and the United Republic of Tanzania.

4.7.2. Strengthening scientific research and knowledge

Oman is committed to strengthening scientific and research knowledge to inform climate adaptation strategies, including efforts to improve systematic observation, early warning systems, and vulnerability assessments. National institutions like the Directorate General of Meteorology and the National Centre for Climate Studies (NCCS) are dedicated to climate research and enhancing systematic observation systems. These systems improve early warning capabilities and provide timely, accurate information for climate services and decision-making. Oman's collaborations with international institutions, such as the IPCC, have expanded the country's ability to understand climate variability and predict future risks.

Research efforts, coordinated by MECA and the National Centre for Environmental Data and Monitoring, focus on identifying vulnerabilities in ecosystems and communities. This research supports the development of targeted adaptation strategies that address specific regional challenges. The government shares its research findings with other countries, contributing to global knowledge on vulnerability and adaptation.

Oman is also committed to improving its monitoring and evaluation systems to track the effectiveness of adaptation actions. These systems are continuously refined to respond to evolving climate risks. By integrating lessons learned from international best practices, Oman enhances the overall effectiveness and sustainability of its adaptation measures.

4.8. Improvement plan for adaptation monitoring and evaluation

The current reporting on applied and planned adaptation measures is evidently lacking verifiable qualitative and quantitative data. To overcome these limitations, Oman will develop clear, traceable qualitative and quantitative indicators for key adaptation policies and measures. This will be further detailed in the NAP under preparation and the new NDC. Moreover, the newly established institutional arrangements will clarify the roles and responsibilities for adaptation projects' monitoring and evaluation.

5. FINANCING, DEVELOPMENT AND TRANSFER OF TECHNOLOGY AND CAPACITY-BUILDING NEEDED AND RECEIVED

Articles 9, 10, and 11 of the Paris Agreement highlight the essential roles of financial support, technology transfer, and capacity building in advancing global climate action. Article 9 focuses on mobilizing financial resources to assist developing countries in their mitigation and adaptation efforts. Article 10 emphasizes the importance of fostering innovation and facilitating the development and transfer of environmentally sound technologies to support sustainable development. Article 11 underscores the need for enhanced cooperation among Parties to promote effective capacity-building initiatives and strengthen institutional capabilities.

In alignment with these principles, the Sultanate of Oman has implemented several initiatives tailored to its unique national circumstances, institutional arrangements, and strategies. This section outlines Oman's specific needs and the support it has received, including financial assistance, development aid, technology transfer, and capacity-building efforts under Articles 9, 10, and 11 of the Paris Agreement.

5.1. National circumstances, institutional arrangements and strategies driven by the country

Oman, recognizing the urgent need to address climate change, has established a national institutional framework to coordinate and implement climate action strategies. The Environment Authority, established in 2020 by Royal Decree No. 106/2020, serves as the principal regulatory body responsible for environmental management, conservation and oversight of climate-related policies and strategies. The EA plays a central role in coordinating efforts to access financial resources and in implementing projects and initiatives focused on both mitigation and adaptation. It also enhances cooperation in technology development and transfer, facilitates the adoption of climate-friendly technologies, and promotes capacity-building initiatives to strengthen Oman's resilience to climate change impacts.

The EA currently acts as the primary national entity responsible for administrative and regulatory action in response to both national and international climate change obligations. In the area of climate finance, the Government of Oman has nominated the EA as the National Designated Authority (NDA) to GCF, ensuring that all GCF-supported activities align with the country's national priorities and policy frameworks.

- **Mitigation:** The Sultanate of Oman is committed to achieving net-zero greenhouse gas emissions by 2050. The pathway to net zero involves significant transformations across key economic sectors, including the adoption of decarbonization levers and behavioral changes in production and consumption patterns. To facilitate this transition, Oman is investing in new infrastructure and introducing policies and legislation that incentivize the green economy approach.

The renewable energy targets have been updated under the National Energy Master Plan: Oman aims to achieve 16 per cent of its electricity generation from renewable sources by 2025 and 30 per cent by 2030. Additionally, Oman plans to secure more than 2.6 GW of clean energy capacity by 2025.

Oman's commitment to the energy transition is further reinforced through its Green Hydrogen Strategy, launched in 2022. As part of this strategy, Oman aims to become one of the leading producers and exporters of green hydrogen, targeting the production of 1 million tons annually by 2030.[68] To date, the country has signed eight project development agreements with a combined anticipated production capacity of approximately 1.4 million tons. Oman is also actively exploring opportunities in the emerging field of geologic hydrogen.

The green transition path is expected to attract an estimated $190 billion in additional investments.[69] This investment will cover infrastructure development, optimization of the socioeconomic impacts of the energy transition and support for decarbonization initiatives across sectors, including transport, oil and gas, buildings and industry.

As of 2021, Oman's net greenhouse gas emissions totaled approximately 90.73 $MtCO_2eq$, with five sectors—industry, oil and gas, power generation, transport and buildings—accounting for about 95 per cent of total net emissions. To achieve its net-zero target, Oman will deploy six decarbonization technologies: energy and resource efficiency, electrification and renewable energy, battery electric technologies, sustainable hydrogen, carbon capture and storage, and negative-emission solutions.

- **Adaptation:** Oman is also subject to climate change-related stresses. In recent years, climate change-related stresses to the Sultanate have increased, as evidenced by changes in the number, duration and intensity of tropical cyclones, record breaking heat waves and storm surge hazards, all of which pose threats to infrastructure, urban areas, and tourism. The trend is likely to continue and the country is likely to continue experiencing higher temperatures, more intense weather events and other climate hazards such as heat waves and droughts.[70] In alignment with its commitments under the Paris Agreement, Oman has identified key priority areas for support and intervention. Given its arid climate and vulnerability to water scarcity, Oman has prioritized initiatives aimed at enhancing water resource management and promoting sustainable agricultural practices resilient to climate variability. Additionally, recognizing the importance of renewable energy in reducing GHG emissions and enhancing energy security, Oman has embarked on ambitious renewable energy development projects, such as wind and solar power installations. Moreover, to enhance preparedness against extreme weather events, the Sultanate has submitted a concept note to

[68] Sustainable Finance Framework Policy Adaptation Report.
[69] *Oman Net Zero Report 2022*.
[70] GCF Country Programme.

GCF for improving the capabilities of its National Multi-Hazard Early Warning Centre by providing targeted state of the art technologies and capacity building.

Oman has also adopted several policies and strategies that reflect its commitment to climate action. Most prominent strategy is Oman Vision 2040, ("the Vision")[71] which sets priority action across six main national programmes, one of which is the National Program for Carbon Neutrality. The Sultanate has also integrated climate considerations into its broader development strategies, including the Ninth Five-Year Development Plan, which emphasizes sustainable development and environmental conservation. Furthermore, Oman's national Strategy for Adaptation and Mitigation to Climate Change 2020-2040 underlines the urgent need to address the challenges faced by urban areas, tourism and infrastructure due to the impending impacts of climate change. With 80 per cent of Oman's population residing in areas prone to flooding, there's a clear emphasis on understanding and mitigating risks associated with sea level rise, tropical cyclones and other extreme events. The strategy incorporates a comprehensive approach, targeting knowledge management, capacity building and enhanced governance. It also highlights the imperativeness of updating hazard maps, coastal zone regulations and conducting climate impact assessments, especially in coastal regions.

MoF has established a Sustainable Finance Framework to issue green, social, and sustainability bonds, loans, or sukuk (collectively, Sustainable Finance Instruments) for projects with environmental and social benefits. The Framework aligns with international standards, including ICMA's Green Bond Principles (2021), Social Bond Principles (2023), Sustainability Bond Guidelines (2021), and LMA's Green Loan Principles (2023) and Social Loan Principles (2023).[72]

Although Oman currently lacks established institutional arrangements to specifically track mitigation and adaptation public climate funding, MoF is in charge of tracking all public funding received, its beneficiaries and its mobilization. Moving forward, a climate fund tracking unit is proposed to be operationalized, with the direct support of ONZC (for mitigation projects) and the EA (for adaptation projects). A clear system of identification and categorization of climate projects under these two pillars shall be established, facilitating access to international funding bodies and enhancing the transparency and completeness of the climate finance tracking aspect.

In addition, Oman Development Bank has been taking concrete steps towards getting accredited under GCF for receiving international climate funding. The bank will be able to track funds allocation and mobilization across approved projects and report back to the designated climate finance monitoring body.

Aligned with Oman Vision 2040, the Muscat Stock Exchange (MSX) has introduced ESG Disclosure Guidelines for public joint stock companies (SAOGs). These guidelines help listed companies report their ESG performance, showcasing their commitment to sustainable growth to stakeholders, investors, and the wider community. In 2024,

[71] https://www.oman2040.om/?lang=en.
[72] Sustainable Finance Framework.
,https://www.mof.gov.om/UploadsAll/ProjectsSectionsTabs/172432409407317048811759 57Sustainable%20Finance%20Frameworkcompressed.pdf.

companies are encouraged to voluntarily report their 2023 activities based on 30 ESG metrics. From 2025, mandatory reporting on 2024 activities will begin, with the first reports due by 31 March 2025.[73]

Oman faces several limitations in tracking and reporting climate finance effectively. One of the key challenges is the limited institutional capacity to systematically monitor and report financial flows related to climate action. Additionally, gaps in data availability, hinder the ability to assess the use and impact of climate finance, making it difficult to ensure transparency and accountability. There is also a need for improved coordination among various entities involved in climate finance and project implementation to enhance efficiency and streamline reporting processes.

The country's engagement programme with GCF also has focused its objectives on leveraging climate investments in strategic areas including water resources, marine and fisheries, agriculture, urban areas, tourism, infrastructure, public health and energy. Oman's strategic engagement with GCF is anchored on the country's climate vulnerabilities and involves knowledge generation, capacity building, governance and policy for climate response. The engagement with GCF will seek to accelerate technology transfer and innovation in climate-resilient infrastructure and practices, starting with early warning systems.

5.2. Underlying assumptions, definition and methodologies

Assumptions based on the reporting requirements for support needed and received, as outlined in Oman's first BTR under Article 13 of the Paris Agreement, are shown in **Table 20**.

Table 20: Underlying assumptions, definition and methodologies

Assumption area	Assumptions description	Underlying assumptions, definitions, and methodologies
(a) Currency conversion	Conversion of domestic currency (OMR) into US dollars	Exchange rates used for conversion are based on the annual average rate provided by the **Central Bank of Oman**.
(b) Estimating support needed	Methodology for calculating the amount of support required for mitigation and adaptation activities	Support needs are calculated based on **national adaptation and mitigation plans**, sectoral investment requirements, feasibility studies, and financing gap assessments. Adjustments consider inflation and projected climate-related costs.
(c) Reporting year or time frame	Determining the appropriate time frame for reporting support needed and received	The reporting period aligns with **Oman's BTR submission cycle**, typically covering a **biennial timeframe**, with financial data reported for the **latest completed year**.
(d) Identification of support sources	Identifying support from specific sources (bilateral,	Financial contributions are categorized by **source**, including **bilateral, multilateral,**

[73] MSX ESG Disclosure Guidance. https://www.msx.om/MSMDOCS/downloads/ESG-MSX-E.pdf.

	regional, multilateral, private sector, etc.)	**and private sector financing**, ensuring transparency in tracking climate finance.
(e) Determining status of support (committed, received, needed)	Categorizing support based on its status: committed, received, or still needed	**-Committed support** refers to pledged or approved funding. - **Received support** includes funds that have been disbursed. - **Needed support** is based on financing gaps identified in **Oman's NDC and adaptation plans**.
(f) Activity status reporting (planned, ongoing, completed)	Methodology to report the status of supported activities	Activities are classified based on the **latest implementation status reports**, financial disbursements, and project monitoring frameworks.
(g) Reporting channels (bilateral, regional, multilateral)	Identifying the channel through which support is provided	Financial flows are categorized by **funding channel**, distinguishing between **bilateral cooperation agreements, regional climate funds, and multilateral funding mechanisms.**
(h) Type of support (mitigation, adaptation, cross-cutting)	Categorizing support based on its focus area	Climate finance is classified under **mitigation, adaptation, or cross-cutting** categories based on **intended project objectives** and sectoral focus.
(i) Financial instruments (grants, loans, equity, etc.)	Specifying the financial instrument used for support	Funding is categorized based on financing agreements, distinguishing between **grants, concessional loans, non-concessional loans, equity investments, guarantees, and other mechanisms**.
(j) Reporting sectors and subsectors	Defining which sectors and subsectors the support is allocated to	Funding allocations are mapped to specific **sectors (energy, transport, industry, agriculture, water, etc.)** and **subsectors** based on **NDC priorities and Oman Vision 2040**.
(k) Use, impact and estimated results of support	Methodology to report on the impact and outcomes of the support received	Information on **fund utilization, project impact, and expected outcomes** is derived from **monitoring and evaluation frameworks** and **ex-ante impact assessments**.
(l) Technology development, transfer and capacity-building	Identifying support contributing to technology and capacity-building activities	Funding allocated for **technology transfer** and **capacity-building** is tracked through initiatives such as **climate-resilient infrastructure projects, renewable energy deployment, and institutional training programmes**.
(m) Avoiding double counting	Ensuring accurate reporting of support needed and received, avoiding duplication across reporting frameworks	Financial reporting follows **strict tracking mechanisms** to prevent **double counting** of funds across **different climate finance categories**, using **national MRV systems and international reporting frameworks**.

