Ministry of Environment

Greater Amman Municipality

THE AMMAN CLIMATE PLAN

A VISION FOR 2050 AMMAN

2019 GREATER AMMAN MUNICIPALITY

CONTENTS

ACRONYMS

BAU	Business as Usual
CDM	Clean Development Mechanism (United Nations)
CO_2e	Carbon dioxide equivalent
GAM	Greater Amman Municipality
GHG	Greenhouse gases
GDP	Gross domestic product
LED	Light-emitting diode
LEED	Leadership in Energy and Environmental Design
PPP	Public-private partnership
PV	Photovoltaic
REEEL	Renewable Energy and Energy Efficiency Law
TMMP	Transport and Mobility Master Plan
UN	United Nations

MESSAGE FROM THE MAYOR OF **GREATER AMMAN MUNICIPALITY**

MESSAGE FROM THE JORDANIAN **MINISTRY OF ENVIRONMENT**

AMMAN VISION 2050

In 2050 Amman is utilizing its unique diversity and natural resources to optimize economic growth and urban livability, equity and health for all its residents. The city has maintained its strong traditions while improving municipal services and building a more prosperous, safe, inclusive and green urban experience. Transportation is sustainable, buildings are efficient, public spaces are open and green, water is clean and plentiful, and waste is minimized.

Amman is the capital city and economic and cultural hub of the Hashemite Kingdom of Jordan. It is the political and administrative center of the Jordanian government and home to more than 40 percent of the country's inhabitants. As one of the oldest continuously inhabited cities in the world, it has a rich cultural heritage and hosts many of the close to 4 million annual tourists that visit the country. The city is a model of peace and multiculturalism in the Arab world and is a major center for investment in the Middle East region.

Adhering to sustainable development and green growth principles is crucial for rapidly growing cities like Amman in order to align economic growth trajectories and environmental and social challenges and minimize the need for trade-offs. The national government recently published its first National Green Growth Plan, Amman has aligned our vision and action plan with it. This model of development is crucial for rapidly growing cities such as Amman, where strengthening sustainability and resilience is as important as economic growth. The quality of life for its residents is dependent on taking action to reduce the impact of and adapt to a changing climate, while growing its economy.

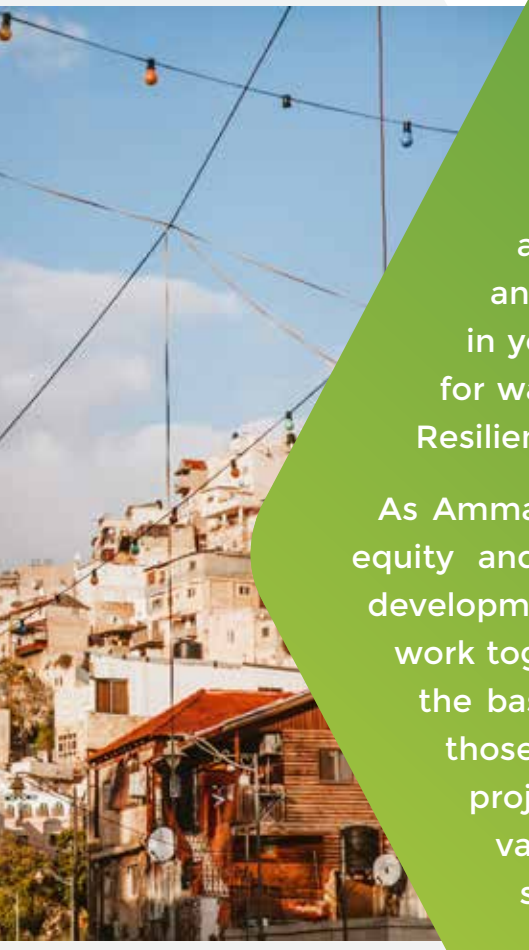
OPPORTUNITIES & CHALLENGES FOR AMMAN

Amman has many strengths that will support achievement of Amman's vision 2050 and set a pioneering example for major cities in the region and across the world.

- Abundant renewable energy sources in solar and wind
- Political stability and peace
- Robust human resources and a high level of education
- A long history of demonstrated commitment to action on climate change at both the national and local level
- A commitment to equity and social development for all
- Committed international development partners
- Local knowledge of native building and design practices that limit emissions and improve quality of life

Amman will be faced with common challenges that come with rapid urbanization, including for example:

- Expanding and managing municipal services in an equitable way
- Collecting and allocating sufficient revenue to build infrastructure and provide services
- Creating coherent planning frameworks that keep pace with city diversification
- Establishing institutional structures that represent the growing constituency, while maintaining the authority to govern effectively.



Other challenges relate more to the unique character of the Hashemite Kingdom of Jordan. The country in general, and the city of Amman in particular, face natural resource shortages, as well as economic and social challenges that have been exacerbated by a large influx of Syrian refugees, climate change impacts, and a lack of quality urban infrastructure. The sharp rise in the city's population has placed a strain on the city's resources and infrastructure, including water, education, jobs, transportation, housing, and medical services. The refugee crisis has contributed to an 83 percent increase in public debt, a 30 percent increase in youth unemployment, a 40 percent increase in the demand for water, and a 17 percent increase in housing rental costs (100 Resilient Cities 2017).

As Amman grows it will need to balance the demands of growth, equity and environmental protection. Moving toward sustainable development can help achieve this balance, especially if all entities work together in solidarity. Good governance and collaboration are the basis for sustainable urban development. Across the region, those involved in developing Amman should consider how their projects anticipate and plan for urban growth, enhance the value of the heritage of the city, and improve equity and the standard of living for all occupants, thereby contributing to this shared vision.

Challenges will not limit the potential of the city as long as the residents of Amman apply their immeasurable innovative spirit and resourcefulness to support sustainable development and help to overcome challenges. They city's commitment to green growth and climate action will focus on leveraging these resources in the pursuit of Amman's Vision 2050.

URGENCY TO ACT NOW

The world is acting to combat climate change, and the Hashemite Kingdom of Jordan is committed to supporting this effort. In December 2015, 195 nations adopted the Paris Agreement during the 21st Conference of the Parties to the United Nations (UN) Framework Convention on Climate Change. The Agreement aims to limit the average rise in global temperatures to well below 2 degrees Celsius, Jordan has committed a nationally determined contribution to this effort of a 14 percent reduction of greenhouse gas emissions compared to a business as usual scenario and dependent on the availability of international funding.

The government and people of Amman will be central to this national level commitment to reduce emissions. The city houses roughly 40 percent[1] of the countries inhabitants and is the economic engine of the country. According to national level projections, the national greenhouse gas (GHG) emissions in 2020 will be roughly 38 million tons of carbon dioxide equivalent (CO_2e). According to CURB (Climate Action for Urban Sustainability) projections, Amman's scenario indicates roughly 11 million tons of CO_2e emissions in 2020, slightly less than a third of national emissions.[2]

Support for global commitments is not the only driver of Amman's pledge to climate action. Amman is committed to leveraging low-carbon, resilient development to deliver a world-class, livable city to the people of Amman.

[1] The Department of Statistics of the Hashemite Kingdom of Jordan estimated in 2017 the Amman governate share of the population as 42%.

[2] A direct comparison of subnational and national emissions is difficult and inexact. However, this illustrates the importance of Amman's contribution to national emission levels.

PILLARS AND GOALS OF THE AMMAN RESILIENCE STRATEGY

PILLAR 1 • INTEGRATED & SMART CITY

- Improve the mobility systems
- Promote walkability
- Institutionalize planning in the city
- Connect the city digitally

PILLAR 2 • ENVIRONMENTALLY PROACTIVE CITY

- Manage and fulfill climate change commitments
- Improve energy efficiency and energy security, including by diversifying energy sources
- Apply green building codes and guidelines
- Improve our waste management system

PILLAR 3 • INNOVATIVE & PROSPEROUS CITY

- Leverage our existing human capital to create employment
- Support entrepreneurs, start-ups and incubators
- Empower women

PILLAR 4 • YOUNG & EQUAL CITY

- Integrate and engage young people equally
- Support youth through cultural campaigns

PILLAR 5 • UNITED & PROUD CITY

- Promote a sense of belonging among citizens
- Promote participation and engagement

CLIMATE CHANGE **RISKS**

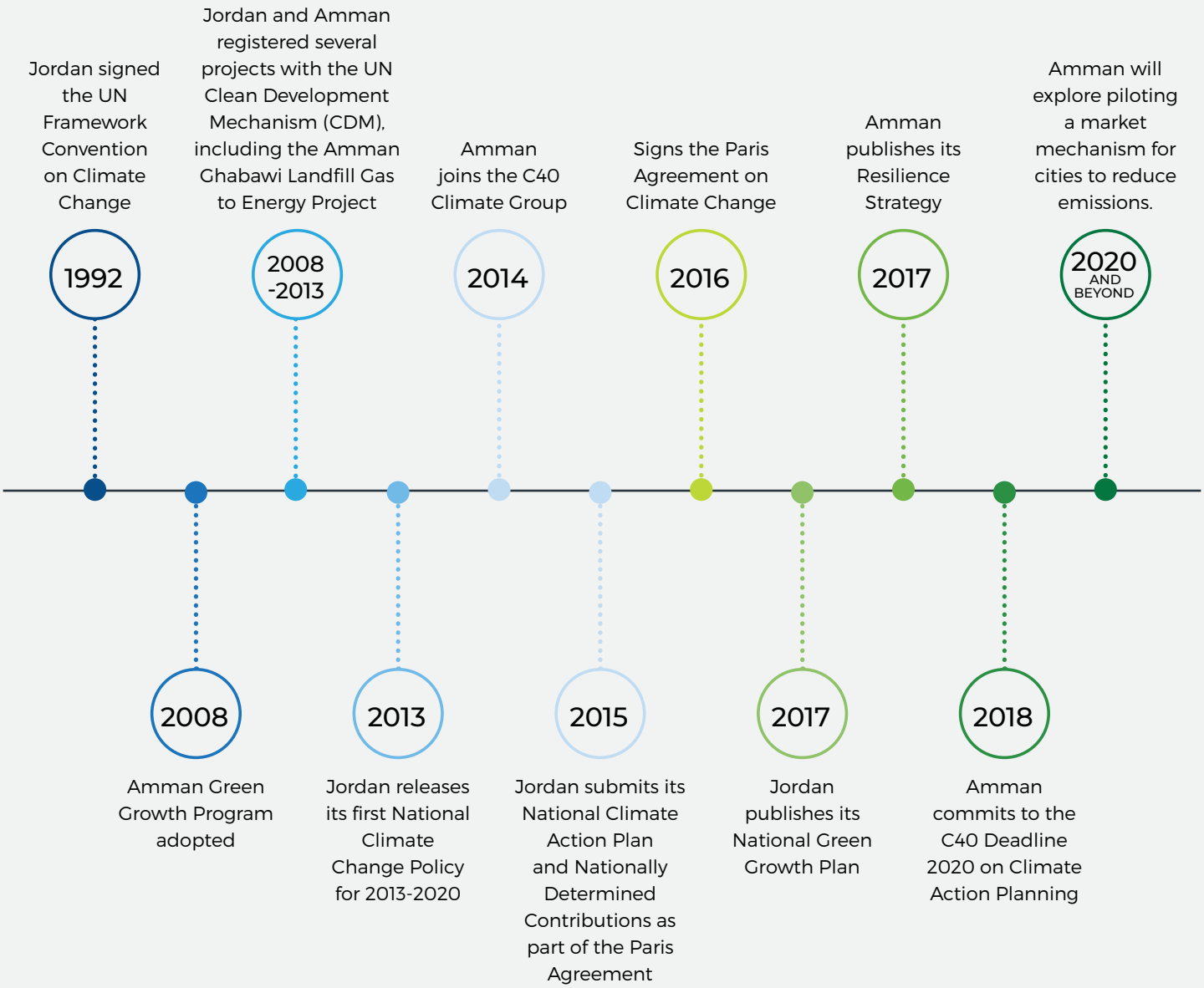
Like other cities around the globe, Amman is already experiencing the impacts of a changing climate. The country is facing decreased rainfall, rising temperatures, and a significant increase in extreme weather events. Heavy rain events are leading to flooding in lower-lying areas of the city, hazardous blizzards have closed schools, and heat waves and water shortages have directly impacted the health of the population and operation of businesses. These adverse impacts of climate change disproportionately affect the poor and most vulnerable in Amman.

