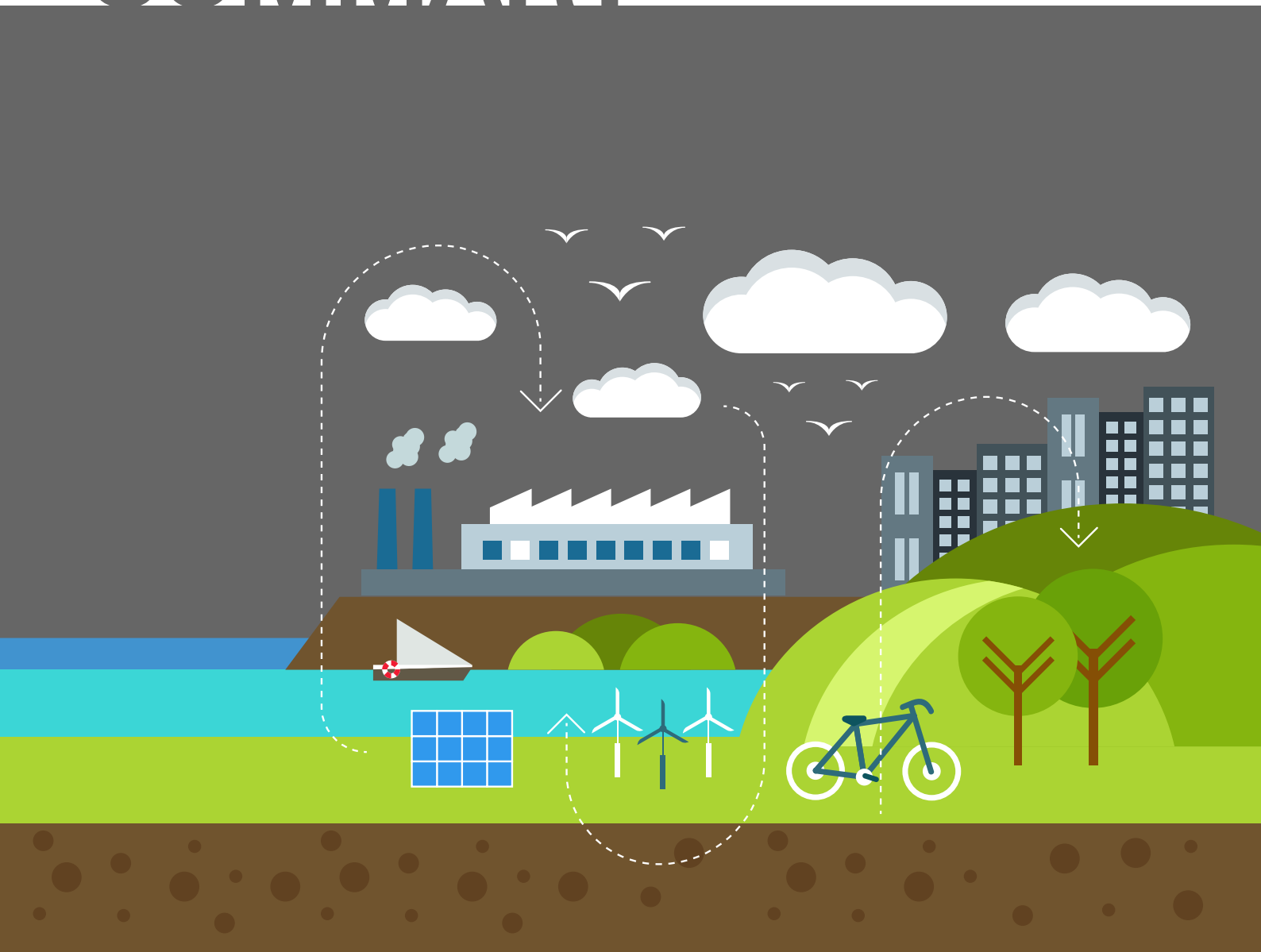
Climate Change Strategy
for Urban Planning and
Urban Development Sector
in the State of Qatar

EXECUTIVE SUMMARY



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Executive Summary

1.1 Stage 1

GHD Global Pty Ltd (GHD) was engaged by the Urban Planning Department of the Ministry of Municipality and Environment (MME) to develop a Climate Change Strategy (CCS) for the Urban Planning and Urban Development Sector in the State of Qatar.

1.1.1 Background

Qatar has seen immense growth during the last 30 years, including in industry, population and the size of urban settlements. This growth has been driven by the oil and natural gas reserves that have been developed, contributing to one of the highest per capita Gross Domestic Product (GDP) in the world (Forbes, 2012).

In 2008, the General Secretariat for Development Planning (GSDP) (now the Ministry of Development Planning and Statistics [MDPS]) developed the Qatar National Vision 2030 (QNV2030). The QNV2030 seeks to manage the opportunities and challenges associated with rapid growth through four key sectors:

- Human development
- Social development
- Economic development
- Environmental development

A number of documents supporting the implementation of this plan have been developed including the Qatar National Development Strategy (QNDS) and the Qatar National Master Plan (QNMP). The QNMP has two key aspects: the Qatar National Development Framework (QNDF) and the Municipal Spatial Development Plans (MSDPs). Both the QNDF and MSDPs aim to manage the planning challenges faced by Qatar. Some of the challenges detailed in the QNDF include:

- *Sensitive environments are being degraded by urban and industrial activities, land reclamation and excavations, and major infrastructure projects with declines in air and water quality and loss of biodiversity* (Box 1 in the QNDF, 2010)
- *Inefficient use and management of energy is increasing the level of greenhouse gas emissions (*Box 1 in the QNDF, 2010)
- *The lack of an integrated Government policy on food security, sustainable water supply and environmental protection is creating pressures on the future of the agricultural industry and the nation's natural environment assets (*Box 1 in the QNDF, 2010)
- *The townscape and landscape of the country are being compromised by the location and massing of national utilities corridors through Qatar and major power and water structures along the coast* (Box 1 in the QNDF, 2010)

The development of this strategy was proposed in the QNDF under Policy **"ENV2: Climate change management"** that states "*Safeguard human life, infrastructure development, economic activities and natural environment of Qatar from the potential impacts of climate change in the Gulf region*" (QNDF, 2010). This plan aims to cover the urban planning and development sectors associated with this statement.

