



VILLE DE DAKAR


Territorial Climate Energy Plan of Dakar 2021-2025





« Dakar, smart city
and low-carbon for
inclusive and resilient
development »



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VILLE DE DAKAR



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Mayor of the City of Dakar

EDITORIAL OF THE MAYOR

Climate change is a global threat that Dakar, like all cities in the world, is facing. We must therefore undertake ambitious efforts to combat it and adapt to its impacts.

Since then, we have committed to producing a Climate Plan, which reflects our vision of making the capital a “smart city and low-carbon for inclusive and resilient development” by 2050.

This commitment, which is consistent with Senegal’s Nationally Determined Contribution (NDC), is a clear response to the Paris Agreement guidelines. Dakar’s Climate Action Plan is structured into 7 strategic axes with 22 adaptation and mitigation actions that integrate the themes of “climate, energy, urban planning, risk and disaster management, living environment.

The city of Dakar is now in the process of strengthening its climate governance. By carrying out a diagnosis of its greenhouse gas emissions and assessing its levels of vulnerability, the municipality is integrating into its policy the development of renewable energies, energy savings in municipal buildings and public lighting, the promotion of soft modes of transport, a circular economy and the development of green spaces for a healthy living environment. To achieve this, Dakar will undertake a participatory and inclusive approach by mobilizing all stakeholders.

I would like to sincerely acknowledge all the institutional, technical and financial partners as well as to the coordination unit and the steering committee of the Territorial Climate Energy Plan of the City of Dakar for their contribution to this work. I would particularly like to thank the European Union, the Covenant of Mayors in Sub-Saharan Africa, the Greater South Paris Community Agglomeration and the C40 for giving us the opportunity to draw up this climate plan, which will contribute to improving the lives of our populations and promote a low-carbon and resilient city.

I assure you about the ambition of the city of Dakar to preserve this beautiful collaboration and remain confident that all city stakeholders are engaged for the implementation.

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ACRONYMS

ADM	Municipal Development Agency
AFD	French Development Agency
MCA	Multi-Criteria Analysis
ANACIM	National Agency of Civil Aviation and Meteorology
NAGGW	National Agency of the Great Green Wall
ANSD	National Agency for Statistics and Demography
BAU	Business As Usual
BRT	Bus Rapid Transit
CAPEX	Capital expenditures
UNFCCC	United Nations Framework Convention on Climate Change
NDC	Nationally Determined Contribution
ECOWAS	Economic Community of West African States
CETUD	Executive Council of Urban Transport in Dakar
UCLGA	United Cities and Local Governments of Africa
AQMC	Air Quality Management Centre
CoMSSA	Convention of Mayors for Sub-Saharan Africa
PNDC	Planned Nationally Determined Contribution
DA	Sanitation Directorate
DAKCLIM	Dakar Acts for Climate
DEEC	Directorate of Environment and Classified Institutions
GCF	Green Climate Fund
GHG	Greenhouse Gas
IPCC	Intergovernmental Panel on Climate Change
GIZ	German Agency for International Cooperation
GPC	Global Protocol on Community-wide GHG Emissions
AQI	Air Quality Index
JICA	Japan International Cooperation Agency
kWh	Kilowatt hour
LBC	Energy-Saving Light Bulbs
LED	Light-emitting diode
LPDSE	Energy Sector Development Policy Letter
LPST	Transport Sector Policy Letter
MEDD	Ministry of Environment and Sustainable Development
MGET	Metropolitan Grant for Energy Transition
MULHP	Ministry of Urbanism, Housing and Public Hygiene
OCB	Basic Community Organizations
SDGs	Sustainable Development Goals
WHO	World Health Organization
ONAS	Senegal's National Sanitation Office
OPEX	Operating Expenses

SEACAP	Sustainable Energy Access and Climate Action Plan
EAP	Environmental Action Plan
NEEAP	National Energy Efficiency Action Plan
PCET	Territorial Energy Climate Plan
PDUD	Dakar Urban Travel Plan
PDV	Dakar Development Plan
GDP	Gross Domestic Product
PSE	Map Senegal Emergent
PUP	Environmentally Urgent Program
RSE	Corporate Social Responsibility
tCO₂eq	Ton CO ₂ Equivalent
TER	Regional Express Train
TOD	Transit-Oriented Development
ROI	Return on Investment
UCG	Solid Waste Management Coordination Unit

A climate Plan allows a local authority area to identify avenues of action in the area of mitigation, i.e. the reduction of GHG emissions and adaptation, i.e. the reduction of territory's vulnerability to climate change.

1. Introduction

The Earth Summit in Rio demonstrated the commitment of many countries to the principles of sustainable development. The conference concluded with the creation of three programmes, the United Nations Framework Convention on Climate Change (UNFCCC), the United Nations Convention on Biodiversity and the Environmental Action Plan for the 21st Century (Agenda 21).

It then presents the challenges of sustainable development and encourages municipalities to develop actions to improve urban management and environmental preservation.

At the same time, cities have been under increasing demographic pressure and environmental challenges for decades. They must also continue to meet the vital needs of citizens while taking responsible steps to preserve the environment. It was from this issue that the concept of a “sustainable city” was born, reflecting the consideration of environmental, social and economic dimensions in urban development: “The city is an asset for the future of the planet and for the further development of the planet. How we plan, build and manage our cities today will be critical to our future. (...) The fight for a sustainable future will be won, or not, in cities.”

With global warming, states under the UNFCCC have committed to reducing their greenhouse gas (GHG) emissions. Despite their ambitions and efforts in various sectors of activity, it is difficult to achieve the goals without the involvement of cities. Therefore, the fight against climate change relies, in large part, on the strong contribution of cities, on their ability to make their energy and ecological transition. Aware of the urgency, the world’s cities are mobilizing by putting in place strategies to combat climate change in which the Territorial Climate Energy Plan (PCET) is part of it.

A PCET should enable the local authority to identify avenues for action in the area of mitigation, i.e., reducing GHG emissions, adaptation i.e., reducing the territory’s vulnerability to climate change. The PCET’s area of action can encompass all sectors affected by climate change, from energy consumption to urban planning including transport, waste and agriculture, as long as these areas fall within the competence of the concerned local community.

Like the world’s greatest cities, Dakar is committed to contributing to the collective effort. By implementing its PCET, the city is setting targets to reduce its GHG emissions and reduce its vulnerability to climate change.

Dakar’s Climate Plan is based on a number of points: including the international context, the national and territorial levels. The political aspect is also clarified, as well as the enabling climate action framework for local authorities.

Citizen engagement, is an important axis of the co-construction of the PCET, through citizen participation in raising awareness and mobilizing actors around climate culture as well as the public consultations (or citizen consultation). This activity allowed to take into account the perception of the Dakar population in the analysis of the vulnerabilities of the City to climate change. In addition, a study was carried out to determine the risks to the territory, current and future hazards and impacts based on different climate scenarios and adaptation strategies.

Dakar has also carried out a city-wide GHG inventory and an energy audit of municipal buildings to quantify consumption levels and energy-saving potential. Together, these studies have helped to define strategic directions with GHG emission reduction targets and objectives.

The Dakar’s PCET is built around a vision of the territory by 2050. Its implementation is supported, in the short and medium term, by a five-year action plan based on a strategy of resource mobilization, communication and action monitoring and evaluation.



2.Context of climate action

2.1 International and national context

From Rio de Janeiro in 1992 to Paris in 2015 via Kyoto and Copenhagen in 2009, the Parties and signatories to the UNFCCC have committed to putting in place protocols and agreements to drive a global dynamic for combatting climate variability and change.

In 1992 in Rio, the Parties agreed on a series of Sustainable Development Goals (SDGs) such as the fight against climate change. SDG 13 calls for “urgent action to combat climate change and its impacts,” while SDG 11 aims to “ensure that cities and human settlements are inclusive, safe, resilient and sustainable.”

In Kyoto in 1997, developed countries pledged that “individually or jointly, their aggregate anthropogenic emissions, expressed in carbon dioxide equivalent, will not exceed the amounts allocated to them, calculated according to their numerical commitments to reduce their GHG emissions by at least 5% from 1990 levels between 2008 and 2012.”

In Copenhagen in 2009, stressing that climate change is one of humanity’s greatest challenges, the Parties confirmed their strong political will to fight against climate change without delay in accordance with the principle of common but differentiated responsibilities and respective capacities.

At COP21 in Paris in 2015, the Parties to the UNFCCC reached a historic agreement to combat climate change by accelerating and intensifying the actions and investments needed for sustainable, low-carbon development.

The central objective of the Paris Agreement is to “strengthen the global response to the threat of climate change by containing the rise in the average global temperature well below 2oC above pre-industrial levels and by continuing efforts to further limit the increase in temperature to 1.5oC. Among other things, the agreement aims to build resilience to the adverse effects of climate change and to make financial flows compatible with low GHG emissions by promoting resilience to these changes.” Thus, the Paris Agreement requires all Parties to submit National Determined Contributions (NDCs) that include the Parties’ commitment to mandatory and regular reporting on their GHG emissions and implementation efforts.

Knowing the importance of the participation of governments and various actors in the fight against climate change, synergies and mechanisms have been developed to facilitate the commitment of non-state organizations to contribute in climate action to the achievement of the goals of the Paris Agreement.

The European Commission has launched the Convention of Mayors to support and support local authorities’ efforts to implement

sustainable energy policies. This convention has been extended to African cities with the launch of the Convention of Mayors in Sub-Saharan Africa (CoMSSA) to support them, strengthening their planning capabilities and providing them with a platform where they can share their knowledge and best practices. To stimulate this momentum on the African continent, the European Union has launched a call for proposals to support cities in sub-Saharan Africa engaged in the fight against global warming to develop a Sustainable Energy Access and Climate Action Plan (SEACAP).

In the same approach, the C40, a global network of greatest cities that unites local government initiatives to combat global warming, has been created. Its objective is to develop and implement policy and programmes to achieve a significant reduction in GHG emissions and limit climate risks. Aware of the unavoidable role it can play through these metropolises, C40 has launched the Deadline 2020 program, which aims to support cities to develop and engage in the implementation of climate action plans (or a series of plans) before the end of 2020, in order to make a significant contribution to the achievement of the ambitions of the Paris Agreement.

To achieve the convention’s objectives, national governments have also understood the importance of establishing a system of mobilization and allocation of financial resources, a new technological framework and capacity building to support developing most vulnerable countries in line with their own national objectives.

Like the Parties, Senegal has ratified the Paris Agreement and tabled its Nationally Determined Contribution. It represents the commitments of the State of Senegal to implement actions to reduce its GHG emissions and adapt to the adverse effects of climate change.

Climate scenarios under the NDC have shown a downward trend in rainfall, an increase in average temperatures, rising sea levels and disturbances in the availability of water and fisheries resources, soils and arable areas.

These scenarios reveal a vulnerability of human settlements and production systems, requiring specific actions to mitigate and adapt to climate change in order to control their potential impact

On the adaptation side, Senegal intends to implement, among other things, structuring projects such as coastal protection infrastructures, retention basins and drinking water supply systems to reduce the vulnerability of populations.

On the mitigation side, specific activities that have an impact on GHG emissions reduction or promote carbon sequestration are planned. These will be achieved both on the basis of national resources (unconditional objectives) and with the support of the international community (conditional objectives). Senegal's target is to reduce its GHG emissions by 7 to 29% by 2030 compared to 2010, the baseline year.

2.2. Territorial context of the City of Dakar

Located in the far west of the African continent, Dakar, the major metropolitan centre of Senegal, has an estimated population of 1,400,974 inhabitants in 2020, covering an area of 78km². The City of Dakar is currently experiencing strong population growth due to sustained urban migration and a natural growth rate of 2.51%. Dakar is bordered on three quarters by the Atlantic Ocean and on the East by the cities of Pikine and Guédiawaye (Figure 1).

The effectiveness of Law no 2013-10 of 28 December 2013, with the general code of local authorities, enshrines full communalisation. Article 28 of this law stipulates that, as a transitional measure, “the powers devolved to the Departmental Council are carried out if

necessary, by the city if its boundary corresponds to the territory of the Department”, which gives the City of Dakar a status as a commune and department. It is thus divided into 19 fully operational municipalities distributed into four districts.

With its geomorphology and rapid urbanization, the City of Dakar faces many environmental constraints and challenges that expose it to the risks of climate change. Sea level rising and coastal erosion threaten beaches and may result in the displacement of populations and infrastructure along the coast.

In addition to its exposure to climate change, the City of Dakar is also suffering the costs of a limited supply of energy and an irregular supply of electricity. Most of this electricity is generated by power plants built between the 1960s and 1980s, with a higher cost of production (170 FCFA/kWh) than its market value (118 FCFA/kWh). Despite the national government's efforts to improve access to electricity with the introduction of solar power plants, the cost of electricity is still very high in Dakar, compared to other cities in sub-Saharan Africa.

Dakar, in its vision: “city, oriented towards good governance and sustainable development for the well-being of its populations”, has carried out several studies including the Environmental Action Plan, the analysis of social and biophysical vulnerabilities, Agenda 21 and the identification of areas at risk allowing to understand its sensitivity and exposure to climate change. Aware of the climate emergency, the city is committed to developing a PCET that allows to adapt, reduce GHG emissions and contribute to the implementation of the NDC. This plan aims to provide a real answer to the climate change issue, by offering an alternative for a sustainable management of resources, the development of renewable energies, the promotion of eco-citizen behaviour, awareness of production and consumption patterns and urban layout allowing each space to play its part.

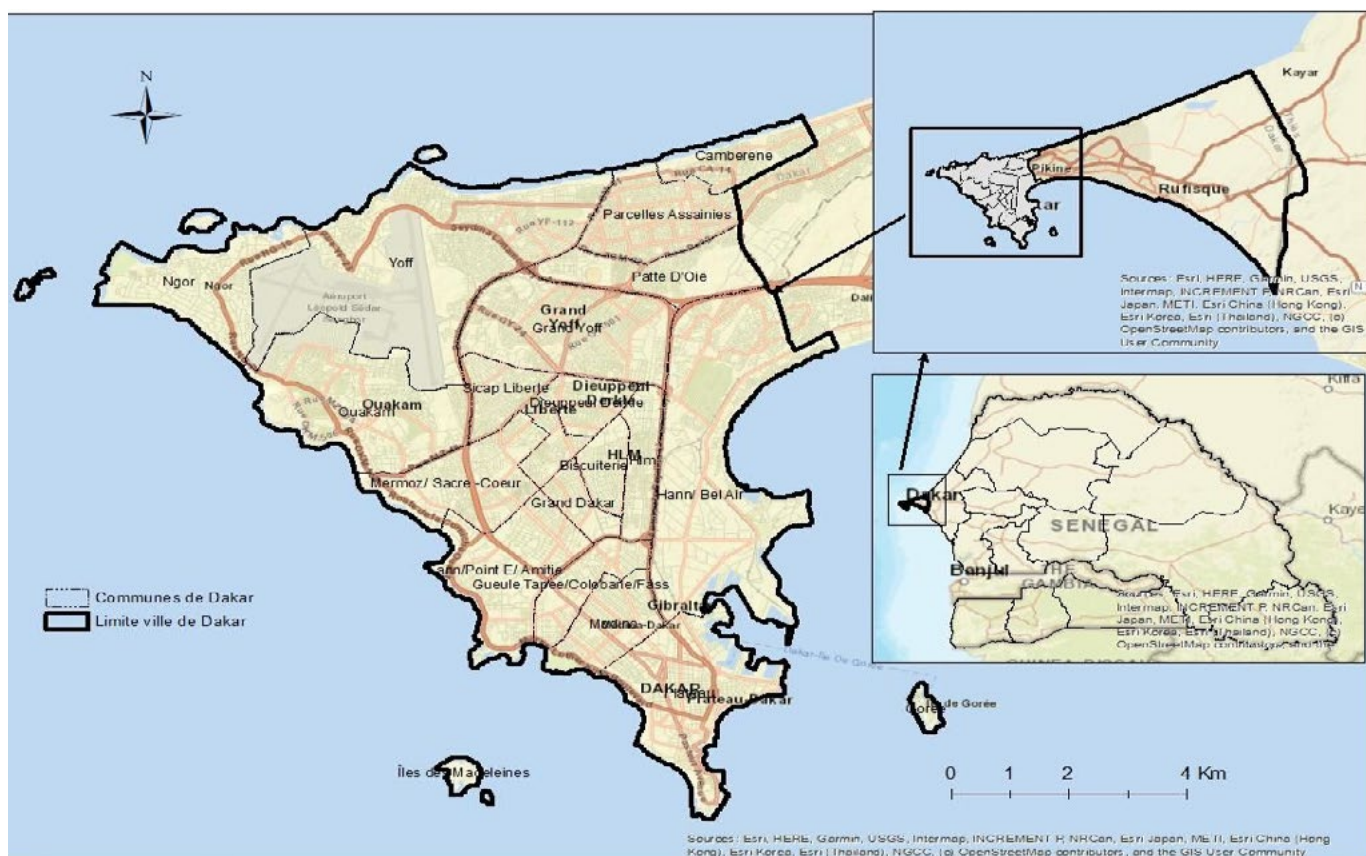


Table 1. Dividing municipalities into districts

	Arrondissements	Communes	Population
1	Almadies	Mermoz-Sacré Cœur ; Yoff ; Ngor Ouakam	211 315 hbts
2	Dakar-Plateau	Fann-Point E-Amitié ; Gorée ; Médina ; Gueule Tapée-Fass Colobane ; Dakar (Plateau)	189 486 hbts
3	Grand-Dakar	Biscuiterie ; Dieupeul-Derklé Grand-Dakar ; Sicap-Liberté ; Hann-Bel Air HLM	306 728 hbts
4	Parcelles-Assainies	Cambéréne ; Grand-Yoff ; Patte d'Oie Parcelles Assainies	438 527 hbts

(2) Recommendations for actions for the resilience and sustainability of the City of Dakar (UN Habitat Report
 (3) Stratégie de résilience de la ville de Dakar, 2017

An aerial photograph of a city, likely Dakar, taken during sunset. The sky is a warm orange and yellow. A large blue rectangular box is overlaid on the left side of the image, containing text. The city below shows a mix of modern and older buildings, with a prominent tall tower in the distance.

3. Stakeholder engagement and communication strategy

Citizen engagement is an important pillar in the climate action planning process. The City of Dakar, as part of its Programme for the improvement of Urban Governance for an Energy and Ecological Transition, has placed particular importance on the mobilization of the territory's actors around climate and energy issues.

The aim is to stimulate collective awareness through a programme of environmental education, information, awareness and capacity building on the issue of climate change.

3.1. Co-construction of the Climate Plan

Launched on 11 September 2017, the planning process for the development of the Dakar City's PCET was part of a participatory and inclusive context, involving all stakeholders, both internal and external, with a range of activities targeting different categories including men, women, children, members of civil society, etc.

Indeed, an organizational system has been set up with a coordination unit and a steering committee composed of elected officials, technical services of the city and representatives of certain decentralized departments and services of the State including the Directorate of Environment and Classified Settlements (DEEC). This institutional architecture has been reinforced by the creation of a platform called Dakar Acts for Climate (DAKCLIM) in order to mobilize community actors in a process of co-construction of the Climate Plan to ensure inclusiveness and effective participation of populations. More than 500 community stakeholders were consulted and sensitized in the city's 19 municipalities as part of the public consultation on climate. This is reinforced by the awareness of more than one million Dakar citizens on climate-related issues.

DAKCLIM is a space for capitalization, management and dissemination of knowledge and is an essential element in the construction of the Dakar Climate Plan. It is an organization that promotes the connection between different actors and helps to create synergies, promote a citizen's awareness in favour of the development of eco-citizen behaviours and the fight against climate change.



In an effort to rethink citizen participation, the Citizen Dialogue Service through its Territorial Coaching programme has collaborated and contributed to the process of raising awareness and building the capacity of community actors in all municipalities. Participation is considered to be one of the levers of social dynamics and is one of the pillars of Dakar's policy.

3.2. Stakeholders identification

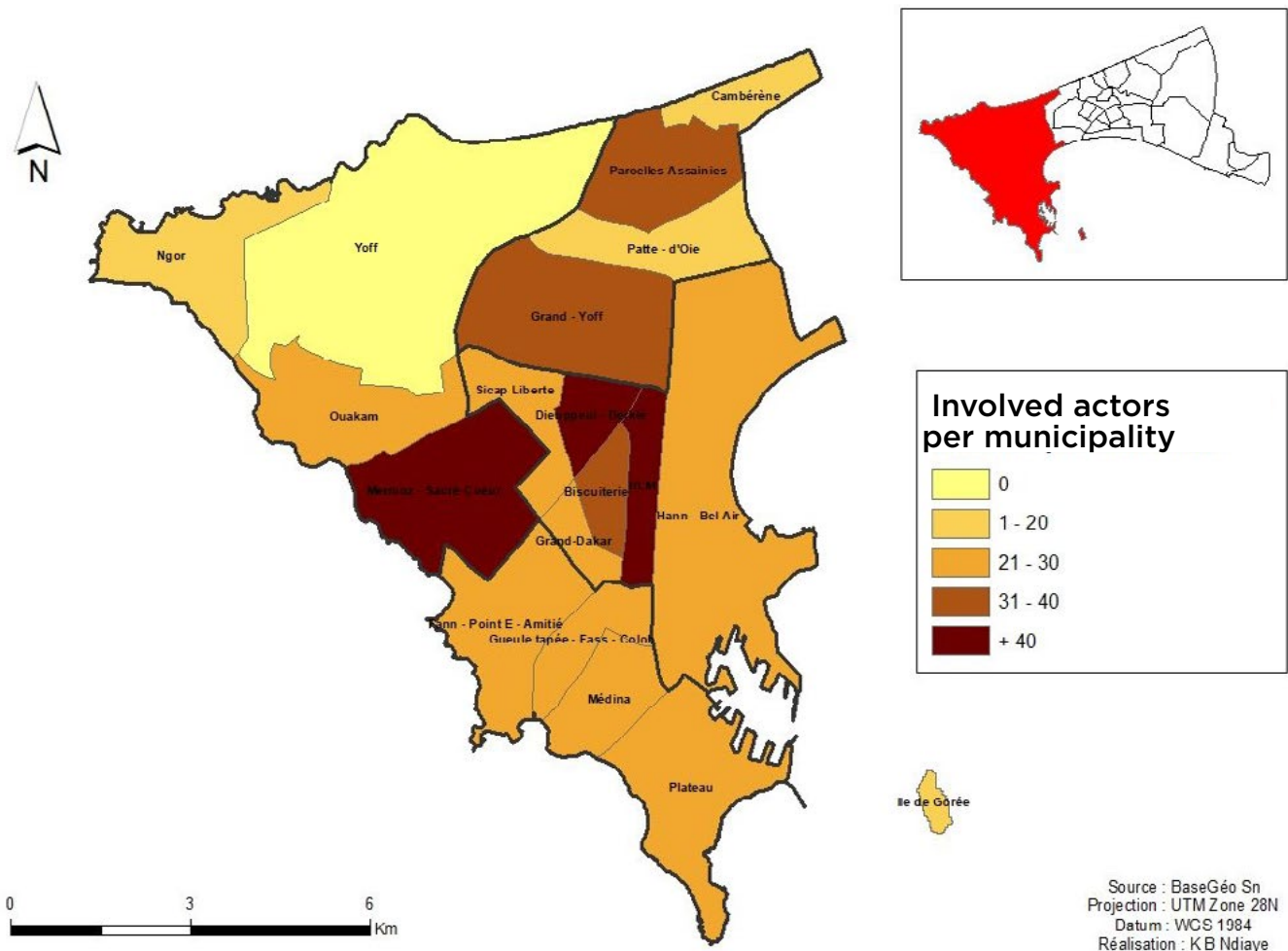
This step involved identifying all the Stakeholders identification and assessing their level of interest and influence in the climate action planning process. This analysis helped to categorize the mobilized actors but also to develop an effective communication strategy:

- Identification and choice of focal point by service (city departments and services and other partner institutions);
- Identification of climate referents in each

municipality;

- Request for expressions of interest from local civil society organizations working in the field of the environment and/or climate change to determine their power or capacity of influence in the process of community engagement.