The Amman city administration is now acting to protect the most vulnerable, as well as improve the resilience of the city and its inhabitants. Amman's Resilience Strategy was published in 2017. It identifies a range of actions that will help city residents survive and adapt to climate shocks and grow stronger. It sets a vision for Amman and establishes specific resilience goals and actions that will help the city achieve this vision.

The Amman Climate Action Plan is an accompanying document to the Resilience Strategy. In the Resilience Strategy, the creation of a Climate Action Plan to mitigate emissions is cited as one action within the environmentally proactive city pillar. The actions within this Plan have been aligned closely with the Amman Resilience Strategy in the areas that overlap. However, the full Resilience Strategy should be referenced to better understand the complete vision of how the city is addressing climate change. Taken together, these two documents chart a path forward for Amman toward a more prosperous, resilient and low-carbon future. With this commitment the city is resolving to prevent the worst climate impacts for its inhabitants, thereby building a more sustainable and resilient future for Amman and the country.

REGIONAL LEADERS ON CLIMATE ACTION

The Hashemite Kingdom of Jordan and the city of Amman have long been committed to action on climate change. Amman's contribution to global climate change is minor. However, as a rapidly developing city in a strategically important region, it aspires to be a leader in showcasing the opportunities that low-carbon, resilient development provides to its inhabitants.



AMMAN PLAN **BENEFITS**

Many of the actions identified in the Amman Plan and Resilience Strategy benefit the community, the economy and the environment in a multitude of ways.

Environmental Benefits	Social/Health Benefits	Economic Benefits
Reduced air, land and water pollution	Protection against natural disasters (e.g. flooding, storms, heat waves)	Increased jobs
Clean water	Improved health outcomes through reduced air pollution	Enhanced and expanded urban services (e.g. public transportation)
Increased water supply	Better quality housing	Reduced utility bills
Protection of biodiversity for animals and plants	Improved equitable access to urban services	Reduced operating costs
Increased green space	Enhanced public open space and green space	Energy security
Reduced heat island effect	Increased community participation	Neighborhood revitalization

DISCLAIMER ON **DATA AND MODELING**

The emission data contained in this report was collected in 2014 using the best available data at that time. The city of Amman used The Global Protocol for Cities, which allows cities to choose to report at a basic level or basic plus level. The basic level inventory does not include industrial processes and agriculture data. Amman does have light industry and limited agriculture activities within the boundaries drawn for the emission inventory. However, those activities were not measured in the 2014 inventory and their emissions have not been considered in the Amman Climate Action Plan to date. The GAM endeavors to measure and manage these emissions in future emission inventories and will update actions to address these emissions in future Plan updates.

Estimating amounts of greenhouse gases is inherently inexact. As such, the amounts identified in this plan are meant to be directional, identifying trends in sector emissions and future projections. They are not exact amounts and are likely to change as Amman collects additional data on city emissions. Amman also endeavors to further expand data sources in future iterations of its inventory, continually improving its understanding of emission sources in the city.

AMMAN
CITY DATA

POPULATION IN BOUNDARY OF GREATER AMMAN MUNICIPALITY:

POPULATION 2017

3,698,362

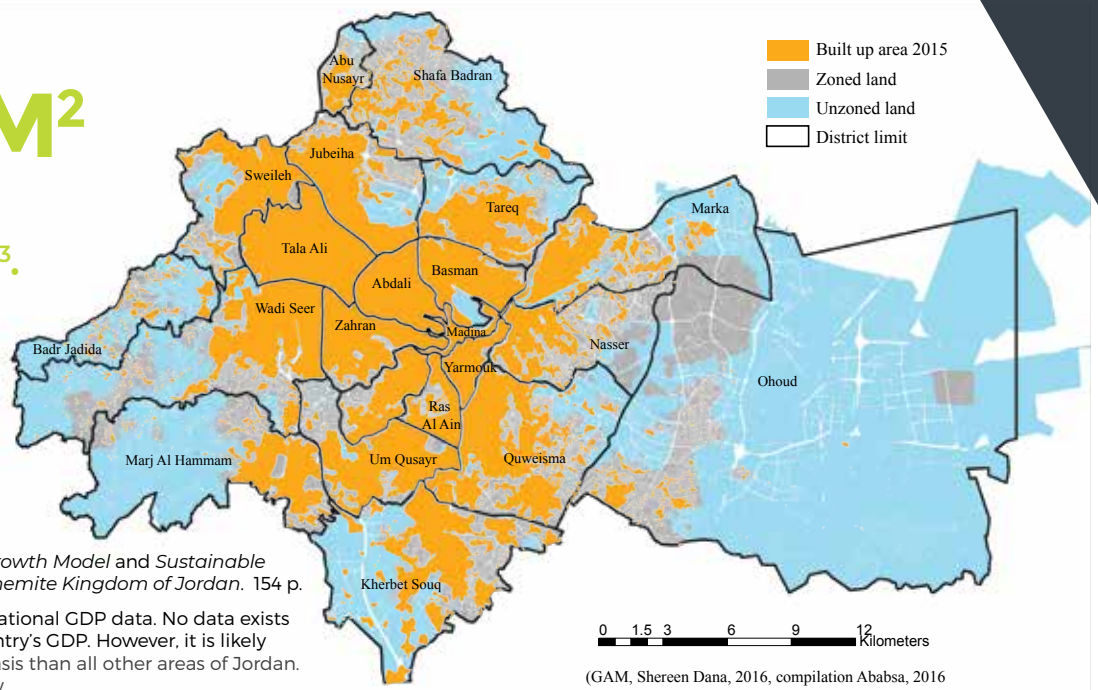
GDP

As of 2017, the population was 3,698,362 (Jordan Department of Statistics 2017). Population growth is expected to increase in Amman at a rate of about 1.8 percent per year until 2030. In recent years, the population has grown at a significantly higher rate due to the humanitarian crisis in Syria. The country has accepted over 1 million refugees from Syria alone, and many more Palestinians and Iraqis reside in the Hashemite Kingdom of Jordan as a result of regional conflicts in the last two decades. Non-Jordanians represent one-third of the population. Amman has a predominately young population, with those aged 24 years old and younger representing the city's largest group and greatest asset.

AREA

800 KM²

built-up area
212 km² in 2015[3].



(GAM, Shereen Dana, 2016, compilation Ababsa, 2016

[3] World Bank 2018, *Urban Growth Model* and *Sustainable Urban Expansion for the Hashemite Kingdom of Jordan*. 154 p.

[4] This figure is scaled from national GDP data. No data exists for Amman's share of the country's GDP. However, it is likely even higher on a per capita basis than all other areas of Jordan. Thus, this estimate may be low.

CLIMATE

The climate in Amman is sub-tropical arid, and the city experiences hot dry summers and cold, wet winters. Amman has a varied topography and diverse climate, with extreme micro-climates in the city. The rainy season is in January and February when almost all of the rain for the year falls. The city is considered dry, with around 250 millimeters (mm) of rain a year.

HISTORICAL CHANGES AND FUTURE PROJECTIONS INCLUDE THE FOLLOWING (WORLD BANK 2019):

- The country's annual maximum temperature has increased by 0.3-1.8 degrees Celsius since the 1960s.
- In most parts of the country, precipitation has decreased over the last several decades. However, there is high variability across the country with some areas recording increased precipitation.
- More frequent heat waves are projected, with an expected temperature increase of 2 °Celsius by the year 2050.
- Intense precipitation is projected to increase, although overall rainfall will decrease with some level of variability.

KEY SOCIAL, ECONOMIC AND ENVIRONMENTAL DATA IN AMMAN INCLUDE THE FOLLOWING (100 RESILIENT CITIES 2017):

30% increase in youth unemployment (2011 to 2015)

40% increase in demand for water (from 2011 to 2015)

15% unemployment rate, highest among women and youth

6% of Jordan's GDP Fiscal impact of migrant influx

25% of government annual revenues

ADMINISTRATION

Amman is divided administratively into 22 districts, each with a high level of autonomy to deliver city services. The Greater Amman Municipality (GAM) maintains central control with regard to zoning and planning, as well as infrastructure design and construction. The GAM is financially independent, with a large percentage of its revenues self-generated from taxes. It also has a long track record of direct engagement with international development institutions for the development of city infrastructure.

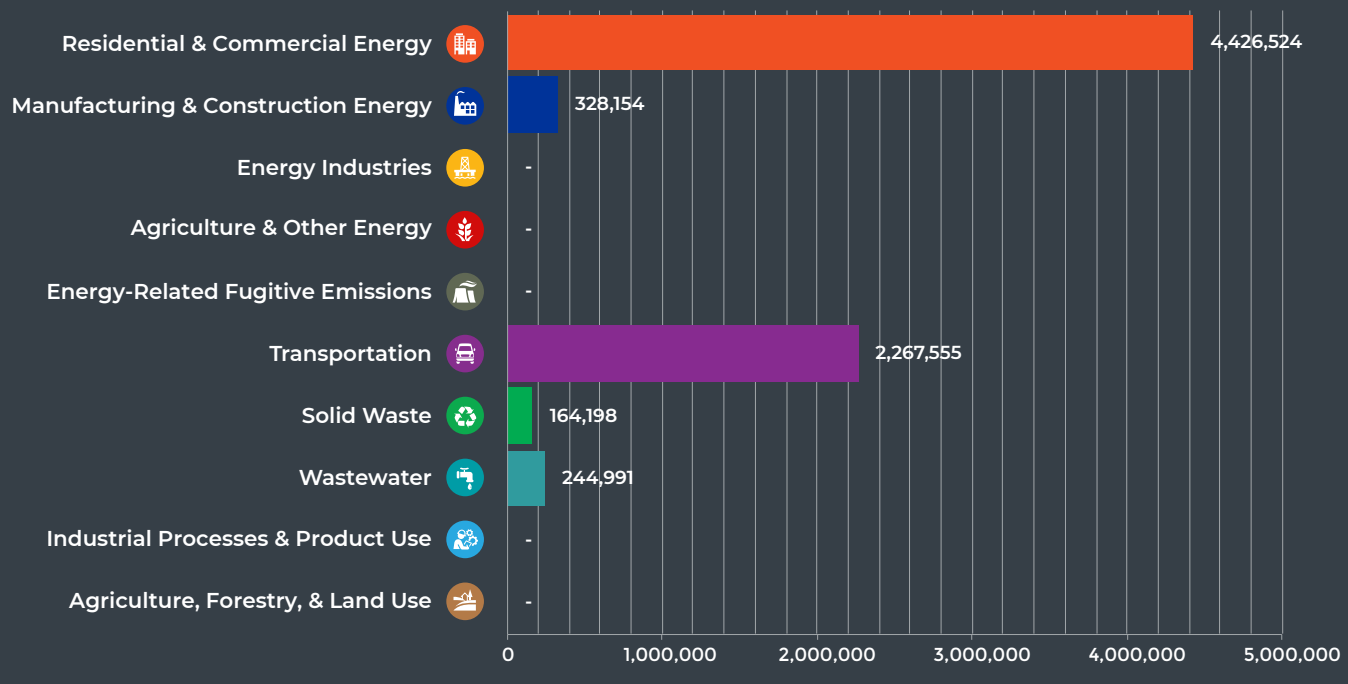
AMMAN'S EMISSIONS INVENTORY

Amman completed its first city-wide inventory of greenhouse gas emissions for the year 2014 using the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories[5]. A city-wide GHG inventory enables cities to measure their overall emissions and understand what level of emissions different activities within the city contribute to the overall amount. This helps cities to better target actions that can reduce emissions.