5.3. Information on financial support needed

Oman recognizes the critical importance of financial support to effectively address climate challenges and transition towards a low-carbon and resilient future. The following areas are key and require financial assistance to enhance climate action and promote sustainable development:

- **Adaptation funding:** Oman requires financial assistance to implement adaptation measures aimed at enhancing resilience to climate impacts, particularly in sectors such as water resources, agriculture, urban development, tourism and climate resilient infrastructure development. Funding is needed to support the construction of climate-resilient infrastructure, implementation of drought-resistant agricultural practices, and conservation of natural ecosystems. **Table 21** summarizes the area of adaptation funding needs across climate vulnerable sectors.

- **Mitigation funding:** The commitment to net zero emissions by 2050 requires investments in 5 sectors which contribute to 95 per cent of Oman's emissions. These are industry, oil and gas, power, transport and buildings. In a BAU scenario, Oman's emissions could increase by 16 per cent by 2050 from the baseline year 2021. Financial support is needed to invest in decarbonizing these five critical sectors for mitigation. **Table 22** summarizes the areas of mitigation funding needs across most carbon-intensive sectors.

Table 21: Adaptation funding needs across climate-vulnerable sectors

Title	Programme/ project description	Estimated amount (Domestic & US dollars)	Expected time frame	Financial instrument	Type of support	Sector & subsector	Technology transfer/capacity-building contribution	Alignment with national strategy/ NDC	Expected use, impact & results
Water resource management & protection	Updating flood hazard maps, climate change risk assessment, erosion control, coastal aquifer protection, desalination	NA	NA	Grant/loan	Adaptation	Water resources	Yes – flood warning systems, policy support	Yes	Improved water security and reduced flood risks
Climate smart agriculture (CSA) development	Research on heat/saline-resistant crops, pest control, conservation of genetic resources, improved irrigation	NA	NA	Grant/loan	Adaptation	Agriculture	Yes – CSA capacity-building	Yes	Enhanced food security and sustainable agricultural practices
Climate-resilient urban development & infrastructure	Early warning systems, updated urban planning, infrastructure resilience measures	NA	NA	Grant/loan	Adaptation	Urban planning, tourism, infrastructure	Yes – risk mapping and regulatory framework updates	Yes	Reduced climate-related urban risks and improved resilience

Ecosystem conservation & restoration	Mangrove & coral reef restoration, biodiversity conservation, sustainable land use planning	NA	NA	Grant/loan	Adaptation	Urban planning, tourism, infrastructure	Yes – risk mapping and regulatory framework updates	Yes	Enhanced biodiversity and ecosystem resilience

Table 22: Mitigation funding requirements for high carbon-emitting sectors

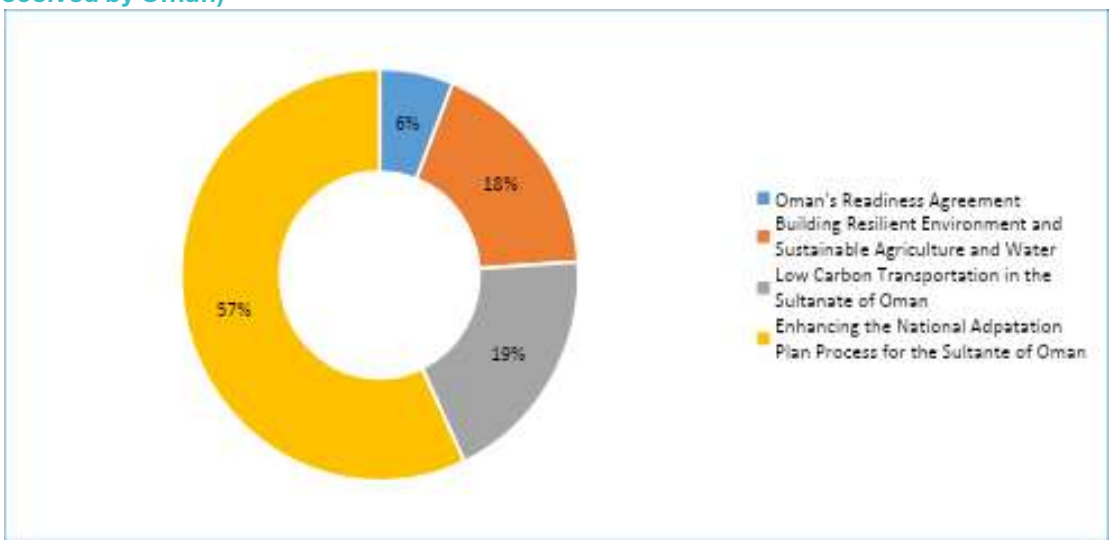
Title	Programme/ project description	Estimated amount (domestic & US dollars)	Expected time frame	Financial Instrument	Type of Support	Sector & Subsector	Technology Transfer/Capacity-Building Contribution	Alignment with National Strategy/ NDC	Expected Use, Impact & Results
Decarbonization of Industrial Sector	Hydrogen-based steel production, electrification of cement & aluminum industries, energy efficiency improvements, renewable energy integration	NA	NA	Grant/Loan	Mitigation	Industry	Yes – Hydrogen technology & energy efficiency measures	Yes	Reduced industrial carbon emissions & increased energy efficiency
Emission Reduction in Oil & Gas Sector	Flaring reduction, repurposing natural gas, electrification of upstream production with renewables	NA	NA	Grant/Loan	Mitigation	Oil & Gas	Yes – Renewable energy integration in production	Yes	Lower methane and CO_2 emissions, improved sustainability

Clean Energy Transition in Power Sector	Development of solar, wind, and other clean energy sources, efficiency retrofits in commercial & residential buildings	NA	NA	Grant/Loan	Mitigation	Power	Yes – Renewable energy deployment & grid modernization	Yes	Increased share of renewables, reduced reliance on fossil fuels
Energy Efficiency in Buildings	Implementing insulation standards, energy-efficient cooling & appliances, new energy-efficient building codes	NA	NA	Grant/Loan	Mitigation	Buildings	Yes – Energy efficiency technology & regulations	Yes	Lower electricity consumption & carbon footprint
Sustainable Transport Transition	Promotion of e-mobility, green hydrogen fuel cells, increased public transit & carpooling, transition of government fleet to electric & hydrogen vehicles	NA	NA	Grant/Loan	Mitigation	Transport	Yes – EV & hydrogen fuel cell technology adoption	Yes	Reduced transport emissions, increased clean mobility options

5.4. Information on financial support received

Oman is eligible for financial support to address climate change challenges. To date, it has received funding from GCF totalling $5.197 million for four activities, as shown in **Figure 18**. Additionally, as a member of the Asian Infrastructure Investment Bank (AIIB), Oman has secured $60 million in funding for a solar project. The loan was approved in 2020 for a solar PV plant in Ibri. Furthermore, Oman is actively seeking Multilateral Investment Guarantee Agency (MIGA) political risk insurance products for several transactions, including the Manah 1 & 2 solar projects and a green fertilizer project at the Duqm industrial zone.

Figure 18: Climate funding received from GCF (share of $5.197 million of climate finance received by Oman)



Despite Oman's target of achieving 30 per cent renewable energy by 2030, climate funding remains insufficient to meet its urgent adaptation needs, particularly in addressing rising temperatures, decreasing rainfall, and rapid urban expansion. **Table 23** outlines the financial support received, categorized by project details, funding channels, and impacts.

Table 23: Total funding support received to address climate change

Title	Programme/ Project Description	Channel	Imple-menting Entity	Amount Received (USD & Domestic Currency)	Time Frame	Financial Instru-ment	Status (Committed/ Received)	Sector & Subsector	Type of Support	Contribution to Technology Development & Capacity Building	Status of Activity	Use, Impact & Estimated Results
GCF Climate Projects	Four climate-related activities funded by GCF	GCF	Various	$5.19 million (USD)	Ongoing	Grant	Received	Climate Adaptation & Mitigation	Cross cutting	Yes	Ongoing	Supports climate adaptation and mitigation efforts
AIIB Solar Project	Solar PV Plant in Ibri	AIIB	Project Developer	$60 million (USD	Approved in 2020	Loan	Committed	Renewable Energy	Mitigation	Yes	Ongoing	Supports Oman's renewable energy goals
MIGA Insurance Support	Political risk insurance for Manah 1 & 2 solar projects and Duqm green fertilizer project	MIGA	Various Private Sector Entities	Not specified	Seeking Approval	Insurance	Pending	Renewable Energy & Green Industry	Cross cutting	Yes	Planned	Risk mitigation for green invest-ments

5.5. Improvement in long-term communications

The information related to the climate finance needs was based on the best available information stemming from the National Strategy for Adaptation and Mitigation to Climate Change 2020-2040. Oman's NAP is an ongoing project that focuses on enhancing the country's resilience to climate change impacts. As this project continues, it is expected to provide increasingly insightful outcomes, especially concerning climate investment. The findings from the NAP will offer valuable perspectives on critical sectors that require focused attention and investment to mitigate the effects of climate change effectively.

Additionally, the NAP will enhance the transparency about the financial needs for the adaptation sector, which will be reported in the forthcoming second BTR. This commitment to transparency aligns with Article 13 of the Paris Agreement, which emphasizes the importance of a transparent framework for action and support to build mutual trust and confidence and to promote effective implementation.

These outcomes will play a key role in pinpointing where financial resources should be strategically allocated to maximize resilience and minimize vulnerabilities. Through this ongoing project, data collected will aid policymakers, investors and stakeholders in making well-informed decisions regarding priority funding areas and support. This targeted investment approach ensures that resources are directed towards areas with the greatest need and potential for positive impact, promoting more strategic and efficient resource use in combating climate change.

Moreover, the dynamic nature of the NAP allows for timely adaptations and adjustments based on real-time environmental and economic feedback, ensuring that Oman’s climate adaptation strategies remain relevant and effective against the backdrop of evolving climate patterns and technological advancements. This flexible approach is crucial for sustaining progress and achieving long-term climate resilience.

Oman plans to submit a readiness proposal to GCF aimed at enhancing climate adaptation technologies. This strategic initiative addresses existing gaps in technology needs assessments (TNAs) and technology action plans. The proposal covers developing comprehensive assessment and planning mechanisms to identify and deploy adaptation technologies, establishing an institutional framework for integrating these technologies into national strategies and creating informed support systems for decision-making on technology adoption.

Further, the proposal includes systematizing the evaluation and prioritization of technologies for vulnerable sectors, conducting sector-specific adaptive capacity assessments, implementing cost-effectiveness analyses of adaptation technologies, and developing strategies for international technology transfer, addressing challenges such as intellectual property rights and financial barriers.