Figure 2. Level of mobilization of community stakeholders by municipality.



Source: Public consultations report, PCET

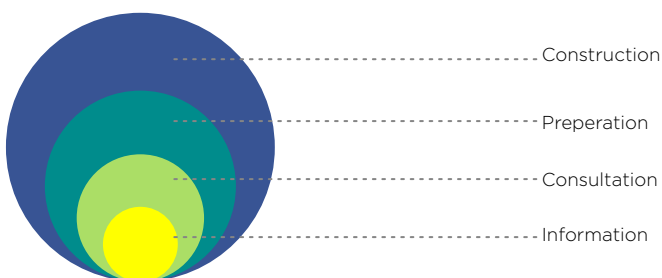
3.3. Awareness and mobilization actions

Both strategic and operational, the City of Dakar's PCET integrates the whole climate-energy issue. A large-scale sustainable development project, it follows a coherent methodology that places a great deal of emphasis on raising awareness and mobilizing the territory's stakeholders. This step is a prerequisite for the success of all PCET actions.

To achieve this, aggregating a sum of information and awareness-raising and inciting activities was required.

In an ongoing outreach strategy, communication plays a cross-cutting role throughout the PCET development process. This cross-cutting has been reinforced by practices dictated by a communication plan defining strategy and targets. The methodology to be followed is based on the following key steps (Figure 3):

Figure 3: The main stages of community mobilization



3.4. Language elements and communication actions

From the beginning of the project, communication has been an essential element for the success of the Urban Governance Improvement Programme for an energy and ecological transition of the City of Dakar. To give more visibility to the action of the project, a specific logo, with a graphic charter, responding to the spirit of the climate-energy duo was created with a PCET label encircling the Map of Dakar. This logo as well as that of the European Union, the City of Dakar and all other strategic partners are used on all documents, videos and materials of the programme.



Similarly, the mobilization of stakeholders (elected, populations, municipal services, decentralized services, civil society organizations, grassroots community organisations (CCO)) was carried out through training and the dissemination of internal communication materials (bulletins, leaflets, etc.) and external communications (radio broadcasts, exhibition advertising, participation in trade shows, social networks,

eco-gesture guide, brochures, kakemonos).

To achieve profound changes in behaviour, one must understand the state of opinion and the conditions of its adherence. Any change, including climate change, often creates a sense of embarrassment and fear in people, given the disruption in lifestyles. To meet this challenge, the approach to engaging actors has been part of a process that inspires confidence, in an inclusive approach that places local culture and language at the heart of the community engagement process.

To succeed in raising awareness, the City of Dakar worked a lot on the language elements and word choice. Indeed, several messages in the Wolof language, mostly spoken in Senegal, have been conveyed. This has helped to establish a better appropriation of the context of climate

risks and vulnerability to the energy crisis through simple and clear messages. The use of this inclusive approach has also provided a better understanding of the environment in which the program is being deployed and to agree on messages that are accessible to all citizens of the city.

Several actions were taken during the process of developing the PCET through a wide range of channels to communicate with different social categories. Target-specific messages were used, regardless of ethnicity, language, age and gender. This communication approach responds to a coherent logic involving all the actors of the territory through practices of awareness, appropriation and capacity building.

Ecological hiking

Organized in July 2018 to raise awareness about eco-gestures and promote eco-citizen behaviour, it has mobilized a large number of citizens. More than 2,000 Dakar residents have been mobilized and sensitized to the harmful impact of plastic pollution on the environment, biodiversity and health. With the support of the Young Environmental Volunteers (JVE), plastic waste was collected. This waste was used to fill the tires and turn them into public benches. The aim was to reduce the proliferation of plastic waste in the Districts of Dakar.

Photo 1. Ecological hike around the City of Dakar



Environmental hip-hop

The concept of environmental hip-hop was initiated to send strong messages this time to the young people of the city. The aim of this activity was to clean up neighbourhoods with community associations and to create graffiti with awareness messages to address social barriers, particularly descriptive standards that relate to perceptions of types of behaviour and opinions.

Photo 2. Awareness activities with hip-hop



Environmental education

“For young people, climate change is a matter of justice. Those who are already vulnerable because of their economic status, age and gender identity are the most affected by climate change and have the least access to decision-making”: Excerpts from the COP24 Katowice Declaration - Poland.

Inspired by this declaration, the PCET has co-organized with the European Union awareness activities on environmental

concepts as well as eco-citizen actions to be adopted in order to preserve nature. Thus, through an inter-school competition, 32 public and private schools in Dakar, Pikine and Guédiawaye, selected on the basis of the criterion of excellence, were introduced to environmental and climate issues in Senegal and around the world. The organization of a day of reforestation at the level of some schools in the municipality of Parcelles assainies has also made it possible to raise awareness among children about the importance of trees in urban areas.

This awareness continued with the organization of the “72 Hours of the Environment” in the municipality of Grand Yoff. An opportunity to train 30 young people from the commune in the techniques of sequestration of plastic waste and the construction of bricks and green benches. They then proceeded to design a garden with plastic waste collected during the cleaning and to the reforestation of 65 trees.

Photo 3. School competitions around environmental challenges and climate change



Photo 4. Reforestation activities and awareness of the importance of the tree



Photo 5. Seventy-two hours of the environment



Capacity building

In accordance with the training plan, elected officials, administrative authorities, city officials, decentralized state services and community actors benefited from capacity-building sessions.

Photo 6. Focus groups with community stakeholders



PCET Public Consultations

The “citizen’s public consultations” were an opportunity to create an open and inclusive space for dialogue that fosters community cohesion throughout the development of the PCET. The aim was to involve populations in diagnosing the vulnerability of the territory to the effects of climate change.

(4) Muslim religious guides who lead prayer in places of worship (mosques), moral leaders and resource people.
(5) Badienou gokh are trusted women, neighbourhood godmothers generally used as intermediaries between families, women, girls and husbands, and health centers. They advise who advises and orientates about sex life.

In fact, 57 focus groups were organized in the municipalities of the City of Dakar with about 500 community actors mobilized. The public consultations were, in a participatory and inclusive approach, opportunities for exchanges, confrontation of opinions and the emergence of adequate solutions to the

current climate and energy problems in the Dakar metropolitan area. They were used to exchange with elected officials, neighbourhood delegates, imams, badienou gokh, sociocultural associations (CSA), and grassroots community organizations.

Table 2. Capacity building on the climate-energy duo

Thematic	Target	Gender		
		Male	Female	Total
Climate change issues and public policies	Elected officials and administrative authorities	20	16	36
Scenario planning	City officials and decentralized technical services	32	9	41
Urban planning and climate change	Elected officials and administrative authorities	23	12	35
Eco-responsibility and eco-citizenship	City officials	20	6	26
Energy efficiency	City officials	19	8	27
Social Responsibility for Organizations (RSO)	City officials	24	4	28
Urban planning	City officials and decentralized technical services	32	12	44
Communication and social marketing	DAKCLIM Members	22	5	28
	Total	209	80	289

Source: Training Workshop Attendance Sheet

Table 3. Public consultations stakeholders

Actors	Roles
Mayors of the municipalities	<ul style="list-style-type: none"> • Portage of the project at the municipal level • Designation of a focal point at the commune level • Making available a space for the organisation of the public consultations
Focal point Common (climate referent)	<ul style="list-style-type: none"> • Support for the alignment between approaches and local realities • Support in identifying the actors to be mobilised • Organizing the public consultations at the municipal level
Neighbourhood delegates, imams and badiénou gokh	<ul style="list-style-type: none"> • Support for identifying resource people • Active participation in all activities • Spreading messages within communities • Active engagement and participation
Basic community organizations (sports and cultural associations, women's advocacy groups and youth associations)	<ul style="list-style-type: none"> • Spreading messages • Facilitating field activities • Proposal of relevant activities
City of Dakar's Citizen Dialogue Service	<ul style="list-style-type: none"> • Involving coaches for the facilitation of the public consultations • Training territorial coaches in facilitation techniques • Contribution to the development of the public consultations Report
Populations	<ul style="list-style-type: none"> • Commitment and participation in diagnosis • Sharing their perceptions of climate change and the events that marked their locality • Dissemination of PCET at all scales

4. Analysis of Dakar's vulnerability to the effects of climate change

The city of Dakar's climate action planning is based on the results of the territory's vulnerability analysis to the effects of climate change. This analysis is based on a detailed and in-depth study of changes in climate trends, extreme events and impacts on the territory.

The identification of vulnerabilities allows the City of Dakar to engage in a planning dynamic in order to break with the ad hoc actions of responses to extreme weather events. The first is to reduce the City's exposure to the effects of climate change by integrating potential hazards in infrastructure upgrades and improving its urban landscape, second, to limit the sensitivity of the territory through structuring investment programmes and a revitalization of its governance capacity, and finally, to develop clear climate projections to frame urban development policies and assist in decision-making.



4.1. Methodological approach

In order to provide a solid database for the literature review and the general framing of the diagnosis of the vulnerability at the territory of the City of Dakar and its citizens, several strategic documents were used. These include the Dakar’s Resilience Strategy, the Urban Development Master Plan, the Dakar urban development plan and its surroundings, the Environmental Action Plan, as well as several national documents. These documents provided important details on the city and specific climate risks, impacts and adaptation opportunities; making it a significant source of information. Other publications and recent data have supplemented this information to provide a complete basis for current and projected climate risks and opportunities in the City of Dakar.

Also, to ensure the participatory dimension of the approach, stakeholders were identified and benefited from interactive capacity building sessions on the challenges of urban planning in the context of climate change. Thus, various stakeholders from the technical directorates of the city, decentralized

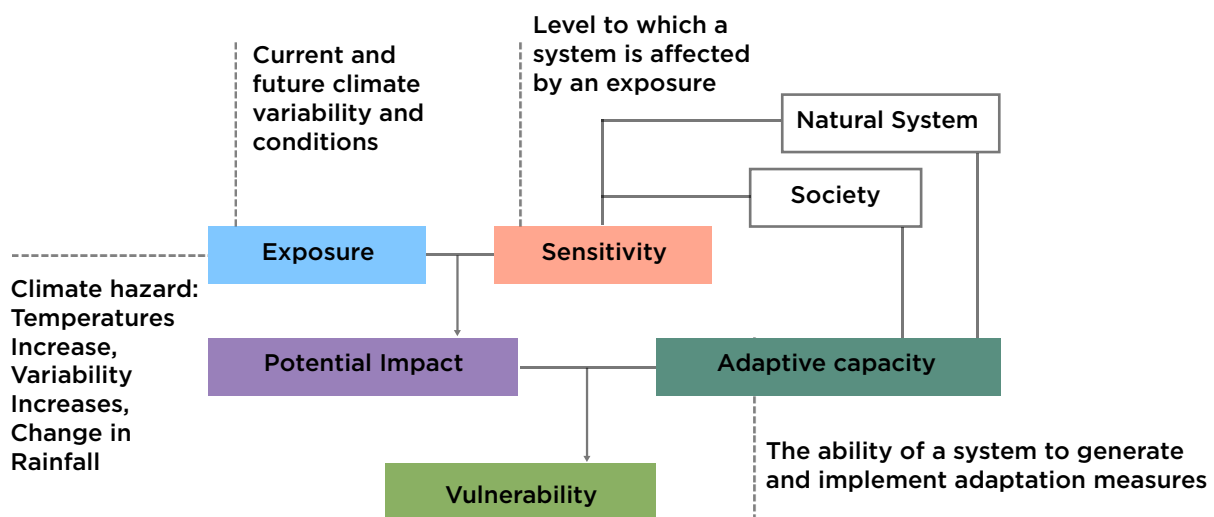
technical services of the state and sectors, were involved through a series of interviews and data sharing.

The vulnerability analysis is based on the approaches to territorial resilience developed by the IPCC, the C40 climate risk assessment practical guides, the World Convention of Mayors (GCoM) and the CoMSSA. Therefore, understanding climate impacts necessitated the study of human-environment interactions.

Vulnerability is considered to be influenced not only by changing biophysical conditions, but also by social, economic, political, institutional and technological structures and processes. For operational purposes, the two paradigms of vulnerability were combined: vulnerability related to consequences and vulnerability related to the context.

The vulnerability assessment methodology was developed based on the construction of sensitivity, exposure, capacity and impact indicators (Figure 4).

Figure 4. Vulnerability Analysis Factors



4.2 Analysis of climate trends

Article 3 of the General Code of Territorial Authorities states: "Territorial authorities are responsible for the design, programming and implementation of economic, social and environmental development actions of local interest." Since then, the City of Dakar, with its expertise in urban planning and environmental governance, has moved towards integrating an adaptation strategy into its priorities. This strategy requires knowledge of past exposures and sensitivities, and consideration of current and future climate trends.

4.2.1. Background of the territory vulnerability analysis

The City of Dakar has a relief characterized by different geomorphological forms (Figure 5):

- A volcanic complex with the Mamelles (highest point at 105 meters), the island of Gorée and the Madeleine Islands;
- A first plateau in the southeast between

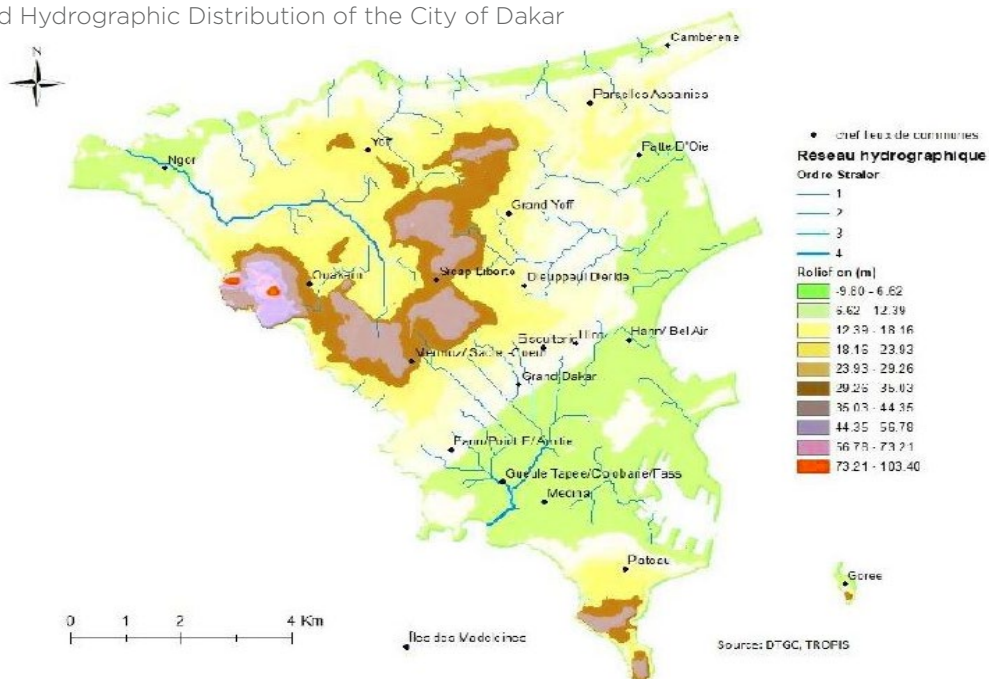
15 and 40 meters. It consists of volcanic flows and a substratum covered in the centre by a lateritic breastplate.;

- A second plateau consisting of a clay-limestone substrate located below 10 metres and located in the vicinity of Medina, Mermoz, Point E and Hann Bel-Air;
- Volcanic massifs in the northwest part around the ancient villages of Ouakam, Ngor and Yoff.

According to the National Agency for Statistics and Demography (ANSD), the Dakar region accounts for 50% of Senegal's urban population, 95% of industrial and commercial enterprises, 80% of the country's infrastructure and services, 87% of formal jobs and 75% of national transfers of goods to and from Dakar.

The City of Dakar is home to most of the infrastructure that generates economic activity. The main driver of economic growth in Senegal is the tertiary sector, particularly located in the Dakar-Plateau area. All of these factors contributed to the City of Dakar's significant share of gross domestic product (GDP), at 68%.

Figure 5 : Relief and Hydrographic Distribution of the City of Dakar



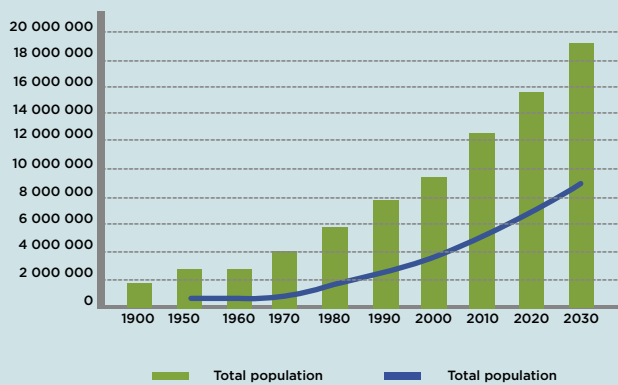
Source : Dakar City Vulnerability Study Report on Climate Change, 2020

4.2.2. Demographic context of the city of Dakar and urbanisation trends

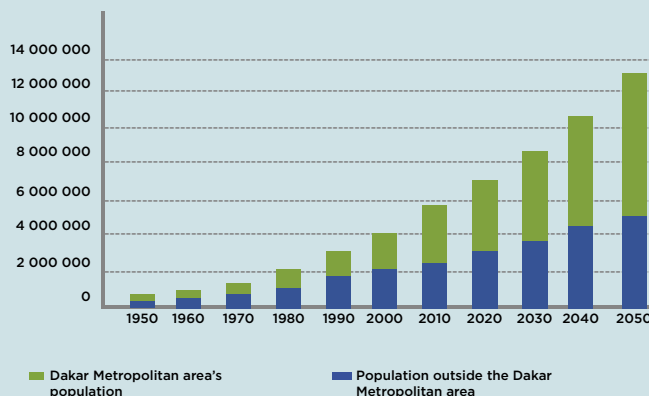
Figure 6 : Evolution of the total urban population compared to the Dakar metropolitan area



Assessment of total population and urban population 1900-2030



Distribution of the urban population between the Metropolitan area of Dakar and the inland



Source: Urbanization Review “Emerging Cities for an Emerging Senegal,” ADM/ANSD Data

Table 4. Demography of the City of Dakar

<p>Region of Dakar Dakar / Pikine / Guédiawaye / Rufisque</p>	<p>550 sq. km 0.28% of the national territory 3,835,019 inhabitants by 2020</p>
<p>City of Dakar</p>	<p>1,400,974 inhabitants by 2020 8.4% of the national population 36.5% of the regional population Density: 17,961 inhabitants/km2</p>
	<p>78 km2</p>

City of Dakar

702 000 inhabitants



1998

1 409 976 inhabitants



2020

680 976 more inhabitants in less than a generation

Source: Population Projection Report 2013-2063, ANSD

Dakar is marked by rampant urbanization. The phenomenon that occurred from the drought sequence of the 1970s to the late 1990s has been exploding since 2000. This results in the grabbing of previously declared non-edificant spaces such as stormwater

receptacles and natural green spaces. Multiple planning attempts have failed to control the occupancy of the space and enforce planning and construction standards.

Figure 7. Evolution of the occupation of the catchment area (Grand-Yoff Municipality)



Figure 8. Changes in land use in the Mariste area (Hann-Bel Air Commune)

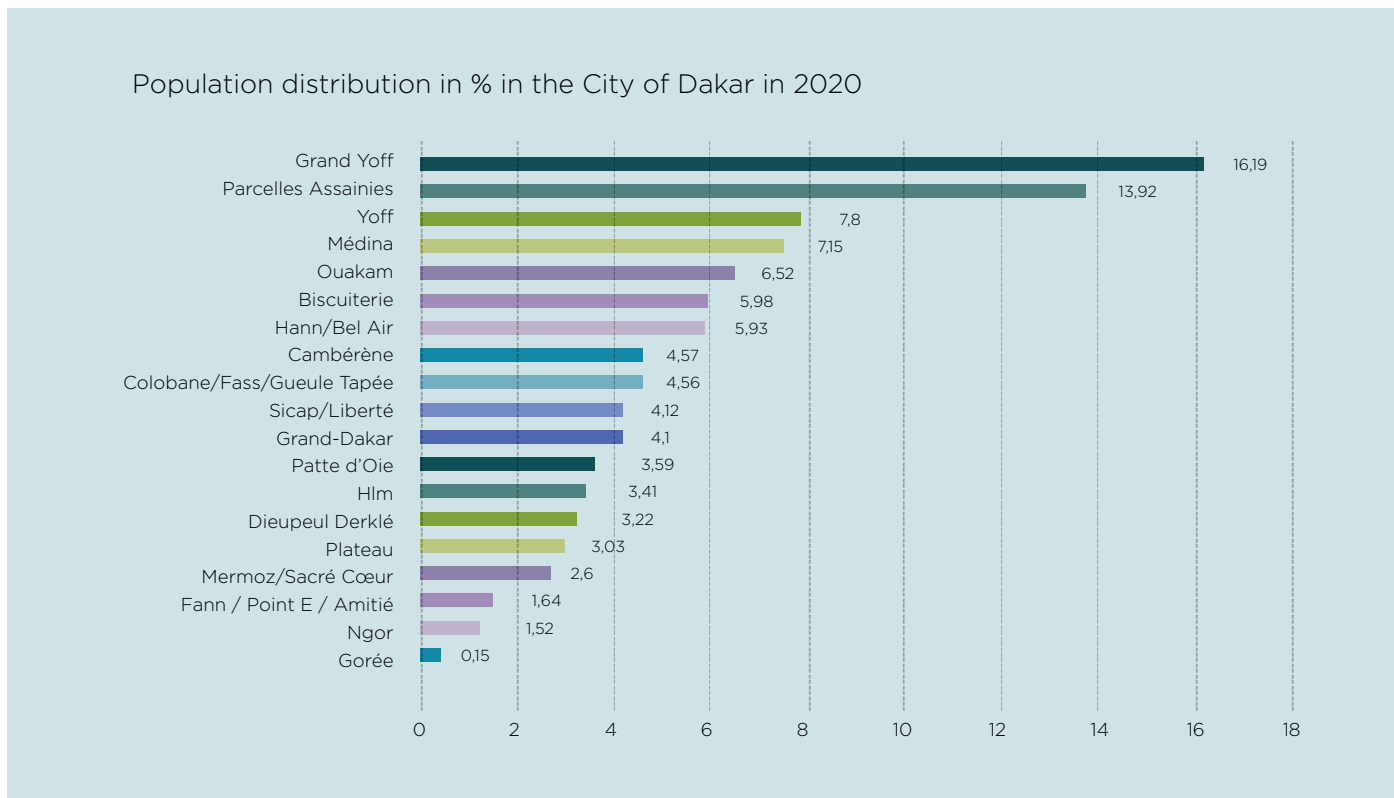


Source : Google Earth Pro

Demographic data from the municipalities of the City of Dakar reveal that the municipalities of Grand Yoff and Parcelles assainies are the most populated with 226,765 and 194,976 inhabitants respectively, or 16.1% and 13.9% of the city population. In contrast, Gorée

and Fann-Point E-Amitié have the lowest populations in the region with 2,054 and 23,032 inhabitants respectively.

Figure 9. Population distribution in Dakar’s 19 municipalities by 2020



Due to its peninsula character, its small space and its rapidly growing demographics, which is growing at an average annual rate of 2.5% over the period 2013-2025, the City of Dakar is moving towards a verticalization of its building and an upgrade of its infrastructure. In this context of growing environmental challenges and exposure to the effects of climate change, the city needs to rethink its urban policy.

Of the 19 municipalities in the City of Dakar, 10 have a density of between 15,000 and 50,000 inhabitants/km². The municipality of Biscuiterie stands out with a density of more than 50,000 inhabitants/km², while Ngor, Fann-Point E and Gorée have a density of less than 5,000 inhabitants/km².

Overall, population projections show an increase in the rate of density across the city even if the future development of new

urban poles across the metropolis is expected to put a brake on this trend.

