Clima–Med
Acting for Climate in South Mediterranean

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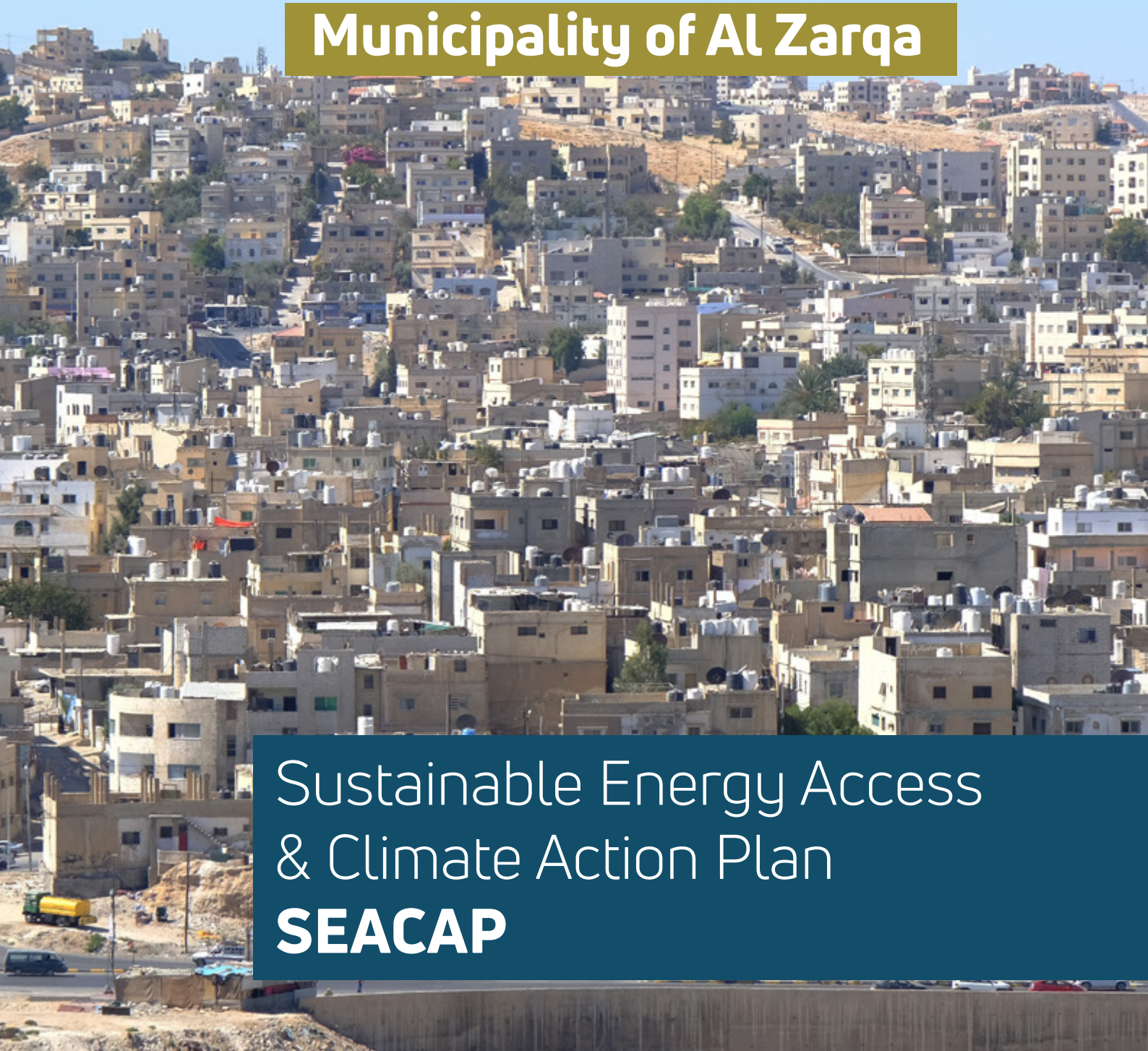
JORDAN

Municipality of Al Zarqa



Sustainable Energy Access & Climate Action Plan
SEACAP

This municipality is a signatory of the Covenant of Mayors for the Mediterranean, CoM Med

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Glossary

AFOLU	Agriculture, Forestry, and Other Land Use
BEI	Baseline Emissions Inventory
CAP	Citizens Awareness Plan
CAS	Climate Action Strategy
CBD	Convention on Biological Diversity
CoM	Covenant of Mayors
CoM Med	Covenant of Mayors for the Mediterranean
Dunam	1000 m2
GHG	Greenhouse Gases
IPCC	Intergovernmental Panel on Climate Change
JRC	Joint Research Centre
LFG	Landfill Gas
MSW	Municipal Solid Waste
NDC	Nationally Determined Contribution
RCP	Representative Concentration Pathways
SCP-NAP	The Jordanian Sustainable Consumption and Production National Action Plan
SEACAP	Sustainable Energy Access and Climate Action Plan
SWDC	Solid Waste Disposal Sites
SWM	Solid Waste Management
TNC	Thirtd National Communication on Climate Change
UNCCD	United Nations Convention to Combat Desertification
UNFCCC	United Nations Framework Convention on Climate Change
VTMS	Vehicle Tracking & Monitoring System

Executive Summary

Al Zarqa is home to over half of Jordan's industrial activity, and 33 km from Amman, the capital. It is an important link to the west of the country as well.

Its diverse population of 886,970 also has an additional 36,605 Syrian refugees.

Al Zarqa hosts 408 industrial facilities, and is rich in field crops, vegetables, and fruit trees as well as an important livestock sector where farm and sheep raising are abundant. Additionally, 11,000 commercial establishments constitute an important pillar of the local economy.

The city is facing difficulties regarding water availability as the semi-arid climate with hot and dry summers and only 180mm of annual precipitation during winter is insufficient and impacting agriculture, health, and the economy overall. Paradoxically, during extreme precipitation, the city witnesses devastating resulting from the rise of the Zarqa River and the weak drainage networks in the city which further threatens lives and impacts farms, businesses, and households.

For the municipality, working on water harvesting and infrastructure upgrading may ameliorate disasters while ensuring needed water resources.

Solid waste is another challenge with increasing amounts and an annual cost of USD 13 million and is a priority for the municipality.

Unemployment is also important, and the recent influx of Syrian refugees has brought the unemployment rate in Al Zarqa Governorate to 18.1%.

The municipality plans expanding public services to construct and maintain roads, street lighting, and reforestation. Creating infrastructure and participating in large-scale urban regeneration and expansion is the city's primary focus.

This document comprises the municipality's Sustainable Energy Access and Climate Action Plan (SEACAP). It is a strategic planning document as well as a practical municipal operational tool. It defines the city's climate action framework with quantifiable objectives to be reached by 2030 based on a Baseline Emissions Inventory (BEI) and an assessment of climate adaptation, mitigation, and sustainable energy needs.

The SEACAP was developed under the framework of the European Union's Clima-Med project (Acting for Climate in South Mediterranean Cities). It complements and is in line with national climate strategies and goals as well as with local development plans. The SEACAP was prepared with the full participation of the municipality's leadership, its technical team, and in collaboration with the members of the National Coordination Group, under the auspices of Clima-Med National Focal Point, the Ministry of Planning and International Cooperation.

By preparing the SEACAP and by joining the CoM-Med, the municipality took an advanced step proving its willingness and dedication to face climate change, reduce its greenhouse gas (GHG) emissions, and build a model sustainable village with a clear vision, objectives, targets, and actions.

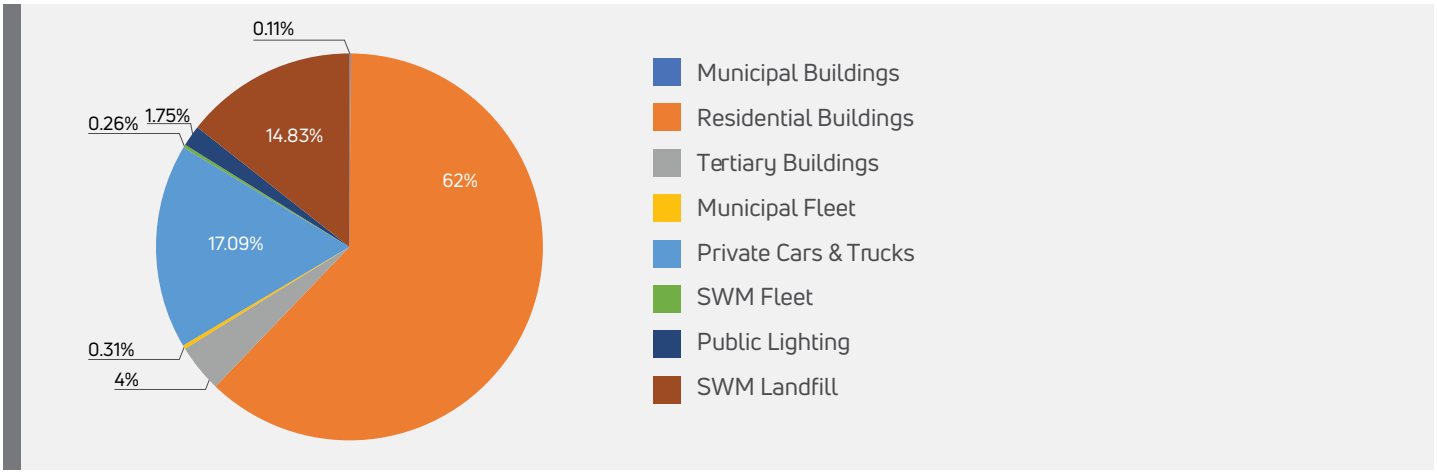
This SEACAP includes seven sections:

- Chapter 1: Municipality Description & Vision
- Chapter 2: Baseline Emissions Inventory
- Chapter 3: Risk & Vulnerability Assessment
- Chapter 4: Capacity Building & Local Governance
- Chapter 5: Mitigation Actions
- Chapter 6: Adaptation Actions
- Chapter 7: Communication

Chapter 1 introduces the municipality's main goals of reducing air pollution, implementing mitigation actions and measures to reduce CO2 emissions as well as cope with the impacts of climate change affecting the area. The city wishes to use climate change action to create jobs, restore farms, sustain tourism, invest in renewables, and introduce eco-friendly water systems to head of looming health, employment, and other crises exacerbated by climate change.

Chapter 2 covers the Baseline Emission Inventory (BEI) quantifying current CO2 emissions and prioritizing mitigation measures. The residential sector is the main contributor of the GHG emission at 62%, followed by the transport sector at 17.6% of city emissions. The BEI is used in Chapter 5 to measure the plan's potential impact. For a one-time investment of EUR 50.5 million, realised jointly by the city and private investors, the plan's implementation would create an annual GHG emission abatement of 305,916.6 tCO2-eq – mitigating 21.3% of emissions and saving EUR 54.5 million annually as well. If the plan is not to be implemented, the city's CO2 emissions could reach 1,432,425.8 tCO2-eq by 2030.

Figure 1 : Emission by Sector



Based on the BEI assessment, adequate mitigation actions (aiming to cut emissions) were selected. Next to this, adaptation actions (aiming at adapting to the irreversible effects of climate change) were identified. Both were further developed into SEACAP projects (chapters 5 and 6).

Chapter 3 assesses the city's risk and vulnerability to the most impacted sectors from the climate hazards taking place in the region.

Chapter 4 focuses on capacity building and local governance, especially for actions related to sustainable energy, climate change adaption, and greening the city.

Chapters 5 and 6 detail mitigation actions by sector -- particularly the impact of a green building code – and quantifies adaptation actions. The table below summarizes the proposed measures and their emissions impacts, costs, and benefits by 2030.

Chapter 7 provides an overall plan to motivate the municipality and its people with the information covered in chapters 1-6.

Table 1: Proposed mitigation measures and their emissions impacts, costs, and benefits by 2030

Sector	Action	Mitigation, MWh/a	Mitigation, tCO2-eq/a	Implementation Cost, EUR	Annual Monetary Savings, EUR	BAU Emissions, tCO2-eq (2030)	Climate Cost Efficiency (2030)
Municipal	5.1.1 Existing Municipal Buildings: Consumption Saving Measures	504.5	350.6	N/A	90,808.2	1,515.25	N/A
	5.1.2 New Municipal Buildings: Implementing & Promoting the Green Building Code	117.6	81.8	N/A	21,168		N/A
Residential	5.1.3 Existing Residential Buildings: Awareness-raising Activities	113,165.8	75,893.7	3,500,000	19,548,542	883,592.1	46.1
	5.1.4 New Residential Buildings: Implementing & Promoting the Green Building Code	96,199.4	47,672.9	2,800,000	11,947,632		58.7
Tertiary	5.1.5 Existing Tertiary Buildings: Awareness-raising Activities	9,182.6	6,204.8	1,400,000	1,603,317	57,026.6	225.6
	5.1.6 New Tertiary Buildings: Implementing & Promoting the Green Building Code	5,018.1	3,076.9	700,000	788,311		227.5
Public Street Lighting	5.2 Municipal Public Lighting	17,162.2	11,928.2	8,086,400	3,089,196	24,983.3	169.5
Transport	5.3.1 Road Asset Planning & Management with Sustainable Mobility Measures	66,774.1	17,444.9	7,000,000	4,865,890.4	249,213.5	401.3
	5.3.2 Municipal Transportation Solid Waste Sector	4,128	1,106.3	7,000,000	222,912	3,687.7	1,581.8
Solid Waste Management	5.4 Solid Waste Management	13,965	129,906	5,900,000	9,078,050	212,407.3	11.4
Renewable Energy Production	5.5 Local Energy Production	17,626.7	12,250.5	14,080,500	3,172,791	-	1,149.4
Total contribution to emissions reduction 305,916.6/ 1,432,425.8= 21.35%		**343,843.8**	**305,916.6**	**50,466,900**	**54,478,615**	**1,432,425.8**	

1 Municipality Description & Vision

Chapter 1: Municipality Description & Vision

1.1 Municipal & NDC Targets

Al Zarqa municipality, as part of the Covenant of Mayors Mediterranean (CoM-Med), is committed to reducing its emissions 20% by 2030 (with 2018 as the baseline), surpassing the unconditional commitment of Jordan's Nationally Determined Contribution (NDC), which is 5%. The overall target set by the local government emphasizes working closely with all community actors. It will take all necessary measures with its facilities to establish a good example for the community while collaborating with the public and achieving significant reductions from the residential, tertiary, and transportation sectors as well as from solid waste, water waste, and agriculture.

1.2 Overview of Municipality

1.2.1 Geographical Location

Covering 60 km2, Al Zarqa is located 20 km northeast of Amman. It is bordered to the north by Mafraq Governorate, to the east by Saudi Arabia, to the south by the Capital Governorate, and to the west by the Balqa and Jerash governorates. An excellent international and main road network facilitates the movement of trade and exchange with sister countries, especially the free zone.

Al Zarqa is also gaining a competitive advantage, especially in the industrial investment, as it includes more than half the national industry in terms of invested capital, labor, and production volume. The city and the Qualified Industrial Zone in Al Dhalil include many factories. It is also considered an important corridor to a number of border posts.

Al Zarqa has a cold semi-arid climate (Köppen climate classification: BSk). The average annual temperature is 17.4°C, and it receives around 182 mm of precipitation annually, mostly in winter months.

1.2.2 Population & Employment

In 2017, the population of Al Zarqa Governorate was about 1,439,500 people (14.3% of Jordan's total population) with a high population density of 302 individuals per km^2.

The population of Al Zarqa city is about 846,126 (60% of the governorate). In addition, it contains one Palestinian refugee camp. Moreover, the job distribution is mainly concentrated in the centre of Al Zarqa because of the large commercial, industrial, and government offices. Unemployment is one of the most important problems in Al Zarqa, and this problem has increased due to the rapid growth in population and successive migrations, notably the recent influx of Syrian refugees. According to the statistical book for the third quarter of 2018, the unemployment rate in Al Zarqa Governorate was 18.1%.

1.2.3 Economic Sectors

The total area of agricultural land in Al Zarqa Governorate is 5,058.761 dunams, including field crops, vegetables, and fruit trees. There are 170 cow farms, fourteen sheep farms and seven livestock farms.

Regarding the industrial sector, Zarqa is the main industrial zone in Al Zarqa Governorate. The number of major industrial facilities in the city is about 408. It includes plastic, paper, cardboard, chemical, and food industries.

Additionally, the commercial sector is very active. The city contains large commercial areas, in addition to retail stores, commercial offices, and more than 11,000 commercial establishments.

Tourism in Al Zarqa Governorate is limited and focused specifically on desert palaces. In 2018, 21,076 tourists visited the governate and there was no tourism within the city.

1.2.4 Infrastructure & Key Services

The city is supplied with electricity through the Jordanian Electricity Company, a limited shareholding company. It is considered a private sector entity and meets 99% of the demand.

Regarding water usage, the Jordan Water Company (Miyahuna) is the provider of water services for Al Zarqa Governorate. The percentage of households depending on the public drinking water network is about 98%.

Based on population and environmental statistics, solid waste generated can reach 500 tons daily, negatively impacting the city's environment. This waste is collected and transferred to a transfer station 7 km from the city centre, then the waste is transferred to the Greater Amman Municipality landfill (Al-Ghabawi dump) which is 35 km from the city centre. The quantities of waste generated in Al Zarqa city are very large and need to be collected and transported by a fleet of vehicles larger than what is currently available to the municipality – and existing transport is worn out especially after having to visit the landfill three times daily.

Regarding its other infrastructure, Al Zarqa Governorate is located on a network of main, secondary, and agricultural roads, with a total length of 1,966 km. The paved and agricultural roads are the longest of these. The number of subscribers to the sewage network is 79.16% of the governorate's population.

1.3 Strategy

1.3.1 Vision for the Future

The vision stems from the municipality's history and intends to capitalise on the city's history and commitment to using its resources sustainably.

The challenges facing the municipality's long-term vision of sustainability are issues related to sustainable growth and population increase.

The municipality's main goal is to reduce air pollution while implementing mitigation actions and measures reducing CO2 emissions as well as cope with the impacts of climate change affecting the area.

The municipality's strategic decisions aim to use future development of the region to create local jobs for residents through reactivating the agricultural sector as it was in the past, developing sustainable tourism, investing in producing renewable energy and energy efficiency equipment and materials, modern water harvesting systems, city greening, introducing a sustainable strategy for livestock development, plus a sustainable solid waste management strategy.

1.3.2 Complementarity & Coordination with Local & National Plans & Authorities

The SEACAP has been developed in line with the Jordanian National Climate Change Policy. The policy is designed to adapt the country to climate change impacts in water, coastal areas, agriculture/food security, health, tourism, biodiversity, and socioeconomic development/ poverty.

Moreover, the country mainstreamed climate change in its National Strategy and Action Plan to Combat Desertification (2015-2020) which was recently aligned with the United Nations Convention to Combat Desertification (UNCCD) 10-year strategy. Jordan also mainstreamed climate change into the National Biodiversity Strategy and Action Plan (2015-2020) which was also recently aligned with the global Convention on Biological Diversity (CBD) 10-year strategy.

Also, SEACAP is in line with the National Strategy and Action Plan for Sustainable Consumption and Production for Jordan (2016-2025) which is mainstreaming sustainable consumption and production into agriculture/food production, transport, and waste management.

Additionally, the SEACAP will play an essential role extremely important in implementing Jordan's Nationally Determined Contribution (NDC) submitted to the UNFCCC.

1.3.3 Adapting Administrative Structures & Involving Local Stakeholders

The plan will be mainstreamed though the current existing structures already set to implement similar initiatives. The municipality has an active technical services department and an environmental committee and the necessary channels to communicate with the local community and various significant local stakeholders.

To assure long-term sustainability, the relevant municipal staff, including members from the municipal council as well as volunteers from the local community, will engage in plan preparation and implementation beyond the current council mandate.

The municipality has appointed a local coordinator, responsible for overseeing the varied work between the different municipal departments, the mayor, and city council as well as with the local stakeholders engaged in the process. This role is especially challenging as authorities in different departments must cope with differing roles and responsibilities. SEACAP implementation usually requires a series of cross-sectoral targets, thus coordination between them and improvement of multi-level governance is of high importance.

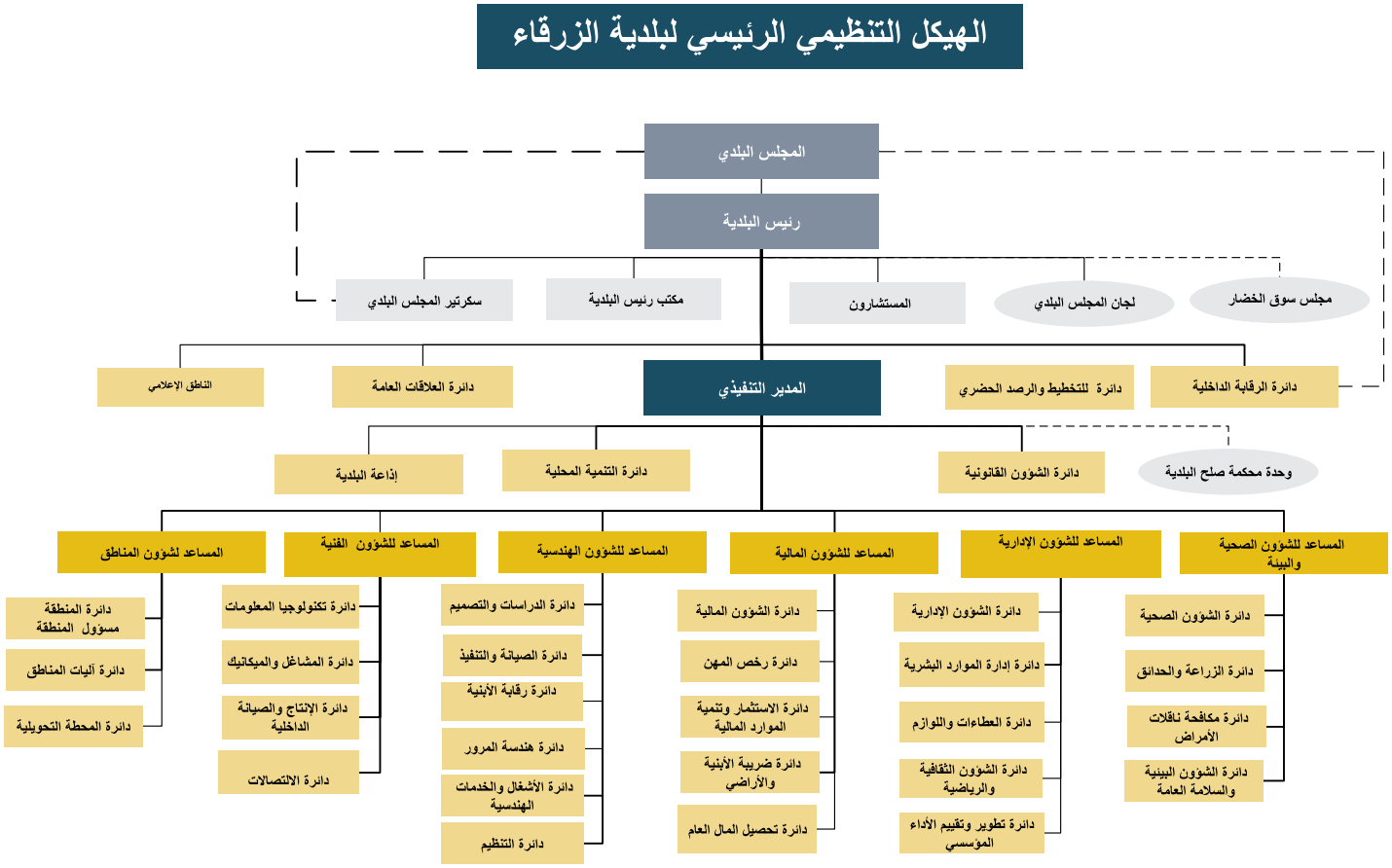
The Al Zarqa municipality has about 4,294 employees distributed among the municipal departments and sections through an organizational structure developed and approved by the municipality based on the organizational structure of the first category municipalities approved by the ministry.

The organizational chart below shows the departments and divisions operating in the municipality presently:

1.3.4 Overall Budget for Implementing & Financing Sources

The municipal funds largely originate from the budget received by the national government as well as municipal taxes (property, school, and licensing) and fees for services offered to citizens (e.g., solid waste removal). The municipal budget allows small-scale investments, but is still heavily dependent on attracting grants or loans to implement planned activities.

Figure 2: Organigram of Al Zarqa municipality



1.3.5 Implementation & Monitoring Process

The monitoring process of the SEACAP's implementation should be set to track indicators allocated across all municipal activities to assess progress and take corrective actions as needed.

1.3.6 Awareness-raising

Implementing the SEACAP's Citizens Awareness Plan requires the participation of all municipal departments working in harmony to avoid conflicts. This requires the special SEACAP Unit working independently on the development of the frameworks and coordinating with each to monitor and evaluate the results.

2 Baseline Emission Inventory (BEI)

Chapter 2: Baseline Emission Inventory (BEI)

2.1 BEI Methodology

The Baseline Emission Inventory (BEI) quantifies the amount of CO2, or CO2-equivalent emissions produced mainly due to energy consumption in the territory of the local authority during the selected baseline year. The BEI identifies the principal anthropogenic sources of CO2 emissions and allows prioritizing the mitigation measures accordingly.

The emission inventory includes direct CO2 emissions due to fuel combustion, indirect emissions related to consumption of grid-supplied energy (electricity, heat/cold), and relevant non-energy related emissions occurring in the territory of the local authority.

As the municipality has been using Intergovernmental Panel on Climate Change (IPCC) emissions factors for CO2-equivalents based on the IPCC 2006 Guidelines (IPCC 2006), the emissions of CH4 and N_2O from the energy generating activities are already included in this methodological approach. For non-energy related activities like solid waste management and others, the CH4 and N2O where applicable will be calculated separately and transformed into CO2-eq. These emissions will be included in the BEI since the municipality is planning to include mitigation measures in these sectors.

Under the guidelines for the Maghreb and Mashreq countries, CO2 emissions from the sustainable use of biomass/biofuels and emissions of certified green electricity are considered as zero in the calculation.

The method adopted in the BEI calculation utilizes the standard emission approach in line with the IPCC principles and complies with the UNFCCC reporting system.

Data collection is a key for the inventory. The following steps have been taken by the local authority for gathering accurate data in conjunction with relevant stakeholders:

- Select the baseline year for which the most complete and reliable data exist.
- Collect data for the sectors to be included in the SEACAP inventory for the baseline year.
- Analyse data, evaluate, and assess for accuracy, transparency, consistency, andcompleteness.
- Compile selected data.

The main data sources include:

- Municipality of Al-Zarqa
- National authorities
- Local fuel suppliers and gas stations

The energy consumption data (or activity data) collected regarding:

- Electricity consumed in buildings (in MWh electricity)
- Fuel used in transportation (in litres of fuel and then converted to MWh fuel)
- Heat consumed in buildings (in litres of fuel, or ton of biomass and then converted to MWh heat)

2.1.1 Baseline Year

A primary component of the inventory process is choosing the baseline year. Determining the baseline year depends on the availability of accurate historical data. The baseline year is the year against which progress in emission reductions by 2030 will be compared. The municipality has selected 2018 as its baseline year.

2.1.2 BEI Sectors

The local authority will report CO2 emissions for the following sectors:

- Municipal buildings, equipment, and facilities including public lighting, tertiary buildings, and residential buildings
- Transportation including the municipal fleet,private transport, and public transport
- Local energy production from renewable energy sources and other local power generation
- Other non-energy related activities such as solid waste management.

2.1.3 Emissions Factors & Conversion Rates

The emissions factors expressed as tCO2-eq/MWh are coefficients quantifying the emissions per category of activity data. The emissions factors used by the local authority are the last updated emissions factors provided by JRC and attributed to electricity consumption. The JRC-CoM-NEFE dataset includes the 1990-2015 time series of the National Emissions Factors for Electricity Consumption (NEFE). Considering the lack of availability of more recent data, and following consultation with the JRC, the emissions factor for 2015 (IPCC approach) is used for calculations is this report. **The emissions factor is 0.695 tCO2-eq per MWh.**

Besides electricity, the fuel emissions factors used by the local authority, expressed in tCO2-eq/MWh and presented in the table below, are the default factors of the IPCC (2006).

Table 2 : CO2 Emissions Factor tCO-2eq/MWh

Fuel	CO2 Emissions Factor tCO2-eq/MWh
Diesel	0.268
Gasoline	0.250
Kerosene	0.259
LPG	0.227

The conversion factors between litres or kg and kWh expressed in kWh/L for fuel combustion used by the local authority are factors provided by the IPCC (2006) in the table below:

Table 3 : Conversion Factor for Energy Fuel Resources to kWh

Fuel	Conversion Factor	Unit
Gasoline	9.2	kWh/L
Diesel	10	kWh/L
Kerosene	9.7	kWh/L
LPG	13.7	kWh/kg

2.2 Energy Consumption in Buildings

2.2.1 Municipal Buildings, Equipment & Facilities

The municipality has 21 buildings under its direct control and management – notably the main municipal buildings, gardens, and storage building. Overall, the municipality is consuming 1,690.09 MWh per year, for lighting, space heating, cooling, and other electromechanical devices in the municipal buildings and facilities. The supplied electricity comes from the national electricity grid. The table below presents the annual electrical consumption and emissions of municipal buildings, equipment, and facilities:

Table 4: Municipal Buildings, Equipment, & Facilities Annual Electrical Consumption and CO2 Emissions

Municipal Buildings, Equipment, & Facilities Annual Electrical Consumption & CO2 Emissions		
Site Category	Annual Consumption, MWh	Annual Emissions, tCO2-eq
Municipal Buildings & Facilities	1,690.09	1,174.61

HVAC units are used so there is no fuel consumption for space heating as it is already accounted for in the total annual electrical consumption for municipal buildings.