The outcomes of this readiness project are expected to significantly enhance the transparency and effectiveness of reporting on technology transfer needs. This effort will

align Oman's climate adaptation strategies with international standards, fulfilling its commitments under the Paris Agreement and improving communication and implementation strategies for long-term climate resilience.

5.6. Information on technology development and transfer support needed

In alignment with Article 10 of the Paris Agreement, Oman's technology development and transfer needs focus on aligning its priorities with TNAs, national climate strategies and low-emission development pathways. Key areas of focus include capacity building, enhancing infrastructure resilience, and ensuring resource security. Additionally, strengthening endogenous capacities through training, skill development, and access to advanced technologies will play a crucial role in supporting Oman's transition toward a low-carbon and climate-resilient economy. By implementing these initiatives, Oman aims to establish a robust national framework that effectively facilitates climate change mitigation and adaptation while advancing its sustainable development goals.

A comprehensive inventory of the Sultanate's technology needs for mitigation and adaptation can be guided by national circumstances. Indeed, Oman's arid climate, characterized by scarce rainfall and reliance on groundwater together with GHG inventories can both guide the prioritization of technology transfer needs, to achieve three objectives:

- Strengthening institutions with the technical skills required to effectively address climate change.
- Developing an infrastructure system that is both low-carbon and resilient to the effects of climate change.
- Achieving climate-resilient agriculture and improving water security.

Given national circumstances and guided by these objectives, the needs for technology transfer are listed in **Table 24**.

Table 3: Needs for technology transfer

Title	Programme/ Project Description	Type of Support	Type of Technology	Expected Time Frame	Sector	Expected Use, Impact & Results
Capacity Building for Climate Science & Reporting	Training programmes for climate-related skills and international reporting frameworks	Cross-cutting	Climate monitoring & reporting systems	NA	Institutional Capacity	Enhanced technical skills for climate monitoring & compliance with international frameworks
Resilient Infrastructure Development		Adaptation	Climate-resilient road and construction technology	NA	Infrastructure & Urban Development	Reduced infrastructure damage from extreme weather events
Renewable Energy Transition	Transfer of renewable energy technologies to reduce fossil fuel dependence	Mitigation	Solar, wind, and other renewable energy technologies	NA	Energy	Increased share of renewable energy in national grid
Climate-Resilient Agriculture	Transfer of drought-resistant & saline-resistant crop varieties	Adaptation	Climate-resilient crop biotechnology	NA	Agriculture	Improved food security & agricultural sustainability
Early Warning & Disaster Preparedness	Transfer of flood warning system technology for better disaster response	Adaptation	Advanced flood early warning systems	NA	Disaster Management	Increased preparedness & reduced flood-related damage
Water Security & Desalination	Transfer of large-scale water desalination technologies	Adaptation	Advanced desalination systems	NA	Water Resources	Improved access to clean water & enhanced resilience to water scarcity

5.7. Information on technology development and transfer support received

As of now, the Sultanate of Oman has not conducted a formal assessment or prioritization of climate adaptation and mitigation technologies specific to its national context. As a result, no technology development and transfer support has been received for climate change adaptation or mitigation measures. However, Oman acknowledges the critical importance of sustainable development and the pivotal role that technology transfer plays in addressing the challenges posed by climate change. Although no technology transfer has occurred to date, the Sultanate is committed to enhancing its capacity to assess and address technology needs in future submissions.

In its future BTRs, Oman will adopt an approach that aligns identified technology transfer needs—based on national priorities—with the support received. This will include clearly articulating concrete technology transfer requests derived from identified needs and providing detailed information on any support received, as available, while ensuring alignment with the country's climate goals and priorities. Oman is dedicated to improving its data collection and reporting mechanisms to ensure the inclusion of this information in future BTRs, fully complying with the transparency requirements of the Paris Agreement.

5.8. Information on capacity-building support needed

Oman seeks to enhance capacity-building support through institutional strengthening, technical training, and financial resource mobilization to address climate change mitigation and adaptation challenges. Key needs **(Table 25)** include improving institutional capacity for climate monitoring and reporting, enhancing technical expertise for climate-resilient infrastructure, and strengthening skills for climate vulnerability assessments. Constraints include limited access to technology and financial resources, which hinder effective implementation. Addressing these needs will improve data tracking, support sustainable planning and increase climate finance access.

GCF readiness support has contributed to some extent to strengthening Oman’s capacity to mitigate and adapt to climate change, but significant needs in this area persist. To date, key priorities for capacity-building support in climate mitigation and adaptation are closely aligned with the need for technology transfer.

Table 25: Capacity-building support needed

Title	Programme/project description	Expected time frame	Type of support	Expected use, impact & results
Institutional capacity for climate monitoring & reporting	Strengthening institutions to effectively monitor and report climate flows, impact indicators, and improve coordination among key sectors	NA	Cross-cutting	Enhanced institutional ability to track climate data and align reporting with international frameworks
Technical capacity for climate-resilient infrastructure	Training and capacity-building programs for developing low-emission and climate-resilient infrastructure in energy, transportation, and urban planning	NA	Mitigation & adaptation	Improved technical expertise for designing resilient and low-carbon infrastructure
Capacity for climate vulnerability assessments	Enhancing skills for conducting climate vulnerability assessments to inform adaptation strategies and urban planning	NA	Adaptation	Strengthened ability to assess and mitigate climate risks across key sectors
Financial resource mobilization & cooperation	Capacity-building in mobilizing climate finance and developing sustainable investment opportunities in agriculture and water security	NA	Cross-cutting	Increased access to climate finance for critical sectors and improved financial planning for adaptation and mitigation projects
Climate-resilient agriculture & water management	Training and technical support for climate-smart agriculture, water conservation techniques, and adaptive management systems	NA	Adaptation	Strengthened resilience in agriculture and water security through sustainable practices and resource efficiency

5.9. Information on capacity-building support received

Oman has not received support for capacity-building as would be expected under Article 11 of the Paris Agreement.

5.10. Information on the support needed and received by developing country Parties for the implementation of Article 13 of the Paris Agreement and related transparency activities, including transparency-related capacity-building

Oman has benefited from technical assistance provided by UNIDO and international experts to improve the quality and accuracy of its GHG inventories and reporting as well as the impacts of climate change, its adaptation needs and financial needs for climate mitigation and adaptation. This assistance has helped Oman address methodological challenges and enhance the reliability of its climate data.

While remaining committed to enhancing transparency in its climate actions and reporting processes in line with its obligations under Article 13 of the Paris Agreement, Oman seeks to foster greater transparency and accountability in line with its climate objectives. **Table 26** outlines the specific needs for support in adaptation priority sectors and mitigation key sectors in Oman, as relevant to Article 13 of the Paris Agreement.

Investments in capacity-building have improved water management and conservation practices, enabling more efficient use of resources and reducing vulnerabilities to climate-related risks. The integration of renewable energy in desalination and industrial sectors has contributed to lowering emissions and increasing energy efficiency. Training programmes in climate-smart agriculture and urban planning have built technical knowledge, fostering sustainable land and infrastructure development.

Table 26: Specific needs for support in adaptation priority sectors and mitigation key sectors

Activity, programme or project	Objectives & description	Recipient entity	Channel	Amount (domestic & US dollars)	Time frame	Status (planned, ongoing, completed)	Use, impact & estimated results
Capacity-building for water management & conservation	Strengthening institutional capacity for efficient water use and conservation techniques	Water authorities	Adaptation	NA	NA	Planned	Improved water efficiency and conservation practices
Development of climate-resilient water infrastructure	Implementation of resilient water supply systems to withstand climate impacts	Ministries of water & energy	Adaptation	NA	NA	Planned	Reduced vulnerability to droughts and extreme weather
Adoption of water-efficient technologies & practices	Supporting the deployment of advanced irrigation and desalination technologies	Agricultural & water institutions	Adaptation	NA	NA	Planned	Enhanced water security and reduced water consumption
Promotion of renewable energy in water desalination	Integrating renewable energy solutions into desalination plants	Energy & water ministries	Mitigation	NA	NA	Planned	Reduced emissions and enhanced energy efficiency in desalination
Capacity-building in climate-smart agriculture	Training farmers on low-emission and climate-adaptive agricultural techniques	MAFWR	Adaptation	NA	NA	Planned	Increased agricultural resilience and food security
Implementation of low-emission agricultural practices	Promoting sustainable farming practices that lower carbon footprint	Agricultural agencies	Mitigation	NA	NA	Planned	Reduction in agricultural emissions and improved sustainability
Integration of climate consideration in urban planning	Ensuring urban planning includes climate adaptation and mitigation strategies	Urban planning authorities	Adaptation	NA	NA	Planned	Climate-resilient and sustainable urban development
Introduction of climate considerations in building codes	Updating regulations to incorporate energy efficiency and resilience measures	Construction & regulatory bodies	Mitigation	NA	NA	Planned	Lower energy consumption and improved building

							resilience
Flood & stormwater management	Strengthening flood control and stormwater management systems	Municipal authorities	Adaptation	NA	NA	Planned	Reduced flood risks and infrastructure damage
Strengthening public infrastructure resilience	Enhancing the ability of public infrastructure to withstand climate shocks	Ministry of Infrastructure	Adaptation	NA	NA	Planned	Increased durability of key infrastructure under extreme weather
Capacity-building on climate risk assessment & adaptation planning	Developing skills for assessing climate risks and adaptation strategies	Industrial sector & government agencies	Adaptation	NA	NA	Planned	Improved preparedness for climate-related risks in industries
Increasing renewable energy share in industries	Supporting the transition to clean energy sources for industrial use	Industrial development authority	Mitigation	NA	NA	Planned	Reduced industrial carbon emissions and energy dependence
Strengthening energy infrastructure resilience	Enhancing energy systems to withstand climate-induced disruptions	Energy authorities	Mitigation	NA	NA	Planned	Improved reliability and resilience of energy supply
Deployment of renewable energy & storage technologies	Scaling up solar, wind, and battery storage technologies	Ministry of Energy	Mitigation	NA	NA	Planned	Increased share of renewable energy and grid stability
Implementation of energy efficiency in buildings	Promoting energy-efficient construction and retrofits	Real estate & regulatory authorities	Mitigation	NA	NA	Planned	Lower energy demand and reduced emissions from buildings
Integration of renewable energy in buildings	Expanding the use of solar panels and other clean technologies in buildings	Building & energy authorities	Mitigation	NA	NA	Planned	Increased use of sustainable energy in residential and commercial sectors
Promotion of electro-mobility	Supporting policies and infrastructure for EVs and clean transport	Ministry of Transport	Mitigation	NA	NA	Planned	Reduced transport emissions and improved air quality

5.11. Improvements in climate finance, capacity-building and technology reporting for Oman's next BTR

In the next BTR, Oman will enhance the reporting of climate finance, capacity-building and technology needs through improved data collection, monitoring systems and institutional coordination. Dedicated capacity-building programmes will equip national institutions with the technical expertise required to systematically identify, assess and prioritize financial, technological and capacity-building needs across adaptation and mitigation sectors. Progress in capacity-building will be measured through specific indicators, such as the number of trained personnel, the establishment of sector-specific climate reporting units, and the development of national guidelines for tracking capacity-building initiatives.

Climate finance tracking systems will undergo significant upgrades to ensure accurate and transparent reporting of financial flows, including domestic investments, international grants, and private-sector contributions. A comprehensive TNA will address gaps in previous reports, focusing on climate adaptation and mitigation technologies aligned with national priorities. The adoption of UNFCCC Common Reporting Tables and advanced data management tools will ensure consistent and reliable reporting. Stronger collaboration with development partners, sectoral agencies and stakeholders will further reflect Oman's climate finance and technology priorities, supporting its transition to a low-carbon and climate-resilient future.

6. INFORMATION ON FLEXIBILITY

6.1. Flexibility for the content of this BTR

6.1.1. Reporting and capacity constraints regarding the application of flexibility

Table 27 summarizes the flexibility provisions applied by Oman in its BTR as per Decision 18/CMA.1 of the Paris Agreement. It highlights key areas such as GHG inventory preparation, QA/QC procedures, gas coverage, and emissions projections, providing explanations on their implementation and future improvement plans to enhance reporting capacity.