Amman's 2014 inventory measured the city emissions at just over 7.4 million tons. This is similar to the total emissions of cities such as Paris, Philadelphia, and Washington, DC. However, on a per capita basis, Amman's emissions are much lower than these cities at roughly 2.1 tons of CO_2e per person. Without action, emissions are projected to double by 2030, and would reach almost 40 million tons by 2050.

The inventory shows that the two sectors that contribute the most to emissions are stationary energy and transportation. According to the inventory, 64 percent of Amman's emissions came from the stationary energy source category (residential and commercial buildings), and 31 percent from transportation. More specifically, the largest sub-sectors of emissions were electricity in buildings, and on-road transport.

HIGHEST EMITTING SECTORS BASED ON 2014 GHG INVENTORY



[5] The city encountered challenges in obtaining data for the emissions inventory and for the CURB scenario modeling tool. Thus, proxy data was used to fill the data gaps. This is a common exercise, as most cities do not have complete data sets for all sectors. The emissions data is used here for directional planning, and is not an exact measurement.

THE MAKING OF A NEW AMMAN: TRANSFORMATION UNDERWAY

The journey to a more sustainable future for Amman has already begun. The city has encouraged sustainable development for a decade, starting with the Amman Green Growth Program. In this context, it has taken decisive action in a few key areas that are essential to reducing emissions. These projects demonstrate the types of changes the city will need to make in order to achieve its 2050 vision. These planned actions are expected to reduce emissions by approximately 20 percent below a baseline scenario by 2030. This is a good start, but more needs to be done to achieve the city's vision.

Taking Action to Improve Amman and Fight Climate Change

TRANSPORTATION • Improvements include the planning and building of the city's first rapid bus transit system, as well as improving the transportation and mobility network.

ENERGY EFFICIENCY • Improvements include enhancing street lighting efficiency with a light-emitting diode (LED) street bulb program and incentivizing green building with a green building density bonus.

WASTE • Improvements include managing waste based on the "4Rs", that is, reduction, reuse, recycling, and recovery, as well as creating fossil fuel free energy in the Al Ghabawi waste to energy facility.

AMMAN'S PATH TO ACHIEVING VISION 2050

THE FIRST MILESTONE: A 40 PERCENT REDUCTION BY 2030

As part of its membership with C40 Cities, Amman has committed to delivering a GHG emission neutral[6] and climate resilient city by 2050. The city also committed to creating a plan and a pathway for reaching that target, with an interim target of a 40 percent reduction over the 2014 baseline by 2030.

The core of this Plan is the commitment to reduce the city's emissions to near-zero in the future. As such, this commitment will drive the transformational shifts, including the scope of those projects and policies that are identified within the plan. To achieve near-zero emissions, per person emissions need to be kept at or below current levels, which have been estimated at approximately 2.2 tCO_2e/person/year. Amman is still a developing city, and currently per person emissions are comparatively low. However, as a rapidly growing city, the challenge will be to achieve economic growth for the expanding population, while barely growing per person emissions.

AMMAN'S FIRST CLIMATE ACTION PLAN

This is Amman's first climate action plan and, indeed, a first in the region. The Plan establishes the 2050 vision, commits to a near-zero emissions target and sets a pathway with major pillars of action. Amman has been implementing climate actions that improve service delivery and reduce emissions for over a decade. This Plan builds and expands on those smaller-scale projects. It is the first step in Amman's formal climate action planning process. The next step will be to design a process for implementation of the actions that achieve the main pillars of the Plan. A process for implementation will identify the human and financial resources, the policies and regulations, and the governance and financing structure needed to implement key actions.

Amman will continue to evaluate and increase the scope of its action plan in accordance with future guidance from C40, as well as the experience of other cities attempting to reach near-zero emissions by 2050.

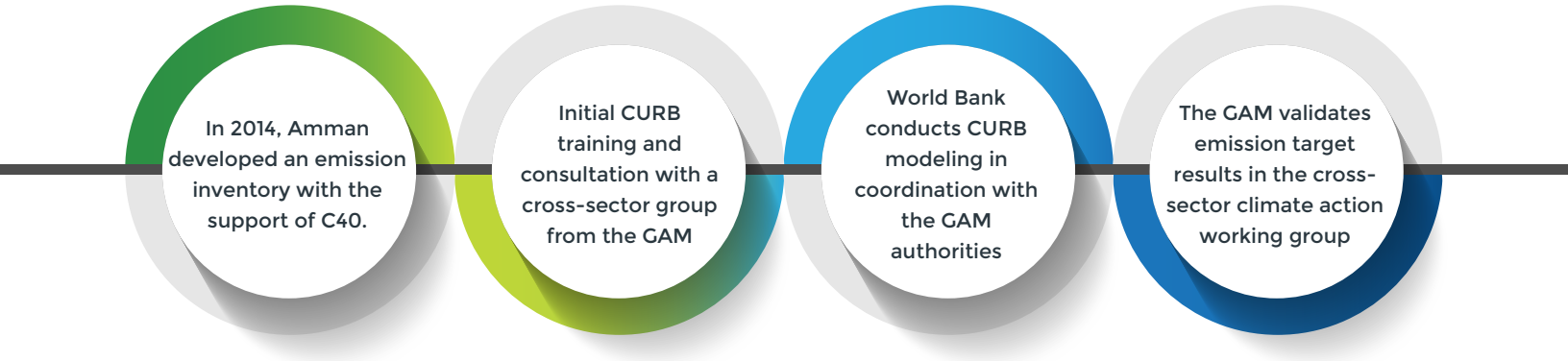
[6] C40 Cities is currently producing research on the level of acceptable offsetting that can occur under a near-zero emissions plan. Currently C40 defines "GHG emission neutral" or near-zero carbon as 0.01tCO_2e/person, as noted in the Glossary.

MODELING A PATHWAY TO VISION 2050 AND INTERIM TARGETS

Amman used a scenario planning tool called CURB to identify and prioritize low-carbon infrastructure and GHG reduction actions that would set the city on a path to achieving its 2050 vision. Data from the 2014 emissions inventory was used in the creation of the model to set the city's baseline emissions. CURB is an excel based model that uses city emission inventory data to project future emissions and suggest actions for reduction. The analysis presented here comes from the CURB model, and it helped Amman to shape its 2050 vision and action plan. The tool was developed in close coordination with the departments and units that manage infrastructure projects and policies in the Greater Amman Municipality, the government formed a technical working group that input data to the model. The actions that are selected to create the scenario are based on discussions with these departments and also reflect actions that the city is already taking.

The baseline scenario is a "business as usual" projection that estimates what emission levels would be in the future with no emission reduction actions taken. The baseline uses Amman's 2014 emissions inventory data, as well as future population and economic growth rates to project emissions. Actions were then selected in the tool for each sector to build a scenario that would reduce emissions below the baseline emission projections.

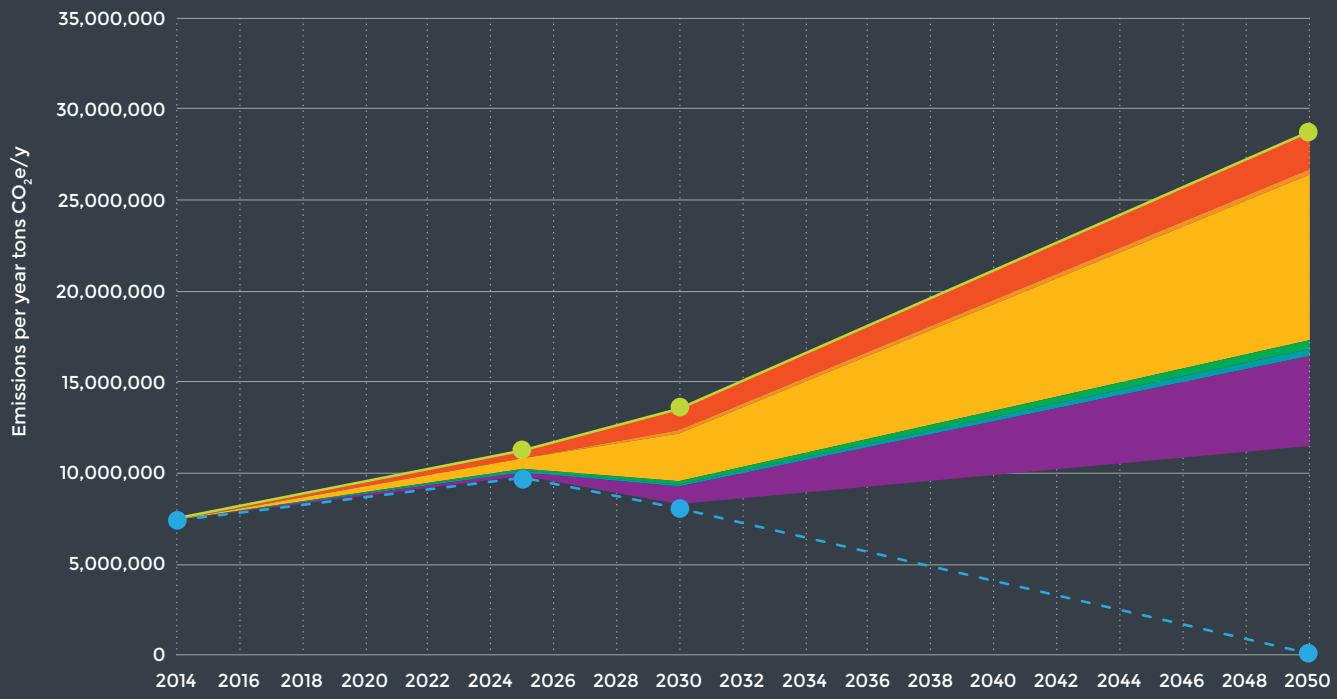
DEVELOPING THE AMMAN PLAN



The CURB model is not designed to account for more complex land use planning scenarios that can achieve significant emission reductions over time. Instead, the tool is limited to actions pertaining to buildings, energy sources, transportation, waste, and wastewater. In 2017, a World Bank Group led team worked with Amman to model green growth scenarios that considered land use changes. It identified the opportunities for cross-sector planning and land use actions. The outputs from these two modeling approaches, along with consultations with all the GAM departments, identified the priority areas of action that need to be addressed to achieve the Amman 2050 Vision.