1.1.2 Project objective

The objective of this project is to "*prepare a Climate Change Strategy for the urban planning and development sector in the State of Qatar*" (MMUP, 2015). The focus on urban planning and development will be achieved by focusing on aspects directly or indirectly related to spatial land use in Qatar. This may include those "policies and regulatory tools", as well as the administrative authorities that manage them. The CCS was based on proposing mitigation and adaptation measures to be incorporated into the urban planning and development sector. The steps and process included:

- Mitigation
  - Investigate current and future land use plans to understand opportunities for reduction in carbon emissions through planning aspects.
  - Investigate connectivity within the future land use plans to assess Greenhous Gas (GHG) emission potential and ways to reduce it.
- Adaptation
  - Analysis of current standards and practice to understand the mechanisms that make developers and investors take climate change and associated issues into account.
  - Consider potential impacts associated with climate change on availability of services and utilities, and how these will be managed.
  - Recommend contingency plans and spatial planning strategies for affected communities.
- Adaptation-Mitigation
  - Identify opportunities to record GHG emissions from future developments to raise awareness and encourage reduction through regulatory tools.
  - Investigate level of governance and attributes of the development approval to assess their effectiveness in understanding and raising awareness about potential impacts from climate change. Understand the willingness of individuals/sectors to take actions to mitigate/adapt to climate change.

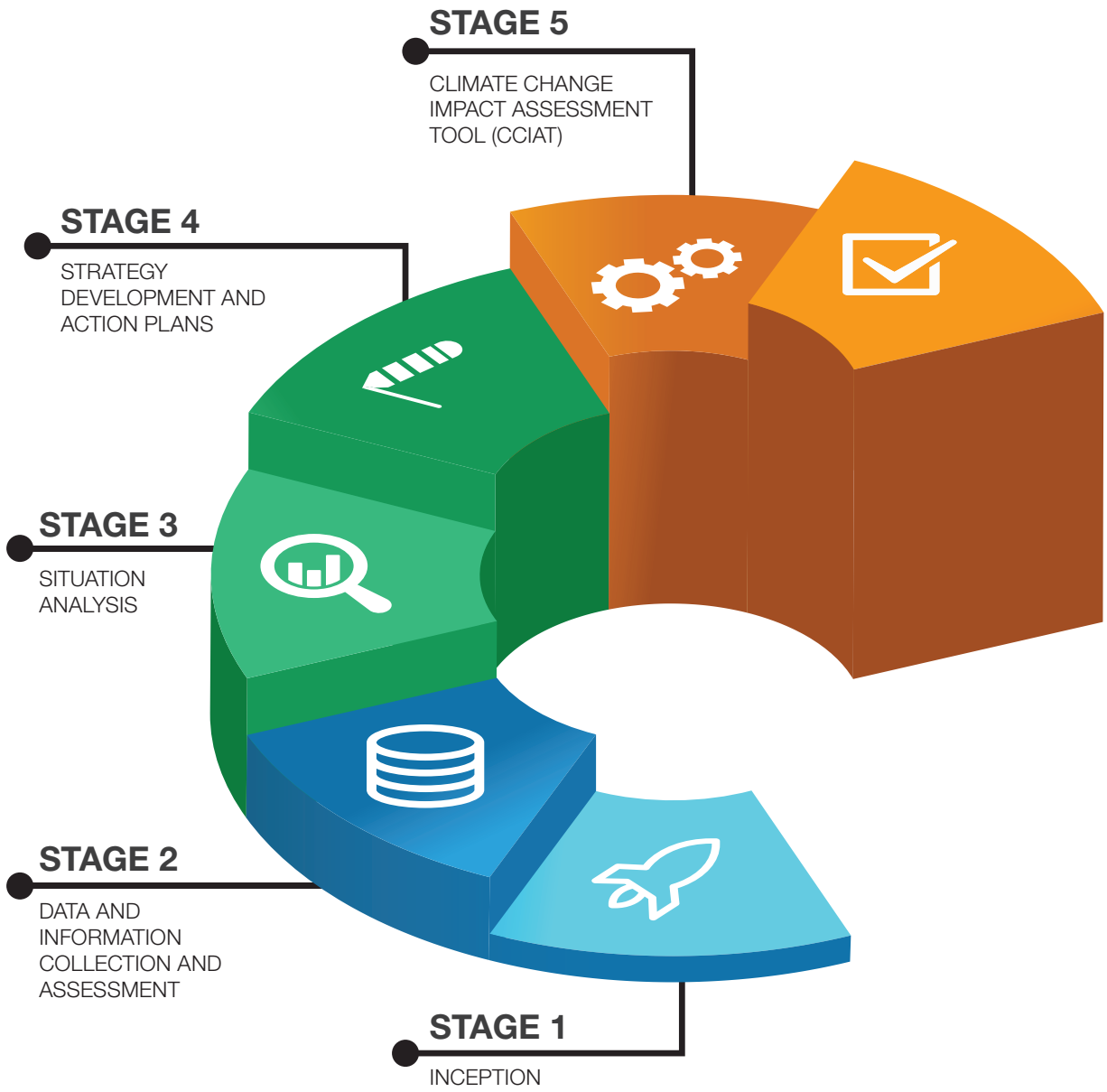
1.1.3 Scope

The focus on urban planning and development was achieved by focusing on aspects directly or indirectly related to spatial land use in Qatar. This included the policies and regulatory tools (QNMP and subsidiary plans) as well as the administrative authorities that manage them. The CCS is based on proposing mitigation and adaptation measures that can be incorporated into the urban planning and development sector.

GHD considers 2032 (working target) to be the end date of the emerging climate change strategy or action plans. This is in line with the QNDF.