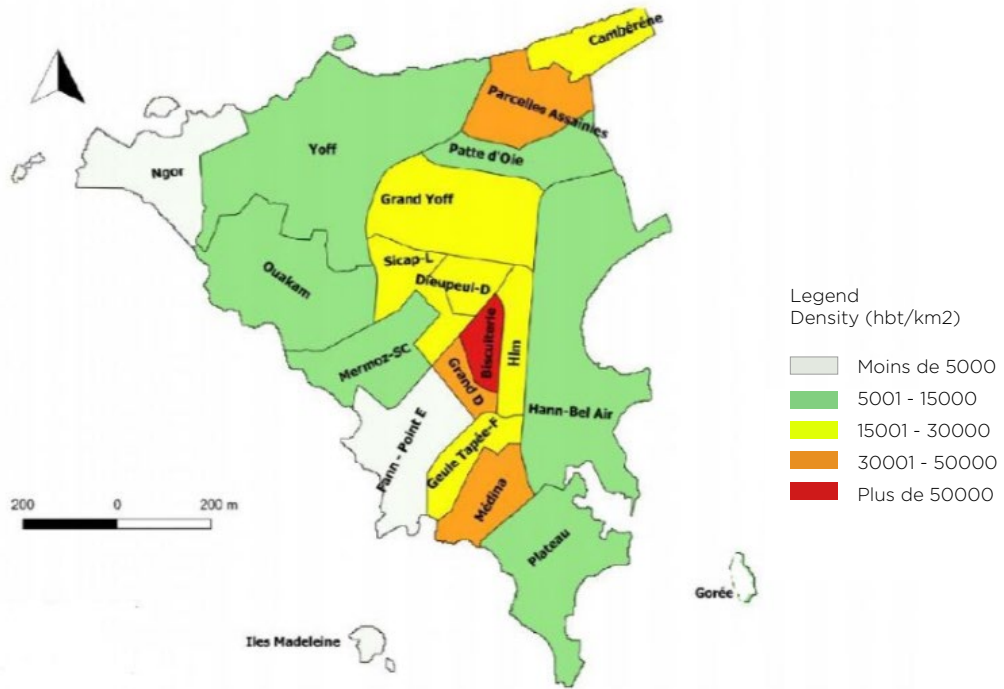
The land use of Dakar is distributed between the waterproofed areas built (69%), the port and industrial complex and the airport area (15%) and vegetated spaces (16%).

The City of Dakar is facing a gradual reduction in the bulk of its natural ecosystem, which was to form its green lung and mitigate global warming. According to the Regional Water and Forestry Service, the last relics of biodiversity are found in the Eastern ledge with an area of 100 ha, Hann Park (60 ha) and the Madeleine Islands National Park (45 ha). Today, the part of the Camberène forest in the territory of the City of Dakar is fully built.

The City of Dakar is strengthened in its climate and environmental planning dynamics by the guidelines of the Dakar's and surrounding areas Master Plan for Urban Development by 2035. This plan

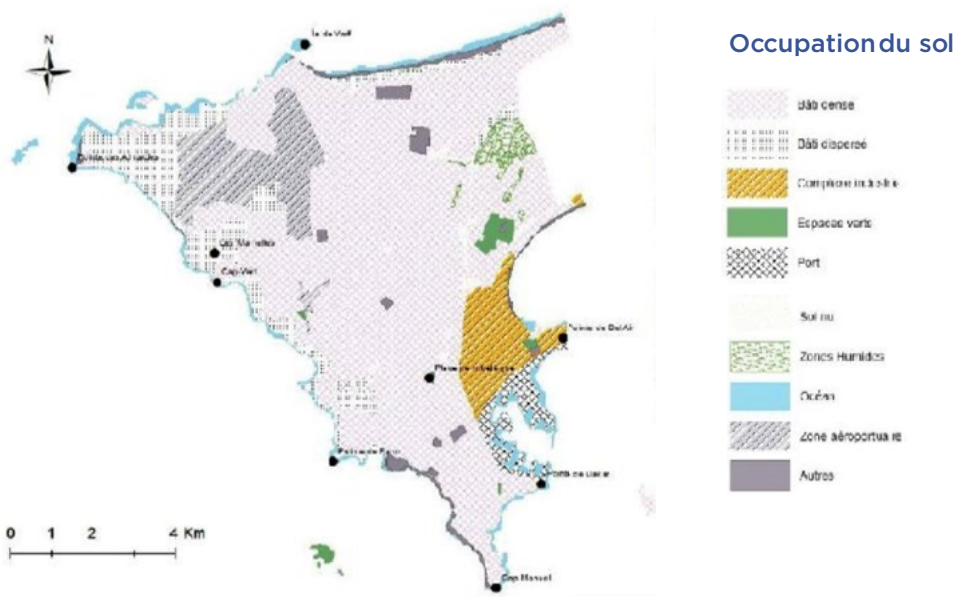
places particular emphasis on taking climate change into account to enable the sustainability of the Dakar metropolitan area.

Figure 10. Demographic density of different municipalities



Source: Dakar City Vulnerability Study Report on Climate Change, 2020

Figure 11. City of Dakar land use map



Source: Dakar City Vulnerability Study Report on Climate Change, 2020

4.2.3. Environmental background and projection

The general state of the environment in Dakar is deteriorating due to increased land use, the anthropogenic pressure on natural habitats and climate change. This is also characterized by air pollution, groundwater from marine waters (Hann Bay in particular), surface water.

4.2.3.1 Air quality

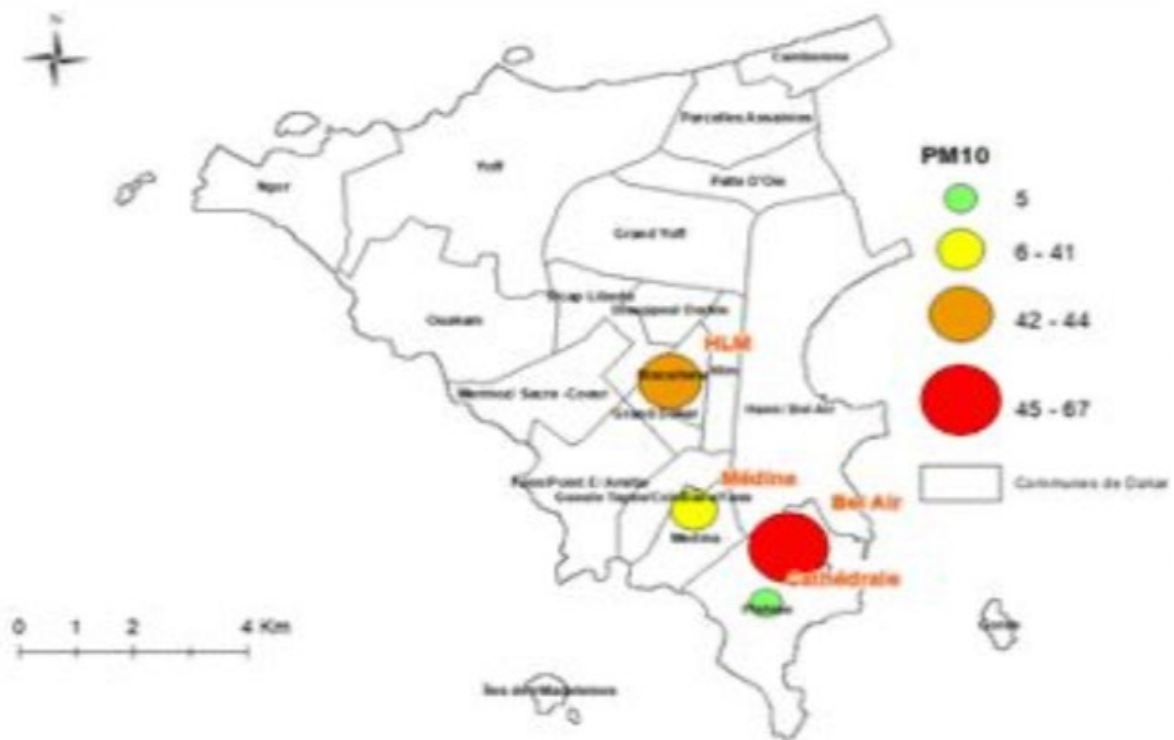
Since 2011, the City of Dakar, in partnership with the Ministry of Environment and Sustainable Development (MEDD), has benefited from daily monitoring of air quality. This monitoring is carried out

by the Air Quality Management Centre (CGQA).

Transport, industry, energy production, solid waste incineration in open pits and Saharan dust are the main causes of air pollution in Dakar.

The map below (Figure 12) shows the distribution of air quality measurement stations in the City of Dakar as well as pollution levels at PM10 in 2017. The measurements taken show that the Bel Air area is most affected by the degradation of air quality. This is due to the concentration of industries operating in various sectoral activities. The HLM and Medina stations have quite remarkable levels of pollution due to the importance of car traffic.

Figure 12. The state of air quality in Dakar



Source: Dakar City Vulnerability Study report on climate change, 2020. CGQA data, 2017

The types of pollutants measured in g/m³ and tracked at the city level are: suspended particles (PM₁₀ and PM_{2.5}), ozone (O₃), sulphur dioxide (SO₂), nitrogen dioxide (NO₂) and carbon monoxide (CO).

Average annual PM₁₀ concentrations are often high and generally exceed the World Health Organization standard (20 g/m³) and the Senegalese standard NS-05-062 (40 g/m³). PM_{2.5}, which is more dangerous to health, also has relatively high levels of concentrations because they exceed the WHO standards (10g/m³) and NS-05-062 (25g/m³). With this in mind, the City of Dakar is carrying out awareness campaigns on the health risks associated with poor air quality in

In 2019, 24% of average daily PM₁₀ concentrations exceeded the NS-05-062 standard of 150g/m³ and 97% were above the WHO threshold of 50g/m³.

The Air Quality Index (AQI) is used to assess airborne particles. This index is calculated daily to assess the level of air pollution in the City of Dakar. It corresponds to the maximum of partial indices calculated for each station and for each of the five pollutants mentioned above.

Figure 13 highlights a seasonality of the phenomenon of air pollution in Dakar. Air quality is generally average during the rainy season (June to September) and

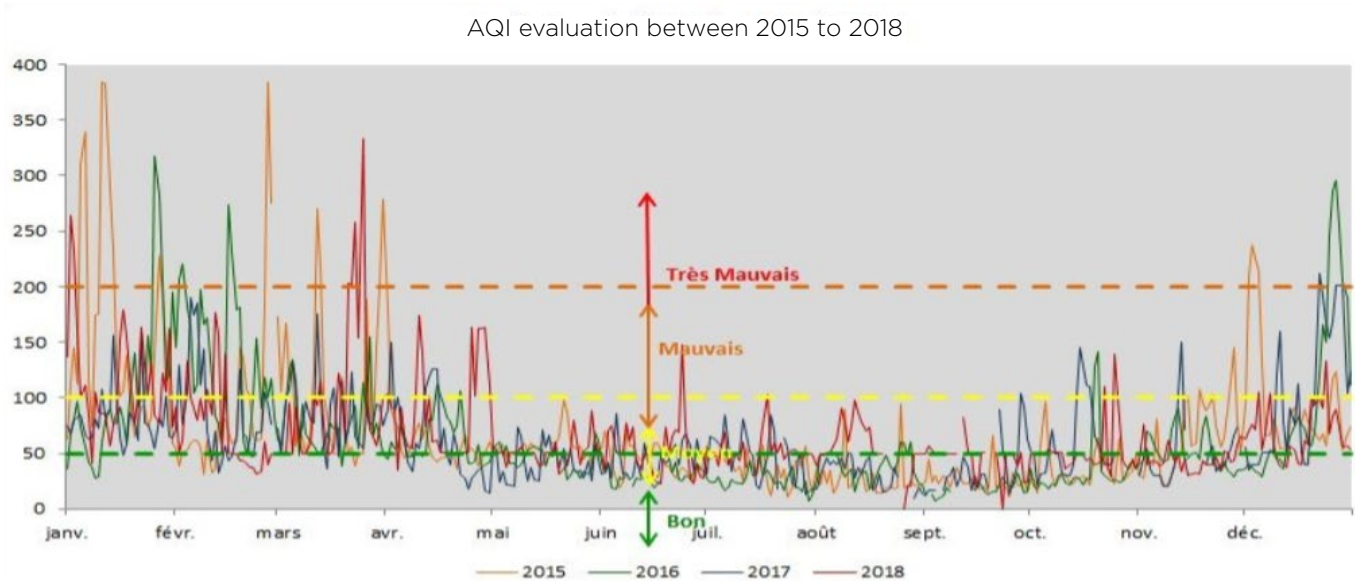
Table 5. Average annual concentrations of pollutants in Dakar in 2019

Stations	Type	PM ₁₀ (µg/m ³)	PM ₁₀ (µg/m ³)	O ₁₀ (µg/m ³)	SO ₁₀ (µg/m ³)	NO ₁₀ (µg/m ³)	CO (mg/m ³)
Bel-Air	Industrial	94	-	-	-	4	-
Bd. République	Urban traffic	-	45	30	37	20	-
HLM	Background urban	174	-	-	-	14	-
Médina	Peri urban traffic	161	-	-	-	19	-
Guédiawaye	Traffic in the suburbs	129	65	25	2	10	3

collaboration with health services and university researchers. Average annual concentrations of other pollutants are generally low and do not pose a major air pollution problem in the city (Table 5).

very poor during the dry season from mid-October to the end of March. Most often periods of high pollution linked to dust inputs from the Sahara Desert have been observed, especially in early January until April, which reinforces the bimodal nature of the phenomenon of air pollution in Dakar.

Figure 13. Monitoring air quality in the City of Dakar from 2015 to 2018



Source : Air Quality Management Centre (MEDD/DEEC)

4.2.3.2 Water and sanitation

The rate of coverage of drinking water is estimated at 100% with 94% of private connections and 6% of public connections. However, in some neighbourhoods, there is a lack of access to water related to the supply system. The volume of water supply does not cover the demand. Indeed, the mechanism is based on:

- a water transfer from Lake Guiers located in the high delta of the Senegal River 300 km from Dakar. From this 170 km² body of water located in the north-west of the country comes the raw resource treated by two factories.
- groundwater along the pipes from Lake Guiers between Louga, Mekhé Thiès and Dakar around nine catchment fields, only three of which are located in Dakar: Point B, Mamelles and Thiaroye (JICA, 2014).

These three catchment fields polarize about 11 boreholes out of about 50 that come in addition to the water collected from Lake Guiers.

This situation reflects the vulnerability of the City of Dakar to sustainable water supplies. On one hand, most of the resource is external and, on the other hand, groundwater representing a good proportion of Dakar's water consumption is fragile due to the mode and recharge characteristics specific to the Sahelian zone. This mode of recharge currently mainly affects surface water tables, but could affect deep water table.

It should be noted that the City of Dakar has no jurisdiction in this area of drinking water supply. Nevertheless, it is a pre-eminent theme because of its vital nature for people and activities.

Dakar's sewerage system consists of two drainage systems: sewage and stormwater. The access rate is estimated at 65%. Traditional villages, neighbourhoods in the Camberène basin and much of the Hann Bel Air municipality are not yet fully covered. Today, The National Sanitation Office of Senegal (ONAS) is in the process of carrying out a programme of extension and renewal of the network throughout the City of Dakar.

The so-called "unconventional" sanitation generates between 178,070 m³ and 182,445 m³ of sewage sludge per year despite the existence of a large sewer system. Faced with difficulties in accessing wastewater collectors, some populations are smuggling their wastewater into storm drains. Added to this is the inadequacy of the sizing of wastewater collectors in relation to the quantities produced. There is an upsurge in sewage discharge points across the city, especially in neighbourhoods where the verticality of the building is booming.

Also, the Dakar coastline is punctuated by numerous sewage discharge sites that are linked to the drainage system, which exacerbates marine pollution and unsanitary beaches.

4.2.3.3. Economic vulnerability: fishing cases

Fisheries, a key sector of the Senegalese economy, due to its contribution to balance of payments and budgetary revenues, is affected by climate change. Studies in this sector have revealed changes in climatic and hydrodynamic conditions that may result in a decrease in catches for all fishing subsectors (marine fishing, inland fishing, among others). The current situation

points to a sharp decline in fish stocks and an overall decline in catch levels. Demersal species with high commercial value are highly threatened.

Fishing is the main economic activity of the primary sector in the City of Dakar. The main fishing sites are: Hann, Yoff, Ouakam, Ngor, Soumbédioune, Anse Bernard and Terrou Baye Sogui. The intensity and direction of ocean winds and currents and the increase in ocean temperature are all phenomena that threaten the fishing subsector in Dakar.

The analysis of the different parameters of the subsector are quite explanatory of the economic vulnerability of Dakar. So, when it comes to:

- Amount of production: The rating of the vulnerability in Dakar has yielded + 2, which reflects that its level of potential and real affection is very important and that the proposed adaptation strategy could certainly contribute in part to the improvement of the quantity of production.
- Quality of production: With a rating of + 2, the quality of the fish, in addition to the fact of suffering from poor fishing practices, also suffers from climatic disturbances that can alter hydrological conditions.
- Cost of production: The cost of production vulnerability index was rated 6. For the fishing actors of the City of Dakar consider that nowadays they face multiple constraints mainly related to the increase of their daily expenses by purchasing more (fuel, ice for the conservation of products that are perishable, provisions for food). This is due to the remoteness of fishing areas due to the migration of species, resulting in an increase in working time.
- Labour force: The labour force has had an equal vulnerability index of + 2, because the phenomenon of climate change affects the socio-economic comfort of fishing actors in the city because of the decrease

in their income.

- Profit: The complexity of the system in the fishing sector in Dakar inevitably results in a decline in profit of between 20 and 25% due to the general increase in the costs of production factors.
- Offer: It is negatively affected by the increase in the frequency of climate change events in fishing activity in Dakar, where demand continues to increase. It is therefore essential to find a sustainable solution, given the socio-economic importance of fishing in the consumption, processing and food security of the citizens of Dakar.

4.2.3.4. People’s perception of the environmental context of the City of Dakar

The control of the environmental issues and challenges of the City of Dakar requires an updated diagnosis that gives the priority to the concerns of the population. For example, public consultations were held to support the inclusive dynamics that frame the elaboration of the PCET. This is one of the key steps in the process of implementing the Urban Governance Improvement Program for an energy and ecological transition.

Figure 14. Major environmental constraints depending on people’s perception

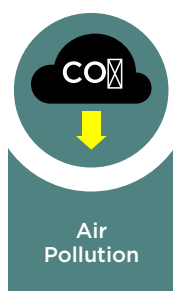
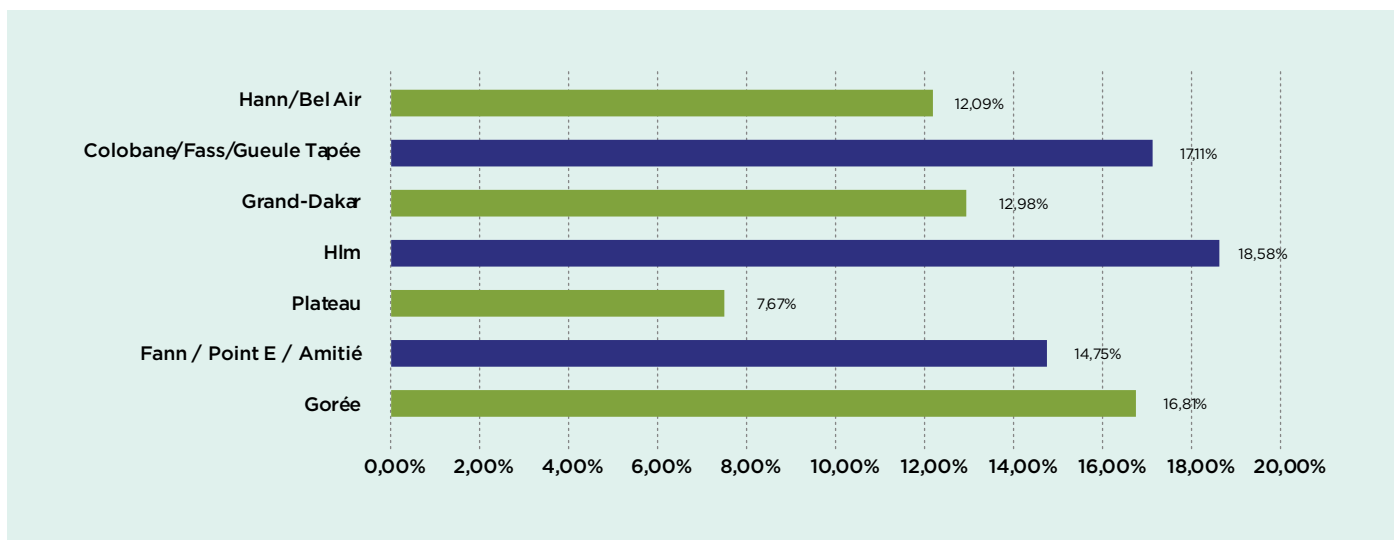


Figure 14 highlights air pollution, waste management and stormwater as the major constraints identified by populations across the City of Dakar. Thus, any strategy to adapt to climate change must prioritize these three issues.

For those consulted, the extent of the adverse effects of poor air quality on public health must be well measured. This threat is manifested by an increase in respiratory and cardiovascular infections or diseases.

Poor waste and stormwater management has a negative impact on people. The waste collection system needs to be revised and adapted to the urban structuring of the city but also to the increase in population. All this combined with a waste sorting system at the household level.

It was also pointed out by the population that the problem of stormwater management persists due to a lack of sizing of the drainage channels but also an unsuitable urban planning in a context of uncontrolled population growth.

The public consultations revealed that community dynamics are a crucial issue

in the implementation of grassroots development policies. It was an opportunity for people to expose their responsibility in the deterioration of the environment and their ability to mobilize in order to improve their living environment and strengthen their resilience to the effects of climate change. Through the public consultations, a mapping of the basic community organizations was carried out in 18 municipalities of the City of Dakar by identifying community influencing stakeholders who are able to stimulate a change of behaviour for sustainable territorial development.

In addition, coastal erosion has also been highlighted, as the City of Dakar is a peninsula that is facing to sea level rising. It mainly threatens traditional fishing villages and the industrial and economic activities that depend on them. Finally, the level of ecological degradation of Hann Bay caused, among other things, by polluted industrial water, the dumping of household waste and domestic wastewater is a major concern for local populations.

Table 6. Major problems in the different municipalities

Municipalities	Coastal erosion	Wastewater management	Waste water	Rain water	Waste management	Atmosphere ric pollution	Pollution	Management of public space	Community Dynamics
Gorée	■	■							■
Médina		■				■			■
Plateau		■				■			■
Gueule Tapée-Fass-Colobane		■				■			■
Fann-Point E-Amitié					■	■			■
Grand Dakar			■	■	■		■	■	
Biscuiterie					■		■	■	
HLM			■	■	■		■	■	
Dieupeul-Derklé			■	■	■		■		
Sicap Liberté					■		■	■	
Hann-Bel Air	■				■		■		
Ngor	■		■						■
Ouakam	■		■				■		
Mermoz Sacré Cœur	■		■		■				
Yoff	■	■		■	■				■
Parcelles Assainies	■						■		■
Grand Yoff		■		■				■	
Patte d'Oie				■			■	■	■
Cambérène				■	■		■		■

Source: PCET Public Consultations Report

4.3. Observation of climatic hazards

With climate change, the City of Dakar is increasingly exposed to certain climate hazards such as floods, coastal erosion, marine submersion, etc. These hazards are often combined with underlying factors that increase the vulnerability of populations.