2.2.2 Residential Buildings

The municipality believes there are approximately 186,602 households in its area. Utility company data reflects annual electricity consumption of 793,166.73 MWh, resulting in an annual electricity consumption per capita of 937 kWh. Based on these assumptions, the table below presents the annual electricity consumption and emissions of residential buildings:

Table5 : Residential Buildings' Annual Electricity Consumption & CO2 Emissions

Residential Buildings' Annual Electrical Consumption & CO2 Emissions		
Site Category	Annual Consumption, MWh	Annual Emissions, tCO2-eq
Residential Buildings	793,166.73	551,250.87

Emissions factor for electricity consumption is 0.695 tCO2-eq/MWh (CoM-JRC)

The municipality households consume LPG for space heating and cooking. The data provided by the municipality shows each household consumes about 18 kg of LPG per month for cooking and 30% of the households consume 12 kg per month for space heating during a four-month heating period. Based on these assumptions, the table below presents the annual fuel consumption and CO2 emission for cooking and space heating:

Table 6: Residential Annual Fuel Consumption & CO2 Emissions for Cooking & Space Heating

Residential Annual Fuel Consumption & CO2 Emission for Cooking & Space Heating			
Fuel Type	Fuel Consumption, kg	Fuel Consumption, MWh	Annual Emissions,
LPG	42,993,101	589,005.48	133,704.24

2.2.3 Tertiary Buildings, Equipment & Facilities

The tertiary sector includes commercial buildings, private offices, banks, commercial and retail activities, private and government schools, hospitals, and other activities offering services beyond the control of the municipality. Based on the annual electricity consumption figures obtained from the utility company, the table below shows the annual energy consumption and emissions from tertiary buildings:

Table 7: Tertiary Buildings' Annual Energy Consumption & CO2 Emissions

Tertiary Buildings' Annual Electricity Consumption & CO2 Emissions		
Site Category	Annual Consumption,	Annual Emissions, tCO2-eq
Tertiary Buildings	59,487.5	41,343.81

Emissions factor for electricity consumption is 0.695 tCO2-eq/MWh (CoM-JRC)

The annual fuel consumption for space heating and the relative CO2 emissions in tertiary buildings are shown in the table below:

Table 8 : Tertiary Buildings' Annual Fuel Consumption & CO2 Emissions for Cooking & Space Heating

Tertiary Buildings' Annual Fuel Consumption & CO2 Emissions for Cooking & Space Heating			
Fuel Type	Fuel Consumption, kg	Fuel Consumption, MWh	Annual Emissions, tCO2-eq
LPG	920,565.89	12,611.74	2,862.86

Emissions factor for diesel is 0.268 in (tCO2-eq/MWh)

Emissions factor for LPG is 0.227 (tCO2-eq/MWh)

2.2.4 Buildings. Equipment & facilities' Synopsis

Buildings consume a lot of electricity for lighting, heating, cooling, and other electrical device operations. The table below summarizes the annual electricity consumption and the CO2 emissions from buildings:

Table 9: Buildings & Facilities Annual Electricity Consumption & Emissions

Final Energy Consumption, MWh						
Sector	Electricity	Diesel	Fossil Fuels Gasoline	LPG	Total (MWh)	Emission tCO2-eq
Buildings, Equipment, & Facilities						
Municipal Buildings	1,690.09				1,690.1	1,174.6
Residential Buildings	793,166.73			589,005.48	1,382,172.2	684,955.1
Tertiary Buildings	59,487.5			12,611.74	72,099.2	44,206.7
Subtotal	854,344.3	0	0	601,617.2	1,455,961.5	730,336.4

2.3 Municipal Public Lighting

The municipality's street lighting is partly provided by LED efficient lights, but still heavily reliant on inefficient lamps (HPS, MH) causing high emissions of CO2. The annual electricity consumption and CO2 emissions for the baseline year are shown in the table below:

Table 10: Public Lighting Annual Electricity Consumption & CO2 Emissions (2018)

Public Lighting Annual Electricity Consumption & CO2 Emissions (2018)					BAU	
Type of Street Lamp	Quantity	Watts per Lamp	Total, MWh	Emissions, tCO2-eq	Total, MWh	Emissions, tCO2-eq
HPS	3,000	70	924	642.18	1,192	828.4
MH	15,000	250	16,500	11,467.50	21,285	14,793
MH	15,000	125	8,250	5,733.75	10,642.5	7,396.5
LED	5,860	85	2,192	1,523.44	2,828	1,965.5
Total			27,866	19,366.87	35,947.5	24,983.4

Emission Factor for Electricity Consumption: 0.695 tCO2-eq/MWh
Annual consumption x BAU coefficient 1.29 for the base year of 2018

2.4 Transport

The transport sector in the city includes only road transport with subcategories such as the municipal fleet as well as private and commercial transport though there are no public transport services in the city. According to the municipality, the municipal fleet is comprised of 57 vehicles and includes passenger vehicles, light trucks, medium to large trucks, construction machinery, and other vehicles. The fuels used for the municipal fleet are gasoline and diesel.

Regarding private cars, their fuel consumption is calculated by the municipality based on the total numbers of cars in the region, the average distance travelled, and the average consumption per kilometre for each type of vehicle. The same approach is used for the commercial vehicles. Based on the numbers provided by the municipality, the table below presents the estimated data for annual diesel and gasoline consumption:

Table 11: Municipal, Private, & Public Transport Fuel Consumption & CO2 Emissions

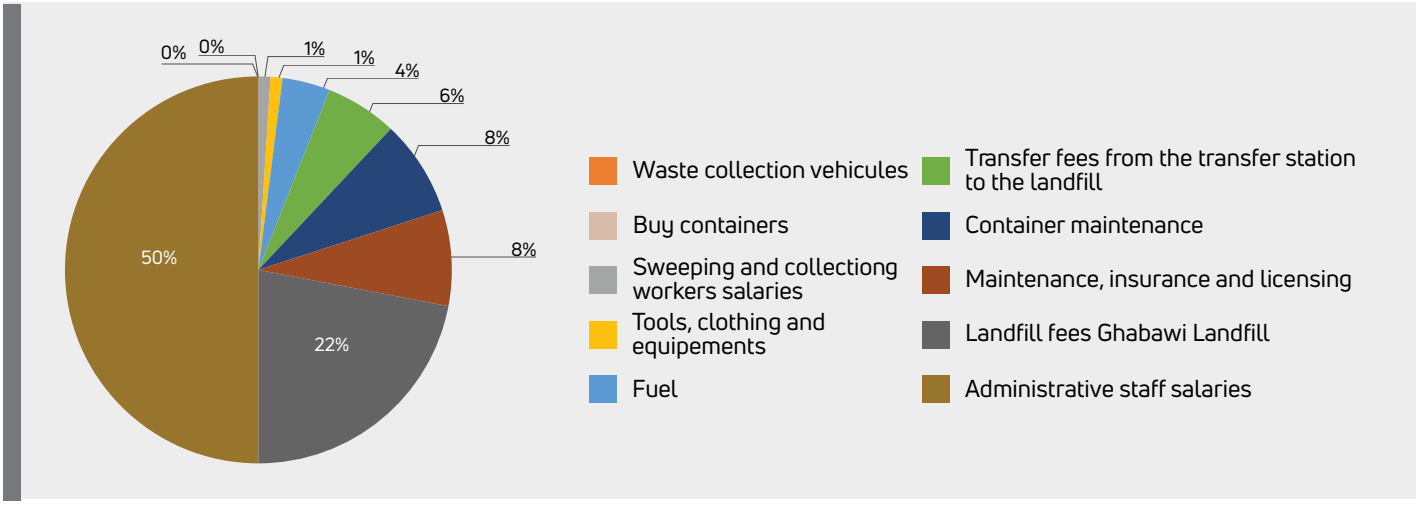
Municipal, Private, & Public Transport Annual Fuel Consumption & CO2 Emissions						
Fuel Type	Municipal Fleet, litres	Private Transport, litres	Public Transport, litres	Fuel Consumption, litres	Fuel Consumption, MWh	Annual Emissions, tCO2-eq
Diesel	**1,248,827**	**44,981,876**	**0**	**46,230,703**	**462,307.03**	**123,898.28**
Gasoline	**31,200**	**30,095,102**	**0**	**30,126,302**	**277,161.97**	**69,290.49**
Total				**76,357,005**	**739,469.00**	**193,188.77**

Emissions factor for diesel is 0.268 tCO2-eq/MWh; emissions factor for gasoline is 0.25 tCO2-eq/MWh
Conversion factor for diesel is 0.010 MWh/L; conversion factor for gasoline is 0.0092 MWh/L

Transport for solid waste management (SWM)

The municipality collects and transfers solid waste using different types of garbage vehicles which consumes significant diesel. The municipality produces 180,000 tons annually of solid waste, 500 tons daily, at an annual cost of JOD 10,790,750 (EUR 13,488,437.50) – and is steadily increasing due to increasing population. The average waste produced per person in the city is around 0.533 kg per day. The solid waste produced by the city is 57% organic waste and 43% other materials based on Jordan Green building council report..[1]

Figure 3: Solid waste management cost analysis



The fuel cost for the collection and transfer of solid waste to the landfill is around JOD 480,000 and uses 1,066,666.66 litres of diesel fuel (JOD 0.45 per litre in 2018).

[1] https://mena.fes.de/fileadmin/user_upload/pdf files /publications/Your_Guide_to_Waste_Management_in_Jordan.pdf

The table below shows the annual fuel consumption and emissions for collection and transport of the city's waste:

Table 12 Transport Emissions from Solid Waste Management

Annual Solid Waste Garbage Vehicles Fuel Consumption & CO2 Emissions				
Municipality	Vehicles	Diesel/a	Consumption, MWh	tCO2-eq
Al Zarqa	69	1,066,666.66	**10,666.66**	**2,858.66**

Table 13 Total Transport Emissions

Sector	Fuel Consumptions (MWh)	Emissions, tCO2-eq
Municipal Fleet	12,775.3	3,418.6
SWM Fleet	10,666.7	2,858.7
Private Cars/Trucks	726,693.7	189,770.2
Total	**750,135.7**	**196,047.5**

2.5 Solid Waste Landfill Emissions

The city collects its solid waste through a municipal service which transfers the garbage to the Al Ghabawi landfill.
Converting organic waste to compost is one solution for 57% of the municipality's waste. Composting is the process of controlling biological maturity under aerobic conditions where the organic matter is decomposed into materials with shorter molecular chains more stable, hygienic, and beneficial for agriculture and for recycling of organic soil matter.

At the solid waste disposal sites (SWDS), the degradable organic carbon in waste is decomposed by bacteria under anaerobic conditions into methane (CH4) and other compounds. The CH4 emissions from SWDS are important contributors to global anthropogenic CH4 emissions.

This report uses the IPCC default method of a simple mass balance calculation which estimates the amount of CH4 emitted from the SWDS assuming that all CH4 is released the same year in which the waste is disposed. The equation below calculates the landfill emissions and can also estimate emission reductions. This method is simple and emission calculations require only input of a limited set of parameters for which the IPCC Guidelines provide default values, where country-specific quantities and data are not available:

Methane emissions (Gg/yr) = (MSWT x MSWF x MCF x DOC x DOCF x F x 16/12-R) x (1-OX)

Where:

MSWT: total MSW generated (Gg/yr)

MSWF: fraction of MSW disposed to solid waste disposal sites (assumption 80%)

MCF: methane correction factor (fraction), 0.6 as general default value.

DOC: degradable organic carbon (fraction) (kg C/ kg SW)

$$DOC = (0.4 \times A) + (0.17 \times B) + (0.15 \times C) + (0.3 \times D)$$

Where:

A = Fraction of MSW that is paper and textiles

B = Fraction of MSW that is garden waste, park waste or other non-food organic putrescibles

C = Fraction of MSW that is food waste

D = Fraction of MSW that is wood or straw

The table below analyses the landfills in Jordan:

Table 14: Analysis of waste composition in landfils in Jordan[2]

Material	Percentage of waste
Paper and cardboard	15%
Plastic	15%
Metal	2%
Glass	2%
Wood	1%
Clothes	1%
Organic Materials	57%
Other Materials or Residues	7%
Total	**100%**

$$DOC= (0.4 \times 0.15 + (0.17 \times 0) + (0.15 \times 0.57) + (0.3 \times 0.01)$$
$$DOC= 0.1485$$

DOCF: fraction DOC dissimilated; The IPCC default value is 0.77

F: fraction of CH4 in landfill gas (IPCC default is 0.5)

16/12: conversion of C to CH4

R: recovered CH4 (Gg/yr). The default value for methane recovery is zero

OX: oxidation factor (fraction); IPCC default is 0

The results:

Methane emissions (Gg/yr) = (180 Gg x 0.8 x 0.6 x 0.1485 x 0.77 x 0.5 x 16/12-0) x (1-0))

Methane emissions (Gg/yr) = 6.586272 Gg/yr

Methane Emisssions, Gg/yr	Methane Emisssions, tCO2-eq/a	2030 BAU, tCO2-eq/a
6.586272	6.586272*1000*25= 164,656.8	164,656.8*1.29= 212,407.3

By 2030 it is projected the waste produced will reach 232,200 tons and produce emissions of 212,407.3 tCO2-eq based on the business-as-usual scenario developed by JRC, so it is important to consider waste as one of the city's priority projects.

2.6 Final Emissions from Fossil Fuels & Non-related Energy Activities

The total energy consumption in the territory of the local authority is the sum of electricity consumption and fuel consumption:

Table 15: Emissions from Fossil Fuel & Non-Energy Activities (2018)

Emissions from Fossil Fuel & Non-Energy Activities in 2018		
Sector	**MWh**	**tCO2-eq**
Buildings, Equipment, & Facilities	**1,455,961.5**	**730,336.4**
Municipality	1,690.1	1,174.6
Residential	1,382,172.2	684,955.1
Tertiary	72,099.2	44,206.7
Transport	**750,135.7**	**196,047.5**
Municipal Fleet	12,775.3	3,418.6
Private Cars/Trucks	726,693.7	189,770.2
SWM Fleet	10,666.7	2,858.7
Public Lighting	**27,866.0**	**19,336.9**
SWM Landfill	**0.0**	**164,656.8**
Total	**2,233,963.2**	**1,110,407.6**

A breakdown of the emissions per sector is presented in the figures below.

Figure 4: *Overview of total emissions breakdown by sector*

Figure 5: Overview of emissions breakdown in the building sector

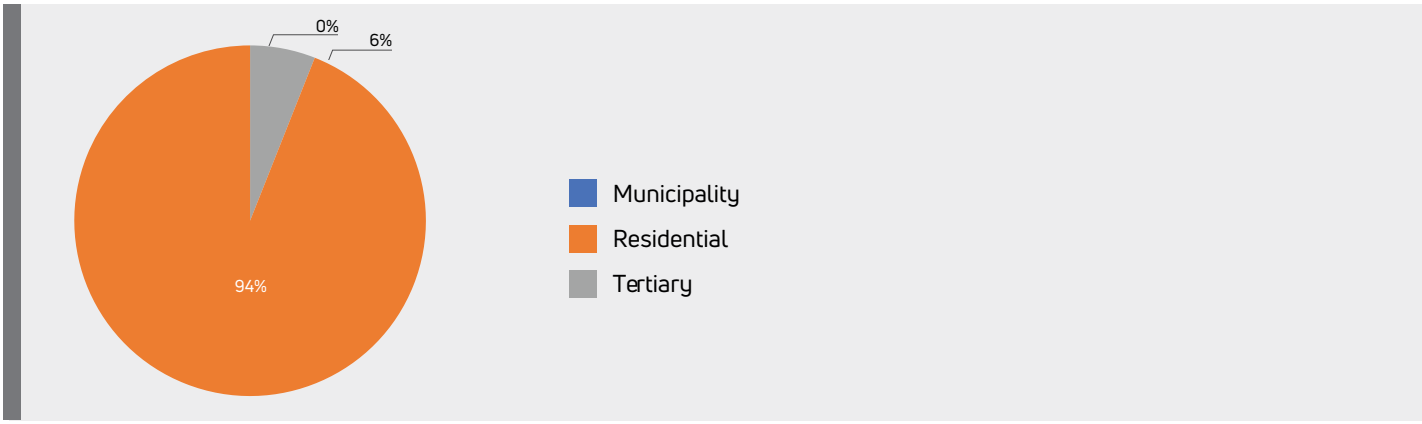
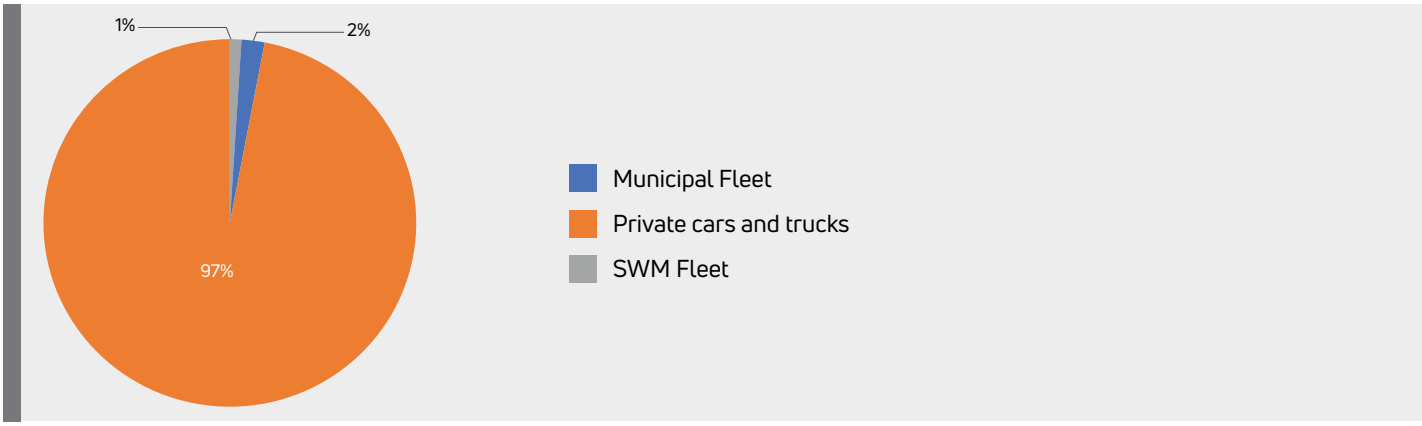


Figure 6: Emissions breakdown in the transport sector



2.7 BAU Scenario & 2030 Targets

According to the methodological approach and guidelines for the MENA region, developed by JRC, an NDC-BAU coefficient has to be utilized for the calculation of the BAU scenario emissions.

The NDC-BAU (KNDC BAU) coefficient indicates the relative projected increase in GHG emissions between the base year and the target year. To obtain the GHG emissions projected for the target year, the emissions in the base year have to be multiplied by the national coefficient KNDC-BAU according to the following formula:

Emissions Target year = Emissions BEI * K NDC BAU

For the year 2018, the KNDC BAU coefficient for Jordan is 1.29.

The table below illustrates the municipality's projected emissions by 2030:

Table 16: Emissions CO2-eq as BAU Scenario & 2030 Target

Municipality final energy and non-energy activities			BAU 2030
Sector	**MWh**	**tCO2-eq**	**tCO2-eq**
Buildings, Equipment, & Facilities	1,455,961.5	730,336.4	942,134.0
Municipality	1,690.1	1,174.6	1,515.2
Residential	1,382,172.2	684,955.1	883,592.1
Tertiary	72,099.2	44,206.7	57,026.6
Transport	750,135.7	196,047.5	252,901.3
Municipal Fleet	12,775.3	3,418.6	4,410.0
Private cars and trucks	726,693.7	189,770.2	244,803.6
SWM Fleet	10,666.7	2,858.7	3,687.7
Public Lighting	27,866.0	19,336.9	24,983.3
SWM Landfill Emissions		**164,656.8**	**212,407.3**
TOTAL	**2,233,963.2**	**1,110,407.6**	**1,432,425.8**

Annual Consumption x BAU Coefficient (1.29 JRC 2018)

3 Risk & Vulnerability Assessment

Chapter 3: Risk and Vulnerability Assessment

3.1 Introduction on climate change impact

The Mediterranean region is rich in a large variety of complex climatic phenomena caused by its morphology and its geographical location. The location of the Mediterranean Sea in a transitional band between subtropical and midlatitude regimes produces large climate variability at multiple timescales and a strong seasonal variability of precipitation in many areas (Lionello 2012). The Mediterranean has been identified as one of the most prominent "Hot-Spots" in future climate change projections (Giorgi 2006). The water cycle and its extremes are one of the major concerns as many countries are over exploiting the water resources – a problem expected to deteriorate in the future. Episodes of extreme precipitation are also taking place and disastrous floods are a major threat for the region and especially the coastal areas. Additionally, phenomena taking place especially in the Southern Mediterranean countries (such as cultivation of marginal land, overgrazing, and firewood harvesting) put more pressure on the environment (Lionello 2012).

The Mediterranean region has experienced drastic changes in its climate over the years and has shown large climate shifts in the past (Luterbacher, et al. 2006). Twenty thousand years ago, cold steppes (with sparse forests) extended from the south of Spain to the Caucasus. In the northern part of the Mediterranean basin, the temperature of the coldest month was 15°C lower than it is today (Peyron, et al. 1998). Less water was available for vegetation. Over the last 2,000 years, the climate over the Mediterranean has experienced a sequence of humid/dry and warm/cold periods impacting environmental conditions.

According to a 2008 EIB report, for the Mediterranean region climate experts anticipate during this century:

- An increase in air temperature in the range of 2.2°C to 5.1°C for the countries of Southern Europe and the Mediterranean region over the period 2080-2099 (compared with 1980-1999);
- A significant decrease in rainfall, ranging between -4 and -27% for the countries of Southern Europe and the Mediterranean region (while the countries of Northern Europe will report a rise between 0 and 16%);
- An increase in drought periods manifested by a high frequency of days during which the temperature would exceed 30°C. Extreme events (such as heat waves, droughts, or floods) are likely to be more frequent and violent; and
- An increase of the sea level which, according to some specific studies, could be around 35 cm by the end of the century.

Giannakopoulos et al. (2005) underlines that in line with the results of the projection scenarios, the most significant temperature increases this century are expected in Eastern Egypt and especially the Nile Delta, Lebanon, Israel, Palestine, and the Maghreb. It is therefore evident that the more vulnerable Mediterranean areas will be those of North Africa adjacent to desert areas, the major deltas (such as the Nile Delta), the coastal areas (northern rim and southern rim of the Mediterranean basin), as well as the high-demographic growth and socially vulnerable areas (southern and eastern rim, densely populated cities and suburbs).

In the Mediterranean region, 50% of the urban population lives at an altitude of less than 10 meters above sea level – areas vulnerable to sea level rise. Additionally, tourist destinations in these areas are vulnerable not only due to the sea level rise, but also due to the temperature increase encountered (Plan Bleu 2009).

The impacts of climate change on the Mediterranean environment will relate particularly to (EIB, 2008):

- Water, via a change of its cycle due to a rise in evaporation and a decrease in rainfall. This water problem will be of crucial importance regarding sustainable development in the region;
- Soil, via the acceleration of already existing desertification phenomena;
- Land and marine biological diversity (animal and plant), via a displacement northward and in the altitude of certain species, extinction of less mobile or more climate sensitive species, and emergence of new species; and
- Forests, via a rise in fire hazards and parasite risks.

These impacts will exacerbate already existing pressures on the natural environment connected with anthropogenic activities, such as agriculture and fishery (reduction of yields), tourism attractiveness (heat waves, water scarcity), coastal areas and infrastructures (significant exposure to the action of waves, coastal storms and other extreme weather events, sea level rise), human health (heat waves), and the energy sector (water needs for power plants, hydropower, and increased consumption).

This all indicates southern and eastern Mediterranean countries appear to be more vulnerable to climate change than the northern Mediterranean countries.

Indeed, they are, on the one hand, more exposed to accelerated desertification, soil aridity and water scarcity and, on the other hand, presenting economic structures that are more strongly dependent on natural resources as well as relying on technical and financial capacities too limited to implement large-scale adaptation options (EIB 2008).

The Mediterranean, especially the Maghreb and Mashreq countries, is and will be more affected by climate change than most other regions of the world during the 21st century. The impacts from the rise in temperatures, the decrease in rainfall, the multiplication of the number and intensity of extreme events and the possible rise in sea level overlap and amplify the already existing pressures of anthropogenic origin on the natural environment.

Through the crucial issue of scarcity of water resources, their impacts are fraught with consequences in the 21st century for human activities, in particular agriculture, fishery, tourism, infrastructure, urbanised coastal areas, and hydropower production. To minimize as much as possible the economic losses and damages, several adaptation options must be thought out and implemented.

Energy lies at the heart of the climate change issue. On one hand, it is the main GHG emitting sector, and CO2 emissions in the future are likely to increase much more rapidly than the global average. On the other hand, hydropower production—relatively significant in certain countries (13% of power production in the Maghreb and Mashreq countries)—is affected by the climate as well as by the plant cooling constraints. Lastly, the energy demand (in particular, electricity) which is growing at a very high pace in the region, is likely to be further accelerated by the additional demand necessary to lessen the impacts of climate change (water desalination, air-conditioning of buildings, etc.).

3.2. National & Regional Strategy on Climate Change Adaptation

3.2.1 National Level Commitments

Jordan ratified Kyoto Protocol on 17 January 2003. The Kyoto Protocol, an international treaty which extends the 1992 United Nations Framework Convention on Climate Change (UNFCCC), commits state parties to reduce greenhouse gas emissions, based on the premise global warming exists and human-made CO2 emissions have caused it.

The Kyoto Protocol implemented the UNFCCC objective fight global warming by reducing greenhouse gas concentrations in the atmosphere to "a level that would prevent dangerous anthropogenic interference with the climate system". The Protocol is based on the principle of common but differentiated responsibilities. It puts the obligation to reduce current emissions on developed countries as they are historically responsible for the current levels of greenhouse gases in the atmosphere.

Jordan submitted its Nationally Determined Contribution (NDC) with a new climate action plan to the UNFCCC in advance of a new universal climate change agreement. The agreement went into effect in 2020, empowering all countries to act to prevent average global temperatures rising more than 2°C and to reap the many opportunities arising from a necessary global transformation to clean and sustainable development.

3.2.2 Jordan's NDC Summary

Jordan is determined to reduce its greenhouse gas emissions 31% by 2030. Jordan can achieve an unconditional 5% reduction, but conditionally, it can achieve an additional 26% with the adaptation actions proposed for the targeted sectors.

3.2.3 National Strategy – Goals, Commitments, Sectors

In 2009-2013, Jordan conducted "Adaptation to Climate Change to Sustain Jordan's MDG Achievements," a major joint program for the water and health sector. The program's outcomes were to develop sustained access to improved water supply sources despite increasing water scarcity due to climate change and to strengthen the capacity for health protection and food security under water scarcity.

Afterwards, Jordan developed its National Climate Change Policy of 2013-2020. The policy set advanced concrete strategic objectives, measures, and instruments to adapt the country to climate change impacts in each involved sector (water, coastal areas, agriculture/food security, health, tourism, biodiversity, and socioeconomic situation/poverty).

Moreover, the country mainstreamed climate change in its National Strategy and Action Plan to Combat Desertification (2015-2020) which was recently aligned with the United Nations Convention to Combat Desertification (UNCCD) 10-year strategy. Jordan also mainstreamed climate change into the National Biodiversity Strategy and Action Plan (2015-2020) which was also recently aligned with the global Convention on Biological Diversity (CBD) 10-year strategy.

Also, the long-term "Jordan 2015 National Vision and Strategy" was set. It charts a path for the future and determines the integrated economic and social framework that will govern the economic and social polices based on providing opportunities for all.

In line with the Jordan 2015 vision, the **Jordanian Sustainable Consumption and Production National Action Plan (2016-2025) (SCP-NAP)** is mainstreaming sustainable consumption and production into agriculture/food production, transport, and waste management.

Jordan's SCP-NAP address key human activities which have a particular impact on the Jordanian environment including marine and coastal areas (albeit the very limited coastline) and related transversal and crosscutting issues. It defines common objectives and identifies actions guiding the implementation of the Sustainable Consumption and Production (SCP) at the national level.