The CCS was developed through the following stages:

- Stage 1: Inception
- Stage 2: Data and information collection and assessment
- Stage 3: Situation analysis
- Stage 4: Strategy development and action plans
- Stage 5: Climate Change Impact Assessment Tool (CCIAT)


STAGE 5
CLIMATE CHANGE IMPACT ASSESSMENT TOOL (CCIAT)
STAGE 4
STRATEGY DEVELOPMENT AND ACTION PLANS
STAGE 3
SITUATION ANALYSIS
STAGE 2
DATA AND INFORMATION COLLECTION AND ASSESSMENT
STAGE 1
INCEPTION

Geographically, this project applies to the areas that are covered by the QNMP. Those areas exempt from the QNMP will also be exempt from the scope of this project. This includes the following:

- Military areas including, army, navy and air force
- Industrial cities/Qatar Petroleum (QP) areas
- Emir's palaces/royal family residences
- US air base

Areas where master plans already exist (e.g. Lusail, Qatar Foundation, Aspire Zone etc.) were considered. However, this will be dependent upon receiving up to date information from those stakeholders and understanding the extent of the MME's influence in these areas.

High and low levels of development, and eventual post high development scenarios as proposed in the QNMP, were considered to establish baseline GHG emission levels with an understanding of what can be influenced by a spatial plan and associated urban form. Due to the nature of rapid economic development experience and planned development in Qatar, these baseline levels would be used for future comparison rather than to establish framework target emission levels.

The established baseline will support the development of conceptual mitigation and adaptation options to reduce greenhouse gas emissions and reduce climate change risks to urban development. The mitigation and adaptation options were developed on the basis of the literature search of Stage 2, the benchmarking exercise, the findings of the Stage 3 workshop and risk assessment, and cost effectiveness and knowledge from GHD and the MME's Technical team.

1.2 Stage 2

Stage 2 provides a summary of the data that has been collected and sourced by GHD. It includes the type of data identified fo the purpose of this Project, the rationale for proposing the data and the identification of data sources. A data assessment was undertaken where information from existing and on-going studies, strategies, plans and policy development initiatives were extracted for future use in the development of the CCS. Data gaps and the proposed alternatives and recommendations for missing data were also identified.

Data was also assessed to identify and establish key climate change risks and measures (mitigation and adaptation) to tackle the challenges posed by climate change in the urban planning and development sector. The top four key critical risk factors identified at this stage of the assessment were:

1. Very high per capita water and energy consumption, extremely high reliance on energy for life.
2. A lack of implementation / enforcement and loopholes in existing plans and energy efficiency standards.
3. Vulnerable infrastructure: water, food and energy security concerns.
4. Vulnerability of population and economic areas.

These key critical risk factors form and shape the Situation Analysis in Stage 3 and Strategy in Stage 4 of the Project.

1.3 Stage 3

Stage 3 of the Project presents an analysis of the current situation in Qatar in relation to urban planning and climate change. This report investigates and addresses the following:

- The nature of land use and developments together with a review of the current and potential future population
- Climate change impacts
- Risk assessment of climate change
- Existing climate change management
- Next steps

A summary of the findings for each of the above aspects is provided below.

Land use and population

An assessment of the existing and projected future land uses and population for Qatar was undertaken. Currently, desert is the most dominant land use (82%), although there has been rapid urbanisation since 2008. The majority of the population resides on the coast, focussed in Doha and Al Rayyan municipalities, with Doha comprising the most densely populated municipality by a large amount, although it is the smallest municipality. Urban sprawl is considered to be one of the key current issues, resulting in large areas of low-density residential areas, which is land-intensive. Another key issue is major infrastructure projects being completed in isolation to national urban planning, meaning that the majority of Qatar's new developments are located on or in proximity to the low lying coastline and required climate change mitigation and adaption measures are not or may not be implemented.

The projected dominant land use for 2032 is desert, followed by the newly classified 'Environmental Conservation Zone / Agricultural and Green Areas', 'Special Development Areas', 'Transportation and Utility (Roads)', 'Industrial', 'Residential', 'Special Use', 'Parks and Recreation', 'Mixed use', and 'Commercial' zones. Low density residential land use would outweigh proposed medium and high density residential, which could exacerbate the current urban sprawl issue.

The projected average future population (2032) for Qatar is 2.1 million, while the projected maximum density scenario is 3.2 million. An overall reduction in population size is projected, which is potentially attributed to the expected reduction in migrant workers once the major infrastructure projects currently under construction in advance of the 2022 FIFA World Cup are completed (QNMP). However, previous population estimates are already being exceeded, so this number could rise further in the future.

Climate change impacts in Qatar

Of the Middle East and North Africa (MENA) countries, Qatar is the most vulnerable to sea level rise and associated flooding. Unfortunately, the majority of the coastal areas will be impacted by this sea level rise. A flood study was completed for Qatar, which modelled flooding under various climate change scenarios with varying levels of rainfall intensity, sea level rise and storm surge. In general, low intensity floods of short duration (typically less than a day) with shallow flood depths (typically < 0.5 m) were projected for Qatar. The flooding would be spread out, primarily due to the flat nature of the terrain. The study found that the majority of the land that is projected to be flooded is desert, with 83% of the total projected inundated area comprising this land use. However, around one third of all other land use areas were projected to be affected. Depending on the land use type, the economic, social and environmental impacts would vary, although the flood modelling projected that much of Qatar's critical infrastructure would be affected by the current situation of flooding including power and water supply infrastructure as well as emergency services and hospitals. Within Doha City Centre, the modelled flood simulations projected that a number of areas are projected to be inundated by up to 2 m of water.

With regards to temperature rise, the IPCC (Intergovernmental Panel on Climate Change) expects temperatures in Middle Eastern countries (including Qatar) to rise by about 2 °C in the next 15-20 years, and by more than 4 °C by the end of the century. In urban areas, this will be exacerbated by heat island effect (which indicates an urban or metropolitan area that is significantly warmer than its surrounding areas due to human activities) intensified in:

- Built-up areas, particularly roads
- Inland areas compared with those nearer the sea (coastal areas)
- Areas with higher population densities

The areas assessed to be particularly affected by the heat island effect were Doha and Al Rayyan municipalities, with six areas noted to be affected in each, while Al Daayen and Umm Slal included one area each. Increased heat can result in critical human health issues as well as impacts to biodiversity and an increase in GHG emissions due to increased power requirements. With regards to GHG emissions, the 2012 per capita GHG emissions for Gulf countries published by World Resources Institute revealed that Qatar had the highest per capita GHG emissions from power and transportation categories. Based on the 2014 data, private passenger vehicles including taxis and motorcycles contributed approximately 99% of the transportation GHG emissions. This data demonstrates the need for public transportation to lower GHG emissions.