Table 27: Template for reporting applied flexibility provisions

	Reference in the MPG (Annexes to Decision 18/CMA.1)	Flexibility provision	Explanation
National GHG Inventory	Paragraph 25 Key category analysis	Identify the key categories using a threshold that is not less than 85 per cent instead of the 95 per cent threshold provided in the IPCC Guidelines.	Oman has applied flexibility by using the 85 per cent threshold to prioritize significant categories for the BTR due to capacity constraints, intending to increase the threshold to 95 per cent in future BTRs.
	Paragraph 29 Uncertainty assessment	Present, as a minimum, a qualitative uncertainty analysis of key categories, using IPCC Guidelines, when quantitative input data are not available to estimate uncertainties quantitatively. Parties are also encouraged to submit a quantitative uncertainty estimate for all source and sink categories of the GHG inventory.	For the BTR, qualitative uncertainty analysis was conducted due to capacity constraints. Oman plans to introduce a comprehensive quantitative uncertainty analysis in future BTRs as data collection and capacity improve.
	Paragraph 34 QA/QC	Parties are encouraged to develop an inventory QA/QC plan in accordance with the IPCC Guidelines, including information on the body responsible for carrying out the QA/QC process.	Oman has developed an initial QA/QC plan and will continue to enhance it as part of ongoing improvements to the national GHG inventory system.
	Paragraph 35 QA/QC	Parties are encouraged to implement and provide information on general inventory QC procedures in accordance with the QA/QC plan and the IPCC Guidelines.	QC procedures are being implemented as per the QA/QC plan. Future efforts will include more robust procedures as Oman's GHG inventory evolves.
	Paragraph 44 Information on methods and cross-cutting elements	Parties are encouraged to provide, at a minimum, a qualitative discussion of uncertainty for key categories, using the IPCC Guidelines, both for the latest inventory year and the trend, instead of quantitatively	Oman has provided the qualitative discussion on. Oman did not develop a quantitative uncertainty analysis as a MRV framework is under development.

		estimating and qualitatively discussing the uncertainty of the emissions and removal estimates for all categories, including inventory totals, for at least the starting year and the latest reporting year of the inventory time series and also estimating the trend uncertainty for these same categories/inventory totals for the entire time series.	
	Paragraph 48 Gases	Provide information on at least three gases (CO_2, CH_4 and N_2O) as well as any of the other four gases (HFC, PFC, SF_6 and NF_3) listed in the Party's NDC under Article 4 of the Paris Agreement, covered by an activity carried out under Article 6 of the Paris Agreement or included in a previous report.	Oman has reported information on CO_2, CH_4, and N_2O, as well as SF_6, PFCs and HFC, reflecting its national circumstances and data availability. Future reports will aim to enhance the coverage of all gases as outlined under the Paris Agreement.
	Paragraph 57 Time series	Parties may provide data covering, as a minimum, the reference period/year for their NDC under Article 4 of the Paris Agreement, as well as a consistent annual time series at least from 2020 onwards.	Oman provided data covering the period from 2020 onwards.
	Paragraph 58 Year reported	The latest reporting year shall be no more than three years prior to the date of submission of the national inventory report.	Oman has complied with the requirement to report data within three years of submission, with the latest data from 2022 being included in this BTR.
NDC implementation and achievement	Paragraph 83 GHG emission reductions policy and measures	Parties may provide the costs, non-GHG mitigation benefits, and mitigation actions, policy and measure reported.	Oman aims to report costs, non-GHG mitigation benefits, and mitigation actions, policy and measures.
	Paragraph 85 GHG emission reductions achieved and projected for GPAs.	Parties are encouraged to report estimates of achieved and projected GHG emission reductions from their GPAs.	Oman aims to report on GHG reductions achieved and projected under its national GPAs as part of tracking NDC implementation.
	Paragraph 87 GHG emission reduction actions, policies and measures	Identify those actions, policies and measures that are no longer in place compared with the most recent biennial transparency report and explain why they are no longer in place.	Oman is preparing its first BTR therefore comparison with previous BTR cannot be made.
	Paragraph 90 Economic and social impact	Parties are encouraged to provide detailed information, to the extent possible, on the assessment of economic and social impacts of response measures.	Oman as a developing country has flexibility in the light of their capacities with respect to this provision and aims to report this information.
	Paragraph 92 Projections of emissions and GHG removals	Parties are encouraged to communicate projections	Projections are being communicated in the BTR, though Oman is gradually improving its capacity to provide more detailed and longer-term projections in future reports.

	Paragraph 95 Expansion of projections	They can extend their projections, at least, until the end of their NDC.	Oman aims to extend its projections to cover the period up to the NDC endpoint, including intermediate milestones for mitigation actions.
	Paragraph 96 Methodologies	Providing information in describing the methodology used to develop the projections.	Oman as a developing country has flexibility in the light of their capacities with respect to this provision and aims to report information related to methodologies.
	Paragraph 97	Parties shall provide projections of key indicators to determine progress towards its NDC under Article 4 of the Paris Agreement.	Oman as a developing country has flexibility in the light of their capacities with respect to this provision and aims to provide projections of key indicators to determine the progress.
	Paragraph 98	Parties shall include projections on a sectoral basis and by gas, as well as for the national total, using a common metric consistent with that in its national inventory report.	Oman as a developing country has flexibility in the light of their capacities with respect to this provision and aims to provide projections on a sectoral basis and by gas.
	Paragraph 99	Projections shall be presented relative to actual inventory data for the preceding years	Oman as a developing country has flexibility in the light of their capacities with respect to this provision and aims present relative to actual inventory data.
	Paragraph 100	Emission projections shall be provided with and without LULUCF.	Oman as a developing country has flexibility in the light of their capacities with respect to this provision and aims to provide projection with and without LULUCF
	Paragraph 101	Projections shall be presented in graphical and tabular formats.	Oman as a developing country has flexibility in the light of their capacities with respect to this provision and aims to present projection in graphical and tabular formats in next BTR.
	Paragraph 102 Coverage or methodology of projections	They may provide information using a less detailed methodology or coverage, see paragraphs 93-101 of the Annex to decision 18/CMA.1	Oman will apply a less detailed approach to projections where data constraints exist, with plans for more detailed future assessments as capacity and data availability improve.
Adaptation strategies, policies, plans, goals, and actions to integrate adaptation into national policies and strategies	Paragraph 109 Adaptation goals, actions, objectives, undertakings, efforts, plans	(b) Parties shall outline the forward-looking adaptation efforts that Parties intend to undertake or are currently implementing. Reported information may include NAPs, sectoral programs, or targeted strategies aimed at reducing the vulnerability of specific groups and enhancing climate resilience.	Oman has provided qualitative information related to adaptation efforts made till this date.
	Paragraph 110 Progress on	(c) Parties shall provide implementation progress on	Oman has not yet submitted its ADCOM.

	implementation on adaptation	adaptation actions that are included in an ADCOM.	
Monitoring and evaluation of adaptation action and progress	Paragraph 112 and 113 Approaches and systems for monitoring and evaluation	Parties shall provide details on the domestic systems used to monitor and evaluate adaptation actions, whether they are already established or under development.	Oman has not yet established a national adaptation monitoring and evaluation system. However, it intended to establish one.
Financial support needed by developing country parties under Article 9	Paragraph 133 Financial support needed	Parties can provide information related to the financial support needed including title of the projects, their time frame, estimated funding required and further details.	Oman as a developing country has flexibility in the light of their capacities with respect to this provision and aims to provide full details on the financial support needed.
Technology development and transfer support needed by developing country parties under Article 10	Paragraph 136 Technology support needed	Parties can provide information related to the technology support needed including title of the project, time frame, type of support, type of technology and further details.	Oman as a developing country has flexibility in the light of their capacities with respect to this provision and aims to provide full details on the technology support needed.
Technology development and transfer support received by developing country parties under Article 10	Paragraph 137 & 138 Technology support received	Parties shall provide case studies, including key success and failure stories; support contribution to technology development, stage of the technology cycle supported, including research and development, demonstration, deployment, diffusion and transfer of technology.	Oman has not yet received any technology and transfer support.
Capacity-building support needed by developing country parties under Article 11	Paragraphs 139 & 140 Capacity-building support needed	Parties can provide information related to county specific capacity-building support needed, constraints and gaps in communicating needs, process on enhancing public awareness.	Oman has provided information to the capacity building support to the extent possible and aims to provide further details in the next BTR.

ANNEX 1. SECTOR-SPECIFIC: METHODOLOGIES, ASSUMPTIONS AND IMPROVEMENT PLANS

Sector	Categories	Tier approach used	Assumptions and emission factors	Improvement plan
Energy	**Energy industries (1.A.1)**	Tier 1	- EF: IPCC 2006 GLs lower limit (54.3 tCO_2/TJ, 0.3 $kgCH_4$/TJ, 0.03 kgN_2O/TJ). - NCV: 48 TJ/kt (IPCC default).	Develop country-specific CO_2 EFs for natural gas combustion to enhance accuracy for the next BTR. Include emissions from liquid fuels used in refineries.
	Manufacturing industries and construction (1.A.2)	Tier 1	- EF: IPCC 2006 GLs lower limit (54.3 tCO_2/TJ, 0.3 $kgCH_4$/TJ, 0.03 kgN_2O/TJ). - NCV: 48 TJ/kt (IPCC default).	Develop country-specific CO_2 EFs for natural gas combustion to adopt Tier 2 methods for improved accuracy in the next BTR.
	Transport (1.A.3)	Tier 1	- EF: IPCC 2006 GLs default range for liquid fuels and natural gas. - Road fuel disaggregation based on fleet data.	Develop country-specific CO_2 EFs for liquid fuels (road transportation) and pipeline transport emissions to improve estimation accuracy for the next BTR.
	Fugitive emissions (1.B)	Tier 1	- EF: IPCC 2006 GLs (Table 4.2.4 for developed countries).	Develop higher tier methods (Tier 2) for Category 1B2b (natural gas processes) to enhance CO_2 and CH_4 emission accuracy. Apply 2019 IPCC GL refinements for the next BTR.
IPPU	**Mineral industry (2.A)**	Tier 1 (Glass, Lime, Others) Tier 2 (Cement)	- Cement Production: EF = 0.52 tCO_2/t clinker. Kiln dust correction factor: 1.02. - Lime Production: EF = 0.77 tCO_2/t lime (dolomitic). - Glass Production: EF = 0.2 tCO_2/t glass, cullet ratio of 0.5.	Assess data gaps in glass production to adopt a higher-tier method. Include more accurate cullet ratio and plant-specific data for lime and glass manufacturing.

	Chemical industry (2.B)	Tier 1	- Ammonia Production: CO_2 captured and utilized in urea production. - Nitric Acid: EF = 9 kg N_2O/t nitric acid (high pressure, no abatement). - Soda Ash Production: EF = 0.138 tCO_2/t natural soda ash.	Conduct comprehensive surveys to refine activity data and evaluate the adoption of Tier 2 methods for ammonia and nitric acid production.
	Metal industry (2.C)	Tier 1	- Iron & Steel: EF = 0.08 tCO_2/t steel (EAFs). - Aluminum: EF = 1.7 tCO_2/t aluminum; PFC EF = 1.6 tCF_4/t aluminum (SWPB tech). - Magnesium: EF = 2.83 tCO_2/t magnesite. SF_6 EF = 1kgSF_6/t Mg casting.	Reassess emissions from aluminum and magnesium production using facility-specific data to reduce uncertainties. Transition to higher-tier methods for key categories.
	Product uses as substitutes for ODS (2.F)	Tier 1	- Refrigeration & AC: EF = 0.5%-5% annual leak rate (HFCs). - Foam Blowing Agents: First year 10%, subsequent years 65%.	Implement Tier 1 method across the entire time series. Assess key categories to determine need for higher-tier approaches in subsequent BTRs.
AFOLU	**Enteric fermentation (3.A)**	Tier 1	- CH_4 emissions estimated using body weight, Dry Matter Intake (DMI), and CH_4 conversion factor. - Parameters applied: 2006 IPCC GLs defaults.	Continue improving activity data accuracy for livestock population. Transition to higher-tier methods with country-specific CH_4 emission factors.
	Manure management (3.B)	Tier 1	- CH_4 EF = 3 kgCH_4/head/yr (IPCC default for Middle East). - N_2O emissions not reported in the current submission.	Assess and report CH_4 emissions from non-dairy cattle, goats, camels, horses, mules, and poultry. Include N_2O emissions in future submissions.
	Urea application (3.H)	Tier 1	- EF = 0.2 tCO_2/t urea applied (IPCC default).	Evaluate urea application activity data for accuracy. Include country-specific fertilizer use practices in the next BTR.
	Agricultural soils (3.D)	Tier 1	- N_2O emissions from fertilizer application and manure spreading are considered minimal.	Assess and include N_2O emissions from agricultural soils in the next BTR.