As a first step is a shift to sustainable patterns in the three priority areas of consumption and production. Such mainstreaming processes will be designed according to:

1. The harmonization between the provisions of Jordan's 2025 National Vision and Strategy (2015) and the actions and instruments of the SCP-NAP plan;

2. Their relevance in the main framework of the Barcelona Convention and its Protocols;

3. Their contribution as mainstream drivers of pollution generation and environmental pressures on the national environment, marine and coastal ecosystems; and

4. Their contribution to the Mediterranean economies and to social well-being.

3.3 Climate Data & Climate Projections

Jordan's Third National Communication on Climate Change report identifies some climate projections and scenarios. Based on historical data obtained from the Jordan Metrology Department (JMD), climatic variables are changing significantly at both the national and station level, indicating climate change is becoming more apparent. Both the Mann-Kendall rank trend test and linear regression trends indicate annual precipitation tends to decrease significantly with time at a rate of 1.2 mm per year. Simultaneously, the mean, maximum, and minimum air temperature tends to increase significantly by 0.02, 0.01, and 0.03 °C/year, respectively. The relative humidity tends to increase significantly by an average of 0.08%/year, while class A-pan evaporation seems to have non-realistic estimations decreasing significantly by 0.088 mm/year.

The number of days of dust storm tends to decrease significantly by 0.09 days/year and 0.06 days/year for visibility less than 1km and 5km. Additionally, the historic data tested on both an annual and monthly basis indicated precipitation reduction is highly significant during the whole rainy season except for January. Similarly, during the dry seasons of June, July, and August, the precipitation has tended to increase over time, although this increase is considered negligible in its quantity as indicated by the magnitude of the slope. Interpolated spatial maps show the locations of these changes to be more apparent at both northern and southern parts. (Environment-Jordan 2014)

Also the report mentions future dynamic projections predict extremely likely warmer summers compared to other seasons, more extremely likely heat waves where the analysis of summer temperatures, monthly values, and the inter-annual variability reveal some thresholds could be exceeded especially for a summer month where the average maximum temperature for the whole country could exceed 42-44°C. Drought events are likely predicted as indicated by the two indices of consecutive dry days and SPI. The maximum number of consecutive dry days would likely increase in the reference model by more than 30 days for 2070-2100.

The municipality is located north-east of the capital, Amman, and it is considered both a local and international transportation node. Al-Zarqa has semi-arid climate characteristics with hot dry summers followed by cool winters and receiving around 180mm annual precipitation in winter months.

The dry summers and low annual rainfall have created a water crisis in the country directly impacting drinking water, agriculture, health, and the economy.

Moreover, in late winter and early spring, Zarqa suffers from floods that have a direct impact (some life threatening) on agricultural lands, Infrastructure, and apartment buildings.

The climate change process requires climate adaptation projects to bridge the gap in various sectors, the most important of which is the water sector and its impacts on the other sectors.

3.4 Climate Change Vulnerability Analysis & Risk Assessment

The main climate hazards the municipality faces are extreme heat, extreme precipitation, and droughts. As mentioned above, the municipality is already dealing with these issues, which are expected to be aggravated in the short-term. These climate hazards affect a number of sectors, such as public health, infrastructure (transport, building, water), as well as the local economy, especially as concerns agriculture. The vulnerability analysis conducted is presented in the table below:

Table 17: Vulnerability Analysis

Vulnerability Analysis				
Receptors		Extreme Weather Event	Potential Impacts	Who/What Impacted
Population	Public Health	Extreme heat	Deaths due to cardiovascular diseases	Everyone, especially elderly, babies, children, workers in outdoor environments, sensitive groups
			Spread of vector-borne & infectious diseases	
			Altered allergic pattern	
			Heat stress	
		Forest fires	Deaths due to cardiovascular diseases	Firefighters, people living around burned areas
			Increased respiratory-related diseases	
Infrastructure	Transport	Extreme heat	Damaged road network	Roads, people mobility
			Changed behaviour patterns	
			Air quality problems	
			Higher maintenance costs	
	Energy	Extreme heat	Altered electricity peaks/demands	Electricity providers and consumers
			Cooling problems	
			Reduced efficiency yield from conventional power plants & distribution grids	
			Higher maintenance costs	
	Water	Extreme heat	Higher water demand	Public health, water infrastructures
			Water quality issues	
			Higher maintenance costs	
		Forest fires	Altered water quality	
	Social	Extreme heat	Higher electricity demand to cover cooling needs	Hospitals, schools, public places, municipal facilities/ infrastructure, athletic facilities
			Changes in behaviour patterns (e.g., living outdoors)	
			Increased patients burdening health care facilities	
Built Environment	Building Stock & Material	Extreme heat	Damaged concrete	All building infrastructure
			Increased cooling demands	
			Higher maintenance costs	
			Urban heat island effect	

Table 17: Vulnerability Analysis

Vulnerability Analysis				
Receptors		Extreme Weather Event	Potential Impacts	Who/What Impacted
Economy	Tourist	Extreme heat	Increased demand for cooling	Tourists, tourist infrastructure, tourist-related economy
			Lower tourist flows during impacted seasons	
			Higher water demand	
	Agriculture	Extreme heat	Changed growth cycle	Farmers, food industry, consumers
			Damaged/lost harvest	
			Livestock loss & health impacts	
			Lower crop yields	
		Forest fires	Decreased crop quality	Farmers, food industry, consumers
			lost crops	
			Lower crop yields	
			Decreased productivity	
			Lost crops	
Biodiversity	Green Zones & Forests	Extreme heat	Fires and destruction of the ecosystem, flora, and fauna	Ecosystem
		Forest fires	Lost green areas	Ecosystem

In the table below, the municipality's risk assessment outlines the impact of each climate hazard on the sectors identified above:

Table 18: Risk Assessment

Receptors		Weather Sensitivity	Future Risk	Impact
Population	Public Health	Extreme heat	Increased deaths	High
			Reinforced heat stress	
			Increased infectious diseases	
			Altered allergic patterns	
		Forest fires	Increased respiratory & cardiovascular diseases	Medium
			Increased spread of infectious diseases	
Infrastructure	Transport	Extreme heat	Damaged road networks	High
			Modified transport frequency & means	
			Air quality problems	
			Higher maintenance costs	
	Energy	Extreme heat	Blackouts & inability to cover demand load	High
	Water	Extreme heat	Water scarcity	Medium
			Water quality issues	
		Forest fires	Altered water quality	Medium
	Social	Extreme heat	Increased need for air-conditioned spaces	Medium
Built Environment	Building Stock & Material	Extreme heat	Damaged concrete	Low
			Increased cooling demands	
			Higher maintenance costs	
			Urban heat island effect	
Economy	Tourist	Extreme heat	Changed tourism season, less tourists	Medium
			Reduced tourism-related economy	
	Agriculture	Extreme heat	Changed growth cycles	High
			Damaged/lost harvest	
			Lost livestock & health impacts	
			Lower crop yields	
			Increased fire risks	
		Forest fires	Lost crops	Medium
Biodiversity	Green zones & forests	Extreme heat	Destroyed ecosystem, flora, & fauna	Medium
		Forest fires	Increased loss of green areas	Medium

4 Capacity Building & Local Governance

Chapter 4: Capacity Building and Local Governance

Developing Capacity for Local Governance

The municipality is disproportionately affected by climate change primarily due to its exposure to impacts as well as various constraints in resources. Local governance suffers from lack of technical know-how, financial and human resources, inflexible legislation and inective monitoring mechanisms – all of which prevent optimal climate change adaptation.

Developing capacity for local governance is essential to ensure the ownership, update and all-encompassing implementation the SEACAP by the local authority.

Action

The development of SEACAP handling capacity cannot be undertaken individually by a municipality. This is to be part of a joint, mutual, interactive, and committed proceedings that involves several climate change local, national, and global actors; and would be part of wide ranged national local development engagement.

In such configuration, focus will be on formulating and accomplishing a Capacity Building National Programme to raise the SEACAPs' implementation capacities of cities that prepared them (and partly those that are planning to prepare theirs), in synergy with a SEACAP Support Mechanism, which principally associates national authorities that are responsible for NDC implementation and regional authorities (Governorate and Districts).

The first step is the identification of local capacity building needs, including specific skills to develop; and the organisational set up to consolidate and apply. After which, the methodology to employ would be broadly based on:

- Human resource development (HRD), which is the process of equipping the municipal team (and its partners from above national and regional actors) with the needed understanding of the SEACAPs and skills to implement it, with access to the necessary information and knowledge to fulfil this task. Some of the knowledge and skills required to carry out these tasks may be readily available. Others, such as working with the financial sectors will need to be developed before they can be applied.

- Instituting the organisational structure to appropriate, update and implement the SEACAP, which is the process to get things done collectively within the municipal orderliness. It is to do with management practices and procedures, rules and regulations and job descriptions. This also deals with legal and regulatory institutional changes that must be made and generally needs the patronage of national government legislative and executive authorities.

- Associating community-based organisations and/or local NGOs, as they rank very close to formal local government in correlating priorities for capacity building, next to their role in mobilizing communities towards implementing the SEACAP.

Policies' support is necessary to bring about the proposed Capacity Building National Program, which necessitates to overcome constraints caused by outdated legislations, restrictive practices, outmoded equipment, and inappropriately trained staff; and to 're-tool' the local authorities, their national partners, enterprises and citizens to enable them to initiate and sustain the SEACAP operations, and to motivate and associate best professionals, technicians and managers[3]..

There are situations, however, where the private sector - notably SMEs - need assistance in the form of training-guidance to best practices, next to application of legislative deregulation and provision incentives to enter the climate action market.

In the proposed Program context, the roles and practices of training establishments (e.g. universities, vocational training centres) would be reviewed and re-defines, leading to the development of a 'demand-led' training institutions that can support areas related to urban development planning and management in general and climate actions in particular. Their role is to go well beyond the traditional conduct of training or the design of performance improvement programmes. It must be much more proactive, assisting local authorities to initiate and implement managerial and, where necessary, structural changes, that will enable them to operate effectively in the context of the SEACAPs.

The operation of the proposed program, which would target municipalities that prepared the SEACAPs, will be addressed with both the NCG and the municipalities along the continuity of Clima-Med project (2022-2025).

Local policies wise, the proposed Capacity Building Program and the SSM would support enhancing the capacity of the municipality to:

-promote and if feasible undertake SEACAP's investments in municipality-owned assets, and set Public Private Partnerships (PPP), such as in energy efficiency and local energy generation based on renewable energy sources

- associate different partners in the processes;

- decide upon and provide, when feasible, climate action oriented urban services;

- select and/or influence over infrastructure development, first and foremost as prescribed in the SEACAP;

- influence and lay down supportive climate-related urban planning regulations.

[3] https://www.urbanet.info/tag/governance-2/

To apply public procurement that is green, sustainable, energy efficient and thus climate action, first and foremost, in SEACAPs and municipal actions to design, construct, and manage SE buildings, energy consuming equipment (HVAC, vehicles, and electrical equipment), and to the purchase of energy (e.g., electricity, gas) and to practices such as lifecycle costing, setting of minimum energy-efficiency standards, and use of energy-efficient criteria in the tendering process

As explained in detail in Chapter 7 of this SEACAP, the proposed Capacity Building Program and the SSM would support enhancing the municipality on the following:

- Web-based platforms, whose popularity is growing.
- Online tools to calculate CO2 reduction or energy savings estimations.
- Make use of databases containing examples of energy efficiency applications.
- Promote or conduct events related to SEACAP's actions, such as Energy Days and Info Points.

5 Mitigation Actions

Chapter 5: Mitigation Actions

5.1 Buildings, Equipment, & Facilities

The building sector accounts for a big share of the overall CO2 emissions in a city; thus, it is essential to take specific measures to mitigate these emissions. This section proposes a set of actions applied to the three essential pillars of the building sector – municipal, residential, and tertiary.

5.1.1 Existing Municipal Buildings: Consumption Saving Measures

Background

The municipality has 21 buildings under its direct control and management consuming 1,690.09 MWh per year (2018) producing 1,174.61 tCO2-eq of emissions. The commitment of the municipal council in mitigating emissions through energy saving projects in municipal buildings and facilities will be a role model at the local level. These set of measures will enable the municipal staff to acquire the needed expertise in implementing energy efficiency actions and promoting the green economy at a local level..

The table below lists the buildings managed by the municipality:

Building	Area, m2
First Area	560
Second Zone	110
Eighth District	390
Main Municipal	1,350
Municipal Market	7,000
Alor Market	3,300
Sword Market	6,300
New Vegetable Market	1,557.6
Central Maintenance	250
Popular Market	720
New Complex - Popular Market	1,026
Hashemite Hall	415
Central Movement Positions	1,064
Central Vegetable Market	3,091
Municipal Stadium	1,000
Sharif Hussein Hall	550
Sixth Region	250
Home Products Fair	1,042
Container Factory	1,000
King Abdullah Complex	
Tenth District	
Stores	

Mitigation

MWh/a	t CO2-eq /a
504.49	350.62

Total Consumption Contribution
29.85%

Implementation Cost
N/A

Stakeholder Involvement		
	LA	H
	External	L
	Other	L

Staff Capacity			
	L	M	H

Implementation Years

Key Performance Indicator
Energy cost

Measurement Units
MWh

Intervention Area
Energy efficiency

Policy Instrument
Awareness raising

Action Origin
Local authority

Action Priority

Below are the municipality's proposed energy efficiency actions:

Actions

Mapping the behaviour of energy consumption in municipal buildings along with energy audits identifies the basic measures to implement leading to energy savings.

Behavioural change through optimal use of energy and consumption savings measures leads to achieve a material amount of savings.

Energy audits are a useful tool for providing information needed to analyse current consumption and implement energy efficiency measures through long-term energy management.

Indicators will quantify the cost of implementing the measures. First, the municipality should assign an energy engineer able to lead the development of measures, identify the steps of implementation, and monitor the results.

Measures to be taken by the municipality are:

- Assign an energy expert to lead the work in municipal buildings as an energy performance advisor. With the expert, the municipality will set its vision and energy saving targets.
- Conduct energy audits in municipal buildings and facilities to identify the source of consumption, then list the measures reducing it and quantify the budget required.
- Identify the source of funding, and apply the measures and monitor the implementation with the energy expert.

The indicative measures may vary between measures reducing consumption and those improving energy efficiency and can be divided into short-term actions and long-term actions:

Short-term actions:

Implementing consumption saving measures, such as turning off the lights after leaving; using natural lighting whenever possible; using office equipment (PCs, printers, etc.) efficiently; adjusting air cooling and heating units according to the thermal calendar; and maintaining equipment and appliances.

Long-term actions:

Using high efficiency equipment through green procurement; replacing old office appliances with new highly efficient ones; using motion sensors in public places such as halls, bathrooms, and stairs; Retrofitting existing lighting with more efficient types such as LED lighting (this could be applied upon the end of existing lamp life); and improving roof and wall insulation.

Financial analysis

In the table below, the calculations for energy savings are presented based on assumptions which can be verified and revised at the time of implementation. Concerning the share of electricity consumption per the original source of consumption, the calculation assumes lighting is 25% of municipal consumption; heating, ventilation, and air-conditioning (HVAC) 40%; and equipment and appliances 35%.

	Assumed Consumption Estimate	Action Period	Proposed Actions	Energy Savings Calculations Assumption	Annual Energy Savings
Electricity Consumption 1,690.09 MW	Artificial lighting accounts for 25% of municipal buildings' electrical consumption	Short-term	- Turn off the lights after leaving - Use natural lighting	5%	25% * 5% * 1,690.09 = 21.13 MWh
		Long-term	- Install motion sensors for controlling lights in public places	1%	25% * 1% * 1,690.09 = 4.23 MWh
			- Replace existing bulbs with efficient alternatives (e.g., LEDs)	50%	25% * 50% * 1,690.09 = 211.26 MWh
	Equipment accounts for 35% of municipal buildings' electrical consumption	Short-term	- Use office equipment (PCs, printers, etc.) efficiently	1%	35% * 1% * 1,690.09 = 5.92 MWh
		Long-term	- Use high efficiency equipment through green procurement	10%	35% * 10% * 1,690.09 = 59.15 MWh
	HVAC accounts for 40% of municipal buildings' electrical consumption	Short-term	- Adjust air cooling and heating units according to the thermal calendar - Maintain equipment and appliances	30%	40% * 30% * 1,690.09 = 202.81 MWh
				Calculated Energy Savings	**504.49 MWh/a**

Energy saving (MWh) = Electricity consumption (MWh) x consumption per original source of consumption (%) x Energy savings based on assumptions (%)

The monetary energy savings have been calculated according to the energy costs at the time of preparing this report.

The energy savings have been calculated against the BEI consumptions and emissions for this category, although they are expected to be significantly more. The energy consumption of the existing buildings will increase and partly contribute to the BAU increased emissions, due to the more intensive use of the buildings, their further expansion etc. Such estimations will be more accurately depicted in future updates of the SEACAP. The energy savings have been calculated against the BEI consumptions and emissions for this category, although they are expected to be significantly more.

The energy consumption of the existing buildings will increase and partly contribute to the BAU increased emissions, due to the more intensive use of the buildings, their further expansion etc. Such estimations will be more accurately depicted in future updates of the SEACAP.

Expected funding resources:

- Total annual energy savings is around 1,690.09 MWh (at JOD 150/MWh), amounting to around an energy cost of approximately JOD 253,513.50 (EUR 304,216.20).
- Budget: The calculated cost for this action is considered low and mainly focuses on the conduction of energy audits, the adoption of low cost measures and the promotion of behavioural change, applying green procurement and following the manufacturer's recommendation on the operation and maintenance of equipment. The budget will be covered by the city's resources.
- Climate cost efficiency: If these measures are implemented by 2025, the expected abatement generated is 350.62 tCO2-eq/a accounting for 2,104 tCO2-eq until 2030. (The climate cost efficiency is equal to the implementation cost divided by the abatement according to the Paris Agreement.)
- Energy savings will approximately reduce the annual bill by EUR 90,808.20, representing 29.85% of annual consumption costs.
- Source of finance: Most of the actions in municipal buildings can be achieved at an affordable cost to the city. The expected funding resources will come from the municipal budget.

Energy Source	Consumption, MWh	Annual Energy Savings, MWh	Annual Savings, EGP (EUR)	Emissions Mitigation, tCO2-eq
Electricity	1,690.09	504.49	150*504.49 = JOD 75,673.50 (EUR 90,808.20)	504.49*0.695= 350.62

Annual savings = Annual energy savings (MWh) x cost of electricity (JOD 150/MWh)

5.1.2 New Municipal Buildings: Implementing & Promoting the Green Building Code

Background

The building sector is the leading contributor to energy consumption and represents the main area to be addressed in the SEACAP.

Green building practice goes beyond enacting legislation. Introducing a new buildings code provides incentives for the environmentally friendly green buildings which conserve energy and rationalize consumption.

Energy consumption in the municipal buildings sector reached 1,690.09 MWh in 2018 and is expected to increase by 2030 to 2,180.2 MWh.

Currently, there is no obligatory legislation in the country, although it is a topic under consideration. The municipality will work nevertheless towards applying green building practices in the new buildings planned. The suggested measures vary between applying green building codes on new buildings; using renewable energy; using electricity and water-saving appliances; insulating buildings; and greening areas surrounding the buildings by growing plants requiring minimal water.

Energy efficiency processes can be applied to design, renovation, operation of buildings.

Assuming that the additional consumption within the BAU scenario will be originating to approximately 80% from new buildings, these practices are estimated to reduce the BAU energy consumption and emissions by approximately 30%, as presented in the table below.

Mitigation			
MWh/a		tCO2/a	
117.6		81.8	
Total Consumption savings			
5.4%			
Implementation Cost			
Not identified			
Stakeholder Involvement	LA		H
	External		L
	Other		L
Staff Capacity	L	M	H
Implementation Years			
Key Performance Indicator			
Energy bill			
Measurement Units			
MWh			
Intervention Area			
Energy efficiency			
Policy Instrument			
Green building code			
Action Origin			
Local authority			
Action Priority			

ANNUAL ELECTRICAL CONSUMPTION OF MUNICIPAL BUILDINGS, EQUIPMENT, & FACILITIES

Site Category	2018 Consumption, (MWh)	2018 CO2 Emissions, tCO2-eq	2030 BAU Consumption, MWh	2030 BAU Emissions, tCO2-eq	Energy increase between BEI & BAU years
Municipality Buildings, Annual Electricity	1,690.09	1,174.61	2,180.22	1,515.25	490.13

SAVINGS' CALCULATION FOR CONSUMPTION & EMISSIONS OF NEW MUNICIPAL BUILDINGS, EQUIPMENT, & FACILITIES

	New buildings' BAU consumption (MWh)	New buildings' BAU emissions (CO2 eq)	Savings due to bioclimatic building practices	Energy savings (MWh)	Emissions savings (CO2 eq)
Electricity	392.1	272.5	30%	117.6	81.8

Description of the action

Energy efficiency of buildings

Ten steps are suggested to improve the energy efficiency of buildings – and implies also adopting measures regarding both thermal and electric energy (e.g., reducing wall transmittance in the former and using efficient appliances in the latter). This approach needs the full adherence of relevant national authorities and the Governorate. It leaves ample freedom to designers while supporting them in adopting solutions involving local climate, culture, and materials:

1. Define the building objectives explicitly with a focus on thermal comfort.
2. Assess microclimatic factors and intervention the site layout and features which can affect indoor comfort.
3. Control the heat gains at the external surface of the building envelope.
4. Control and modulate heat transfer through the building envelope.
5. Control the internal gains from appliances and lighting.
6. Allow for local and individual adaptation.
7. Use passive means and strategies to deliver and remove thermal energy to/from the building.
8. Use HVAC systems assisted by natural (and renewable) energy sources.
9. Use high-efficiency active conventional cooling plants, if still necessary.
10. Train building managers and occupants on how to use, monitor the performance and adequately operate and maintain the building.

Indicative suggestions for improvement of the envelope and other aspects

One of the most common strategies for energy retrofit of buildings usually consists in reducing both thermal losses through the envelope and cooling loads and in controlling the solar heat gains.

The losses of energy through the envelope may be reduced by implementing several measures related to glazing and framing as well as wall and roof characteristics:

- Internal and external thermal insulation of walls reduces their transmittance values according to specific needs and the location of the buildings. Commonly used types of insulation in building construction include fibreglass, polyurethane foam, polystyrene foam, cellulose insulation, and rock wool, in addition to the traditional use of mud brick, which is now suitable only for rural buildings. These materials also reduce the effect of thermal bridges as well as improve sound insulation and thermal inertia.
- Abatement of cooling loads is achieved by reducing solar radiation penetration using shading devices such as movable devices controlled manually or automatically, or internal and external blinds helping to control lighting level and uniformity plus stopping solar radiation from penetrating a room.
- Increased energy performance of buildings is achievable by operating on the heating system. The overall efficiency of the space heating/cooling system includes the efficiency of the generator and the losses of distribution, emission, and inaccurate control systems.

General objectives

The aim of the actions undertaken by the municipality is to promote a green building code by raising awareness and guiding investment in energy efficiency measures in municipal buildings yielding energy savings.

Financial analysis

In the table below, the calculations for energy savings are presented based on assumptions which can be verified and revised at the time of implementation.

Energy Source	Consumption, MWh	Annual Energy Savings, MWh	Annual Savings, JOD (EUR)	Emissions Mitigation, tCO2-eq
Electricity	392.1	117.6	150*117.6= JOD 17,640 (EUR 21,168)	117.6 *0.695= 81.8

The monetary energy savings have been calculated according to the energy costs at the time of preparing this report.

Expected funding resources

- Total annual energy savings is around 117.6 MWh (at JOD 150/MWh) amounting to around JOD 17,640 (EUR 21,168).
- Budget: Further studies are needed to calculate the cost for this action which mainly focuses on applying green building code to new municipal buildings, promoting behavioural change, applying green procurement, and following the manufacturer recommendations on the operation and maintenance of equipment, all in coordination with the Governorate and central authorities.
- Climate cost efficiency: If these measures are implemented by 2027, the expected abatement generated is 81.8 tCO2-eq/a accounting for 327.2 tCO2-eq until 2030. (The climate cost efficiency is equal to the implementation cost divided by the abatement according to the Paris Agreement.)
- Source of finance: Most of the actions in the new municipal buildings can be achieved at affordable cost to the municipality. The expected funding resources are the municipal budget used to finance the construction of the new infrastructure.

5.1.3 Existing Residential Buildings: Awareness Raising Activities

Background

Citizen engagement is of utmost importance since almost the 61.9% of energy consumption is due to the residential sector. The municipality's role should support its citizens in reducing their energy consumption bills, increasing their living standards, and preserving local natural resources. Awareness campaigns can influence customer consumption patterns and modify purchasing behaviour towards more energy efficient products. The municipality can use licensed ads and publish them at different times and has the initiative and ability to raise awareness in collaboration with various governmental parties, communities, and residents.

The suggested measures may need to be applied in collaboration with national authorities and the Governorate.

The residential sector is responsible for 61.7% of the city's emissions, therefore it is important to encourage citizens to consider energy saving as the most important action at the household level.

Mitigation			
MWh/a		t CO2-eq /a	
113,165.8		75,893.7	
Sectoral Emissions Reduction			
11%			
Implementation Cost			
EUR 3,500,000			
Stakeholder Involvement	LA		H
	External		L
	Other		H
Staff Capacity	L	M	H
Implementation Years			
Key Performance Indicator			
Energy cost			
Measurement Units			
MWh			
Intervention Area			
Energy efficiency			
Policy Instrument			
Awareness raising			
Action Origin			
Local authority			
Action Priority			

ANNUAL ENERGY CONSUMPTION OF RESIDENTIAL BUILDINGS

Site Category	2018 Consumption, MWh	2018 Emissions, tCO2-eq
Residential Buildings	793,166.73	551,250.88
Fuel for Cooking & Space Heating (LPG)	589,005.47	133,704.24
Total	**1,382,172.20**	**684,955.12**

Description of the action

Awareness raising campaigns for the city's residents should be organized frequently by the municipality through 2030 such as:

- Organizing "Energy Days" stressing the importance of energy saving and protecting the environment through simple actions such as modifying energy behaviour, exchanging incandescent lamps with fluorescent or LED lamps, purchasing high-efficiency appliances, and installing solar panels for water heating in existing buildings.
- Delivering freely available environmental documentaries.
- Participating in the WWF's "Earth Hour" where people across the world turn their lights off for one hour on a designated day.
- Issuing and distributing a booklet to households with tips for saving water and energy.

Holding awareness campaigns through the audio-visual communication means social media, lectures in schools as well as places of worship to motivate citizens to pursue sustainability and highlight its positive effects on the economy and society such as:

- **Water:** Rationalizing water consumption; demonstrating methods to reduce water consumption; holding campaigns to encourage residents to obtain a permit allowing them to build water harvesting tanks to store water within the existing residential structure conforming with modern buildings principles.
- **Electricity:** Encouraging residents to install solar water heaters, using energy-efficient lighting such as LED and setting air-conditioners at moderate temperatures in the summer or winter.
- **Insulating Buildings:** The importance of building insulation and the benefits.
- **Tree-planting:** Greening the areas around private buildings, using trees and plants requiring minimum water.
- **Solid Waste:** Promoting sorting at the source, using degradable trash bags and using reusable grocery bags
- **Cooking:** Promoting the use of responsible cooking methods, rationalizing food waste and the use of kitchen utensils, achieving savings in the consumption of oils and fuels such as LPG using devices such as pressure cookers.

Note that Guidelines for the design and implementation of Citizens' Awareness Plans are detailed in Chapter 7 of this SEACAP.

In the table below, the calculations for energy savings are presented based on assumptions which can be verified and revised at the time of implementation.

	Assumed Consumption Estimation	Action Term	Proposed actions	Energy Savings Calculation Assumption	Annual Energy Savings
Electricity Consumption 78,294 MWh	20% electrical water heaters	Long-term	Replace electric water heater with solar water heaters (15% penetration)	70%	70% * 20% *15%* 793,166.73= 16,656.5 MWh
	21% artificial lighting	Short-term	Use natural lighting whenever possible, turn off lights after leaving place (50% will apply)	5%	21% * 5% * 50%* 793,166.73 = 4,164.1 MWh
		Long-term	Replace existing inefficient lights with efficient types like LEDs (assuming 50% of households will apply LED lights)	50%	21% * 50% * 50% * 793,166.73 =41,641.25 MWh
	Home appliances: - 12% refrigeration - 8% washing machines - 4% TV, computers, mobile chargers	Long-term	Replace refrigerators and freezers with new energy efficient A+++ rated ones (assuming 15% will apply)	50%	12% * 50% * 15% * 793,166.73 = 7,138.5 MWh
		Long-term	Replace existing washing machines with new energy efficient A+++ rated ones (assuming 20% of households will be able)	10 %	8% * 10% * 20% * 793,166.73 = 1,269.07 MWh
		Short-term	Use electronics and equipment efficiently	1%	4% * 1% * 793,166.73= 317.27 MWh
	35% air-conditioning	Short-term	Adjust cooling and heating units to thermal calendar, and maintain equipment and appliances (assuming 30% of households will apply)	30%	35%*30%* 30%* 793,166.73= 24,984.75 MWh
		Long-term	Replace old air condition with efficient one (assuming 20% of households will apply)	20%	35% * 20% * 20% * 793,166.73= 11,104.33 MWh
Space Heating & Cooking Consumption with LPG, 589,005.47 MWh	Space Heating & Cooking	Long-term	Improve roof and wall insulation, promote the use of responsible cooking methods, and use of pressure cookers (assuming 10% of households will be able)	10%	10% * 10% * 589,005.47 = 5,890.05 MWh
				Calculated energy saving	**113,165.8 MWh**

Assumptions for electrical consumption and savings are based on Ruble & Karaki Energy policy 52(2013)608-617
https://www.sciencedirect.com/science/article/pii/S0301421512008749

The following table indicates annually mitigated emissions and the energy savings:

Energy Source	Consumption, MWh	Annual Energy Savings, MWh	Annual Savings, JOD (EUR)	Emissions Mitigation, tCO2-eq
Electricity	793,166.73	107,275.71	150 *107,275.71 = JOD 16,091,357 (EUR 19,309,628)	107,275.71 * 0.695 = 74,556.62
Fuel (LPG)	589,005.47	5,890.05	5,890.05* 0.56 * 1000 / 13.7 = JOD 240,761.17 (EUR 288,913.40)	5,890.05*0.227= 1,337.04
Total	1,382,172.2	113,165.8	JOD 16,332,118 (EUR 19,598,542)	75,893.7

Average consumer prices in Jordan for LPG in 2018 equal to 0.56 JOD/kg (0.67 EUR/kg)
Emissions factor tCO2-eq/MWh LPG 0.227 with fuel conversion factor for LPG of 13.7 kWh/Kg using IPPC defaults (2006)

The return of investment is estimated at EUR 19,598,542 per year.