Risk assessment

A number of key issues were highlighted during the review of climate change impacts in Qatar. Each of these key issues were then assessed via a risk assessment to categorize the risk level, which ranged from low to extreme. The following risk levels were designated for the 38 identified issues evaluated:

- The majority (71%) were evaluated to be high risk and therefore require intervention in the short term. These issues mainly corresponded to flooding and sea level rise impacts to municipalities and critical infrastructure.
- Two issues were evaluated to be an extreme risk, both of which related to temperature as a result of the projected increase in temperatures combined with the heat island effect. These issues would require urgent intervention.
- Two issues were assessed to have moderate risk, associated with the projected flooding of health centres to depths of < 0.5 m. These items can be addressed in the longer term.
- Seven issues (18%) were evaluated as low risk, which related to critical infrastructure experiencing major flooding at less than or equal to 0.2 m. These items, along with the moderate risk category, can be addressed in the longer term.

Existing climate change management in Qatar

A number of studies and initiatives addressing climate change have been undertaken by the community and private entities in Qatar, which were reviewed as part of this study. From these studies and initiatives, it can be surmised that there is a general acknowledgement and understanding of climate change and its effects in Qatar by its citizens and commercial entities. However, knowledge of certain impacts and how they may be mitigated seems poor. This may negatively affect the support of changes introduced by the government in terms of development controls, funding direction and actions required of the community itself.

There is an opportunity for the outcomes of this study to encourage the preparation of an education campaign to increase awareness and support of new climate change management and mitigation measures that may be adopted by the MME. It may also lead to innovative solutions implemented by the private sector and community groups.

Further, a review of existing planning frameworks, policies, action plans, strategies, guidelines and applicable international treaties and conventions was undertaken to understand the limitations of the current planning framework and interventions in comparison to identified key climate change issues in Qatar. From a review of a range of framework documents, it is clear that a role exists for intervention from the urban planning and development sector in the form of policy and guideline development that assists in addressing and responding to the various identified potential climate change impacts for Qatar. Notably, with regards to the urban heat island effect, urban design also has a role in influencing design outcomes that serve to mitigate against such impacts in the public realm.

1.4 Stage 4

1.4.1 Introduction

Stage 4 of the Project presents climate change mitigation and adaption measures for Qatar in relation to urban planning and the associated action and implementation plans.

1.4.2 Climate Change Strategy framework

The strategy is structured through the establishment of a hierarchical framework comprising a set of specific actions delivering outputs, which contribute to higher level objectives aimed to achieve the overall vision of the strategy (Figure 1.1).

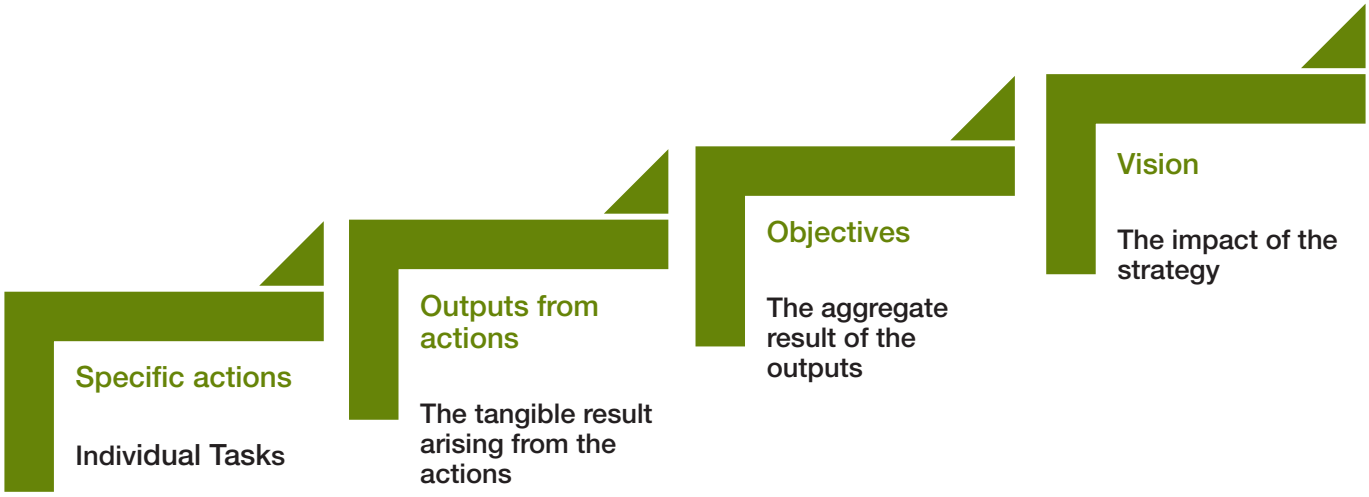


Figure 1.1: Hierarchical framework of the Climate Change Strategy

A vision statement for the Climate Change Strategy (CCS) for Urban Planning and Urban Development in Qatar was developed by reviewing existing climate change policy statements in the QNDF, QNV2030 and other Qatari planning framework documents. The vision statement sets the overall course for the CCS.

"Urban development in Qatar will progressively reduce average per capita greenhouse gas emissions and be resilient to the potential impacts from climate change"

The objectives for the CCS are set out in Figure 1.2.