	LULUCF (4)	Tier 1 & Tier 2	- Land Representation: Approach 1 applied; indirect land-use changes estimated by comparing land area differences over time. - Cropland: Annual and perennial disaggregation. - Forest Land: Managed and unmanaged mangroves areas reported. - EF: Defaults from 2006 IPCC GLs.	Improve accuracy by incorporating detailed land conversions for upcoming BTR submissions.
	Settlements (4.E)	Tier 1 (Soils) & Tier 2a (Biomass)	- Above and Below Ground Biomass: EF = 2.9 tC/(ha crown cover)/yr (IPCC 2006 GLs default). Crown cover area = 5,425 ha. - Soils: SOC ref = 31 tC/ha for sandy mineral soils. Entire settlement area used.	Reassess the settlement area to exclude non-vegetated portions and avoid overestimation of CO_2 removals for the next BTR submission.
Waste	**Solid Waste Disposal (5.A**	Tier 1 & FOD Model	- CH_4 emissions estimated using the First Order Decay (FOD) model. - Waste composition: IPCC defaults for Western Asia & Middle East. - Key parameters (DOC, MCF, k) applied from IPCC 2006 GLs.	Reassess oxidation factors and expand historical waste disposal data to improve FOD model accuracy (minimum 50-year data inclusion) for the next BTR.
	Biological Treatment of Solid Waste (5.B	Tier 1	- CH_4 EF = 4 gCH_4/kg waste treated (IPCC default).	Include N_2O emissions in the next BTR submission by improving activity data for composting facilities.
	Wastewater Treatment and Discharge (5.D)	Tier 1	- Domestic Wastewater: CH_4 EF (constructed wetlands) = IPCC defaults. N_2O EF = 3.2 g N_2O/person/year. - Industrial Wastewater: Bo = 0.25 kgCH_4/kg COD; MCF = 0.4. - Indirect N_2O: EF = 5 g N_2O-N/kg N.	Improve data collection on wastewater flows, particularly for industrial facilities. Assess the need for transitioning to Tier 2 methods for key categories.

ANNEX 2. CURRENT AND PLANNED MITIGATION MEASURES

Name	Description	Objective	Type of instrument	Gases affected	Implementing entity or entities	Non-GHG mitigation co-benefits
National Energy Strategy	Aims to increase the share of renewable energy in Oman's energy mix to 35-39 per cent by 2040, promoting the development of solar and wind power projects.	Increase renewable energy, reduce fossil fuel reliance, enhance energy security.	Economic, fiscal, regulatory	CO_2	Ministry of Energy and Minerals and Nama Power & Water Procurement.	Enhanced energy security, reduction in fossil fuel dependence, job creation in the renewable sector.
Residential initiative	Allows for the deployment of grid-connected PV systems in residential premises, providing subsidies and promoting solar investments.	Encourage residential solar panel installations, promote solar energy investment.	Economic, fiscal, regulatory	CO_2	Ministry of Energy and Minerals and Authority for Public Services Regulation.	Reduced electricity costs for residents, increased adoption of solar energy.
Retirement of diesel power plants	Planned retirement of all diesel power plants by 2028 to shift to cleaner and more sustainable energy sources.	Reduce reliance on fossil fuels, increase renewable energy share.	Economic, fiscal, regulatory	CO_2, NOx, SO_2	Ministry of energy and Minerals, Environment Authority	Significant reduction in CO_2 and other pollutants, enhanced environmental quality, increased focus on sustainability.
Net-metering scheme	Enables sales of excess electricity to the grid, offering incentives for renewable energy adoption, including green bonds to promote solar energy investment.	Promote solar energy investment, allow for excess electricity sales.	Economic, fiscal, regulatory	CO_2	Ministry of energy and Minerals and Authority for Public Services Regulation.	Increased adoption of renewable energy, financial benefits for residential users, greater energy efficiency.
Waste-to-energy project	A waste-to-energy project that utilizes waste products for power generation.	Reduce waste, generate renewable energy, avoid CO_2 emissions.	Economic, fiscal, regulatory	CO_2, CH_4	Be'ah (Oman Environmental Services Holding Company)	Waste reduction, energy diversification, increased renewable energy contribution.
Enhanced energy efficiency	Implementation of energy efficiency standards for appliances (Energy Efficiency Ratio - EER) and pilot programs	Reduce overall energy consumption, enhance energy	Economic, fiscal, regulatory, information	CO_2	Ministry of Energy and Minerals, Ministry of Housing and Urban Planning	Energy savings, reduced operational costs, improved energy security

	for Energy Service Companies (ESCOs).	efficiency in buildings.				
Protection of ozone layer	Regulations for refrigerant gases used in appliances, banning ozone-depleting substances.	Prevent harm to the ozone layer.	Regulatory, information	Ozone-depleting	Environment Authority	Environmental protection, compliance with international agreements
Transition to LED Lighting	Promotion of LED lighting for reduced energy consumption and lower emissions.	Improve energy efficiency in lighting	Regulatory, information	CO_2	Ministry of Housing and Urban Planning	Reduced electricity costs, lower maintenance needs
Electrification of vehicle fleet	Sustainable Transport Master Plan aims to reduce carbon intensity by 20% and electrify 34% of cars by 2030.	Reduce carbon emissions in the transport sector	Economic, fiscal, regulatory	CO_2	Ministry of Transport, Communications and Information Technology; Authority for Public Services Regulation	Improved public transport, enhanced air quality, reduced traffic congestion
Infrastructure for EVs	Policy revisions and investments to facilitate adoption of battery and fuel cell EVs by 2050.	Make EVs and fuel cell vehicles cost-competitive	Economic, fiscal, regulatory	CO_2	Ministry of Transport, Communications and Information Technology; Authority for Public Services Regulation	Economic growth, job creation in green technology sectors
Maritime and aviation sector	GHG reduction measures in ports, including studying solar power viability at Oman Airport.	Mitigate emissions in the maritime and aviation sectors	Economic, fiscal, regulatory	CO_2	Civil Aviation Authority	Improved operational efficiency, cost savings in fuel usage
Sustainable aviation fuel (SAF)	Exploration of SAF to reduce carbon emissions in aviation.	Lower carbon emissions in the aviation industry	Research and information	CO_2	Civil Aviation Authority	Innovation in aviation fuels, potential for new industry growth
Electric vehicle charging infrastructure	Establishment of 350 charging stations throughout Oman to support EV adoption.	Facilitate the transition to EVs	Economic, fiscal, regulatory	CO_2	Ministry of Transport, Communications and Information Technology; Authority for Public Services Regulation	Increased accessibility for EV users, enhanced infrastructure
Biofuels blending	Pilot project for incorporating biofuels blending (B5) to reduce emissions from internal combustion engine vehicles.	Reduce emissions from traditional vehicles	Research and information	CO_2	Ministry of Transport, Communications and Information Technology	Development of local biofuel industry, energy diversification
Gas recovery project	Projects aimed at reducing flare emissions by recovering gas	Recover and repurpose natural gas.	Regulatory	CO_2, CH_4	Ministry of Energy and Minerals	Reduced flaring, energy security, and enhanced gas utilization.

Methane emission reduction	Oil and gas companies pledge to reduce methane emissions by 30 per cent by 2030 using Gold Standard level 4 measurements.	Reduce methane emissions from oil and gas operations.	Research, information, regulatory	CH4	Ministry of Energy and Minerals, Ministry of Transport and Communications	Reduced air pollution, improved data accuracy for methane emissions.
Green fuel hub development	Identifying suitable locations for hydrogen or ammonia-based green fuel hub.	Promote green hydrogen and ammonia production.	Regulatory	CO2	Ministry of Energy and Minerals, Private Sector	Job creation, enhanced energy security, and green fuel production.
CO_2 utilization and storage	Mapping CO_2 sources and identifying sinks for utilization and storage opportunities in Oman.	Facilitate CO_2 CCUS.	Regulatory	CO2	Ministry of Energy and Minerals	Enhanced resource efficiency, long-term carbon storage, and industry innovation.
Emission reduction in industrial sector	The Chamber of Industry encourages industries to adopt green initiatives, including electrification of refining processes and connecting selected sectors to the grid.	Anticipated reductions include a 14% reduction from electrification and a 9% reduction from grid connections.	Economic, fiscal, and regulatory	CO_2	Ministry of Energy and Minerals	Enhanced industry sustainability and competitiveness
Initiatives to enhance natural carbon sinks	Ongoing efforts in Hayma city, including tree planting, green buffer zones, and the EA's “Plant a Tree” initiative in Special Economic Zones. Aims to protect and restore coastal habitats. Aims to plant 10 million tree	Mitigate environmental impact and enhance carbon sequestration.	Information and research	CO_2	EA(OPA)	Enhanced biodiversity, improved air quality, and coastal resilience.
Biogas production initiatives	The Biogas Project aims to divert 60 per cent of municipal solid waste from landfills by 2025 and 80 per cent by 2030.	Reduce landfill waste and GHG emissions.	Economic, fiscal, and regulatory	CO_2	Oman Environmental Services Holding Co. - be'ah	Improved waste management, energy recovery, and public health benefits.

Methane recovery - landfill gas recovery for direct use (only Al-Multaqa LF)	The project recovers methane from Al-Multaqa landfill and repurposes it as fuel for the Al-Multaqa HCW incinerator, replacing LPG.	Reduce methane emissions and replace fossil fuel use with methane from the landfill.	Regulatory	CH_4	Oman Environmental Services Holding Co. - be'ah	Reduces dependence on LPG, promotes circular economy through waste repurposing.
Methane recovery - landfill gas recovery for electricity self-generation (Barka and Al-Multaqa LF)	Captures methane from Barka and Al-Multaqa landfills and uses it for electricity generation to meet internal facility power needs.	Self-generate electricity using captured methane.	Regulatory	CH_4	Oman Environmental Services Holding Co. - be'ah	Reduces fossil fuel consumption and reliance on grid electricity.
Methane recovery - landfill gas recovery for electricity exportation	Captures methane from Barka and Al-Multaqa landfills to generate electricity for export to the local grid.	Generate electricity for grid export using methane from landfills.	Regulatory	CH_4	Oman Environmental Services Holding Co. - be'ah	Supports renewable energy and reduces grid dependency on non-renewable sources.
Waste-to-energy at Barka LF	Organic waste from Barka landfill is diverted for electricity generation.	Convert organic waste-to-energy, reducing landfill volume.	Regulatory	CH_4, CO_2	Oman Environmental Services Holding Co. - be'ah	Reduces landfill waste and provides renewable electricity.
Fish waste treatment	Diverts food (fish) waste from Barka landfill.	Reduce fish waste by repurposing it for treatment.	Regulatory	CH_4, CO_2	Oman Environmental Services Holding Co. - be'ah	Reduces landfill waste, promotes resource efficiency.
Biogas and compost facility	Organic waste is diverted from Barka landfill to produce electricity (sold to SQU) and compost (sold to Omani Agriculture Association).	Generate renewable electricity and compost from organic waste.	Regulatory	CH_4, CO_2	Oman Environmental Services Holding Co. - be'ah	Supports sustainable agriculture and reduces chemical fertilizer use.