The energy savings have been calculated against the BEI consumptions and emissions for this category, although they are expected to be significantly more. The energy consumption of the existing buildings will increase and partly contribute to the BAU increased emissions, due to the more intensive use of the buildings, their further expansion etc. Such estimations will be more accurately depicted in future updates of the SEACAP.

Expected funding resources:

- Total annual energy savings from the residential sector is around 113,166 MWh amounting to around JOD 16,332,118 (EUR 19,598,542).
- Budget: Estimated to cost EUR 3,500,000 for awareness-raising activities.
- Climate cost efficiency: If these measures are implemented by 2030, the expected abatement generated is 75,893.7 tCO2-eq/a. (The climate cost efficiency is equal to the implementation cost divided by the abatement according to the Paris Agreement.)
- Source of finance: The homeowner should pay for all costs for greening the building, however the municipality has a role in promoting greening of the existing buildings, either from the municipal budget or through innovative outsourcing. For example, the municipality can amend the contracts signed with advertising companies to allocate days for unpaid advertisements promoting the use of energy efficient products in houses, plus encouraging companies selling household appliances to promote energy savings products through their annual advertisement programmes.

5.1.4 New Residential Buildings: Implementing & Promoting the Green Building Code

Mitigation			
MWh/a		t CO2-eq /a	
96,199.2		47,672.9	
Sectoral Emissions Reduction			
5.4%			
Implementation Cost			
EUR 2,800,000			
Stakeholder Involvement	LA		H
	External		H
	Other		H
Staff Capacity	L	M	H
Implementation Years			
Key Performance Indicator			
Start implementation			
Measurement Units			
Number of new green licenses			
Intervention Area			
Integrated action			
Policy Instrument			
Building standard			
Action Origin			
LA			
Action Priority			

Background

Energy consumption in the city's residential buildings reached 1,382,172.2 MWh in 2018 and is expected to reach 1,783,002 MWh by 2030 based on a business-as-usual scenario and without a plan to reduce the energy demand.

Currently, there is no obligatory legislation on the topic in the country, although it is under consideration. The municipality will work towards promoting green building practices and applying the legislation, which is expected to be mandatory by 2030.

If green building practices are applied, it is estimated that 25-35% less energy than traditional buildings in the country will be used and approximately 40% less water. This means lower electricity and water bills for those living in such buildings as well as less reliance on imported energy overall.

Assuming that the additional consumption within the BAU scenario will be originating to approximately 80% from new buildings, these practices are estimated to reduce the BAU energy consumption and emissions by approximately 30%, as presented in the table below.

ANNUAL ENERGY CONSUMPTION OF THE RESIDENTIAL SECTOR

Site Category	2018 Consumption, (MWh)	2018 CO2 Emissions, tCO2-eq	2030 BAU Consumption, MWh	2030 BAU Emissions, tCO2-eq	Energy increase between BEI & BAU years	Emissions' increase between BEI & BAU years.
Residential Buildings, Annual Electricity Consumption	793,166.73	551,250.88	1,023,185.1	711,113.6	230,018.4	159,862.8
Space Heating & Cooking Fuel Consumption (LPG)	589,005.47	133,704.24	759,817.1	172,478.5	170,811.6	38,774.3
Total	**1,382,172.2**	**684,955.12**	**1,783.002.1**	**883,592.1**	**400,830.0**	**198,637.3**

Average consumer prices in Jordan for LPG in 2018 equal to 0.56 JOD/kg (0.67 EUR/kg)
Emissions factor tCO2-eq/MWh LPG 0.227 with fuel conversion factor for LPG of 13.7 kWh/Kg using IPPC defaults (2006)

Savings' calculation for Consumption & Emissions of new Residential Buildings

	New buildings' BAU consumption (MWh)	New buildings' BAU emissions (CO2 eq)	Savings due to bioclimatic building practices	Energy savings (MWh)	Emissions savings (CO2 eq)
Electricity	184,014.7	127,890.2	30%	55,204.4	38,367.1
LPG	136,649.3	31,019.4	30%	40,994.8	9,305.8
Total	**320,664.0**	**158,909.6**	**30%**	**96,199.2**	**47,672.9**

Suggested measures vary between promoting green building and other measures including:

- Using water storage tanks in modern buildings during winter, and in other scarcity periods
- Installing solar water heaters to reduce electricity consumption
- Using thermal insulation to reduce energy consumption in buildings by preventing heat loss
- Greening areas surrounding the buildings and growing plants requiring minimal water
- Providing car parking for buildings
- Using surface rebound and construction ratios
- Using heat insulated windows

Description of the action

The following indicative measures can be reviewed and updated by municipal council and stakeholders:

- Work with national and regional authorities and stakeholders to prepare a green building recommendations guide which can be used with new building licences.
- Conduct awareness raising campaigns addressing citizens on the importance of green buildings, aimed at protecting the environment as well as reducing costs and encouraging citizens to impose pressure on real estate developers. This would be achieved through audio-visual communication means, social media, lectures held in schools and places of worship to encourage them to use environmental friendly renewable energy sources and recognize their positive effects on the economy and society.

General objectives

The aim of the actions undertaken by the municipality is to reduce consumption and pollution caused by burning fuel to generate electricity as well as save consumption costs while reducing government subsidies to support the energy sector, thus easing the burden on citizens in multiple ways.

Financial analysis

In the table below, the calculations for energy savings are presented based on assumptions which can be verified and revised at the time of implementation.

MONETARY SAVINGS' CALCULATION

	Energy savings (MWh)	Emissions savings (CO2 eq)	Annual Monetary Savings, JOD (EUR)
Electricity	55,204.4	38,367.1	150 * 55,204.4 = JOD 8,280,660 (EUR 9,936,792)
LPG	40,994.8	9,305.8	0.56 * 40,994.8 * 1000 / 13.7 = JOD 1,675,700 (EUR 2,010,840)
Total	**96,199.2**	**47,672.9**	**JOD 9,956,360 (EUR 11,947,632)**

Average consumer prices in Jordan for LPG in 2018 equal to 0.56 JOD/kg (0.67 EUR/kg)
Emissions factor tCO2-eq/MWh LPG 0.227 with fuel conversion factor for LPG of 13.7 kWh/Kg using IPPC defaults (2006)

The monetary energy savings have been calculated according to the energy costs at the time of preparing this report.

Expected funding resources:

- Total annual energy savings from the residential sector is around 96,199.4 MWh amounting to around JOD 9,956,368 (EUR 11,947,641.6).
- Budget: Estimated to cost EUR 2,800,000 for awareness-raising activities.
- Climate cost efficiency: If these measures are implemented by 2030, the expected abatement generated is 47,672.9 tCO2-eq/a. (The climate cost efficiency is equal to the implementation cost divided by the abatement according to the Paris Agreement.)
- Source of finance: The homeowner should pay for all costs for greening the building, however the municipality has a role in promoting greening of the existing buildings, either from the municipal budget or through innovative outsourcing. For example, the municipality can amend the contracts signed with advertising companies to allocate days for unpaid advertisements promoting the use of energy efficient products in houses, plus encouraging companies selling household appliances to promote energy savings products through their annual advertisement programmes.

5.1.5 Existing Tertiary Buildings: Awareness Raising Activities

Background

The tertiary sector represents the non-municipal and non-residential buildings, equipment, and facilities (e.g., example shops, offices, banks, commercial and retail activities, schools, hospitals) which consume around 4.95% of the energy consumed in the building sector.

The municipality's role along with the stakeholders should be support the tertiary sector in reducing its energy consumption cost by highlighting the most important measures to change their consumption behaviour and to take actions toward energy efficiency and renewable energy use.

ANNUAL ENERGY CONSUMPTION & EMISSIONS OF TERTIARY BUILDINGS

Site Category	2018 Consumption, MWh	2018 Emissions, tCO2-eq
Tertiary Buildings Annual Electricity Consumption	59,487.50	41,343.81
Fuel Consumption (LPG)	12,611.74	2,862.86
Total	**72,099.24**	**44,206.68**

Mitigation	
MWh/a	t CO2-eq /a
9,182.6	6,204.8
Sectoral Emission Reduction	
10.9%	
Implementation Cost	
EUR 1,400,000	
Stakeholder Involvement	LA H
	External H
	Other H
Staff Capacity	L M H
Implementation Years	
Key Performance Indicator	
Start implementation	
Measurement Units	
Number of new green licenses	
Intervention Area	
Integrated action	
Policy Instrument	
Building standard	
Action Origin	
Local authority	
Action Priority	

Description of the action

This action will be conducted in coordination and in complementarity with the Governorate's action.

Awareness-raising campaigns for the city's residents should be organised frequently by the city through 2030 and involve common actions for all types of tertiary buildings:

a. **Replacement of inefficient old lamps:** Indoor illumination of tertiary-sector buildings use the largest proportion of electrical energy. The most common strategy is replacing old inefficient lamps with new, better performing ones. In a typical lighting system only 30% of the lumens emitted by the lamp contribute to the lit environment with huge losses due to the luminaire, the light absorption on surrounding surfaces and the light redirection to avoidable areas. Additional factors influencing energy consumption due to lighting: (1) the choice of the type of lamp; (2) the displacement of lamps; (3) the relation between lamp and luminaires; and (4) the lumen per watt. Plus, using natural light during daylight hours limits the use of artificial light reducing electrical consumption and thermal load while improving comfort.

b. **Smart use and adopting thermometer calendars** in air-conditioning with programmable timers will help in reducing energy consumption as every degree matters! Setting your thermostat at a comfortable temperature won't make your unit work too hard, but will still make you feel like you're comfortable.

c. **The use of inverter type air-conditioning** reduces energy consumption and lowers energy bills.

d. **Regulate water use** and use of a tap adaptor to reduce water consumption. This could be applied in public areas and can be heavily implemented in mosques, and will rationalise water consumption.

e. Replace electrical water heaters **with solar water heaters** in restaurants, clinics, mosques, etc.

f. **Efficient office appliances:** Energy savings in appliances are possible through selecting energy-efficient products.

More specific actions for large and more complex buildings such as hospitals, shopping malls, etc. include:

a. **Behavioural changes:** Adequate behaviour of large building occupants may also generate significant savings.

b. **The management of technical installations in Large modern buildings** may lead to energy savings: make sure heating is turned off during weekends, holidays, and after work. Also, fine tune heating/cooling by setting temperatures. For simple buildings, a technician or an energy manager could be appointed for such tasks. For complex buildings, the help of a specialised company may be necessary. Therefore, it may be necessary to renew or set up a new contract with a competent maintenance company with adequate requirements in terms of energy performance.

c. **Improving the performance of large modern buildings through retro-commissioning:** This process improves the efficiency of an existing building's equipment and systems and involves a systemic evaluation of opportunities to improve energy-using systems. It can often resolve problems occurring during design or construction, or address problems developed throughout the building's life as equipment has aged, or as building usage has changed (e.g., bringing equipment up to its proper operational state, improving indoor air quality, increasing equipment lifespan, improving maintenance operations). Retro-commissioning will identify and fix: (1) Equipment or lighting on when unnecessary; (2) systems that simultaneously heat and cool; (3) belts and valves not functioning properly; (4) thermostats and sensors out of calibration; (5) air balancing systems less than optimal; 6) economizers not working as designed; (7) control sequences functioning incorrectly; (8) variable-frequency drives operating at unnecessarily high speeds or at a constant speed even though the load being served varies.

d. **Improving the building's thermal envelope** through walls and roof insulation, white reflective paints on roofs, and integration of double-glazed windows. Promoting efficient pressure cookers in restaurants, hospitals, hotels, etc.

Note that Guidelines for the design and implementation of Citizens' Awareness Plans are detailed in Chapter 7 of this SEACAP.

There is no official study available at the time of this report's preparation regarding energy consumption in the tertiary sector and the estimated contributions of lighting, office equipment, etc. The calculations for energy savings are presented in the table below, based on assumptions using information from the European Council for an Energy Efficient Economy,[4] and will be verified and revised at the time of implementation.

	Assumed Consumption Estimate	Action Period	Proposed Actions	Energy Savings Calculations Assumption	Annual Energy Savings
Electricity Consumption 59,487.50 MWh	25% artificial light	Short-term	Use natural lighting whenever possible, turn off lights after leaving place	5%	25 % * 5% * 59,487.50 = 743.59 MWh
		Long-term	Install motion sensors for controlling lights in public places	1%	25 % * 1% * 59,487.50 = 148.72 MWh
			Replace existing inefficient lights with efficient types (assuming 50% penetration)	50%	25 % * 50% *50%* 59,487.50 = 3,718 MWh
	35% electrical equipment	Long-term	Use of efficient office appliances; replace electrical water heater with solar one (assuming 30% penetration)	10%	35 % * 10% * 30%* 59,487.50 = 624.6 MWh
	40% air-conditioning	Short-term	Adjust cooling and heating units to thermal calendar, and maintain equipment and appliances (assuming 50% will apply)	30%	40 % * 30% * 50%* 59,487.50 = 3,569.3 MWh
		Long-term	Use inverter type a/c (assuming 50% will apply)		
Space Heating & Cooking Consumption (LPG), 12,611.7 MWh	Space heating & cooking	Long-term	Improve roof and wall insulation (assuming 10% will apply)	10%	12,611.7* 30% *10%= 378.4 MWh
				Calculated Energy Savings	**9,182.6 MWh**

The energy savings have been calculated against the BEI consumptions and emissions for this category, although they are expected to be significantly more. The energy consumption of the existing buildings will increase and partly contribute to the BAU increased emissions, due to the more intensive use of the buildings, their further expansion etc. Such estimations will be more accurately depicted in future updates of the SEACAP.

[4] https://www.eceee.org/static/media/uploads/site-2/library/conference_proceedings/eceee_Summer_Studies/2007/Panel_6/6.178/paper.pdf

Financial analysis

Energy Source	Consumption, MWh	Annual Energy Savings, MWh	Annual Savings, JOD (EUR)	Emissions Mitigation, tCO2-eq
Electricity	59,487.5	8,804.2	150 * 8,804.2 = JOD 1,320,630 (EUR 1,584,756	8,804.2* 0.695 = 6,118.9
Fuel (LPG)	12,611.74	378.4	378.4*0.56*1,000/13.7 = JOD 15,467 (EUR 18,561)	378.4* 0.227 = 85.9
Total	72,099.24	9,182.6	JOD 1,336,097 (EUR 1,603,317)	6,204.8

The return of investment is estimated at EUR 3,431,713.94 per year.

Expected funding resources:

- Total annual energy savings from the tertiary sector is around 9,182.6 MWh amounting to around JOD 1,336,097 (EUR 1,603,317).
- Budget: Estimated to cost EUR 1,400,000.
- Climate cost efficiency: If these measures are implemented by 2030, the expected abatement generated is 6,204.8 tCO2-eq/a. (The climate cost efficiency is equal to the implementation cost divided by the abatement according to the Paris Agreement.)
- Source of finance: The tertiary building owners should pay for all costs for greening the building, however the municipality has a role in promoting greening of the existing buildings, either from the municipal budget or through innovative outsourcing. For example, the municipality can amend the contracts signed with advertising companies to allocate days for unpaid advertisements promoting the use of energy efficient products in houses, plus encouraging companies selling household appliances to promote energy savings products through their annual advertisement programmes.

5.1.6 New Tertiary Buildings: Implementing & Promoting the Bioclimatic Building Practices

Background

In 2018, the city's energy consumption in the tertiary sector was 72,099.2 MWh, and is expected to reach 93,008 MWh by 2030.

Currently, there is no obligatory legislation on green building codes in the country, although it is under consideration. The municipality will work towards promoting green building practices and applying the legislation, which is expected to be mandatory by 2030.

If green building practices are applied, it is estimated that 25-35% less energy than traditional buildings in the country will be used and approximately 40% less water. This means lower electricity and water bills for those who will live in such buildings, as well as less reliance on imported energy.

Assuming that the additional consumption within the BAU scenario will be originating to approximately 80% from new buildings, these practices are estimated to reduce the BAU energy consumption and emissions by approximately 30%, as presented in the table below.

Mitigation			
MWh/a		t CO2-eq /a	
5,018.1		3,076.9	
Sectoral Emission Reduction			
5.4%			
Implementation Cost			
EUR 700,000			
Stakeholder Involvement	LA		H
	External		H
	Other		H
Staff Capacity	L	M	H
Implementation Years			
Key Performance Indicator			
Start implementation			
Measurement Units			
Number of new green licenses			
Intervention Area			
Integrated action			
Policy Instrument			
Building standard			
Action Origin			
Local authority			
Action Priority			

ANNUAL ENERGY CONSUMPTION & EMISSIONS OF TERTIARY BUILDINGS

Site Category	2018 Consumption, (MWh)	2018 CO2 Emissions, tCO2-eq	2030 BAU Consumption, MWh	2030 BAU Emissions, tCO2-eq	Energy increase between BEI & BAU years	Emissions' increase between BEI & BAU years.
Annual Electricity Consumption	59,487.5	41,343.8	76,738.9	53,333.5	17,251.4	11,989.7
Fuel (LPG)	12,611.7	2,862.9	16,269.1	3,693.1	3,657.4	830.2
Total	**72,099.2**	**44,206.7**	**93,008.0**	**57,026.6**	**20,908.8**	**12,819.9**

Description of the action

The core activities for raising awareness about a green building code plays important roles in promoting green building standards benefitting the municipality which can encourage practices lowering the city's environmental footprint as well as developers and owners who can invest in green buildings offering lower utility bills and attracting corporations wanting to demonstrate their commitment to sustainability. The municipality with the support of stakeholders can play a vital role in reducing energy demand in the tertiary sector.

The following indicative approach for green buildings was obtained from the World Green Council:

Taking an intelligent approach to energy

- Minimising energy use in all stages of a building's lifecycle, making new and renovated buildings more comfortable and less expensive to run, and helping building users learn to be efficient too.
- Integrating renewable and low-carbon technologies to supply buildings' energy needs once their design has maximised inbuilt and natural efficiencies.

Safeguarding water resources

- Exploring ways to improve drinking and wastewater efficiency and management, harvesting water for safe indoor use in innovative ways, and generally minimising water use in buildings.
- Considering the impact of buildings and their surroundings on storm water and drainage infrastructure, ensuring these are not put under undue stress or prevented from doing their job.

Minimising waste and maximising reuse

- Using fewer, more durable materials and generating less waste, as well as accounting for a building's end of life stage by designing for demolition waste recovery and reuse.
- Engaging building users in reuse and recycling.

Promoting health and wellbeing

- Bringing fresh air inside, delivering good indoor air quality through ventilation, and avoiding materials and chemicals creating harmful or toxic emissions.
- Incorporating natural light and views to ensure building users' comfort and enjoyment of their surroundings while reducing lighting energy needs in the process.
- Designing for ears as well as eyes. Acoustics and proper sound insulation play important roles in helping concentration, recuperation, and peaceful enjoyment of a building in educational, health, and residential buildings.
- Ensuring people are comfortable in their everyday environments, creating the right indoor temperature through passive design or building management and monitoring systems.

Keeping our environment green

- Recognising that our urban environment should preserve nature while ensuring diverse wildlife and land quality are protected or enhanced, by, for example, remediating and building on polluted land or creating new green spaces.
- Looking for ways we can make our urban areas more productive, bringing agriculture into our cities.

Creating resilient and flexible structures

- Adapting to our changing climate, ensuring resilience to events such as flooding, earthquakes, or fires so that our buildings stand the test of time and keep people and their belongings safe.
- Designing flexible and dynamic spaces, anticipating changes in their use over time, and avoiding the need to demolish, rebuild, or significantly renovate buildings to prevent them from becoming obsolete.

Connecting communities and people

Whenever realistically applicable

- Creating diverse environments that connect and enhance communities, asking what a building will add to its context in terms of positive economic and social effects, and engaging local communities in planning.
- Ensuring transport and distance to amenities are considered in design, reducing the impact of personal transport on the environment, and encouraging environmentally friendly options such as walking or cycling.

Considering all stages of a building's lifecycle

Whenever realistically applicable

- Seeking to lower environmental impacts and maximise social and economic value over a building's whole lifecycle (from design, construction, operation, and maintenance, through to renovation and eventual demolition).
- Ensuring resources such as energy or water used to produce and transport the materials in the building are minimised so that buildings are truly low impact.

SAVINGS' CALCULATION FOR CONSUMPTION & EMISSIONS OF NEW TERTIARY BUILDINGS

	New buildings' BAU consumption (MWh)	New buildings' BAU emissions (CO2 eq)	Savings due to bioclimatic building practices	Energy savings (MWh)	Emissions savings (CO2 eq)
Electricity	13,801.1	9,591.8	30%	4,140.3	2,877.6
LPG	2,925.9	664.2	30%	877.8	199.3
Total	**16,727.0**	**10,256.0**	**30%**	**5,018.1**	**3,076.9**

Financial analysis

The monetary energy savings have been calculated according to the current energy costs at the time of preparing this report.

MONETARY SAVINGS CALCULATION

Energy source	Energy savings (MWh)	Emissions savings (CO2 eq)	Monetary Energy Savings, JOD (EUR)
Electricity	4,140.3	2,877.6	150 * 4,140.3= JOD 621,045 (EUR 745,254)
LPG Space Heating	877.8	199.3	0.56*877.8*1000/13.7= JOD 35,881 (EUR 43,057)
Total	**5,018.1**	**3,076.9**	**JOD 656,926 (EUR 788,311)**

Average Consumer Prices in Jordan for LPG year 2018 equal to 0.56 JOD/kg and equal to 0.67 EUR/kg

Emissions Factor tCO2-eq/MWh LPG 0.227 Fuel: Conversion Factor for LPG 13.7 KWh/Kg (the default factors of IPCC (2006) Fuel).

The monetary energy savings were calculated according to the current energy costs at the time of preparing this report.

Expected funding resources:

- Total annual energy savings from the tertiary sector is around 5,018.1 MWh amounting to around JOD 656,926 (EUR 788,311).
- Budget: Estimated to cost EUR 700,000.
- Climate cost efficiency: If these measures are implemented by 2030, the expected abatement generated is 3,076.9 tCO2-eq/a. (The climate cost efficiency is equal to the implementation cost divided by the abatement according to the Paris Agreement.)
- Source of finance: The tertiary building owner should pay for all costs for greening the building, however the municipality has a role in promoting greening of the existing buildings, either from the municipal budget or through innovative outsourcing. For example, the municipality can amend the contracts signed with advertising companies to allocate days for unpaid advertisements promoting the use of energy efficient products in houses, plus encouraging companies selling household appliances to promote energy savings products through their annual advertisement programmes

5.2. Municipal Public Lighting

Background

With outdated, inefficient street lighting systems, a significant amount of municipal energy cost goes on street lighting.

Modern LED lighting solutions are advancing rapidly and can deliver significant energy saving potentials. Increasing efficacy, optimized luminaire design, and flexible lighting control enable enhanced performance at lower cost for different lighting and traffic conditions.

Advanced technology nowadays can offer 30-70% of electrical energy savings from the public lighting sector. The street lighting improvement project can include using LED technology, smart LED drivers, and astronomical timers. Intelligent control systems create additional savings as the lighting level can be adjusted depending on the time of day and other requirements.

Mitigation			
MWh/a		tCO2/a	
17,162.2		11,928.2	
Total Consumption Contribution			
58.27%			
Implementation Cost			
EUR 8,086,400			
Stakeholder Involvement	LA		H
	External		L
	Other		H
Staff Capacity	L	M	L
Implementation Years			
Key Performance Indicator			
Start implementation			
Measurement Units			
Number of replaced lights			
Intervention Area			
Energy efficiency			
Policy Instrument			
Energy management / Public procurement			
Action Origin			
Local authority			
Action Priority			

Description of the action

Replacing old street lighting with a modern type saving energy will provide better quality lighting, reduce light pollution, and lower maintenance costs. The municipality should:

- **Develop a master plan** for the city identifying streets and paths with recommended types and models of street light luminaires to be used.
- **Modernise the protection components** of street light systems by installing:
  - Surge protection on feeders and pole sides
  - Proper grounding systems
  - Overload and short-circuit protections
  - Astronomical timers
  - Switching components
  - Energy consumption metering
  - Differential relays
  - Permanent over-voltage protection
- **Procure, install, and maintain the new lights** along with necessary protection devices and control systems. The procurer should specify the streets and paths for which the street lighting system will be designed, or lighting system components will be procured. The system will be specified based on the standard EN13201 and related national standards. Among other things, the procurer will determine illuminance levels, uniformity levels, and system maintenance factors.
- **Obtain the measurement for light distribution** before and after the work is completed.
- **Setup an operational and maintenance plan** for public lighting.
- **Conduct training on operation and maintenance** for the technical staff to ensure quality of services and to extend the lifespan of the components.

General Objectives

Modern public lighting systems positively impact social aspects of the city including traffic safety, crime rates, productivity (due to security at night) as well as cost-oriented aspects such as reduced costs due to energy efficiency, plus environment-related parameters such as reduced toxic gases and emissions.

Existing Types of Public Street Lights (2018)				BAU
Type of Street Lamps	Quantity	Watt per Lamp	Annual Consumption, MWh	Annual Consumption
HPS	3,000	70	924	1,192
MH	15,000	250	16,500	21,285
MH	15,000	125	8,250	10,643
LED	5,860	85	2,192	2,827
Total			**27,866**	**35,947**

Emissions factor for electricity consumption is 0.695 tCO2-eq/MWh
Annual consumption x 2018 BAU coefficient 1.29

Planned Replacement for Public Street Lights				
Type of Street Lamps	Quantity	Watt per Lamp	Annual Consumption, MWh	Energy Savings, MWh
LED	3,000	40	528	396
LED	15,000	100	6,600	9,900
LED	15,000	70	4,620	3,630
LED	5,860	85	2,192	0
Total			**13,940**	**13,926**

The expected results from replacing the street lighting system are shown in the table below:

Key Actions & Measures	BAU Scenario		Mitigation		Mitigation, %	Cost, EUR
	MWH/A	TCO2/A	MWH/A	TCO2/A		
Public Street Lighting	**35,947**	**24,983**	**17,162.2**	**11,928.2**	**47.7%**	**8,086,400**
Developing master plan	35,947	24,983				5,000.0
Modernize protection components			3,236.2	2,249.2		725,400
Procure, install, maintain new lights			13,926	9,679		7,350,000.0
Obtain measurements for light distribution						2,000.0
Setup operational & maintenance plan						2,000.0
Conduct training for operations & maintenance						2,000.0

Expected funding resources:

- Total annual energy savings from the street lighting sector is around 17,162.2 MWh amounting to around JOD 2,574,330 (EUR 3,089,196).
- Budget: Estimated to cost EUR 8,086,400.
- Climate cost efficiency: If these measures are implemented by 2027, the expected abatement generated is 11,928.2 tCO2-eq/a accounting for 47,712.8 tCO2-eq until 2030. (The climate cost efficiency is equal to the implementation cost divided by the abatement according to the Paris Agreement.)
- Source of finance: Municipality can finance the project whenever changing any lamp, change it to LED; partnerships with the private sector; through energy performance contract (EPC); and many other forms of financial mechanisms.

5.3 Transport

The transport sector in the city includes only road transport and comprises subcategories such as the municipal fleet and private transport while there are no public transport services in the city. According to the municipality, the municipal fleet of 57 vehicles includes passenger vehicles; light, medium, and large trucks; construction machinery; and other vehicles. The fuels used for the municipal fleet are gasoline and diesel. Regarding private cars, fuel consumption is calculated by the municipality based on the total numbers of cars in the region, the average travelled distance, and the average consumption per kilometre for each type of vehicle. The same approach is used for commercial vehicles and private/public transportation.