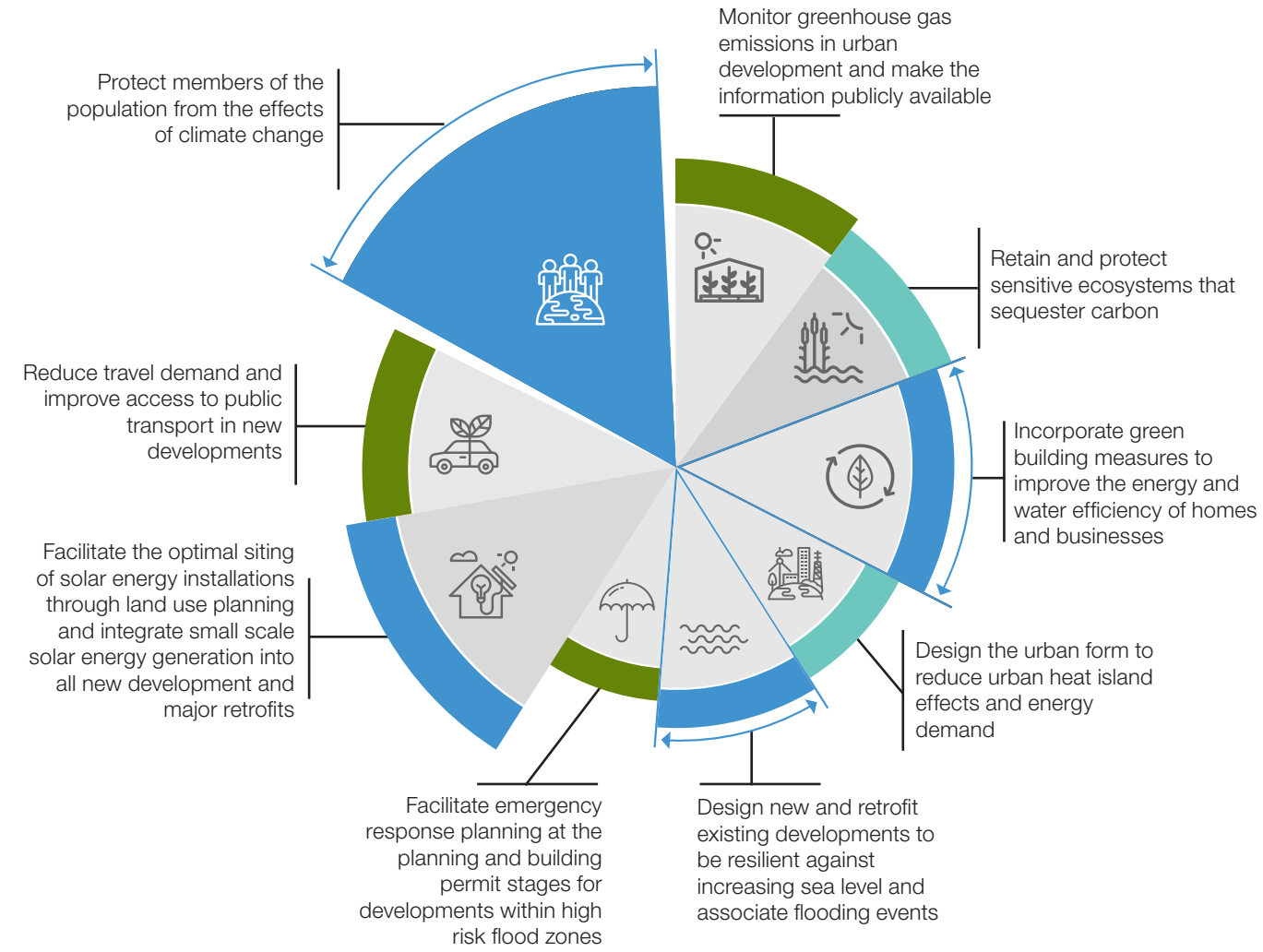


Figure 1.2: CCS Objectives

Specific actions have been identified which are intended to achieve outputs that, taken together will meet the objectives. These are summarised in the following sections.

1.4.3 Summary of Action Plan

Responding to Sea Level Rise and Flooding

A number of initiatives are proposed to address the threats arising from long term sea level rise and associated risks. These are detailed below.

SL1: Establish Vulnerable Coastal Zone to communicate risk and regulate development

In order to reduce the risk to property over the long term, new developments should be avoided in areas currently identified in the Coastal Flooding Maps (CFMs) as vulnerable, defined as having a 1% Annual Exceedance Probability (AEP) of flooding conditions occurring under Scenarios 6 (the 'worst case' scenario), which takes into account changes in rainfall intensity, sea level rise and storm surge. The 1% AEP mapping should be used to produce a boundary within which there is a presumption against new development (*Avoidance*), with certain exceptions (such as temporary development, necessary and strategic defence or industrial installations). This land should be identified in the Municipal Spatial Development Plans (MSDPs) as the Vulnerable Coastal Zone (VCZ) with the development restrictions described above. The actual boundaries of the VCZ should be based on the 1% AEP contour but will need to be rationalised to reflect the features of the natural and built environment.

SL2: Update planning, policy and regulatory framework documents to address flood risk in vulnerable coastal areas

MSDPs, where necessary, should be revised to require a Coastal Flood Risk Assessment that incorporates flood mapping. Any facilities within the Coastal Risk Zone (CRZ), the VCZ or high risk areas landward of the VCZ should be required to adopt flood accommodation measures.

SL3: Develop a framework to evaluate protection vs retreat options

In areas with higher than acceptable risks (i.e. within the CRZ) some aspects of climate adaptation cannot be adequately managed through flood accommodation measures.

Strategic retreat involves the safe removal or relocation of development, assets and settlements from encroaching shorelines, or areas vulnerable to flood or sea level rise, allowing the water to advance unimpeded. It involves abandoning, demolishing or moving existing buildings and infrastructure to higher ground. It also includes prohibiting new development in areas likely to be inundated.

For land within the Coastal Risk Zone it is recommended that planning authorities should evaluate the social, economic and environmental cost : benefit of structural coastal protection measures vs strategic retreat. Such an evaluation can involve formal cost benefit studies or multi-criteria analysis of the options. This option evaluation process will identify:

- Whether interim protection measures are justifiable in each coastal management unit
- Where they are justifiable, the nature and timing of the works.

In order to conduct studies on specific parts of the coast it will be necessary to designate coastal management "units" which separate the coast into sections that exhibit similar coastal processes and morphology. It will also be necessary to prepare a compendium of coastal protection measures appropriate to Qatar conditions.

SL4: Develop a framework for the strategic retreat from vulnerable land

In new coastal development areas, the release of private land should consider leasehold rather than freehold sale, to avoid future pressures and costs to protect private coastal land.