Blue bins project	Collects and recycles plastic bottles.	Increase plastic recycling.	Regulatory	CO_2	Environmental Services Holding Co. - be'ah	Reduces plastic pollution, supports recycling industry.
Paper and cardboard collection & recycling	Collects and recycles paper and cardboard.	Increase recycling of paper and cardboard.	Regulatory	CO_2	Environmental Services Holding Co. - be'ah	Reduces deforestation, supports recycling industry.
Reuse centre	Collects and resells sorted products.	Promote reuse and reduce waste.		CO_2	Environmental Services Holding Co. - be'ah	Extends product life, reduces waste generation.
Food waste project	Converts food waste in Muscat to compost.	Produce compost from food waste.	Economic	CH_4, CO_2	Environmental Services Holding Co. - be'ah	Supports agriculture, reduces landfill waste.
LF Cell Closure (Al-Multaqa Cell 1 and Cell 2)	Closure of landfill cell with flaring system.	Manage landfill emissions.	Regulatory	CH_4, CO_2	Environmental Services Holding Co. - be'ah	Improved landfill management, environmental health.
LF Cell Closure - Barka Cell 1 and Cell 2	Closure of landfill cell with flaring system.	Manage landfill emissions.	Regulatory	CH_4, CO_2	Environmental Services Holding Co. - be'ah	Improved landfill management, environmental health.
LF Cell Closure - Tahwa Cell 1 and Cell 2	Closure of landfill cell with flaring system.	Manage landfill emissions.	Regulatory	CH_4, CO_2	Environmental Services Holding Co. - be'ah	Improved landfill management, environmental health.

ANNEX 3. SECTOR-SPECIFIC PROGRESS IN CLIMATE ADAPTATION

1-Water sector

Category	Subcategory	Activity description	Degree of implementation (%)	Comments and future direction
1. Strategic vision	**1.1 Long-term goal formulation**	Establishing overarching objectives for the water sector in Oman amid climate change.	**65%**	The long-term goals are well-defined, focusing on water conservation and sustainable management practices. However, there is a need to integrate climate change adaptation more explicitly into these goals, particularly in response to increasing water stress and the reliance on groundwater. Future direction will involve collaboration with local experts to refine these goals further, addressing specific regional challenges.
	1.2 Alignment with national and international goals	Harmonizing with Oman's national policies and global commitments.	**60%**	Oman is actively working to align its water management strategies with both national and international commitments. Although the existing Royal Decrees and National Conservation Plan provide a strong foundation, there is still room for improvement. Specifically, more focus is needed on integrating international best practices and climate adaptation strategies, particularly to strengthen Oman's **Climate Change Strategy 2020-2040**. Moving forward, Oman will need to place greater emphasis on aligning its water management strategies with global standards while tailoring solutions to fit the country's specific environmental challenges. This will help enhance sustainability and improve resilience to climate change.
2. Foundation for adaptation	**2.1 Assessment of current state**	Analyzing the current state of water resources in Oman, including groundwater and surface water management.	**70%**	The current state assessment is progressing well, with detailed studies on groundwater resources and the effectiveness of recharge augmentation techniques. However, more recent data are needed on the impacts of climate change on water availability, especially regarding wadi systems and rainfall patterns. Future work will focus on updating data and conducting further studies on the sustainability of current water usage and the long-term viability of groundwater reserves.
	2.2 Development of adaptation strategies	Initiating the groundwork for adaptive measures in	**55%**	Adaptation strategies are being developed, particularly in areas like wastewater management and surface water management. The focus will now shift to enhancing governance frameworks for climate adaptation and integrating these strategies into existing water management policies. Future direction will prioritize pilot projects to test innovative

		water management, aligned with strategic actions identified in Oman's climate change strategy.		water conservation techniques and alternative water sources, with a focus on scaling successful methods.
3. Evaluating climate change risks and vulnerabilities	**3.1 Analysis of climate projections and impacts**	Investigating future climate scenarios and their potential effects on water resources.	**60%**	Climate projections are being analyzed, with a focus on understanding the impacts of reduced rainfall and increased temperatures on water availability. There is a need for more localized climate models to predict specific impacts on Oman's wadis and groundwater recharge rates. Future work will integrate these projections into water resource planning to ensure long-term sustainability, with a focus on adapting management practices to anticipated changes.
	3.2 Vulnerability identification	Pinpointing areas and populations at risk, especially those reliant on vulnerable groundwater resources.	**60%**	Vulnerability assessments are under way, particularly focusing on regions heavily dependent on groundwater. Further work is needed to identify the most at-risk communities and sectors, especially those in remote areas where water scarcity is already a significant issue. Future direction will include expanding the scope of these assessments to consider risks such as potential saltwater intrusion in coastal aquifers and developing targeted strategies to support vulnerable populations.
	3.3 Impact evaluation	Assessing the prospective impacts on water availability, quality, and resource management.	**50%**	Impact evaluations are progressing, with initial focus on groundwater quality and availability. However, more comprehensive evaluations are needed to understand the long-term impacts of climate change on water resources, particularly in relation to the sustainability of groundwater extraction and the potential for increased pollution. Future direction will include a deeper exploration of the economic implications of water scarcity on key sectors like agriculture and industry, with strategic responses planned accordingly.
4. Exploring adaptation options	**4.1 Investigation of adaptation approaches**	Exploring diverse adaptation methodologies, including traditional water management practices and	**55%**	Various adaptation approaches are being considered, including recharge augmentation, wastewater reuse, and improved governance frameworks. There is a need to evaluate the effectiveness and scalability of these approaches within the Omani context, particularly in regions prone to water stress. Future direction will explore the integration of traditional practices like the falaj system with modern techniques to enhance water security, ensuring that adaptation methods are both innovative and culturally appropriate.

		modern technologies.		
5. Selection and assessment of adaptation options	**5.2 Execution of cost-benefit analysis for adaptation measures**	Implementing the analysis for particular adaptation options in water management.	**40%**	Cost-benefit analyses are in the early stages, focusing on identifying the most effective and economically viable adaptation measures. These analyses are crucial for prioritizing investments in high-cost interventions like recharge dams and advanced water treatment facilities. Future direction will focus on accelerating these analyses to ensure that resources are allocated efficiently and that the most impactful measures are implemented promptly, with a particular emphasis on long-term sustainability.
6. Climate finance	**6.1 Overview of climate finance sources**	Identifying potential climate finance resources specific to water resource management.	**55%**	Initial efforts to identify climate finance sources, including potential funding from GCF and international donors, are showing progress. However, securing long-term and diversified funding remains a challenge. Future direction will emphasize accessing grants and loans that specifically support water conservation and climate adaptation projects, with a focus on creating sustainable financing strategies that target vulnerable communities and ensure the longevity of key initiatives.
	6.2 Strategies for accessing climate finance	Approaches to secure funding from climate finance mechanisms for water management projects.	**50%**	Strategies for accessing climate finance are under development, with ongoing efforts to strengthen funding proposals by highlighting the critical need for water resource adaptation in Oman. Future direction will include collaboration with international finance experts and agencies to enhance the success rate of funding applications, ensuring that proposals align with global climate finance priorities and address the specific needs of Oman's water sector.
7. Implementation of projects	**7.1 Plans for implementation**	Outlining strategies for executing water resource adaptation projects, particularly under initiatives like the National Conservation Plan.	**55%**	Implementation plans are progressing, particularly in areas like groundwater management and rainwater harvesting. However, there are delays in finalizing specific projects and securing stakeholder engagement. Future direction will focus on speeding up the development of pilot projects, particularly in regions experiencing severe water stress, and integrating these projects with existing water management systems to ensure coherence and sustainability.
	7.4 Risk management strategies	Formulating plans to address potential risks to water resources,	**50%**	Risk management strategies are being developed, focusing on mitigating risks from overextraction, pollution, and climate change impacts. These strategies need to be more comprehensive, incorporating contingency plans for extreme weather events and long-term changes in water availability. Future direction will emphasize collaboration with local communities and stakeholders to ensure that risk management strategies are both

		including pollution and overextraction.		effective and socially acceptable, with a focus on building resilience at the community level.
9. Adaptation monitoring and evaluation	**9.1 Establishment of monitoring systems**	Implementing mechanisms to track the progress of water resource adaptation projects.	**50%**	Monitoring systems are being established, with a focus on tracking changes in groundwater levels, water quality, and rainfall patterns. However, there is a need for better integration of these systems across different regions and a stronger emphasis on real-time data collection and analysis. Future direction will ensure that monitoring systems are adaptable and capable of providing timely information to policymakers, with an emphasis on integrating new technologies for improved data accuracy and response capabilities.
	9.2 Setting evaluation criteria	Defining metrics for assessing the success of water resource adaptation projects.	**50%**	Evaluation criteria are being developed, with a focus on practical metrics such as improvements in water use efficiency, reductions in groundwater depletion, and enhancements in water quality. Future direction will ensure that these criteria are tailored to the specific challenges of the Omani water sector and aligned with broader climate adaptation goals. Additionally, the metrics will be adaptable to evolving climate conditions and the changing needs of water resource management to ensure long-term success.

2-Agriculture sector:

Category	Subcategory	Activity description	Assessment score (%)	Comments and future direction
1. Strategic vision	**1.1 Long-term goal formulation**	Establishing overarching objectives for the agriculture sector in Oman amid climate change.	**65%**	The long-term goals are informed by the Sustainable Agriculture and Rural Development Strategy (SARDS 2040). SARDS 2040, focusing on achieving a net zero water balance and boosting water productivity. Further refinement is needed to ensure these goals are adaptable to emerging climate challenges. Future direction will emphasize localized goals for coastal regions and areas affected by salinity and sea level rise.
	1.2 Alignment with national and international goals	Harmonizing with Oman's national policies and global commitments.	**60%**	Efforts to align with Oman Vision 2040 and the Paris Agreement are ongoing, but stronger integration of climate resilience measures in agricultural practices is necessary. Future direction will involve continued collaboration between the Ministry and international bodies like the Food and Agriculture Organization of the United Nations (FAO), with further alignment with international best practices recommended.
2. Foundation for adaptation	**2.1 Assessment of current state**	Analyzing the current state of agriculture in Oman, focusing on water resources, soil	**70%**	The current state assessment is progressing well, particularly through initiatives like the FAO-supported project, which addresses key climate hazards and water management issues. However, there is a need for more comprehensive data on the long-term impacts of climate change on soil salinity and crop viability. Future direction will focus on gathering and analyzing this data to better inform adaptive strategies.