ANNUAL FUEL CONSUMPTION & CO2 EMISSIONS OF MUNICIPAL & PRIVATE TRANSPORT

Transport Sector	Diesel (L)	Gasoline (L)	Fuel Consumptions MWh	Emissions tCO2-eq	2030 BAU Energy Demand, MWh	2030 BAU Emissions, tCO2-eq
Municipal Fleet	1,248,827	31,200	12,775.31	3,418.62	16,480.1	4,410.0
Private Sector	44,981,876	30,095,102	726,693.70	189,770.16	937,434.9	244,803.5
Total	46,230,703	30,126,302	739,469.01	193,188.78	953,915.0	249,213.5

Emissions factor for diesel is 0.268 tCO2-eq/MWh; emissions factor for gasoline is 0.25 tCO2-eq/MWh
Conversion factor for diesel is 0.010 MWh/L; conversion factor for gasoline is 0.0092 MWh/L

5.3.1 Road Asset Planning & Management with Sustainable Mobility Measures

Background

In Al Zarqa city many private vehicles are moving on daily basis emitting a considerable quantity of CO2. The peak hours of congestion are in the morning around 8:00 am and in the afternoon between 2:00 pm and 4:00 pm as residents are moving to their jobs and students to their schools then returning homes. During the working hours, there is traffic congestion the whole day. In addition to the absence of public transportation in the region makes citizens' transport between the regions difficult and costly. Implementing measures and actions to improve and enhance citizens' transport is crucial in establishing a sustainable and environmentally friendly transport system.

In table below, the transportation sector contributes 17.6% of city emissions:

ANNUAL FUEL CONSUMPTION OF TRANSPORT SECTOR

SITE CATEGORY	2018 Consumption, (MWh)	2018 CO2 Emissions, tCO2-eq	2030 BAU Consumption, MWh	2030 BAU Emissions, tCO2-eq
TRANSPORT SECTOR	739,469.01	193,188.78	953,915.0	249,213.5

Description of the Action

This action will be conducted in coordination and in complementarity with the Governorate's action after assessing the sector's capacity and plans to be modernized and upgraded:

1. **Long-term vision** for road asset management at the township level, securing road connectivity to form a continuum of arterial field paths, and reliable access to social, economic, and administrative services. (4)
2. **Improve road network planning** to develop rural areas based on best practices from urbanisation, agriculture, and industry as well as livelihoods promotion, passenger transportation, access to socio-economic services, and achieving SDGs. Strengthen local community and governance institutions to play a proactive role in planning and maintaining public transportation services and road safety. (5)
3. **Road asset management** is the strategic and systemic process of operating, maintaining, upgrading, and expanding physical road assets throughout their lifecycle while improving network efficiency. This may require introducing a hierarchy of roads, integrating with other transport modes, and incorporating economic growth and strategic requirements.

Mitigation		
MWh/a	tCO2/a	
66,774.1	17,444.9	
Sectoral Emissions Reduction		
7%		
Implementation Cost		
EUR 7,000,000		
Stakeholder Involvement	LA	H
	External	L
	Other	L
Staff Capacity	L	M H
Implementation Years		
Key Performance Indicator		
Start of planning & progress in work		
Measurement Units		
Number of users		
Intervention Area		
integrate urban & public transport services		
Policy Instrument		
Land use planning regulation		
Action Origin		
Local authority		
Action Priority		

4. **Sustainable mobility** measures for minimising the use of conventional private vehicles and increasing sustainable transportation means. The measures can be taken under 3 pillars:
   - **Active mobility.** People can shift their mobility habits from car to walking and cycling, as a large portion of car trips cover less than 5 km. These two options can contribute both to achieving energy and climate goals and to a number of benefits for personal health, the city, etc. Some of the benefits are improved public health, reduced road temperature, better air quality, low noise levels, reduced congestion, more free spaces, and reduced road accidents.
   - **Shared/collective mobility.** Shared mobility means a bold promotion of the solutions based on the public transportation system and the collective use of the available cars. Public transport must be established and put at the forefront of sustainable mobility measures, both environmental/health issues and car reduction goals. Moreover, it encourages accessibility and equity, providing low-income people (with no car) with affordable mobility solutions and breaking the isolation barriers of distant communities. Apart from public transportation, other collective forms of mobility can be taxi multi-use, car-sharing, ride-sharing, bike-sharing, and demand-responsive transport, helping people be less reliant on private vehicles.
   - **Sustainable mobility awareness.** This pillar includes "soft measures" toward changing travel attitudes and behaviours to reduce single-occupancy car use. Such measures can be public/business incentives to increase cycling and walking to work, awareness-raising campaigns, info points, school/authority/ company travel plans, and apps for mobility gamification. Soft measures can pave the way for the effectiveness of hard measures and, moreover, requires only a small portion of the total transportation investments.

General objectives

1. Combat social exclusion by providing an opportunity to travel for all in rural areas
2. Improve access between villages and urban centres
3. Optimise resources by efficient routing, ride-matching, and dispatching
4. Integrate rural transport services with existing transport options

Financial analysis

In the table below, the calculations for energy savings are presented based on assumptions which can be verified and revised at the time of implementation.

ENERGY SAVINGS CALCULATION

SITE CATEGORY	2030 BAU Energy Demand, MWh	2030 BAU Emissions, tCO2-eq	Estimated Savings Assumption, %	Calculated Energy Savings, MWh/a	Calculated Emissions Savings, tCO2-eq
TRANSPORT SECTOR	953,915.0	249,213.5			
Improve road network planning			2%	19,078.3	4,984.3
Road asset management			3%	28,617.5	7,476.4
Sustainable mobility measures			2%	19,078.3	4,984.3
Total			**7%**	**66,774.1**	**17,444.9**

Average consumer prices in Jordan for fuel (gasoline) is JOD 0.80 in 2018
Emissions factor for diesel is 0.268 tCO2-eq/MWh; emissions factor for gasoline is 0.25 tCO2-eq/MWh
Conversion factor for diesel is 0.010 MWh/L; conversion factor for gasoline is 0.0092 MWh/L

Energy Source	Consumption, litres	BAU 2030	Annual Savings, JOD (EUR)
Fuel (Diesel)	46,230,703.0	59,637,606.9	JOD 1,878,584 (EUR 2,254,301.50)
Fuel (Gasoline)	30,126,302.0	38,862,929.6	JOD 2,176,324 (EUR 2,611,588.90)
Total	**76,357,005.00**	**110,717,657.30**	**JOD 4,054,908.70 (EUR 4,865,890.40)**

Expected funding resources:

- Total annual energy savings from the transportation sector is around 66,774.1 MWh amounting to around JOD 4,054,908.70 (EUR 4,865,890.40).
- Budget: Estimated to cost EUR 7,000,000
- Climate cost efficiency: If these measures are implemented by 2030, the expected abatement generated is 17,444.9 tCO2-eq/a. (The climate cost efficiency is equal to the implementation cost divided by the abatement according to the Paris Agreement.)
- Source of finance: The municipality is the main implementor using funds either from the municipal budget or outsourcing to the national budget or grants. Sustainable mobility can be implemented through the participation of the private sector or investors. The municipality must enact the necessary legislation for the private sector to facilitate and support the action, noting that this can only be done in close cooperation and under the Governorate and concerned national authorities.

5.3.2 Transportation Solid Waste Sector

Mitigation		
MWh/a		tCO2/a
4,128.0		1,106.3
Total Consumption Contribution		
30%		
Implementation Cost		
EUR 7,000,000		
Stakeholder Involvement	LA	
	External	
	Other	
Staff Capacity	L	M H
Implementation Years		
Key Performance Indicator		
Start of planning		
Measurement units		
Fuel saving & sorting percentage		
Intervention Area		
Managing resources		
Policy Instrument		
Waste management		
Action Origin		
Local authority		
Action Priority		

Background

In 2018, Jordan generated 1.318 million tons of solid waste, 15% of paper and cardboard, 57% organic and 43% of other types of waste. As with all environmental problems, the increase in solid waste production goes hand in hand with growing population and rising consumption. Along with these rising levels, the investment, management, and maintenance of solid waste collection and transport vehicles is seeing a continual increase in financial outlay.

Solid Waste Management: The municipality collects and transfers solid waste using different types of garbage vehicles consuming significant diesel.

The municipality has a total population of 846,126 people annually producing solid waste of about 182,500 tons (350 tons daily), and is steadily increasing due to the continuously increasing population.

The table below presents the annual fuel consumption and CO2 emissions for solid waste collection:

ANNUAL FUEL CONSUMPTION & CO2 EMISSIONS OF SOLID WASTE GARBAGE VEHICLES

Municipality	Vehicles	Diesel/a	Consumption MWh	tCO2-eq	BAU Consumption,* MWh	BAU Emissions, tCO2-eq
Al Zarqa	69	1,066,666.7	10,666.7	2,858.7	13,760	3,687.7

*Annual consumption x BAU coefficient 1.29 (JRC)

Description of the Action

1. **Optimise fuel consumption for municipal solid waste collection through routing design and control.**
   The procedure will be based on the development of a GIS-based model to calculate the fuel consumption of vehicles collecting municipal solid waste. The model will then be used to explore optimal conditions for waste collection in the city and to improve the efficiency of the waste management system, thus reducing the cost of waste collection resulting in environmental benefits.

   First, the municiplaity should collect detailed data on the routes used in waste collection, the cost of operations and maintenance, the amount of waste collected, the number of garbage bins and their locations as well as details related to solid waste collection and transportation management (e.g., for example, what is incinerated and dumped in a landfill or recycled). This information will be used is to assess the progress of work in the next stages when implementing measures related to better waste management.

   Second, the municipality should equip collection vehicles with GPS, and use a GIS-based model to explore and test different collection scenarios and ensure effective solid waste management. The GPS-based Vehicle Tracking & Monitoring System (VTMS) will confirm in real-time the movement of vehicles and provide live compliance for vehicles using data feeds.

Third, IP cameras should be installed at landfill entries and exits and linked with the Integrated Weighbridge Vehicle Monitoring System (IWVMS).

Fourth, VTMS should be integrated with the control center in the municipal administration building and stakeholders should be trained on managing the entire ecosystem of the VTMS system.

Fifth, a GIS-based model should be developed to explore different scenarios to reach the optimal way to collect waste. This will include calculating fuel consumption and greenhouse gas emissions under current conditions and for scenarios explored without changing waste bin numbers or locations, investigating the adequacy of the number and positions of existing collection bins, conducting route improvement for the location of the proposed bins, implementing the new municipal solid waste collection plan, reviewing the results, and making an update necessary when needed.

2. Optimise fuel consumption for municipal solid waste collection by sorting at the source

Sorting at the source requires understanding the nature of people, preparing a long-term plan, creating the appropriate conditions, securing containers, conducting awareness campaigns, encouraging community participation with training courses, motivating work, and support from national authorities as well as past experiences in the same context with other municipalities.

General Objectives

To better manage urban waste by solving the daily challenges of planning, managing, and operating municipal solid waste programs and facilities, handling city waste in an environmentally acceptable way, raising public awareness of waste-related problems, incorporating good practices in the waste management systems, reducing emissions resulting from lower fuel consumption, reducing costs related to waste management, and creating new job opportunities for the local community.

Fuel Saving Calculation

Some municipalities have saved about 10% of their fuel by adjusting the routing, and up to 30% when sorting-at-the-source is adopted. Reducing collection to 3 times a week, returns from recycling materials, and creating jobs also leads to increasing conservation and environmental improvements.

Financial analysis

In the tables below, the calculations for energy savings are presented based on assumptions which can be verified and revised at the time of implementation.

ENERGY SAVINGS CALCULATION

Site Category	2030 BAU Energy Demand, MWh	2030 BAU Emissions, tCO2-eq	Estimated Savings Assumption, %	Calculated Energy Savings, MWh/a	Calculated Emissions Savings, tCO2-eq
TRANSPORT SECTOR	13,760	3,687.7			
Routing, design, & control			10%	1,376	368.8
Applying sorting from source			20%	2,752	737.5
Total			**30%**	**4,128**	**1,106.3**

Average consumer prices in Jordan for diesel in 2018 equal to 0.45 JOD/litre (0.54 EUR/litre)
Emissions factor for diesel is 0.268 tCO2-eq/MWh; emissions factor for gasoline is 0.25 tCO2-eq/MWh
Conversion factor for diesel is 0.010 MWh/L; conversion factor for gasoline is 0.0092 MWh/L

Energy Source	Consumption, litres	BAU 2030	Annual Savings, JOD (EUR)
Fuel (Diesel)	1,066,666.7	1,066,666.7 *1.29 = 1,376,000	30% * 1,376,000* 0.45=JOD 185,760 (EUR 222,912)

Expected funding resources:

- Total annual energy savings from the SWM transport fleet is around 4,128 MWh amounting to around JOD 185,760 (EUR 222,912).
- Budget: Estimated to cost EUR 7,000,000.
- Climate cost efficiency: If these measures are implemented by 2027, the expected abatement generated is 1,106 tCO2-eq/a accounting for 4,424 tCO2-eq until 2030. (The climate cost efficiency is equal to the implementation cost divided by the abatement according to the Paris Agreement.)
- Source of finance: The municipality is the main implementor using funds either from the municipal budget or outsourcing to the national budget or grants.

5.4 Solid Waste Management

The municipality has a total population of 846,126 people producing 180,000 tons per year (around 500 tons per day) of solid waste – approximately 0.56 kg per person per day.

The tax imposed by the municipality is JOD 36 on each house, however, the amount of tax collected according to municipality is JOD 2,308,194 JOD only 29% of the total tax due.

If the number of houses is 202,865, then the total tax revenue should be JOD 7,303,140, and if we add the commercial and industrial sector it should be JOD 8,000,000 or more per year.

This financial deficit is expected to increase every year as a natural result of the increase in the population and the increase in energy cost, so it is important that the municipality find solutions to ensure the continuation of providing these services and reduce the resulting deficit.

The analysis shows 50% of expenses are for admin staff, 22% on fees to the Ghabawi landfill, 8% on maintenance cost, 8% on container maintenance, 6% on transfer fees, and 4% on fuel cost.

As a first step, the emissions produced will be calculated to obtain the produced methane gas which can be used for energy generation.

Emissions produced in landfill

The emissions produced in the landfill reached 164,656.8 tCO2-eq at 2018 and are expected to increase to 212,407 tCO2-eq by 2030.

Methane Emissions, Gg/yr	Methane Emissions, tCO2-eq/a	2030 BAU, tCO2-eq/a
6.586272	6.586272*1,000*25= 164,657	164,657*1.29= 212,408

By 2030, the waste produced will reach 232,200 tons based on the business-as-usual scenario developed by the JRC, so waste is one of the city's priority projects.

Conclusion & Results

The management of solid waste costs the city around JOD 10,790,710 per year.

The emissions are around 164,657 CO2-eq per year and will reach 212,408 CO2-eq per year by 2030 due to population growth.

Solid waste in Al Zarqa city puts a huge burden on the municipality's cost in addition to tons of CO2 and methane emitted, and should be managed through a specific strategy for waste while ensuring the income tax matches the expenses at the very least.

Description of the Action

The planned actions to reduce the emissions and management cost for solid waste are:

- Short term actions
  - a. Improving measures related to waste management
  - b. Enhancing community participation
  - c. Improving tax collection on waste collection services
- Long term actions
  - a. Applying sorting at the source, investing in building a sorting facility
  - b. Investing in a biogas system

Short terms actions

Improving the municipal solid waste management as well as investing in technology and efficient resource management will reduce management cost, and increase the collection of taxes by:

a. Improving the municipal solid waste management system and strengthening institutional governance in accordance with the strategic objectives and approved municipal policies for municipal solid waste management and hygiene services.

b. Strengthening the municipality's ability to provide cleaning services, collect solid waste, develop work methodologies, and make optimal use of the municipality's allocated resources.

c. Employing modern technology and methods in a tracking system for mechanisms, determining collection paths, re-evaluating container distribution sites and plans for distributing cadres, workers and mechanisms in service areas within the municipality.

d. **Monitoring actively** with follow-up and evaluation programs to improve the level, quantity, and quality of services provided by the municipality, and link operational efficiency with actual measurement indicators.

e. **Developing methods of planning tools and setting priorities** from the work needs matrix, such as equipment, mechanisms, tools, cadres, labor, and the distribution of functional powers and responsibilities.

f. **Building a comprehensive electronic database** to document basic information related to cleaning, collecting and transporting operations and their various requirements, and using this to help choose appropriate alternatives and make appropriate decisions.

g. **Improving financial management** and estimating operational costs related to the solid waste management sector in the municipality.

Enhancing community participation

a. **Updating local instructions regarding the time of solid waste collection in the city,** along with community awareness campaigns and community participation leading to reduced collection costs.

The table below summarizes the expected results and assumptions:

Sector	Cost, JOD	Percentage of cost, %	Planned Reduction, %	Saving in JOD
Administrative staff salaries	5,359,196	49.66	20	1,071,839
Landfill fees Ghabawi landfill	2,406,000	22.30	0	0
Maintenance, insurance, & licensing	859,000	7.96	0	0
Container maintenance	850,000	7.88	0	0
Transfer fees from the transfer station to the landfill	600,000	5.56	0	0
Fuel	480,000	4.45	10	48,000
Tools, clothing, & equipment	120,495	1.12	0	0
Sweeping & collecting workers' salaries	54,874	0.51	0	0
Buy containers	48,082	0.45	0	0
Waste collection vehicles	13,063	0.12	0	0
	10,790,710			**1,119,839**

As result of the action the operation cost will be reduced from JOD 10,790,710 per year, to JOD 9,670,871 per year, achieving savings of JOD 1,119,839 annually.

Improved fee collection on waste services

Collecting a fee or tax on city garbage services is one of the main challenges faced by municipalities. Notably, Irbid city subcontracted the collection of their tax and they signed an agreement with the provider for electricity to include the tax on solid waste as part of their collection invoices. They distributed the cost of JOD 36 over 12 months of invoices and this became an affordable way to pay.

If the number of houses in Al Zarqa is 202,865, the tax due should be JOD 7,303,140, and if the commercial and industrial sectors are added, the amount due is around JOD 8,000,000 or more per year.

As a result of the action, it is estimated 90% of tax collection can be achieved.

Planned results for short term measures:

In 2018, the municipality incurred a significant financial deficit. The suggested measures will improve the service, reduce the operation and maintenance cost, and improve tax collection. The financial deficit will be reduced from JOD 8,482,517 per year to JOD 1,670,871 as per the table below:

Activities	Amount, JOD
Operations cost (2018)	10,790,710
Savings in operation cost	
Efficient management	1,119,839
Improved collection of tax	8,000,000
Total savings and income	9,119,839
Uncovered cost of operations	**1,670,871**

Long terms actions

-Applying sorting from source

-Recycling recyclable material

-Investing in building sorting facility

Al Zarqa city produces 500 ton of solid waste daily of which 32% are recyclable materials. The table below estimates the cost of raw materials derived from recyclable solid waste:

Recyclable item	Price (JOD/TONE)
Mixed plastics	280
PET	80
Nylon	250
Steel waste	65
Aluminium waste	600
Paper	35
Cardboard	30
Newspapers	40
Paper magazines	35

Figure 7 Solid waste recyclable material

Source:https://mena.fes.de/fileadmin/user_upload/pdf-files/publications/Your_Guide_to_Waste_Management_in_Jordan.pdf

In the figure below, the composition of waste is 57% organic material; 15% paper and cardboard selling at JOD 30 per ton; 15% mixed plastic selling at JOD 280 per ton; 1% wood; and 2% metal selling at JOD 65-600 per ton.

Material	Percentage of waste
Paper and cardboard	15%
Plastic	15%
Metal	2%
Glass	2%
Wood	1%
Clothes	1%
Organic Materials	57%
Other Materials or Residues	7%
Total	**100%**

Figure 8: Solid waste composition

source https://mena.fes.de/fileadmin/user_upload/pdf-files/publications/Your_Guide_to_Waste_Management_in_Jordan.pdf

The following table applies the above figures regarding annual city waste of 180,000 ton and projects the estimated selling costs:

Type of Waste	Percentage of Solid Waste	Solid waste, tons	Cost per ton, JOD	Total, JOD
Organic	57	102,600		
Paper & cardboard	15	27,000	30	810,000
Metals	2	3,600	203	730,800
Plastics	15	27,000	280	7,560,000
Glass	2	3,600		
Wood	1	1,800		
Cloth	1	1,800		
Others	7	12,600		
Total				**9,100,800**

The estimated income from selling the recyclable material from solid waste is around JOD 9,100,800.

The figures above are an estimate. A detailed final feasibility assessment should be conducted by qualified professionals to calculate the revenue from recyclable material.

Some families' income originates from collecting and selling recyclable waste. Planning must take these families into consideration, and solutions must be developed to secure their income before the project is implemented.

Communication plans should be developed, especially with these families, to avoid implementation failure and to ensure a proper and smooth operation.

The recycling waste action includes building a sorting facility and promoting sorting at the source:

a. Enhancing community participation by activating sorting and recycling programs within the municipality's activities, increasing environmental awareness programs, and communicating with the local community on issues related to solid waste management:

b. Building and operating a sorting facility for solid waste

The table below indicates the expected savings from sorting at the source and operating a sorting facility:

Sector	Cost, JOD	Percentage of Cost	Planned Reduction, %	Savings, JOD
Administrative staff salaries	5,359,196	49.66	0	0
Landfill fees Ghabawi landfill	2,406,000	22.30	32	769,920
Maintenance, insurance, & licensing	859,000	7.96	0	0
Container maintenance	850,000	7.88	0	0
Transfer fees from the transfer station to the landfill	600,000	5.56	32	192,000
Fuel	480,000	4.45	20	96,000
Tools, clothing, and equipment	120,495	1.12	0	0
Sweeping & collecting workers' salaries	54,874	0.51	0	0
Buy containers	48,082	0.45	0	0
Waste collection vehicles	13,063	0.12	0	0
Total	**10,790,710**			**1,057,920**

Sorting from source requires a budget for enhancing community participation and active recycling in addition to have a sorting facility and land.

The estimated cost is around JOD 4,166,666 (EUR 5,000,000).

The annual income is JOD 1,057,920 + JOD 9,100,80 = JOD 10,158,720.

Investing in biogas system (methane)

Methane (CH4) is the main component in natural gas. It is an odourless, colourless, tasteless gas lighter than air. With sufficient amounts of oxygen, methane burns to give off carbon dioxide (CO2) and water (H2O) and when it undergoes combustion, it produces a great amount of heat, which makes it very useful as a fuel source.

Methane is considered a biogas which is produced after organic materials (organic residues of solid waste) are broken down by bacteria in an oxygen-free environment, a process called anaerobic digestion which occurs in nature in landfills.

Landfills are the third largest source of human-related methane emissions in the cities. Landfills contain the same anaerobic bacteria present in a digester that break down organic materials to produce biogas, in this case landfill gas (LFG). Instead of allowing LFG to escape into the atmosphere, it can be collected and used as energy.

MWh/a		tCO2/a	
13,965		129,906	
Implementation Cost			
EUR 5,900,000			
Stakeholder Involvement	LA		
	External		
	Other		
Staff Capacity	L	M	H
Key Performance Indicator			
Conduct feasibility study and start of implementation			
Measurement Units			
Green energy produced			
Intervention Area			
Biofuel energy			
Policy Instrument			
Saving resources			
Action Origin			
Local level			
Action Priority			
Local level			
Action Priority			

Description of the Action

- Conduct feasibility study for investing in biogas system for landfill.
- Implement a biogas system to utilize the methane gas from the landfill and convert it to electricity which can be sold back to the national utility network.

The main benefits from a biogas system are:

- Biogas systems use anaerobic digestion to recycle organic materials, turning them into biogas which contains both energy (gas) and valuable soil products.
- Biogas systems are a waste management solution that solve multiple problems and create multiple benefits, including revenue streams.
- Biogas systems turn the cost of waste management into a revenue opportunity for solid waste.
- Converting waste into electricity or heat or provides a renewable source of energy that can reduce dependence on foreign oil imports, reduce greenhouse gas emissions, improve environmental quality, and create local jobs.

In this report we have used the methodology developed by United States Environmental Protection Agency, LFGcost-Web, and the Landfill Methane Outreach Program (LMOP) to estimate the costs of a landfill gas energy project and to obtain an initial economic feasibility analysis for a specific type of land fill gas energy project. Though this methodology is based on the United States, it is a useful initial method to be followed with further study in the future.

Based on LFGcost, the most economical technology is the Standard Reciprocating Engine-Generator Set.

Climate Benefits & Emissions Abatement

Analyse the abatment of emissions due to combustion of methane in the engine.

The methane produced by the landfill is 6.586272 Gg per year which is equal to 164,657 tCO2 per year – and the Standard Reciprocating Engine-Generator Set will produce 2.75 times the CO2 from the burned quantity of methane.

6.586272 Gg x 2.75 = 18.112248 Gg CO2-eq is equal to **18,112.248 tCO2-eq.**

The emissions savings is:

164,657 tCO2-eq minus 18,112.248 tCO2-eq is equal to **146,544.7 tCO2-eq.**

Using biogas technology to produce electricity and burn the methane saves 89% of methane emissions.

Electricity Production & Sales Summary

Total Generation capacity (kW): 2,250.57

Average Generation (million kWh/yr): 13,965 (during the lifetime of the project), this is equal to emissions savings of 0.695 tCO2-eq/MWh x 13,965 MWh per year which is equal to **9,705.68 tCO2-eq.**

The abatement from using methane and producing electricity is:

146,544.7 tCO2-eq + 9,705.68 tCO2-eq = 156,250.4 tCO2-eq

Economic analysis of prospective landfill gas with Standard Reciprocating Engine-Generator Set

Financial projections

Investment

Total Capital Costs (for year of construction): USD 6,662,883 (EUR 5,900,000)

Annual O&M Costs (for initial year of operation): USD 335,298 (EUR 300,000)

Financial Results:

Net Present Value: USD 3,907,439 (EUR 4,400,000) at year of construction

Internal Rate of Return: 23%

Years to Breakeven: 8 (years after operation begins)

Financial Assumptions

Loan Lifetime (years): 10

Interest Rate: 6.0%

General Inflation Rate: 2.5%

Equipment Inflation Rate: 2.0%

Discount Rate: 8.0%

Down Payment: 20.0%

Electricity Production & Sales Summary

Total Generation Capacity (kW): 2,250.569

Average Generation (million kWh/yr): 13,965 (during the life of the project)

Initial Year Electricity Generation Price (USD/kWh): 0.2110

Price to Achieve Financial Goals (USD/kWh): 0.0828 (determined by Financial Goals Calculator results)

(5) Emission Factor for Electricity Consumption is 0.695 tCO2-eq/MWh (CoM-JRC)

Results from solid waste management short- and long-term actions:

Economic analyses of actions related to solid waste management

The annual expense on managing the waste in Al Zarqa is around JOD 10,790,710 where on 29% of taxes are collected resulting in the municipality incurring a financial deficit of JOD 8,482,517 JOD.

It is important to efficiently manage the collection of taxes to guarantee stable income for collecting waste in the city, and allow further actions to reduce emissions and conserve resources.

	Action	Annual Operations Savings, JOD	Annual Income, JOD	Action Cost, JOD
a	Improving the municipal solid waste management, investing in technology and efficient resource management	111,983.90		Minor cost
b	Action related to improved tax collection waste		8,000,000	Minor cost
c	Applying sorting from resources, investing in building sorting facility	1,057,920	9,100,800	4,166,666
d	Investing in biogas system, producing 2.25MW electricity		2,094,750	4,916,666
		1,169,903.90	**19,195,550**	**9,083,332 one-time cost**

The above actions save JOD 1,169,903.9 annually and produce annual income of JOD 19,195,550 in annual base, for a total annual savings of JOD 20,365,453.90 JOD. This requires a one-time investment is JOD 9,083,332.

Energy Savings Calculation

SITE CATEGORY	2030 BAU Emissions, tCO2-eq	Calculated Energy Savings, MWh/a	Calculated Emissions Savings, tCO2-eq
Landfill emissions	212,407		
Sorting resources, investing in building sorting facility		4,128	1,106 [6]
Investing in biogas system		13,965	129,906 (6)
Total		**18,093**	**131,012**

Expected funding resources:

- Total annual energy savings is around 18,093 MWh amounting to around JOD 7,750,800 (EUR 9,300,960) monetary savings.
- Budget: Estimated to cost JOD 9,083,332 (EUR 10,900,000).
- Climate cost efficiency: If these measures are implemented by 2030, the expected abatement generated is 131,012 tCO2-eq/a. (The climate cost efficiency is equal to the implementation cost divided by the abatement according to the Paris Agreement.)
- Source of finance: The municipality is the main implementor using funds either from the municipal budget or outsourcing to the national budget or grants. Solid waste management can be implemented through participation of the private sector or investors. The municipality must enact the necessary legislation for the private sector to facilitate and support the action starting with a feasibility study identifying the finance.

[6] This have been calculated in previous transportation action

5.5 Local Energy Production

Background

Jordan's high potential for renewable energy (especially solar) makes investment in local solar projects attractive if supported by government regulations. [7]

Electricity consumption the municipality is about 868.3 GWh (in 2018). Demand is expected to increase more than three times the current consumption by 2030 according to the business-as-usual scenario. The city receives annual sunshine of 3,000 hours at an average global horizontal radiation of 6.3 kWh/m2/day. The typical average production factor for PV systems is 1,690 kWh/kWp per year.
The municipality should work with investors to promote the use of renewable energy in public and private buildings.