It should be noted that carbon sequestration activities were not modeled for Amman. Future iterations of this climate action plan could explore the level that urban forestry and other carbon sequestration actions could play in helping Amman achieve drastic emission reductions.

AMMAN EMISSIONS TRAJECTORY AND TARGET 2014-2050



- National/Regional Actions (All Sectors)
- Private Building Energy
- Municipal Building & Public Lighting
- Electricity Generation
- Baseline Forecast
- Solid Waste
- Wastewater
- Transportation
- Carbon Sequestration
- Target Trajectory

2030 EMISSIONS LEVELS

13,000,000	Baseline Forecast
40.0%	Target (% below 2030 baseline level)
8,000,000	Allowable Emissions
40%	Achieved reduction

2050 EMISSIONS LEVELS

28,000,000	Baseline Forecast
99.5%	Target (% below 2050 baseline level)
140,000	Allowable Emissions
11,500,000	Achieved with Actions
11,360,000	Achievement Gap

ANTICIPATED GAP IN **ACHIEVING 2050 GOALS**

Currently, the model pathway does not show that Amman can reach its 2050 near-zero emissions target. C40 considers near-zero emissions to be 0.01 tCO_2e/person. Many cities who have committed to this goal are still exploring how to achieve aggressive long-term targets. The achievement gap should be used as an indication of the scale of ambition needed to achieve near-zero emissions.

No new actions have been added between 2030 and 2050, only a dramatic scaling up of existing actions and an increase in penetration rates. New actions and technologies will be identified in the future that can close the gap by 2050.

The modeling used to produce emission projections does not adequately consider emissions saved from more complex multi-sector approaches, such as increasing density, improving transit-oriented development and reducing urban sprawl. As noted, carbon sequestration actions were not considered for this iteration of the climate action plan. The analysis for Amman shows that land use strategies and carbon sequestration could be more effective in reducing emissions than some energy sector or transport actions. More studies and modeling are needed to support this analysis.

This action plan will identify important cross-sector and urban planning actions that will be necessary to help Amman achieve their vision, which goes beyond simply reducing emissions.

THE PILLARS OF THE AMMAN PLAN

Achieving a deep decarbonization of Amman's economy and developing resilience against climate change will require a major transformational shift in every sector. These transformations will reduce emissions, but they will do much more than that. They will change the fabric of the city, significantly improving the daily life of residents of Amman.

These shifts will be referred to as the pillars of the Amman Plan.

PILLARS FOR ACHIEVING 2050 VISION

Decarbonizing electricity sources for the city

Improving energy efficiency in buildings

Enabling sustainable transport mobility

Enhancing waste management and reducing waste

Reducing water use and improving efficiency

Improving integrated planning for denser, transit-oriented development and green infrastructure

Modeling complex activity 30 years into the future involves making assumptions and projections about behaviors of a multidimensional system. Assumptions have been documented in the Annex, detailing the CURB model. The outcome shared in this report relies on analysis that is based on assumptions regarding the level of technology development, market changes, and impacts of national policies. These factors are largely outside of Amman's control, and very hard to predict far into the future. This model considers technologies that are currently available and does not incorporate any assumptions regarding behavioral changes that could change consumption patterns. New technologies and major shifts in behavioral change will be needed to achieve a 1.5-degree scenario, but it is challenging to forecast what these might be.

PARTNERING TO ACHIEVE GOALS

City action alone will not be sufficient to deliver Amman's Vision 2050. Additional actions by the national government, the private sector and other stakeholders will be necessary. Collaboration with external partners will be crucial to deliver the requisite transitions. Indeed, C40 research shows that while city actions continue to deliver savings against the business as usual scenarios, beyond 2023, their own cities cannot deliver on the steep, aggressive trajectories necessary to achieve the Paris Agreement.

The action areas identified in this Plan would help Amman to achieve a deep reduction in emissions over a baseline by 2030. However, many of these actions will require leadership from other levels of government and partnering with the GAM. For example, many actions in the building and water sector cannot be implemented by the city alone, and building codes are set at the national level. Thus, the Greater Amman Municipality government does not have the policy making, regulatory or fiscal power needed to lead implementation on all actions.

Amman has a strong track record of collaborating with all levels of government, the international development community, and the private sector. The goal of the Amman Plan is to provide a structure under which these partnerships and projects can be coordinated to ensure that overlapping or conflicting work does not occur.

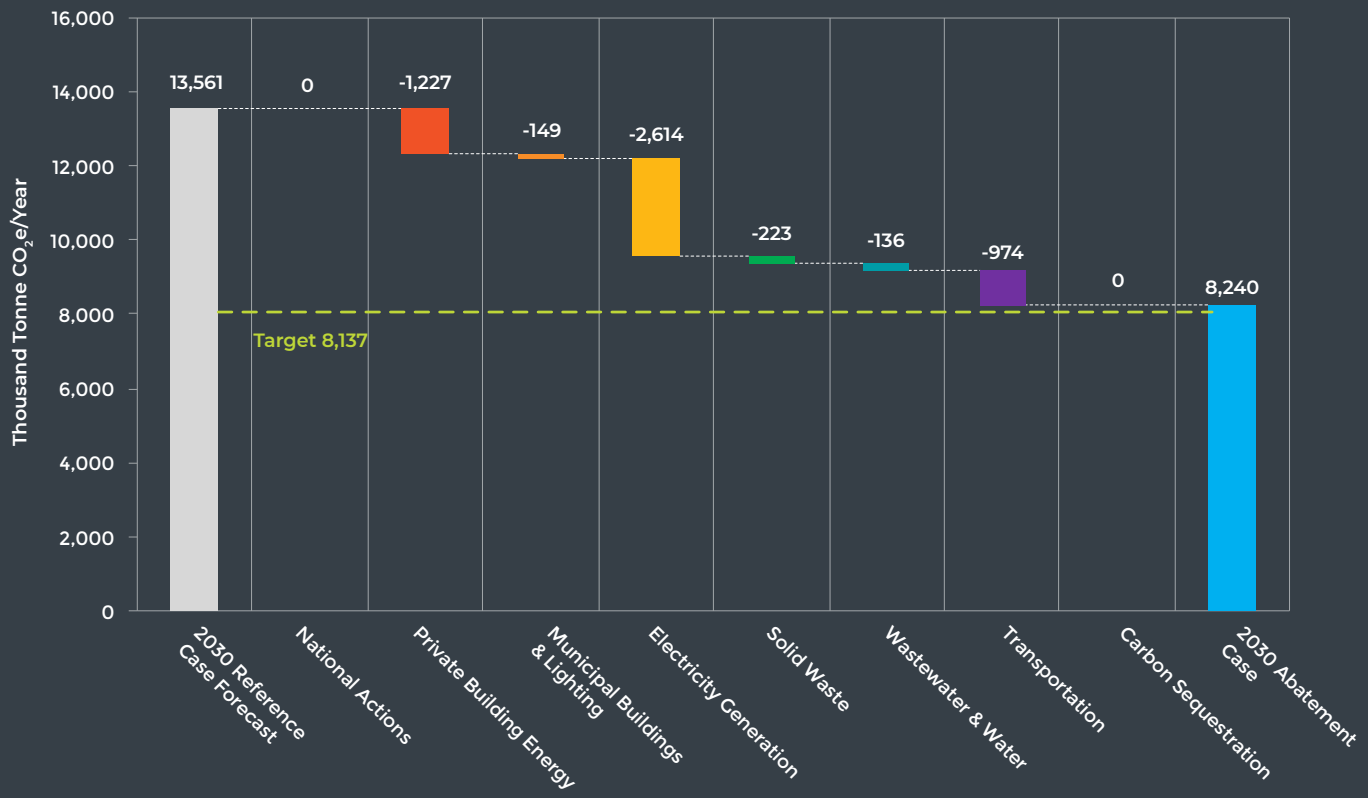
PARTNERSHIPS IN THE FOLLOWING AREAS WILL BE KEY

ENVISIONING
AMMAN 2050

A transformational shift is required across all sectors in Amman in order to achieve the 2050 Vision. A massive change will be required in how Amman's population uses energy and water in its buildings, travels to and from jobs, disposes and treats waste products, and consumes and uses land. These changes will be hard, but they will strengthen the city, support the livelihoods of Amman residents, improve the quality of life, and create a world class city.

The actions below are prioritized to focus on producing significant benefits for Amman's population by acting on key social, economic and environmental challenges that the city is currently facing.

SECTOR CONTRIBUTIONS TO 2050 EMISSION REDUCTION TARGET



COMMUNITY ENGAGEMENT

The support of the residents of Amman will be critical in achieving Vision 2050 and the Resilience Strategy. Indeed, success depends on collective action. In this regard, raising awareness of the impacts of climate change and the benefits of actions will be key to achieving the city's Vision 2050.

Stakeholder engagement is an essential part of a city's climate action plan. This Plan provides a framework for engagement between government agencies, citizens and the private sector. The objective is to involve stakeholders in the development, design and implementation of actions, providing an opportunity for obtaining a better understanding of the social and environmental impacts of proposed projects. Stakeholder input will improve the design and increase local ownership and involvement. As a result, outcomes will improve and residents will experience a better quality of life.

Individual participation and behavior change is core to many of the actions of this Plan. As such, the residents of Amman will have to be engaged in the implementation and invested in the outcomes. Therefore, a general public awareness raising campaign will be implemented to address the role of important stakeholders in the climate actions proposed in the Plan.

The city of Amman will also be included in a national project implementing a climate action monitoring system. This monitoring, reporting and verification system will identify all emission reduction actions in Amman, which can then be shared publicly. Furthermore, it will provide transparency and help to inform the public about the progress of Plan implementation.

AMMAN PLAN SECTOR GOALS

Within these pillars, measures have been identified across all sectors that will be essential to achieving Amman's 2050 vision. The goals for each sector will drive the actions identified in the following section.

THE ELECTRICITY SOURCE for the city will need to be predominately carbon free in 2050.

NEWLY CONSTRUCTED BUILDINGS will all comply with green building guidelines, and a majority of existing buildings will be renovated to improve energy efficiency.

RENEWABLE ENERGY WILL BE EXPANDED

- Building integrated solar photovoltaics (PVs) will provide residential and commercial buildings with the majority of their energy needs.
- The Greater Amman Municipality will produce its own renewable energy.

SUSTAINABLE MOBILITY

- Public transport will be clean, efficient and widespread.
- A majority of private vehicles and taxis will be electric powered.
- Walking will be a core mode of mobility in the city center.

WASTE

- Waste will be reduced, sorted, composted and recycled.
- Remaining solid waste will be processed in waste to energy sites.

WATER AND WASTE WATER

- Water will be efficiently used.
- Rainwater will be captured and reused.
- Waste water will be effectively treated, with a focus on capturing gases for energy use.

URBAN PLANNING AND LAND USE

- New development areas will be focused on public transit-oriented corridors
- Green spaces, parks and urban forestry will increase, billing underutilized land.

CLIMATE ACTIONS IN AMMAN'S KEY SECTORS

This section will address the challenges and opportunities identified in each key sector. It will also present current projects or policies that are contributing to emission reductions. In addition, it will identify future actions that build the foundation for sustainable growth. When implemented, these actions will produce a range of benefits for Amman's inhabitants, including improved health, job growth, and enhanced livability. Amman will forge partnerships to implement and achieve these sector goals.