		health, and climate impacts.		
	2.2 Development of adaptation strategies	Initiating the groundwork for adaptive measures in agriculture, particularly under SARDS 2040.	**55%**	Adaptation strategies are being developed under SARDS 2040, with a focus on water management and climate-resilient crops. However, the integration of these strategies with traditional practices like the falaj system needs to be strengthened. Future direction will prioritize pilot projects to test and refine these strategies in affected regions like Al-Batinah.
3. Evaluating climate change risks and vulnerabilities	**3.1 Analysis of climate projections and impacts**	Investigating future climate scenarios and their potential effects on agriculture.	**60%**	Climate projections are being analyzed with support from international partnerships. However, there is a need for more localized data to assess the impacts of saltwater intrusion and reduced groundwater recharge on agricultural productivity. Future direction will focus on developing models that incorporate these specific challenges, which will be critical for effective adaptation planning.
	3.2 Vulnerability identification	Pinpointing areas and populations at risk, especially smallholder farmers in coastal regions.	**60%**	Vulnerability assessments are under way, with a focus on regions like Al-Batinah and Salalah. More detailed mapping of vulnerable areas and at-risk populations, especially smallholder farmers, is needed to ensure targeted interventions. Future direction will prioritize these assessments in the context of salinity and sea level rise.
	3.3 Impact evaluation	Assessing the prospective impacts on crop production, agricultural livelihoods, and water resources.	**50%**	Impact evaluations are in progress, with initial focus areas including crop viability and water resource management. However, more comprehensive evaluations are required to understand the economic impacts of climate change on smallholder farmers and the long-term sustainability of current agricultural practices. Future direction will focus on expanding these evaluations to provide a more complete understanding of climate change impacts.
4. Exploring adaptation options	**4.1 Investigation of adaptation approaches**	Exploring diverse adaptation methodologies, including technological and traditional approaches.	**55%**	Various adaptation approaches are being considered, including the use of salt-tolerant crops and improvements in irrigation efficiency. The SARDS 2040 initiative is exploring these options, but further evaluation is needed to determine their scalability and effectiveness in the Omani context, particularly in regions prone to salinity. Future direction will include rigorous testing and evaluation of these approaches.
5. Selection and assessment of adaptation options	**5.2 Execution of cost-benefit analysis for**	Implementing the analysis for particular	**40%**	Cost-benefit analyses are in the early stages, with a focus on identifying the most effective adaptation measures for key crops and livestock. These analyses are crucial for prioritizing investments, particularly in high-cost interventions like water infrastructure and crop

	adaptation measures	adaptation options in agriculture.		diversification. Future direction will focus on accelerating these analyses to enable timely decision-making and resource allocation.
6. Climate finance	**6.1 Overview of climate finance sources**	Identifying potential climate finance resources specific to agriculture.	**55%**	Initial efforts to identify climate finance sources, including GCF funding and partnerships with FAO, are showing progress. However, securing sustained funding for long-term projects remains a challenge. Future direction will focus on accessing more diversified funding sources and leveraging international partnerships to support climate-resilient agriculture.
	6.2 Strategies for accessing climate finance	Approaches to secure funding from climate finance mechanisms for agricultural projects.	**50%**	Strategies for accessing climate finance are under development, with ongoing work to strengthen funding proposals by highlighting the specific vulnerabilities and needs of Oman's agricultural sector. Future direction will include collaboration with experienced international consultants in climate finance to enhance the quality and success of funding applications.
7. Implementation of projects	**7.1 Plans for implementation**	Outlining strategies for executing agricultural adaptation projects under initiatives like SARDS 2040.	**55%**	Implementation plans are progressing, particularly in areas like water management and crop diversification. However, delays in finalizing specific projects and securing stakeholder buy-in are slowing progress. Future direction will focus on accelerating the development of pilot projects, particularly in regions like Al-Batinah and Salalah, to test and refine adaptation measures.
	7.4 Risk management strategies	Formulating plans to address potential risks to agriculture.	**50%**	Risk management strategies are being developed, focusing on mitigating risks from salinity, water shortages, and extreme weather events. These strategies need to be more comprehensive and include contingency plans for long-term climate variability and its impacts on key agricultural regions. Future direction will emphasize the development and implementation of these contingency plans, ensuring they are robust and adaptable.
9. Adaptation monitoring and evaluation	**9.1 Establishment of monitoring systems**	Implementing mechanisms to track the progress of agricultural adaptation projects.	**50%**	Monitoring systems are being established, with a focus on tracking changes in crop yields, soil health, and water quality. However, there is a need for better integration of these systems across different regions and a stronger emphasis on data collection and analysis. Future direction will ensure that monitoring systems are equipped to handle real-time data collection and analysis, which will be critical for adaptive management.
	9.2 Setting evaluation criteria	Defining metrics for assessing the success of agricultural	**50%**	Evaluation criteria are being developed, with a focus on practical metrics such as yield improvements, water use efficiency, and farmer income levels. Future direction will ensure these criteria are tailored to the specific challenges of the Omani agricultural sector and

		adaptation projects.		that they align with broader climate adaptation goals. Metrics will also be adaptable to evolving climate conditions and the changing needs of the sector.

3-Fisheries Sector				
Category	**Subcategory**	**Activity description**	**Assessment score (%)**	**Comments and future direction**
1. Strategic vision	**1.1 Long-term goal formulation**	Establishing overarching objectives for the fisheries sector in Oman amid climate change.	**60%**	The long-term goals for the fisheries sector are aligned with the programme developed by the Ministry of Agriculture, Fisheries, and Water Resources and the World Bank. Future efforts will focus on explicitly integrating climate change adaptation into these goals to address vulnerabilities in marine biodiversity and the potential impacts of climate variability on fisheries. Collaboration with climate scientists and marine biologists will help refine these goals to ensure sustainability in the face of climate change.
	1.2 Alignment with national and international goals	Harmonizing with Oman's national policies and global commitments.	**55%**	Efforts to align with national and international fisheries management standards are ongoing. Future work will focus on incorporating international best practices for climate resilience, with additional alignment to global agreements on marine protection and sustainable fisheries.
2. Foundation for adaptation	**2.1 Assessment of current state**	Analyzing the current state of fisheries resources, including the impact of climate change on marine biodiversity.	**65%**	The current state assessment is progressing, with efforts to define the status of fisheries resources and their vulnerability to climate change. Future work will include collecting more comprehensive data on the impacts of climate variability on marine species and ecosystems to develop effective adaptation strategies and ensure long-term sustainability of the fisheries sector.
	2.2 Development of adaptation strategies	Initiating the groundwork for adaptive measures in fisheries management, particularly under the Climate Change Strategy.	**50%**	Adaptation strategies are being developed, focusing on improving knowledge management and governance in the fisheries sector. Future direction will involve integrating these strategies with broader goals of the sustainable management programme. Prioritizing pilot projects to test adaptive management approaches and livelihood diversification initiatives will be key to building resilience in the sector.
3. Evaluating climate change risks and vulnerabilities	**3.1 analysis of climate projections and impacts**	Investigating future climate scenarios and their potential	**55%**	Climate projections are being analyzed, with a focus on understanding the impacts of ocean warming, acidification, and changes in marine currents on fisheries. Future efforts will focus on developing more localized models to predict specific impacts on Oman's

		effects on fisheries and marine resources.		marine biodiversity and fisheries productivity, and integrating these projections into fisheries management plans for better adaptation to long-term climate changes.
	3.2 Vulnerability identification	Pinpointing areas and populations at risk, especially coastal communities reliant on fisheries.	**60%**	Vulnerability assessments are under way, particularly focusing on coastal communities and small-scale fishers who are most at risk from climate change impacts. Future work will identify specific regions and marine species most vulnerable to climate variability, including risks of overfishing and habitat degradation. Tailoring adaptation strategies to address these vulnerabilities will be crucial for maintaining the resilience of the sector.
	3.3 Impact evaluation	Assessing the prospective impacts on fisheries productivity, marine ecosystems, and fishing livelihoods.	**50%**	Impact evaluations are in progress, focusing on the economic and ecological impacts of climate change on fisheries. Future directions will include more comprehensive evaluations to understand the long-term sustainability of fisheries under different climate scenarios. Exploring economic diversification to reduce dependence on fishing and build resilience in coastal communities will also be prioritized.
4. Exploring adaptation options	**4.1 Investigation of adaptation approaches**	Exploring diverse adaptation methodologies, including sustainable fisheries management and alternative livelihoods.	**55%**	Various adaptation approaches are being considered, including improved governance frameworks and livelihood diversification. Future efforts will evaluate the effectiveness and scalability of these approaches within the Omani context, particularly through pilot projects and stakeholder consultations to refine strategies.
5. Selection and assessment of adaptation options	**5.2 Execution of cost-benefit analysis for adaptation measures**	Implementing the analysis for specific adaptation options in fisheries management.	**40%**	Cost-benefit analyses are in the early stages, focusing on identifying the most effective adaptation measures for fisheries and marine resource management. Future directions will accelerate these analyses to prioritize investments in high-cost interventions like marine protected areas and fisheries monitoring systems, ensuring that resources are allocated efficiently, and impactful measures are implemented promptly.
6. Climate finance	**6.1 Overview of climate finance sources**	Identifying potential climate finance resources	**50%**	Initial efforts to identify climate finance sources, including potential funding from GCF and international marine conservation organizations, are showing progress. Future efforts will focus on securing sustained and diversified funding, accessing grants and loans that

		specific to fisheries management.		specifically support marine conservation and fisheries adaptation projects, particularly those that target vulnerable coastal communities.
	6.2 Strategies for accessing climate finance	Approaches to secure funding from climate finance mechanisms for fisheries and marine resource management projects.	**45%**	Strategies for accessing climate finance are under development, with ongoing efforts to strengthen funding proposals by highlighting the critical need for fisheries adaptation in Oman. Future work will include collaboration with international finance experts and agencies to enhance the success rate of funding applications and ensure alignment with global climate finance priorities.
7. Implementation of projects	**7.1 Plans for implementation**	Outlining strategies for executing fisheries adaptation projects, particularly under the Sustainable Management of the Fisheries Sector programme.	**55%**	Implementation plans are progressing, particularly in areas like fisheries management and stakeholder engagement. Future efforts will address delays in finalizing specific projects and securing stakeholder engagement. Speeding up the development of pilot projects, particularly in regions experiencing the most significant impacts of climate change, will be key to testing and refining adaptation measures. Integrating these projects with existing fisheries management systems will ensure coherence and sustainability.
	7.4 Risk management strategies	Formulating plans to address potential risks to fisheries and marine resources, including overfishing and habitat degradation.	**50%**	Risk management strategies are being developed, focusing on mitigating risks from overfishing, habitat degradation, and climate change impacts. Future directions will involve creating comprehensive strategies that include contingency plans for extreme weather events and long-term changes in marine ecosystems. Collaboration with local communities and stakeholders will be crucial for successful implementation.
9. Adaptation monitoring and evaluation	**9.1 Establishment of monitoring systems**	Implementing mechanisms to track the progress of fisheries	**50%**	Monitoring systems are being established, with a focus on tracking changes in fisheries productivity, marine biodiversity, and oceanographic conditions. Future efforts will aim to integrate these systems better across different regions and emphasize real-time data collection and analysis. Ensuring that monitoring systems are adaptable and capable of

		adaptation projects.		providing timely information to policymakers will be critical for effective fisheries management.
	9.2 Setting evaluation criteria	Defining metrics for assessing the success of fisheries adaptation projects.	**50%**	Evaluation criteria are being developed, focusing on practical metrics such as improvements in fisheries productivity, reductions in overfishing, and enhancements in marine biodiversity. Future directions will tailor these criteria to the specific challenges of the Omani fisheries sector, aligning them with broader climate adaptation goals and ensuring they are adaptable to evolving climate conditions.

4-Infastructure and urban areas

Category	Subcategory	Activity description	Assessment score (%)	Comments and future direction
1. Strategic vision	**1.1 Long-term goal formulation**	Establishing overarching objectives for urban infrastructure and climate resilience in Oman, including flood management and cyclone preparedness.	**55%**	The strategic vision for infrastructure is gradually integrating climate resilience, particularly regarding flooding and tropical cyclones. Both the Oman Spatial Strategy and the Oman Climate Change Strategy have a clear focus on climate adaptation, which will guide future efforts to explicitly integrate climate change adaptation into long-term goals for urban development and disaster preparedness. Developing a comprehensive vision that includes flood management and cyclone preparedness will be essential.
	1.2 Alignment with national and international goals	Harmonizing with Oman's national policies and global commitments, including early warning systems for climate-related hazards.	**50%**	Current strategies lack explicit climate change adaptation priorities. Future work will involve aligning urban infrastructure strategies and early warning systems with national climate change policies and international best practices for climate resilience. The Oman Spatial Strategy and Oman Climate Change Strategy provide a strong foundation for this alignment, which will enhance the integration of global standards for resilient infrastructure and disaster preparedness.
2. Foundation for adaptation	**2.1 Assessment of current state**	Analyzing the current state of urban infrastructure and its vulnerabilities to climate change,	**60%**	The current state assessment of infrastructure is ongoing, but significant gaps remain in addressing vulnerabilities to flooding and tropical cyclones. Future efforts will include comprehensive assessments of infrastructure and early warning systems to identify climate-related risks. This data will be crucial for developing targeted adaptation strategies. The Oman Spatial Strategy also partially focuses on climate adaptation.