Region	Altitude, m	Latitude, degree	Longitude, degree	GHI, kWh/m2
Al-Zarqa	608	32.05	36.08	6.3

Mitigation			
MWh/a		tCO2/a	
17,626.7		12,250.5	
Implementation Cost			
EUR 14,080,500			
Stakeholder Involvement	LA		
	External		
	Other		
Staff Capacity	L	M	H
Implementation Years			
2023			
Key Performance Indicator			
Installed renewable energy			
Measurement units			
Green energy produced			
Intervention Area			
Renewable energy			
Policy Instrument			
Renewable energy			
Action Origin			
Local level			
Action Priority			

Description of the Action

This action will be conducted in coordination and in complementarity with the Governorate's action and after assessment of the sector's capacity and plans to be modernized and upgraded.

The experiences in the use of renewable energy in the country are many and varied, and this helps in popularizing the use of renewable energy. Moreover, the investment in renewable energy requires high capital investment, experience as well as knowledge of the latest technologies. Where the municipality does not have the technical expertise and financial resources, the municipality can work with the private sector and enter into partnerships with investors who have successful experiences in implementing renewable energy projects and possess sufficient financial assets guaranteeing the implementation of long-term projects.

It is important here to pay attention to the need for there to be a third party to ensure the design, implementation, and operation of these projects. Hence, the importance of securing contracts that guarantee this work is not only for its implementation, but also to ensure sustainable operation and the efficiency of the desired results from this project. Thus, the investor guarantees the economic return on his investment and the municipality guarantees the sustainable operation of the project.

Below is the suggested list of projects the municipality should implement:

- Use online grids for municipal buildings with a connected PV system varying from 5 to 9 kWp based on their average daily consumption. Such projects in municipal buildings are important even if they are small in size as they develop confidence in the use of renewable energy and give practical experience to individuals working in the city and make them talk about the project's success with others and help in understanding the new technologies. The payback period for the investment in grid-connected photovoltaic systems ranges from 4 to 7 years and is considered a good investment.
- Use PV systems with water pumping stations for drinking water and irrigation water to ensure stability in water supply reducing energy bills and dependence on fossil fuels. The city can work with EU and international programs to implement such projects in the city as well as the city can partner with the private sector to implement similar projects through energy performance contracts to guarantee such projects. The payback period for the investment in grid-connected photovoltaic systems ranges from 4 to 7 years and is considered a good investment.
- Upon regional coordination with the governorate, a PV solar farm could be created to secure electricity stability and reduce dependence on fossil fuels. A PV farm project should be coordinated with national authorities and IEC to secure the stability of the grid during the daytime and guarantee the return on investment. A long-term EPC should be applied along with third party role to monitor the performance and guarantee the long term of operation and protect the interests of both the municipality and the investors.

[7] Economic Assessment of PV Investments in Jordan by Loiy Al-Ghussain*

The costs and benefits of the green energy program are summarized in the table below:

Solar PV Farm Annual Electricity Production

Site Category	System Type	Annual Production, MWh	Emissions Savings, tCO2-eq	Project Cost, EUR
PV system on municipal building	20 x 9 kWp	180kWp x 1,690 kWh/kWp= 304,200 kWh /1,000=304.2 MWh	304.2 * 0.695 = 211.4	243,000
PV systems with water pumping stations	5 x 50 kWp	250 kWp x 1,690 kWh/kWp= 422,500 KWh /1,000= 422.5 MWh	422.5 * 0.695 = 293.6	337,500
PV systems on residential and tertiary buildings	2,000 x 5 kWp (10,000 kWp)	10,000 kWp x 1,690 kWh/kWp= 16,900,000 kWh/1,000=16,900 MWh	16,900 * 0.695 = 11,745.5	13,500,000
		17,626.7 MWh	**12,250.5**	**14,080,500**

Financial analysis

Energy Source	Green Energy Production	Annual Monetary savings, JOD (EUR)
Renewable Energy	17,626.7	150 * 17,626.7 = JOD 2,643,993 (EUR 3,172,791)

The return of investment is estimated to be EUR 3,172,791 per year.

Expected funding resources:

- Total annual energy production is around 17,626.7 MWh amounting to around JOD 2,643,993 (EUR 3,172,791).
- Budget: Estimated to cost EUR 14,080,500
- Climate cost efficiency: If these measures are implemented by 2030, the expected abatement generated is 12,250.5 tCO2-eq/a. (The climate cost efficiency is equal to the implementation cost divided by the abatement according to the Paris Agreement.).
- Source of finance: The municipality can build long-term partnerships with the private sector.

[6] This have been calculated in previous transportation action

6 Adaptation Actions

Chapter 6: Adaptation Actions

6.1 Population & Public Health

Extreme heat events can be dangerous to health – even fatal. These events result in increased hospital admissions for heat-related illnesses as well as cardiovascular and respiratory disorders.

- Extreme heat events can trigger a variety of heat stress conditions, such as heat stroke. Heat stroke is the most serious heat-related disorder. It occurs when the body becomes unable to control its temperature. Body temperature rises rapidly, the sweating mechanism fails, and the body cannot cool down. This condition can cause death or permanent disability if emergency treatment is not given. Small children, the elderly, and certain other groups including people with chronic diseases, low-income populations, and outdoor workers have higher risk for heat-related illness.

- Higher temperatures and respiratory problems are also linked. One reason is because higher temperatures contribute to the build-up of harmful air pollutants.

- One of the most important effects of climate change is the shortage of water. One of the adaptation measures to cope with water shortage includes reuse of grey or treated wastewater in irrigation of trees or vegetables. This could increase the opportunity for transmission risk of several pathogens through crop contamination leading to outbreaks like typhoid or hepatitis if the water is not treated. [8]

- Rising temperatures due to climate change increase microorganism growth leading to increases in water- and food-borne diseases. In contrast, flooding as a result of extreme rainfall concentrating annual rainfall in a small interval disrupts water purification with contamination from sewage disposal systems leading to increased probability of epidemics due to vector borne water- and food-borne diseases.

- Climate change may also influence the seasonal pattern for respiratory diseases, cardiovascular diseases, and mortality. The most visible effect of climate change on respiratory diseases is on chronic respiratory diseases including bronchial asthma and chronic obstructive pulmonary diseases. Acute infectious respiratory diseases seem not to be directly impacted.

- Impacts on the health sector range from insignificant (malnutrition) to catastrophic emerging epidemics (haemorrhagic fevers). Young children and elderly are the most sensitive group mainly to food- and water-borne diseases where admission rates will increase followed by respiratory diseases resulting in increased mortality rates.

- Increased temperatures from climate change will increase the frequency of days with unhealthy levels of ground-level ozone, which is a harmful air pollutant and a component in smog resulting in damaging lung tissue which reduce lung functioning and results in premature deaths.

Main adaptation measures suggested at the national level:

In coordination with national and regional related actions:

- Establish an early warning system.

- Adopt healthy buildings using building guidelines which include instructions for advanced sanitary installation that separate grey water from black water.

- Sustain and improve sanitary conditions.

[8] National report MOE & UNDP TNC

The following table explains the adaptation actions related to population and public health:

Action Type	Adaptation measures in complementarity with national and regional actions
Strategic	Develop a health action plan for extreme events the municipality is facing (e.g., extreme heat)
	Provide access to air-conditioned public buildings during heat waves or other extreme events for citizens lacking protective infrastructure (e.g., people living in underground apartments lacking AC during extreme temperatures)
	Update building codes and landscaping laws to increase energy efficiency and improve the ability of buildings to provide protection against extreme heat events (e.g., green roofs and strategically located shade trees)
	Reorganize working hours and reschedule the working time to avoid mid-day work
	Collaborate with regional medical services to increase preparedness level
Alerts & Communication	Develop an early warning system to alert citizens of extreme weather events or natural disasters (e.g., heat waves, floods)
Educational	Conduct educational and awareness campaigns about health-related effects of heat waves, vector-borne diseases, etc. while informing residents on ways to protect their health and prevent infection or impact (see Guidelines in Chapter 7 of this SEACAP)
	Provide instruction for public on staying hydrated and avoiding strenuous outdoor exercise during heat alerts
	Provide easy access to public drinking fountains, swimming pools, and spray pads, also take preventive action like opening cooling centres where the public can gather for relief from the heat
Technical	Clean and maintain sewage and drainage systems
	Identify potential hot spots for the development of vector borne diseases
	Cultivate urban forests, including street and wooded areas
	Monitor frequently water and air quality

Years								
2022	2023	2024	2025	2026	2027	2028	2029	2030

6.2 Infrastructure

Climate change has the potential to impact the safety of existing structures, increase the frequency of weather-related disasters, increase premature weathering regionally, and change significantly design criteria and engineering of structures. Because infrastructure built in current times is intended to survive for decades to come, it is critically important adaptation options for climate change be developed today, incorporated into design, and implemented as soon as possible. Prioritization of required adaptation actions will need to account for existing and future vulnerabilities, the variable lifecycles of structures and replacement, and maintenance cycles.

"No regrets" types of adaptation actions available today need to be applied as soon as possible in complementarity with national and regional actions. These may include measures to reduce uncertainties in climatic design values, regularly updated climatic design values, enforcement of codes and standards, maintenance of climate data records and networks, consistent forensic analyses of infrastructure failures, regular maintenance scheduling, and community disaster management planning. However, given the potential changes expected, it is also likely that many impacts on communities and infrastructure will lie outside of the coping ranges of infrastructure. When this occurs, engineering and planning practices will need account for these growing uncertainties while new adaptation options are developed over time.

Water Sector

The main climate hazards the water sector faces are increased temperatures, decreased precipitation, increased incidents of drought, and increased evaporation. Climate impacts on the water sector include reduced groundwater recharge, deteriorating groundwater quality, reduced stream flow, and increased water demand.

Adaptation strategies and measures suggested for the water sector in complementarity with at the national and regional level are:

- Rainwater harvesting, where quantitatively justified and feasible.
- Wastewater treatment
- Increasing efficiency of irrigation technologies
- Grey water reuse
- Public awareness
- Flood water retention

The following table explains the adaptation actions related to the water sector:

Action Type	Adaptation measures in complementarity with national and regional actions
Strategic	Develop a water and wastewater management plan
	Model predicted supply changes in the electricity from locally available resources
	Monitor frequently infrastructure to spot and quickly repair any damages
	Reduce uncertainties in climatic design values, regularly updated climatic design values, enforcement of codes and standards, maintenance of climate data records and networks, consistent forensic analyses of infrastructure failures, regular maintenance scheduling, and community disaster management planning.
Alerts & Communication	Issue alerts when infrastructure has been severely damaged and should be avoided
Educational	Develop guides and awareness campaigns saving water and energy, especially during crisis
Technical	Integrate sustainable drainage systems
	Establish underground water reservoirs
	Cultivate green roofs on top of impermeable surfaces to deal with rainwater storage and heat
	Rehabilitate springs
	Increase use of renewable energy to decrease pressure on the public grid and contribute to ameliorating power plant failures
	Develop flood management zones and harvest flood waters
	Use advance tap water such as the aerator tap to regulate water flow
	Improve efficiency of water storage systems to reduce evaporation
	Collect rainwater through building roofs for household usage

Implementation Years								
2022	2023	2024	2025	2026	2027	2028	2029	2030

6.3 Built Environment

Adaptation actions improve the resilience of the built environment in the face of climate change and also protects the wellbeing of communities through targeted policy initiatives and better urban and building design, ensures appropriate institutional arrangements facilitating adaptation, realises economic benefits from early adaptation through effective strategic planning and risk minimization, advances sustainability through better resource and risk management strategies, and increases community education and awareness about climate change risks and adaptation.

Urban Sector

According to Jordan's Third National Communication on Climate Change (TNC), at the kingdom level, the overall exposure in RCP 4.5 is low and moderate in RCP 8.5. Although the exposure is low, the events concentrate in certain geographic areas and thus the kingdom exposure is not the best representation for specific urban areas like Amman and Al Zarqa. The main factor, which reduced the exposure score, is the confidence of occurrence due to the large geographic coverage which is not uniform in exposure.

For the purpose of better representation of climate change impact on communities, the exposure has been assessed for the pilot area specifically and for the kingdom as a whole to cover the adjacent urban centres; Amman and Al Zarqa.

Adaptation measures suggested for the urban sector in complementarity with national and regional levels are:

- Introduce climate responsive building techniques and elements to reduce the effect of heat and reduce demand on energy for cooling;
- Promote the use of energy saving devices, and raise awareness on the long-term benefits of energy efficiency and saving devices;
- Amend sector policies and regulations, such as building codes, to reflect climate change risks and direct people towards insulating buildings to reduce energy demand;
- Construct proper storm water network to discharge storm water from built environment;
- Adjust zoning and development regulations to address vulnerability of specific locations and/or resources.

The following table explains the adaptation actions related to the urban sector:

Action Type	Adaptation measures in complementarity with national and regional actions
Strategic	Modify building codes allowing more energy efficient and heat tolerant structures
	Modify building codes against seismic activity
	Reduce municipal taxes for adopting adaptation measures for their houses
Alerts & Communication	Not applicable
Educational	Conduct educational campaigns informing citizens on the benefits of adopting the suggested actions
Technical	Build greening infrastructure such as buildings' roofs and walls
	Increase the amount of shade and green areas in the city by planting trees to reduce the heat island effect
	Build exemplary districts with adapted urban forms and buildings
	Paint roofs white (or other cooling colours) and introduce shading and bioclimatic design
	Collect rainwater while adopting methods to reduce water demand
	Use water resistant construction materials
	Update sewage system by separating grey and black water while benefitting from recycling grey water with several household applications
	Adopt flood resistance techniques applied on buildings, such as building elevation or wet flood proofing

Years								
2022	2023	2024	2025	2026	2027	2028	2029	2030

6.4 Economy

Socio-economic Analysis

The Third National Communication on Climate Change (TNC) has developed a socioeconomic analysis to determine expected impacts of climate change on local communities and their adaptive capacities by employing socio-economic and adaptation analysis tools on the pilot area composed of four villages in the Amman-Zarqa Basin near Irbid.
The study used an income assessment as the main critical indicator to the sensitivity of local community to the climate change. The importance of these indicators are linked to the impacts of climate change on agricultural productivity at the study site. Notably, 54.47% of the community income is based on agriculture making it the most sensitive sector to climate change.

Further measures are required to explore the linkages between socio-economic studies and climate change impacts to enhance the adaptive capacity in communities.

Such measures include:

- Increasing women's skill-development and capacity building opportunities through training in community and political participation skills and link them to general literacy and education initiatives
- Taking measures to increase the labour productivity of rural women through improved access to training, extension services, and technology
- Prioritizing by national governments of inclusive economic growth which does not exclude the rural poor
- Mainstreaming the role of media in climate change and supporting NGOs and community-based organizations well placed to spearhead awareness efforts in different community segments, and in their climate change media-targeting activities
- Conducting a pilot study on vulnerability to food security due to climate change using a multilevel approach including an analytical and relatively comprehensive chain of logical events regarding the impacts of climate change for farm households is needed.

6.5 Agriculture, Forestry, & Other Land Use (AFOLU)

The rural poor in Jordan are expected to face the most severe consequences of climate change through disruption of livelihood options that depend on natural resource management. In particular, the expected impacts of climate change are reduced agricultural productivity and water availability which will threaten livelihoods and keep vulnerable people insecure. Poor families and households are the most vulnerable to the impacts and deserve priority in the design of appropriate adaptive measures. Additionally, rising temperature will stimulate agricultural pests, diseases, and vector diseases requiring further treatments to keep crops healthy.

The **major climate exposure risks** associated with agriculture in the municipality have been identified as:

1. Temperature increase
2. Rainfall decrease
3. Droughts
4. Rainy season shifts
5. Floods

The **major sectors of high climate sensitivities** are:

1. Cropping systems
2. Livestock production
3. Livelihood and food security

The key adaptation measure to climate change is **setting and implementing a sustainable agriculture policy in concert with national and regional authorities.**

Adaptation measures vary horizontally according to the agricultural subsectors and their vulnerability to climate change. These measures vary vertically according to the different actors involved in the development and implementation of this policy.

The adaptation strategies to a changing climate include:

- Agronomic and crop strategies intended to offset either partially or completely the loss of productivity caused by climate change by applying protection through different temporal scales (e.g., short-term adjustments and long-term adaptations), and spatial scales (e.g., farm, regional, or national level adaptation)
- Socio-economic strategies meeting agricultural costs of climate change

Generally, the most important adaptation measures in agriculture are:

- Modifying cropping patterns
- Modifying crop calendar including planting and harvesting dates
- Implementing supplemental irrigation and water harvesting techniques
- Improving water use efficiency
- Using different crops varieties
- Modifying policies and implementing action plans

Most of the **interventions** to **upgrade rain-fed agriculture** can be cost-effective in farming systems, especially where irrigated agriculture is not feasible. For example, supplemental irrigation (the watering of rain fed crops with small amounts when rainfall fails to provide sufficient moisture) has proven to be a drought-proof strategy in most areas.

Increased water available for supplementary irrigation can be achieved through **on-farm rainwater harvesting and management system**, i.e., small farm ponds for micro-irrigation using drip or sprinkler irrigation systems. Larger rainwater storage structures can also be constructed to provide supplementary irrigation water to a number of small farms or fields by using the micro-dams.

Conservation agriculture, on the other hand is very efficient, leading to increased crop yield. In this adaptation measure, several techniques are used to enhance soil water storage. Water conservation is usually enhanced through mulching and crop residue retention through zero or minimum tillage, stubble mulch tillage, strip tillage, and crop rotation. Conservation agriculture, however, requires extension programs such as training and providing equipment.

The following table explains the adaptation actions related to agriculture:

Action Type	Adaptation measures in complementarity with national and regional actions
Strategic	Elaborate a drought, water, and ground water management plan
	Assess agriculture land for soil quality
	Adopt integrated land use planning for tourism
Alerts & Communication	Prepare a protective system for any fire hazard
	Improve forecasting and become familiar with forecasting information available via the media and on internet-weather radar and lightning detectors
Educational	Educate farmers and tourism personnel on conserving natural resources, especially during extreme weather events
	Adopt awareness sessions agricultural sustainability, and encourage the participation of youth and young farmers and their integration with the old farmers to benefit from their experiences
Technical	Use drought resistant crops
	Adopt agroforestry systems
	Use drip irrigation practices
	Adopt energy efficient and water conservation programs at resorts
	Reduce cooling needs in resorts by installing automations and setting thermostats at given temperatures
	Promote renewable energy sources in resorts
	Adopt the fertigation technique (dripping chemical and/or organic fertilizers with water)
	Adopt Groasis Waterboxx tech to minimize water and improve plant growth
	Conserve organic agriculture by combining zero or low tillage with permanent soil cover
	Protect forests and prevent overgrazing

Implementation Years								

Additional Actions for the Agriculture Sector

Study the modernization of agricultural production, practices, and tools; enhance the quality of agricultural fertilizers and pesticides; and improve the marketing of agricultural products through the following measures and actions:

- Conduct feasibility studies on potential new crops.
- Include financing and developing alternative crops suitable to the region.
- Establish an agricultural equipment cooperative providing modern equipment suitable to the characteristics of the land and the cultivated crops.
- Establish an agricultural observatory to conduct soil analysis and measure humidity and other weather indicators affecting production and select optimal crops and the best fertilizers as well as their optimal amounts and the timing of their application.
- Follow up on the wastewater treatment plant project to produce and provide agricultural fertilizers at competitive prices.
- Encourage local authorities and agricultural cooperatives to establish packaging and cooling centres in the most prominent fruit production zones responsive to farmers' needs.
- Establish firms specializing in labelling and exports.
- Conduct studies on the exploitation of the arable lands.
- Organize awareness campaigns on the techniques of using fertilizers and pesticides.
- Organize marketing campaigns for the crops.
- Establish composting projects to aerobically compost unused biomass from agriculture such as harvest residuals, fruit-food waste, pruning material, and manure.
- Launch a field agricultural school to build the capacity of farmers.
- Introduce agroforestry to manage and integrate trees, crops, and livestock and control run-off and soil erosion, reduce water loss, soil material, and organic nutrients.
- Improve water quality and management, protect natural water resources, reduce water losses, and establish water harvesting systems.
- Install new irrigation techniques reducing water consumption.

6.5.1 City Greening

Background

Agricultural and forest areas in Al Zarqa are very small as it is an active industrial area. It enjoys a strategic location linking all the main roads connecting Al Zarqa to the capital, Amman, as well as to Al Balqa, Jericho, Irbid, and Al Mafraq.

The municipality faces long drought seasons due to scarcity of water as well as high summer temperatures making life uncomfortable. The municipality covers over 164 km2 with significant air pollution do to a lack of green areas, and a large number of industrial factories emitting toxic gases into the air.

Description of the Action

The municipality aims to green itself by planting trees in streets, around buildings, and in unused lands to improve the public health statement, urban beauty, and to connect the community to the green environment by encouraging residents to plant trees around their houses by linking new building permits to the availability of a green space. The municipality is preparing a master plan for city greening including, but not lmited to, the following steps:

- Mapping the points and areas to be planted with trees
- Selecting trees adaptable to local climate (minimal water required in summer and unlikely to pose preservation problems)
- Creating a tree census (location, species, size, number, and condition)
- Studying the possibility to plant trees in the soil or in Groasis Waterboxx
- Financing program elaboration
- Acquiring plant stock
- Planting program in collaboration with specialized institutions and experts
- Depolying proper irrigation systems using new technologies like water dripping systems
- Conserving trees through proper irrigation and protection

The project consists of planting 20,000 trees throughout the city in 5 phases over 5 years (4,000 trees per year). An average tree absorbs 43.6 kg of CO2 per year meaning the project will absorb 174,400 kg annually. The estimated budget requires EUR 200,000.

General Objectives

Planting trees and green spaces are associated with better air quality, reduced traffic noise, cooler temperatures, and greater diversity. Trees:

- Improve emotional and psychological health
- Beautify the environment
- Provide shade, keep the earth cool, and reduce cooling costs
- Reduce greenhouse gases by capturing carbon dioxide during growth
- Improve air and water quality by absorbing air pollutants like ozone and nitrogen oxides while intercepting particulates like dust and smoke
- Reduce energy consumption and cool the atmosphere
- Decrease topsoil erosion
- Increase economic stability
- Conserve soil carbon while storing more carbon in the soil
- Reduce storm water runoff
- Foster a safer and more sociable neighbourhood environment

6.5.2. Public Learning Garden

Background

Public gardens are in the forefront of organizations committed to promoting the conservation of plants and their habitats, developing sustainable environmental management practices, and providing green spaces where residents can reconnect with the natural world.

The urban area suffers from lack of green areas such as public gardens and parks. The city is a flat, crowded area with many industrial facilities. High temperatures and dry weather in the summers make life uncomfortable.

Description of the Action

The municipality aims to establish public gardens with multipurposes including awareness raising for climate change as well as social activities, sports, and pilot projects.

The project development and implementation steps are:

- Choose the garden site
- Assess the proposed site (size, neighbourhood, landowners, soils, water availability, etc.)
- Select the garden type and mode for a public garden composed of three areas:
    - Climate change demonstration area
        - Experiment with new species, planting, and harvesting dates, manage water, protect plants against frost, be aware of any new threats, reduce and replace nitrogen fertilizers, plant strategically, etc.
    - Biking and hiking area
        - Construct biking and hiking paths and walkways for the local community and visitors
    - Pilot projects related to mitigation and adaptation to climate change
        - Organic matter composting, crop residues mixed with animal manure, organic waste composting
        - Solid waste sorting-at-the-source, separation of plastics, cartons, glass, organic matters, hazardous materials
        - Aquaponics combining aquaculture (raising fish) and hydroponics (soil-less growing of plants)
        - Solar PV cells illuminating the garden and for water pumping
        - Water management through water harvesting rainwater tanks
        - Sustainability using recycled and local materials and growing a variety of plants for biodiversity
        - New irrigation technologies
- Create your management plan and garden layout
    - Design garden involving a professional landscape architect to lead the discussion in meetings and ensure all ideas are heard and the resulting plan will be something all can own

- Apply and receive approval for funding by developing a budget and considering potential financial resources like sponsorship by local businesses of a section of the garden, grants from the city or other bodies, donations from local businesses for materials, plants, trees
- Construct garden and develop garden group, grow plants and trees, install water tanks and pumps, construct biking pathways, construct hiking paths, etc.
- Install signage to educate the community on energy consumption awareness-raising, efficient water usage, renewable energy use, solid waste sorting, etc.
- Provide guided tours for school children and other groups
- Establish pilot projects
- Promote the garden through the municipality website, media releases, publications, and events
- Monitor and maintain the garden

General objectives

Public gardens are a unique form of open space managed by the municipality to encourage a healthier lifestyle within the local community and to contribute to a sustainable urban environment. They are the place to learn about climate change and can be used to understand the global impacts of a changing climate. Public gardens have a lot of benefits such as:

- Place for physical activities, provide hiking and biking trails and other amenities designed to get people active
- Place for kids to be outside, being outside and playing in nature is crucial for the healthy development of children
- Mental health boost, a place where people are able to make connections, meet new friends, and participate in recreational activities, in addition to physical activities
- Centre of community, provide space for neighbourhood residents to interact with each other and meet new people
- Storm water collection, trees and grass are a far more efficient and less expansive method of managing storm water than sewers and drainage ditches made of concrete
- Clean air and reduced CO2 emissions, trees and plants remove pollutants from the air and eat CO2 during growth
- Create job opportunities for the local community

6.6 Society

6.6.1. Gender Equality and Climate Change as applied in the SEACAP

"Climate change is not gender neutral and neither should climate action be". Women not only have a role to play in tackling the climate change threats but also their knowledge, experiences and views can better guide the actions adopted. Excluding women from the process and overlooking their needs, interests and creativity isolates fifty percent of the world and marginalize potential innovative solutions that can generate more environmental justice while bridging gender gaps and overcoming gender specific barriers".

(Gender Equality and Climate Change in Jordan: Explanatory Gender Analysis Report (2022) - Ministry of Environment and the United Nations Development Programme (UNDP))

Background

Initial evidence indicates that Jordanian women and girls are more vulnerable to the risks of climate change. Men and women within vulnerable communities experience climate change differently and have varying coping mechanisms that are restricted by social norms and values, particularly for women and girls. Women are also most affected during extreme natural weather events (drought, flood, heat waves and snowstorms).

Women's voices, interests and needs are frequently marginalized in climate change actions even though their knowledge and experiences can be pivotal in advancing environmental stewardship, resilience, behavioural change and adoption of new technologies and practices that advance adaptation and mitigation strategies and solutions.

Women are also marginalized from strategic and community discussions that relate to climate change, management of resources, and defining of coping, adaptation, and mitigation strategies. The situation is further exacerbated by the regional political instability, influx of refugees and growing tensions over natural resources, most notably water, and who controls it.

Jordan's engagements to advancing gender mainstreaming efforts in climate change policy and action is well confirmed. The Kingdom fulfils the commitments articulated in the UNFCCC, Paris Climate Accord, and Enhanced Lima Climate workplan for Gender. it was the first country in the region to integrate a gender equality perspective in its

National Climate Change Policy (JNCCP), the National Adaptation Plan (NAP) and the Third National Communication Report (TNC).

General Objectives

In practice, Jordan is engaged in mainstreaming a gender perspective in climate change adaptation and mitigation policies, strategies, and actions, including at local level, namely within the SEACAPs.

To translate this into SEACAP action, this calls for approaching priorities, design projects' design, planning, implementation, and monitoring of progress in a more responsive and targeted manner towards gender equality. This can be applied through a number of approaches presented hereafter

Description of the Action

Generate a strong local discourse on gender equality in climate change

- Selectively collect data and identify gender related indicators along the planning, design and implementation of SEACAP actions. The aim is to understand and address in each one the different impact of climate change on women, men, girls and boys, which is pivotal to adopt a more gender responsive, equitable solutions that ensures inclusive solutions that leaves 'no one behind'.

Develop strong synergies among and between gender equality and climate change actors

- It is essential that synergies are drawn to find the common grounds between gender equality, women empowerment and the practices climate change activists and practitioners that are responsible for executing the SEACAPs, towards mitigating climate change impacts on women.

Enhance capacities to mainstream gender in the SEACAP climate change actions

- Within the SEACAPs direct or indirect capacity building activities, mainstream the concept of gender in climate change applications, including to experts as well as national and local authorities' personnel.

Enhance awareness of communities and decision makers

- Within all the SEACAPs communication and awareness raising activities - including as directly prescribed in Chapter 7 of this document - about the gender dimension and how communities are affected by climate change differently, towards strengthening women and girls' resilience and engaging them in identifying gender climate just solutions.

6.6.2. Creating a Climate Adaptation Network

Background

The climate is changing, and challenges to society in the form of floods, heatwaves and landslides are becoming more common. The municipalities play a crucial role individually in efforts to ensure Jordan is adapted to climate change, as they are de facto facing and responsible for adaptation actions on a local level.

Several of the municipalities that prepared the SEACAPs felt that there was a need for more collaboration and more support regarding their SEACAPs work, plus and in particular regarding climate adaptation. This is crucial considering that those who work with climate adaptation in a municipality often work alone, thus makes it important to identify forms of collaboration.

In this context, it is recommended to form a Climate Adaptation Network associate local authorities that prepared SEACAPs, through which the municipalities can learn from each other and support each other

Action

Create a Climate Adaptation Network associating the 10 Jordanian municipalities that prepared SEACAPs. Each municipality will be represented by a Climate Adaptation Team.