GUIDANCE ON THE SECTOR ACTIONS

Actions identified in each sector will be measured according to the following metrics:

- Timeframe – short-term actions identify those actions that can be implemented in 10 years; medium-term for those to be implemented in 10-15 years; and long-term actions for those to be implemented in 15-30 years.
- The volume of emissions (low, medium or high) describes the general reduction in emissions. These do not equate to specific tonnages. Rather, they are meant to be directional. As such, the exact volume of emissions that will be reduced for each action has not been calculated.
- Sustainability benefits refer to those benefits that will accrue from this project, apart from emission reductions.
- The pillars and the actions identified in this Plan are aligned with the following documents: the Jordan National Green Growth Plan; Jordan's National Determined Contributions; the Amman Resilience Strategy; and the Amman Metropolitan Growth Plan. Some actions will inevitably overlap, signifying an even greater need for national, local and private sector collaboration.

BUILDINGS
WHERE AMMAN RESIDENTS LIVE, WORK, AND STUDY

Highest Emitter:
COMMERCIAL & RESIDENTIAL ELECTRICITY USE

CHALLENGES

The energy sector is the highest emitting sector in the Hashemite Kingdom of Jordan, and in Amman in particular. A large portion of the country's energy needs are met using imported oil and gas because the country lacks large fossil resources of its own. In recent years the percent of renewable energy sources steadily increased. However, the national grid still predominately uses fossil fuels. Therefore, the country's reliance on imported foreign energy is a significant burden on its economy, leaving it vulnerable to price fluctuations.

Electricity usage in commercial and residential buildings is the primary source of emissions in Amman. During 2004-14, residential energy consumption grew at a rate of 8.5 percent at the national level, notably faster than the overall economic growth (Hashemite Kingdom of Jordan 2017). The country is making progress toward a decoupling of economic development and energy consumption. This trend needs to continue and scale up in order to achieve Amman's 2050 Vision.

Amman has limited direct control over the building sector. The municipality issues building licenses, provides certificates of occupancy, and sets zoning regulations. Building codes and incentive structures are set at the national level through the Ministry of Public Works and Housing, the Ministry of Finance, and the Ministry of Energy and Mineral Resources. Voluntary green building guidelines were published in 2014 by the Jordan Green Buildings Council, and are based on Leadership in Energy and Environmental Design (LEED) certification. These guidelines cover energy, water, and indoor air quality, as well as sites and materials. Both mandatory building codes and voluntary guidelines have a low level of penetration in Amman because of a lack of enforcement. In addition, there is a misalignment of incentives and a perception that more efficient buildings greatly increase costs.

KEY GOALS AND **OPPORTUNITIES**

KEY SHORT-TERM GOALS

- Improving energy efficiency in all GAM-controlled municipal buildings and public lighting to show leadership and demonstrate cost effectiveness.
- Improving enforcement of existing building codes.
- Incentivizing best practices for new construction of commercial and residential green buildings.
- Partnering with the national government and international organizations to implement energy efficient programs for existing residential buildings.

The national government has demonstrated a strong commitment to energy efficiency. The recently completed Second National Energy Efficiency Action Plan for the Hashemite Kingdom of Jordan commits the country to a 20 percent improvement in energy efficiency by 2020 (over the 2006-2010 baseline). Despite the existence of building codes and green building guidelines at the national level, enforcement of building codes is weak.

As national attention is now turned toward energy efficiency, Amman can facilitate a pipeline of projects that addresses residential, commercial and public building energy efficiency standards.

CASE STUDY **AMMAN'S GREEN BUILDING DENSITY BONUS**

CHALLENGE • Green building has been slow to build market share in Amman because of cost concerns, to date only seven buildings have received green building certification in Jordan. The government of Amman is constrained in acting, as building codes and policies are set at the national level.

SOLUTION • The city focused on encouraging participation in green building through a voluntary density bonus program linked to the Jordan Green Building Guide published in 2013 by the Jordan Green Buildings Council. The incentive provides a 'Density Bonus' in the form of an additional percentage to the original floor area ratio (FAR). As an additional incentive, building applications are free of charge.

BENEFITS • Lowered costs for developers and residents.

GRAPHIC Based on Amman's climate and heating and cooling demand, improvements in the following areas of the building sector can create the highest emission reductions:

Residential

New construction

- building lighting, envelopes (insulation and windows)
- cooling and heating equipment

Existing buildings

- lighting
- appliances
- cooling and heating equipment

Commercial

New and Existing buildings

- lighting
- cooling and heating equipment

BENEFITS

Improving energy efficiency in buildings results in positive economic and social impacts at the household level, as well as for the broader economy. At the household level, increased efficiency means smaller utility bills and better health due to reduced air pollution. For the broader economy, scaled up building retrofits could potentially produce a 150 percent increase in jobs in a city the size of Amman by 2030 according to the Global Covenant of Mayors for Climate and Energy Opportunity Dashboard.[7]

PARTNERS & STAKEHOLDERS

The city government has limited ability to control policies and regulations in the building sub-sector. In this context, partners will be key to developing projects that can scale across the residential and commercial building sub-sectors. Addressing energy efficiency in buildings will require close coordination with national ministries and regulatory organizations. Amman alone cannot lead many of the actions identified in this plan because of national control of policy and regulatory structure for buildings. Therefore, the government of Amman is working closely with the national government to identify existing and new policies that will support these actions. The city can act as an advocate, expanding awareness among its residents and can perform regulatory and licensing actions that support these transformational shifts.

There are additional local organizations that will have a key role in this sector, including the Jordan National Building Code Council. It is active in the country, helping to establish local green building guidelines. In this sector, it is especially important to have the engagement of private sector actors, for example real estate developers, commercial banks, energy-efficient building product manufacturers and others. Together, they will be key partners for the city.

[7] The Global Covenant of Mayors for Climate and Energy Opportunity Dashboard uses city data to estimate the impacts from climate action in cities. https://www.globalcovenantofmayors.org/climate-opportunity/

CASE STUDY
LED STREET LIGHTING AND MUNICIPAL BUILDING LIGHTING

CHALLENGE • The electricity costs of street lighting make up the bulk of GAM's electricity bill, and the city is spending close to JD12 million annually on street lighting.

SOLUTION • The city has two projects under implementation to replace existing street lights and municipal building lights with more efficient LED lights. There are close to 120,000 street lights which are operated by GAM. By 2017, almost half of these had been replaced by LED bulbs, which are more efficient and longer lasting. By the end of 2019 the remaining existing street light bulbs will be switched to LEDs and additional LED street lights will be added to improve safety and security in the city. It is projected the project will reduce consumption of electricity in public lighting up to 50 percent. In 2017 the GAM building maintenance department installed 1500 LED bulbs in key municipal buildings, by 2019 all of GAM municipality buildings will have LED lights.

BENEFITS • Reduced costs for municipality, less maintenance, improved quality of lighting for residents.

ACTIONS TO INCREASE ENERGY EFFICIENCY IN THE BUILDING SECTOR

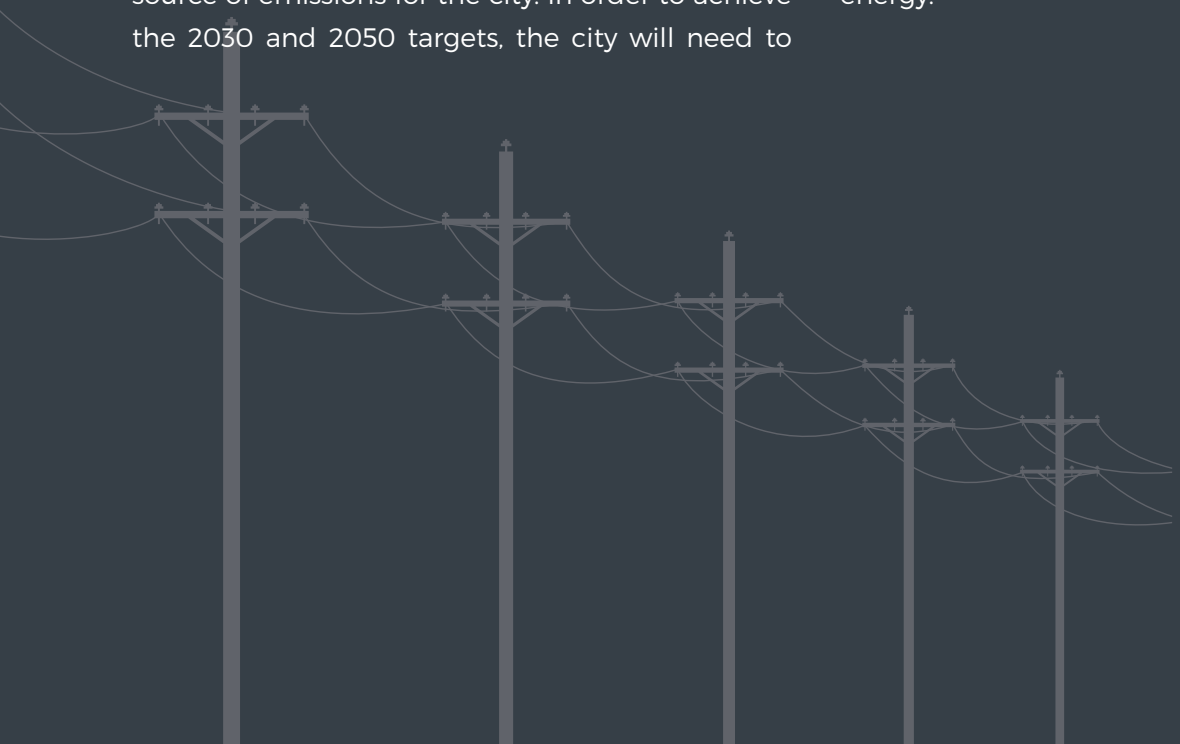
ACTIVITY	TIMEFRAME*	VOLUME OF EMISSIONS REDUCED	SUSTAINABILITY BENEFITS
Improve energy efficiency in GAM-owned municipal buildings	Medium	Low	Reduced costs for the municipality, and improved comfort of buildings
Implement green building strategies in public schools, universities, and religious institutions	Medium	Medium	Reduced operational costs for schools and universities, and improved environment for learning
Implement green building strategies in public hospitals	Medium	Medium	Reduced operational costs, and improved indoor environment
Improve enforcement of building codes	Medium	Medium	Reduce costs for residents and improved living environment
Incentivize adoption of the Thermal Building Code and Retrofit Guidelines	Medium	Medium	Reduced costs for residents and improved living environment
Increase participation in green building incentive program (Density bonus)	Medium	Medium	Reduced costs for residents and improved living environment
Create a building energy rating and label program	Short	Unknown	Improved perception of green building, incentivize efficient behavior, building awareness of benefits
Energy-efficient street lighting and lighting in parks	Short	Low	Safer streets, and reduced costs for the city
Rebate program for energy efficient appliances	Short	Medium	Reduced costs for residents
Solar water heater program incentive program	Short	Low	Reduced costs for residents
Energy efficiency engagement plan for large energy users	Medium	Medium	Reduced costs for residents
Existing buildings (residential): city-wide retrofit program	Medium	High	Reduced costs for residents, and improved comfort and living environment

Short – 10 years **Medium – 10-15 years** **Long 15-30 years**

RENEWABLE ENERGY **POWERING CITIZENS' LIVES**

CHALLENGES

The national government is steadily increasing the percent of renewable energy sources for the national grid. Indeed, it was on track to reach 10 percent of all energy needs in 2017. Amman currently sources the majority of its electricity from the national grid. As a result, stationary energy emissions, and specifically building electricity use, are the largest source of emissions for the city. In order to achieve the 2030 and 2050 targets, the city will need to diversify the source of its electricity and convert to largely renewable sources by 2050. Amman has little control over the percent of renewables in the national grid. However, it can explore sourcing its own electricity from different, cleaner sources. This Plan will focus on decentralized, renewable options and the development of municipal renewable energy.