4.3.1 Floods

At the end of the drought cycle of the 1970s and 1990s, floods became a problem for major urban centres such as Dakar. The map below (Figure 15) shows areas at risk of flooding and highlights low pressure zones that are natural stormwater drainage paths. Indeed, urban developments (housing, urban infrastructure, paving, etc.) promote the presence of low points that are all places of water storage and which amplify

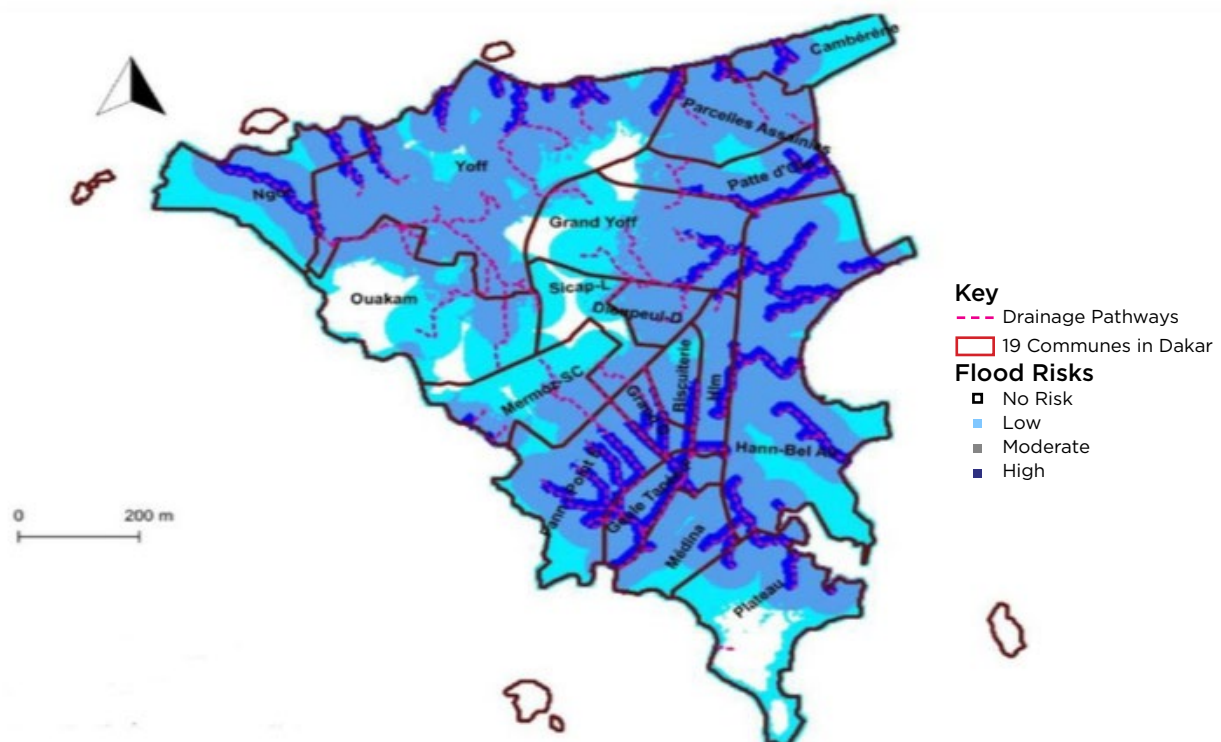
the phenomenon of flooding.

4.3.2. Coastal erosion on the Dakar peninsula

Coastal erosion is due to wind, swell, sea level variations and sedimentary inputs. Its intensity depends heavily on the geology and configuration of the coastline. To these natural factors are often added anthropogenic factors (coastal construction, sand extraction) that aggravate this phenomenon.

A diachronic study showed that since 1954, the coastline has declined significantly with the exception of Yoff's (-0.02 m/year less than the margin of error of ± 0.04 m/year). The tendency towards stability of the beach is due, on the one hand, to the island of Yoff, which would act as breakwaters but also as spikes through the boulders that connect it to the village and allow a build-up of sediment. On the beach

Figure 15. Exposure to flood risk in Dakar

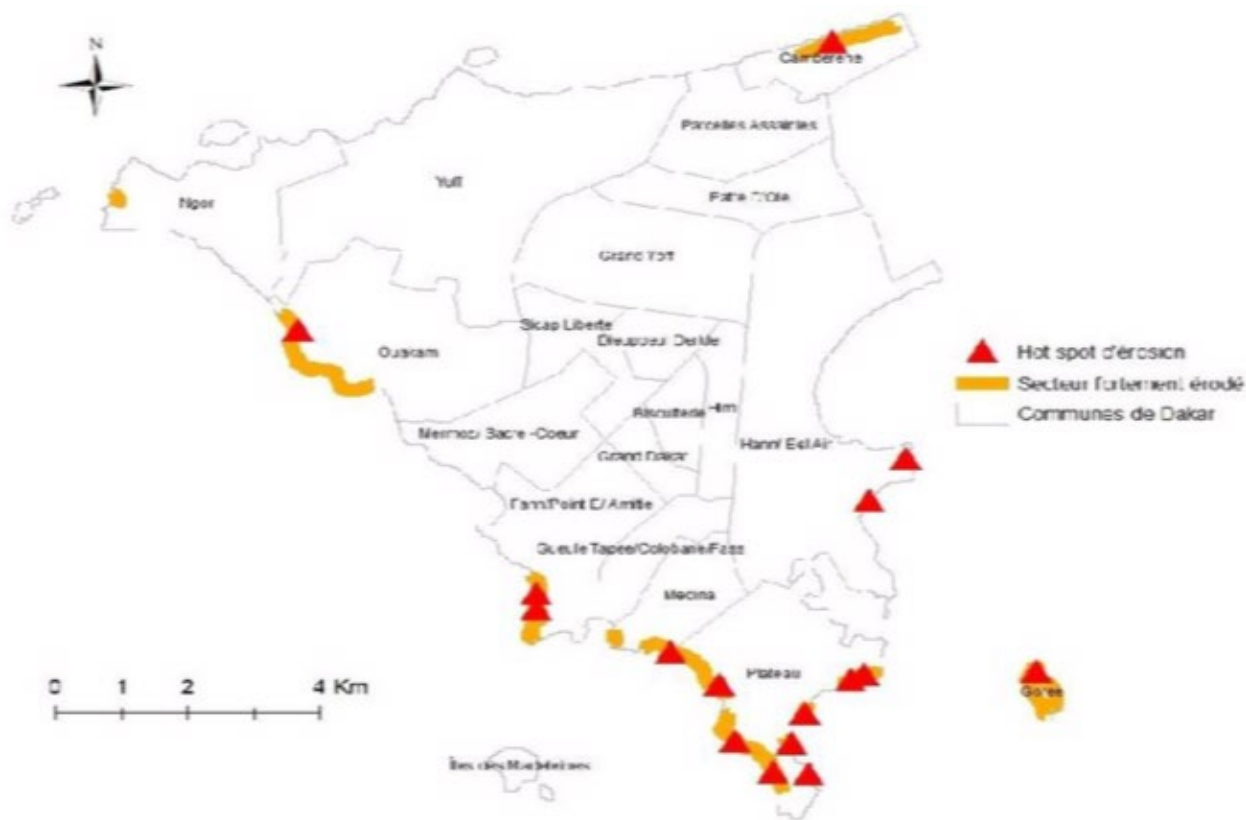


Source: Dakar City Vulnerability Study Report on Climate Change, 2020

of the Parcelles assainies, erosion during the same period was - 4 m/year. Data from the western ledge show that each of the beaches has a relatively small width with an average of 27.53 m in Ouakam and 32.98 m in The Mamelles. The slopes are 7.82% and 9.37% respectively.

The annual balance of vertical movements is negative in The Mamelles and positive in Ouakam. Accretions are more pronounced during the dry season, while the rainy season is predominantly eroded.

Figure 16. Coastal Erosion Vulnerability Map



Source: Dakar City Vulnerability Study Report on Climate Change, 2020

4.3.3 Marine Submersion

Marine submersion is a temporary and possibly episodic flood of coastal areas, generated by the nearby sea, with salt or brackish water, during meteorological events (storm, tropical cyclone, strong depression and sea wind) or oceanographic (swell, tide, tsunami) of very unusual magnitude.

The large-scale coastal analysis carried out as part of the World Bank's study of the vulnerability of the Senegalese coastline has helped to define the sensitivity of the coastline to submersion hazard, with regard to its morphology.

Regarding the City of Dakar, the available data show that marine submersion is currently low between Yoff Island and the Port of Dakar except for small cliff-backed beaches where this hazard is considered as medium. At Gorée Bay, marine submersion is also low. However, in 2015, a swell of the Southwest sector reaching 2.5 meters in height, propelled by a wind of 40 km/h had produced a lot of material damage (the fall of a section of the fence wall of the Mariama Ba Education House, part of the mosque) and logistical damage including the disruption of the ferry linking Dakar-Gorée for at least 48 hours.

In 2030, the Camberène area is classified as a major hazard which poses a threat to the North Clearance Way (VDN), while Yoff Beach is classified as medium submersion hazard given the position of the beach in relation to sea level, which limits the intrusion of marine waters. In addition, on the small beaches backed by the western cliff of Dakar, the hazard of marine submersion is estimated as medium in

2030 and strong in 2080.

The combined information from ANACIM and other relevant structures will make it possible to more adequately prevent populations by taking steps to mitigate the likely impacts of this phenomenon. The ANACIM Daily Vigilance Map is an important alert tool to be popularized among populations and people operating along the coast.

4.4 Future climate hazards and impacts

The City of Dakar has a semi-arid or steppes climate in the ranking of Koppen-Geiger. Dakar temperatures are rising with year-to-year variability observable. The increase in temperature is correlated with that of the building, which contributes to the heat islands located on the peninsula.

Rainfall is characterized by high interannual variability. The rainy season covers 4 months (July to October). Maximum decadent rain is recorded in the third decade of August. Analysis of the daily rains of recent decades shows the recurrence of the daily 10-year rain, which each year exceeds 113.6 mm. The occurrence of the flood hazard in Dakar is now closely linked to this ten-year daily rain.

4.4.1 Climate Scenarios

4.4.1.1. Projected annual temperatures

Temperatures are calculated based on the annual average values of the daily average over a 30-year period. This index is provided as an absolute change from the

1981-2010 reference period.

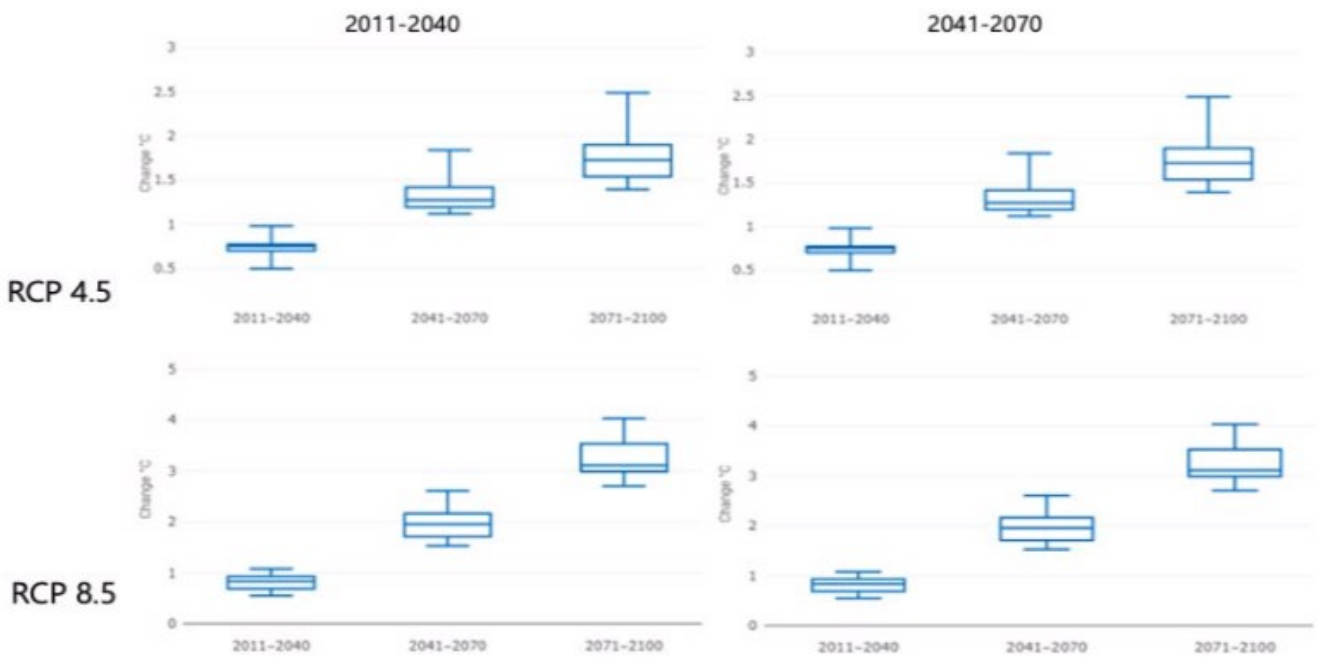
The description of the average annual temperature indicator (RCP 4.5) for the period 2011-2040 compared to 1971-2000 will see a median change of 0.7°C compared to the overall average. 50% of the temperature data series shows an upward trend in the range of 0.7 to 0.8°C.

The median change in the average annual temperature is 1.3°C for the period 2041-2070 compared to the period 1971-2000 (RCP 4.5), or 50% of the series indicating a change in the range of 1.2 to 1.4°C.

The description of the average annual temperature indicator (RCP 8.5) for the period 2011-2040 compared to 1971-2000 shows a median variation of 0.8°C. In fact, 50% of the data set has a variation in the range of 0.7 to 0.9°C.

The annual average (RCP 8.5) for the period 2041-2070 compared to 1971-2000 shows a median variation of 2.0°C, or 50% of the series with an increase of between 1.7 and 2.2 degrees Celsius.

Figure 17. Average annual temperatures



Changes compared to the historic period

4.4.1.2. Projected annual precipitation

The projection of average annual precipitation is calculated using the average annual daily values over a 30-year period. This index is given in the form of relative change.

The average annual precipitation indicator (RCP 4.5) for 2011-2040 compared to 1971-2000 has a median variation of 0.2%. In addition, a median variation in the range of 10.5% to 10.3% is observed in the precipitation data series.

Average annual precipitation (RCP 4.5) for the period 2041-2070 compared to 1971-2000 has a median variation of 14.4%. 50% of the data set shows that the variation ranges between 28.8% and 1.3%.

The average annual precipitation indicator (RCP 8.5) for 2011-2040 compared to 1971-2000 shows a median variation of 4.7%.

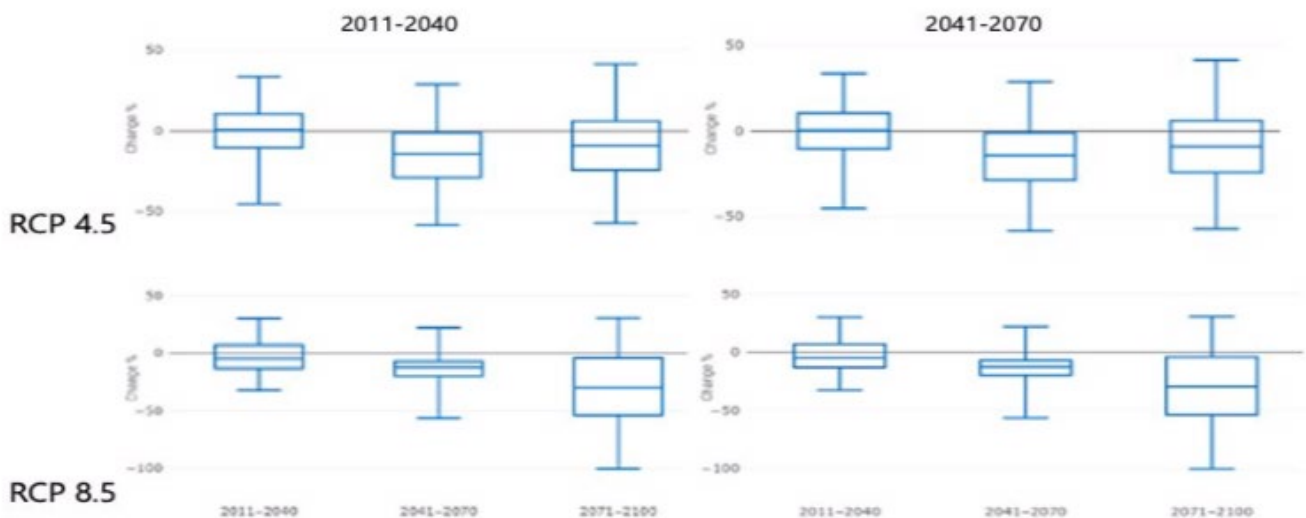
50% of the data set indicates that the variation ranges between 13.2% and 7.1%.

Average annual precipitation (RCP 8.5) for the period 2041-2070 compared to 1971-2000 has a median variation of 12.5%. To this end, 50% of the data series shows that this variation ranges between 19.7% and 7%.

The climate of the City of Dakar is set to become warmer at the end of the 21st century according to the scenarios used. It is estimated that the average annual temperature will increase by 2°C, in the case of RCP 4.5, and by more than 3°C in the case of RCP 8.5. In the worst-case scenario (RCP 8.5), global warming in this urban area is expected to accelerate considerably after 2070.

Overall, precipitation will be downward depending on the period and the moderate or pessimistic scenario. Over the 2011-2040 period, the trend is rather slight (2% RCP 4.5 and 6% RCP 8.5). Rainfall is likely

Figure 18. Average annual precipitation



Changes compared to the historic period

to decrease by about 16% between 2041 and 2070 for both scenarios. At the end of the century 2071-2100, the projections were alarming: 10% for RCP 4.5 and 35% for RCP 8.5. However, it should be noted that the variations will be more noticeable at the monthly level.

4.4.2. Scenarios of sea level rise in Dakar

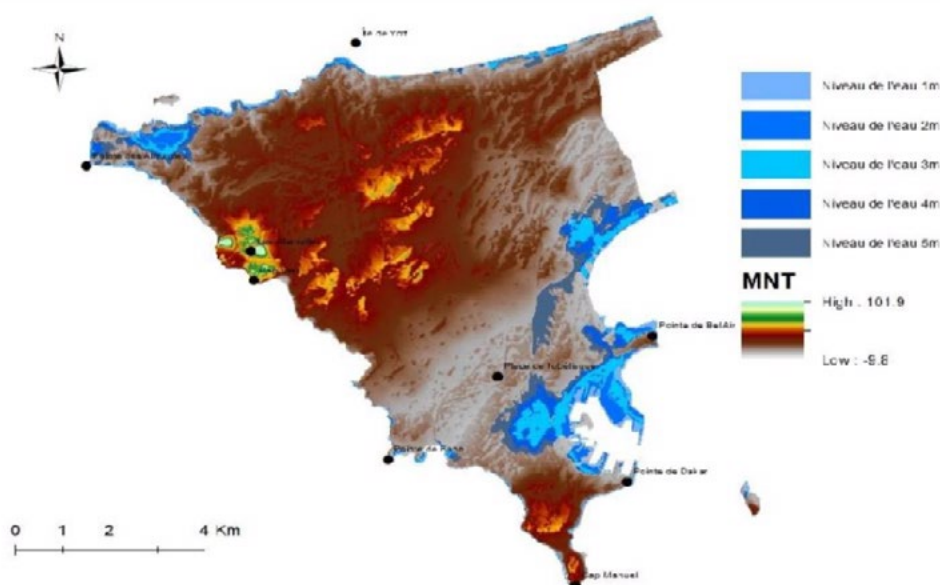
In the absence of protective arrangements, forecasts of sea level rise and marine submersion show that at the same deadlines, the same areas will be affected regardless of the scenario (moderate or pessimistic). These include the port of Dakar, Hann Bay, the Ngor estuary and the northern beaches.

Table 7 : Climatic Scenarios

Scenarios	Periods					
	2011 - 2040		2041 - 2070		2071 - 2100	
	T °C	P (mm)	T °C	P (mm)	T °C	P (mm)
RCP 4.5	+1°	-2%	+1°	-16%	+2°	-10%
RCP 8.5	+1°	-6%	+2°	-16%	+3°	-35%

Source: Climate Information, Providing climate science basis for climate adaptation and mitigation activities(<https://climateinformation.org/>)

Figure 19. Pessimistic scenario of sea level rise in Dakar



Source: Dakar City Vulnerability Study Report on Climate Change, 2020

4.4.3. Future vulnerabilities for the City of Dakar and affected sectors

Table 8. Future vulnerabilities

Predicted phenomena related to climate change (probability)	Urban Risk Factors and Vulnerability	Consequences for the city in the absence of measures	Affected sectors
Temperature rise, fewer cool days and nights, more hot days and nights (almost certain) Heatwaves (very likely)	Urban heat island effect Insufficient of trees, especially in many habitat areas.	Heat-related illness and death Increased discomfort	Public health, building, industry
	Inadequate energy supply	Disruption in distribution due to increased demand	Energy
Episodes of heavy precipitation - increased frequency (very likely)	Construction of habitats on sites that are not adequately connected drainage systems, or with blocked sewer systems	Water contamination and spread of waterborne diseases	Land use, solid waste and wastewater, public health
	There are many low points related to inadequate development	Flooding worsens	
	Transportation system failure	Blocking emergency access lanes in case of flooding of roads causing delays in emergency evacuations Economic losses due to disruption of the movement of people and goods	Transportation, private sector, trade
	Failure of the stormwater collection system aggravated by waterproofing and degradation of natural stormwater filtering functions	Increased runoff and increased flooding	Development, solid waste and wastewater, habitat
Sea level rise (almost certain)	Submersion of land located a short distance from the coast line	Increased marine submersions and steep coastal subsidence	Land use, tourism, fishing
Increased drought (likely)	Water supply problem, water shortages (drinking water) Loss of biodiversity	Increased shortages and undermined social stability	Water and building, urban agriculture, public hygiene Ecotourism

4.5 Assessment of the adaptive capacity of the City of Dakar

The term adaptation refers to “The ability of a system to adapt to climate change (including climate variability and extreme weather events) in order to reduce potential damage, take advantage of opportunities, or adapt to impacts.”

Through the reform on urban land, new metropolitan developments, funds dedicated to urban planning and renovation, the PSE, which is the benchmark for Senegal’s public policies by 2035, presents a favorable framework for the implementation of the adaptation strategy of the city of Dakar.

It is in this perspective that the implementation of major public investment programs and mobility improvement projects will help strengthen the city’s capacity to adapt to the climate vulnerabilities it faces.

The assessment of adaptive capacity is based on three levers:

- Knowledge of vulnerabilities linked to natural factors and ability to take them into account in strategic planning;
- The possibilities offered by a clearly defined institutional framework as well as specific skills allowing actions to take place in favor of adaptation to climate change ;
- The availability of internal or external financial resources to enable adaptation projects funding.

Table 9. Breakdown of CO2 emissions from municipal heritage

Documents produced by the City of Dakar in favor adaptation	Diagnosis and projection of natural risks	Diagnosis and projection of anthropogenic risks	Institutional capacity to meet its commitments	Diagnosis of funding tools already used to finance projects
<p>“Strategy of resilience of the City of Dakar “(2016), with the support of the Rockefeller Foundation’s 100 Resilient Cities Initiative</p>	<ul style="list-style-type: none"> • Floods • Marine submersion • Coastal erosion 	<ul style="list-style-type: none"> • Air pollution • Access to drinkable water • Sanitation 	<ul style="list-style-type: none"> • New general code of local authorities Law n ° 2013-10 of December 28, 2013 	<ul style="list-style-type: none"> • Budget specific to the City of Dakar • International technical and financial partners
<p>“Action Recommendations for Resilience and Sustainability “(2020), with the support of UN-Habitat</p>	<ul style="list-style-type: none"> • Sea level rise • Increased temperatures 		<ul style="list-style-type: none"> • Senegal NDC 	<ul style="list-style-type: none"> • Bilateral cooperation
<p>“Territorial Climate and Energy Plan of the City of Dakar” 2021, with the support of C40 and COMSSA</p>	<ul style="list-style-type: none"> • Decreased precipitation 		<ul style="list-style-type: none"> • National Climate Change Adaptation Plan (PNA) 	<ul style="list-style-type: none"> • Public-private partnership • Commercial banks • Fundraising on the green bond market or Green Bonds

Source: Dakar City Vulnerability Study Report on Climate Change, 2020

5. GHG emissions balance

The City of Dakar has published its first GHG emissions inventory in 2019 with 2016 as a reference year. This inventory forms the basis for climate action planning for the development of the Emissions Reduction Strategy Action Plan. The city collected quantitative and qualitative data from national institutions or agencies responsible for targeted sectors including energy, transport and waste. The inventory was completed in accordance with the requirements of the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC).