In all instances, an effective and appropriate planning response is to place a notification on title on all affected landholdings, informing landholders of the status of the land being located within a vulnerable coastal area which has a retreat strategy applicable to it. This ensures all existing and potential land holders are aware of the risks, and assists to avoid an assumption that the land value will be retained in perpetuity through coastal protection works.

SL5: Implement emergency management measures

It is recommended that a flood Emergency Management Plan (EMP) be required from developers so that flood risk for each development within high risk flood zones is managed. Preparing a flood EMP enables strategic decisions about where, what and how to develop, while reducing residual risk to an acceptable level.

An EMP sets out the prevention, preparation, response and recovery arrangements and the responsibilities of individuals, agencies and organisations with regards to these functions.

Responding to Increasing Temperatures

Densely built inner city and urban areas have a propensity to store large amounts of heat because the density of buildings, networks of asphalt streets and concrete or stone paving and prevalence of concrete and steel, means they have a high thermal mass. These locations are often several degrees warmer than surrounding low density suburbs and rural countryside. This is commonly known as the Heat Island Effect. The initial results of the Qatar University 'hot spot' study identify areas particularly prone to the heat island effect.

A number of initiatives are proposed to address the threats arising from increasing temperatures and the associated heat island effect.

UH1: Improve green space in areas vulnerable to the Heat Island Effect

Green areas reduce the impact of hot days and the urban heat island effect through evaporative cooling and by providing shade. Opportunities exist to expand green areas through the greening of parking lots, developing green corridors along roads and pavements, and increasing publicly accessible green space.

UH2: Ameliorate the Urban Heat Island Effect

It is proposed to integrate the Global Sustainability Assessment System (GSAS) Heat Island Effect Calculation into the building permit application process. The GSAS calculation computes pre and post albedo values (the ratio of solar energy reflected off a surface to solar energy striking a surface) which determines the potential heat island effect due to the proposed development.

The adoption of design measures that incorporate a range of interventions aimed at the passive cooling buildings, i.e. without the use of air conditioning, is proposed, including traditional Middle Eastern architectural design practices.

Light coloured pavements if installed in public spaces and near roads will help to reflect heat rather than absorb it. This generally involve the use of concrete rather than bitumen, topping asphalt with a light-coloured aggregate, or applying a light-coloured overlay to existing pavement.

Measures to reduce energy use within buildings can also reduce the build-up of heat in the buildings and help to keep them cool, including LED lighting, occupancy sensors and smart controllers for air conditioning.

UH3: Introduce shading requirements

Shading systems such as awnings, sails, pergolas, photovoltaics as shading, arcades over pavements, public spaces and parking areas are an easy way of reducing the ground temperature and improving the amenity of an area for pedestrians. It is proposed to require shading of 60 % - 70% of hardscaped pedestrian pathways and parking areas, and 25% - 30% of hardscaped common areas.

UH4: Support urban canyons and street orientation

'Cool islands' in urban areas can be formed by street canyons or narrow streets and tall buildings, especially if shade trees are also present. It is proposed to promote 'urban canyons' in city centers through optimization of building heights, street widths, setbacks and site coverage, and to orient streets to allow penetration of cool coastal breezes.

UH5: Develop a heat wave emergency response plan

For instances of extreme heat, it is necessary to develop a response plan that will reduce illness and death in the community due to heat stress, particularly among older people, children and other vulnerable groups. Given the increasing potential for extreme heat to occur in Qatar, heat-wave response planning is critical.

It is proposed that an emergency response plan is developed for cases of heat wave, which includes preparedness / preventive action, monitoring and communication, and a plan of action during the emergency.

Reducing Greenhouse Gas Emissions

Measures to mitigate greenhouse gas emissions include interventions to reduce the sources of emissions, or enhance carbon sequestration (which is the process by which carbon dioxide is removed from the atmosphere and held in solid or liquid form).

A range of measures has been identified to improve GHG mitigation in the land use sector in Qatar involving: reducing travel demand, improving energy and water efficiency, reducing the embodied energy of development, and promoting renewable energy. 'Embodied energy' is the energy needed, directly or indirectly, in constructing and demolishing a building.

GE1: Develop GHG emission inventory and benchmarks

It will not be possible to measure the success of the CCS without a reasonably accurate measurement of GHG emissions from the built environment. Stage 5 of the CCS involves the development of a tool to estimate and predict GHG emissions from the built environment.

It is proposed to develop a consumption-based GHG emissions inventory for the built environment based on international best practice, devise emissions indicators appropriate for use in monitoring domestic GHGs, establish benchmarks and prepare and publish an annual report outlining consumption-based emissions and key metrics.

GE2: Create higher densities and mixed use to reduce travel demand

Compact urban areas with high densities reduce the distance between land uses and make walking and cycling feasible alternatives to vehicle travel, while improving the feasibility of public transport. Locating different types of land uses near each other and within smaller development blocks reduces the need to travel because services are within walking or cycling distance of each other.

It is proposed to require compact, mixed use development in city centres and inner suburbs at the densities necessary to promote public transport use, integrate walking, cycling and public transport networks into existing mega-projects and required higher residential density targets for new development.

GE3: Improve walkability

Reducing the demand for car travel requires the provision of appropriate public transport, walking and cycling facilities.

It is proposed to develop a street design code that stipulates walkability requirements within higher residential density centres and mixed use zones, and progressively upgrade existing areas for compliance with the street design code, where possible.

GE4: Create Transit Oriented Development

Transit Oriented Development (TOD) is the creation of compact, walkable, pedestrian-oriented, mixed-use communities centred around high quality public transport systems.

It is proposed to establish mixed use zones within 480 m of the planned stations of the Doha Metro, and create a zone a further 480 m from this radius for medium density and other uses that would benefit from proximity to rail stations, including park and ride facilities. It is also proposed to require public facilities (e.g. town/district centres, parks, schools, sports clubs) to be accessible by walking, cycling or public transport.

GE5: Introduce parking restrictions

Studies have determined that “Higher motoring and parking costs will be more effective than well-intended urban design strategies at creating the kinds of urban densities needed for cost-effective transit services”. In other words, car drivers with established patterns of transport are likely to need disincentives to driving as well as incentives to switch from their cars to other transport modes.