The role of the network will be closely related to that of national and regional authorities dealing with Climate Change and with municipal staff leading the implementation of the SEACAPs. Moreover, the network activities will complement and interact with those of the proposed SEACAP Support Mechanism.

The purpose of the network is to allow members to share their experiences and to learn from one another, thereby creating a common knowledge base and consensus. The members come from different backgrounds, and they have different skills that they are able to share.

The network will give new members clear perspectives of adaptation problems and the chance to find solutions and will enable them to stay updated about other parts of their region and other regions, which means that they can identify areas where they can cooperate, create synergies, and avoid conflicts of interest.

The network will also provide an arena for shared external monitoring and dialogue with other organisations and networks (nationally, regionally and globally), and will function as a facilitator of external support of work on climate adaptation, and further complementing the role of sectoral agencies and that of the SSM

It is highly recommended that an Expert Group be associated with the Network. This Group can comprise researchers from nearby universities and specialists representing sectoral agencies.

Specific issues to confront and challenges through the Network includes

- the incorporation of the climate change adaptation dimension at local and municipal levels,
- the creation of a community of municipal officers, aware of the issue and trained in the use of tools for decision support in adaptation,
- the promotion and provision of local knowledge on adaptation to climate change, particularly building links with national authorities and specialists towards developing strategies, planning and implementation of adaptation action,
- the reduction of barriers and constraints to the involvement of local actors in processes of adaptation; and f
- promote the integration of adaptation policies into planning and decision processes at the municipal level.

6.7 Biodiversity

Biodiversity and Ecosystems

Background

The expected impacts from climate change on ecosystems in Jordan are droughts, forest dieback, and community composition change, expansion of drier biomes into marginal lands, habitat degradation, and species loss.

According to the TNC's exposure and vulnerability analysis, the highest exposure to climate change impacts is expected to be in Jordan's eastern and southern areas and in the mountainous areas of the north.

The highest sensitivity based on vegetation type is expected to be in the northern highlands and across the middle areas, especially the Jordan Valley.

For water vegetation, the analysis expects reduced growth and reduced growth range due to lower soil moisture. Evergreen oak and pine forests are expected to have lower regeneration rates, change in community composition, and shrinkage in geographic range.

Mediterranean non-forest vegetation is expected to have reduced growth in lower elevations and shift toward higher elevation with time.

Highest adaptive capacity was noticed in desert vegetation, tropical vegetation, and to a lesser extent in marginal vegetation types such as steppe vegetation.

Description of the Action

The priority adaptation interventions should be in the most vulnerable areas – forests (especially in the north) and freshwater ecosystems (especially in Jordan Rift Valley).

Adaptation measures and programs that can be adopted at the national level and implemented in the framework of the SEACAP actions in Jordan include:

- Restoring degraded forests and encouraging the establishment of community forests to control soil erosion;
- Introducing diverse conservation governance forms including Protected Areas (PAs), Hima, and Special Conservation Areas (SCAs) empowering local communities to conserve their natural resources and improve their livelihoods;
- Protecting and enhancing ecosystem services in conservation areas; improving access to ecosystem services of high quality which empower local communities and increases the resistance/resilience of local communities to climate change impacts;

- Preserving water quality and flows in water catchment areas using buffer zones surrounding PAs and SCAs;
- Restoring and protecting rangelands to reduce the vulnerability of livestock to drought; and
- Adopting water management procedures providing alternative water sources for fauna and avifauna such as retention dams.

According to the prioritization done by the TNC it was found that enhancing ecosystem services provided by conservation areas and empowering local communities is the most important adaptation measure in Jordan followed by diversification of conservation methodologies and governance systems.

The following table explains the adaptation actions related to biodiversity:

Action Type	Adaptation
Strategic	Establish a fire management plan
Alerts & Communication	Create an early warning system for flooding or fire hazards
Educational	Educate citizens
Technical	Divide the forest into sections to allow better fire management
	Plan, construct, and maintain forest roads
	Plant trees

Implementation Years								
2022	2023	2024	2025	2026	2027	2028	2029	2030

6.8 Water Harvesting System

Background

Surface water harvesting is the technique of gathering or accumulating and storing rainwater, and it provides drinking water, domestic water, water for livestock, water for irrigation, and a way to increase groundwater levels.

Description of the action

To meet multiple water demands, and to reduce the water shortage for residents and farmers, the municipality is establishing a multi-purpose water harvesting system including the construction of new reservoirs or ponds in farms, urban areas, streams, and valleys.

The project development and implementation steps are:

- Determine the location of the ponds or of the concrete reservoirs
- Draft study plans with specialized engineers
- Construct the water reservoirs or ponds as per plans
- Construct a water distribution system to deliver the water to its proposed destinations
- Equip the water harvesting system with PV cells to solar power the new pumping system

General Objectives

Collecting rainwater from natural seasonal streams during winter and spring season is important to secure a strategic amount of water needed for agriculture while reducing the use of ground water for a certain period of time.

The main objectives of the project are:

- Creating a water run-off harvesting system
- Saving the underground water tables from depletion, and ameliorating water quality
- Supplying water for domestic service use, public green spaces, farms, and flocks
- Preventing over pumping of the aquifers
- Maintaining crop levels
- Maintaining livestock level in the city by providing drinkable water

- Controlling seasonal floods
- Expanding tourism by increasing the green areas related to tourism
- Providing a model for nationwide application
- Increasing green areas reducing air pollution, CO2 quantities, and dust levels
- Raising awareness among citizens and tourists regarding water harvesting to counter expected droughts

7 Communication

Chapter 7: Communication

I - Background

Climate Change is one of the greatest threats facing humanity. A recent report from the Intergovernmental Panel on Climate Change (IPCC) on global warming identifies the southern Mediterranean region (including the Maghreb and Mashreq countries) as a climate change hotspot. The region is increasingly subject to the numerous effects of climate change such as increasing water scarcity, droughts, agricultural and food risks, rising temperatures, and growing rates of desertification. Among the common challenges Mediterranean cities face are changing behaviour, building climate awareness, and accessing complex and sometimes inaccessible scientific climate change information as public awareness and social engagement is pivotal. Achieving them requires breaking psychological barriers so specific measures can be applied to change behaviour and provide education.

Awareness about the important link between environment and development in the Mediterranean is increasing.[1] Existing authorities have the capacity and means to inspire, motivate, and engage citizens in global challenges and good practices towards sustainable development by promoting and supporting relevant initiatives in different fields and integrating policies to increase public awareness. Thus, they can become drivers for change as natural leaders of awareness-raising at the local level.

Additionally, young people - who constitute the largest segment of the MENA population - are becoming involved in climate change through new information technology.[2] They are more than ever much more likely to believe climate change will have a severe negative impact. More effective education and awareness is one way to provide them with more effective ways to take action on climate issues.

As hundreds of cities are developing and launching their Sustainable Energy Access and Climate Action Plans (SEACAPs), they undeniably need to build impactful and compelling communication strategies and awareness actions. This chapter guides local authorities and cities in communicating their SEACAPs with a step-by-step action plan and strategy, planning guidelines, communication tools, modes, methods, and channels. It also includes guiding principles to set up the vision of the cities, survey templates, and examples of sector-specific awareness actions to implement awareness-raising campaigns successfully.

[1] https://www.eib.org/attachments/country/climate_change_energy_mediterranean_en.pdf
[2] https://www.arabnews.com/node/1564706/middle-east

II- Developing a Communication and Awareness Plan (CAP)

The Communication and Awareness Plan (CAP) is a pillar of a SEACAP. The CAP serves as a practical, action-oriented guide to cities developing systematic and effective approaches to communicating support for their local SEACAP and its related projects.

In the long run, developing a successful CAP and maintaining it can be a significant challenge as it can encounter inertia or active opposition, particularly from audiences who are climate sceptics, as well as due to a lack of staff, skills, and budget.

Providing information and raising public awareness is therefore vital for inspiring voluntary changes in behaviour, generating stakeholder support for local authorities' policies, and addressing the arguments of those who oppose specific actions.

The CAP is an essential measure that should be feasible, efficient, and adapted to local needs and cultural contexts. It is based on the following six steps:

Step 1: Set the city's vision

When committing to developing a SEACAP, the municipality must have a vision of what needs to be achieved to engage partners and stakeholders, connect with citizens, plus design and execute the awareness campaign.

The vision will define the identity and uniqueness of a city and its communities and imagines what it will look like decades from now. It should be structured around storytelling and a slogan as a "concept idea" reflecting the city's values.

To achieve the new vision for the city, developing the communication and awareness plan and goals should include broad public involvement, community consultation, and engaging community members on issues affecting them.

Figure 9:Examples Of Slogans From Cities' Vision In The Seacaps

See Annex 1 for guidelines on developing a city's vision.

Step 2: Identify priority actions and measures

During the development of a SEACAP, cities identify and validate several priority adaptation and mitigation projects in the relevant sectors including energy, transport, waste management, water management, agriculture, public lighting, etc. They need to communicate these projects effectively by launching a customised range of communication actions and products from brochures, radio programmes, and social media outreach by elaborating on educational curricula for secondary schools, publishing training manuals for technical staff, etc., that will be adapted to each one of them. Some of these activities will require significant investments and ambitious campaigns. In contrast, others can be successfully carried out in collaboration with local NGOs and associations within existing capacities and with minimum funding.

A clear strategy with understandable actions includes inspiring messages related to concrete and achievable action plans establishing a sustainable and long-term climate awareness programme.

Step 3: Conduct a local needs assessment

Awareness-raising actions and campaigns are most likely to succeed if developed in cooperation with local stakeholders and citizens with various roles throughout the local economy. Their views and insights about climate change as well as environmental and energy issues may differ from or possibly complement those of the municipality. As potential partners, they can play a key role in implementing and supporting the local outreach programme.

Observing audiences' behaviours, perceptions, and socio-demographic characteristics is the best way to anticipate barriers impacting their choices and preferences. It is essential to (1) identify target audiences and dig deeper into their true motivations (possibly rooted in cultural norms and beliefs) and present the message to reflect them; and (2) identify the situation, goals, drivers, and challenges while being clear about precisely what behaviour we want to change.

For this reason, a questionnaire survey must be developed and used to:

- Test the audience's opinions and capabilities for exploring climate change priorities, awareness levels, perceptions, social/peer groups influence as well as assess existing resources for communicators, socio-cultural influences, and environmental practices.
- Help define a few population characteristics regarding age, urban environment, degree of education, employment, family situation and income, receptiveness and level of awareness, willingness to change behaviour. This will allow the communicators to gather the resources responding to those specific situations.
- Identify current attitudes to environmental issues, barriers to action (possibly including cost; "not my problem as an individual"-attitudes; performance and effort expectancy; absence of facilitating conditions; lack of information; etc.).
- Guide the awareness-raising strategy, messaging, and materials to be developed and communication channels used to convey the information.

See Annex 2 for a sample questionnaire adaptable to specific local needs.

Step 4: Analyse the risks, challenges, and opportunities

When promoting an action, it is likely needed to communicate both the consequences and solutions it will generate. As a follow-up to the survey, it is necessary to review and validate the needs assessment findings, agree on a list of priority activities to be conducted, bring recommendations on how to implement these activities, and allocate necessary resources. Then, produce a coordinated strategy and action plan to establish a long-term well-balanced climate awareness programme in communicating local impacts of climate change so citizens could grasp what this issue may mean for their well-being and how they can join forces to fight it.
It is important to:

Some identified barriers to change include economics; differing management views; insufficient, inadequate, or conflicting information; doubts over likely success; age and/or health of the individual; lack of government incentives; lack of time; and lack of financial resources.

1. Review some existing or previous actions and the issues that may have negatively impacted the success of the communication. A SWOT analysis may help identify potential threats or risks for that purpose;
2. Draft a list of tools through which the audience should be reached; and
3. Draw an action plan to implement key actions.

On the other hand, the driving factors may involve those drawn from social networks and influencers' support. Therefore, to be better received, an awareness campaign should focus on the audience's needs, address the whole community, and empower them with knowledge.

Step 5: Design the Strategy

The communication strategy seeks to answer the following questions:

- Who are the stakeholders with whom the local authorities need to engage?
- What changes in opinions or behaviour do we seek?
- What messages should be used?
- What communication channels will be most efficient?
- How are the communications-related responsibilities shared among the different actors?
- What are the best processes for internal coordination?

The communications strategy should focus on strengthening internal communications among government agencies and identifying non-governmental allies with whom the local authorities need to engage. The strategy also considers the types of behavioural changes required by stakeholders along with the messages that might trigger change.

To bring about behaviour change in environmental practices, the strategy should:

- Build broad-based public awareness and increase it in all aspects of the city policies and the SEACAPs while promoting its actions.
- Raise the profile of the cities' SEACAPs regionally and internationally, particularly among policymakers and donors.
- Spread awareness about understanding the impact of climate change.
- Target different groups and cover several environmental sectors.
- Elaborate on a communication strategy and methodology tailoring strong key messages to each target group.
- Inform, inspire, and convince the public of the need and benefits for allocating resources in climate change adaptation (sooner rather than later) from public and private investments to get more significant support.
- Support civil action to educate and mobilise citizens on climate change by providing them with tools, resources, and opportunities.

The strategy can also draw on the wide range of experiences and best practices other organisations and governments have had in conducting outreach in the areas of environment, climate, and clean energy as well as take inspiration from regional and international experiences. Countries and cities worldwide are integrating strategic communications into their climate change plans, providing a wealth of best practices from which to draw.

Section III addresses steps for communications and awareness campaigns.

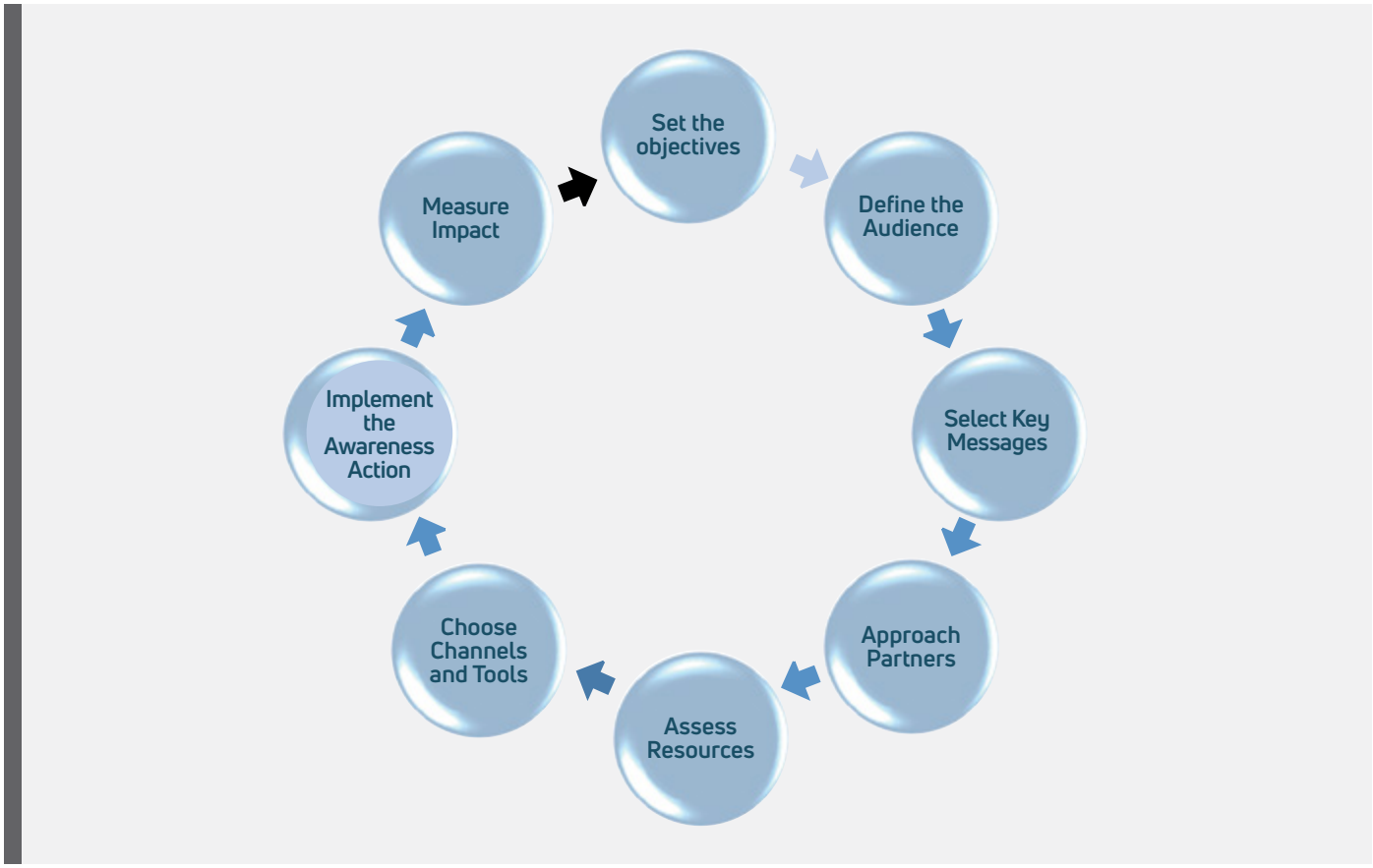
Step 6: Assess sustainability

Sustainability is a significant challenge for CAP and outreach campaigns. Funding, mobilisation, and collaborative partnerships secured during an awareness campaign must be maintained over the long term. The effectiveness of awareness-raising activities and the overall communication strategy needs to be assessed through formal surveys or informal means that will lead the communication team to revise its original strategy and plans if necessary. Monitoring feedback from the field and implementing the activities can contribute to the CAP's overall success.

III- Designing and implementing the communication and awareness campaign

A- Set the main communication objectives
B- Identify key audiences, both internally and externally
C- Develop key messages
D- Approach potential partners
E- Assess and strengthen your resources
F- Select the most effective and available communication tools, modes, methods, and channels
G- Implement the awareness campaign
H- Evaluate, amend, and monitor the impacts and results of the communication campaign\

Figure 10: The eight key components of a communications strategy



Effective communication is essential to a municipal plan or project, both internally among different departments of the local authorities, associated public authorities, and all those involved as well as externally with relevant stakeholders including citizens, associations, and NGOs. It should be driven from the bottom up and involve a broad community group.

From the very beginning, a carefully designed communication/outreach strategy should be integrated into the SEACAPs. This will ensure that its objectives and implementation will align with the Action Plan and its supporting activities.

This section guides local authorities in designing and implementing a well-conceived and impactful communication and awareness-raising campaign by setting the objectives; identifying key target audiences and potential partners; defining key messages; selecting the most effective modes, methods and channels; creating a realistic action plan, timing, and deadlines for each activity stage; planning the resources and the budget; evaluating the campaign's impacts; monitoring results; and amending as necessary.
The strategy should also draw on previous and current communications activities, and establishing an internal communication department within the municipality may be crucial too.

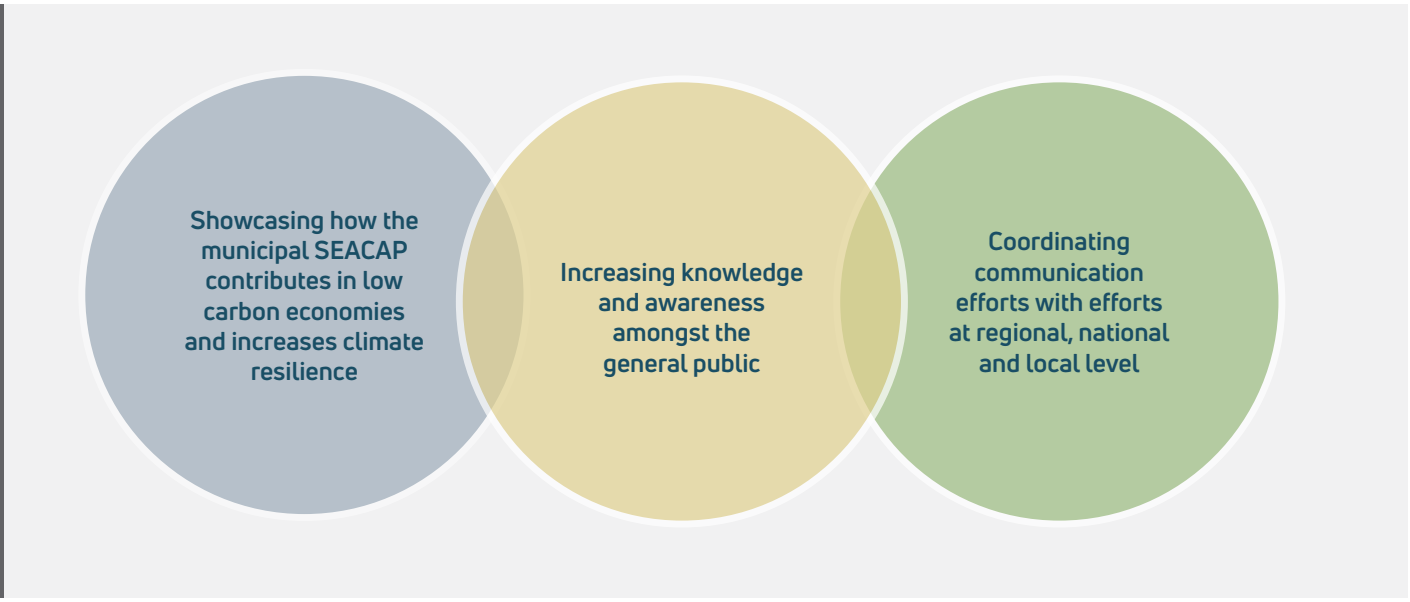
A- Set the main communication objectives

Setting objectives are the key to the success of the communications strategy.

Ensure communication objectives are "**SMART**": **Specific** (what, why, who, where), **Measurable** (how much and how many), **Achievable** (how realistic is it), **Relevant** (is it applicable), and **Time-bound** (when).

The strategy can be designed to meet one or more clear, measurable, and specific objectives, such as:

- Build broad-based public awareness of the city's climate change policies and frameworks.
- Plan a course of action providing specific public information on all aspects of the SEACAPs, promote its priority actions addressing climate change and communicate the new vision of the city.
- Raise the profile of the cities' SEACAPs regionally and internationally, particularly among policymakers and donors.
- Encourage a municipality-driven approach to adapt to climate change so that the target population and other stakeholders act in concert and speak with one voice, and actively contribute in a collaborative effort to develop and implement climate change policies.
- Raise the EU profile and actions in the South Neighbourhood and internationally.
- Help build and solidify partnerships with key actors between governments and civil society including local communities, women's groups, and the private sector.
- Promote regional coordination with other local/national authorities and stakeholders.
- Provide general information to the community of the opportunities and threats brought about by climate change and raise the level of awareness about its impact and risks to the public.
- Support civil action to educate and mobilise citizens on climate change by demonstrating the practical steps they can take while empowering them with tools, resources, and opportunities. Provide advice and examples of best practices for communicating adaptation to climate change and mitigation through reducing emissions.
- Build on the work on awareness-raising actions previously implemented.
- Link awareness activities to other capacity-development activities.



B- Identify key audiences, both internally and externally

Climate change should concern everybody, but in truth, some people will feel more concerned than others because they face specific risks or because they can play a particular role in solving problems.

- Consider the benefits of identifying the possible target audience's primary groups (and sub-groups), including policymakers, community leaders, business and industry leaders, farmers, technical experts, youth, religious leaders, citizens at large, opinion shapers, women, academia, funding institutions, and the media.
- Identify the profile of the audience (primary and secondary target groups) based on relevant data such as age, social, and economic status, education level, current behaviour, level of environmental awareness and knowledge, preferred methods for receiving information, motivation/barriers to hearing and accepting the information.
- Assess their knowledge, attitudes, behaviours, and interest focusing on the needs of your target audience: Why should they care about climate change? What is it in for them? The profile of each potential target group can be assessed through formal surveys or informal conversations with small but representative samples of individuals. (See the survey questionnaire in Annex 2).
- Aggregate information and resources responding to specific situations and their communication goals, the audience, the subject matter, and the available media.

As climate change is a global problem with wide-ranging impacts, the climate change messages must be communicated successfully with many different groups, including residents, partners, opinion formers, and stakeholders.

Do not overlook the importance of engaging youth in long-term campaigns against climate change. Schools and local organisations such as the Scouts can offer useful channels for reaching young people. Teaching kids at a very early age how to respect and protect their environment will preserve their future as adults, plus they will also encourage their elders and relatives to apply it too.

Religious groups are also important as their views often shape attitudes toward the natural world.

Partnerships with key actors are often necessary to develop and successfully implement a SEACAP project. Together with specialised groups such as NGOs, media, academia, and businesses, the general public is also a priority. NGOs, media, and journalists can prove to be valuable partners in promoting climate change awareness because of their extensive outreach networks. Industries should be involved as key partners because of their contribution to emissions and their potential contribution to effective responses.

C- Develop key messages

Effective messaging passed through an awareness campaign is the foundation of any well-built campaign. When elaborating a message, make sure to keep it as simple as possible, easy to understand in the local language, adequate and attractive to the target group, and inspiring.

Consider what your different audiences care about and the messaging that will help reach them and develop messages designed for each specific target. By tailoring to each audience, you get their engagement and break the barriers

preventing them from responding as you wish. Remember, people should be able to recognise their own values, interests, aspirations, and benefits in the messages they receive.

The effectiveness of an information campaign relies mainly on the effectiveness of the delivered messages.

- With an uninformed public, communication focusing on raising basic awareness on climate change, the messages should recommend simple actions the audience can take to reduce emissions or reduce risks. Messages with a strong sense a social norm supports action can be more effective in encouraging the adoption of new behaviours.
- With an audience already motivated to change behaviour, the most appropriate messages may focus on providing practical or logistical information.

Messages with a strong sense a social norm supports action can be more effective in encouraging the adoption of new behaviours.

- With an audience already motivated to change behaviour, the most appropriate messages may focus on providing practical or logistical information.
- With an audience already taking action, it may be helpful to provide encouragement and guidance on how to overcome perceived obstacles. A target audience successfully involved in the new behaviours may benefit from reinforcement and reminders on the benefits of sustaining the behaviour.

Base the messages on the "Four E's" approach:

- **Encourage**: offer benefits/praise. Epower stakeholders with knowledge, skills, and open fresh ideas in the process.
- **Enable**: the first step to changeshould be easy. Emphasise short-term gains as well as long-term benefits.
- **Engage**: involve in the whole community, use the schools and academia, and involve young people and women.
- **Exemplify**: utilise community leaders to set by example, to discuss their approches; chose a likable, and inspirational messenger that people relate to.

The most effective public outreach campaigns tend to establish a "human face" for an issue. When building the narrative, four main aspects need to be considered:

Emotions and rational arguments: Emotions are a very appropriate way to raise awareness. Once the target group is aware of the problem and its own role, it makes sense to provide rational arguments supporting a change of behaviour. Citizens will be able to link their issues directly to their day-to-day concerns and, in particular, to how they manage their lives. This can help motivate and empower people to act themselves.

Tone: pessimistic and catastrophic messages do not necessarily translate into positive behavioural changes. Messages need to be tailored, positive, and must engage the audience based on cooperation and self-responsibility. Positive messages providing solutions can be more effective than negative messages simply sounding the alarm bell without giving information on what people can do to contribute.

Feasibility: This may be the most important aspect to be addressed to ensure the effectiveness of measures. Citizens need to be informed and motivated, but they need to be able to adopt the measures. The role of the authorities is to provide opportunities for feasible actions. Outreach messages can also encourage support for specific projects or public expenditures.

Repeated messages: The issue of climate change has gained prominence with increasing repetitive media coverage and has helped raise awareness of local and global environmental issues, generating climate actions worldwide. People are preoccupied primarily with their daily issues (economic, internal crisis, health, etc.) To overcome this, motivation, recognition, promotion, and constant dialogue must become familiar tools used whenever you try to convince people to change their behaviours in ways that will mobilise them and change their attitudes. Repetition of the messages is recommended as it generates constant exposure and keeps them in the target group's minds, and this favours success.

Types of messages that may be appropriate in a climate change campaign targeting the general public or key stakeholders:

- Even minor changes in personal and consumer habits reduce emissions and promote adaptation to climate impacts.
- Using public transport and turning off electrical appliances when not in use reduces greenhouse gas emissions.
- As farms are highly vulnerable to a potentially drier and hotter climate, agricultural policymakers and farmers should incorporate climate change concerns into their strategic planning.
- Energy efficiency and renewable energy sources reduce air pollution and improve industrial efficiency, thereby reducing both health problems and business/household costs.
- At work, energy awareness leads to cost savings, higher profit margins, and increased job security.

D- Approach potential partners

NGOs, academics, public personalities, and journalists concerned about climate change are potential partners for climate change outreach. They can often reach out effectively and serve as powerful champions and ambassadors of the climate issue. They may also have networks, skills, resources, or credibility to contribute to the outreach campaign. Non-governmental organisations tend to benefit from being flexible, cost-effective, very helpful in identifying participants, and are highly motivated. For example, establishing a Climate Change Committee drawing together local NGOs and associations and engaging the entire local citizens more fully in the issue of climate change can help to develop and support outreach activities.

Institutions, civil society representatives, businesses, and the media, in general, are all positioned to draw society's attention to issues of public concern.16 This makes them "mediators" whose operating principles, status, and objectives must be clearly identified. Social groups that may already exist (e.g., schools, communities) and established networks are vital for awareness-raising and initiatives as well.