This methodology is adapted to the urban context and incorporates the guidelines of the Intergovernmental Panel on Climate Change (IPCC). It provides greater flexibility in data reporting but requires, at a minimum, reporting emissions from the three sectors that are generally the largest sources of GHG emissions in a city. These are the areas of:

- Stationary energy: fuel burned to produce energy for use in buildings (residential, commercial and industrial), including solid/liquid fuels (scope 1) as well as electricity supplied to buildings by the grid (scope 2);
- Transportation: fuel burned to produce energy for travel purposes, including liquid fuels (scope 1) as well as grid energy for electric motors (scope 2);
- Waste: emissions from solid waste treatment (e.g., open dump waste, spillage, and incineration) and wastewater (e.g., treated wastewater in septic systems, anaerobic digestion, and open discharge) both within city limits (scope 1) as well as waste produced in the city but treated outside the city limits (scope 3).

Other sectors, such as agriculture, forestry, industrial processes and product use, were not taken into account. These areas are recommended but are not required for the BASIC inventory level of the GPC standard.

Emissions were calculated using available data and using the City Inventory Reporting and Information System (CIRIS) . This GHG inventory covers the administrative boundaries of the City of Dakar (78km²), or 0.039% of the national area and 15% of the regional territory.

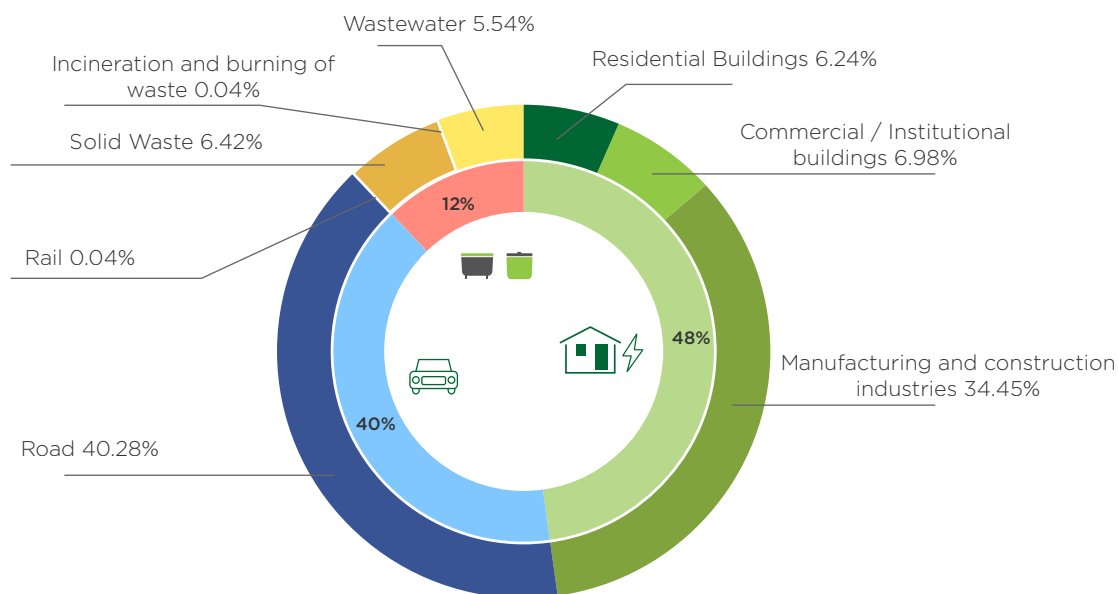
5.1 Profile of GHG emissions from the City of Dakar

According to the results of the city-wide GHG inventory, Dakar is responsible for the total emission of 2,626,843 tonnes of carbon dioxide equivalent (tCO₂eq) in 2016. These emissions are distributed as follows: 1,697,834 tCO₂eq (scope 1), 779,935 tCO₂eq (scope 2) and 149,074 tCO₂eq (scope 3). Stationary energy is the sector that contributes the most to GHG emissions (48%) with a large proportion coming from the industrial sector, followed by transport (40%) and waste (12%) (Figure 20).

Average per capita emissions are estimated at 2.1 tCO₂eq. Thus, compared to the national average (0.6 tCO₂eq/inhabitant), a resident of the City of Dakar emits 3.5 times more than a resident of the interior of Senegal. This is because Dakar is the country's main economic hub, home to more than 83% of industrial and commercial enterprises, 80% of the country's infrastructure and services and about 68% of the country's GDP. Taking all these factors into account, 27% of the national emissions projected in 2016 are attributable to the City of Dakar.

(6) Cities Inventory Reporting Information System

Figure 20. Overview of GHG emissions by sector and subsector in the City of Dakar (BAU, 2016)



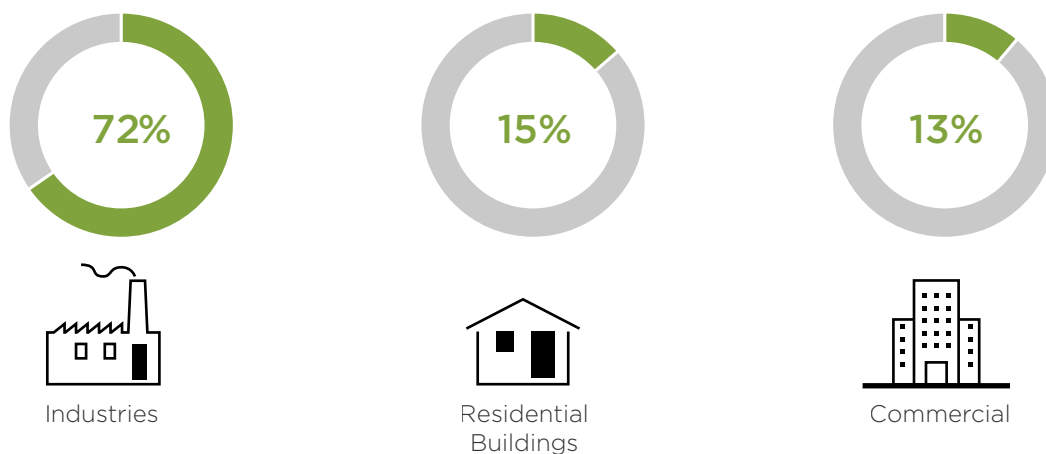
Source: City of Dakar GHG Emissions Inventory Report, 2019

5.1.1 Stationary energy sector

Emissions from the stationary energy sector come mainly from fuel consumption and fugitive emissions emitted during the energy production, distribution and consumption process. In 2016, this sector

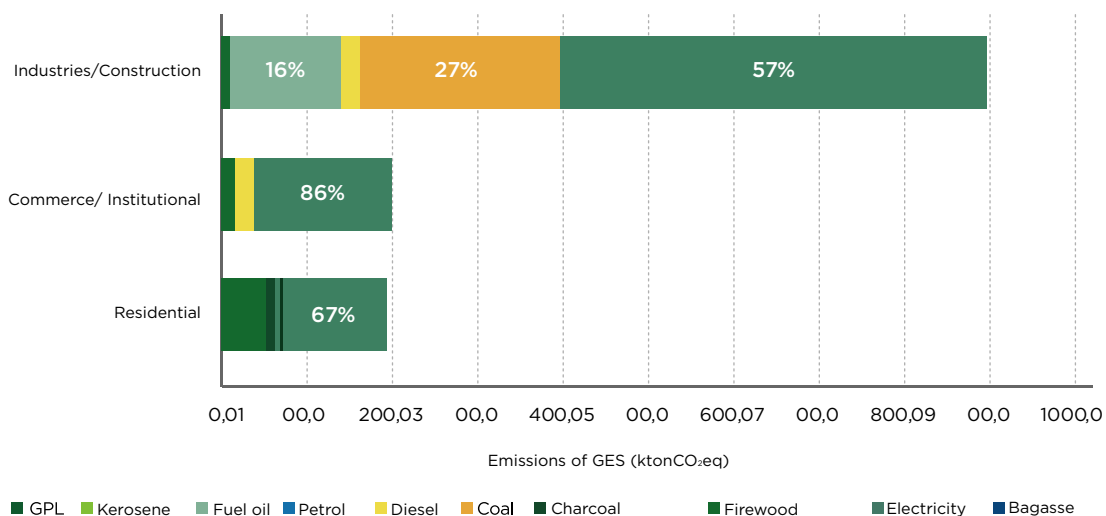
contributed 1.3 million tCO₂eq to the total emissions estimated in the City of Dakar. The subsector of industries (food, chemical, mechanical, building materials, textiles, leather, wood, paper and cardboard, and other manufacturing industries) accounts for 72% of GHG emissions compared to 15% for residential and 13% for commercial (Figure 21).

Figure 21. Contribution to stationary energy emissions by subsector



Source: City of Dakar GHG Emissions Inventory Report, 2019

Figure 22. Stationary energy emissions by subsector and fuel



Source: City of Dakar GHG Emissions Inventory Report, 2019

A significant portion of emissions come from the electricity grid, which contributes more than 2/3 of emissions in each subsector. Indeed, the City of Dakar is highly dependent on fossil fuels. The different sources of emissions come from the use of fairly diversified fuels such as electricity, fuel oil, coal and diesel.

Outside the manufacturing and construction industries, strong demand for energy in the commercial and residential subsectors is increasing the city's emissions. Buildings account for 183,541 tCO₂eq, mainly from electricity consumption, LPG and a small share of charcoal (Figure 22).

5.1.2 Transportation Sector

Emissions from the transport sector account for 40% of total emissions. They are mainly due to road transport, which contributes to 1.1 million tCO₂eq, or 99.8% of the total emissions of this sector.

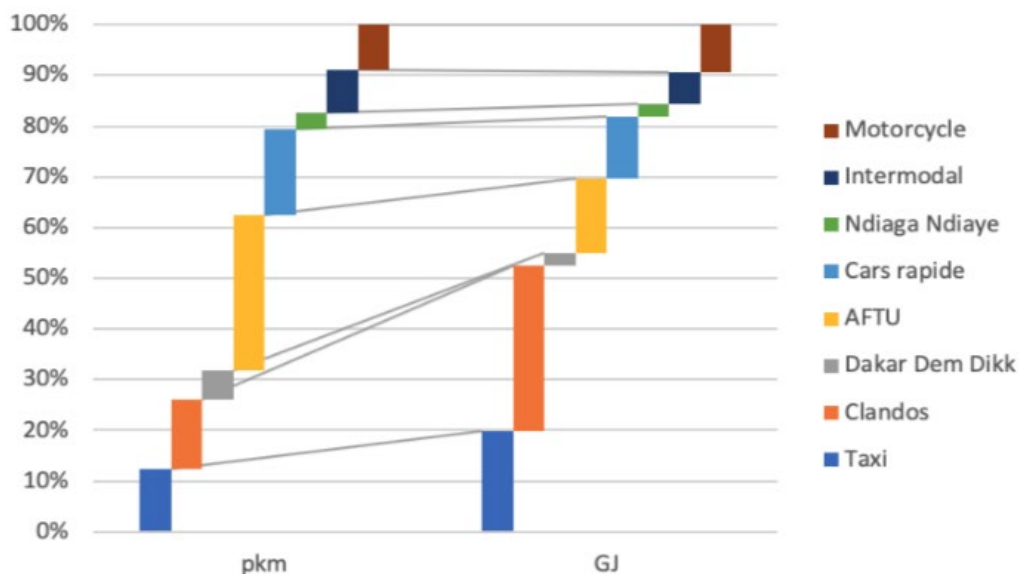
Freight is responsible for 55%, while private and public transport account respectively for 31% and 14% of the emissions from the road sub-sector. Approximately 472 000 tCO₂eq of emissions come from passenger transport.

Figure 23 highlights the relationship between the number of passengers transported and fuel consumption, and even CO₂ emissions and is a powerful tool to support decision taking with the objective of shifting the mode of transport to disadvantage private vehicles.

This level of emissions is mainly related, among other things, to the dilapidated Dakar car fleet (80% of cars are more than 5 years old) and to the high fuel consumption. Fuel consumption is responsible for 88% of emissions. These combined factors are an important source of GHG emissions.

Rail transport accounts for a small proportion (0.2%) of total emissions from the transport sector. These emissions are estimated at 1,100 tCO₂eq of which 22% are produced within the limits (scope 2) and 78% outside the city (scope 3).

Figure 23: Passenger-km and energy consumption by type of vehicle in the city of Dakar



Source: City of Dakar GHG emissions inventory report, 2019

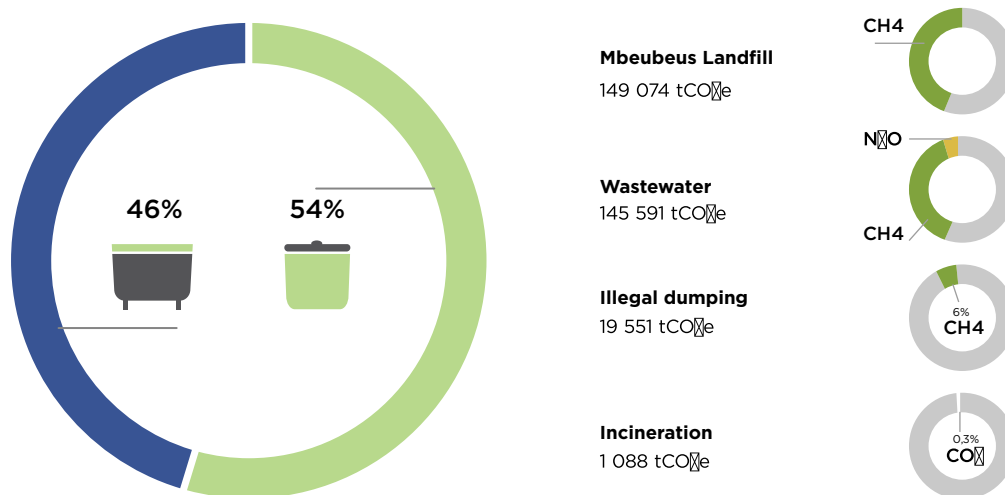
5.1.3 Waste Sector

Emissions from waste are due to the decomposition of organic matter under anaerobic conditions. This biodegradation process results in the production and release of methane (CH⁴) into the atmosphere. CH⁴ has a global warming potential (GWP) 25 times higher than CO². Waste is also the source of CO² and N²O emissions depending on the management method.

Emissions from the waste sector amount to 315,000 tCO₂eq, or 12% of the total emissions of the City of Dakar (Figure 20). Solid waste and wastewater account respectively for 54% and 46% of these emissions, (Figure 24). Average daily solid waste production is estimated at 232 kg/inhabitant/year.

A significant amount of solid waste produced in the City of Dakar is dumped at the uncontrolled Mbeubeus landfill, the main solid waste receptacle. Because this landfill is located outside the city limits, 88% of emissions come from scope 3, while emissions from wastewater treatment fall under scope 1.

Figure 24. Waste emissions by subsector and GHG type



Source: City of Dakar GHG Emissions Inventory Report, 2019

5.2 Comparative analysis of GHG emissions

The City of Dakar’s contribution to projected national emissions is very high for a territory that represents 0.039% of the country’s area. Dakar is responsible for 27% of national emissions in 2016. This is due to the strong presence of institutional and commercial industries and establishments, but also to the concentration of the population and an aging fleet. Long-term projections, taking into account the business as usual (BAU), show that GHG emissions are likely to rise rapidly to the point of degrading the living environment with implications for air quality and health. It is therefore essential, as part of the Commitment of the State of Senegal, through the NDC, to pay particular attention to efforts of reducing GHG emissions in the City of Dakar in order to achieve its climate change mitigation targets.

5.3 GHG emissions from municipal heritage

This section gives a general overview of the results of the carbon footprint carried out on the heritage of the City of Dakar following the diagnosis on electricity consumption. Emissions estimates mainly concerned built heritage and public lighting. Indeed, a fairly representative sample of six municipal buildings was audited. The results obtained were aggregated with secondary data and extrapolated to the entire built heritage managed by the city and public lighting.

Consumption analysis shows that the six municipal buildings audited are responsible for 541.58 tCO₂eq while public lighting emits about 3,801.35 tCO₂eq. The entire heritage, apart from waste and the car fleet, represents 4,586.95 tCO₂eq. Public lighting alone covers 82.87% of the estimated total emissions with very high mitigation potential from solar and LED lamps.

By implementing the recommended energy efficiency actions, the city will avoid issuing 441.39 tCO₂eq, 81% less than the BAU emissions in audited buildings. This potential is 2182.89 tCO₂eq in public lighting, representing a 57% reduction in GHG emissions. A potential 62% reduction in emissions is estimated overall if a coherent

and effective implementation is made on the entire heritage of the city, which will avoid emitting on average 2,823 tCO₂eq/year. The details of the broadcasts of the various heritage buildings are presented in Table 10.

Table 10. Breakdown of CO₂ emissions from municipal heritage

Municipal Heritage Buildings	Emissions (tCO ₂ eq)	Municipal Heritage Buildings	Emissions (tCO ₂ eq)
Public lighting	3801.35	HLM socio-cultural centre	8.94
Olympic swimming pool	232.71	House of Arts	6.73
Communal building	125.26	Gibraltar Social Centre 2	4.37
Technical Services Directorates	101.85	Ngor Sociocultural Centre	3.97
Derklé Sociocultural Centre	56.55	Fass Sociocultural Centre	3.85
Sacred Heart Sociocultural Centre	43.93	Hann Mountain Sociocultural Centre	3.60
Ouakam Geriatrics Centre	42.35	Grand Yoff Sociocultural Centre	3.10
City Hall	35.06	Social centre behind Al Akbar Cinema	2.91
Civil State Centre	28.27	Goose Paw Sociocultural Centre	2.88
Re-asegment Félix Eboué	20.25	HLM Sociocultural Centre 2	2.18
Freedom 4 IPG Sociocultural Centre	17.99	Grand Dakar Sociocultural Centre	1.84
Ouakam Boul Sociocultural Centre	14.27	Freedom 6 Sociocultural Centre	1.17
Centre for Vocational Training and Development of Municipal Staff	11.15	Yoff Sociocultural Centre	1.08
Point E Sociocultural Centre	9.37		

Source : Report of the energy audit for municipal buildings in the city of Dakar, 2020

An aerial photograph of a city with various buildings and a road. A large blue semi-transparent rectangle is overlaid on the left side of the image, containing text. The text is in yellow and white. The background shows a mix of modern and older buildings, with a road and some greenery in the foreground.

6 Energy audit of municipal buildings

6.1 Breakdown of energy consumption

The energy audit of administrative buildings and municipal services revealed that electricity consumption is dominated by air conditioning (378,113 kWh/year), office equipment (105,232 kWh/year) and lighting (54,784 kWh/year) (Figure 24).

These stations account for 63.30% of electricity consumption, followed by pumping (269,800 kWh/year) and hot sanitary water (ECS) which account for 31.97%. Ventilation, refrigeration and other appliances account for 4.73% of the energy bill of audited establishments.

The assessment of electricity consumption shows considerable differences between facilities and types of use. The six audited buildings have an estimated total power of 403 kW and an average annual consumption of 850.295 kWh. As a result, better management of this consumption will reduce the annual cost of paying the electricity bill and will have a positive impact on the city’s environmental performance.

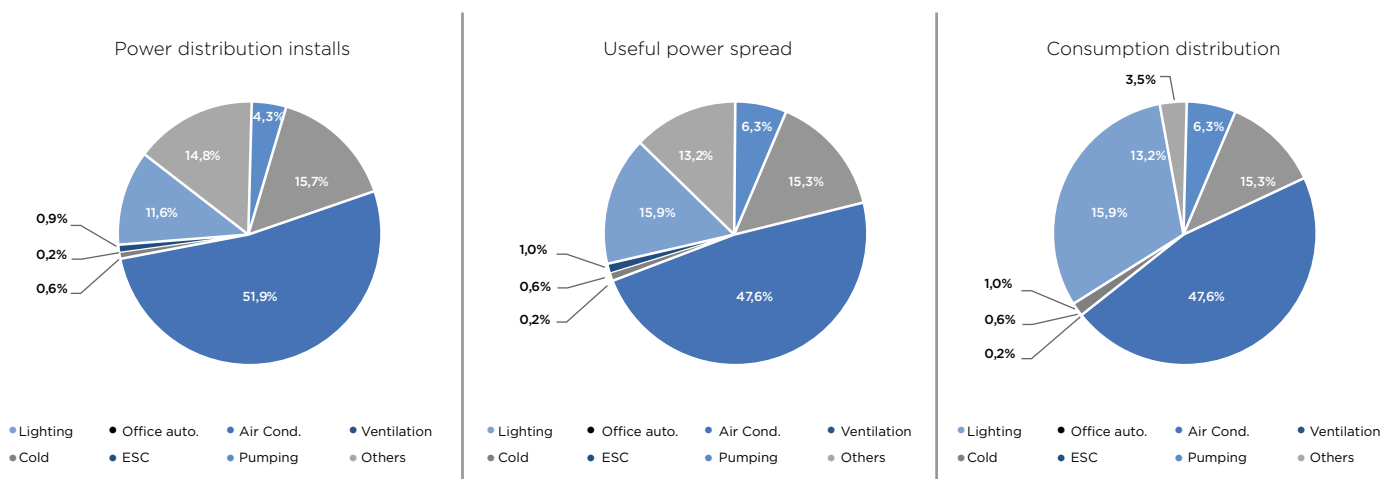
Considering the weight of electricity costs on the annual budget and the potential savings that may result from it, the City of Dakar has fully realized the importance of reducing its energy dependence. This has resulted in the establishment of an energy and ecological transition programme that considers energy efficiency as a priority. This program is consistent with the National Energy Efficiency Action Plan (PANEE), which includes a legislative and regulatory framework (energy efficiency standards and requirements, quality control, energy audit, etc.), encourages the mass distribution of low-energy lamps (LBCs), audits in the residential, commercial, industrial and transport sectors, and standardization and labelling of home and

office electrical equipment.

The areas of improvement recommended in response to the anomalies found during the energy audit are grouped around the following scenarios:

- Improved electrical pricing with the optimization of subscribed power and the improvement of the power factor (Cos Phi).
- Improved lighting management with the use of LED lamps. This suggests replacing fluorescent and/or sodium lamps with LED lamps and installing presence or movement detection systems.
- Improved air conditioning with more efficient and energy-efficient systems. This option is of paramount importance as air conditioning is the second most important energy consumption station and would reduce energy consumption by 4% on each 1°C reduction in temperature control.
- Electronic desktop equipment: Replacing fixed computers with laptops is a possible solution in the energy-saving process.
- Improved performance of hydraulic pumps: pumps are the most important energy consumption station among the audited sites.
- Integration of renewable energies: this

Figure 25 : Distribution of energy consumption and power by type of use



Source: City of Dakar Municipal Buildings Energy Audit Report, 2020

axis involves the installation of mini solar power plants in roofs or parking lots and the installation of solar water heaters.

All the areas of improvement can achieve a saving of 51% on the electricity subscribed and 81% on energy consumption.

6.2 Balancing priorities with decision-making

The city of Dakar's electricity consumption, particularly in audited municipal buildings, is well above the optimum level according to energy efficiency best practices. This has resulted in a very high electricity bills. Implementing energy efficiency actions and integrating renewable energy can help

stabilize electricity costs.

Decisions on the type of measures or initiatives to be taken are based on an approach that takes into account a range of key factors such as energy security, sustainability, energy bill optimization and the potential for GHG emission reductions. The areas of improvement described in Table 11 show how the city has allocated its priorities in municipal buildings taking into account investment costs in compliance with environmental standards.