Highest Emitter:
GRID ELECTRICITY

KEY GOALS AND **OPPORTUNITIES**

KEY SHORT-TERM GOALS

- Incentivize and promote residential and commercial rooftop solar energy units
- Explore sites for municipal solar opportunities
- Research other clean, renewable source options

In order to achieve the envisioned transformational shift, the city will need to rapidly shift to non-carbon energy sources. Amman is already working to identify renewable energy opportunities and the country has abundant quality solar and wind resources. Reducing GHG emissions from the energy sector in Amman goes hand-in-hand with the national priority of reducing reliance on external fossil fuels.

Multiple national level regulations are in place that allow Amman to pursue municipal renewable energy resources.

- **In 2018, the national government signed a policy that allows all public institutions to build and own a solar PV plant up to 10 megawatts (MW). Amman would need to produce many times this amount, and it should focus on raising this ceiling.**
- **The Renewable Energy and Energy Efficiency Law (REEEL) No. 13 (2012) promotes renewable energy production. It is the umbrella regulation for all other supporting schemes and incentives.**
- **Under the REEEL, net metering regulations allow individuals and municipalities to connect renewable energy back to the grid.**

CASE STUDY **SOLAR PV ROOFTOP GUIDELINES**

CHALLENGE • Jordan is dependent on fossil fuel imports for almost all their energy needs, yet they have robust renewable energy resources. City level governance have little influence over national grid policies.

SOLUTION • Distributed renewable energy systems present a great opportunity for cities, companies and individuals to take control of their energy sources. GAM has created and shared design guidelines for rooftop solar PV systems. Combined with the 2012 Renewable Energy Law that allows individuals to sell excess output back to the grid, a substantial uptake in rooftop solar PV has occurred. Around 25MW of rooftop solar capacity was installed by 2017.

BENEFITS • Improved air quality, savings on utility bills, support of green jobs

This enabling environment is encouraging and supportive of renewable energy installations for individuals and the municipal government. As such, it should be leveraged to allow Amman to reduce their own emissions from the electricity sector, reducing dependence on the national grid.

BENEFITS

Using local renewable energy sources, such as solar energy, has a potentially large impact on the city and its inhabitants beyond the benefits of reduced emissions. Creating energy using clean sources at the city level will reduce city government spending on energy, freeing up resources for other initiatives. It can also lead to an increase in jobs and a reduction in air pollution, while reducing reliance on imported fuel and oil. For individuals installing building-integrated solar systems, household spending on utilities will be reduced. In addition, jobs in renewable energy engineering, construction, operations and maintenance sectors will increase.

PARTNERS & STAKEHOLDERS

Amman cannot alone change the mix of the national grid, but it can look at alternatives to grid-provided electricity. To do this, Amman will need to partner with utilities, the national ministries and regulatory bodies, and the private sector.

There is a long history of developing renewable energy in Amman. In addition, the national government is working hard to develop additional renewable sources. Amman can leverage existing partners — from international donors to local manufacturers and universities — to explore options for shifting its sources of energy.

ACTIONS TO INCREASE RENEWABLE ENERGY PRODUCTION

ACTIVITY	TIMEFRAME	EMISSION REDUCTION POTENTIAL (H,M,L)	SUSTAINABILITY BENEFITS
Develop solar power generation farm to power the GAM's municipal sites	Medium	High	Improved air quality, and lower reliance on imported energy
Develop solar PV street lighting	Short	Low	Reduce operating costs for the city
Outreach and awareness-building program to encourage installation of rooftop solar PV using existing national government financial incentives	Short	Unknown	Reduce long-term energy costs for residents
Install rooftop solar units on GAM-owned municipal buildings	Medium	Low,	Reduce operating costs for the city, provide leadership and an example for city residents
Explore renewable power purchase agreements for providing renewable energy for municipal use	Medium	High	Support development of renewable energy

TRANSPORT
HOW JORDANIANS MOVE AROUND THE CITY

Highest Emitter:
ROAD TRANSPORT

CHALLENGES

The transport sector is the second largest contributor to emissions in Amman, and traffic congestion is the top challenge facing the city. On-road vehicles contribute to the majority of transportation emissions. The number of private vehicles in Amman has increased dramatically, exceeding 1.2 million vehicles and 7.5 million daily internal trips (GAM 2017). The growth in vehicular traffic has risen by over 10 percent per year since 2005 (GAM 2017).

There is a lack of reliable public transport, as well as safe pedestrian and bicycle areas, making private vehicles the safest and most efficient way to get around. Additionally, non-motorized transportation faces a perception challenge in Amman. Specifically, there is a social opinion that cars are superior, especially given the hilly topography and extreme hot and cold climate in Amman, which does not favor walking or biking.

Current services are operated by a mixture of large buses, minibuses, service taxis (on fixed routes) and yellow taxis. Coordination of these services is limited, and insufficient travel schedules, routes, or ticketing information are available. With the rapid increase in population, the lack of adequate public transportation has led to massive traffic congestion issues, a lack of parking and a reduction in the productivity of residents.

Traffic congestion has negatively affected the air quality in Amman, especially during the hot summers. However, the large-scale infrastructure projects needed to provide a transformational shift away from personal cars are expensive and require long-term planning and financing. Now is the time to plan for a transformation, not just of infrastructure but of local culture and behavior.

KEY GOALS AND **OPPORTUNITIES**

KEY SHORT-TERM GOALS

- Conduct a new transport survey and update the Transport and Mobility Master Plan (TMMP) alongside an integrated land use planning exercise.
- Improve pedestrian and bicycling experiences and safety.
- Incentivize electric vehicles and show leadership by electrifying the municipal bus fleet.
- Prioritize low carbon modes of transportation in infrastructure investments.

The city has well managed and extensive road ways. It has also implemented an initial technology system to help manage traffic. There has been significant investment in recent years in the road network. In addition, the transport sector has seen an opening of the market to private operators and investors. There is much interest from international partners in this sector, as well as opportunities to leverage private sector interest. Additionally, there are multiple examples of cities overcoming cost barriers to implementing small and large transport improvement projects.

The Greater Amman Municipality developed a Transportation and Mobility Master Plan in 2010, based on data collection and surveys. The plan established a framework for the city's growth and identified corridors for intensification. The plan has faced barriers to implementation, but the first stage of the Bus Rapid Transit system is now undergoing development.

The information from the former TMMP is now almost a decade old. A new TMMP should be developed. Indeed, there is a great opportunity to plan new development alongside an integrated mobility plan that looks at all possible forms of public, electric, and non-motorized transportation.

CASE STUDY **ELECTRIC CAR**

CHALLENGE • Emissions from gas-fueled, on-road transport are one of the largest contributors to poor air quality in Amman. Existing infrastructure for electric car charging, which would reduce emissions, is minimal.

SOLUTION • The national government is incentivizing the purchase and use of electric cars in multiple ways. The municipal government has purchased 100 electric cars for city government use, as well as 30 electric taxis as a pilot and will expand in the future. There is now legislation that requires all new gas stations to install electric charging stations.

In 2018, the German based company, E-Charge, signed an agreement to install 10,000 electric charging stations across the country, many of which will be located in Amman. The GAM can further expand on their efforts by creating an awareness program for electric car incentives.

BENEFITS • Reduced local air pollution and reduced operating costs for owners of vehicles.

BENEFITS

Enhanced bus networks and a shift from cars to public transport will help to ease traffic congestion, reducing the number of polluting cars, decreasing other air pollutants associated with traffic, and lowering emissions from public transport vehicles. According to the Amman traffic model, 4,720 tons of CO_2/year could be reduced based on the results for the Amman-Zarqa BRT system. Research indicates that by 2030 these transport improvements would help avoid 1,000 premature deaths per year due to air quality improvements in the Middle East (Global Covenant of Mayors Opportunity Dashboard).

Better transit systems also reduce commute times and minimize traffic related deaths. Fewer vehicle kilometers travelled and less cars lead to safer streets. In South Asia, bus rapid transit systems have reduced commute time by 45 hours per person/ per year. In this context, it is projected that road fatalities could be reduced by up to 35 percent in a city the size of Amman by 2030 (Global Covenant of Mayors Opportunity Dashboard).

CASE STUDY
BUS RAPID TRANSIT (BRT)

CHALLENGE • Private vehicles dominate the roadways and public transportation is not efficient.

SOLUTION • Create an integrated public transport network that connects the neighborhoods of Amman, Reseifa and Zarqa using rapid bus transit. Premium, high-capacity buses will run on segregated lanes. Development of the first phase is complete, with construction of two main lines completed. When fully completed, it will consist of 25 kilometers (km) of BRT with small feeder buses that deploy into key neighborhoods off of the main lines, thereby improving access to public transportation.

The BRT lines are largely being built along existing bus lines and will replace the slower buses. Amman's BRT is expected to reduce the distance traveled using private vehicles by 85 million kilometers per year, and the distance traveled using taxi by 12 million kilometers per year. Each BRT bus will accommodate up to 150 passengers, or the equivalent of about 110 private vehicles. By 2020, the 150 rapid buses in Amman will be carrying 315,000 passengers a day.

BENEFITS • Benefits include shorter commutes, improved mobility, increased productivity, and improved air quality.

PARTNERS AND STAKEHOLDERS

Amman currently partners with private operators to run portions of the public transportation system in the city. This model will continue, and these operators will be key stakeholders in developing low-carbon solutions to public transport. In fact, there are many opportunities to engage with the private sector to bring the necessary technology and smart cities infrastructure to Amman to support the electrification of its transportation.

Amman will work closely with the Ministry of Transportation and other neighboring city governments to explore mores sustainable modes of inter-city transport.

ACTIONS FOR IMPROVING SUSTAINABLE TRANSPORTATION

ACTIVITY	TIMEFRAME	VOLUME OF EMISSIONS REDUCED	SUSTAINABILITY BENEFITS
Plan and construct a Bus Rapid Transit system	Medium /Phase 1 complete	High	Reduced commute times, improved productivity, and better air quality
Implement a public transportation awareness plan to change perceptions and behavior	Short	Unknown	Awareness raising
Install electric vehicle charging stations around the city	Short	Unknown	Improved infrastructure
Give preferred treatment for zero/low emission vehicles, including fast lanes, parking discounts, and reduced fees	Medium	Unknown	Reduced costs
Replace GAM-owned fleet vehicles with electric vehicles	Short	Low	Reduced operating costs for city
Replace 75 percent of taxis with electric taxis	Short	Medium	Reduced local air pollution
Install bike paths and other bike safety measures	Short	Unknown	Improved land use, and preserved open space
Promote walkability through installation of new sidewalks and maintenance; improve existing sidewalks; increase green space; and introduce pedestrian safety measures to enhance use	Short	Unknown	Improved public health, and enhanced livability of the city
Enhance the efficiency of the city bus network using improved fuel specifications	Short	Low	Reduced local air pollution, and improved public health

SOLID WASTE
REDUCING AND TREATING CITY WASTE

Highest Emitter:
LANDFILL

CHALLENGES

Inadequate solid waste management is a serious threat to the environment and public health in Jordan. No significant amount of solid waste is recycled in the country. Furthermore, solid waste generation is growing and Amman accounts for almost half of the total solid waste generated in Jordan according to waste disposal data from 2014 and 2016. However, Amman is also home to one of the only lined landfills in the country, and the solid waste infrastructure in the city has improved greatly in the last decade.