It is proposed to introduce parking fee minimums, require companies to provide the minimum number of parking spaces necessary for their workforce, stipulate parking maximums for development in zones with good public transport and incorporate the final stipulations from the Qatar Parking Master Plan within the Zoning Regulations.

GE6: Improve energy efficiency in new development

Qatar’s Vision 2030 and the Qatar National Development Strategy 2011-2016 aim to reduce the energy intensity of the economy through awareness campaigns, standardisation and shutdowns. By far the most cost-effective mitigation action is the avoidance of emissions through energy efficiency measures.

It is proposed to mandate a minimum of GSAS Level 2 energy performance for all new development.

GE7: Improve water efficiency

Qatar has very limited potable water resources and consequently the country largely relies on desalination plants, which are highly energy intensive. Therefore reducing water consumption will also reduce Qatar's GHG emissions.

It is proposed to mandate a minimum of GSAS Level 2 water performance for all new development, require major industrial and agricultural developers to prepare water efficiency plans, require the use of certain water efficient irrigation practices and mandate the use of native and drought-tolerant species.

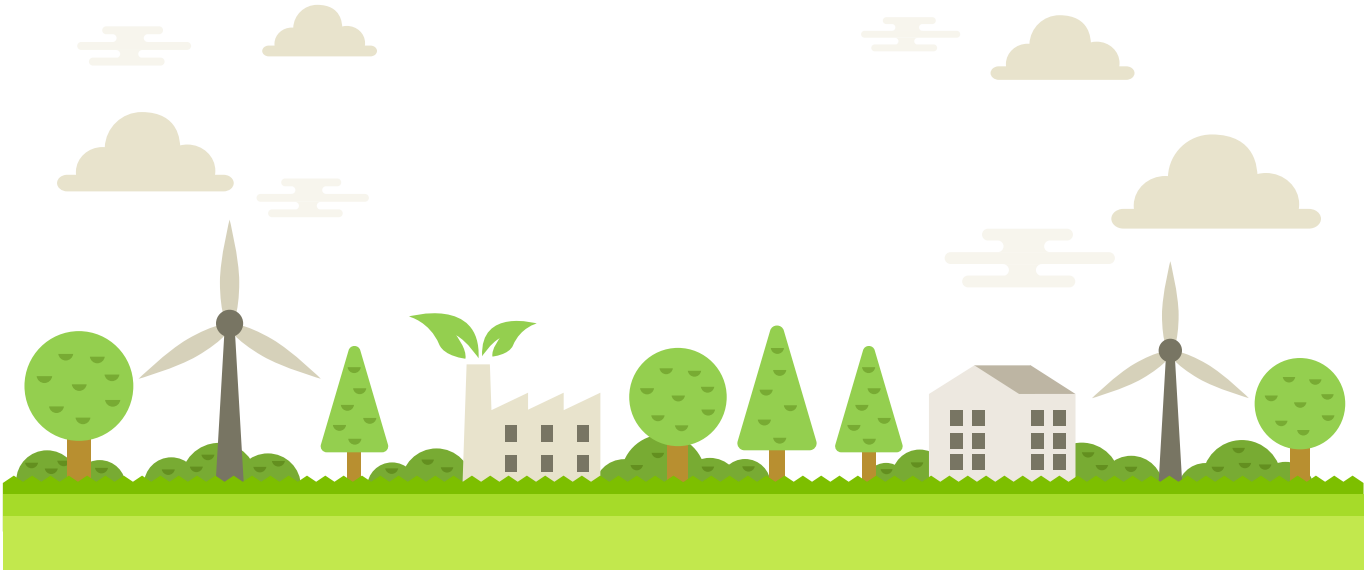
GE8: Increase the use of recycled water in new development

By requiring the reuse of water in future developments, demand for water resources would decrease.

It is proposed to incentivise or require new development to incorporate wastewater recycling facilities for the production of greywater or recycled wastewater for non-drinking purposes such as watering street trees or irrigation.

GE9: Improve the energy and water efficiency of retrofitted development

Retrofitting of existing buildings offers the possibility of making them more energy and water efficient, including through improved insulation, LED lighting and lighting controls, more efficient cooling systems, photovoltaics and water efficient fixtures and fittings.



GE10: Reduce the embodied energy of development

'Embodied energy' is the energy needed, directly or indirectly, in constructing and demolishing a building. Embodied energy can account for up to half of a building's lifetime CO_2 emissions. As such, retrofitting a building to extend its life is often more energy-efficient than constructing a new building. Using recycled/reused building materials is also a way of reducing embodied energy.

It is proposed to require developers to consider retrofit/ refurbishment over new build, demonstrate how they will minimize their use of virgin materials, and recycle the maximum amount of the building materials.

GE11: Design for structure reuse

The embodied energy of development is also reduced by ensuring that buildings, or at least their component materials are adaptable and can be disassembled. Designing buildings for re-use or re-purposing (so-called 'adaptive reuse) is one way of achieving this objective, and ensuring their components can be re-used is another.

It is proposed to require developers to produce designs that facilitate the re-purposing of the building and reuse of their components.

GE12: Plan for large scale renewable energy production

As Qatar's heavy use of fossil fuel-generated power is a primary contributor of greenhouse gas emissions, transitioning to renewable energy has the potential to significantly reduce Qatar's greenhouse gas emissions over time. The Qatar National Vision 2030 establishes a 20% renewable energy target by 2024.

It is proposed that MME identify and reserve possible sites for medium to large-scale photovoltaic energy developments near high voltage infrastructure, and depict them on the zoning maps.

GE13: Increase onsite renewable energy in new development

As Qatar has some of the best solar insolation characteristics in the world, and is a manufacturer of solar technology, new development can play an important role simultaneously supporting local industry and reducing emissions by mandating solar PV in new development.

It is proposed to require all new development and major retrofits to produce at least 20% of their energy needs from on-site renewable energy, require that all roofs be capable of supporting solar PV panels and protect solar access for rooftop solar PV. Also to ensure that there are no planning or design restrictions that will prevent the installation of small-scale renewable energy systems, and provide regulatory incentives for the installation of onsite renewable energy systems.