Table 11. Summary of energy efficiency measures and potential savings in municipal buildings

Priorities	Areas for improvement	Estimated investment (Euro)	Potential Savings (kW)	Consumption (kWh/year)	Avoided emissions (tCO ₂ eq/year)	TRI (year)
Priority 1	Cos Phi Upgrade	4 891.16	0	0	—	0,9
	Power optimization	0	79	0	—	Immediate
	Lighting management system, corridors	1 248.18	0	1 868	1.19	3.3
	Lighting management system, office	9 376.56	0	6 841	4.35	6.9
	Change in set temperature to 24°C	0	0	30 249	19.27	Immediate
Priority 2	Replacement of office lights - LEDs	5 890.44	13	14 431	9.19	2
	Replacement of lane lights - LEDs	1 106.30	3.06	3 006	2.00	1.8
	Replacement of outdoor fixtures - LEDs	927.11	3.02	4 688	3.00	1
	Replacing fixed PCs with laptops	66 674.32	50.04	71 143	45.31	4.5
Priority 3	Installing solar collectors - ECS	3 200.35	0	1 983	1.26	10
	Replacing existing air conditioners with less energy-intensive split inverter systems	182 648.67	56	77 714	49.50	12.2
	Installing a solar system	309 746.30	0	363 454	231.50	6
	Setting up an energy management system	9 133.02	0	42 515	27.08	1.1
	Installing a variable refrigerant volume (VRV) system for pumps	42 339.50	32	73 116	46.60	3.6
Total priorities		640 382.27	237	692 989	440 126	5

Source: Energy audit report of municipal buildings in the City of Dakar, 2020

The priorities for energy efficiency measures are summarised in Table 11. In order to prioritise the measures or initiatives of reducing energy consumption (reduction of the city’s electricity bill) and CO2 emissions, indices have been defined according to three parameters. Due to the fact that these parameters do not have the same units, the weight of each action was calculated on the basis of investment, monetary gain and the potential GHG emission reduction.

Most often the focus is on energy costs. In

a logic of sustainable climate governance, this cannot be the only criterion for decision-making for solutions to ensure and accelerate the transition to clean and sustainable energy. It is essential for the City of Dakar to assess the entire energy system and consider the environmental, economic, social and technical impacts of innovative energy solutions. Figure 26 provides an overview of the value of the energy system and its co-benefits in line with the sustainable development objectives.

Figure 26: Overview of energy system value and benefits





7. Projections of GHG emission reductions

7.1 Dakar GHG emission reduction targets by 2030-2050

In recent years, the City of Dakar has embarked on a major project to improve its governance in terms of sustainable development and climate action planning. Thus, to show its leadership and contribution in line with the commitment of the State of Senegal under the NDC, Dakar has set up a Programme to improve urban governance for an energy and ecological transition in order to strengthen its resilience to climate change, the real driving force behind this climate plan.

Dakar also recognizes its responsibility as a global metropolitan leader and is committed to the C40 Deadline 2020 program to set ambitious targets for reducing GHG emissions in the medium and long term.

This section presents a projection of the city’s GHG emissions between 2016, the year of the baseline inventory, and 2050, the target year for meeting the Paris Agreement’s targets to limit global warming to 1.5°C. This projection shows potential short, medium and long-term emissions if no mitigation measures are implemented.

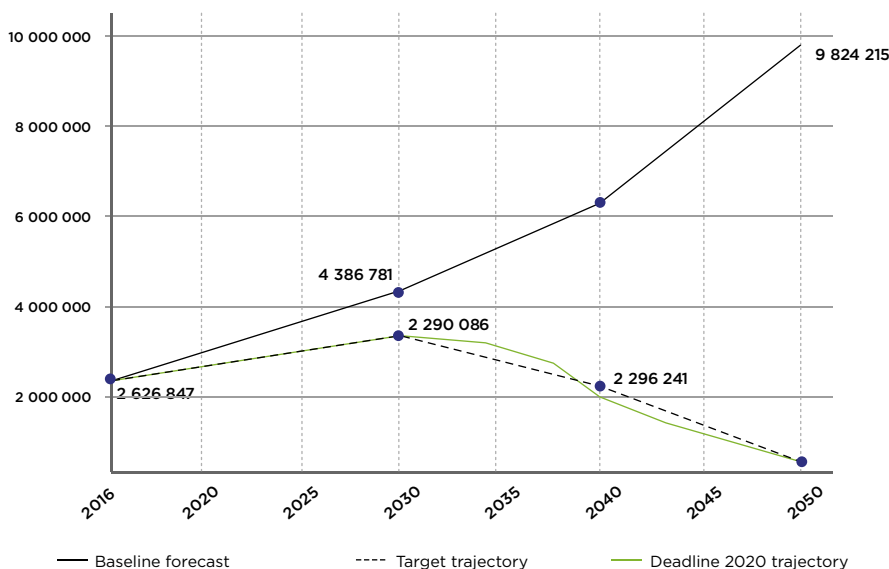
7.2 Benchmark emissions trajectory

A baseline emission trajectory, or BAU, was developed based on the city’s economic and demographic growth forecasts. It

essentially assumes that no climate action is taken by the city and describes a situation in which the population and economy of Dakar would continue to grow. The growth rates used for population projection are 2.51% per year until 2025 and 3.14% per year between 2025 and 2050, while GDP growth of 4% is expected until 2050. Figure 27 shows the projected baseline emissions for the City of Dakar until 2050, when the city has set an ambitious target to reduce GHG emissions in line with international commitments.

It is therefore expected that in the absence of GHG mitigation measures, the city’s emissions will increase from 2.6 million tCO₂eq in 2016 to 4.4 million tCO₂eq in 2030 and 9.8 million tCO₂eq in 2050. This represents a 60% increase in GHG emissions in 2030 and 45% in 2050 with an annual average of 4% and 2% respectively.

Figure 27. GHG emission reduction targets



Source: City of Dakar GHG Reduction Scenario Planning Report, 2020

7.3 Scenarios for reducing GHG emissions

The development of emission reduction scenarios aims to demonstrate how the city can achieve its carbon reduction target in 2030 and 2050 by making a significant contribution to the national effort to mitigate climate change. This was to demonstrate the city's GHG emission reduction potential with a scenario of current or planned actions and an ambitious action scenario towards a low-carbon trajectory.

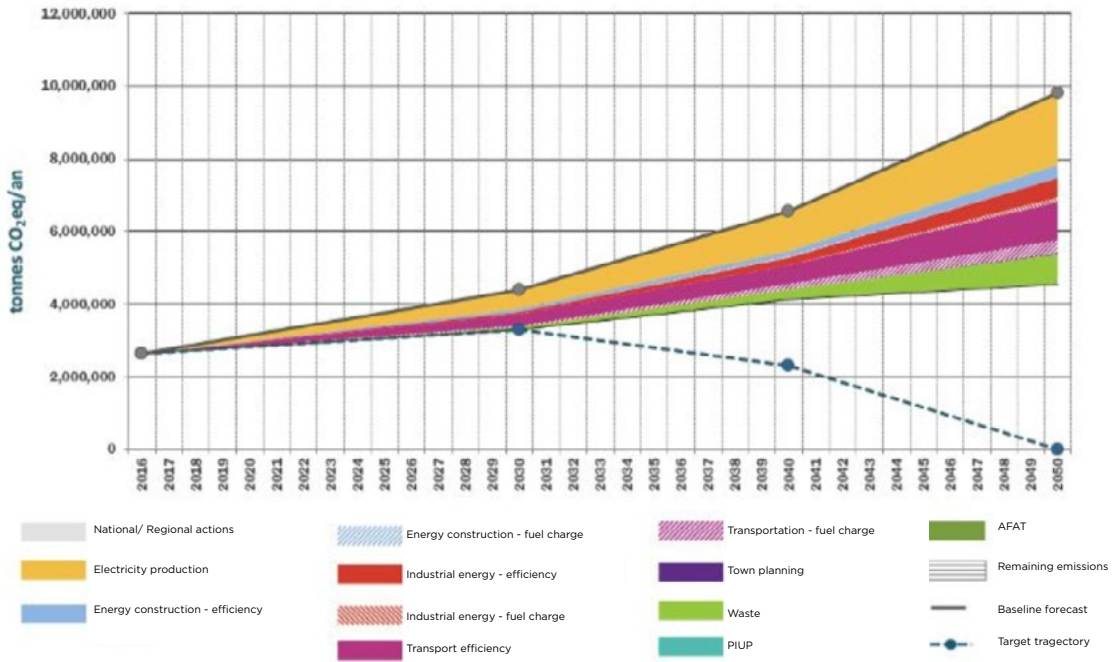
7.3.1 Scenario of current or planned actions

The basic information for this scenario is contained in the city's plans, programmes and policies, as well as the institutions responsible for strategic sectors including energy, transport and waste. Through this scenario, the city will reduce its emissions by 12% in 2030, 23% in 2040 and 26% in 2050 below the BAU projections. However, despite this significant contribution, emissions will continue to grow from the baseline year (2016) to the point of generating a lot of residual carbon emissions in all sectors so more ambition is needed.

7.3.2 Scenario of ambitious actions

This scenario is the most important and is used in the development of the Climate Plan. It includes ambitious strategies and actions that can be achieved across the city. Mitigation targets were set with national and municipal energy and waste policies, strategies, plans and programs. They are the result of extensive research, combined with a series of working sessions with stakeholders and industry experts. The information collected was analysed using the scenario planning tool "Pathways 1.5°C" developed by the C40. According to the assumptions defined, the implementation of ambitious actions will reduce future GHG emissions by 25% in 2030, 36% in 2040 and 54% in 2050 below the BAU projections. This represents an average reduction of approximately 3.3, 4.2 and 4.5 million tCO₂eq respectively for the same timeframe. This scenario achieves GHG reduction targets in 2030, but does not meet the 2040 and 2050 targets. Figure 28 shows the mitigation potential of ambitious actions.

Figure 28. Ambitious GHG emission reduction scenario

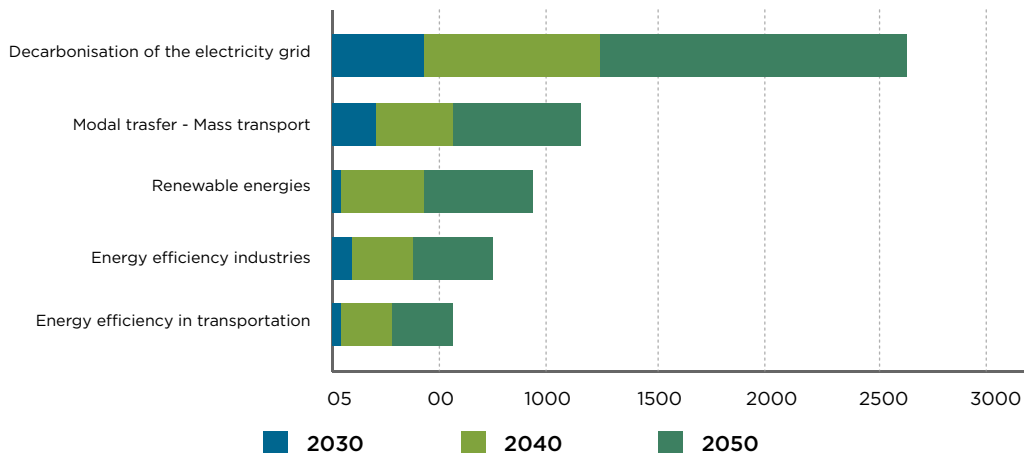


Source: City of Dakar GHG Reduction Scenario Planning Report, 2020

Under the ambitious scenario, the greatest potential for emission reduction is demonstrated, in descending order, by the decarbonisation actions of the electricity grid. This is followed by the modal transfer to mass transport and the deployment of renewable energies. Energy efficiency in transportation industries and systems could also have a significant impact in

reducing GHG emissions. This potential varies from target year to another one. Overall, it is estimated that the five areas of action in Figure 29 can achieve emission reductions of approximately 0.8 million tCO₂eq by 2030, 1.7 million tCO₂eq by 2040 and 3.5 million tCO₂eq by 2050.

Figure 29. Top 5 ambitious actions to reduce GHG emissions by 2050



Source: City of Dakar GHG Reduction Scenario Planning Report, 2020

Management of residual GHG emissions



The ambitious scenario achieves a 54% reduction in GHG emissions from 2016 to 2050. The residual emissions come mainly from road transport (2,427,821 tCO₂eq), (323,708 tCO₂eq) and wastewater treatment (242,574 tCO₂eq) and water treatment (242,574 tCO₂eq). The city of Dakar has relatively limited power in these different sectors but will need to show a lot of leadership to work closely

with national sectoral institutions to ensure a sustainable energy transition.

To reduce its environmental footprint and move towards carbon neutrality, the city must undertake much more ambitious actions on effective and sustainable strategies.

8 Strategic directions

8.1 Dakar's vision for 2050

Climate change is an emergency that requires relevant and coordinated action. The key lever to address this emergency is the Paris Agreement, whose implementation is essential to achieve the SDGs.

This demonstrates the importance of the integrated approach to providing a roadmap for action to reduce GHG emissions and strengthening the climate resilience of territories and communities. Among other things, SDG 13 calls for “urgent action to combat climate change and its impacts,” while SDG 12 calls for “sustainable consumption and production patterns” and SDG 11 aims to “ensure that cities and human settlements are inclusive, safe, resilient and sustainable.” SDG 7 aims to “ensure everyone’s access to reliable, sustainable and modern energy services at an affordable cost.”



The City of Dakar's PCET incorporates three issues: adaptation, mitigation and energy transition. The 2030 horizon is based on an operational action plan to be carried out in the coming years, while the 2050 horizon sets a course on which the city must guide and size its future energy and ecological policies. Overall, the goals that the city could achieve are:

- a 54% reduction in GHG emissions by 2050;
- a 75% reduction in the energy bill in the built heritage of the City of Dakar by 2050;
- an increase in the share of renewable energy in the energy mix of at least 65% by 2050.

8.2 Strategic areas for adaptation and mitigation

The adaptation and mitigation strategy are based on seven strategic axes that focus on the analysis of the vulnerability of the territory, reference emissions at the sectoral level and the BAU by 2030 and 2050. The strategic areas of adaptation and mitigation identified under the City of Dakar's PCET are:

The city's vision for 2050 is:

...Dakar, a smart, low-carbon city for inclusive and resilient development.

- Strategic Axis 1: Making natural risk and disaster management operational and effective.
- Strategic Axis 2: Promote urban planning and development oriented towards the challenges of climate change and sustainable development.
- Strategic Axis 3: Improving the living environment and public hygiene to strengthen people's resilience.
- Strategic Axis 4: Promoting low-carbon and affordable energy and buildings for all
- Strategic Axis 5: Promoting low-carbon transport and gentle travel through urban planning
- Strategic Axis 6: Encourage the recovery of waste streams with a circular economy for a clean and sustainable city.
- Strategic Axis 7: Upgrade the City of Dakar for access to climate finance.

9. Action Plan

9.1 Approach to prioritizing adaptation and mitigation actions

The prioritization of actions to reduce climate risks (adaptation) and GHG emissions (mitigation) is based on a transparent and inclusive approach aimed at promoting the choice of actions with greater impacts.

For example, a multi-criterion analysis (MCA) was conducted taking into account a number of relevant criteria relating to climate change, feasibility and potential co-benefits derived from the inclusive analysis of actions. The main criteria are:

Climate change analysis

The following criteria assess actions based on their potential for adaptation and mitigation of climate change:

- Risk reduction: benefits in improving adaptive capacity and resilience to the impacts of climate change.
- Reducing GHG emissions: benefits in reducing significant amounts of GHGs based on inventory results and the 2030 and 2050 emission reduction scenario in line with national commitments under the NDC and the Paris Agreement.

Feasibility of implementation

The following criteria assess the opportunities, obstacles and feasibility of specific actions:

- The city's power and capacity to implement: the capacity of the Dakar territorial community to implement action and/or influence decision-making.
- Consistency with existing policies, plans and programs, including the national level: the extent to which action aligns with national and municipal policies and plans.
- Costs: CAPEX (capital expenditure) and OPEX (operational expenses) including capital and operating costs.
- Political acceptability: the potential for political support or opposition.
- Social and cultural acceptability: the potential for social support.

Inclusive analysis of actions

The following criteria categorize the ability of each action to generate sustainable development benefits:

- Essential utilities: housing, transportation, energy, solid waste, water, sanitation, technology, communications.

9.2 Synergy and co-benefits of priority actions

Mitigation measures address the cause of climate change by reducing GHG emissions or sequestering carbon from the atmosphere. For the City of Dakar, these actions are specific to the sectors of stationary energy, transport, waste and urban planning. Some have a direct impact on reducing emissions, while others inspire the transition to a low-carbon economy through environmental education or behaviour change.

Adaptation measures aim to address the effects of climate risks by improving climate resilience and promoting global adaptive capacity. The priority adaptation actions identified are generally related to the diagnosis of vulnerability and are aimed at mitigating potential losses due to climate risks. These relate to the adaptation of social, environmental and economic systems within the city and their interrelationships with external systems. Thus, Dakar integrates the risk

reduction potentials for each action in order to strengthen its adaptive capacity which can be referenced qualitatively or quantitatively according to the extent and damage caused by the impact of the hazards.

However, priority actions, whether for mitigation or adaptation, generally offer additional benefits in addition to those derived from reducing GHG emissions and climate risks. Therefore, it is important to identify synergies or interdependencies as well as the co-profits generated by the different actions.

The implementation of these actions contributes to the improvement of air quality, the living environment, health and well-being of populations. It will reduce poverty by promoting the creation of green jobs and new economic opportunities focused on sustainable development. Thus, the City of Dakar's PCET integrates the issues defined for the achievement of the SDGs. Appendix 1 provides details of the equity synergies analysis using the AMIA tool⁷.

(7) Mitigation Interaction Assessment (AMIA) tool: This tool helps cities assess and understand the interactions and interdependencies associated with climate change adaptation and mitigation

9.3 Operational Adaptation and Mitigation Action Plan

9.3.1 Risk and disaster management

—Making risk and disaster management operational and effective
SDG 13 of the new global agenda urges states and local governments to take “climate change action.” The negative impacts of these on economic activities, people and goods, on the sociology of communities and on ecosystems, are no longer to be demonstrated.

Dakar to take a part in the financing of protection infrastructure, to play a leading role in the early warning system, but also to communicate with people so that they are at the heart of risk and disaster management.

9.3.1 Urban planning and development

— Promote urban planning and development oriented towards the challenges of climate change and sustainable development.
From the new National Planning Plan to the Dakar and surrounding City Planning Master Plan, the triptych of climate change/urban planning/sustainable

#	Actions
1	Strengthening the system for forecasting, monitoring, early warning and climate risk control
2	Coastal protection infrastructure development
3	Strengthening communication, awareness and citizen participation in risk and disaster management

The City of Dakar has always been at the forefront of the occurrence of a climatic hazard on its territory. However, this presence in emergency management needs to be enhanced by a stronger partnership with national risk and disaster management bodies and institutions. This partnership will enable the City of

urban development appears to be a necessary integration. It is now accepted that “urbanization is an inevitable phenomenon, a positive force that must be mobilized in the service of social equality, cultural vitality, economic prosperity and environmental security. The fight for a sustainable future will be won, or not, in cities.”

(8) Excerpt from the Manifesto for the City - June 2012 - Global Urban Campaign.

#	Actions
4	Integrating the climate dimension into urban planning and urban planning operations
5	Development of integrated catch-up infrastructure
6	Promoting nature-based solutions by enhancing water resources

9.3.3 Living environment and public hygiene

– Improving the living environment and public hygiene to strengthen people’s resilience.

The urban phenomenon in Dakar is characterized by two major elements: the mineralization of spaces and the huge increase in the population. This is taking place in a context of environmental degradation, the disappearance of vegetation cover and production of solid and liquid waste. The City of Dakar must take advantage of the activities implemented by the Solid

Waste Management Coordination Unit (UGC), ONAS and the National Agency for the Great Green Wall (ANGMV) to consolidate its interventions for the protection or preservation of green spaces but also to make the concept of “Dakar, clean city” effective.

Adaptation measures aim to strengthen the resilience of natural and human systems to climate risks and impacts. The objectives set are as follows:

- Strengthen networks for observing, measuring and collecting climate, coastal and urban pollution data.
- Reduce the number of people vulnerable to the effects of climate change through awareness-raising and communication.

#	Actions
7	Development of wetlands and green spaces in the City of Dakar
8	Development of green infrastructure and income-generating activities for populations most vulnerable to the effects of climate change
9	Improving access to water and sanitation

Excerpt from the Manifesto for the City - June 2012 - Global Urban Campaign.

- Reduce the vulnerability of populations to heatwaves.
- Increase initiatives to protect populations against risks and disasters linked to extreme events and climate change.
- Reduce air pollutants by 2030 to improve air quality and lower the rate of respiratory disease.
- Increase urban green spaces by 150 ha in Dakar by 2030
- Increase areas of ecological urban agriculture and access to better quality agricultural products by 2030 to strengthen citizens' food security
- Increase the proportion of infrastructure adapted and resilient to climate risks.

9.3.4 Energy and energy efficiency

- Promoting low-carbon and affordable energy and buildings for all

The City of Dakar's energy policy strategy is based on the promotion of renewable energy and energy efficiency in buildings. However, these two areas of intervention do not fully reflect the city's power in implementing large-scale actions across the territory. However, the city alone is home to 83% of Senegal's industries, giving it a strategic position to influence the flow and use of energy in this sector.

The following sections describe the actions already underway and the additional actions proposed under the Climate Plan to ensure a continued reduction in GHG emissions from the energy sector.

Existing policies and plans

- Decarbonisation of the electricity grid

and sustainable energy production

The decarbonisation strategy for the grid is in line with the economic community of West African States (ECOWAS) guidelines on energy efficiency and renewable energy development.

In Senegal, the promotion of renewable energy, energy efficiency and access to energy are governed by the Energy Sector Development Policy Letter (LPDSE) signed in October 2012, which sets the share of renewable energy in the national energy balance at 15% by 2020. This is reinforced by the Emerging Senegal Plan (PES), which foresees an increase in the share of renewable energy in the electricity mix of 23% by 2030.

These objectives are supported at the city level by territorial strategies such as the Environmental Action Plan (PACTE) and the Urban Master Plan for Dakar and its surroundings (2035).

- Buildings

The energy efficiency targets set out in the LPDSE aim to achieve 40% energy savings by 2020. The main plans and strategies that have incorporated the areas to be developed for the energy efficiency subsector in buildings are: the PES, the Energy Control Strategy of the Energy Management and Economy Agency (AEME) and the National Action Plan on Energy Efficiency (PANEE).

At the city level, PACTE and the Resilience Strategy support the National Energy Saving Policy. This is reinforced under the PCET by reducing consumption in municipal buildings and public lighting.

Long-term mitigation opportunities

The main areas of intervention for the energy sector are: decarbonisation of the electricity grid, autonomous renewable

#	Actions
10	Adoption of energy efficiency standards (building code) to improve the energy performance of new buildings
11	Realising energy savings in the buildings in the City of Dakar
12	Widespread use of solar LED lamps in public lighting
13	Strengthening electricity generation capacity with by renewable energy to boost energy transition

energy systems, energy efficiency in new building construction and energy efficiency in lighting. Implementing the actions of the energy sector generates significant social, environmental and economic co-benefits, including the creation of green jobs, improved air quality and empowerment in energy production and consumption. The GHG reduction targets for the energy sector's main sources of emissions are presented below:

- Decarbonisation of the electricity grid
 - Increase the share of renewable energy in the energy mix to at least 65% by 2050
- Autonomous renewable energy systems
 - Increase to 40% the share of residential buildings equipped with autonomous renewable energy systems and connected to the electricity grid
 - Increase to 50% the share of commercial and institutional buildings equipped with autonomous renewable energy systems and connected to the electricity grid
- Energy efficiency in new building construction
 - Almost all cooking in new

households will be done through clean energy sources

- 30% of the energy needs for air conditioning in commercial buildings will be based on high performance equipment
- 85% of the buildings will be equipped with LED bulbs.
- Efficiency in public lighting
 - Increase the share of LEDs to 75% of total street lighting lamps by 2050.

Priority is given to the following actions for the implementation of the action plan in the stationary energy sector.

9.3.5 Transport

— Promoting low-carbon transport and gentle travel through urban planning

The transport sector plays an important role in the development of the City of Dakar and is an issue for reducing GHG emissions and improving air quality. Its direct contribution to the city's economic and social performance places it at the heart of sustainable development strategies such as the SDGs. However, this sector is not a

transferred jurisdiction, it is managed by the Dakar Urban Transport Executive Council (CETUD). Nevertheless, it presents many opportunities for collaboration between the city and the central government.