Municipalities are fully responsible for solid waste management operations in the country. However, they often lack the funds to establish modern waste collection infrastructure, recycling facilities and waste disposal systems. Source-segregation is not practiced in the country and mixed waste is collected and dumped without any treatment. Recycling, both formal and informal, is in the early stages due to a lack of trained manpower and modern machinery. The role of the private sector in solid waste management is also limited, except for some new pilot projects.

The GAM operates the Al Ghabawi landfill. It has the responsibility to collect, transport, and dispose of waste to the Al Ghabawi landfill, which is the largest and only sanitary landfill in Jordan serving Amman and 10 other major cities. Waste collection contributes significantly to emissions because Amman lacks an adequate number of transfer sites. In addition, collection trucks travel longer distances to the dumpsites and landfills, increasing collection intervals and total management costs.

KEY GOALS AND **OPPORTUNITIES**

KEY SHORT-TERM GOALS

- Sort waste for composting and recycling
- Separate and divert waste, and implement recycling and composting programs
- Improve and establish additional waste infrastructure

A 2011 waste composition study found that 50 percent of Amman's solid waste is organic, 16 percent is plastic, 7 percent is cardboard, and 8 percent is paper. A large portion of these waste types can be removed from a landfill using recycling, reuse and composting methods. This provides an important opportunity to use existing technologies, such as composting, the capture of biogas, and recycling. Such production and consumption shifts can lead to immediate, beneficial results.

Ultimately, Amman will work on moving toward a zero-waste framework. However, in the short-term, implementing existing technologies can reduce waste and improve waste management. The GAM has complete control over the waste sector and plays a key role in issuing licenses for waste collection companies and granting regulatory approval for the establishment of waste processing facilities.

The GAM concluded a municipal solid waste management strategic planning study in 2012 for the 2012-2022 time horizon. The study defined

CASE STUDY
AL GHABAWI LANDFILL WITH GAS CAPTURE

CHALLENGE • Safe,Most landfills are not covered or adequately treated in the country, and sorting of recyclable materials or organic waste is not practiced.

SOLUTION • The Al Ghabawi landfill was established in 2003. It was the country's first and still only engineered safe and lined landfill with methane gas capture. It was also the first municipal carbon finance partnership in the Middle East.

To date, three cells have been filled and safely capped and methane gas is being extracted. Donors continue to fund development of the project to build additional cells and cap the filled ones. The site receives around 3000 tons of waste per day, or nearly one million tons per year (1,099,217 in 2017).

Currently, the captured landfill gas produced is flared off, as there has been a delay in approval for the grid connection. Once connected, the gas will fuel the electricity needs of Al Ghabawi and the remainder will be set back to the national grid. In 2019, the current cells will produce 4.8 MW per hour. The production of methane gas in the new cells will compensate for the depreciation in cells 1-3, thereby ensuring a constant flow of gas.

BENEFITS • Benefits include reduced environmental pollution and litter, protection of ground water from contamination, lower operating costs for Amman, as well as a reduction in local air pollution.

plans for equipment renewal; the phased introduction of waste separation at the source; improvements to the transfer network; land fill gas recovery; and public-private partnership (PPP) options. It also identified a need for additional transfer stations in the western district of Amman because one of the existing transfer stations now transfers 90 percent of the waste to the landfill. The city will build on this strategic plan to propose actions that will create a transformation in waste reduction and management in Amman.

BENEFITS

Improving the way Amman sorts, collects and disposes of waste will reduce air pollution from waste transportation and waste processing sites. It will also provide a source of low carbon energy for exploitation, increase jobs in the sector and protect the local environment from pollutants. These actions will improve the appearance and quality of life in the city by reducing litter and providing cleaner public spaces.

PARTNERS AND STAKEHOLDERS

The waste sector includes all three tiers of government, from the national government, where waste plans and goals are set, to the provincial and local authorities where the building and operating of waste infrastructure and waste collection and processing facilities are done. Amman is responsible for a large portion of waste management actions. However, establishing policies and regulations will require close coordination with the national government.

ACTIONS FOR REDUCING WASTE AND IMPROVING WASTE MANAGEMENT

ACTIVITY	TIMEFRAME	VOLUME OF EMISSIONS REDUCED	SUSTAINABILITY BENEFITS
Develop and implement a waste management framework that sets targets for reducing waste, with zero waste as a vision.	Short	Unknown	Awareness raising
Development of waste transfer sites in the northern and western parts of Amman	Short	Medium	Reduced local air pollution, and lower operating costs
Implement waste sorting	Short/ Pilot projects in progress	Medium	Reduced exposure to toxins from untreated waste, and an increase in job opportunities
Recyclable waste collection Recyclable / re-usable item drop-off sites	Short	Medium	Reduced exposure to toxins from untreated waste, and an increase in job opportunities
Implement anaerobic digestion site for organic waste	Long	High	Reduced exposure to toxins from untreated waste, increased job opportunities, and energy source provided to the city
Collect organic waste	Medium	High	Reduced exposure to toxins from untreated waste, improved job opportunities, and energy source provided to the city
New fleet and equipment for solid waste operations	Short	Medium	Reduced local air pollution, and lower operating costs for the city
Build a maintenance workshop for the existing waste fleet based at the Ghabawi landfill to ensure that the fleet is running efficiently	Short	Low	Reduced operating costs, and increased job opportunities
Complete design, building and operation of the Bio Gas system in Cell number 4 of the Al-Ghabawi landfill and connect it to the current operations	Short	High	Reduced operating costs, reduced local air pollution, and increased provision of renewable energy

WATER AND WASTE WATER **SOURCING, TREATMENT, AND PROTECTION OF WATER**

Highest Emitter: TREATMENT OF WASTEWATER

CHALLENGES

The Hashemite Kingdom of Jordan suffers from severe water scarcity and is one of the top four most arid countries in the world. The scarcity of water is a key constraint to growth and development. Available water resources per capita are falling. At the same time, water demand is increasing. Indeed, the water shortage is drastically increasing due to economic and population growth. To control water consumption, water is now delivered only once a week to citizens and businesses. It is then placed in storage tanks. Municipal water use (including in the GAM) is currently being met primarily through the use of groundwater sources.

If supply remains constant, per capita domestic consumption is projected to fall to 90 cubic meters per person per year by 2025. This would place the country in the category of having an absolute water shortage that could constrain economic growth and potentially endanger public health (Hashemite Kingdom of Jordan 2014).

Water supply, pumping and delivery are the responsibility of the national government of Jordan, specifically the Ministry of Water and Irrigation. The treatment of waste water in Amman is also the responsibility of the national government. Importantly, both water supply and waste water treatment are under pressure from the growing refugee crisis and influx of refugees.

POTABLE WATER

Groundwater levels have dramatically declined showing that groundwater use is unsustainable. Despite significant improvements in water-supply infrastructure, a critical and serious supply-demand imbalance remains. From 2011 to 2015 there was a 40% increase in demand for water (Hashemite Kingdom of Jordan 2013). As the country is impacted by climate change, precipitation will potentially decrease, exacerbating the existing problems.

STORM WATER

Whereas overall precipitation is decreasing, there has been an increase in severe storms that cause rapid heavy rainfall. As a result, areas in Amman are frequently affected by flash floods. In 2015, a 30-minute heavy rainfall event caused a severe flash flood in Amman, leading to loss of life, damaged properties, flooded streets, and people trapped in their cars and homes. Thus, the effective management of storm water is one of the main priorities of the Resilience Strategy.

KEY GOALS AND **OPPORTUNITIES**

KEY SHORT-TERM GOALS

- Encourage and incentivize rainwater harvesting for residential and commercial buildings
- Implement water saving measures and water recycling or rainwater harvesting in municipal buildings
- Develop green infrastructure to capture and treat storm water in public spaces.

The Hashemite Kingdom of Jordan has developed a comprehensive water strategy entitled "Water for Life" for 2008-2022. The Strategy was updated in 2012. It focuses on effective water demand management and water supply operations, as well as institutional reform. Amman can contribute to this by reducing water consumption and managing storm water through the management of its own operations. It can also contribute through the enabling of green building and support for green infrastructure sectors.

Emissions from the water sector are not a factor in Amman's inventory. However, reducing water usage and effectively managing waste and storm water are key to the city's future health and to managing emission reductions. In this regard, the efficient use of water in buildings will lower water consumption, thereby decreasing the amount of energy needed to treat, transport and supply water to Amman.

CASE STUDY **GREEN INFRASTRUCTURE IN EAST AMMAN**

CHALLENGE • Communities in East Amman lack access to open space and greenery. Deteriorated streets and sidewalks have affected the social cohesion of the neighborhood and cut services to residents. In some areas, there has been exposure to hazards, such as flooding and soil pollution.

SOLUTION • Pilot areas in East Amman have been selected to showcase green urban design and infrastructure. The projects will add green space, rehabilitate sidewalks and stairs and use green infrastructure to build better drainage areas. Communities will also be involved in the design and planning of the space to ensure that it meets their needs.

BENEFITS • Benefits include improved access to transportation, improved walkability, access to public green spaces, improved stormwater drainage, reduced flooding, preservation of biodiversity, soil stabilization and reduction of pollutants.

BENEFITS

Water security is one of the most serious threats facing Amman. Improving water efficiency in households can save money and ensure the availability of water. Such actions to improve the efficiency of Amman's use of water will be essential to ensuring the availability of clean water for future generations.

Improving the capture and treatment of stormwater will reduce flooding, saving people and property from the damage of flash floods. It will also protect Amman's natural ecosystems from pollution caused by runoff. Managing stormwater more efficiently will reduce emissions, lowering air pollution levels.

PARTNERS AND STAKEHOLDERS

Coordination on water and wastewater actions is complex. As noted, Amman does not have lead responsibility for these services, as they are provided through the national level government. In addition, the policies and regulations that govern them are set by the national government. However, he city can take the lead in action areas related to municipal buildings, open space and the efficient use of water or water reuse in these areas. In other action areas, the city will act as an advocate for its residents and a partner in delivery.

ACTIONS TO REDUCE WATER DEMAND AND IMPROVE WASTE WATER MANAGEMENT

ACTIVITY	TIMEFRAME	VOLUME OF EMISSIONS REDUCED	SUSTAINABILITY BENEFITS
Implement rainwater harvesting at GAM-owned municipal sites	Short-Medium	Low	Reduced water usage for landscaping, and slow runoff into the storm water system
Implement greywater recycling at GAM-owned municipal sites	Medium	Medium	Reduced water use
Install water efficient fixtures in GAM buildings	Short-Medium	Low	Reduced water use and costs
Create a storm water master plan for Amman	Short	Unknown	Reduced water use and costs
Develop areas of green infrastructure in the city to capture and slow storm water	Medium	Unknown	Reduced flooding and costs of managing storm water
Plant drought-tolerant plants in parks and public areas, and install efficient irrigation systems. Use recycled greywater or captured rain water in all municipal green sites to reduce groundwater uptake	Short	Low	Reduced water use and cost

URBAN PLANNING
ENHANCING THE QUALITY OF LIFE IN AMMAN

CHALLENGES

Approaches to urban development and land use policy can change the shape of cities and affect the quality of life in drastic ways. Policies that encourage sprawl lead to long transit times, increased energy use, air pollution and increased cost of living. Encouraging density in previously developed areas of the city helps reduce energy use, support public transportation use, and contribute to a vibrant city center. Amman created a Metropolitan Growth Plan in 2008 that focused on planning and development in key areas of the city. It recognized that if Amman continued growing as it had in the past, (at a density of 5 persons per dunum) vast areas of agricultural land would need to be settled, and the entire Metropolitan Planning Area would be filled by 2025 (Greater Amman Municipality 2008).