Protecting Biodiversity

The rich biodiversity of the Arabian Gulf includes dozens of mammal species, hundreds of bird species, and scores of amphibian and reptile species; and highly productive coastal habitats, including intertidal mudflats, seagrasses, algal beds, mangroves, and coral reefs, and a variety of fish species. Climate change is a major threat to the retention of this biodiversity.

Ecosystems such as mangroves, rawdah, wadis, urban parks, sea grass communities and coral reefs provide important ecological services. These include the provision of food, soil formation, and nutrient cycling. Mangrove forests and seagrass communities are also highly productive carbon sinks with production rates equivalent to tropical humid forests.

PB1: Introduce buffer zones to protect sensitive ecosystems

Sensitive ecosystems include Protected Areas, mangroves, coral reefs, sea grasses, and other habitats that are not formally protected but are of ecosystem importance. Buffer zones around sensitive habitats help to protect these ecosystems from the impacts of development which include dust, noise, light, recreational disturbance and run off.

It is proposed to commission a study into appropriate buffer zones and migration corridors for Qatar's Protected Areas and mangroves. As an interim measure, it is recommended to prohibit development within 250 m of Protected Areas, mangroves, seagrass and coral reefs.

PB2: Introduce environmental offsets

An environmental offset compensates for unavoidable impacts on valuable species and ecosystems. It is proposed that an environmental offset should be required as a condition of approval when any development is likely to result in a significant residual impact on valuable species and ecosystems, especially on mangroves, seagrass and coral reefs.

1.4.4 Implementation of the CCS

An implementation framework has been developed which, for each of the specific actions:

- Identifies the parties mainly responsible for this output, and those whose assistance will be required
- Establishes the mechanism of implementation, including the relevant standard / code / policy that is related to the specific action
- Sets out the approximate timeframe for implementation, defined as: Immediate, Short term (2 – 5 year) or Long term (>5 year)
- Outlines the proposed performance indicator
- Where appropriate, describe the targets related to performance indicators
- Provides an indication of the resource implications of the actions; defined as: Low cost, Medium cost, or High cost

1.4.5 Change Management

The change management process is the sequence of steps or activities that a team or project leader follow to apply changes in order to drive individual or entity transitions and ensure the project meets its intended outcomes.

The two key challenges involved in the implementation of the CCS will be:

- Getting stakeholders/agencies/communities on board and ensuring their understanding of the objectives and the specific actions relevant to them
- Achieving the cooperation of stakeholders/agencies/communities in successfully progressing the actions

The change management process should incorporate engagement with:

- Government Agencies
    - The Urban Planning Department – as the entity mainly responsible for implementation
    - Other departments within the Ministry of Municipality and Environment whose participation is required, i.e. the Climate Change Department, the Infrastructure Planning Department, the Public Parks Department, the Building Permit Complex, and the Laboratories and Standardization Affairs Department
    - Other government agencies whose participation and cooperation is required, i.e. Ashghal, Kahramaa, and the Ministry of Interior
- Development Community
    - The private development community, i.e. developers, construction firms, and consultants
- The public

1.4.6 Monitoring and Evaluation

An outline monitoring and evaluation (M&E) plan has been developed that describes how the program works, including the indicators, who is responsible for collecting them, and how the data will flow through the organisation. The core of the M&E plan is the logical framework, which summarises the key elements of the strategy, identifies indicators, and the means by which verification will be achieved.

Indicators, and where applicable benchmarks and targets, have been developed for each level of the framework hierarchy. Where information is not presently available or sufficient to establish benchmarks / targets for some of the quantitative indicators, specific actions will be proposed as part of the implementation process to establish these.

1.4.7 Implications of implementing the CCS

A qualitative assessment of the consequences of the CCS implementation of each specific action has been undertaken in respect of the resource implications for MME.

The resource implications for implementation of the CCS are considered to be relatively modest, and the effort for most actions can be absorbed within the agency, albeit with additional staff and / or external consultancy support.

The direct social impacts of the CCS are overwhelmingly positive, particularly in respect of the reduced risk of health and safety impacts arising from flooding and heat stress.

The direct economic consequences are also mainly positive, with reduced costs of energy and water accruing to households and businesses. However some resistance from developers to these (and any new) measures is to be expected as some will increase construction costs, while savings accrue to owners and occupiers. A rational approach to the retreat from vulnerable coastal land will also yield positive economic benefits as losses of land value will be offset by avoided costs of flood damage and relocation of assets over time as sea levels rise.

The direct environmental consequences are also mainly positive as the CCS will lead to protection and / or reinstatement of threatened coastal ecosystems, and reduced pollution.

1.5 Stage 5

Three Climate Change Impact Assessment Tools were developed for this stage of the Project as web applications. The Climate Change Tools were developed within the .NET Framework version 4.5 web development model. The tools are setup within a simple framework which allows the MME to define its own scenarios and assumption in terms of emissions from for construction and land use scenarios. The map interfaces of the tools utilize the ESRI JAVA API (v3.23).

An overview of each tool is provided below:

1.5.1 Urban Planning Tool

The Urban Planning Tool is intended to be used to assess the change in annual CO_2e emissions associated with changes in the land use designation for a particular parcel of land. This tool captures GHG emissions associated with land use changes and can estimate GHG emissions from any form of development. It also displays heat island and flood surface information at the site location. The flood surface layer functionality allows the user to determine what flood depth can be anticipated at the development site due to Sea Level Rise and increased rainfall associated with Climate Change. The heat island layer functionality allows the user to determine what surface temperature can be anticipated at the development site

The tool allows the user to estimate either the GHG emissions from a new development, compare different scenarios (based on variable land use areas and population) for a Project, or estimate the GHG emission difference arising from a land use change at a particular site.

1.5.2 Building Construction Application

The Building Construction Application is intended to be used to assess the one-time CO_2e emissions associated with materials and activities during the construction of a building or other project. This tool captures greenhouse gas emissions associated with the construction process.

1.5.3 GHG Emission Tracker

The GHG Emission Tracker is intended to be used to collect annual CO_2e emissions resulting from specific reportable activities undertaken by major urban emitters. This tool captures greenhouse gas emissions associated with ongoing operations at a site.

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Ministry of Municipality
and Environment

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Executive Summary