Transit-oriented development (TOD) is a structuring element of spatial and urban organization. It aims to foster an articulation of urbanization and mass transport and responds to many social, economic and environmental issues too often dependent on the automobile. The TOD in Dakar is facing urban sprawl due to rapid population growth and land use problems. The planning and TOD issues are thus detailed in the following section.

The following sections describe the current and additional actions proposed under this plan to ensure a continued reduction in transportation-related GHG emissions.

Existing policies and plans

The main planning document for this sector is the Fourth Transport Sector Policy Letter (LPST) for the period 2016-2020, which set out strategic directions, the most essential of which are internal openness and regional integration. This planning is consistent with the PES' 2014-2023 10-year strategy, which is based on three pillars, including Pillar 1, which states that "an efficient transport sector is needed to support production transformation and economic growth."

These strategic directions have enabled the development of three mitigation scenarios for the transport sector recorded in Senegal's NDC. These include the establishment of (i) the regional express train (TER), (ii) rapid bus transport (BRT),

and (iii) the renewal of the car fleet in road transport.

At the city level, the urban mobility strategy is presented in the Dakar Urban Travel Plan (PDUD, 2008-2025) and is based on the LPST's objectives of improving quality and comfort in transport.

Long-term mitigation opportunities

The Pathways model identified areas of intervention that could have a significant impact on GHG reductions. To support the implementation of the LPST, the City of Dakar is considering the renewal of its fleet taking into account age and energy efficiency criteria.

The implementation of the actions of the transport sector generates important social, environmental and economic co-benefits, including the fluidity of urban traffic, the reduction of pollution and the improvement of air quality.

Beyond mitigation objectives, the integration of TOD principles ensures inclusive spatial growth that promotes accessibility. The implementation of TOD's actions will have social, environmental and economic benefits and will improve urban mobility, air quality and the living environment of Dakarians, while promoting the establishment of a framework for green jobs.

The reduction targets for each of the major sources of transportation emissions and urban resilience due to the strengthening of the TOD are:

- increase the modal shares of the BRT to 20% and the TER to 15% by 2050;

- Make 50% of taxis and private vehicles more fuel efficient;
- Increase the share of electric vehicles in the city’s fleet by 2050;
- Increase the share of new households in transit-oriented development to 25% by 2050;
- Significantly reduce the number of passenger journeys in 2050 due to the effective implementation of the TOD principles.

Priority is given to the following actions for the implementation of the action plan in the transport sector.

community of the agglomerations of Rufisque (CADAK-CAR) which includes the City of Dakar and the other neighbouring cities (Rufisque, Pikine and Guédiawaye) thus forming the large metropolitan area of Dakar. Today, solid waste management is entrusted to the Solid Waste Management Coordination Unit (UCG), a central government institution attached to the Ministry of Planning, Housing and Public Hygiene (MULHP). Sanitation in the Dakar region is managed by two structures: the Senegalese National Sanitation Office (ONAS) and the Sanitation Directorate

#	Actions
14	Development of rapid bus transport (BRT)
15	Establishment of a fleet that meets fuel efficiency standards by fuel type
16	Development around transit stations and promotion of transit-oriented development
17	Construction of pedestrian and cycling lanes and paths in municipalities

9.3.6 Solid waste and wastewater

– Encouraging the recovery of waste streams with a circular economy for a clean and sustainable city

The waste sector is cross-cutting and is in line with the three pillars of the PSE. In Dakar, the management of household waste was the responsibility of the inter-community agreement Community of the agglomerations of Dakar and the

(DA), which coordinates the sector’s strategy and new policies¹⁰.

The following sections describe the actions in progress and those proposed under this plan to ensure a continued reduction in GHG emissions from the waste sector.

Existing policies and plans
As part of the remediation, the priority areas identified in the PDU to expand the coverage of the sewerage system include (i) the affordable and strategic extension of the sewerage network coverage area, (ii) the proper management of waste sludge

produced by self-contained sanitation in unserved areas, and (iii) the use of wastewater to produce biomass energy and water.

With regard to solid waste, the Ministry of Local Governance has set up the Emergency Cleanliness Programme (PUP) and the improvement of the living environment to enable Dakar to dispose of its rubbish. Priority areas of intervention under the PDU are: (i) promoting the reduction and sorting of waste at source, (ii) increasing the rate of waste collection and transport, and (iii) establishing an appropriate intermediate waste treatment system and the safe closure of the Mbeubeuss landfill, among others.

Long-term mitigation opportunities

The waste sector presents a wide range of opportunities for the creation of a circular economy in the City of Dakar. The

implementation of mitigation actions in this sector will have social, environmental and economic benefits. These include creating green jobs for young people and women through the establishment of a “waste” value chain, improving the living environment and air quality.

The targets for each of the waste sector’s main sources of emissions are:

- Composting
- 50% of organic waste and 30% of garden waste will be composted by 2050.
- Wastewater treatment
- 32% of wastewater treatment by 2050 will be done through the treatment of activated sludge.

Priority is given to:

#	Actions
18	Development of organic waste recovery channels
19	Proper management of the sludge produced by self-contained sanitation in unserved areas to reduce the pollution load

9.3.7 Funding climate action

– Upgrade the City of Dakar for Access to Climate Finance

In order to build a resilient and low-carbon city, Dakar will have to address the issue of overlaying the levels of governance at the territorial level and avoid dispersal in the implementation of programmes and projects to combat climate change.

Funding for these projects can come from an endogenous source (State, local authorities), development aid institutions (the German Agency for International Cooperation (GIZ), the French Development Agency (AFD), the Japan International

Cooperation Agency (JICA), Nordic Fund, World Bank, etc.) but also from the Green Climate Fund. In any case, access to its funding or its uses requires extremely rigorous skills. Understanding the bidding procedures, the types of eligible projects, the anchor structures, but also the best way to fill out the various forms, is an essential prerequisite.

Indeed, the issues and challenges related to climate change transcend the administrative boundaries of the municipalities that make up the City of Dakar. Particular attention must be paid to integrated projects with strong impacts in the adaptation and mitigation strategy.

#	Actions
20	Establishing an institutional framework for governance of the energy and ecological transition
21	Strengthening human capital in formulating climate change adaptation and mitigation projects
22	Establishing autonomous financing mechanisms for the risks and vulnerabilities of the City of Dakar

9.4 Five-Year Action Plan (2021-2025)

Table 12. Five-year plan to implement the PCET

Code couleur :	Adaptation		Atténuation		Transversal								
	En cours	Achevé	En cours	Achevé	En cours	Achevé	2021	2022	2023	2024	2025	Beyond 2025	
Action #1: Strengthening the system for forecasting, monitoring, early warning and combating climate risks													
Develop a partnership with dedicated structures for the exchange of strategic information around a knowledge management platform													
Set up a mechanism to collect and update strategic information for coordinated emergency response													
Strengthen the capacity of municipal technical services to manage risks and disasters													
Building the capacity of elected officials to help decision-making in multi-risk management													
Action #2: Development of coastal protection infrastructure													
Introducing coastal protection structures in erosion-prone areas													
Restoring public beaches at high risk of disappearing													
Action #3: Strengthening communication, awareness and citizen participation in risk and disaster management													
Promoting the broadcasting of audio-visual programmes on climate change													
Strengthen the capacity of community relays to raise awareness of risks and disasters													
Supporting the promotion of community dynamics for the development of climate change adaptation initiatives													
Raising people’s awareness of citizenship and eco-responsible behaviours													

Action #4: Integrating the climate dimension into urban planning and urban planning operations					
Introduce a geographic information system on climate data to better take climate change into account in urban planning		■	■	■	■
Encouraging the integration of climate change into communal development plans	■	■			
Encouraging compliance with the planning code in the construction of buildings		■	■		■
Action #5: Development of integrated catch-up infrastructure					
Restructuring informal settlements to connect to storm drains		■	■	■	■
Build suitable water infrastructure in occupied flood zones		■	■	■	
Resize the stormwater collection and drainage system				■	■
Developing multifunctional public spaces in neighbourhoods			■	■	■
Action #6: Promoting nature-based solutions by enhancing water resources					
Set up a rainwater collection and reuse system in municipal buildings		■	■	■	■
Implementing rainwater treatment and reuse solutions in water bodies				■	■
Introduce a valve water treatment and reuse system in municipal buildings			■	■	■
Action #7: Development of wetlands and green spaces in the City of Dakar					
Putting in place plans for the development and management of the various wetlands in Dakar		■	■	■	■
Strengthen tree alignment at major arterial roads in the city	■	■	■		
Promoting neighbourhood-level reforestation activities	■	■	■		
Develop roofing vegetation initiatives		■	■	■	■

Action #8: Developing green infrastructure and income-generating activities for the populations most vulnerable to the effects of climate change						
Strengthening the City of Dakar’s urban agriculture programme	■	■	■	■	■	■
Putting in place community initiatives to promote plastic waste		■	■	■	■	■
Promote the development of green infrastructure through the development of horticultural activities	■	■	■	■		
Action #9: Improving access to water and sanitation						
Organize awareness campaigns on the water economy	■	■	■	■	■	■
Strengthen the system for managing and maintaining wastewater treatment works		■	■	■	■	■
Building the capacity of Grassroots Community Organizations on advocacy for access to water			■			
Implement innovative initiatives to reduce water access problems			■	■	■	■
Action #10: Adoption of energy efficiency standards to improve the energy performance of new buildings						
Incorporate the energy efficiency standard in the appraisal of building authorisation and permit applications	■	■				
Promote the application of the energy efficiency standard in new buildings			■	■	■	■
Raising awareness among property developers about taking energy efficiency into account in buildings				■	■	■
Action #11: Realizing energy saving in the buildings of the City of Dakar						
Implementing a pilot energy efficiency project in administrative buildings and municipal services	■	■				
Renovating municipal buildings for better thermal comfort and energy savings		■	■	■		
Monitor and evaluate the direct and indirect impact of energy-saving measures		■	■	■	■	■

Action #12: Widespread use of solar LED lamps in public lighting					
Reinforce collaboration with the central government to continue the policy of replacing conventional streetlights with LED solar streetlights	Light	Light	Dark	Light	Light
Make an inventory of existing lamps and renovate the city's system with a target of carbon neutrality in public lighting by 2030	Light	Light	Light	Light	Dark
Strengthen the capacity of city officials on the management and maintenance of photovoltaic panels	Light	Light	Dark	Light	Light
Action #13: Strengthening electricity generation capacity by renewable energy to boost energy transition					
Initiate technical and financial feasibility studies of options for decarbonising the grid via renewable energy	Light	Light	Dark	Light	Light
Initiate pilot projects through the deployment of mini-renewable energy plants to ensure clean, reliable and affordable energy for all	Light	Light	Light	Dark	Light
Lobbying the central government to increase the share of renewable energy in Dakar's energy production and supply system	Light	Light	Light	Light	Dark
Action #14: Development of rapid bus transport (BRT)					
Carry out road widening work	Light	Light	Dark	Light	Light
Initiate a pilot project to set up a modern charging station for the transition to electric mode	Light	Light	Light	Dark	Light
Assess the impact of the modal share of the BRT on improving the efficiency of the mass transport sector and reducing GHG emissions	Light	Light	Light	Light	Dark
Action #15: Establishment of a fleet that meets fuel efficiency standards by fuel type					
Initiate a public-private partnership to implement the energy efficiency strategy in transport	Light	Light	Light	Light	Dark
Advocate to reduce the age of imported vehicles to 5 years	Light	Dark	Light	Light	Light
Lobbying the central government for the large-scale adoption of a less polluting Euro 6 fuel	Light	Dark	Light	Light	Light

Implement a pilot project by promoting the installation of an energy-saving device in the vehicle system						
Action #16: Development around transit stations and promoting TOD						
Development of multi-modal exchange hubs to improve the quality of service provided to users						
Partner with the private sector to develop electric charging stations						
Action #17: Construction of bike lanes and pedestrian paths in municipalities						
Introduce car-free days in the City of Dakar						
Develop bike lanes along strategic roads and secondary roads in municipalities with appropriate signage						
Raising awareness among young people about cycling						
Develop neighbourhood-wide mobility initiatives						
Action #18: Development of organic waste recovery channels						
Raising awareness about the waste value chain and the circular economy						
Conduct technical and financial feasibility studies for the implementation of organic waste recovery infrastructure						
Setting up a local waste collection and sorting system						
Partner with the private sector to develop organic waste composting						
Action #19: Proper management of sludge produced by self-contained sanitation in unserved areas to reduce pollution load						
Strengthen consideration of sludge management in real estate and urban planning operations						
Develop a strategic plan for self-contained sanitation to improve the management of sludge drains						

Vulgarize appropriate technologies to enhance the capacity and efficiency of wastewater treatment at the Camberène wastewater treatment plant										
Action #20: Establishing an institutional framework for governance of the energy and ecological transition										
Establishing a climate governance body in the City of Dakar										
Facilitate a consultation process with local authorities										
Putting in place an organizational framework for inter-territoriality for climate governance										
Action #21: Strengthening human capital in formulating projects for access to climate finance										
Strengthen the capacity of territorial actors on mechanisms for access to climate finance										
Raising awareness among elected officials about climate finance opportunities										
Establish a framework for technical support and coordination for access to climate finance										
Action #22: Implementation of autonomous financing mechanisms for risks and vulnerabilities in the City of Dakar										
Creating an urban risk and disaster management fund										
Putting in place a mechanism for the participation of municipalities in the risk and disaster management fund										

A smiling man wearing a green raincoat and a grey and red cap is rowing a boat. The boat has colorful stripes (red, white, yellow, green, blue) along its side. The background shows a blue sea and a clear sky.

10 Implementation of the action plan

10.1 Institutional device

The City of Dakar's PCET has followed a process that will lead to the implementation of a series of measures. In order to meet its commitments, the city must have an operational body to coordinate and monitor the Climate Action Plan to involve the territory's stakeholders.

In order to mobilize the financial resources necessary to implement the Climate Plan, Dakar must sustain its leadership and strengthen its climate governance.

10.1.1 The steering committee

The steering committee, made up of elected officials, representatives of decentralized state services and civil society, will meet once a year.

Its main role, within the framework of the monitoring-evaluation system, is to:

- represent the implementing body PCET work at the municipal council level and municipalities;
- monitor the progress of the update implementation of the action plan and ensure the involvement of all management and services from the city ;
- validate any adjustments proposed by the executing body;
- submit the annual report on the implementation status of the PCET to the municipal council during the budgetary orientation debate.

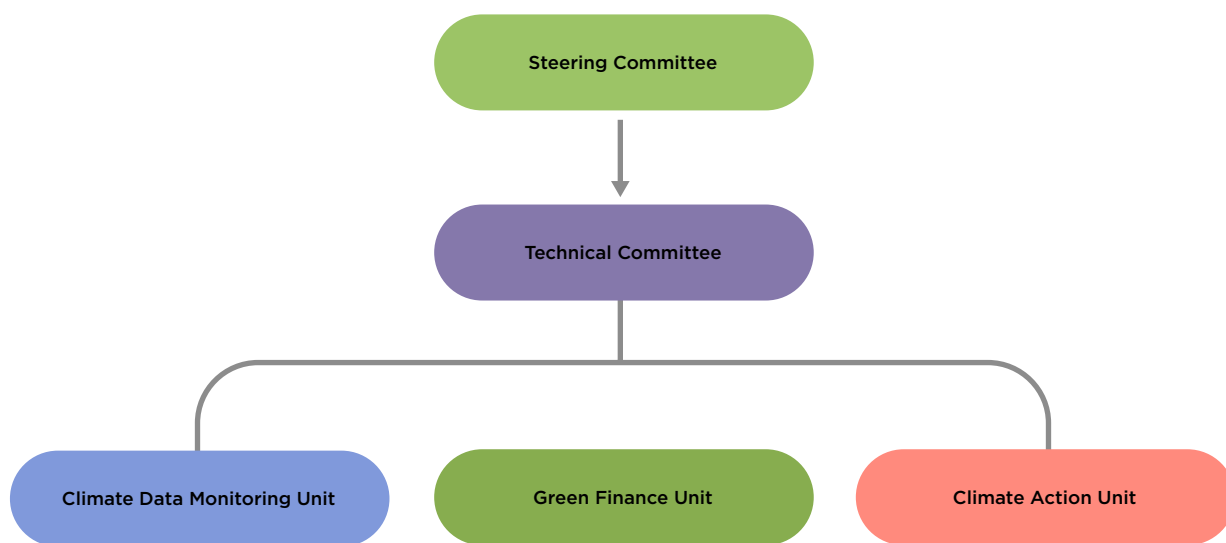
10.1.2 Technical committee

The establishment of the executing body is essential to monitor, evaluate and capitalize the actions carried out by the city as part of its climate change mitigation and adaptation strategy. The climate governance body, in addition to

the steering committee will be backed by a technical committee subdivided into three sub-entities:

- database management unit for climate data. Composed computer scientists, statisticians and monitoring and evaluation specialists, this unit will be responsible for informing, close-up, the indicators climate related. It will also be responsible for the management of the software package.
- unit of practical implementation of climate actions. To contribute to the climate resilience of the territory, this unit, in synergy with all departments and services of the city and decentralized services, will be responsible for implementing the climate initiatives and actions. It will composed of specialists in adaptation, mitigation and energy efficiency.
- green financing unit and call to projects. Execution of the action plan necessarily goes through an exceptional mobilization of resources both internally than external. It is therefore essential to define a strategy for finding green funding, based on existing levers. To achieve this, it is necessary to understand the access mechanisms to funds and fixtures related institutions. This unit will be composed of experts in support institutional research funding.

Figure 30. Institutional implementation



10.2 Implementation strategy

Being of paramount need to put the City of Dakar’s climate vision into practice, the implementation strategy is a crucial link to not only mobilize all direct stakeholders but also take into account the dissemination of results throughout the implementation of the actions. As part of support for the participation of sub-Saharan African cities in the Convention of Mayors, the European Commission has launched Phase 3 and the City of Dakar is receiving funding for the feasibility studies of the projects prioritized in the action plan. In this phase, the implementation of actions in some thirty cities will be carried out through four development agencies of EU member countries: the French Development Agency (AFD) which works in partnership with Expertise France; the Spanish Agency for

International Development Cooperation (AECID) and the German Development Agency (GIZ).

AECID will implement Phase 3 in 6 cities in sub-Saharan Africa, including Dakar, which perfectly meets the desire of municipal authorities and technical and financial partners to move towards the large-scale dissemination of the action plan as part of a strategy to seek green financing for the medium and long term.

The areas of focus in Phase 3 of the CoMSSA are:

- Increase access to sustainable energy and support local climate action.
- Empowering local authorities in the success of NDCs and sustainable development goals (SDGs).
- Improve institutional frameworks and technical and resource mobilization

capabilities of local authorities.

- Promote political ownership and the dissemination of good practices.

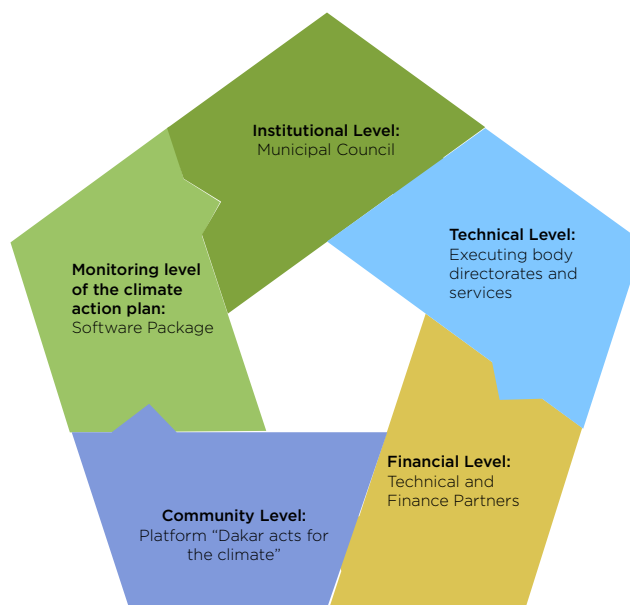
It is in this vein that the different actors and their level of intervention must be

serialised in order to create visibility and remove any uncertainty in the execution of the priority actions.

Table 13. Role of implementation actors based on levels of intervention

Level	Implementation actors	Intervention	Information tools
Strategic	State	Approval	Follow-up report
Political	City Council	Validation Monitoring	Follow-up report
Technical	Execution body	Implementation	Follow-up report
	Steering committee	Technical follow-up	Software package
Technical and financial	Technical and financial partners	Technical and financial support	Follow-up report
Community	DAKCLIM - Community Actors	Participation and dissemination	Fora and communication campaigns

Figure 31. Level of stakeholder intervention



10.3 Funding mechanism

To support the implementation of its priority actions to mitigate and adapt to climate change, the City of Dakar will combine various sources of funding such as local, national or transnational funding from public, private, bilateral and multilateral sources.

Indeed, making Dakar a resilient and low-carbon territory by 2030-2050 is a goal that requires the support of strategic financial and technical partners. The City of Dakar will need to develop an effective strategy for managing and mobilizing resources. The latter is a fundamental component of the Climate Plan and will help to ensure its successful implementation and measure its impacts and co-benefits.

Dakar, with its experience in mobilizing financial resources in several sectors, will draw on lessons learned and good practices.

10.3.1 Define a strategy for mobilizing resources

In terms of financing, international funds for low-carbon and climate-resilient development projects are growing rapidly. The City of Dakar will need to quickly put in place a strategy for mobilizing resources that will serve as a roadmap outlining precisely how they could be mobilized to meet the funding needs of its Climate Action Plan. This mobilization of resources will take place in a targeted and coordinated approach, with communication tools that will place a strong emphasis on strategic

axes and priority actions.

“The city will place an important emphasis on the financing, on equity, of certain actions directly within its jurisdiction. In this particular context, implementation planning must align with budget planning according to the planned cycle.”

The strategy for mobilizing the city's financial resources will focus, on fundraising to finance adaptation and mitigation actions - on the other hand on advocating for resource allocation for all climate change and energy transition programmes (including those that can be implemented under inter-municipality framework).

It will also consider the various fundraising opportunities, attract technical and financial partners and explore opportunities in green finance that is giving rise to new trends and new challenges.

10.3.2 Identify financing mechanisms

For the implementation of sectoral projects, the City of Dakar often uses traditional sources of funding, such as government grants, local economic contributions or other types of subsidies. The entry into force of Act III of decentralisation enshrined in Law No. 2013-10 of 28 December 2013, bearing the General Code of Local Government, was not followed by the transfer of sufficient resources.

As this situation does not guarantee the availability of traditional resources, the City

of Dakar must further explore and diversify its donor portfolio through the proposal of bankable projects. This will require an appropriate approach for each funder.

10.3.3 Public Sector

- The State and its decentralized technical services: The City of Dakar will continue to work closely together and forge partnerships with the national government and its services to consolidate adaptation and mitigation gains. A permanent commitment and sustained dialogue of all actors is the basis for achieving national objectives (CDN).
- International bodies: Since 2016, the City of Dakar has benefited from the support of technical and financial partners including the European Union under the CoMSSA and the C40 for the implementation of its Urban Governance Improvement Programme for an energy and ecological transition in order to strengthen its resilience to the effects of climate change. This support will continue with funding for Phase 3 of the CoMSSA and the implementation of the Metropolitan Grant for Energy Transition (MGET). The city will thus strive to maintain its collaboration with these institutions and strategic partners.
- International financial institutions: The World Bank, multilateral, regional or national development banks are key partners in achieving the SDGs. The city will take advantage of the financing opportunities offered by them.
- The Green Climate Fund (GCF) and the Adaptation Fund: With the cooperation and approval of the MEDD, the City of Dakar will explore the opportunities offered

by the GCF for funding for the preparation or implementation of the Climate Plan's priority actions. The City, through its efforts in the fight against climate change, will seize the opportunity to capture funding from this fund through direct access arrangements in collaboration with accredited implementation support entities present in Senegal.

10.3.4 Private Sector

The private sector is a key player in the implementation of the priority actions contained in the City of Dakar's Climate Action Plan. Companies and banks could strengthen their environmental awareness and promote their activities as part of their Corporate Social Responsibility (CSR) programme. Many actions present negligible risks with relatively easy-to-cover returns on investment. For the implementation of actions specific to the city's heritage or territorial scope, the local or regional private sector offers loan opportunities for, for example, investments in renewable energy, energy efficiency and waste recovery.