As a result of the Metropolitan Growth Plan, improved planning policies were put into place to increase population density. However, since 2008, new pressures emerged from the rapid increase in population that have intensified the expansion of the city boundary. Based on projections done by the World Bank, land consumption in Amman will increase by 14 percent between 2015 and 2030 in a business as usual scenario. Almost half of this growth (17 square kms) is expected to happen outside of zoned areas, even with the policies put into place in the Metropolitan Growth Plan. Green or arable lands in the east and south of Amman are likely to be converted to urban uses.

New zoning laws in Amman are aiming to slow this growth and freeze development outside of core urban areas. These efforts will need to be scaled up and coordinated with green building incentives, as well as public awareness and enforcement campaigns.

KEY GOALS AND **OPPORTUNITIES**

KEY SHORT-TERM OPPORTUNITES

- Include the Plan goals in future urban and transport planning, including updates.
- Further develop transit-oriented development policies to concentrate infill along the BRT lines being built.
- Increase green open spaces by modifying existing regulations, enabling the GAM to zone and create more public open spaces in the city.

Creating cross-sector policies that encourage density will be key to controlling urban sprawl. Compact growth will reduce service costs to the municipality, locate residents closer to amenities and reduce travel time. Additionally, it will leave green and arable land intact for agriculture and recreation use. Residents benefit from increased density when it is planned alongside of good public transport connections, shared green spaces, and a mix of housing, shops, services, and businesses.

BENEFITS

The Hashemite Kingdom of Jordan, and Amman in particular, have experienced rapid urbanization and population growth, causing urban sprawl, a loss of green space, and an increase in informal settlements. Because of the lack of public transport in the city, this sprawl has led to an increase in private vehicle and taxi use, causing traffic jams, a loss of productivity and an increase in air pollution.

Closely managing land use, infilling existing development areas, reducing sprawl and increasing smartly planned density will bring many benefits to the people of Amman. It will also reduce transportation costs for inhabitants, improve air quality and connect communities across Amman. At the same time, it will provide informal settlements with improved neighborhoods.

PARTNERS AND STAKEHOLDERS

All sectors in Amman — from infrastructure, waste management and transportation —will be involved in planning for compact growth. Urban planning policies need to be well aligned with national development goals. This must also include considerations of social development, cultural heritage, tourism and more. The city of Amman will work closely with community groups and universities to devise innovative and sensitive policies that encourage smart densification.

ACTIONS FOR CROSS-SECTOR PLANNING

ACTIVITY	TIMEFRAME	VOLUME OF EMISSIONS REDUCED	SUSTAINABILITY BENEFITS
Examine housing policies to determine the factors driving the high vacant housing rate	Medium	Unknown	Increased available housing, and decreased housing costs
Coordinate transit-oriented planning with the planning and transportation departments	Short	Unknown	Maintained open spaces, reduced costs, and improved access to amenities
Explore zoning and other policies that can expand green open spaces and protect land from development	Short	Unknown	Improved air quality and walkability
Plan for increased green spaces to enhance tree cover and increase the number of trees in Amman	Medium	Unknown	Reduced heat island effect, improved walkability, and reduced local air pollution
Explore opportunities to incentivize urban agriculture in Amman, including zoning, financial incentives and other policies	Short	Unknown	Provide source of food for low-income households and possible, source of income

NEXT STEPS
THE AMMAN PLAN BLUEPRINT

AMMAN HAS SET A VISION FOR 2050 AND ESTABLISHED A FRAMEWORK FOR ACHIEVING IT.

The action areas identified in this analysis should serve as the focus for policy priorities in future city governance actions and documents. The technical, financial and governance components of these transformational shifts need to be explored in order to identify a path for implementation. By 2020, Amman will provide an update on this initial Plan. It will also create the next version of the Amman Plan, identifying an implementation plan and timeline for action. As part of this effort, the city is creating a process for stakeholder engagement that will guide the process of action implementation.

Implementation of the actions identified in this Plan will require significant resources. Streamlining and facilitating financial flows for green growth will be key. As such, it will be crucial to coordinate across and within government agencies, engage with the private sector, and connect planning, and financing options. The components of this Plan can easily be aligned with and worked into the typical planning, budgeting and administration processes undertaken by municipal governments. Regarding financing, moving beyond conventional financial structures will be essential for Amman if it is to achieve its goals and meet the growing infrastructure demands.

Public investment needs to focus on funding public goods and services, while also creating a supportive environment for the use of private and foreign investment. This will result in a more efficient allocation of resources, leveraging scarce public funds to create a greater development impact. External financing can bridge gaps that cannot be covered by public revenues. It can include market-based borrowing, private sector partnerships, and donor aid and grants. The Plan facilitates the engagement of the private sector in a transparent and inclusive manner by creating opportunities for partnerships and green investments. Amman is seeking these types of investment partners in every sector to address climate change. Many of these actions have positive returns on investment and will be attractive to private sector financiers.

GLOSSARY

CURB

CURB, or Climate Action for Urban Sustainability, is an Excel-based tool that is used by cities for climate action planning. It provides tailored analyses using city emissions data to help cities evaluate low carbon actions, and project future emissions based on the actions selected.

Near zero emissions

C40 Cities Climate Leadership Group defines near zero emissions for their Deadline 2020 commitment as 0.01 tons of carbon dioxide equivalent (tCO_2e)/person/year.

Residual emissions

Residual emissions are the emissions remaining after all technically and economically feasible opportunities to reduce emissions in all covered scopes and sectors have been implemented.

Carbon neutral

used interchangeably with near-zero emissions, considering that offsetting can be applied to any minimal residual emissions that still occur at the year 2050.

C40 Cities

C40 is a network of the world's megacities committed to addressing climate change. C40 supports cities in effectively collaborating, sharing knowledge and driving meaningful, measurable and sustainable action on climate change.

Business as usual

a baseline projection that estimates what emission levels would be in the future with no emission reduction actions taken.

ANNEX 1
CURB TOOL ANALYSIS

Amman completed the first city-wide inventory of greenhouse gas emissions for the year 2014 using the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories. This inventory of greenhouse gas emissions reports emissions in the following sectors: stationary energy (electricity and gas use in residential and commercial buildings); transportation; and waste and waste water. At the time, there was little data available for reporting emissions from industrial processes or agricultural activities within Amman. As such, for now, these are not included in the climate action plan. However, Amman is continuing to improve its data collection and tracking processes. It will also attempt to include these sectors in future updates of the emissions inventory.

Amman's 2014 inventory shows that the two sectors that contribute the most emissions are stationary energy and transportation. According to the inventory, 64 percent of Amman's emissions came from the stationary energy source category, and 31 percent from transportation. More specifically, the largest sub-sectors of emissions were electricity for buildings, and on-road transport.

Data from the inventory was used in the creation of a CURB model. The CURB tool provides tailored analyses to help cities evaluate low carbon actions, and projects future emissions based on the actions selected. The outputs below come from the CURB model. The scenario projects the GAM achieving the 2030 reduction target based on a set of actions across all sectors. There are no new actions added between 2030 and 2050, only a dramatic scaling up of existing actions and an increase in penetration rates.

The actions were selected based on discussions within the GAM regarding what is feasible for particular sectors. Almost all of the actions reflect actions that Amman is already taking or exploring, albeit on a much smaller, pilot project scale.

BUSINESS AS USUAL SCENARIO DATA

TYPE	VALUE	SOURCES
Population (2014)	3,400,000	Amman Urban Observatory
Emissions (2014)	7,431,422 tons of carbon dioxide equivalent	GAM Inventory (Basic, not including industry and agriculture sectors)
Boundary (square kms)	801.92	GAM Inventory
Population growth factor until 2030	1.795	Hashemite Kingdom of Jordan Department of Statistics
GDP growth factor	2%	Economist Intelligence Unit, 2015

BUSINESS AS USUAL (BAU) SCENARIO

The business as usual scenario shows a projection of future emission levels in Amman without taking any action to reduce emissions. The scenario includes assumptions about projected population growth (obtained from the Jordan Department of Statistics) and GDP growth, and uses the 2014 emissions data. Below are the key data points included in the business as usual scenario.

TARGET SCENARIO

An interim 2030 target will provide a check for the city on its path to carbon neutrality. As noted, looking to 2030, absolute emissions for Amman can grow. However, per person emissions need to be kept at or below current levels of around 2.2 tons of carbon dioxide equivalent (tCO_2e)/person. This is based on analysis done by C40. To achieve this, the 2030 target should be set at a 40 percent reduction in emissions over the baseline scenario.

The tool allows for the identification of the year by which actions will be implemented. For all actions inputted (as reflected in the Plan), target dates for implementation were set as follows:

- **The 2030 target actions are projected to be implemented by 2030.**
- **The 2050 target actions are projected to be implemented by 2045.**

ACTION AUTHORITY

The national government sets policies regarding building efficiency, and action in this sector will need to be led by the national government. However, for illustration purposes, the CURB model currently assumes that GAM has control over the private building sector policies and actions – this sector is the largest contributor to emissions in Amman

2030 OUTCOMES

The following is a list of the key actions and scale of implementation that would be needed to achieve Amman's target:

ELECTRICITY GRID DECARBONIZATION

- Renewables = 30%
- Gas = 42%
- Oil = 27%

DECARBONIZATION OF AMMAN'S ELECTRICITY SOURCE

- Renewables = 30% or more

MUNICIPAL ACTIONS

- 100 MW of installed municipal solar PV
- 100% LED street lights

GREEN BUILDING PENETRATION

- 15-90% for existing and newly constructed buildings depending on income level

ROOF TOP SOLAR

- 20% penetration rate for residential buildings
- 25% penetration rate for commercial buildings

MODE SHARE SHIFT

- Private automobile reduction from 33 to 23% mode share
- BRT from zero to 9% of mode share, and public standard bus mode share stays roughly the same

ELECTRIFICATION OF VEHICLES

- 20% of private passenger vehicles are electric
- 20% of taxis are electric
- 100% of BRT buses are electric

WASTE TREATMENT IMPROVEMENTS

- 30% of food and yard waste is treated in anaerobic digester and 10% is composted
- Landfill gas capture increases from 85 to 95%
- Bio gas capture is achieved for 50% of anaerobic treatment of waste

and action in this sector can potentially contribute over 1 million tons of emission reductions by 2030. Amman and the national government will need to work together to leverage policy setting and the private sector, along with local enforcement of licensing, to achieve more widespread adoption of green building strategies. Additionally, as noted in the report, any achievement of Amman's emission reduction targets is reliant on national action to decarbonize the electrical grid.

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