Similarly, businesses can encourage responsible behaviour by consumers, forge partnerships with the stakeholders, and/or provide accurate quantitative information on consumption practices (e.g., energy, green products).

Lastly, media (in general) and journalists (in particular) can make decisive contributions to public awareness-raising and act as opinion formers. You can use them to lobby, convey your message, and run your campaign. Workshops, conferences, and trainings provide opportunities to continue to build new relationships with the media and invite them to deliver articles and capitalise on climate change messages. However, many journalists are unfamiliar with climate issues, therefore it is essential to appoint a credible and recognised voice on climate change.

A potential drawback to working with partners may be a lack of control over the message and how it is delivered. When choosing a partner, it is essential to consider its particular interest in the issue and its knowledge, credibility, reputation, and image.

E- Assess and strengthen your resources.

Early consideration should be given to the budget and staffing available for the awareness campaign. Establishing an internal communication department with assigned responsibilities may be crucial to facilitate collaboration between the services and stakeholders involved.
It is worth considering the benefits of providing training in communications skills to key staff early in the process or bringing in specialists where necessary.

Estimate the time and money involved in your awareness campaign. It is recommended 5% of the total funded research budget be allocated for communication. Ensure good value by targeting communication effectively through prioritising the audiences and channels while focusing on high impact/low-cost activities.

In addition to budget and staff, other resources should be considered such as equipment, contact lists, and other databases. Communication budget and staff resources are usually limited, so the communication effort should be adjusted to focus more intensely on one or two key goals rather than spreading them around. Other ways to leverage limited resources could be partnering with other stakeholders (NGOs, local associations) and emphasizing synergies with other initiatives, projects, or themes. For example, tapping into local or international resources including expertise, copyright-free materials, and funding opportunities, can also be valuable.

F- Select the most effective and available communication tools, modes, methods, and channels

Start considering the best way to transmit your message. One of the most important factors to be considered in the planning phase is selecting the communication channel and tool. This is based on cost-efficiency, media coverage and access, cultural factors, long-term view, and repetition.

You must make sure citizens have an adequate opportunity to learn about projects affecting their lives through the choice of communication tools. To engage the citizens' interest, think about the actual and preferred channels your target audiences might use and whether you plan to use the right ones for maximum impact. It is crucial to specify the most appropriate communication channels (i.e., the most accessible and the easiest to implement and finance) for each target group. Moreover, you should also attract media attention.
There are several communication and dissemination tools available for implementing selected communication and awareness activities related to selected SEACAP actions such as: Face-to-face, networking, advertising, mail, email, internet and social media, blogs, talks/meetings, films, brochures, posters, newsletters, printed publications, media releases, newspapers articles, public relation, sponsorship, broadcast media (TV/radio spots), educational material, high impact events, factsheets, promotional material, contests, as well as organising capacity-building workshops, competitions, etc.

[16] P. Favre 1992

Digital social platforms enable users to exchange information and allow people to network. Their unique feature is the systematic collection and analysis of data and its associated network effects which facilitates exchanges between several groups, creates an exchange of experiences, information and ideas, creates a network community, and promotes cooperation between users.

However, pure information doesn't necessarily result in behavioural changes. Allowing people to reproduce a new behaviour, information materials must be accompanied by actions and events such as exhibitions, public meetings, demonstrations, site visits, citizen juries, public meetings, teleconferences, surveys and questionnaires, media events and press conferences, social events (like screenings, concerts, plays, etc.), discussion groups, forums, open houses, etc.

Public awareness aims at early results and is often pursued via the media and outreach campaigns as communicating with the public, and engaging stakeholders is very important. It should be coupled with education programmes to get to more profound, long-term change in habits, particularly among the young. These programmes tend to use formal methods and settings to transmit a more substantial understanding of the climate change problem and its potential solutions and scientific, technical, and municipal personnel training. Widespread involvement in shaping policy and implementing climate change programmes can contribute enormously to effective action.

Driving factors include those that tap into existing social networks and provide social support. Campaigns that focus on the needs and address the community as a whole are better received and provide more incentives and influence. Empower stakeholders with knowledge, skills, and confidence in the new practice, have the tools to help, and ensure the technology aligns with their views and interests.

Exploit seasonality to maximum benefit: Climate change issues are most likely to be raised in people's minds at times of extreme weather, winter storms, floods, summer droughts, water shortages, hurricanes, heat waves, etc.

G- Implement the awareness campaign

Once the tools are selected, and the planning above is done, you may start designing and implementing the awareness campaign. This is where we go into more specificity in the objectives, detailed target, messages, content, etc. Implementation requires coordination among all actors and open channels of communication with non-government stakeholders in civil society and the private sector. In many cases, successful implementation will also entail persuading stakeholders of the benefits from early action.

Awareness campaigns must be simple and emotional and use understandable language for most people as they have an essential role to play in achieving significant change across cities in the pursuit of change. They should have their own identity, tone of voice, and creative look and feel.

Key aspects of a campaign require a series of tactical concepts when designing them:

- Create a common visual campaign identity by designing a logo that will be a visual representation of your campaign and communicates your values and principles. The logo will be used through all your communication channels as well as promotional materials and as a symbol, will create consistency and make people recognise and remember your campaign quickly.
- Develop a creative theme or 'big idea' that will capture your audience›s attention and encourage engagement.
- Engage audiences with graphically appealing campaigns using real photos with real people. Stand out with eye-catching infographics bringing data to life, clean and airy designs, and easy to read fonts.
- Make your content coherent and consistent– repeat structures, colours, and the images and infographics style. Well organised content keeps the reader's attention and makes the content more attractive and readable.

Every city has its own issues, culture, and priorities; thus it is important to reflect these in your communications.

- Images work, so visualise your message with a graphic, an icon, or a photographic image summing up your campaign.
- Use testimonials or human-interest personal stories to add depth from real people, ambassadors, and heroes. That will give people a voice.
- Make it a positive light and feel-good campaign by adding humour and using illustrations.
- Tap into data if you have got some big numbers or killer facts you can use to captivate people.

- Build an interactive space where your audience can share their views and give the campaign a human dimension.
- Make it visually attractive with a catchy slogan.

If you're hosting an event, this involves excellent planning, management, and evaluation. To make it successful, choose an appealing event name, a concept, a slogan, or a hashtag that fits your broader awareness campaign and messaging and connects with your overall campaign look and feel.

You may choose to go for large events which are an opportunity to reach a bigger audience, create impact, attract media and raise visibility, present a wide range of topics, and invite renowned experts worldwide. Smaller events are more effective in bringing people closer, and creating bonds.

Don't forget to promote your event, send formal invitations, and "save the date" notes and other reminders.

H- Evaluate, amend, and monitor the impacts & results of the communication campaign

Since successful communication is about sharing the correct information, at the right time, with the right audience, evaluating the effectiveness and the impact of a communication campaign on public perception is well worth the effort.

Once the message has been communicated to the audience after a campaign phase, monitoring and evaluating the communication and awareness actions is the next step. It entails sharing quantitative and qualitative information about how activities are performing and the impact they have produced. It also investigates increased awareness, increased pride, and willingness to get involved and ensures the lessons drawn from that analysis reach the right people at the right time.

The key questions to be asked are: Has the message been heard/understood/pursued? Credible feedback on these questions from the target audience can be obtained through follow-up interviews or surveys and close observation of behaviour changes. Such monitoring and feedback about how communication and awareness actions are performing helps evaluate how the strategy is being implemented and adapt a campaign as you go along, improving it for next time, and justifying future budgets.

The qualitative evaluation is very useful and needs to be made at three levels:

- Increased awareness: Polling stakeholders before, during, and after a campaign assesses the shift in awareness over time. For example, if launching an awareness campaign in the local area to help residents understand the value of the biosphere reserve, conducting a street poll with a sample of residents that includes questions on their level of understanding of what a biosphere reserve is would indicate the change in the level of awareness.
- Increased pride: Asking questions about what they value most about the local area and how they feel about living there, points towards their feeling of belonging and their level of satisfaction.
- Increased willingness to get involved: Asking stakeholders how likely they are to want to get involved or what more they might need to participate are good ways to gauge their willingness to participate.

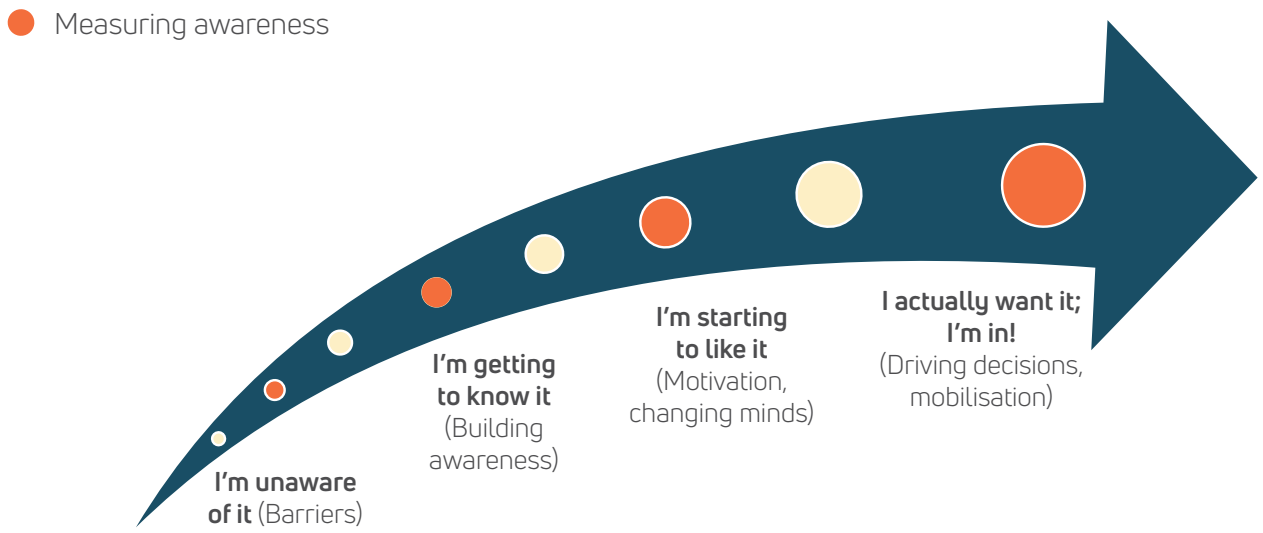
The quantitative evaluation should measure:

- Reach: Determines the number of people directly targeted by your communication and the number of people indirectly contacted by your communications.
- Impact: Assesses the increase in awareness and changes in the behaviour and the increased willingness of people to get involved in the action.
- Investment: Accounts for the funds provided for the awareness activity

The monitoring and evaluation step must be integrated into the planning phase, especially when adapting or modifying human behaviour. Evaluating the effectiveness of the communication and awareness action requires choosing an evaluation method. There might not be harmonised worldwide methods for comparing behavioural measures, so the current challenge is to find better ways to evaluate measures effectiveness and establish indicators such as a headcount at a seminar, quantitative/qualitative surveys, video views on YouTube, hits on the website, social media interactions, feedback via e-mails, press clippings, etc. This will:

- Evaluate the impacts of the communication.
- Measure if higher awareness is translated into more energy-efficient/environmentally friendly individual behaviours.
- Collect the data.
- Conduct the evaluation, report results, and disseminate the results to improve the effectiveness of future programs.

Figure 11: Awareness Process: Building Levels Of Awareness Leading To A Change In Attitude



Overall recommendations and best practices

There is still a lack of knowledge among end-consumers about how the information is provided. It might be deduced that previous approaches such as the price-based approach (save money) and the environmental approach (save the planet) were not completely successful. People need to be inspired, engaged, and have fun when receiving the message.

Repeated exposure to the message is especially important and favours simultaneous reception from multiple sources. Repetition or further development of the campaign is recommended to keep the message in the target group's minds.

Set up internal communication to improve collaboration among all municipal departments.

Establishing an internal communication department responsible within the local authority may be crucial for facilitating and improving collaboration between the services and stakeholders involved.

Adhering to the Covenant of Mayors for the Mediterranean (CoM-Med), and building a regional network with other local authorities, especially CoM signatories, allows sharing experiences and best practices. It is highly recommended as it accelerates learning and highlights the actions taken by each local authority which may also attract investors and additional funding to support pilot and demonstration projects.

Develop a better understanding of consumer behaviour across genders, integrating lessons learned from behavioural insights and an up-to-date survey on gender differences in consumer attitudes to sustainability and their drivers. Men and women express different preferences, perceptions, and beliefs when acting in environmentally friendly ways. Mainstreaming gender equality in environmental strategies/policies is therefore crucial in advancing towards a fairer and more sustainable form of development.[1]

Encouraging individual actions, citizen initiatives, and volunteering; facilitating more affective and experiential engagement (personal stories) are also helpful.

Turning principles into practice requires communication and mediation efforts driven by public authorities: informing, raising awareness, influencing perceptions and behaviour, and relaying and legitimising the implementation of public policies are all among the objectives for the communication efforts of institutional actors. [2]

[1] Gender and the Environment; Building Evidence and Policies to Achieve the SDGs
[2] R. Debray 1993; C. Ollivier-Yaniv 2000

Taking into account

Consumption and behaviour patterns can be heavily influenced via effective public communications campaigns. Building on behavioural insights can support consumers in reaching more sustainable consumption choices by adapting messages across different social groups. Media and citizen engagement can play a significant role in changing unsustainable consumption patterns and transitioning towards a sustainable economy.

Targeting gender roles and behavioural preferences in climate actions is recognising that women's exposure to environmental stress factors need to be considered in this effort.[1]

Facilitate ongoing communication between the city and the citizens and carrying out a public consultation to ensure they learn about projects affecting their lives and assure their involvement and engagement.

Scientific information is critical to telling the climate change story, but it needs to be translated in an accessible or entertaining way for the general non-scientist public.

Dramatic visual portrayals of climate change are persuasive, even in animated form. However, it is not necessary to emphasise fear to create urgency and response.

Avoid duplication of actions. If there are parallel initiatives already in process, it will be efficient to collaborate in a joint, unified effort.

Awareness-raising takes time. All of the most successful public awareness campaigns are sustained consistently over a number of years. During the process, the positive message needs to be constantly reinforced.

[1] Sorensen et al., 2018 [17]

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ANNEX 1

The Vision of Your City / What You Want to Achieve

The vision for your city is based on what you see today and what you hope for tomorrow.

Creating your city's vision defines the city's desired future, a vision of "A Community for a Lifetime" – a great place to live, learn, work, and play, a "city with a sustainable future," etc.

- A vision is a broad statement of the desired outcome for a target community or audience.
- A vision should be:
  - Specific enough to describe what life might be like if the vision were implemented and guide goal-setting activities.
  - Broad enough to encompass many goals and implementation strategies.
  - Ambitious enough to articulate a measurable Action Plan.
- It includes themes like sustainable development, healthy communities, and quality of life.
- It is one of the required ingredients in realising a comprehensive SEACAP and making it succeed together with leadership, action, and partnerships.
- It is one of the key elements in articulating the communication plan.

The Importance of a City's Vision

For a city to develop a strong magnetic pull, its leaders need to:

- Make conscious decisions together with its city council about WHAT they want to become as a community.
- Establish the priorities that need to be addressed.
- Shape the vision for the future and set the direction to develop achievable strategies and plans

Creating the Vision

Ask yourselves and the community a real question as to whether anyone would want to live in such a place as your city, whether it is a place to "be in".

Look further ahead, imagining what your city will look like decades from now.

My city will be a city of....

- Conservation and use of our natural resources and environment
- Active citizens and business partnering with city government
- Mobility for citizens, businesses, tourists by coordinating alternative transport
- Safety for our people
- Health with a focus on the well-being of people and our environment

The Vision of your "city of tomorrow" should be structured around storytelling with a slogan. It all depends on the world you want to centre the story around. If you have a story that centres on climate change, you need to imagine and remake your city in that image.

An Example from Jordan's Aqaba Special Economic Zone Authority (ASEZA)

The slogan: "Go green – The future of Aqaba city"
Aqaba is a rapidly growing city that has almost doubled its population within a decade. This trend is expected to continue though at a lower rate. This population increase poses significant pressures on the existing and future infrastructure and the city's further development. The ASEZA is deeply committed to a sustainable future for the city.

The storytelling: Its vision expressed through the actions selected in its SECAP focuses not only on reducing energy consumption through energy efficiency or producing more clean energy, but also on "greening" the existing as well as future infrastructure at the municipal level.

The image Aqaba projects are strikingly clear in showing a perspective of what a green city will look like.

A) Guiding principles when setting up the vision of the city

- Always maintain a **long-term view**.
- **Put people and community well-being at the centre of the vision**: engage, inform, and create opportunities for people to participate in achieving a shared vision.
  Citizens also play a role in establishing the direction of the city and creating a compelling vision for the community. Listen to what people have to say to develop a shared project vision. Think of young wealth creators and becoming highly attractive to educated, ambitious young people.
- Keep in mind **places, heritage, culture, environment**: celebrate and share the great features in the city that mean the most to its citizens.
- Think about **prosperity, economic development, transportation, and infrastructure**: encourage the growth of the local economy where there is an opportunity for everyone to contribute and succeed.
- Connect to **other cities**.
- Cultivate **new and innovative ideas**.

It is easy to focus on short-term gains and lose sight of the potential to make long-term changes. A good city manager stays in the post for only a few years, but they can affect the lives of citizens for much longer. A thriving city is one that goes further and creates a sense of belonging and purpose.

B) Where to start

A city should identify the needs to shape its vision, recognise the opportunities to answer the needs and determine the priorities leading to actions.

An Example from Lebanon's Kab Elias-Wadi El Delm A Sustainable Pilot City

Needs: With 75,000 people in 2013 producing 19,162 tons of municipal solid waste (MSW) per year, the MSW in Kab Elias is collected and transported by municipality trucks and then manually sorted in the landfill. The unsorted wastes are disposed of in an unsanitary waste landfill.

Opportunities: Changing behaviour in solid waste management and transitioning to a smart way to sort solid waste at the source.

Recommendations: Ensuring capacity development and enhancing public awareness; enhancing plans for sorting solid waste at the source; developing a waste strategy plan with a waste management plan to overcome the high cost in collection and transportation and look for a solution to the landfill either by converting it to a sanitary landfill or utilising another one near the city; and implementing waste power generation from solid waste to feed energy to a future solid waste plant.

C) Planning requirements for your city

One of the most important actions any organisation can take is to focus on what they want to be and how they will get there. With this in mind, the city council will place considerable time and effort into adopting a mission statement, vision statement, values statement, and strategic goals for the city.

Vision

Define the City's identity:

The city should promote the uniqueness of its founding communities, heritage, rivers, environment, cultures, and common future. It should be clear that a city's identity reflects its residents' values, interests, and skills.

Looking into the future:

A city should own its identity and celebrate it.
A city can refine, re-establish, or entirely reinvent what a city is known for. A totally new identity can be established for a city if its old identity is lost.

Develop a vision statement (slogan):

The slogan is a mental picture of the city's possible or desirable future state.
Example:
The City of X will become a vibrant community focused on a booming town centre while preserving its natural character and agricultural roots.

Mission

The city's mission is an important statement describing why the city staff, council, and members exist as an organisation. **A mission statement** is the purpose or role of the organisation describing the organisation's reason for its existence (working together, serving our community...)

"As the world moves toward a focus on a Sustainable Pilot City and a low-carbon approach to meet the growing energy requirements, Kab Elias-Wadi El Delm is taking action to create a conservative culture and ensure a sustainable economic future and clean environment. (...) Kab Elias-Wadi El Delm is looking forward to building a future where it can be confident that the decisions taken today ensure its citizens grow up in an environment that is productive and protected by all."

Core Values

A city's values enable the development of its vision. The city has to commit to its core values (i.e., ethics and integrity, open and honest communication, respect of the citizen, professionalism...); These values will set the example and play an essential role in the decisions and actions of the city. (For example, if sustainability is one of the city's core values, we need to have all municipal employees think and act in such a manner.)

Sometimes a values statement describing those values is necessary to fulfilling the city's mission.

Strategic Plan & Goals

Developing long-term strategies and initiatives to achieve the vision should include broad public involvement, community consultation, and engagement of the community members on issues affecting it.
The strategic plan represents a base for decision making, connects the community's vision and goals with the corporate mission, values, and actions of the city, allows debates and fosters collective responsibility. The Strategic Plan can be developed in three phases:

- Phase 1: Reach out to the community and hear from them about what should be focused on to make life in it better (could be done online or during consultations).
- Phase 2: Get a summary of community feedback and next steps on the categories for developing the strategic plan (heritage & architecture, environment, transportation, infrastructure...)
- Phase 3: Drafting recommendations, goals, and objectives of each main point; the process of implementation, financial impacts...

"Sometimes, the people who make a lot of noise against something drown out the larger number of people who support an idea and recognise the long-term benefit to the city. True leadership is about being prepared to work to achieve that long-term dividend and remembering that a resilient city is one that plans for the future."

George Ferguson, Mayor of Bristol

ANNEX 2

SURVEY QUESTIONNAIRE FOR CONDUCTING A LOCAL NEEDS ASSESSMENT

An awareness campaign is likely to succeed if we address the right messages to the right stakeholders and have them play a key role in its implementation.

The following survey questionnaire will help identify the possible audiences in your city, assess their level of awareness, knowledge, attitudes, interests, and behaviour, plus explore climate change priorities, existing resources for communicators, barriers to action, etc.

According to the findings, the information revealed in the survey will help you design audience-specific messages and build your awareness and communication campaign.

The survey can be carried out through in-person and informal telephone conversations or a formal written questionnaire with small but representative samples of people. Moreover, you may enhance it with additional questions related to further investigations and goals.

GENERAL ENVIRONMENTAL CONCERNS

What is your level of agreement with the following regarding global warming/climate change?				
	Completely agree	**Not fully agree**	**Completely disagree**	**Don't know**
It is a real threat to the population around the world.				
It is a serious threat to you and your family				
It is caused by human activities				
Its impacts are underestimated in the news				
The government should increase the incentives for people who try to reduce climate change				
I am ready to reduce my energy usage to tackle climate change				
The global temperatures have changed compared to the previous decade				
Climate change is happening right now				

In your opinion, how important do you think the following issues are on a global scale?				
	Very Important	Important	Slightly Important	Don't know
Air pollution				
Pollution of rivers and seas				
Flooding				
Litter				
Poor waste management (e.g., overuse of landfills)				
Traffic/congestion				
Temperature rise or drop				
Hole in the ozone layer				
Using up the earth's resources				
Radioactive waste				

Do you think that climate change is caused by natural processes, human activity, or both?		
	Yes	No
By natural processes		
By human activity		
Equally by both		
Climate change is not happening		
Don't know		

Which strategies reduce greenhouse gas emissions?		
	Yes	No
Turning off lights when leaving a room		
Walking or riding a bicycle instead of driving short distances		
Turning down the thermostat by at least 1°C.		
Using energy-saving lights		
Turning off stand-by switches on appliances		
Taking shorter showers		

GLOBAL ENVIRONMENTAL ISSUES

Which alternative energy sources do you think will be the most important in [city]?	
Wind	
Solar	
Nuclear	
Natural gas	
Coal	
Other	

How worried are you that energy may be too expensive for many people in [city]?	
Very worried	
Somewhat worried	
Not at all worried	
Don't know	

Regarding the environment, would you say:	
	Environmental issues don't interest me
	Environmental issues are interesting to me, but the subject is complex, and I don't understand or master it
	Environmental issues worry me, I think about them, but I don't know what to do
	Environmental issues worry me, I think about them, and I am careful in my behaviour
	Environmental issues are a challenge to me, I think about them, I am committed and mobilized within associations

GENERAL VIEWS ABOUT THE ENVIRONMENT

How concerned are you about air pollution?	
Very concerned	
Slightly concerned	
Not at all concerned	

How concerned are you about the extinction of endangered species?	
Very concerned	
Slightly concerned	
Not at all concerned	

How willing are you to change your lifestyle to reduce environmental damage?	
Very willing	
Not so willing	
Not willing at all	
Don't know	

What actions do you implement in your mobility choices?	
	I try to reduce the usage of my car
	I prefer public transport for my daily journeys
	I do car sharing
	Other

How often do you recycle?	
Always	
Most of the time	
Occasionally	
Never	

PERSONAL AWARENESS

Do you tend to buy the most energy-efficient home appliances?	
Most of them	
Some of them	
Not at all	

Do you think that limiting your own energy use would help reduce climate change?	
Very likely	
Not at all	
Don't know	

In your daily life, how often do you do things to reduce your energy use?	
Always	
Very often	
Sometimes	
Never	
Cannot reduce	
Don't know	

In your residential choice, do you consider the following items as important?

	Very important	Important	Not very important	Unimportant	Don't know
Energy-saving housing					
Technology for tracking energy consumption					
Low carbon heating system production					
Energy production system (i.e., PV)					
Smart and recycling system for water management					

In your residential choice, do you consider the following items as important?					
	Very important	Important	Not very important	Unimportant	Don't know
Presence of a green space (e.g., garden)					
Shared green space					
Presence of green walls					
Ecological maintenance of natural areas					
Facilities for fauna and flora (e.g., beehives)					

Are you aware of the global policies or initiatives taken by various organisations to reduce climate change/global warming?	
Yes	No

Are you aware of the environmental policies in your country/city?	
Yes	No

ABOUT YOU

Tell us more about yourself.	
Gender	
Age group	
Education level	
With/without children	
Occupation/profession	

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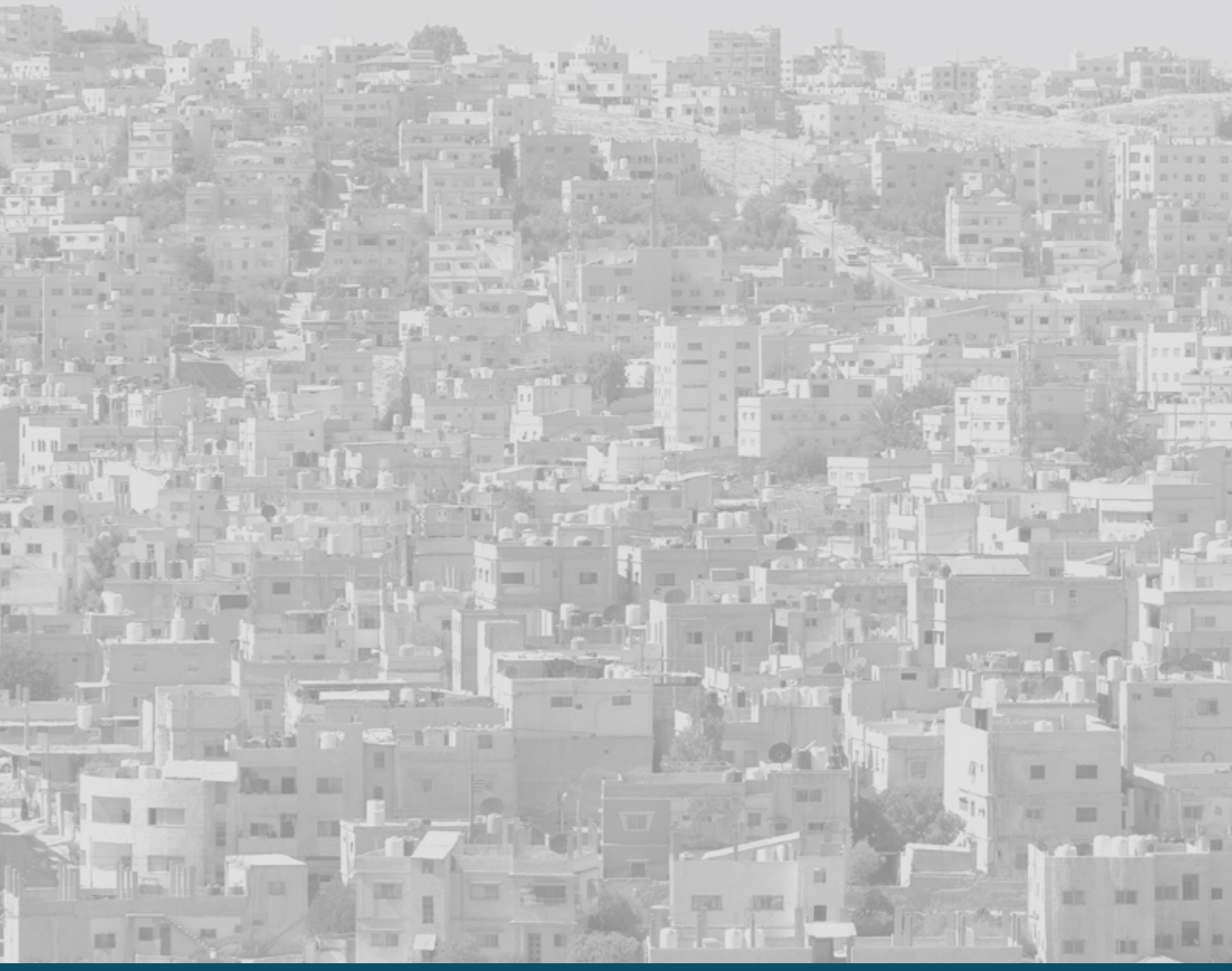

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