10.3.5 Decentralized cooperation

Despite certain differences between cities, the majority face similar obstacles when it comes to implementing sustainable development strategies. Today, many cities are innovating and developing effective tools to address a specific problem in order to move towards a more inclusive and environmentally friendly development. However, most of these experiments are carried out in a sectoral and localised

manner. However, in recent years, a new form of cooperation has emerged, which tends to strengthen and expand: it is the decentralized cooperation applied to cities.

It is in this sense that the City of Dakar has developed several actions in the field of sustainable development through decentralized cooperation with cities such as Milan (micro-gardening project) and the Greater Paris South (development of the PCET). Initiatives of this nature are to be encouraged and multiplied by the city as part of the development of effective tools to respond to climate emergencies.

Through this form of cooperation, the City of Dakar will be able to develop projects with its technical and financial partners. Several organizations, to varying degrees, are working to foster this type of partnership. These include local government organisations such as ICLEI Africa, United Cities and Local Governments of Africa (UCLGA), C40, Cities Alliance, CoMSSA or donors or funding agencies such as the European Commission, cooperation agencies.

While it is true that many local and regional actors are increasingly interested in access to climate finance, the fact remains that these funds follow a complex process requiring qualified human resources for successful project development.

10.3.6 Fundamentals of resource mobilization

Incorporating sources of public and private funding, the City of Dakar's strategy for

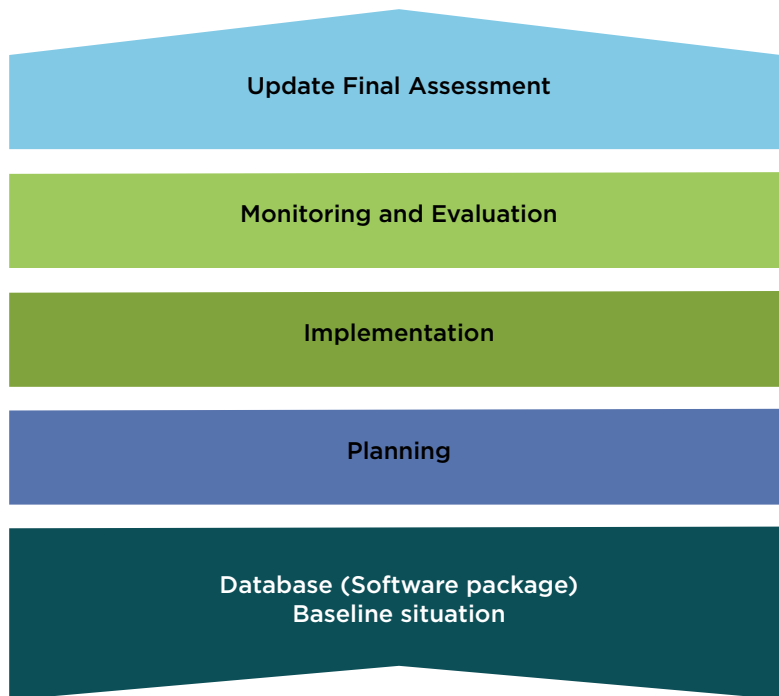
mobilizing financial resources for the implementation of its Climate Plan involves:

- promote a shared vision of action priorities with the widest possible range of financial partners (governments, international financial institutions, foundations, businesses, etc.) as a basis for strong, sustainable, flexible and accessible resources for the city;
- Establish sustainable partnerships to ensure that resources are secured to link international, national and municipal priorities to tackle climate change and achieve the SDGs;
- take advantage of the city's commitment to networks (CoMSSA, C40, etc.) to assist in securing funding and advocate for the implementation of priority actions across the territory;
- Prepare for climate finance by developing the city's capacity for climate planning and finance, access to different forms and types of financing, execution and verification of financial expenditures and results;
- Ensure results-based management and budgeting, ensure quality reporting, and systematically recognize partner contributions.

11 Monitoring and evaluation system

The implementation of a Monitoring and evaluation system is essential to monitor the progress of the implementation of the PCET in order to make adjustments as necessary. Indicators must incorporate several evaluation criteria such as impact (results based on the target), perception (population response and perceived value of the proposed action) and performance (quantitative assessment of the state of action implementation).

Figure 32. PCET monitoring and evaluation device



11.1 Monitoring, reporting and verification system for the PCET

The realization of a Monitoring, Reporting and Verification System or MRV helps to understand the main sources of emissions and the main carbon sinks, to design adjustment strategies, to assess the impact of mitigation and adaptation actions and policies and to monitor progress in achieving climate goals. To this end, the City of Dakar will apply the principles of consistency, transparency and precision to monitor and communicate climate data. Within the framework of the PCET, the

MRV of actions can be classified as follows:

- The MRV relating to emissions of GHG: it consists of estimating, declaring and verifying the real emissions on a defined period of time. This type of MRV can be performed at the scale of the territory of the city or municipal heritage.
- The MRV relating to the measures of mitigation: it consists of making an ex ante or ex post evaluation of GHG emission reductions and progress towards achieving mitigation goals. It is also about assessing the effects of policies or climate actions on sustainable development, as well as

monitoring their implementation trend.

- MRV for adaptation measures: it consists in making an evaluation of adaptation actions in terms of reducing climate risks and impacts and progress towards improving the resilience of the territory and populations.
- The MRV relating to support: it consists of tracking budget allocations dedicated to climate action, financial flows mobilized through bilateral channels or multilateral, knowledge techniques and strengthening capacities, as well as on the evaluation of their impacts. The MRV system of the City of Dakar is embodied by the development of dynamic tools and efficient monitoring and evaluation of climate action in general and implementation of the PCET in particular.

11.2 PCET monitoring tools

11.2.1 The software

The establishment of a PCET also supposes the provision of a tool for monitoring and evaluating actions. This is what justifies the establishment of a software package that serves as a platform open to all stakeholders in the PCET. The software package is a computer platform for managing and automating data to guarantee their reliability and processing, in order to ensure that the decisions that will be taken on the climate plan are correlated with a precise knowledge of the realities of the territory. It

is a database that will list all the activities and initiatives carried out as part of the implementation of the city's Climate Plan.

It will also involve informing, through this platform, the level of achievement of actions and sharing good practices and lessons learned related to climate change with the population. To ensure the dissemination and replicability of the results of the PCET, online training workshops will be held in the platform which will also integrate a data collection tool called ODK Collecte. The software will make it possible to:

- centralize all information and documents related to sustainable development;
- monitor and evaluate the indicators of environmental performance of the City of Dakar;
- build a management tool and automation of climate data;
- create a working tool for actors and monitoring of the achievements of PCET;
- create an IT platform, which will interact directly with stakeholders, through webinars, posts on eco-friendly actions and alerts on the weather.

11.2.2 The dashboard

This tool identifies for each strategic axis relevant indicators that make it possible to measure the effectiveness of the implementation of the PCET.

The dashboard of indicators includes the following elements:

- Actions to follow;
- The unit of the indicator collected (by example,%, number, tonnes, kWh, etc.);
- The frequency of updating the indicator;
- The data source.

Table 14. The follow-up-assessment dashboard

Axis	Actions to follow	Indicators	Frequency	Sources
Axis 1: Improving the living environment and public hygiene to build resilience	System strengthening forecasting, monitoring, early warning and control against climate risks	- Number of past alerts - Number of newsletters produced - Number of reports	- Annual - Annual - 5 years	- IPCC report - Studies - Dedicated platforms - ANACIM - DEEC - Universities - CSE
	Coastal protection infrastructure development	- Number of protective infrastructures - Number of beaches restored	- 5 years - 5 years	- Ministries - City of Dakar
	Strengthening communication, awareness and citizen participation in risk and disaster management	- Number of communications and awareness-raising carried out through social media and networks - Number of people trained - Number of strengthened associations - Behavior improvement	- Annual - Annual - Annual - Annual	- City of Dakar
	Integrating the climate dimension into urban planning and urban planning operations	- Formulating the repository for integrating climate change into urban planning - Number of new bioclimatic buildings meeting urban planning standards (COS, CES, Prospect)	- 2 years - 3 years	- Ministries - City of Dakar - Municipalities

Axis 2: Promote urban planning and development oriented towards the challenges of climate change and sustainable development.	Development of integrated catch-up infrastructure	- Restructuring area of informal settlements - Number of kilometres of linear drainage of stormwater built - Number of public spaces built	- Annual - Annual - Annual	ONAS - Ministry - City of Dakar - Municipalities
	Promoting nature-based solutions by enhancing water resources	- Number of buildings equipped with rainwater collection and reuse in municipal buildings - Amount of stormwater treated and reused in water bodies - Amount of valve water treated and reused in municipal buildings	- Annual - Annual - Annual	ONAS - Ministry - City of Dakar - Municipalities
Axis 3: Improving the living environment and public hygiene to strengthen people's resilience.	Development of wetlands and green spaces in the City of Dakar	- Number of Dakar Wetland development and Management Plans - Number of trees planted - Number of green roofs	- 5 years - Annual - Annual	- Ministry - City of Dakar - Municipalities - Waters and forests
	Development of green infrastructure and income-generating activities for populations most vulnerable to the effects of climate change	- m2 area dedicated to urban agriculture - Amount of waste recovered - m2 of area for green infrastructure	- Annual - Annual - Annual	UCG - Water and forest services - City of Dakar - Municipalities
	Improving access to water and sanitation	- Number of awareness-raising activities on access to water and water saving - Number of sewage discharge points - Number of households with water access difficulties	- Annual - Annual - Annual	- SenEau ONAS - City of Dakar - Municipalities
Axis 4: Promoting low-carbon and affordable energy and buildings for all	Adoption of energy efficiency standards (building code) to improve the energy performance of new buildings	- Number of energy efficiency awareness sessions in the building - Number of new buildings incorporating energy efficiency	- Annual - Annual	- Ministry in charge of urban planning - City of Dakar - Municipalities
	Energy-saving buildings in the City of Dakar	- Amount of energy (kWh) saved - Number of municipal buildings renovated for better thermal comfort	- Annual - 5 years	- City of Dakar - Municipalities
	Installing solar streetlights and LED lamps	- Number of sodium streetlights replaced by solar and LED - Number of training sessions on the management and maintenance of photovoltaic panels - Number of sanitary and educational facilities supplied with solar energy	- Annual - 2 years - Annual	- City of Dakar - SENELEC
	Strengthening electricity generation capacity with renewable energy and reducing GHGs	- Number of mini-renewable energy plants - Share of renewable energy in Dakar's energy production system - % reduction in GHG emissions	- Annual - 5 years	- City of Dakar

Axis 5: Promoting low-carbon transport and gentle travel through urban planning	Development of the BRT	- Length of linear of widened roads and traffic carry-on lanes - Number of electric charging stations - Modal share of clean-site transport	- Annual - Annual - Annual	- CETUD AGERROUTE - City of Dakar - Commons
	Introducing a fleet that meets fuel efficiency standards by fuel type	- Lowering the age of imported vehicles - Share of Euro 6 fuel consumed - Share of vehicles with an energy-saving device	- 3 years - 5 years - Annual	- CETUD DEEC - CSE - City of Dakar
	Development around transit stations and promotion of transit-oriented development	- Number of multimodal trading hubs - Density around transit stops	- Annual - Annual	- Ministry - CETUD - City of Dakar
	Construction of pedestrian and cycling lanes and paths in municipalities	- Linear bike lanes - Linear pedestrian pathways - Number of trips by bike	- Annual - Annual - Annual	- CETUD - City of Dakar - Municipalities
Axis 6: Encouraging the recovery of waste streams with a circular economy for a clean and sustainable city	Development of organic waste recovery channels	- Amount of organic waste valued in relation to the amount produced in the city - Number of households selectively sorting their waste - Number of valuation units set up	- Annual - Annual - 3 years	- UCG - City of Dakar - Municipalities - OCB - ONG
	Proper management of the sludge produced by self-contained sanitation in unserved areas to reduce the pollution load	- Amount of draining sludge collected - Number of households covered - Amount of wastewater treated by the Camberène station	- Annual - 5 years - 5 years	- ONAS Household surveys - Specialized report - Studies
Axis 7: Upgrade the city to access to climate finance	Establishing an institutional framework for governance of the energy and ecological transition	- Number of deliberations and orders taken in this regard - Number of meetings, workshops and seminars held - Signing the framework agreement	- 2 years - 2 years - 2 years	- City of Dakar - Municipalities - Prefectures - Deconcentrated technical services
	Strengthening human capital in formulating climate change adaptation and mitigation projects	- Number of projects formulated and funded from the city's own budget - Number of community projects supported by the city - Number of projects funded by the GCF	- Annual - Annual - 5 years	- City of Dakar - Municipalities - Partners
	Establishing autonomous financing mechanisms for the risks and vulnerabilities of the City of Dakar	- Share of risk prevention in the city budget - Rate of change in the budget allocated to risk management	- Annual - Annual	- City of Dakar - Municipalities

12. Communication around the action plan

To support the implementation of the PCET, it is essential to put in place an effective communication strategy. This communication will be done by means of supports adapted to the target. For example, for the general public, it can take the form of forums which will be great moments of citizen debate or through vectors such as the Municipal Radio of Dakar, social networks or the media.



This strategy will consist of activities to be initiated and others to be strengthened.

- **Activities to initiate :**

Create and run “Climate Clubs”

in schools : In the continuity of the inter-school “Environmental issues” competition and beyond seminars and workshops, the mobilization of local stakeholders could lead to the creation of “Climate Club” in medium and high schools levels in Dakar on the one hand and in Sporting and Cultural Associations (ASCs) on the other. It will be up to the City of Dakar to work with school governments for the establishment and coordination of these clubs.

Visibility of actors : We must seek to give more visibility and organization to the actors intervening in the field of climate and/or energy by attributing, for example, trophies according to their level of commitment towards populations.

Collective story : Climate culture must be shared by all. To do this, it is necessary to build an identity for the territory of Dakar and integrate it into its ecological heritage. This cultural identity owes the cement of the resilience of populations.

- **Activities to be reinforced:**

Pool initiatives and local entertainment

: Several actors from Civil Society Organizations (CSOs) show up in the city and offer activities to the public. Thus, in order to pool or even strengthen experience sharing between these different actors, it is important to revitalize the DAKCLIM platform and set up a shared agenda of events planned locally in order to jointly promote consultation and the implementation of actions for more impact.

Events : This involves placing major annual events in the city’s agenda dedicated to energy and ecological transition and sustainable development, as well as organizing a Fair or a Festival on the environment and the climate in collaboration with CSOs and others at the grassroots.

Annex

Analysis of synergies and co-benefits of mitigation and adaptation actions

Type	Action Name	Description	Potential Synergy	Other Opportunities
Mitigation	Energy efficiency of buildings - operational improvements to building energy	Implementing improved operational requirements for buildings to reduce energy consumption	Operational improvements to buildings reduce energy consumption and GHG emissions, but also improve network resilience in extreme heat	Operational improvements to buildings for energy efficiency offer opportunities to integrate adaptation measures such as improving water efficiency at the same time
Mitigation	Energy efficiency of buildings - energy efficiency of appliances and lighting - all buildings	Implementing policies or hardware improvements to the system (e.g., switching to LED fixtures) to reduce energy consumption in building lighting	Increase device efficiency to reduce energy consumption and GHG emissions, which can also reduce peak demand and improve network resilience during periods of extreme heat	In response to strategic axis 1: This action will guarantee low-carbon and affordable energy and buildings for all citizens of Dakar
Mitigation	Building-level clean energy development - building-level photovoltaic	Install solar photovoltaic electricity generation at the building level	Building-scale photovoltaics can improve air quality while providing resilience to the electrical system if combined with energy storage; roof-mounted solar panels can, in some cases, provide shade to reduce the effect of extreme heat days, while ground-mounted panels could simultaneously consider landscaping to prevent flooding	Building-scale solar photovoltaic can in some cases be combined with white roofs or walls or with green roofs or walls.
Mitigation	Buses - vehicle efficiency	Modernize bus fleet vehicles to be more fuel efficient, reducing fuel consumption and therefore CO2 emissions	Increase the resilience of the transportation system by diversifying the types of fuels used in public transit	In response to strategic axis 2: Promoting low-carbon CO2 adapted public transport systems, low-emission (electric) buses will help improve air quality and thus the health of citizens
Mitigation	Improved infrastructure, services and bus operations - rapid bus transport (BRT)	Add a BRT system, which is a high-quality transportation system that provides fast and efficient service that can include reserved lanes, bus lanes, priority at traffic lights, perception of affordable fares and improved stations	Reduce the urban heat island effect by reducing car journeys, traffic jams and emissions of major air pollutants	New bus rapid transit infrastructure can be combined with adaptation measures such as permeable pavements, weather-proof roads and greening urban areas. In response to strategic axis 2: Promoting low-carbon CO2 adapted public transport systems, this action has the effect of improving connectivity between people and places and combating the marginalization of

				communities on the outskirts of the city (including low-income and informal communities); this could also lead to better access to transport services and integration of people with disabilities.
Mitigation	Electric vehicle charging infrastructure	Increase the number of charging electric vehicle stations throughout the city to help encourage the adoption of electric vehicles by the public	Increase the resilience of fuel supply by diversifying the types of transportation fuels; Reducing the urban heat island effect by reducing emissions of major pollutants	New electric vehicle charging infrastructure can incorporate adaptation measures such as water waterproofing; Integrating shading and urban greening; and be associated with the construction of adaptation infrastructure, such as storm barriers
Mitigation	Protecting and expanding green spaces by restoring and/or conserving natural or semi-natural areas, reforestation, carving or planting trees	Protect and extend green areas, trees or other vegetation in the city	Sequester carbon, reduce stormwater runoff, mitigate urban heat island effect and promote biodiversity	The protection and extension of green spaces for carbon sequestration purposes may also include measures that have adaptation benefits, such as xero-landscape, wind corridors for the creation of urban microclimates, development of urban floodplains, water-sensitive development
Mitigation	Capture methane from landfills	Capture and burn landfill gases, or use them as a fuel source to generate electricity, to avoid direct methane emissions into the atmosphere	Reduce the urban heat island effect by reducing car travel and reducing emissions of major air pollutants	
Mitigation	Public lighting - more efficient lighting (LED)	Replace streetlights with more energy-efficient technologies to reduce electricity consumption and related GHG emissions		
Mitigation	Public transport-oriented development (TOD)	The TOD is a principle of urban planning that creates dynamic, population-centred neighbourhoods with maximum access to public transport and economic activity. The TOD involves planning a high-density, mixed-use development, alongside a robust public transport system		When promoting and implementing a TOD, adaptation planning strategies can be incorporated. In response to strategic axis 3: Promoting an active, connected and resilient city through development this action will promote the development of modern flood-proof neighbourhoods that are sensitive to water and heat

Mitigation	Energy recovery of waste - anaerobic digestion	Use of biogas from anaerobic digesters (an organic waste disposal method that maximizes methane production during the biodegradation process) for electricity generation		
Cross-cutting	Development of urban parks and green spaces	Parks and urban forests create green spaces and microclimates in the city; unpaved surfaces absorb precipitation	Sequester carbon and reduce energy consumption in buildings by mitigating the urban heat island effect, in addition to improving biodiversity; the development of urban parks and green spaces can also encourage cycling, walking and recreation	The development of urban parks and green spaces can provide opportunities to integrate other urban greening initiatives, such as the use of compost, which offers mitigation benefits through alternative organic waste management. The development of alternative transport (bike lanes and pedestrian lanes) can they also rely on ornamental vegetation corridors that provide residents with comfortable recreational and recreational spaces. This action helps to respond to: Strategic Axis 3: Promoting an active, connected and resilient city through urban planning Strategic Axis 2: Urban Planning and Development
Adaptation	Diversification of water supply	Having multiple water sources makes the city less vulnerable to drought if one of the water sources fails	Reducing energy and GHG emissions associated with water demand by using grey water for non-potable use	At the building level, the diversification of the water supply can be combined with actions to modernize the water distribution system. For example, rainwater collection may be associated with the construction or modernization of water infrastructure. Diversifying water supplies will improve safety and ensure continued water supply, with a particular benefit to citizens who do not currently have safe and regular access to water. This is an important step towards achieving the strategic axis 1: Risk and Disaster Management

Adaptation	Coastal protection (beaches)	Beaches offer natural protection from flooding due to the sea; this protection can be strengthened by artificially expanding beaches	The preservation of beaches offers opportunities for natural coastal protection and can promote the growth of vegetation that play an important role in carbon sequestration, helping to mitigate the urban heat island effect and improve biodiversity	Coastal protection can help enhance the potential for carbon sequestration and thus contribute to better air quality and other ecosystem services and public health. In response to strategic axis 1: Risk and disaster management, and strategic axis 3: Life framework
Cross-cutting	Planting trees in public spaces	Trees in public spaces create shade and refresh their direct environment	Sequester carbon and reduce energy consumption in buildings by mitigating the urban heat island effect, in addition to improving biodiversity	Planting trees in public spaces can often be added to infrastructure modernization with mitigation benefits or other sustainable solutions. In response to strategic axis 3: this action will strengthen the potential for sequestration, thereby helping to improve air quality and the health of populations.

GLOSSARY

Adaptive capacity

Adaptive capacity refers to the ability and willingness of systems to adapt to potential damage, take advantage of opportunities or respond to the impacts of climate change. Systems can be natural systems, individuals or institutions such as governments.

Danger

Climate risks threaten climate events, which in turn can cause damage to humans, property and natural systems.

Reference year emissions

Emissions and absorptions of the reference year for all gases and sectors included in the assessment scope, including emissions outside the territory, if applicable.

Territorial Emissions

Emissions from sources within the geopolitical perimeter of the territory.

CO₂ equivalent (eq. CO₂)

Universal unit of measurement indicating the global warming potential of each greenhouse gas, expressed on the basis of the global warming potential of a unit of carbon dioxide. It is used to assess the release (or avoid release) of different greenhouse gases relative to a common base.

Exposition

Exposure refers to the presence of people and/or assets in areas potentially affected by climate change.

Greenhouse Gas (GHG)

Gas components that absorb infrared radiation emitted from the Earth's surface and contribute to the greenhouse effect. The increase in their concentration in the Earth's atmosphere is causing global warming. GHGs correspond to seven gases covered by the Kyoto Protocol: carbon dioxide (CO₂), methane (CH₄), nitrogen oxide (N₂O), hydrofluorocarbons (HFC), perfluorocarbons (PFC), sulphur hexafluoride (SF₆) and nitrogen trifluoride (NF₃).

Global Protocol for the Community (GPC)

A method of assessing greenhouse gas emissions.

Impact

The term impact is used to describe the effect of extreme weather and climate events on natural and human systems. The impact can affect lives, health, the economy, infrastructure and ecosystems. They are often referred to as “consequences.”

Indicator

Indicators are measures used to collect relevant climate data. This may include information on climatology, which provides important evidence of climate change, such as precipitation, hot days or storm intensity. It may also include non-climatic information such as information on sectors, demographics, land use, flood damage or maps of critical infrastructure.

Inventory of greenhouse gases

Quantified list of greenhouse gas emissions and absorptions from a territory by emission source, sector and gas.

Kilowatt-hour (kWh)

Energy consumed with 1 kW for one hour.

Light-emitting diode (LED)

The light-emitting diode (LED) is a lighting device with a lower consumption than incandescent lamps and the same order of magnitude as fluorescent tubes.

Reducing emissions

Reducing greenhouse gas emissions from a baseline year or baseline scenario.

Climate risk

Climate risk is related to the likelihood of negative effects of climate change. It is caused by adverse climate events or trends that have a negative impact on cities around the world. Risk is determined by an interaction of hazards, exposure, vulnerability and sensitivity.

Business as usual (BAU) or Business as Usual Scenario)

Baseline situation that represents the most likely events or conditions for the future as a result of the policies and actions adopted and implemented.

Sensitivity

Sensitivity is the extent to which a system or species is negatively or positively affected by climate change.

Vulnerability

Vulnerability refers to the extent to which people or goods are sensitive to the adverse effects of climate change. It is related to the lack of ability to cope and adapt.

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