		including risks from flooding and tropical cyclones.		
	2.2 Development of adaptation strategies	Initiating the groundwork for adaptive measures in infrastructure and early warning systems, particularly under the Climate Change Strategy.	**55%**	Adaptation strategies are being considered, focusing on updating hazard maps, coastal zone setback lines, incorporating climate risks into infrastructure projects, and strengthening early warning systems. Future directions will involve developing and implementing these strategies, ensuring they are integrated into urban planning, development, and disaster preparedness processes. Piloting these strategies in vulnerable regions will be essential. The Oman Spatial Strategy also partially focuses on climate adaptation.
3. Evaluating climate change risks and vulnerabilities	**3.1 Analysis of climate projections and impacts**	Investigating future climate scenarios and their potential effects on infrastructure, urban areas, and the effectiveness of early warning systems.	**55%**	Climate projections are being analyzed to understand their impacts on urban areas and infrastructure, with a focus on flooding and tropical cyclones. However, there is a need for more localized and sector-specific data to guide adaptation efforts. Future efforts will focus on integrating these projections into urban planning, infrastructure design, and the enhancement of early warning systems to improve resilience. The Oman Spatial Strategy also partially focuses on climate adaptation.
	3.2 Vulnerability identification	Pinpointing areas and populations at risk, especially urban centers and regions vulnerable to flooding and cyclones.	**60%**	Vulnerability assessments are beginning to identify areas at high risk, particularly in coastal and urban regions prone to flooding and cyclones. Future work will involve refining these assessments to focus on critical infrastructure and the effectiveness of early warning systems, ensuring that the most vulnerable areas are prioritized for adaptation efforts. The Oman Spatial Strategy also partially focuses on climate adaptation.
	3.3 Impact evaluation	Assessing the prospective impacts on urban infrastructure and associated livelihoods, particularly from	**50%**	Impact evaluations are in the early stages, focusing on understanding how climate change, including flooding and tropical cyclones, will affect urban infrastructure. Future directions will include more detailed evaluations of potential economic impacts, particularly how disruptions to infrastructure could affect local and national economies, and the role of early warning systems in mitigating these impacts. The Oman Spatial Strategy also partially focuses on climate adaptation.

		flooding and cyclones.		
4. Exploring adaptation options	**4.1 Investigation of adaptation approaches**	Exploring diverse adaptation methodologies, including resilient urban planning and the enhancement of early warning systems.	**55%**	Various adaptation approaches are being explored, such as updating building codes, improving urban planning to incorporate climate resilience, and enhancing early warning systems for floods and cyclones. Future efforts will evaluate the effectiveness of these approaches, particularly through pilot projects that integrate climate risks into urban development plans. Stakeholder engagement will be crucial to refine these strategies. The Oman Spatial Strategy also partially focuses on climate adaptation.
5. Selection and assessment of adaptation options	**5.2 Execution of cost-benefit analysis for adaptation measures**	Implementing the analysis for particular adaptation options in urban infrastructure and early warning systems.	**40%**	Cost-benefit analyses are currently underdeveloped, focusing on identifying the most cost-effective adaptation measures for infrastructure and early warning systems. Future directions will accelerate these analyses to guide investment in climate-resilient infrastructure projects, ensuring that resources are allocated to the most impactful and sustainable measures, including the enhancement of early warning systems. The Oman Spatial Strategy also partially focuses on climate adaptation.
6. Climate finance	**6.1 Overview of climate finance sources**	Identifying potential climate finance resources specific to urban infrastructure and early warning systems.	**45%**	Initial efforts to identify climate finance sources are under way, with a focus on securing funding for infrastructure and early warning systems adaptation projects. Future efforts will focus on diversifying funding sources, including international grants and loans, to support the development of climate-resilient urban areas and the enhancement of early warning systems. The Oman Spatial Strategy also partially focuses on climate adaptation.
	6.2 Strategies for accessing climate finance	Approaches to secure funding from climate finance mechanisms for infrastructure and early warning systems projects.	**40%**	Strategies for accessing climate finance are being developed, with an emphasis on creating compelling proposals that highlight the need for resilient infrastructure and early warning systems. Future work will involve strengthening these proposals to align with global climate finance priorities, increasing the likelihood of securing the necessary funding. The Oman Spatial Strategy also partially focuses on climate adaptation.
7. Implementation of projects	**7.1 Plans for implementation**	Outlining strategies for executing adaptation	**50%**	Implementation plans are progressing, with a focus on integrating climate resilience into urban development and improving early warning systems. Future efforts will address the slow pace of project execution by prioritizing pilot projects in high-risk areas and ensuring that climate resilience and effective early warning systems are core components of all new

		projects in urban infrastructure and early warning systems.		infrastructure developments. The Oman Spatial Strategy also partially focuses on climate adaptation.
	7.4 Risk management strategies	Formulating plans to address potential risks to infrastructure, urban areas, and the effectiveness of early warning systems.	**50%**	Risk management strategies are being developed, focusing on mitigating risks from climate-related events such as flooding and tropical cyclones. Future directions will include the creation of comprehensive risk management frameworks that incorporate contingency plans for extreme weather events and long-term climate shifts, ensuring the safety and resilience of urban infrastructure and the reliability of early warning systems. The Oman Spatial Strategy also partially focuses on climate adaptation.
9. Adaptation monitoring and evaluation	**9.1 Establishment of monitoring systems**	Implementing mechanisms to track the progress of infrastructure and early warning systems adaptation projects.	**45%**	Monitoring systems are being established to track progress, but there is a need for more robust systems that can provide real-time data on climate resilience in urban and early warning systems projects. Future efforts will focus on enhancing these systems to ensure they are effective and capable of guiding adaptive management practices in response to climate change. The Oman Spatial Strategy also partially focuses on climate adaptation.
	9.2 Setting evaluation criteria	Defining metrics for assessing the success of adaptation projects in urban areas and early warning systems.	**45%**	Evaluation criteria are in development, focusing on metrics such as reductions in climate-related damage, improvements in infrastructure resilience, and the effectiveness of early warning systems. Future directions will refine these criteria to ensure they are specific, measurable, and aligned with broader climate adaptation goals, providing a clear framework for assessing the effectiveness of adaptation efforts in urban and early warning systems sectors. The Oman Spatial Strategy also partially focuses on climate adaptation.

5-Public health

Category	Subcategory	Activity description	Assessment score (%)	Comments and future direction
1. Strategic vision	**1.1 Long-term goal formulation**	Establishing overarching objectives for public health in Oman amid climate change.	**50%**	The strategic vision for public health, as outlined in Health Vision 2050, is comprehensive, but it currently lacks a focus on climate change adaptation. Future efforts will focus on integrating climate change adaptation into long-term public health goals to address vulnerabilities to climate-related health risks. This integration will be essential for building a climate-resilient public health system.
	1.2 Alignment with national and	Harmonizing with Oman's national policies and global	**45%**	Current strategies, including Health Vision 2050, do not explicitly address climate change adaptation. Future work will involve aligning public health strategies with national climate change policies and international best practices for health resilience. This alignment will

	international goals	commitments, including climate change adaptation in public health.		help ensure that Oman's public health system is prepared to respond to climate-related health challenges.
2. Foundation for adaptation	**2.1 Assessment of current state**	Analyzing the current state of public health in Oman, including vulnerabilities to climate change impacts.	**55%**	The current state assessment of public health is ongoing, with some focus on sectoral integration through wilayat health committees. However, significant gaps remain in addressing vulnerabilities to climate change. Future efforts will include comprehensive assessments of public health vulnerabilities to climate change, particularly in areas such as vector-borne diseases, heat stress, and waterborne illnesses.
	2.2 Development of adaptation strategies	Initiating the groundwork for adaptive measures in public health, particularly under the Climate Change Strategy.	**50%**	Adaptation strategies are being considered, focusing on raising public awareness, enhancing resilience, and building partnerships. Future directions will involve developing and implementing these strategies, ensuring they are integrated into public health planning and emergency preparedness. Pilot projects aimed at increasing health sector resilience to climate change will be crucial.
3. Evaluating climate change risks and vulnerabilities	**3.1 Analysis of climate projections and impacts**	Investigating future climate scenarios and their potential effects on public health in Oman.	**50%**	Climate projections are being analyzed to understand their impacts on public health, particularly regarding heatwaves, disease spread, and extreme weather events. However, there is a need for more localized and sector-specific data to guide adaptation efforts. Future efforts will focus on integrating these projections into public health planning to improve resilience and preparedness.
	3.2 Vulnerability identification	Pinpointing areas and populations at risk, especially vulnerable groups such as the elderly, children, and those with pre-existing health conditions.	**55%**	Vulnerability assessments are beginning to identify areas and populations at high risk, particularly in relation to climate-sensitive health outcomes. Future work will involve refining these assessments to focus on the most vulnerable groups and regions, ensuring that adaptation efforts are targeted and effective.
	3.3 Impact evaluation	Assessing the prospective impacts on public health, healthcare infrastructure, and community well-being.	**45%**	Impact evaluations are in the early stages, focusing on understanding how climate change will affect public health and healthcare infrastructure. Future directions will include more detailed evaluations of potential health impacts, particularly in relation to emerging health threats like vector-borne diseases and the strain on healthcare services.

4. Exploring adaptation options	**4.1 Investigation of adaptation approaches**	Exploring diverse adaptation methodologies, including public health campaigns, emergency preparedness, and healthcare infrastructure improvements.	**50%**	Various adaptation approaches are being explored, such as public awareness campaigns and improvements to healthcare infrastructure. Future efforts will evaluate the effectiveness of these approaches, particularly through pilot projects that integrate climate risks into public health planning and emergency response systems. Stakeholder engagement, including collaboration with NGOs and community leaders, will be crucial to refine these strategies.
5. Selection and assessment of adaptation options	**5.2 Execution of cost-benefit analysis for adaptation measures**	Implementing the analysis for particular adaptation options in public health.	**40%**	Cost-benefit analyses are currently underdeveloped, focusing on identifying the most cost-effective adaptation measures for public health. Future directions will accelerate these analyses to guide investment in climate-resilient healthcare infrastructure and public health initiatives, ensuring that resources are allocated to the most impactful and sustainable measures.
6. Climate finance	**6.1 Overview of climate finance sources**	Identifying potential climate finance resources specific to public health.	**45%**	Initial efforts to identify climate finance sources are under way, with a focus on securing funding for public health adaptation projects. Future efforts will focus on diversifying funding sources, including international grants and loans, to support the development of a climate-resilient public health system.
	6.2 Strategies for accessing climate finance	Approaches to secure funding from climate finance mechanisms for public health adaptation projects.	**40%**	Strategies for accessing climate finance are being developed, with an emphasis on creating compelling proposals that highlight the need for resilient public health systems. Future work will involve strengthening these proposals to align with global climate finance priorities, increasing the likelihood of securing the necessary funding.
7. Implementation of projects	**7.1 Plans for implementation**	Outlining strategies for executing adaptation projects in public health.	**50%**	Implementation plans are progressing, with a focus on integrating climate resilience into public health planning and improving emergency preparedness. Future efforts will address the slow pace of project execution by prioritizing pilot projects in high-risk areas and ensuring that climate resilience is a core component of all new public health initiatives.
	7.4 Risk management strategies	Formulating plans to address potential risks to public health, healthcare infrastructure, and community well-being.	**50%**	Risk management strategies are being developed, focusing on mitigating risks from climate-related health impacts such as heatwaves, disease outbreaks, and extreme weather events. Future directions will include the creation of comprehensive risk management frameworks that incorporate contingency plans for emerging health threats and long-term climate shifts, ensuring the safety and resilience of public health infrastructure and services.
9. Adaptation monitoring and evaluation	**9.1 Establishment of monitoring systems**	Implementing mechanisms to track the progress of	**45%**	Monitoring systems are being established to track progress, but there is a need for more robust systems that can provide real-time data on climate resilience in public health projects. Future efforts will focus on enhancing these systems to ensure they are effective and capable of guiding adaptive management practices in response to climate change.

		public health adaptation projects.		
	9.2 Setting evaluation criteria	Defining metrics for assessing the success of adaptation projects in public health.	**45%**	Evaluation criteria are in development, focusing on metrics such as reductions in climate-related health impacts, improvements in public health infrastructure resilience, and the effectiveness of public awareness campaigns. Future directions will refine these criteria to ensure they are specific, measurable, and aligned with broader climate adaptation goals, providing a clear framework for assessing the effectiveness of adaptation efforts in the public health sector.